

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL
CRITICAL CARE TRANSFERS

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Clinical Emergency Care

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Table of Contents

DEDICATION	5
ABBREVIATIONS	6
PART A: BACKGROUND.....	8
<i>Neonatal Critical Care Transfers.....</i>	<i>8</i>
<i>South African Pre-Hospital Neonatal Education.....</i>	<i>9</i>
<i>Curriculum.....</i>	<i>11</i>
<i>Theory Of Situated Learning</i>	<i>12</i>
LITERATURE REVIEW	12
<i>Literature search strategy.....</i>	<i>12</i>
<i>The current state of neonatal critical care retrieval.....</i>	<i>14</i>
<i>Education in neonatal critical care transfers.....</i>	<i>19</i>
<i>Current South African neonatal transfer education</i>	<i>24</i>
<i>International neonatal critical care curricula</i>	<i>26</i>
<i>Summary and interpretation</i>	<i>34</i>
<i>References.....</i>	<i>36</i>
TABLE 7: LITERATURE REVIEW JOURNAL ARTICLES SUMMARY	40
PART B: MANUSCRIPT.....	49
ABSTRACT.....	50
BACKGROUND.....	51
METHODS.....	52
<i>Research Paradigm</i>	<i>53</i>
<i>Study setting</i>	<i>53</i>
<i>Sampling</i>	<i>53</i>
<i>Data collection instrument</i>	<i>54</i>
<i>Data Collection.....</i>	<i>54</i>
<i>Data analysis.....</i>	<i>55</i>
<i>Trustworthiness</i>	<i>56</i>
<i>Ethical considerations.....</i>	<i>56</i>
RESULTS	57
DISCUSSION.....	71
LIMITATIONS.....	73
CONCLUSION	74

FUNDING AND CONFLICT OF INTEREST	74
REFERENCES	75
APPENDICES	78
PART C.....	87
PROPOSAL.....	87
RETROSPECTIVE CHART REVIEW.....	104
<i>Aim</i>	104
<i>Method</i>	104
<i>Summary of findings</i>	104
<i>Informed discussions</i>	104
<i>Limitations</i>	105
<i>References</i>	106
APPENDICES	107
<i>Appendix 1: Ethics Clearance Letter</i>	107
<i>Appendix 2: Participant Consent Form</i>	109
<i>Appendix 3: Expert group pre-reading document</i>	114
<i>Appendix 4: Learner group pre-reading document</i>	130
<i>Appendix 5: Discussion Schedule</i>	134

Dedication

I dedicate my dissertation work to the following people;

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- To Elzarie Theron, for helping me overcome some technical stumbling blocks and refining my dissertation.
- To Dr Waseela Khan for showing me the light at the end of the daunting education tunnel.

Abbreviations

AACCN - American Association of Critical Care Nurses

ABG – Arterial Blood Gas

AEs – Adverse Events

AET – Ambulance Emergency Technician

ALS – Advanced Life Support

ANT – Ambulance Emergency Technician

APLS - Advanced Paediatric Life Support

BEMC – Bachelor’s degree in Emergency Medical Care

EC – Emergency Centre

ECP – Emergency Care Practitioner

ECSSA - Emergency Care Society of South Africa

ECT – Emergency Care Technician

EMS – Emergency Medical Services

ENCCO – Essentials in Neonatal Critical Care Orientation

CCA – Critical Care Assistant

CCR – Critical Care Retrieval

CCRS – Critical Care Retrieval Service

CCT – Critical Care Transfer

CI – Confidence Interval

CPAP – Continuous Positive Airway Pressure

CPR - Cardio Pulmonary Resuscitation

HPCSA – Health Professions Council of South Africa

HC – High Care

HEI – Higher Education Institution

HIC – High Income Country

IFEM – International Federation for Emergency Medicine

IBSC - International Board for Speciality Certification

ICU – Intensive Care Unit

IFT – Inter-facility transfer

KZN – Kwazulu Natal

LMIC – Low- and Middle-Income Country

MDG - Millennium Development Goals

NAPSTaR – Neonatal, Adult and Paediatric Safe Transfer and Retrieval

NHS – National Health Service

NICU – Neonatal Intensive Care Unit

NQF – National Qualifications Framework

OSCE - Objective Structured Clinical Examination

PALS - Paediatric advanced life support

PICU – Paediatric Intensive Care Unit

SDG - Sustainable Development Goals

SASCC - Southern African Society of Critical Care

SAQA – South African Qualification Authority

STABLE - Sugar and Safe Care, Temperature, Airway, Blood, Lab work, Emotional Support

TLA – Teaching, learning and assessment

TRIPS - Transport Risk Index of Physiology Stability

WC – Western Cape

PART A: BACKGROUND

This section aims to contextualise the research by providing a discussion on the service of neonatal critical care transfers, the type of practitioners usually involved in the transfer of neonates, and the history of education within this field.

Neonatal Critical Care Transfers

The level of care provided in neonatal transfers in South Africa can be described as either inter-facility transfers (IFT) or critical care retrieval (CCR). CCR refers to the stabilisation and transport of critically ill or injured patients from a healthcare facility where the healthcare requirements of the patient outweigh the diagnostic or treatment abilities to an appropriate facility where these are available (1). These neonates are critically ill and have life threatening conditions that require life support, invasive monitoring techniques, and potentially resuscitation. The neonatal patient population have special needs during transfer, which include the monitoring and regulation of all haemodynamic parameters.

Owing to limited neonatal care resources, the transfer of neonates to district and tertiary facilities is inevitable in Low- and Middle-Income Countries (LMICs), such as South Africa. In an analysis conducted by Naidoo et al. on the status of Intensive Care Unit (ICU) / High Care (HC) beds in South Africa, it was determined that only 25% of ICU beds are found in the public sector and most of these are in major centres of Gauteng, Kwazulu-Natal (KZN) and Western Cape (WC) provinces. (2) A descriptive study by Bhagwanjee and Scribante found that there is a major shortage of Neonatal ICUs in the state sector (3). This shortage is not limited to ICU beds only, it also includes a need for trained nurses and doctors to manage these patients. The study concurred with Naidoo et al. that most ICUs were located in three provinces, leaving the rest of the country in need for this specialist service. Rhoda et al. found that the lack of transport between hospitals were one of the top ten preventable healthcare system causes of neonatal deaths in South Africa (4). There is a great need to transfer neonates from one facility to another in a LMIC such as South Africa, which was demonstrated by Ashokcoomar (5). In this study of a single district the average transfer rate was 2.79 per day, which is almost six times higher when compared to developed countries like Ireland (0.482) and Slovenia (0.487). This demonstrates the severe shortage of specialised resources creating the need for transfer.

Internationally, the transfer of neonatal patients is reserved to specialised retrieval teams (6). In High Income Countries (HICs) neonatal critical care transfers are often staffed by a combination of doctors,

pre-hospital providers and nursing staff. This is not the case in South Africa, where neonatal transportation is on the scope of practice for all prehospital providers registered with the Health Professions Council of South Africa (HPCSA). These providers often receive limited neonatal-specific training as part of their education. There are currently no courses dedicated to neonatal critical care transfer in South Africa. This service in South Africa is provided by various prehospital emergency services, with varied personnel qualifications and experience (7).

Research has shown that the use of dedicated transfer teams with specialised equipment in developed settings are less prone to adverse events when compared to developing settings using non-dedicated teams, (8) thus indicating that there is a need for specialised training and education especially in a setting where neonatal transfers occur often. Specialised equipment, such as humidification, Continuous Positive Airway Pressure (CPAP), and high flow therapy is available on select critical care transfer units, but this is not the norm in a LMIC such as South Africa.

The transfer of neonates from one medical facility to another is high risk in nature, especially in the critically ill patient requiring intensive care (9). Common adverse clinical events include hypotonia, hypoxia, hypothermia and acidosis (10-12). Several studies, investigating the risks associated with neonatal transfers within the South African context, found low education and training of transferring personnel to be an exacerbating factor to these adverse events (13, 14) and that an increase in training and education is vital in reducing adverse events in neonatal transfers (9).

South African Pre-Hospital Neonatal Education

The HPCSA has changed the way that education is conducted in the pre-hospital setting by discontinuing all forms of short courses (15). The current offerings are presented at tertiary institutions and qualifications now fit into the National Qualifications Framework (NQF). These qualifications are often described in the industry under the term Advanced Life Support (ALS), which consist of: ECP (Emergency Care Practitioner)(Bachelor's degree in Emergency Medical Care (BEMC), CCA (Critical Care Assistant), ECT (Emergency Care Technician), Paramedic (Diploma in EMC, Old National Diploma in Ambulance Emergency Technician (AET)).

The tertiary institutions that offer pre-hospital qualifications are called Higher Education Institutions (HEIs). HEIs operate autonomously and do not report to government (16). The South African Qualification Authority (SAQA) is a South African statutory body mandated to develop and implement

the NQF. The NQF is a formal framework that describes qualifications. SAQA sets the NQF boundaries and guidelines for South African qualifications and all forms of education, including HEI qualifications that fit into this framework (16). The SAQA online register for qualifications provides information regarding course outcomes and assessment criteria. Qualifications that form the basis of the prehospital sector were found under the search term “Emergency Medical Care”. All of these qualifications make none or very limited mention of neonates with none making mention of neonatal transfers (17).

The level of care and scopes of practice of prehospital personnel are regulated by the HPCSA. The HPCSA have published a list of prehospital personnel capabilities. The capability of inter-facility transfers have been assigned to all levels of care with no distinction made for neonates (18). Some specific neonatal skills have been assigned to ECPs only, namely needle thoracentesis and mechanical ventilation (18). The skill of managing a neonate in cardiac arrest have been assigned to all levels of care with only the medications separating the qualifications in scope of practice (18). With both SAQA and HPCSA providing limited guidance on education content in neonatal critical care transfers, the course content delivered by HEIs will vary between institutions (19, 20).

Understanding the need for specialised equipment in specific patients come with knowledge. It is important for prehospital providers who transfer neonates to be able to identify the special needs of a patient and to apply the equipment or refer the case to a team that can provide the appropriate level of care. A South African study, assessed the prehospital provider’s subjective opinion on the level of knowledge and equipment they require to manage a neonate during transfer (21). The study found that prehospital providers perceived that they were greatly under-equipped and required additional standardised training to close the knowledge gap (21). Expert opinion also suggests that prehospital providers who perform critical care transfers lack training and knowledge which can result in adverse events (AEs) (13, 14).

With the neonatal transfer knowledge gap of ALS providers identified, it is recommended that the transfer of neonates warrant additional training over and above that of current offerings. The management of an acutely ill neonate requires a level of advanced knowledge and skill from the provider. Expertise in a field such as this does not automatically develop as a result of experience and traditional education (22). Training opportunities must be created where deliberate practice can be applied at specific levels to develop an expert in a field (22). There is a need to explore available

curricula in neonatal critical care transfer education or consider the development of a new curriculum in this field; that is appropriate for the South African context.

Curriculum

The development of a new curriculum in neonatal critical care transfer education requires a structured approach. Kern et al. provides such a framework in six steps to facilitate analysis of the problem within curriculum development. The term curriculum originates from the Latin word *currere* which means “to run”. A curriculum provides a template for learning. It provides a definition of the learning that is expected to take place during a course in terms of knowledge and skills. The curriculum must also define the methods that will be used for teaching and assessment and what resources will be needed for effective delivery. A curriculum is more than a syllabus, where a syllabus forms part of the curriculum and only focusses on the content of learning. The formal published curriculum of a course must be delivered as a functional curriculum and there must be no mismatch as development turns into implementation (23).

Kern describes the steps that need to be followed during curriculum development (24). In the first step, the general needs assessment has to clearly define the problem which will help focus the curriculum’s goals and objectives (24). This comprehensive definition of the problem must describe the impact that it has on health care professionals and their patients. The second step of targeted needs assessment identifies the group of learners and guides the educational intervention will seek to solve the problem identified (24). Information obtained from learners include perceptions of previous learning experiences, perceived deficiencies, learning preferences, barriers and available resources. In step three the identified needs are addressed by defining goals and objectives. The goals describe the overall purposes of the curriculum and the objectives are more specific measurable directives (24). In step four, the educational strategies develop the content and the methods in which it will be delivered to the group of learners. Step five is implementation and identifies the resources that will be needed to deliver the curriculum (24). The final step of evaluation and feedback creates a continuous cycle of development and improvement for the curriculum.

Theory Of Situated Learning

While Kern's model is an appropriate process for the development of curricula, it does not provide any basis on which learning takes place. In this study, the theory of situated learning was followed. It states that learning does not only originate from a single source or institution but occurs rather as a result of the community in which these providers find themselves. The community that these providers will learn from are not limited to the prehospital environment either, but will include the EC and ICU settings as well. Essential knowledge is shared between these individuals and form part of the learning process (25). It is thus important to include all the role-players that form part of this community when developing a new curriculum. Community of practice falls within the theory of situated learning and forms part of a conceptual framework in education (25). The inclusive process of communities of practice helps with the identification of outcomes during curriculum design as the participation in input by all parties are essential (25). It is important to understand how teaching-learning occurs in the pre-hospital context. The field of pre-hospital emergency care cannot be taught in a classroom alone, but must include aspects of active learning in the form of skills lab and workplace-based learning. This, when included in the curriculum, facilitates authentic and deeper learning. (26, 27)

Before developing a new curriculum in neonatal critical care transfer education, it is important to first explore current literature in the field to see other researchers' findings. It is also important to explore current international education offerings in the field as there may be existing courses that may be adopted to close this knowledge gap.

LITERATURE REVIEW

Aim

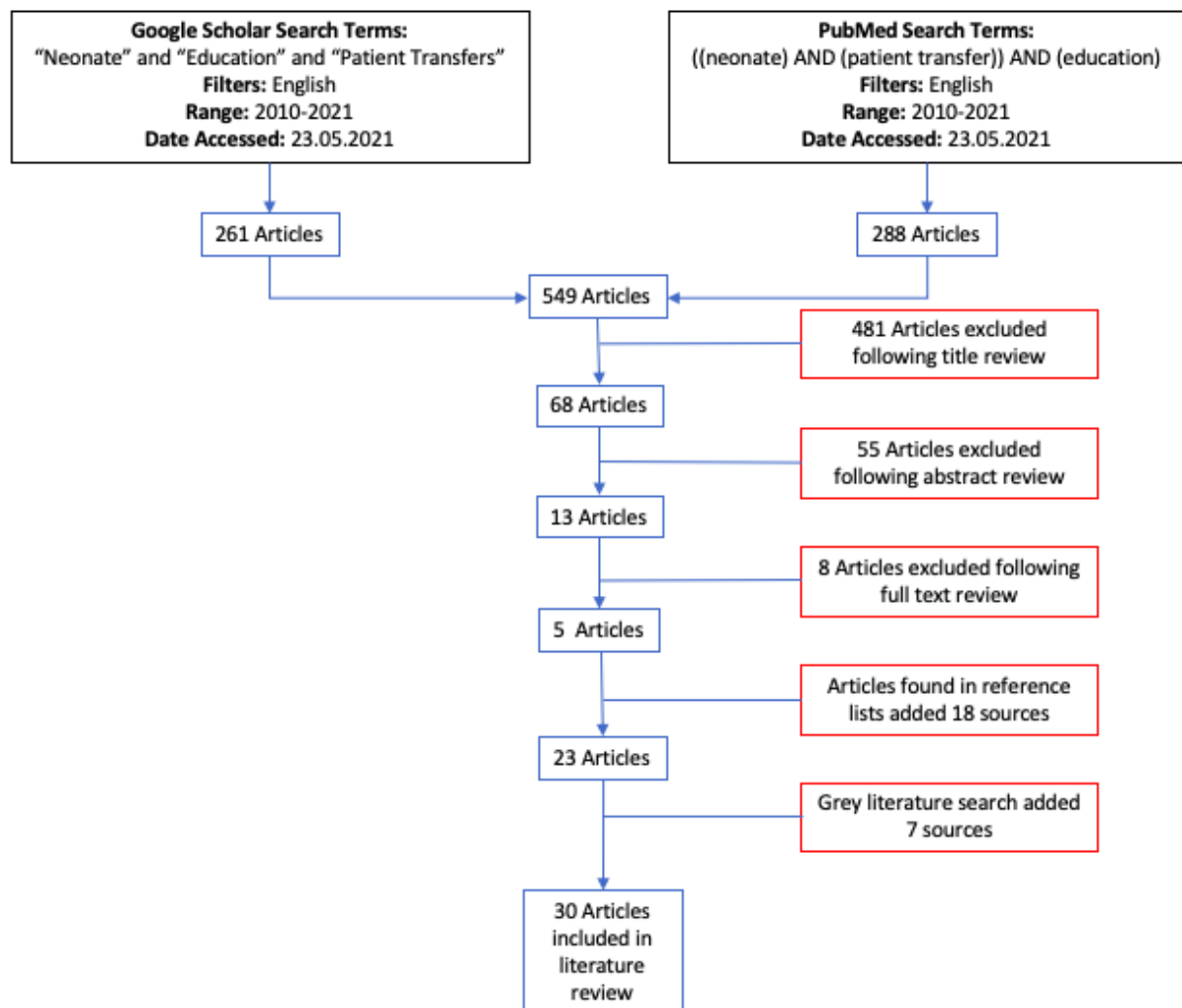
The aim of this literature review was firstly to describe the current state of neonatal critical care retrieval, then to describe education in neonatal critical care retrieval, and finally outlines neonatal critical care transfer curricula in both the local and international contexts.

Literature search strategy

A structured literature search was conducted using the Google Scholar and PubMed platforms. The following terms were used to extract information related to neonatal training programmes: neonate,

education and patient transfers. Literature that contained information about neonatal transfers and education published in English over the past eleven years (2010 – 2021) were included in the review. Information not published in medical journals from a ‘grey’ literature search on the Google platform was also included. Articles that were published in languages other than English and those with publication dates prior to 2010 were excluded from the review. Irrelevant articles were firstly excluded following title review and secondly by abstract. Following full text review, the relevant articles were included in the literature review. The reference lists of included articles were then interrogated and a similar process was followed to increase the acquisition of additional relevant literature.

Figure 1. Consort diagram of literature search strategy



The current state of neonatal critical care retrieval

The following section will describe the current state of neonatal critical care retrieval in both HICs and LMICs. The service of neonatal transfers has changed over years in many respects. From an ad hoc function provided by emergency services to the development of full-time inter-hospital transfer units with specialised equipment to match the needs of this patient group. The introduction of such specialised medical equipment in the form of heated high flow humidified nasal oxygen and heated humidified CPAP via nasal prongs or mask has eliminated the need for all neonates that require respiratory support to be intubated before transport (28). Understanding the need for specialised equipment in specific patients come with knowledge in neonatal critical care transport. It is important for prehospital providers who transfer neonates to be able to identify the high risk patient and to apply the equipment or refer the case to a dedicated team that can provide the level of care.

Dedicated CCR teams have become the norm for the inter-facility transfer of critically ill neonates in HICs. These dedicated teams often consist of multi-disciplinary team members that bring specialist care to the patient. In Sweden, Hamrin et al. (29) conducted a single centre, retrospective descriptive study on paediatric patients admitted to a PICU. Patients transferred by ambulance were managed exclusively by specialist retrieval teams. This group of patients (n=221) were compared to a much larger group of patients (n=3444) admitted to the same Paediatric Intensive Care Unit (PICU) by direct admission. This made it impossible to compare the performance of specialist and non-specialist teams and the effect on patient outcome. In this setting, the patients were critically ill, and the author came to the conclusion that the use of specialist teams were appropriate. External validity to our local context is limited as multidisciplinary specialist retrieval teams are not currently a reality in South Africa. Data that were statistically significant ($p < 0.05$) and accurate within 95% confidence interval (CI) were reported. Patients enrolled in the study were consecutive admissions which ruled out selection bias, and patient data was collected automatically from bed side monitoring to a patient data management system which limited human error.

In England and Wales, Ramnarayan et al. (30) compared the outcome of paediatric patients that were transferred by specialist and non-specialist teams. This multicentre study of consecutive admissions was conducted over a four-year period where patients admitted to 29 PICUs were analysed. A total of N=16 875 patients were transferred by ambulance, of which 81% (n=13729) were transferred by specialist teams and 19% (n=3146) by non-specialist teams. A risk adjustment method was used due to the case mix variations between the groups. Following the adjustment, the specialist retrieval teams' patients had a lower risk of death (0.58, 0.39-0.87) (30). This risk adjustment method however

had the potential to introduce selection bias due to the large variation between the groups. This study was multi-centre by design with a large cohort which gives it better internal validity when compared to small single centre studies. The findings of the study however cannot be directly related to our local context as the use of multidisciplinary teams with specialist physicians is not the norm in LMICs. These studies in HIC settings indicate that the use of specialist teams reduces patient risk during transfer.

The reality however in LMICs are that many neonates are being transferred without any medical escorts. This was demonstrated in Kenya by Sogomo et al. (31) where only 79% (n=96) of the N=122 patients were transported by ambulance with a medical escort. The rest of the patients were transported by other means, including public transport, due to costs and availability of ambulances. The medical escorts for these patients were mostly nurses for 59% (n=73) of patients, 22% (n=27) had no escort and 13% (n=16) of cases were paramedics (31). In India, Dalal et al. (32) demonstrated that only half of neonates that were admitted to hospital arrived by ambulance and that only 44% (n=133) of the total patients were escorted by trained paramedics (32). Both studies were single centre cross sectional, descriptive studies. Sogomo et al used consecutive sampling and Dalal et al used random sampling. Both studies relied on the receiving medical personnel completing the questionnaires which had risk of observation bias as the receiving physicians would be sensitised to the risk of documenting any mistakes on their side and was already aware of the challenges during transfer. Both studies had external validity to our local context where the qualified medical personnel that escort patients are a limited resource in LMICs.

The importance of having these trained medical escorts during neonatal transfers continue in a qualitative study by Lambert and Wade (7) where they describe the challenges of inter-facility transport of paediatric patients including neonates in Johannesburg, South Africa. Interviews with purposefully identified role players in the field identified the main challenges which were low levels of education and training of ambulance attendants. This study confirms the common theme of a lack of education of EMS personnel in the management of this high acuity patient population during transfers (7). This study was limited to the state sector in the Gauteng province, and only one role player per discipline was interviewed. It would have been beneficial to get input from the private sector and other provinces. Transferability in neonatal transfers was achieved by interviewing key role players that are involved in the transfer of paediatric patients in our local context. Ismail et al. (21) assessed the prehospital provider's subjective opinion on the level of knowledge and equipment they require to manage a neonate during transfer. Questionnaires were sent to South African ALS Emergency Medical Services (EMS) personnel through a convenience sampling strategy. The N=145

questionnaires consisted of 35 questions that had to be rated on a scale. This study was limited to the WC province and 75% (n=109) of the participants were from the ANT scope with the majority from the CCA short course qualification. It would have been beneficial to include the opinion of BEMC qualified providers and those from other provinces to ensure external validity. This study confirmed that according to ALS EMS personnel, they feel that they require additional exposure and training (21).

This level of education of the transferring team can also be linked to adverse event rates, especially in resource limited settings (5, 10, 31-33). These studies all had external validity to our local context in that they were conducted in LMIC countries. The major limitation to these studies were the single centre design with data collection on arrival by receiving physicians which could lead to observation bias. Many of the studies lacked patient data before departure at the dispatching facility making it impossible to gauge the effect of care during transport. Even in resource rich settings like England, high adverse event rates have been linked to the provider's level of education (8). In this study by Senthikumar (8), N=1289 emergency transfers were observed of which 43% (n=560) reported adverse events. Most adverse events reported by the specialised teams were associated with ventilation strategies and/or endotracheal tube displacement. The suggested corrective intervention was education addressing neonatal ventilation. The study was limited to a single service and would have been beneficial to get data from various specialised services. Expert opinion also suggests that prehospital providers who perform critical care transfers lack training and knowledge which increases the risk of Adverse Events (AEs).

In a modified Delphi study by Venter M (13), N=7 experts in the field reached a consensus of 70% (n=57/81) which included the need for paramedics to have additional training and increased scope of practice to conduct Critical Care Transfers (CCT) (13). External validity would have been strengthened with a larger sample of experts. In a study by Venter C (1), consensus on what defines a Critical Care Retrieval Service (CCRS) was sought from experts in the field. One of the five key aspects of the CCRS definition identified was dedicated crew members with additional training. This definition was endorsed by the Emergency Care Society of South Africa (ECSSA), the Southern African Society of Critical Care (SASCC) and the International Board for Speciality Certification (IBSC) (1). The need for additional neonatal CCR education has been identified and the potential clinical risk of having ALS providers with limited neonatal CCR knowledge conducting these transfers should be explored.

The risk of developing physiological changes in the neonatal patient during transfer that can lead to clinical deterioration. This was demonstrated in South Africa by Ashokcoomar and Naidoo (5) who

performed a descriptive analysis of a N=120 inter-healthcare facility neonatal transfers. They reported an 8.3% physiological adverse event rate (5). This study was limited to a single district in the state sector. It was at risk of bias as the data collection tool was a questionnaire completed by EMS and call centre personnel of various qualifications. Thwala (11) performed a cross sectional descriptive study of N=96 neonatal transfers with clinical AEs found in the form of hypotonia (32%), hypoxia (22%), hypothermia (21%) and acidosis (40%). The mortality rate at 48 hours post transfer was 7% (n=6) (11). Gauging the quality of care during transport by measuring vital signs on arrival would have had stronger internal validity if they were compared to vital signs on departure at the referring hospital. The study does have strong external validity however as it highlights that many neonates arrive in unstable condition at the receiving hospital if transferred by paramedic led team in both the private and public sector in a LMIC setting.

In Argentina, Goldsmit et al. (12) described the risk factors associated with the clinical deterioration of new-born infants during transfer through a prospective observational study. Of the N=160 patients captured by the study, 57% (n=91) experienced clinical deterioration and 46% (n=73) had hypothermia. The clinical condition of the neonate was recorded by both a physician at the referring hospital and receiving hospital using the Transport Risk Index of Physiology Stability (TRIPS) score on which they received training. This method of pre and post transfer data collection ensured internal validity, and the TRIPS score only requires the entry of simple parameters avoiding subjective views which mitigates measurement bias. This study shows that the transfer of neonates were associated with a likelihood of clinical deterioration during transfer in more than half of the patients. (12). In Jamaica, a prospective descriptive study by Henry et al. (10) described the challenges experienced during transfer. Fifty neonates were transferred over a 15-month period. A checklist was completed upon arrival at the receiving hospital as a data gathering tool. 34% (n=17) of the patients experienced adverse events during transfer. On arrival 54% (n=27) of patients required warming, 84% (n=42) required fluid resuscitation and 28% (n=14) Cardiopulmonary Resuscitation (CPR). 36% (n=18) of the patients died (10). In this study, internal validity was limited due to a lack of monitoring data during transport and also a lack of patient data from the referring hospital. The study is relatable to our LMIC setting with similar challenges with regards to resources. In Kenya, Sogomo et al. (31) conducted a cross sectional study which described the transfer of a N=122 neonates (31). They were transferred due to a lack of speciality care or resources and for surgical review. On admission, 44% (n=54) of neonates were hypothermic and 20% (n=25) were hypoglycaemic. This study also highlights the risk of neonatal transfer in a LMIC setting, but limitations in the study design also need to be considered. Data collection was performed post transfer by receiving personnel at a single centre with no patient

data before transfer. Another limitation was the interview of transferring personnel post transfer who may not have been entirely open about mistakes made during transfer.

Other studies continue to discuss the risk of transfer including Dalal et al. (32) where a cross sectional study described the admission of N=300 neonates in India. This study had limitations in that it was single centre design with recording of patient parameters only on arrival. The randomised sampling method is also not described which means that sampling bias cannot be ruled out. The study does have external validity however in that India shares similar limitations in resources when compared to our local context. The parameters that were most altered at admission was hypothermia 55% (n=166), hypoxia 27% (n=82), hypoperfusion 23% (n=70) and hypoglycaemia 20% (n=62) resulting in high mortality rates. In Iran, Sabzehei et al. (33) conducted a cross sectional study of a N=100 neonates that were transported to a major Neonatal Intensive Care Unit (NICU). The main reasons for transfer were respiratory distress and surgical consultations. Complications during transfer were recorded in 32% (n=32) of patients with hypotension and hypothermia being the most prevalent. This study has strong external validity to our local context, but the study design had a limitation in that it relied only on patient data collection at a single centre receiving facility by sensitised physicians that could lead to observation bias. All of these studies were conducted in resource limited settings, and it is evident that the transfer of neonates in these circumstances are high risk.

The risk of neonatal transfers can also be attributed to various challenges in a neonatal transfer system. Time delays were cited as a major contributor to adverse events in several studies (5, 7, 8, 14). Further to time delays, the lack of specialised equipment or their failure during transfer forms an integral part of the continuum of care and has an impact on adverse event rates (5, 7, 10, 21, 31, 33).

Despite these risks associated with the transfer of neonates, the need remains a global phenomenon as a result of the centralisation of specialist care (29). In a LMIC such as South Africa, specialist neonatal care is a scarce resource. Neonates born ill or prematurely outside of specialist centres require inter-facility transport by ambulance. If these services are available, they often have to transport these patients over long distances.

Where these services are not available, it has a negative impact on the under-5 mortality rate (34). This rate has however decreased since the implementation of the Millennium Development Goals (MDG). South Africa had an under-5 mortality rate of 80 per 1000 live births in 2003, which decreased to 37 per 1000 live births in 2015 (4). This reduction in under-5 mortality rates was an improvement

but still fell short of the MDG 4 target. The MDG were replaced by the Sustainable Development Goals (SDG), with the under-5 mortality rate target to be reduced to 25 per 1000 live births by 2030 (34). Many of the factors that contribute to the under-5 mortality rates are avoidable and related to the healthcare system. The top ten avoidable health care system factors that contribute to the under-5 mortality rates include the lack of transport from home to the institution and between institutions (4). Other avoidable factors included inadequate facilities, nosocomial infections, undetected foetal distress, delays in referral, access to a NICU, inadequate neonatal care management plan, inadequate neonatal monitoring and limited nurses on duty (4). The need to transfer neonates between hospitals are inevitable and one method to decrease the risk is to introduce specialist teams with additional education.

This reduced risk demonstrated by multidisciplinary specialist teams (30) warrants the development of additional education in neonatal critical care transfers in our local context. Both ALS paramedics (21) and experts in the field (7) suggest that additional education in neonatal transfers are needed which may require the development of a new curriculum.

Education in neonatal critical care transfers

Curriculum design

This section will discuss methods of curriculum design and the factors that should inform this process. The literature review did not find any local studies on curriculum design in neonatal critical care transfers. A South African study by Cohen and Wallis (35) demonstrated the importance of how the local burden of disease should inform the core curriculum of a programme. This retrospective, cross sectional audit study, collected data of patients in all age groups that presented to three academic Emergency Centres (ECs) in the WC. The data collection period included randomly chosen 24 hour periods on one week date and one weekend date and in both winter and summer months for fair representation of clinical complaints associated with a change in season. Of the 697 cases, 11.9% (n=83) of the files could not be found and a further 6.3% (n=44) of patients absconded. The remaining 570 cases yielded 1283 total medical and trauma related diagnoses. Only seven of the top ten frequent diagnoses were covered by the curriculum. The study does highlight that the local burden of disease should inform curriculum design, as international curricula cannot be applied verbatim to the local patient population. The International Federation for Emergency Medicine (IFEM) curriculum used at the time was a good starting point for a new speciality but had to be tailored to the local burden of disease. This principle should also be applied during the development of a neonatal critical care

transfer curriculum as international curricula may not match the content demanded by our local patient case mix. With the paucity of research in local neonatal curriculum design, it is important to understand how international neonatal curricula were designed.

In an article by Petty (36), the author describes the process of curriculum development for nursing in neonatal surgical care in the National Health Service (NHS). Other areas of neonatal education were already established, and it was the aim to develop a module that specifically addressed the surgical care of neonates. The approach to the design of this new module was that of competency design, which consisted of a needs and task analysis. This analysis of specific knowledge and skills informed the list of objective competencies. The Teaching, Learning and Assessment (TLA) strategies were also defined in this analysis. Although the curriculum design was competency-based, the nature of this nursing role was practical in nature with much knowledge gained during experience. This warranted the curriculum development to include the social context of learning (36). The curriculum development for this module was broken down into eight steps: needs analysis, student characteristics, programme structure was modular, learning outcomes, content, goals/objectives/outcomes, TLA approaches and evaluation/review. The learning outcomes for this module was informed by expert opinion and a literature review in the field. The decided method of teaching was classroom-based lectures and group discussions led by clinical and surgical experts in the field. The assessment of competency was firstly a portfolio of skills that were performed on real patients during surgical placements. This portfolio was accompanied by a student reflection that included current evidence to support current practice. Evaluation and review was conducted by collating stakeholder inputs regarding the module (36). This article highlights some important factors that need to be considered when developing a new curriculum in neonatal critical care transfer education namely: Establishing the need for specialised training in a developing field to bridge knowledge gaps, performing a literature review, and lastly to gather expert opinion to inform broad course outcomes. Due to the paucity in literature describing neonatal critical care transfer curriculum design, in-hospital neonatal education methodologies should be explored for relevance and transferability.

In another in-hospital article by Sawyer (37), the author describes how transforming a paediatrician into a neonatal/perinatal medicine practitioner can be achieved. The author noted that incoming paediatricians often lack neonatal resuscitation skills due to a lack of exposure. To overcome this barrier, a basic training programme referred to as “boot camps” was developed as an introduction to the programme. This approach ensures that the core skills required to succeed in the programme are

mastered. The curriculum development for this training module adopted Kerns six steps in curriculum design. The content of the course is largely practical skills, with the method of delivery in skills laboratories for technical skills and simulations for non-technical skills. The duration of these boot camps are usually one to two days. The article was generic in its description of boot camps and did not specify exactly how content would be determined but did note that local context must be considered (37). This article is relatable to our local context as a lack of exposure to neonatal transfers can lead to an attrition of skills (21). This method of short, intense training days that focusses on the mastery of core practical skills can be applied to education in neonatal CCR as an introduction to a wider learning experience and should be explored during the curriculum design process. There are various approaches to curriculum design and some creative ways of content delivery that can be considered.

In a prospective observational study by French et al. (38), a pilot curriculum in neonatal education utilising online content for knowledge acquisition and flipped classrooms for knowledge application was reviewed for effectiveness. The content for education in neonatal-perinatal medicine is dictated by the American board of paediatrics. The methods of implementation are up to the individual training institutions. The concept of flipped classrooms requires the student to acquire knowledge before coming to class (e.g. viewing online videos), followed by group discussions and projects in class to explain the application of said knowledge. The curriculum design began with a need's assessment through surveys completed by students in the field asking them to identify an area of difficult content. This content was then developed by the authors into an online content / flipped classroom course. The course was rolled out as a pilot, and feedback via anonymous surveys requested after the course. Following the survey analysis, focus group discussions with n=41 students and n=6 educators gave a deeper understanding of the findings. The responses in general were positive and found to be much more effective than traditional didactic methods of teaching. One theme identified was that educators reported that this method was a lot less time intensive, freeing up more time for other responsibilities. The student group found this method to be interactive, facilitate skills acquisition and an effective way to gain knowledge (38). This study has strong external validity to our local context as the design of a neonatal critical care transfer curriculum could benefit from the same approach. It would be beneficial to get input from experts and potential students in the field during the design phase. The use of online content with flipped classrooms can then be put to these groups during a focus group discussion for comment.

There were no articles that discussed curriculum design in neonatal critical care transfers. The articles that discussed curriculum design for in hospital neonatal content can be related to this study as it is expected that many outcomes will be similar in our context. The potential students that will participate in this field of education are already working individuals and it would be beneficial to get their input in the curriculum design. It is also important to understand what kind of patients we see in South Africa before developing a new curriculum or adopting international curricula.

Neonatal patient outcomes following education as a risk mitigation intervention

This section will discuss the outcome on neonatal patients following the use of education as an intervention to mitigate clinical risk. In Mexico, Veronica et al. (39) conducted a study on the implementation of a program known as S.T.A.B.L.E. (Sugar and Safe Care, Temperature, Airway, Blood, Lab work, Emotional Support). Education was implemented in the form of theory and practical sessions. Personnel that participated were from various disciplines involved in neonatal transfers. They were then assessed through written tests and patient simulations. The education content had a lot of focus on communication pathways for referral, patient criteria for transfer, and on admission, the necessary workup required. A total of 3277 neonates were evaluated based on their clinical picture on admission at a single centre. Only 12 (%) neonates were retrospectively assessed for condition without the implementation of the education program. The rest of the sample of 2893 patients were assessed post education intervention. When comparing the pre- and post-intervention groups, normal body temperature was present in 59% (n=227) versus 87% (n=516) of patients on admission. The pre- and post-intervention comparison of normal blood sugar levels on admission were 45% (n=173) versus 93% (n=690). There was a reduction in the mortality rate post intervention from 22% (n=84) compared to 14% (n=405). There is no explanation of how data capturing of vital signs were conducted on admission leaving room for measurement bias. The participants were aware of the patient outcomes pre-education intervention which may have led to outcome bias as they altered their vital sign measurements and patient management. This study was single-centered by design and as data collection occurred at this point only questioning reliability of the findings. It would have been beneficial to get an indication of the clinical condition of the neonates prior to and during transfer. The reliability of the study is questionable as there is limited information shared on the study design process, especially patient data collection. This study does show a reduction in clinical risk for neonates that were transferred before and after an educational intervention, but it is unclear if the result was due to education alone or an improvement in the system as a whole.

In another educational intervention study in the United States of America, Kilday et al. (40) used education as an intervention to improve patient outcome following the neonatal rapid response team's activation. This response team was multi-disciplinary and focused on stabilizing neonates in the in-hospital setting. An evidence based didactic curriculum with skill laboratory practice sessions were implemented across two hospitals with n=29 participants. Of the participants, 26 (90%) completed the post intervention surveys. Patient simulations were conducted pre- and post-education to assess team performance. This performance assessment was conducted by experienced neonatal nursing sisters which added rigour. The team members also completed questionnaires to rate their perceived improvement in teamwork and knowledge. Multiple choice theory assessments pre- and post-intervention was used to test knowledge gained. The team members demonstrated a perceived improvement in teamwork, patient safety and knowledge. Internal validity of the study would have been stronger if the patients' clinical condition were measured before and after intervention to conclude on patient outcome. The study had limited external validity as a multidisciplinary team in hospital will have different patient management capabilities when compared to a stand-alone ALS provider in a CCR setting.

In the resource constrained setting of Malawi with a high burden of neonatal deaths, Hole et al. (41) conducted a study to establish the effectiveness of implementing neonatal resuscitation education on decreasing in hospital mortality. The curriculum to be implemented was that of the international neonatal resuscitation program (NRP) with a duration of 6 hours. A total of n=26 birth attendants work at the hospital where the study was conducted and n=14 attended the resuscitation course. This course was suitable to the resource limited setting as it did not require advanced equipment. A pre-course survey was requested to measure impact of the education. The education was implemented followed by student evaluations after the course. This survey tool assessed the domains of attitude, knowledge and skills. The pre-post education impact assessment showed a positive impact on learners' skills, knowledge and attitudes. This was followed by a study on the impact of neonatal in-hospital mortality. A total of n=3449 births pre-education and n=3515 post education was assessed. The neonatal mortality rate before education was 20.9/1000 live births, compared to 21.9/1000 births post education (41). There are several possible reasons for this increase in neonatal mortality rates. The curriculum of six hour may have not been comprehensive enough to have a change on patient outcomes. There was also a staff turnover of seven of the fourteen birth attendants that attended the training who resigned during the study period. The international curriculum used may not have been well suited to the resource constrained setting. The two groups of patients had limited data which

prevented a comparison of patient characteristics and maternal risk factors having a negative impact on trustworthiness.

Education as an intervention to mitigate clinical risk does show a positive impact on perceived knowledge gain, attitudes and skills development. How these perceived improvements translate into patient outcome has to be interpreted with caution as there are many barriers in a resource constrained setting that can have an effect on patient outcome. It is important to explore what local and international curricula in neonatal critical care transfer education are available, as these may be used to address the limited neonatal specific education of ALS providers.

Current South African neonatal transfer education

This section will explore the South African curricula in neonatal critical care transfer education. The curricula found, were those in critical care presented by three of the South African universities in BEMC as compared in a study by Conradie et al. (19). Importantly, these curricula were not neonatal specific only. The study found that one of the universities differed largely from the other two in its curriculum design. The theme of critical care presented by these Universities include neonatal critical care transfer content. (19). The curricula are described in the table below:

Table 1: South African University critical care curricula (19)

Content or competency descriptors
<p>General</p> <p>Under the general section some of the functions in the ICU setting are described such as the management of pressure ulcers and care of inter costal drains.</p> <p>Ventilation</p> <p>Various aspects of ventilation are discussed under this heading. Broad categories are mentioned, from when to ventilate, modes of ventilation, use of equipment and what parameters to monitor.</p> <p>Patient monitoring</p> <p>This section describes the monitoring aspects to consider for a patient in ICU with a focus on ventilation.</p> <p>Arterial blood gas</p> <p>Method of obtaining an Arterial Blood Gas (ABG) sample and how to interpret ABG readings are discussed in this section.</p> <p>Monitoring</p>

The general haemodynamic parameters that require monitoring in an ICU environment are listed here such as temperature and non-invasive blood pressure for example.

Infusions

The various applications and use of infusion devices in an ICU setting is discussed here. How to troubleshoot the device and calculate infusion rates as well as nasogastric feeds and total parenteral nutrition.

Fluid balance

This section describes considerations of how to choose the correct fluid for specific conditions and how to monitor the balance.

Imaging

The interpretation of chest x-rays is listed as an outcome under this heading.

Preparation for transfer, transfer and handover

This section describes various considerations that have to be made before transporting a patient in a CCR environment. These outcomes included: patient referral documentation, how to package the patient, the negative effects that transport may have on the patient and what to hand over at the receiving facility.

Special populations

This section describes special populations which included neonates. The neonatal content was covered in the different sections and some specific neonatal content covered under this heading.

Obstetrics and gynaecology emergencies

This section describes the entire process from conception through to birth and includes the foetal circulation and transition post birth. Other general obstetric emergencies are also covered in this section.

Program structure (subjects, units etc.)

The modules of critical care consisted of intensive care, thrombolytics, aeromedical transportation and dive emergencies. It is interesting that neonatal critical care transfers were not a stand-alone discipline. The one university opted to incorporate the critical care curricula with other modules and the other two universities present it as a stand-alone module.

Learning activities (Lectures, workshops etc.)

Lectures were the main platform with some online content delivered as a supplement. The online content varied from pre-reading material to videos and tutorials. Information technology used by the universities were the Blackboard and Moodle platforms to deliver online content (19). Work integrated learning was another form of acquiring knowledge and skills in the field of critical care. The learning sites did include Neonatal ICU for all three universities.

Assessments (Tests, clinical examinations)
The assessment component was divided into practical and theory. Practical assessments consisted of patient simulations and Objective Structured Clinical Examination (OSCE). The theory evaluations were divided into different sub-components with different weightings. The weightings and sub-components varied widely between the universities. The theoretical assessments consisted of assignments, written tests, simulations, orals and OSCE (19).
Schedules (Date, time, location)
Full time study as part of the BEMC qualification. The critical care curricula are presented over either a full year or semester period.
People (Students, faculty etc.)
The first university employed four staff members (2 x PhD in EMC, 1 x BEMC, 1 x Prof. Nurse), the second 1 x PhD in EMC and the third 1 x BEMC. One could interpret this as a different importance weighting per university on the subject of critical care
Resources (Teaching materials, equipment etc.)
Not described
Course evaluations (By students, faculty and external bodies)
Not described
Learning portfolios
Assessment for the integrated learning was in the form of case studies, oral presentations, reflective journals and patient report forms (19).
Financial information
Cost not specified as it forms part of the 4-year BEMC programme.

The curriculum offered by the Universities do not feature as a standalone neonatal critical care transfer module and although many of the content can relate to neonatal critical care, there are special considerations for this patient group that require dedicated time, content, evaluations and specialists in the field to present it. This raises the question of whether the neonatal content delivered has enough depth to prepare new graduates for critical care transfers? As this was the only study found to compare local critical care transfer curricula, international offerings have to be explored.

International neonatal critical care curricula

This section describes the international curricula that covers some or all aspects of neonatal critical care transfer education. Paediatric and neonatal critical care transport is a book published by BMJ

books and cited as the only manual of neonatal and paediatric transport practice for the UK (42). This book only provides content and not a full curriculum, which will be specified by the training institution.

Table 2: Paediatric And Neonatal Critical Care Transport (42).

Content or competency descriptors
<p>Planning for safe and effective transport</p> <p>This section describes what the principles of safe transport are and the type of equipment required for a safe transfer. The physiological considerations of patients during transport especially children during flight are also listed.</p> <p>Practical transport management</p> <p>This section lists some important considerations for management of a critically ill neonate in the back of the ambulance. This included resuscitation, ventilation, fluid management, how to manage an airway, pharmacological intervention, documentation and some drug calculations.</p>
Financial information
Book cost \$64-50

The headings of this book cover many aspects that can be included in a neonatal CCR course but is limited to content only and does not give guidance on the TLA aspects.

NAPSTaR (Neonatal, Adult and Paediatric Safe Transfer and Retrieval) is a short course for medical professionals involved in transfers, presented by the Advanced Life Support Group in the United Kingdom (43) The curriculum is described in the following table:

Table 3: NAPSTaR (Neonatal, Adult and Paediatric Safe Transfer and Retrieval) (43)

Content or competency descriptors
<p>This curriculum starts off with an introduction to neonatal transfers. Communication is a prominent feature under the content which spans from the call centre to accepting and final handover stages. The methods of preparing your patient for transfer and the various equipment used, safety and adverse events are also discussed.</p>
Program structure (subjects, units etc.)
Single unit short course
Learning activities (Lectures, workshops etc.)
Lectures taught in class with practical workshops, skill stations and simulations
Assessments (Tests, clinical examinations)

Continuous assessment during course but methods not specified
Schedules (Date, time, location)
Two-day face to face course presented in the UK
People (Students, faculty etc.)
Students from medical, nursing and paramedic backgrounds. Faculty not specified.
Resources (Teaching materials, equipment etc.)
Not specified
Course evaluations (By students, faculty and external bodies)
Not specified
Learning portfolios
None
Financial information
Unknown

This course appears to be more of an introduction to neonatal transfers but does cover some essential topics.

Advanced Paediatric Life Support (APLS) is a short course that has been adopted by the European resuscitation council as its prescribed training for medical professionals that manage paediatric patients (44).

Table 4: Advanced Paediatric Life Support (APLS) (44).

Content or competency descriptors
Broad course outcomes are listed and outlines a general approach to the ill child. How to recognise the seriously ill child and different presentations of different pathologies. The conditions discussed include both trauma and medical and how to manage these children under the various conditions including resuscitation and stabilisation.
Program structure (subjects, units etc.)
Single short course with no subjects
Learning activities (Lectures, workshops etc.)
<ul style="list-style-type: none"> • Lectures • online pre-preparation • skill stations

<ul style="list-style-type: none"> workshops scenarios
Assessments (Tests, clinical examinations)
<ul style="list-style-type: none"> Multiple choice questions Basic Life Support Airway management Scenario
Schedules (Date, time, location)
One day online and two-day face to face training course
People (Students, faculty etc.)
Faculty not specified. Student candidates from medical and nursing backgrounds.
Resources (Teaching materials, equipment etc.)
Not specified
Course evaluations (By students, faculty and external bodies)
Student feedback required
Supervisory visits at training institutions
Learning portfolios
None
Financial information
450 GBP for the two-day course

This course does cover some essential content for neonatal critical care transfer education but is more structured for in hospital users with emphasis placed on resuscitation and trauma.

The Paediatric advanced life support for experienced providers (PALS) course is a two day short course by the American heart association presented by training centres world-wide (45).

Table 5: Paediatric Advanced Life Support (PALS) (45).

Content or competency descriptors
The content of this course focusses on a systematic approach to the sick or injured paediatric patients. The focus is recognition and management of life-threatening presentations including resuscitation.
Program structure (subjects, units etc.)

Short course
Learning activities (Lectures, workshops etc.)
Two-day face to face course with online pre-course preparation
Assessments (Tests, clinical examinations)
<ul style="list-style-type: none"> • Online pre-course assessment • Multiple choice test in class • Simulations • Skills stations
Schedules (Date, time, location)
Two-day course presented across the world
People (Students, faculty etc.)
All medical professionals interested in paediatric care
Resources (Teaching materials, equipment etc.)
Online content
Videos
Books
Practical scenarios with medical dolls and training aids
Course evaluations (By students, faculty and external bodies)
By students after course (questionnaire)
Learning portfolios
None
Financial information
R3300

This course covers essential information that can relate to neonatal critical care transfer education, but it does not cover in depth content and specialised equipment often used in these transfers.

The Essentials in neonatal critical care orientation (ENCCO) course is an online course offered by the American Association of Critical Care Nurses (AACN) (46). The course is aimed at the nursing environment and has a more in-depth approach to neonatal critical care compared to some of the short courses reviewed. Many of the components listed here are applicable to the neonatal critical care transfer environment.

Table 6: Essentials in neonatal critical care orientation (ENCCO) (46).

Content or competency descriptors
<p>Patient Care</p> <p>This module discusses various topics that range from the transition from foetal to neonatal circulation to how to assess the neonate comprehensively. The care of the neonate in an ICU setting is discussed with considerations for the inclusion of family members. Neonatal pain management, nutrition and skin care are some of the topics included under this section.</p> <p>Respiratory Care</p> <p>Respiratory system conditions in the neonate are covered under this section including prematurity, those that present at birth and complications that arise due to invasive ventilation.</p> <p>Infectious Diseases</p> <p>Severe neonatal infection that progresses to septic shock is covered in this section.</p> <p>Neurology</p> <p>This section covers intracranial bleeds and seizure activity in the neonate.</p> <p>Metabolic Function and Disorders</p> <p>Blood sugar and bilirubin regulation are some of the topics included</p> <p>Neonatal Vascular Access</p> <p>Vascular access including central lines are covered in this section.</p>
Program structure (subjects, units etc.)
<p>Six units:</p> <ul style="list-style-type: none"> • Patient Care • Respiratory Care • Infectious Diseases and Management • Neurology • Endocrine • Neonatal Vascular Access.
Learning activities (Lectures, workshops etc.)
Online content in the form of videos and lessons
Assessments (Tests, clinical examinations)
Online tests
Schedules (Date, time, location)
One year
People (Students, faculty etc.)
Nurses that want to work in the NICU

Resources (Teaching materials, equipment etc.)
Online content
Course evaluations (By students, faculty and external bodies)
Not specified
Learning portfolios
None
Financial information
\$468-00

The Advanced Neonatal Life Support (ANLS) course is a one day short course by the American Heart Association presented by training centres world-wide (47).

Table 7: Advanced Neonatal Life Support (ANLS) (47).

Content or competency descriptors
The content of this course focusses on the resuscitation of newborns. The student will learn how to recognise the at risk pregnancy and how to prepare for the potential resuscitation. Students will coordinate the resuscitation as a team leader, focussing on advanced airway management, ventilation, fluid management and medications. The course will also cover ethical considerations and finally post resuscitation care.
Program structure (subjects, units etc.)
Short course
Learning activities (Lectures, workshops etc.)
One-day face to face course with online pre-course preparation
Assessments (Tests, clinical examinations)
<ul style="list-style-type: none"> • Online pre-course assessment • Multiple choice test in class • Simulations
Schedules (Date, time, location)
One-day course presented across the world
People (Students, faculty etc.)
All medical professionals interested in neonatal resuscitation.
Resources (Teaching materials, equipment etc.)
Online content

Videos
Books
Practical scenarios with medical dolls and training aids
Course evaluations (By students, faculty and external bodies)
By students after course (questionnaire)
Learning portfolios
None
Financial information
+/- R2000

This course covers essential information that can relate to neonatal critical care transfer education, but it does not cover in depth content and specialised equipment often used in these transfers.

Summary and interpretation

The literature review demonstrated that there is a need for the inter-facility transfer of neonates due to the centralisation of limited specialist neonatal resources (29). The lack of neonatal transport is one of the top ten avoidable causes of under-5 mortality (4). In HICs, the service of neonatal transfers is usually performed by dedicated inter-disciplinary teams. In South Africa this is not the case, where this service is mostly provided by ALS providers with variable education backgrounds (7). These ALS providers are also of the opinion that they lack training and specialised equipment to safely conduct neonatal transfers (21).

Neonatal transfers are high risk in nature in both LMIC and HIC settings. Neonates can experience physiological changes during transfer that can lead to clinical deterioration (5, 8, 10-12, 31-33). Time delays were also cited as a major contributor to adverse events (5, 7, 8). The level of education of the transferring professional is also a contributing factor to adverse events (5, 7, 8, 10, 13, 14, 21, 31-33). A lack of specialised equipment during these transfers can also lead to adverse events (5, 7, 10, 21, 30, 31, 33). The use of dedicated transfer teams is less prone to adverse events than non-dedicated teams (29, 30).

There are no dedicated courses in South Africa in neonatal critical care transfer education. A local study in emergency medicine curricula demonstrated the importance of informing your curricula with the local patient case mix (35). International approaches to curriculum development in neonatal care was explored with variable approaches found, but with most being designed as an add on to existing education in neonatal care (36-38). It is important to note that the implementation of a training programme does not necessarily translate into reduced adverse events or mortality rates (41). The entire system needs to be evaluated to assess problem areas in neonatal critical care retrieval transport.

The current education in neonatal critical care for pre-hospital providers are conducted at university level on the BEMC programmes. A local study compared the critical care curricula (19). Neonatal critical care was not a stand-alone discipline offered and the content was mixed with other age groups. The curricula did not mention the special needs of neonates or how it would be covered.

International sources of neonatal critical care curricula were compared in the final section of the literature review. Some courses were very short and can be described as an introduction to neonatal

critical care but focused mostly on resuscitation interventions and not the holistic approach to neonatal critical care transfers (43-45, 47). A textbook with a focus on neonatal critical care transfers found during the 'grey' literature search, demonstrated only content and no information on what the full curriculum would entail (42). An online course in neonatal critical care shows a more in-depth approach to neonatal care of high acuity patients, but the course was designed for the nursing field and does not include the aspects of transfer outside of the NICU. There also appeared to be a lack of consensus on the duration of the course, ongoing accreditation, and/or recertification. (46).

This literature review demonstrates that the need to transfer neonates remains a reality in our local context, but that this service comes at a high risk. Unfortunately, in our limited resource setting, many neonates are transferred by teams that are under equipped and lack neonatal specific knowledge. South Africa has limited dedicated CCR teams, and if they exist, they are ALS paramedic led and not multidisciplinary as seen in resource rich settings. As the current and past neonatal educational offerings for these ALS providers were limited, the need for additional education in this field have been identified. This additional education as a proposed intervention will aim to reduce the risk of adverse events in neonatal critical care transfers as seen globally with specialised teams. This proposed intervention should not be implemented by itself though, but consideration for various factors that can improve the system as a whole need to be included. It is important to explore the type of patients that are being transferred in South Africa and the findings should be shared with experts in the field so that they can relate it to their own experiences.

The aim of this study is to initiate the curriculum design in neonatal critical care transfer education. This is done through the integration of literature, local patient case mix and discussion with key experts and learner stakeholders. The completed curriculum has the potential to change the way that neonates are transferred in South Africa, especially if it becomes the standard through buy-in from governing bodies.

References

1. Venter C, Conradie N, Venter M, Jordaan L, Venter M, Stanton D, et al. A proposed definition of Critical Care Retrieval in the South African context. *South African Journal of Pre-hospital Emergency Care*. 2021;2(1).
2. Naidoo K, Singh J, Lalloo U. Critical analysis of ICU/HC beds in South Africa: 2008-2009. *South African Medical Journal*. 2013;103(10):751-3.
3. Bhagwanjee S, Scribante J. National audit of critical care resources in South Africa—unit and bed distribution. *South African Medical Journal*. 2007;97(12):1311-4.
4. Rhoda N, Velaphi S, Gebhardt G, Kauchali S, Barron P. Reducing neonatal deaths in South Africa: Progress and challenges. *South African Medical Journal*. 2018;108(3):9-16.
5. Ashokcoomar P, Naidoo R. An analysis of inter-healthcare facility transfer of neonates within the eThekweni Health District of KwaZulu-Natal, South Africa. *South African Medical Journal*. 2016;106(5):514.
6. Whyte HE, Jefferies AL. The interfacility transport of critically ill newborns. *Paediatr Child Health*. 2015;20(5):265-75.
7. Vincent-Lambert C, Wade G. Challenges relating to the inter-facility transport of high acuity paediatric cases. *African Journal of Emergency Medicine*. 2018;8(1):29-33.
8. Senthilkumar R, Corpuz N, Ratnavel N, Sinha A, Mohinuddin S. Adverse events during emergency transfer of neonates performed by regionalised dedicated transfer service. *Archives of Disease in Childhood*. 2011;96(Suppl 1):A91-A.
9. Ratnavel N. Safety and governance issues for neonatal transport services. *Early Human Development*. 2009;85(8):483-6.
10. Henry S, Trotman H. Challenges in neonatal transport in Jamaica: A resource-limited setting. *Journal of tropical pediatrics*. 2017;63(4):307-13.
11. Thwala MD. The quality of neonatal inter-facility transport systems within the Johannesburg metropolitan region. Johannesburg: University Of Witwatersrand; 2012.
12. Goldsmit G, Rabasa C, Rodríguez S, Aguirre Y, Valdés M, Pretz D, et al. Risk factors associated to clinical deterioration during the transport of sick newborn infants. *Arch Argent Pediatr*. 2012;110(4):304-9.
13. Venter M, Stassen W. The capabilities and scope-of-practice requirements of advanced life support practitioners undertaking critical care transfers: A Delphi study. *Southern African Journal of Critical Care*. 2016;32(2):58.

14. Royal C, McKerrow N. A retrospective review of the transfer of critically ill children to tertiary care in KwaZulu-Natal Province, South Africa. *South African Journal of Child Health*. 2015;9(4):112-8.
15. Sobuwa S, Christopher LD. Emergency care education in South Africa: past, present and future. *Australasian Journal of Paramedicine*. 2019;16.
16. Education CoH. NATIONAL QUALIFICATIONS FRAMEWORK 2008 [19.10.2021]. 1-25]. Available from: <http://www.saga.org.za/docs/legislation/2010/act67.pdf>.
17. SAQA. SAQA qualification database 2020 [19.10.2021]. Available from: <http://allqs.saga.org.za/search.php>.
18. PBEC H. Clinical Practice Guidelines HPCSA Portal2018 [19.10.2021]. Available from: <https://www.hpcs.co.za/Uploads/EMB/CLINICAL%20PRACTICE%20GUIDELINES%20%20-%20PROTOCOLS-%20JULY%202018.pdf>.
19. Conradie NJ. A comparison of critical care transportation modules taught in bachelor's degrees in emergency medical care in South Africa: Faculty of Health Sciences; 2020.
20. Venter M, Stanton D, Conradie N, Jordaan L, Venter C, Stassen W. The need for setting standards in critical care transfers. *Southern African Journal of Critical Care (Online)*. 2017;33(1):32-.
21. Ismail E. Preparedness of Western Cape ALS providers to provide clinical stabilisation and intensive care for neonates during the patient journey. <https://openscholar.dut.ac.za/handle/10321/12>: Durban University of Technology; 2018.
22. Anders Ericsson K. Deliberate Practice and Acquisition of Expert Performance: A General Overview. *Academic Emergency Medicine*. 2008;15(11):988-94.
23. McKimm J. Curriculum design and development [19.10.2021]. Available from: https://www.researchgate.net/publication/41041272_Curriculum_and_course_design.
24. Kern DE. A six-step approach to curriculum development. P Thomas, D Kern, M, Hughes, & B Chen, *Curriculum development for medical education*. 2016:5-9.
25. Lave J, Wenger E. *Situated learning: Legitimate peripheral participation*: Cambridge university press; 1991.
26. Werner JM, Scovotti C, Cummings RG, Bronson JW. Building a Case for Active Learning: The Use of Lecture vs. Other Classroom Activities at LMBC. *Journal of Learning in Higher Education*. 2018;14(1):7-15.
27. Reime MH, Johnsgaard T, Kvam FI, Aarflot M, Engeberg JM, Breivik M, et al. Learning by viewing versus learning by doing: A comparative study of observer and participant experiences during an interprofessional simulation training. *Journal of Interprofessional Care*. 2017;31(1):51-8.
28. Boyle MA, Dhar A, Chaudhary R, Kent S, O'Hare SS, Dassios T, et al. Introducing high-flow nasal cannula to the neonatal transport environment. *Acta Paediatrica*. 2017;106(3):509-12.

29. Hamrin TH, Berner J, Eksborg S, Radell PJ, Fläring U. Characteristics and outcomes of critically ill children following emergency transport by a specialist paediatric transport team. *Acta Paediatr.* 2016;105(11):1329-34.
30. Ramnarayan P, Thiru K, Parslow RC, Harrison DA, Draper ES, Rowan KM. Effect of specialist retrieval teams on outcomes in children admitted to paediatric intensive care units in England and Wales: a retrospective cohort study. *The Lancet.* 2010;376(9742):698-704.
31. Sogomo JA. Care of referred neonates during transport to the newborn unit at Moi Teaching and Referral Hospital, Eldoret-Kenya: Moi University; 2018.
32. Dalal E, Vishal G, Solanki D. Study on neonatal transport at tertiary care centre. hospital. 2013;84(28):49.
33. Sabzehei MK, Basiri B, Shoukhi M, Torabian S, Razavi Z. Factors affecting the complications of interhospital transfer of neonates referred to the Neonatal Intensive Care Unit of Besat Hospital in 2012–2013. *Journal of Clinical Neonatology.* 2016;5(4):238.
34. Bose A. Transfer of the Sick Neonate: What Is Needed? *J Trop Pediatr.* 2017;63(3):165-6.
35. Cohen KL, Wallis LA. Is the current South African emergency medicine curriculum fit for purpose? An emergency medicine practice analysis. 2011;28(11):955-8.
36. Petty J. Neonatal Surgical Nursing: Widening the scope of neonatal nurse education. 2011;17(1):11-6.
37. Sawyer T, French H, Soghier L, Barry J, Johnston L, Anderson J, et al. Educational Perspectives: Boot Camps for Neonatal-Perinatal Medicine Fellows. 2014;15(2):e46-e55.
38. French H, Gray M, Gillam-Krakauer M, Bonachea EM, Carbajal M, Payne A, et al. Flipping the classroom: a national pilot curriculum for physiology in neonatal–perinatal medicine. *Journal of Perinatology.* 2018;38(10):1420-7.
39. Verónica RM, Gallo LL, Medina DR, De la Torre M, Mancilla JLS, Amezcua MM, et al. Safe neonatal transport in the state of Jalisco: impact of the STABLE program on morbidity and mortality. *Bol Med Hosp infantile Mex.* 2011;68(1):31-5.
40. Kilday D, Spiva L, Barnett J, Parker C, Hart P. The Effectiveness of Combined Training Modalities on Neonatal Rapid Response Teams. 2013;9(7):e249-e56.
41. Hole MK, Olmsted K, Kiromera A, Chamberlain L. A Neonatal Resuscitation Curriculum in Malawi, Africa: Did It Change In-Hospital Mortality? *International journal of pediatrics.* 2012;2012:408689.
42. Barry P, Leslie A. Paediatric and neonatal critical care transport: Wiley-Blackwell [Imprint]; 2003.

43. Bruisten S, Nilsson-Ihrfelt E, Buhrman M, Ekselius L, editors. TOXBASE. Emerg Med J. 2006 Aug; 23 (8): 614-7. PMID: 16858093 [PubMed-in process] 24: Team V, Markovic M. Internet advertising of artificial tanning in Australia. Oncol Nurs Forum; 2006.
44. Group ALS. Advanced paediatric life support: the practical approach: John Wiley & Sons; 2011.
45. Chameides L. Pediatric Advanced Life Support Provider Manual: AMER HEARTH ASSN; 2016.
46. (AACCN) AAoCCN. Essentials of Neonatal Critical-Care Orientation 3.0 2020 [Available from: <https://www.aacn.org/store/books/encco3ind/essentials-of-neonatal-criticalcare-orientation-30>].
47. Association AH. Advanced Neonatal Life Support Course [03.07.2022]. Advanced Neonatal Life Support Course]. Available from: <https://www.cardiocare.co.za/advanced-neonatal-life-support-course.html>.

Table 7: Literature review journal articles summary

YEAR AUTHOR REFERENCE & TITLE	SAMPLE SIZE/ SETTING	STUDY DESIGN/ METHODOLOGY	PRIMARY OUTCOME	LIMITATIONS AND CONFOUNDERS
2016: Ashokcoomar P, Naidoo R. An analysis of inter-healthcare facility transfer of neonates within the eThekwini Health District of KwaZulu-Natal, South Africa. (5)	120 inter-healthcare facility neonatal transfers that were conducted between December 2011 and January 2012. All transfers were conducted by road in the eThekwini Health District in Kwazulu-Natal.	Prospective, quantitative descriptive analysis. Questionnaires used for data collection.	Identify shortfalls in neonatal IFTs: Time delays, equipment problems and adverse events.	Only public sector EMS personnel. Risk of observation bias as participants were from variable education backgrounds. Strong external validity in that it highlights many important shortfalls of neonatal transfers in LMICs.
2012: Thwala MD. The quality of neonatal inter-facility transport systems within the Johannesburg metropolitan region. (11)	96 neonatal transfers in Johannesburg between Oct and Dec 2007.	Cross sectional, descriptive study with analytical components	Adverse event reporting description. Confirms poor clinical condition of neonates on arrival at hospital with high mortality rates.	Stronger internal validity could have been assured if vital signs on departure at the referring hospital were available. The study does have strong external validity due to LMIC setting.
2018: Sogomo JA. Care of referred neonates during transport to the newborn unit at Moi Teaching and	N=122 neonates. Single centre newborn unit in Kenya at a teaching hospital who	Cross sectional descriptive study	Majority of the neonates had hypothermia on admission. Despite ambulances being used, the monitoring,	Consecutive sampling limited sampling bias. Risk of observation bias as the receiving physicians would be sensitised to the risk of

Referral Hospital, Eldoret-Kenya. (31)	received neonates between Feb 2016 to July 2016.		warmth provision of enteral feeds or intravenous fluids received by the neonates during transport was inadequate.	documenting any mistakes on their side and was already well aware of the challenges during transfer. Good external validity to our LMIC context.
2013: Dalal E. Study on Neonatal Transport at Tertiary Care Centre. (32)	N=300 neonates received at a tertiary NICU in India between July 2010 and July 2012 and clinical parameters recorded.	Cross sectional, descriptive study with analytical components	Patients on admission experienced hypothermia (55%), hypoxia (27%), hypoperfusion (23%) and hypoglycaemia (20%) resulting in high mortality rates. Only half of neonates that were admitted to hospital arrived by ambulance and that only n=133 (44%) of patients were escorted by trained paramedics.	Random sampling not described which could lead to selection bias. Risk of observation bias as the receiving physicians would be sensitised to the risk of documenting any mistakes on their side and was already well aware of the challenges during transfer. Strong external validity to our local context where the qualified medical personnel that escort patients are a limited resource in LMICs.
2018: Vincent-Lambert C, Wade G. Challenges relating to the inter-facility	Interviews with 6 participants from public sector in Johannesburg.	Qualitative, explorative design. Interviews with purposefully identified role players.	Identified main challenges namely: time delays, low levels of education and training of ambulance	This study was limited to the state sector in the Gauteng province, and only one role player per discipline was interviewed. Input

transport of high acuity paediatric cases. (7)			attendants, poor communication between role players and a lack of appropriate equipment	from private sector and other provinces required. External validity strong as key role players participated.
2016: Sabzehei MK. Factors affecting the complications of inter-hospital transfer of neonates referred to the Neonatal Intensive Care Unit of Besat Hospital in 2012–2013. (33)	n=100 neonates that were transported to a major NICU in Iran between 2012 and 2013.	Cross sectional descriptive study	Complications were recorded in 32% of patients with hypotension and hypothermia being the most prevalent.	Strong external validity as it was conducted in a LMIC country. Limited by the single centre design which could lead to observation bias. Lacked patient data before departure.
2018: Ismail E. Preparedness of Western Cape ALS providers to provide clinical stabilisation and intensive care for neonates during the patient journey. (21)	n=145 questionnaires completed by ALS EMS personnel in the western cape.	Quantitative, descriptive study.	ALS EMS personnel felt that they require additional exposure, training and specialised equipment	Convenience sampling. ALS personnel inclusion criteria not based on neonatal transfer. This study was limited to the WC province. It would have also been beneficial to include the opinion of BEMC providers.
2012: Goldsmit G, Rabasa C, Rodríguez S, Aguirre Y, Valdés M, Pretz D, et al. Risk factors associated to	N=160 neonatal transfers were analysed in Argentina at a single receiving facility	Observational study comparing pre and post transfer risk scores of neonates.	High percentage of referred neonates deteriorate during transfer.	The method of pre and post transfer data collection ensured internal validity, and the TRIPS score only requires the entry of

clinical deterioration during the transport of sick newborn infants. (12)	between Jul 2009 and May 2010.			simple parameters avoiding subjective views which mitigates measurement bias.
2017: Henry S, Trotman H. Challenges in neonatal transport in Jamaica: A resource-limited setting. (10)	N=50 neonatal transfers over 15 months were described in Jamaica.	Prospective observational study. Clinical status of the neonates described before, during and after transfer. Checklist completed upon arrival at receiving hospital.	Lack of equipment and trained personnel were cited as contributing towards poor outcome of patients.	Internal validity was limited due to a lack of monitoring data during transport and a lack of patient data from the referring hospital. The study is relatable to our LMIC setting.
2016: Hamrin TH. Characteristics and outcomes of critically ill children following emergency transport by a specialist paediatric transport team. (29)	N=222 patients admitted to a tertiary PICU in Sweden from 1 January 2008 to 31 December 2013	Retrospective descriptive study	Patients admitted to PICU by specialist teams were sicker and were admitted for longer compared to other acutely ill patients admitted.	External is limited as multidisciplinary specialist retrieval teams are not currently a reality in South Africa. Patients enrolled in the study were consecutive admissions which ruled out selection bias.
2011: Senthilkumar R, Corpuz N, Ratnavel N, Sinha A, Mohinuddin S. Adverse events during emergency transfer of neonates performed by	N=1289 transfers were conducted over a 13-month period by a single service in the UK and adverse events were analysed.	Prospective observational study. Adverse event reporting was analysed for common themes.	Major contributors to adverse events were delay in transfer, difficult ventilation (tube placement or over ventilation). Education of	Single service performed neonatal transfers. It would have been beneficial to get data from various specialised services to ensure trustworthiness.

regionalised dedicated transfer service. (8)			these employees required to address the problem.	
2017: Boyle MA. Introducing high-flow nasal cannula to the neonatal transport environment. (28)	N=75 neonates had blood gas analysis done post arrival by team that initiated high flow nasal cannula therapy.	Service evaluation project	The therapy was well tolerated by the patients' avoiding intubation for transfer	Not all neonates had blood gas analysis done on arrival that could lead to sampling bias.
2013: Kilday D. The Effectiveness of Combined Training Modalities on Neonatal Rapid Response Teams. (40)	N=29 participants involved in neonatal transfers took part in an educational intervention study. The study involved questionnaires and patient simulations pre and post intervention.	Quasi-experimental, pre-post-test design and a simulation observational method	Increased team performance, teamwork and safety.	Study did not evaluate actual effect on patient care and was a single centre study with a small sample size. Internal validity would have been stronger if the patients' clinical condition were measured before and after.
2010: Ramnarayan PT. Effect of specialist retrieval teams on outcomes in children admitted to paediatric intensive care units in England and	N=16 875 paediatric patients were transferred by ambulance, of which 81% were transferred by specialist teams and 19% by non-specialist teams in England	Retrospective cohort study	The patients transferred by specialist teams had a lower risk-adjusted mortality rate in PICU.	This risk adjustment method had the potential to introduce selection bias. The findings of the study are not relatable to our local context as the use of multidisciplinary teams is not the norm in LMICs.

Wales: a retrospective cohort study. (30)	and Wales between 2005 and 2008.			
2016: Venter M. The capabilities and scope of practice requirements of advanced life support practitioners undertaking critical care transfers: A Delphi study. (13)	Three rounds of online surveys completed by seven experts in the field.	Delphi Study	Paramedics that undertake specialist transfers should have additional training	External validity would have been strengthened with a larger sample of experts.
2015: Candice R. A retrospective review of the transfer of critically ill children to tertiary care in KwaZulu-Natal Province, South Africa. (14)	N=57 PICU referrals and 79 ward referrals were retrospectively reviewed in South Africa. January to June 2012.	Retrospective chart review	Paediatric transfers in KZN South Africa are insufficient due to patients not being stabilised prior to transfer	Retrospective design subject to incomplete medical records which could lead to measurement bias. Single district study gave the study limited external validity.
2011: Cohen KL, Wallis LA. Is the current South African emergency medicine curriculum fit for purpose? (35)	n= 1283 EC cases in the Western Cape was analysed to determine the type of cases that EM registrars faced.	Cross sectional retrospective audit.	The EM curriculum at the time did not cover all the conditions, procedures and investigations encountered in the EC.	The secondary level hospitals used for data collection did not represent the true burden of disease. Accuracy of data collection tools in state hospitals are not

				accurate which could lead to measurement bias.
2011: Petty J. Neonatal Surgical Nursing: Widening the scope of neonatal nurse education. (36)	Description of the process of curriculum design for a new module in surgical neonatal care in the NHS.	Literature review and expert opinion.	Complete design of a new curriculum in modular form to supplement the current nursing degree.	A summary of the design process without insight into all scientific processes involved.
2014: Sawyer T, French H, Soghier L, Barry J, Johnston L, Anderson J, et al. Educational Perspectives: Boot Camps for Neonatal-Perinatal Medicine Fellows. (37)	Description of curriculum design for boot camps in neonatal-perinatal medicine	Description of Kerns methodology of curriculum design, but generic in approach.	New curriculum in boot camps for neonatal-perinatal medicine fellows.	Content was generic with minimal specifics on how the course outcomes were derived. This article is relatable to our local context as a lack of exposure to neonatal transfers can lead to an attrition of skills.
2018: French H, Gray M, Gillam-Krakauer M, Bonachea EM, Carbajal M, Payne A, et al. Flipping the classroom: a national pilot curriculum for physiology in neonatal-perinatal medicine. (38)	A pilot study in the United States on the neonatal-perinatal medicine programme. To explore the effectiveness in the online / flipped classroom method of teaching.	Prospective observational study. n=62 respondents to the surveys. N=6 educators and n=41 fellows (students) took part in the focus group discussions.	Positive response to method of teaching.	Multiple training institutions would have achieved stronger trustworthiness. This study has strong external validity to our local context as the design of a neonatal critical care transfer curriculum could benefit from the same approach.

<p>2012: Hole MK, Olmsted K, Kiromera A, Chamberlain L. A neonatal resuscitation curriculum in Malawi, Africa: did it change in-hospital mortality? (41)</p>	<p>Implementation of international neonatal training in Malawi with pre-post impact analysis through surveys. Impact on in-hospital mortality rates through observation of pre-post training patient statistics. N=3449 births pre-training and n=3515 post training was assessed.</p>	<p>Observational, longitudinal study of secondary patient data.</p>	<p>Training did not improve in hospital mortality rates.</p>	<p>The two groups of patients had limited data which prevented a comparison of patient characteristics and maternal risk factors having a negative impact on trustworthiness. This study does have strong external validity as it indicates that pre-post education surveys do not necessarily translate into improved patient care in a resource limited setting.</p>
<p>2011: Veronica RM. Safe neonatal transport in the state of jalisco: impact of the S.T.A.B.L.E. program on morbidity and mortality. (39)</p>	<p>N=3277 infants observed. N=384 before educational intervention and 2893 post intervention over a 5-year period.</p>	<p>Prospective observational study</p>	<p>Improved patient care</p>	<p>Data capturing method info limited. Single Centre design. External validity was limited as none of these patients were mechanically ventilated. The reliability of the study is questionable as there was limited information shared on the study design process.</p>
<p>2020: Conradie NJ. A comparison of critical care transportation modules</p>	<p>Comparison of the critical care curricula presented by three</p>	<p>Qualitative content analysis of critical care curricula components</p>	<p>Two universities had similar curricula and one university differed in most aspects.</p>	<p>External validity of the study would have been strengthened if all the</p>

<p>taught in bachelor's degrees in emergency medical care in South Africa. (19)</p>	<p>of the South African Universities in BEMC.</p>			<p>universities that present the BEMC course participated.</p>
<p>2021: Venter C. A proposed definition of Critical Care Retrieval in the South African context. South African Journal of Pre-hospital Emergency Care. (1)</p>	<p>Consensus on what defines a Critical Care Retrieval Service (CCRS) was sought from experts in the field</p>	<p>Consensus from various Emergency Care Bodies</p>	<p>One of the five key aspects of the CCRS definition identified was dedicated crew members with additional training. This definition was endorsed by the Emergency Care Society of South Africa (ECSSA), the Southern African Society of Critical Care (SASCC) and the International Board for Speciality Certification (IBSC)</p>	<p>External validity to our context is strong as it defines CCR which supports the service as a speciality in the field.</p>

PART B: MANUSCRIPT

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL CRITICAL CARE TRANSFERS

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ABSTRACT

Background

Owing to limited neonatal care resources, the transfer of neonates to district and tertiary facilities is inevitable in a Low- and Middle-Income Country (LMIC) such as South Africa. The lack of neonatal transport is one of the top ten avoidable causes of under-5 mortality. In South Africa, these transfers are mostly conducted by Advanced Life Support (ALS) Providers with limited neonatal specific education. The transfer of neonates by teams with limited neonatal knowledge can lead to high adverse event rates. Dedicated Critical Care Retrieval Services (CCRS) teams have providers with additional education in neonatal critical care transfers and have shown a lower risk of adverse events in developed settings. Given the limited neonatal education of ALS providers that conduct transfers and the lack of dedicated CCRS teams in South Africa, it is the aim of this study to initiate the development of a neonatal critical care transfer curriculum.

Methods

A general and targeted needs assessment was conducted through semi-structured interviews with experts in the field and a focus group discussion with a learner group. The voice recordings were transcribed verbatim and data were analysed inductively, using content analysis to the manifest level.

Results

Six experts in neonatal critical care transfers participated in semi-structured interviews with a mean duration of 59 minutes (51-68min). Following transcription and analysis, 372 codes were extracted. Seven learners that involved in neonatal transfers in South Africa participated in a semi-structured focus group discussion with a duration of 91 minutes. The audio recording was transcribed and analysed with 97 codes extracted. The main categories were: Current status of neonatal CCR in South Africa; Learning and education in neonatal CCR; and proposed curriculum structure. The proposed curriculum structure described 13 broad course outcomes to be delivered as a blended postgraduate programme. Participants noted that funding, employer buy-in and internet resources would be required. The targeted student group should be all ALS providers with a change in their scope of practice on completion.

Conclusion

This study described the specific needs of prehospital learners as it pertains to the teaching, learning and assessment (TLA) of a curriculum in neonatal critical care transfers. It also described some of the limitations in the current and past education systems in neonatal critical care transfers. This study provides broad course outcomes and the results can be used to inform the next steps in curriculum development for education in neonatal critical care transfers.

BACKGROUND

Owing to limited neonatal care resources, the transfer of neonates to district and tertiary facilities is inevitable in Low- and Middle-Income Countries (LMICs), such as South Africa. The lack of neonatal transport is one of the top ten avoidable causes of under-5 year mortality (1). Neonatal transfers are high risk in nature in both LMIC and High-Income Country (HIC) settings. Neonates can experience physiological changes during transfer that can lead to clinical deterioration (2-9). Time delays and level of education of the transferring professional are major contributors to adverse events (AEs) (2, 5-13). A lack of specialised equipment during these transfers can also lead to AEs (2, 5, 6, 8, 10, 11, 14). Specialised equipment, such as humidification, continuous positive airway pressure (CPAP), and high flow therapy is often available on dedicated critical care transfer units in HICs, but this is not the norm in a LMIC.

In HICs, the service of neonatal transfers is usually performed by dedicated inter-disciplinary teams staffed by a combination of doctors, pre-hospital providers and nursing staff. In South Africa, however, this service is mostly provided by Advanced Life Support (ALS) providers with variable education backgrounds (10) and who have reported that they lack the education and specialised equipment to safely conduct neonatal transfers (11). The use of dedicated transfer teams is less prone to adverse events than non-dedicated teams (14, 15). Despite this, there are currently no courses dedicated to neonatal critical care transfer in South Africa.

The Health Professions Council of South Africa (HPCSA) has changed the way that education is conducted in the pre-hospital setting by discontinuing vocational training short courses. All courses are now provided by tertiary institutions and graded on the National Qualifications Framework (NQF). These qualifications, which are often described in the industry under the term ALS, include ECP (Emergency Care Practitioner: Bachelor's/B-Tech BEMC), CCA (Critical Care Assistant), ECT (Emergency Care Technician), and Paramedic (Diploma in EMC, Old National Diploma in Ambulance Emergency Technician (AET)).

The critical care curricula taught at University level on the BEMC programmes to ALS provider students were compared in a local study (16). Neonatal critical care was not a stand-alone discipline offered and the content was mixed with other age groups. The curricula did not mention the special needs of neonates or how it would be covered. This limited education in neonatal critical care transfers affects the level of care that these patients will receive during retrieval.

The level of care provided in neonatal transfers in South Africa can be described as either inter-facility transfers (IFT) or critical care retrieval (CCR). CCR refers to the stabilisation and transport of critically ill or injured patients from a healthcare facility where the healthcare requirements of the patient outweigh the diagnostic or treatment abilities to an appropriate facility where these are available (17). The definition of a Critical Care Retrieval Service (CCRS) include five aspects namely a patient population that meets specific criteria, case selection by specialised call centre personnel, dedicated CCR crew members with additional training, dedicated equipment, and quality management and continuous training (17). These neonates that require CCR have life threatening conditions that require life support, invasive monitoring techniques, and potentially resuscitation. The HPCSA recommend that the transfer of ventilated neonates should be limited to the ECP scope of practice (18). This, however, is dependent on available resources and not always a reality in an LMIC such as South Africa. The Critical Care Retrieval Work Group (CCRWG) of South Africa defined that the transfer of neonates that meet CCR criteria should be reserved to dedicated CCR crew members with additional education in this field (17).

Given the limited neonatal education of ALS providers that conduct transfers and the lack of dedicated CCR teams in South Africa, it is the aim of this study to initiate the development of neonatal critical care transfer curriculum which has the potential to reduce AEs.

Curriculum Development Framework

To develop additional education in neonatal critical care retrieval requires a structured approach. Kern (19) provides a framework of curriculum development in six steps. The first three steps include a general and targeted needs assessment that informs the goals and objectives of the course that is being designed. The next steps namely: educational strategies, implementation, evaluation and feedback were beyond the scope of this study. In these steps it will be necessary to further consult with the different stakeholders and then undertake a consensus process (such as Delphi or nominal group technique) in order to finalise the work. During these phases, a broader and more systematic consultation with neonatology and other expert groups will be necessary.

METHODS

This study followed a descriptive qualitative design. Opinions were explored by semi-structured interviews and a focus group discussion. This study explored the first three steps of curriculum development as described by Kern (19). In the first step, one on one interviews with experts in

neonatal CCR was used to conduct the general needs assessment, which clearly defined the problem that helped focus the curriculum's goals and objectives (19). The second step of the targeted needs assessment was conducted through a focus group discussion with a targeted group of learners. (19). Information obtained from learners included perceptions of previous learning experiences, perceived deficiencies, learning preferences, barriers and available resources. In step three the identified needs were used to derive course outcomes.

Research Paradigm

This study was conducted within the social constructivist paradigm (20). The paradigm's assumptions of relativist ontology are that reality is subjectively based on the understanding of social and experimental levels (21). This paradigm also includes community of practice as learning does not only originate from a single source or institution, but occurs rather as a result of the community that these providers find themselves in. The community that these providers will learn from are not limited to the prehospital environment either, but include the Emergency Centre (EC) and Intensive Care Unit (ICU) settings as well. Essential knowledge is shared between these individuals and form part of the learning process. It was thus important to include the role-players that form part of this community when developing a new curriculum. Community of practice falls within the theory of situated learning and forms part of a conceptual framework in education (22). The inclusive process of communities of practice helps with the identification of outcomes during curriculum design as the participation in input by all parties are essential (22).

Study setting

The study was conducted in the LMIC setting of South Africa where the transfer of neonates are mostly conducted by ALS providers with variable education backgrounds (10) and these ALS providers are of the opinion that they need additional education and specialised equipment to conduct these transfers safely (11). The participants represented various provinces across South Africa. Both urban and rural areas were represented from the state and private sectors.

Sampling

One on One Interviews

The study made use of purposive sampling to recruit participants. The first group of participants were experts in neonatal CCRS and neonatology who were invited to individual one-on-one interviews. The

expert group included doctors, nursing professionals and ALS providers working in the field of CCRS with at least five years' experience.

Focus Group Discussion

The second group of participants were represented by learners. The term "learner" in this context was any individual that would potentially enrol in the neonatal critical care transfer course in future. Through purposive sampling, learners from different genders, representing urban, rural, state and private sectors were recruited. The learner group participants were registered with the HPCSA on the ANT or ECP registers and actively involved in the transfer of at least one neonate per month.

Data collection instrument

The discussion schedule was developed by the authors collaboratively through constant discussion and revision. This schedule was used as a guide by the facilitator during the interviews. The first section of the document was an introduction that gave a background and rationale to the study. The second section gave prompts for obtaining demographic information from the participants with the aim to determine experience and fair representation. The third section of the document provided prompts on exploring the current limitations to education in neonatal critical care transfers within academic and health institutions in South Africa. The fourth section provided prompts on deriving the objectives of a curriculum. The final section focussed on the specific needs to teaching, learning and assessment (TLA) in neonatal critical care transfer education.

Data Collection

The interviews and focus group discussion were conducted online due to the COVID-19 pandemic and the geographic spread of participants. The one-on-one semi-structured interviews with the experts were conducted first.

Participants were provided with a pre-reading document that informed the interviews and focus group discussion. The expert group's pre-reading document described the neonatal population currently transferred in South Africa, as described by Venter (23). The diagnoses, attachments and medications involved during the critical care transfer of these neonates by dedicated CCR teams were represented in charts and tables. The document also described the neonatal critical care curricula found during a literature review (16, 24-28).

The learner group's pre-reading document contained the same information, but had the addition of the expert group's suggested course content and methods of delivery and assessment. The participants were asked to share their opinion on the subject in their private capacities and not those of their employer or organization.

The interviews were guided by formulated questions but strict adherence to these were not required. Some new questions arose, and probing was required. The participants were encouraged to speak freely about the topic. Interviews were audio recorded and conducted up to the point where data saturation was achieved. Data saturation was defined as the point where further data collection was counterproductive and new data did not add any more value (29).

Data analysis

All voice recordings were transcribed verbatim, anonymised, and pseudonyms assigned to the transcripts. Data were analysed inductively to the manifest level. Meaning that categories and sub-categories were developed from the raw data while staying close to the words that were used by the participants (29). The steps of content analysis was based on the methods described by Erlingson et al. (30) and conducted on nVivo qualitative data analysis software (QSR International, Massachusetts, USA) (31). The transcripts were read and re-read by WW to get a sense of the content. The text was then divided into condensed meaning units by WW and shared with WS and ET for researcher triangulation. Codes were formulated by WW from the meaning units while maintaining the core meaning. These codes were then grouped into categories to the manifest level and shared with WS, ET and WK for investigator triangulation. For the development of the curriculum map, the codes of topic examples were expanded into course outcomes by WW, and shared with WS, WK and ET for review and refinement. The categorical development is presented in coding tree tables (Table 1, Appendices S1 and S2).

Table 1: Categorical development

Meaning unit	Code	Subcategory	Main Category
<i>“you would have to understand something about the critically ill infant and where you are taking them”</i>	Critically ill neonates	Characteristics of neonatal transfers	Current status of neonatal CCR in South Africa
<i>“I do think there is a difference between rural and urban.”</i>	Urban and Rural variation	Characteristics of transfer teams	Current status of neonatal CCR in South Africa
<i>“Oh yes, I think there's a need, knowing that the medical field evolves ...”</i>	Identifying a need for additional training	Identifying learning needs (Learners)	Learning and education in neonatal CCR

Trustworthiness

The trustworthiness of the research was ensured through credibility, transferability, confirmability, and dependability (32). Credibility deals with how believable the research findings are. During the interview, the researcher asked the participants if the captured information was interpreted correctly using summarisation and clarification. To achieve transferability and dependability, (33) the researcher and co-authors analysed the data collectively, as multiple points of view balance out the subjective views of the interpreters. Peer debriefing sessions with the co-authors provided different interpretations of the data in an attempt to reduce researcher bias. It was important to ensure that enough contextual information about the study was provided so that the reader can come to the conclusion of transferability in neonatal critical care transfers (32). The data were described in such detail that the reader can decide whether it is applicable to their own context. Confirmability was ensured through a transparent and reflexive process of data description and interpretation.

Ethical considerations

Ethical approval for the study was obtained from the Human Research Ethics Committee of the University of Cape Town (HREC Ref 474/2020). Written and verbal consent was obtained from all participants prior to data collection. See Annexure E for the consent form. The research information was explained to the participants and all questions they had about the study were answered.

Confidentiality was discussed. The participants were free to withdraw from the study up to the point of data analysis. The data obtained was only accessible to the authors and kept on a password protected laptop and in secure cloud storage. Participation in the study was not shared with any employer, organisation or other third party.

RESULTS

Expert group

The first group of participants enrolled were the expert group, which included six participants with extensive experience in neonatology and CCRS. The participants' demographic information is presented in Table 2.

Table 2: Demographics of expert group participants in semi-structured interviews

Expert Group Participant	Self-identified Gender	Qualification	Neonatal Critical Care Transfer Experience
E1	Male	ECP	Extensive local CCR and education experience
E2	Female	Paediatrician	Extensive international CCR experience
E3	Female	ECP, Nursing Sister	Extensive local CCR and education experience
E4	Female	CCA, Nursing Sister	Extensive local CCR experience
E5	Female	Neonatologist	Extensive in hospital neonatal experience
E6	Male	CCA	Extensive local CCR experience

ECP: Emergency Care Practitioner; CCA: Critical Care Assistant; CCR: Critical Care Retrieval

Learner group

The second group of participants included seven learners (as previously defined) involved in neonatal transfers in South Africa. The participants' demographic information is presented in table 3.

Table 3: Demographics of learner group participants in focus group discussion

Participant	Self-identified Gender	Qualification	Area of employment	Sector of employment	First Language
L1	Male	CCA	Gauteng	State, Rural	Non-English
L2	Male	CCA	Gauteng	State, Urban	Non-English
L3	Male	ECP	Gauteng	State, Rural	Non-English
L4	Male	ECP	Eastern Cape	State, Urban	Non-English
L5	Male	CCA	Limpopo	State, Rural	Non-English
L6	Female	ECP	Western Cape	Private, Urban	English
L7	Female	ECP	Gauteng	State, Urban	Non-English

CCA: Critical Care Assistant, ECP: Emergency Care Practitioner

The semi-structured expert group interviews had a mean duration of 59 minutes (51-68 min). The semi-structured focus group discussion had a duration of 91 minutes.

The recordings were transcribed, analysed and 372 codes were extracted. The audio recording from the learner group online discussion was transcribed and analysed with 97 codes extracted. The main categories were: Current status of neonatal CCR in South Africa; Learning and education in neonatal CCR; and proposed curriculum elements. The results are summarised in table 4.

Table 4: Main categories, sub-categories and codes

Main Category	Sub-category	Code
Current status of neonatal CCR in South Africa	Characteristics of neonatal transfers	Transfer case mix differences and similarities
		Long distance transfers
		Transfer to tertiary units
		Time delays
		Need for improved systems
		Critically ill neonates
		High Risk
	Characteristics of transfer teams	Urban and Rural variation
		The Ideal CCR Team

		Variable competency levels
	Limited Resources	Limited backup Limited Dedicated teams Variable equipment levels Limited Neonatologists Limited NICU units
	Current education in CCR in South Africa	Need for additional neonatal education Limited neonatal exposure Limited time to cover neonatal content Barriers to accessing international education Lack of local context in offerings
Learning and education in neonatal CCR	Bridging the knowledge gap (Experts)	Lack of preparedness for neonatal CCR Experience and exposure during neonatal transfer Mentorship Self-Study Clinical shifts in NICU
	Identifying learning needs (Learners)	Identifying a need for additional training Bridging knowledge gaps Preparedness for neonatal CCR Limited operational exposure Curtailment of scope

Category 1: Current status of neonatal CCR in South Africa

This category describes the current state of neonatal CCR in South Africa as perceived by the expert and learner groups. It outlines current practices, shortcomings, caseload/volume in neonatal CCR. It also outlines the importance of neonatal CCR. This category was sub-divided into: characteristics of neonatal transfers, characteristics of transfer teams and limited resources.

Characteristics of neonatal transfers

This sub-category describes the type of patients transferred and under what conditions these transfers took place, including limitations and challenges experienced.

Perceptions of the expert group on the presented case mix from Venter et al. (23) is described first. Experts agreed with the representation in the case mix when compared to their own experiences. However, some experts felt that CHD and prematurity were underrepresented in the description. *“We do see a lot of CHD as well. Prematurity and CHD are the bigger ones”* **Expert no. 3 (ECP/nursing sister)**. Experts also discussed the variation in case mix between Private EMS and the state sector. They felt that the state was *“perhaps a little bit less cluttered and a little bit less complex, maybe very sick, but maybe not as complex as this”* **Expert no. 5 (Neonatologist)**. They also felt that it was important to have a better understanding of what types of cases are being transferred in both the state and private sector when informing studies. *“But I do feel it'd be important to see what type of cases they would see in state as well”* **Expert no. 1 (ECP)**.

Learners explained that one of the challenges in neonatal CCR are long distance transfers. *“Then we have a tertiary hospital that is about 197 kilometres away from the base that I work from”* **Learner no. 5 (CCA)** and that the distance does come with risk of adverse events occurring. *“...adverse events during these long-distance transfers”* **Learner no. 2 (CCA)**.

Another challenge with CCR transfers described was the effect that time delays had on the patients. *“Because of the time delays, very often that child was much sicker than they probably would have been if they had been able to get there much quicker”* **Expert no. 5 (Neonatologist)**.

The conditions under which these transfers occur were further elaborated on when experts explained that the teams also have to transfer neonates *“across the province, and from various outlying facilities”* and it was also suggested that there needs to be a *“better system in place to say, to prevent adverse events in neonates”* **Expert no. 1 (ECP)**.

The neonates transferred in South Africa were also described by the experts as *“really sick intubated, ventilated neonates”* and needed to be transferred based on their acuity. **Expert no. 1 (ECP)**. The experts also described the current conditions of neonatal transfers. They indicated that it was high risk in nature. *“Because, these transfers are high risk, and these neonates are very sick”* **Expert no. 5 (Neonatologist)**.

Characteristics of transfer teams

This sub-category describes the qualification and composition of current team members who conduct neonatal transfers and the ideal team composition. The experts felt that there was a difference between the qualifications of the ALS providers that transfer neonates in rural and urban areas. *“I do think there is a difference between rural and urban. Where in Johannesburg it is ECPs and in Welkom it is a CCA. And in Kathu it is a CCA. That is why I think the reality is we cannot exclude those people [in training initiatives]”* **Expert no. 3 (ECP/nursing sister).**

The learner group shared their frustration on the limited number of ECP's currently available to do ventilated neonatal transfers. The learners explained that *“I understand that they are pushing so hard in universities to produce extra ECPs. But I doubt it's going to be enough”* **Learner no. 5 (CCA).**

The ideal CCR team/system was described by experts. This included team composition (Dedicated/Multidisciplinary) and specialised equipment *“...the international standard is that transfers or transport of neonates, especially the sick ones should actually be a multidisciplinary team event”* **Expert no. 5 (Neonatologist).**

Dedicated CCR teams were suggested to ideally transfer neonates. *“I know we're very fortunate with our company that, you know, we've pretty much got an understanding here that anything that smells, sounds or looks like a neonate we'll be going with the critical care retrieval team”* and the service was also described as *“..in order to make it safe for the practitioner and safe for the client (patient), I think it needs to be a speciality”* **Expert no. 4 (CCA/Nursing sister).** A multidisciplinary team approach was described as the ideal *“because if you've got those different disciplines with different scope of practice.....and do the transfer to the best of the ability of the team”* **Expert no. 6 (CCA).** This team was also described from a standard setting perspective as *“the international standard is that transfers or transport of neonates, especially the sick ones should actually be a multidisciplinary team event”* **Expert no. 5 (Neonatologist).**

The experts described the documentation that the teams should have during CCR transfers as currently limited *“shortcomings was documentation”* and that from *“medical legal perspective, this is a concern”*. Extensive documentation was described as a necessity *“to communicate effectively to the other side [receiving centre]”* **Expert no. 2 (Paediatrician).**

There was also “a variation in confidence” described where some current ALS providers were found to be “nervous about handing over to the ICU doctor” and then others that had “high level of confidence amongst the staff picking up babies for transport” **Expert no. 2 (Paediatrician)**.

Limited resources

This sub-category describes the limited in-hospital specialist services available creating the need for transfer and the limited resources available to transfer high acuity neonates.

Experts felt that there is “limited sort of backup” and that these ALS providers who conduct the transfers “have to have backup” **Expert no. 2 (Paediatrician)**. The experts went on to describe dedicated CCR teams as a limited resource. “What we understand is that the advanced teams are very few” **Expert no. 5 (Neonatologist)**. Learners also described dedicated CCR teams as limited. “...in the Western Cape, we have a (single) dedicated neonatal transfer unit” **Learner no. 6 (ECP)**.

Equipment failure as a limitation was described as “sometimes they (transfer team) were also let down to a certain extent by the quality of the equipment they had” **Expert no. 5 (Neonatologist)**.

Limited specialists available to care for these patients was also described as a challenge and reason for transfer. “Retrieving babies from outlying areas, bringing them back into level one hospitals and to the neonatologists” **Expert no. 4 (CCA/Nursing sister)**. Experts also described that there “aren't that many neonatal intensive care units” in the rural areas and that “they're only really in the major cities” **Expert no. 2 (Paediatrician)**. Learners also described NICUs as a scarce resource. “Here in Limpopo we have about seven hospitals, of which six of those are primary. And one is secondary. There's the one with about two to three neonatal ICU beds (for the province)” **Learner no. 5 (CCA)**.

Category 2: Learning and education in neonatal CCR

This category describes the current state of education (including barriers to access) in neonatal CCR and how any identified educational gaps were bridged. The category was divided into the following sub-categories: current education in CCR in South Africa; bridging the knowledge gap (experts); and identifying learning needs (learners).

Current education in neonatal CCR in South Africa

This sub-category describes why there is a need for additional education in neonatal CCR and barriers to accessing further education in the field.

Experts attributed the need for additional education to limited exposure to neonates in the current education system and was described as “ *I think that is maybe why the basics is so lacking because they don’t see neonates.... you see them but you see them from a distance*” **Expert no. 3 (ECP/nursing sister).**

The time spent on neonatal education was described as limited. “*ideally yes, if we can edit the time spent on neonatal content we could get more value out of it.*” and that “*I don’t think that they can be adequately prepared in the time frame*” **Expert no. 3 (ECP/nursing sister).**

Experts expressed some barriers to accessing international neonatal CCR education. The international courses were firstly described as limited “*..quite limited programs out there*” and cost-prohibitive “*the (high) cost associated with them as well*”. Some of these courses were also described as “*.. reserved for physicians and not so much for paramedics*” **Expert no. 3 (ECP/nursing sister).**

The learner group discussed the availability of resources to access additional neonatal CCR education. Learners felt that electronic devices and internet access to participate in online teaching was not such a barrier any more. “*People, kids in the rural areas have tablets, we have cell phones, like I'm currently using my cell phone*” **Learner no. 7 (ECP).**

From a cost perspective, learners felt that employer buy-in and funding was very important. “*I think it's imperative for the employer to support this kind of program, because it's going to be beneficial for both practitioners and their employer*” **Learner no. 2 (CCA).** Learners also felt that paying for the course themselves would be possible for some. “*But if it's something that you personally feel like you will be doing, you can also try and pay for yourself*” **Learner no. 7 (ECP).**

The learner group felt that this kind of education should be inclusive for all ALS providers and that it should change the current scope of practice limitations. “*So, I think a course like this, if then allowed afterwards for the CCA and the short courses to have access to, those qualifications where they can*

now do these transfers would be such a huge help” Learner no. 6 (ECP). It was also suggested to be a specialty for qualified pre-hospital providers. “It should be as a standalone course for a specialized team” Learner no. 5 (CCA).

The experts suggested that some sections of the international curricula presented in the pre-reading document (Annexure A) could *“literally take the courses that you’ve outlined here, and pull pieces out and put them all in to make a course”* but that *“we can’t just take one of those courses and use it as is in our local context” Expert no. 4 (CCA/Nursing sister)* as they lack local context specific content.

Bridging the learning gap (Experts)

This sub-category describes the expert group’s preparedness and perceived learning gaps and how they overcame them.

The experts described the current situation of education in neonatal CCR in South Africa. They described that *“very little of the training that we actually did, prepared me for that first neonatal transfer”* and that there is a *“need for new graduates to get more training in neonatology”*. The current programmes were also described as *“not designed in such a way that you have a critical care retrieval specialist” Expert no. 1 (ECP).*

The expert participants shared their experience of how they bridged the learning gap when they started conducting neonatal CCR. Exposure to neonates in transfer was described as *“...the more you do it (neonatal CCR), the more you get comfortable...”* They mentioned that mentorship played an important role too. *“...what was very nice is that at the state hospital there was quite a great doctor, that every time we went there with a patient, we could get some knowledge from her and especially on things that we did not know” Expert no. 6 (CCA).*

Experts also described self-study as a way of bridging the learning gap. *“..then obviously some literature searching from a lot of the American stuff helped fill some of those gaps”*. Spending time in a NICU was also described as a way to learn more about neonates *“go to the unit and started discussions... would like to understand more from NICU” Expert no. 1 (ECP).*

Identifying learning needs (Learners)

This sub-category explored the learner's need for additional education in neonatal CCR through discussions on perceived knowledge gaps, preparedness, exposure and limitations in scope of practice.

The learner group agreed with the need for additional education in neonatal CCR. *"Most definitely. Let me tell you about my experience. I remember doing my first neonatal ICU transfer. It was really nerve wracking because now you don't have anyone to rely on. If you could get a course and do it part time"* **Learner no. 3 (ECP)** and *"Oh yes, I think there's a need, knowing that the medical field evolves ...so there's definitely a need to always get more knowledge"* **Learner no. 1 (CCA)**.

Learners also shared how they closed their perceived neonatal CCR knowledge gaps. Learners expressed how they became more comfortable with managing neonates following exposure during actual transfers on the job. *"But you learn every day, when it comes to how to handle the patient you learn every day because you handle a patient in a certain way, when you transferring a patient, when it comes to the tube securing or the other attachments with a patient"* **Learner no. 7 (ECP)**. They also felt that literature searches helped close the knowledge gap. *"...go into the internet and read about that patient and what they had and how to manage them better in future"* **Learner no. 7 (ECP)**.

Learners were asked to share their opinion on their preparedness for neonatal CCR when they were newly qualified. They felt that they were not prepared for these transfers. *"But we didn't cover much of how to manage a neonate in the ICU transfers"* **Learner no. 2 (CCA)**. They felt like they were better prepared on a basic level for neonatal transfers. *"I feel like the university did pull through in like preparing me on the basics that I need to know about transferring a neonate or treating a neonate patient"* **Learner no. 7 (ECP)**.

They also reflected on the time that was dedicated to neonatal CCR on their respective courses. Learners with the university BEMC/B-Tech qualifications shared that neonatal content was mainly covered in fourth year and that time was limited. *"You only really deal with neonates in fourth year towards the second half of the year, where we did intensive neonatal ICU training, including medication dosages, pathology, ICU transfers, etc."* and *"Because even within the BEMC (program) things felt rushed, there were definitely topics that we could have gone in more depth or spend more*

time with” Learner no. 6 (ECP). The learners with the CCA qualification background shared a similar experience where they felt not enough time was allocated to neonatal content. *“The CCA program was about nine months. Now we have to cover the literature and the practicals within that nine months. Now we didn't spend much of the time in terms of paediatrics and neonatology” Learner no. 2 (CCA).*

Learners shared some of the content that they were taught on their programs as it relates to neonatal CCR. *“...regarding neonates, the way the curriculum works is that during first and second year you do anatomy and physiology” Learner no. 6 (ECP).* Neonates and the rest of the paediatric group were combined during lectures on the BEMC program and only separated by individual drug dosages. *“I'd say basically, because they didn't actually separate it. It was paediatrics and neonates, but then obviously, the doses and how you treat them” Learner no. 7 (ECP).*

The learner group felt that experiential learning on their programs were beneficial but had some limitations. *“And a lot of the learning that took place was also reliant on what you learned during your experiential shifts” Learner no. 6 (ECP).* One limitation was exposure to neonates in a CCR environment. *“But because it's such a specialist service, there were not that many neonatal transfers going around as a learner to get exposure.” Learner no. 1 (CCA).* Learners felt that more hands on experience was gained during NICU shifts. *“Whereas I got more experienced learning in the neonatal ICU shifts where the sisters were really kind and gave you a baby for a week to look after and you would feed the baby, clean the baby, do all those things with the nurses” Learner no. 6 (ECP).* In addition to exposure as a student, learners also explained that operational ALS providers have limited exposure to neonates. *“...working on the road, see minimal neonatal transfers in the private sector, just because of medico-legal risks, and they have a specialized unit” Learner no. 6 (ECP).*

Learners also felt that there is a need for additional neonatal CCR education due to the change in scope of practice with the CPG update, which prevented many competent ALS providers from transferring ventilated neonates. *“Where we have an emergency transfer for a neonate. But the practitioner (ALS provider) that's on shift cannot be doing the transfer, they need to wait for a night shift, or they need to call someone (ECP) from another area” Learner no. 7 (ECP).*

Proposed course structure and outcomes

Table 5 describes the curriculum structure as proposed by the expert and learner groups. Further, broad course outcomes derived from the interview content is proposed. The derivation process is shown in the coding trees contained in the supplementary attachments (Appendices S1 and S2).

Table 5: Proposed Curriculum Structure

Proposed Curriculum Structure			
Course Duration	<ul style="list-style-type: none"> • Part time post graduate diploma (Proposed by learner and expert group) or,] • Part time master’s degree (Proposed by expert group) 		
Course Model	<ul style="list-style-type: none"> • Blended course – Online/Workplace/Simulation-Based Teaching Learning & Assessments • Mentorship programme 		
Resources	<ul style="list-style-type: none"> • Electronic Devices • Specialist supervision • Cost: self/employer funded 		
Targeted Student Group	<ul style="list-style-type: none"> • The course should be inclusive for all Advanced Life Support providers 		
Suggested scope of the course	<ul style="list-style-type: none"> • Scope of practice should change after course • The course should be considered as an elective speciality for ALS providers in South Africa 		
Developing Curriculum Map			
Course Outcomes	Proposed Assessment Methods		
	Formative Assessments	Continuous Summative Assessments	Summative Assessment

Describe anatomy and physiology as it relates to the neonate ¹	Work-Based	Work-Based	Portfolio of Evidence
Describe the components of an effective critical care retrieval service. ²	Assessments	Assessments	
Apply transport considerations and the effect of transport stress on a range of conditions specific to the critical neonate. ³	Simulation-Based Assessments	Simulation-Based Assessments	
Explain the continuity and maintenance of neonatal critical care and its application during retrieval and transport. ⁴	Written Assessments	Written Assessments	
Describe and prepare the documentation required for safe transitions of care during the handover of a neonatal patient. ⁵			
Demonstrate competence in the application and performance of emergency procedures for neonatal resuscitation and stabilisation. ⁶			
Demonstrate the safe use of equipment utilised for the monitoring and management of the neonate during transport, heating, mechanical ventilation and infusion devices. ⁷			
Describe and demonstrate the monitoring, care, management and troubleshooting of a variety of indwelling attachments as they relate to neonatal critical care and transport, including drains and different methods of vascular access. ⁸			
Describe and demonstrate the monitoring, care and management of a variety of medications as they relate to neonatal critical care and transport. ⁹			
Demonstrate the initial and ongoing assessment of a neonate as it relates to neonatal critical care and transport. ¹⁰			
Apply and analyse a variety of methods used for the monitoring of a critical neonate during retrieval and transport. ¹¹			

Describe the physiological effects that the different modes of transport could have on the neonate and apply methods to mitigate potential risks to the neonatal patient during transport. ¹²			
Describe and demonstrate the monitoring, care and management of a variety of ventilation modes and methods as they relate to neonatal critical care and transport. ¹³			
<p>Topic examples provided by participants:</p> <ol style="list-style-type: none"> 1) Neonatal anatomy and physiology 2) Critical Care retrieval systems 3) Specific conditions suggested are: Conditions from the study (23); congenital heart defects; infection; prematurity; respiratory conditions (bronchopneumonia, diaphragmatic hernia, meconium aspiration, persistent pulmonary hypertension); surgical emergencies (gastroschisis, necrotising enterocolitis) 4) Examples include feeding and skin care 5) Specific to referral documents, information gathering, and handover 6) Examples include: airway management, neonatal resuscitation, thoracentesis 7) Examples include: incubators, infusion devices, mechanical ventilators (see no. 13) 8) Examples include: Colostomy bags, drains, vascular access (arterial access, central intravenous access, intraosseous access, peripheral intravenous access, umbilical vascular access) 9) No specific examples given 10) Assessment of the neonate, and specifically for the conditions in 3. 11) Examples include: arterial blood gas, electrocardiogram, end-tidal carbon dioxide monitoring, fluid balance, glucose management, perfusion, thermoregulation. 12) Examples include: acceleration and deceleration forces and effects, mode of transport and their stressors, motion and movement, noise, patient packaging. 13) Examples include: manual bag valve mask resuscitators, device neonatal resuscitator (e.g. NeoPuff), oxygen blending, humidification, heating of air and circuits, continuous positive airway pressure, mechanical ventilator modes, oscillation and oscillation takeover. 			

Discussion

This study aimed to derive course outcomes in neonatal critical care retrieval education by conducting a general and targeted needs assessment. First, a group of experts in neonatology and neonatal CCR took part in semi-structured one on one online interviews. Next, a group of learners participated in an online focus group discussion. The first main category identified during content analysis was: Current status of neonatal CCR in South Africa, which described the characteristics of neonatal transfers, the teams that conduct them and the limited resources in the South African setting. The second main category was learning and education in neonatal CCR, which described current education offerings, how participants bridged their perceived knowledge gaps and identifying learning needs. Finally, proposed curriculum elements and course outcomes were derived.

Neonatal CCR transfers were described as often taking place over long distances, which was also reported in a single centre retrospective study by Royal et al. (13) in the Kwazulu-Natal province of South Africa. Time delays were reported as a challenge, which was one of the contributing factors to adverse events in a single centre prospective study by Senthilkumar et al. (9) in the United Kingdom. Neonatal CCR transfers were also described as high risk in nature. This result was echoed in a prospective observational study by Goldsmit et al. (4) in Argentina, and in a prospective descriptive study by Henry et al. (5) in Jamaica, where the clinical deterioration of neonates during transfer was described. The ideal CCR transfer team was described as a dedicated multidisciplinary team, also reported by Ramnarayan et al. (14) in the United Kingdom, where patients transferred by these teams had a better outcome than patients transferred by non-specialist teams. Limited dedicated teams that can conduct neonatal transfers safely was described, a finding also reported by Dalal et al. (7) in India where only half of neonates that undergo inter-facility transfer arrived by ambulance, leading to high adverse event rates. Interestingly, the lack of neonatal transport is one of the top ten preventable causes of under 5 year mortality in South Africa (1). In a cross sectional study by Sogomo et al. (6) in Kenya, a lack NICUs and specialists created the need for neonatal transfers, which was also reported by the participants, especially in rural settings.

Current education in neonatal CCR in South Africa was described as limited due to time constraints to cover content. This finding was similarly demonstrated by Conradie et al. (16) where the CCR curricula offered on the South African emergency medical care degree programmes were compared. The study found that neonatal CCR was not offered as a standalone module, but rather covered with other age groups. Experts in neonatology and neonatal CCR described perceived knowledge gaps, which they

had to overcome to conduct neonatal CCR transfers safely. Similarly, in a study by Senthilkumar et al. (9) adverse events were linked to the level of education of the transferring team. The need for additional education in neonatal CCR transfers was described by the learner group. This result was also reported by Ismail et al. (11) in a descriptive study where ALS providers from the Western Cape, South Africa felt that they require additional exposure and training in neonatal transfers.

The need for adequately trained personnel to safely transfer high acuity paediatric patients in South Africa was described in a qualitative study by Vincent-Lambert et al. (10). In addition to this, the CCR working group of the Emergency Care Society of South Africa highlighted the importance of dedicated CCR crew members with additional education in this field, to undertake neonatal CCR (17). The limitations in current offerings of South African neonatal CCR transfer education and the desperate need described by participants of this study warrants the urgent development of additional training in this field. To this end, we report a proposed curriculum structure with course outcomes as a solution towards improving neonatal CCR in a LMIC setting.

A post-graduate diploma was suggested as the most favourable exit level for the proposed education programme. A master's degree exit level was also reported as an option, however this may be a barrier to access for non-degree ALS paramedics. This cadre of ALS providers would benefit from the proposed education, as their scope of practice was curtailed by the HPCSA to transfer only non-ventilated neonates. A decision that inadvertently created a major burden on the healthcare system. Such a programme, as an elective speciality, might allow for an increased scope of practice of learners as a standard in neonatal CCR. A model of blended learning was suggested which included online, workplace and simulation based TLA with a robust mentorship programme. In a prospective study by Tabas et al. (34) a blended approach including online, face-to-face and practical hands-on components were successfully employed to teach advanced emergency procedures to medical students in South Africa. The benefit of an online component was also demonstrated by Stassen et al. (35) where the implementation of an online course in managing traumatic brain injury (TBI) patients improved the care provided by Helicopter Emergency Medical Services (HEMS) personnel. The Covid-19 pandemic accelerated the use of online learning as a teaching medium, which is controversial in a LMIC setting with a digital divide due to an unequal society. In this study, participants reported that most students have access to online learning resources. Mpungose (36) suggests the inclusion of free social media platforms as part of online learning offerings to make information more accessible to underprivileged students.

The participants suggested topics that they felt should be covered on the proposed course and suggested that these are essential areas of knowledge and skills needed to manage an acutely ill neonate during transfer. The transfer of neonates is not limited to road ambulances, as some specialised services also make use of helicopter and fixed wing ambulances. These modes of transport could have negative physiological effects on the neonate and participants felt that it was important to understand how to mitigate potential risks and ensure safe continuity of care to the receiving facility. It is important to note that these topics were informed by actual patients from the study by Venter et al. (23). The importance of informing a South African curriculum with a local case mix was demonstrated by Cohen et al. (37) in a cross sectional retrospective audit study. The participants provided topics based on real life experiences and actual patients representing various provinces across state and private sectors.

It is encouraging that some neonates are being transferred by dedicated CCRS teams in South Africa. Unfortunately, this service is very limited in LMIC settings, especially in rural areas where access is mostly reserved for patients that can afford private health care. The only way to reduce adverse events during neonatal transfers is to invest in developing CCRS systems. Policymakers have to agree that neonates that meet specific criteria, irrespective of socio-economic status, have to be transferred by specialised CCRS teams. Once course content has been developed through consensus and wider engagement, it is essential that additional education in neonatal CCR should become an adopted standard qualification for all CCRS team members. Importantly though, education in neonatal CCRS should be widely accessible to all providers that will transfer neonates, whether complex critical care cases or not. In this manner, successful implementation of such an educational programme has the potential to improve patient safety, minimise adverse events during transfer, and impact under-five mortality favourably.

Limitations

This study had some important limitations. The number of experts in neonatal critical retrieval that participated were limited. It will be necessary to further consult with the different stakeholders and then undertake a consensus process (such as Delphi or nominal group technique) in order to finalise the curriculum and content. During these phases, a broader and more systematic consultation with neonatology and other expert groups will be necessary. The learner group of participants were representative of the current South African ALS providers involved in neonatal transfers, but a larger more diverse sample would benefit the curriculum design process. This study only focussed on the

initial steps of curriculum design, but the development of curriculum content and implementation models do create an opportunity for future research.

Conclusion

This study described the specific needs of prehospital learners as it pertains to the TLA of a curriculum in neonatal critical care retrieval. It also described some of the limitations in the current and past education systems in neonatal critical care transfers. This study provides a curriculum structure with course outcomes and the results can be used to inform the next steps in curriculum development for education in neonatal critical care transfers.

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References

1. Rhoda N, Velaphi S, Gebhardt G, Kauchali S, Barron P. Reducing neonatal deaths in South Africa: Progress and challenges. *South African Medical Journal*. 2018;108(3):9-16.
2. Ashokcoomar P, Naidoo R. An analysis of inter-healthcare facility transfer of neonates within the eThekweni Health District of KwaZulu-Natal, South Africa. *South African Medical Journal*. 2016;106(5):514.
3. Thwala MD. The quality of neonatal inter-facility transport systems within the Johannesburg metropolitan region. Johannesburg: University Of Witwatersrand; 2012.
4. Goldsmit G, Rabasa C, Rodríguez S, Aguirre Y, Valdés M, Pretz D, et al. Risk factors associated to clinical deterioration during the transport of sick newborn infants. *Arch Argent Pediatr*. 2012;110(4):304-9.
5. Henry S, Trotman H. Challenges in neonatal transport in Jamaica: A resource-limited setting. *Journal of tropical pediatrics*. 2017;63(4):307-13.
6. Sogomo JA. Care of referred neonates during transport to the newborn unit at Moi Teaching and Referral Hospital, Eldoret-Kenya: Moi University; 2018.
7. Dalal E, Vishal G, Solanki D. Study on neonatal transport at tertiary care centre. hospital. 2013;84(28):49.
8. Sabzehei MK, Basiri B, Shoukahi M, Torabian S, Razavi Z. Factors affecting the complications of interhospital transfer of neonates referred to the Neonatal Intensive Care Unit of Besat Hospital in 2012–2013. *Journal of Clinical Neonatology*. 2016;5(4):238.
9. Senthilkumar R, Corpuz N, Ratnavel N, Sinha A, Mohinuddin S. Adverse events during emergency transfer of neonates performed by regionalised dedicated transfer service. *Archives of Disease in Childhood*. 2011;96(Suppl 1):A91-A.
10. Vincent-Lambert C, Wade G. Challenges relating to the inter-facility transport of high acuity paediatric cases. *African Journal of Emergency Medicine*. 2018;8(1):29-33.
11. Ismail E. Preparedness of Western Cape ALS providers to provide clinical stabilisation and intensive care for neonates during the patient journey. <https://openscholar.dut.ac.za/handle/10321/12>: Durban University of Technology; 2018.
12. Venter M, Stassen W. The capabilities and scope-of-practice requirements of advanced life support practitioners undertaking critical care transfers: A Delphi study. *Southern African Journal of Critical Care*. 2016;32(2):58.
13. Royal C, McKerrow N. A retrospective review of the transfer of critically ill children to tertiary care in KwaZulu-Natal Province, South Africa. *South African Journal of Child Health*. 2015;9(4):112-8.

14. Ramnarayan P, Thiru K, Parslow RC, Harrison DA, Draper ES, Rowan KM. Effect of specialist retrieval teams on outcomes in children admitted to paediatric intensive care units in England and Wales: a retrospective cohort study. *The Lancet*. 2010;376(9742):698-704.
15. Hamrin TH, Berner J, Eksborg S, Radell PJ, Fläring U. Characteristics and outcomes of critically ill children following emergency transport by a specialist paediatric transport team. *Acta Paediatr*. 2016;105(11):1329-34.
16. Conradie NJ. A comparison of critical care transportation modules taught in bachelor's degrees in emergency medical care in South Africa: Faculty of Health Sciences; 2020.
17. Venter C, Conradie N, Venter M, Jordaan L, Venter M, Stanton D, et al. A proposed definition of Critical Care Retrieval in the South African context. *South African Journal of Pre-hospital Emergency Care*. 2021;2(1).
18. PBEC H. Clinical Practice Guidelines HPCSA Portal2018 [Available from: <https://www.hpcsa.co.za/Uploads/EMB/CLINICAL%20PRACTICE%20GUIDELINES%20%20-%20PROTOCOLS-%20JULY%202018.pdf>].
19. Kern DE. A six-step approach to curriculum development. P Thomas, D Kern, M, Hughes, & B Chen, *Curriculum development for medical education*. 2016:5-9.
20. Thomas A, Menon A, Boruff J, Rodriguez AM, Ahmed S. Applications of social constructivist learning theories in knowledge translation for healthcare professionals: a scoping review. *Implementation Science*. 2014;9(1):54.
21. Patton MQ. *Qualitative research & evaluation methods: Integrating theory and practice*: Sage publications; 2014.
22. Lave J. *Situating learning in communities of practice*. 1991.
23. Venter M, Theron E, Williams W, Khan W, Stassen W. A national retrospective review of neonatal critical care transfers in dedicated critical care transport services in the private sector. *South African Medical Journal*. 2021;111(10):981-4.
24. Barry P, Leslie A. *Paediatric and neonatal critical care transport*: Wiley-Blackwell [Imprint]; 2003.
25. Bruisten S, Nilsson-Ihrfelt E, Buhrman M, Ekselius L, editors. *TOXBASE*. *Emerg Med J*. 2006 Aug; 23 (8): 614-7. PMID: 16858093 [PubMed-in process] 24: Team V, Markovic M. Internet advertising of artificial tanning in Australia. *Oncol Nurs Forum*; 2006.
26. Group ALS. *Advanced paediatric life support: the practical approach*: John Wiley & Sons; 2011.
27. Chameides L. *Pediatric Advanced Life Support Provider Manual*: AMER HEARTH ASSN; 2016.
28. (AACCN) AAoCCN. *Essentials of Neonatal Critical-Care Orientation 3.0 2020* [Available from: <https://www.aacn.org/store/books/encco3ind/essentials-of-neonatal-criticalcare-orientation-30>].

29. Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & quantity*. 2018;52(4):1893-907.
30. Erlingsson C, Brysiewicz P. A hands-on guide to doing content analysis. *African Journal of Emergency Medicine*. 2017;7(3):93-9.
31. Bazeley P, Jackson K. *Qualitative data analysis with NVivo*: SAGE publications limited; 2013.
32. Shenton AK. Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*. 2004;22(2):63-75.
33. Birt L, Scott S, Cavers D, Campbell C, Walter F. Member checking: a tool to enhance trustworthiness or merely a nod to validation? *Qualitative health research*. 2016;26(13):1802-11.
34. Tabas JA, Rosenson J, Price DD, Rohde D, Baird CH, Dhillon N. A comprehensive, unembalmed cadaver-based course in advanced emergency procedures for medical students. *Acad Emerg Med*. 2005;12(8):782-5.
35. Stassen W, Wylie C, Holgate R. An online learning programme improves traumatic brain injury guideline adherence in a South African Helicopter Emergency Medical Service. *African Journal of Emergency Medicine*. 2015;5(4):171-5.
36. Mpungose CB. Emergent transition from face-to-face to online learning in a South African University in the context of the Coronavirus pandemic. *Humanities and Social Sciences Communications*. 2020;7(1):113.
37. Cohen KL, Wallis LA. Is the current South African emergency medicine curriculum fit for purpose? An emergency medicine practice analysis. 2011;28(11):955-8.

Appendices

Appendix S1: Coding tree for course outcomes

Course Outcome	Topic	Code	Participant Quote
Describe anatomy and physiology as it relates to the neonate	Neonatal anatomy and physiology	Anatomy and physiology Neonatal specific	The participants shared their opinions on the learning objectives that should be included in the proposed course. Neonatal specific <i>“anatomy and physiology were to be covered”</i> and a <i>“good understanding of the general pathophysiology that we would find in neonates”</i> Expert no. 1 (ECP) .
Describe the components of an effective critical care retrieval service.	Critical Care retrieval systems	CCR Systems Adverse events Appropriate receiving facility Escalation pathways Network limitations Patient criteria for transfer	The participants mentioned that there should be a better understanding of CCR systems. <i>“...from the time the call comes in, and how the call gets screened, and how the call then gets dispatched to which vehicles and so on”</i> Expert no. 6 (CCA) . Under CCR systems, they mentioned that learners must understand <i>“what adverse events are...and quality assurance and patient safety”</i> Expert no. 1 (ECP) . Learner participants also felt that quality assurance was lacking in the EMS industry and that it should be included in the proposed curriculum but should be implemented across the industry to affect change. <i>“Definitely, I do think so. But if quality assurance isn't existing with any patient at all, I don't think you know, just trying to implement that for the neonate side will be effective”</i> Learner no. 4 (ECP) . The importance of choosing an appropriate receiving facility was described as <i>“you would have to understand something about the critically ill infant and where you are taking them”</i> Expert no. 5 (Neonatologist) . The understanding of escalation pathways was also highlighted as you need to <i>“consult with maybe the receiving specialist to discuss...”</i> and <i>“know when and who to call for help”</i> Expert no. 2 (Paediatrician) . The network limitations were also discussed where the transferring professional has to understand the <i>“limitations and the physical sort of directions of care within the networks”</i> . There also needs to be an understanding of the patient criteria for transfer and that some patients are <i>“not stable enough to be moved...the outlook is that they are not going to survive”</i> Expert no. 2 (Paediatrician) .

<p>Apply transport considerations and the effect of transport stress on a range of conditions specific to the critical neonate.</p>	<p>Specific conditions suggested are: Conditions from the study (23); congenital heart defects; infection; prematurity; respiratory conditions (bronchopneumonia, diaphragmatic hernia, meconium aspiration, persistent pulmonary hypertension); surgical emergencies (gastroschisis, necrotising enterocolitis)</p>	<p>Conditions Conditions from study (23) Congenital heart defects Infection Prematurity Respiratory: Bronchopneumonia Diaphragmatic hernia Meconium aspiration Persistent pulmonary hypertension Surgical emergencies Gastroschisis NEC</p>	<p>The participants described the neonatal specific conditions that will have to be covered during the proposed education. Participants suggested that the conditions described by M. Venter (2021) (23) should be included. <i>“The curriculum should be weighted on those specific studies and the cases that we’ve seen (in the study)”</i> Expert no. 6 (CCA). Specific conditions were described as <i>“...understanding of congenital (cardiac) abnormalities”</i> was mentioned by Expert no. 1 (ECP) and that <i>“I know that with cardiac conditions it can be a bit tricky”</i> Expert no. 5 (Neonatologist). The learner group participants shared their opinion on some specific conditions that need to be covered in the proposed curriculum. <i>“I think it is very important, what can be included in this is the various birth defects that neonates may have. Whether common or rare”</i> Learner no. 3 (ECP). Participants added other conditions that are not that common. <i>“...when you start working with this little ones you start to experience things that you will never experience in class and all the practical stages. I worked for 10 years in Gauteng and never came across a case of gastroschisis”</i> Learner no. 5 (CCA). Infections as a condition in the neonate was mentioned as <i>“sepsis and how to manage these patients”</i> Expert no. 1 (ECP). Participants added to the conditions with <i>“prematurity, I would put as its own medical emergency or disease category”</i> Learner participants also shared that how to <i>“prevent contamination, infection, all those things”</i> Learner no. 5 (CCA) should be included. The inclusion of trauma in neonates was also shared as an outcome. <i>“Trauma was not something that was deeply dealt with when it comes to these small little babies”</i> Learner no. 7 (ECP). Participants further elaborated on specific conditions under respiratory. It was described that <i>“a practitioner should know more aboutbronchopneumonia of these patients”</i> Expert no. 6 (CCA). <i>“Diaphragmatic hernia”, “meconium aspiration”</i> and <i>“persistent pulmonary hypertension”</i> Expert no. 5 (Neonatologist) was added to the respiratory conditions. Surgical emergencies were described as a condition but more specifically <i>“gastroschisis...but I think surgical emergencies would probably be a little stand alone”</i> Expert no. 5 (Neonatologist) and <i>“...your open abdominal things like NEC (necrotising enterocolitis)”</i> Expert no. 3 (ECP/Nursing sister).</p>
<p>Explain the continuity and maintenance of neonatal critical care</p>	<p>Examples include feeding and skin care</p>	<p>Continuity of care Feeding Skincare</p>	<p>Participants felt that there needs to be an understanding of <i>“feeding of premature neonates”</i> and <i>“aspects of transfer like skin care”</i> as a continuity of care from the NICU Expert no. 1 (ECP).</p>

and its application during retrieval and transport.			
Describe and prepare the documentation required for safe transitions of care during the handover of a neonatal patient.	Specific to referral documents, information gathering, and handover	Documentation Referral and handover specific	Participants also felt that the necessary <i>“documentation and the handover communication”</i> Expert no. 2 (Paediatrician) needs to be included in the course.
Demonstrate competence in the application and performance of emergency procedures for neonatal resuscitation and stabilisation.	Examples include: airway management, neonatal resuscitation, thoracentesis	Emergency Procedures Airway management Chest decompression Resuscitate	Participants felt that emergency procedures have to be taught on the course. Airway management was described as <i>“Managing airways ...placement of an ET tube”</i> and chest decompression was also added as <i>“needle decompression”</i> Expert no. 2 (Paediatrician) . Resuscitation of a neonate was described as important to include under procedures as <i>“..doing a full neonatal resus(citation) from the beginning through straight to the end”</i> Expert no. 1 (ECP) . Learner participants also felt that <i>“training with regards to neonatal resuscitation”</i> Learner no. 6 (ECP) should be included as an emergency procedure.
Demonstrate the safe use of equipment utilised for the monitoring and management of the neonate during transport, heating, mechanical ventilation and infusion devices.	Examples include: incubators, infusion devices, mechanical ventilators (see ventilation)	Equipment Incubator Infusion devices Troubleshooting	Participants further added that neonatal specific equipment will also have to be covered during this course. <i>“The handling of the incubatorhow to manage it”</i> Expert no. 1 (ECP) was described under incubators. Equipment was further elaborated on by the addition of infusion devices. <i>“The real, proper use of infusion devices...is quite important because its not just a matter of putting in a syringe and pushing start”</i> Expert no. 1 (ECP) . Learners will also have to be taught how to troubleshoot equipment as <i>“tips and tricks, because you’re not always going to have the same equipment”</i> Expert no 4 (CCA/Nursing sister) . The learner group added to the equipment with humidification and charging stations to the expert group list provided. Specialised equipment described as <i>“...looking at your equipment as well, you have very limited equipment with treating trauma patients that are that tiny”</i> Learner no. 7 (ECP) .
Describe and demonstrate the monitoring, care, management and troubleshooting of a variety of indwelling attachments as they relate to neonatal critical care and transport, including drains and different methods of vascular access.	Examples include: Colostomy bags, drains, vascular access (arterial access, central intravenous access, intraosseous access, peripheral intravenous access, umbilical vascular access)	Vascular access Arterial Lines Central Line IO access IV peripheral Umbilical Indwelling attachment	Participants described vascular access as an important inclusion. Various vascular access methods were described as <i>“Then line management, select your central lines and you’re a-lines (arterial), reading of that and safety and so forth”</i> Expert no. 1 (ECP) . Participants further felt that intra osseous access should also be included. <i>“...just the whole discussion about intra osseous infusionsthat should be reserved for emergency cases”</i> Expert no. 5 (Neonatologist) . Peripheral IV access was also emphasized as <i>“emergency practice skills such as bag valve mask, ventilation, and placement of an ET tube and then IV access...”</i> Expert no. 2

		Colostomy bags	(Paediatrician) . Umbilical vein catheterization was also an important vascular access point mentioned. <i>“Usually the neonate, you have the advantage of an umbilical cord. So you get into the umbilical vein if you need to use as an emergency”</i> Expert no. 5 Neonatologist . Participants discussed indwelling attachments as an important inclusion with <i>“colostomy bags”</i> Expert no.2 (Paediatrician) mentioned as a specific attachment on neonates.
Describe and demonstrate the monitoring, care and management of a variety of medications as they relate to neonatal critical care and transport.	No specific examples given	Medication Neonatal CCR specific	Participants felt that neonatal specific medications have to be included. <i>“And you know, a lot of medications that they (in hospital) use, we (ALS paramedics) don’t have those type of medication on our scope”</i> and <i>“when you get to the hospital, you should know what is the adverse effect”</i> Expert no. 6 (CCA) .
Demonstrate the initial and ongoing assessment of a neonate as it relates to neonatal critical care and transport.	Assessment of the neonate, and specifically for the conditions in 3.	Patient assessment Neonatal assessment	Participants described that the assessment and monitoring of a neonate is important. <i>“I would say basic neonatal assessment...what is normal for a neonate?”</i> Expert no.3 (ECP/Nursing sister) . Patient assessment was further described as an important inclusion <i>“...the whole assessment process and the treatment and management of disease processes”</i> Learner no. 5 (CCA) .
Apply and analyse a variety of methods used for the monitoring of a critical neonate during retrieval and transport.	Examples include: arterial blood gas, electrocardiogram, end-tidal carbon dioxide monitoring, fluid balance, glucose management, perfusion, thermoregulation	Patient monitoring ABG ECG ETCO2 Fluid balance Glucose management Perfusion Thermal regulation	Under patient monitoring, more specific considerations were highlighted. Arterial blood gas monitoring was described as <i>“we would like to see the ABG, especially when we do the transfers that’s very long”</i> Expert no.6 (CCA) . ECG monitoring was also mentioned by participants. <i>“12 lead ECGs on the neonate? I mean, we don’t do those on the road”</i> Expert no. 4 (CCA/Nursing sister) . ETCO2 was also specifically mentioned under monitoring. <i>“...what we are doing is we’ve got your capnography for the little ones”</i> Expert no.6 (CCA) . Monitoring of the neonate’s fluid balance was mentioned as <i>“emphasis on fluid balance, because that’s one of the main things”</i> and under glucose management <i>“...is metabolic stability, particularly something like managing hypoglycaemia”</i> Expert no. 5 (Neonatologist) . The neonate’s perfusion and thermal regulation was described as <i>“...absolutely key...how do I manage this baby’s perfusion”</i> and <i>“thermal regulation is so important...admission temperature is more predictive of their mortality”</i> Expert no.2 (Paediatrician) . The learner group of participants added to patient monitoring. They mentioned that fluid balance and thermal regulation are important parameters to monitor and should be included in the course. <i>“...make sure that the fluids balanced”</i> Learner no. 5 (CCA) and <i>“...warming (kangaroo care etc.)”</i> Expert no. 6 (ECP) .

Describe the physiological effects that the different modes of transport could have on the neonate and apply methods to mitigate potential risks to the neonatal patient during transport.	Examples include: acceleration and deceleration forces and effects, mode of transport and their stressors, motion and movement, noise, patient packaging.	Transport considerations Acceleration deceleration Modes Movement and sound Patient packaging	Various transport considerations were described by participants as important inclusions. One consideration was the “ <i>effects of acceleration and deceleration during transport</i> ” and the “ <i>movement and sound considerations</i> ” Expert no. 2 (Paediatrician) on the neonate. Careful consideration of the mode of transfer as “ <i>appraisal of transfers, whether you should be air or road</i> ” Expert no.1 (ECP) was also included. The packaging of the neonate in the incubator was described as “ <i>...if we consider how are we going to package this patient so that the patient is safe</i> ” Expert no. 6 (CCA)
Describe and demonstrate the monitoring, care and management of a variety of ventilation modes and methods as they relate to neonatal critical care and transport.	Examples include: manual bag valve mask resuscitators, device neonatal resuscitator (e.g. NeoPuff), oxygen blending, humidification, heating of air and circuits, continuous positive airway pressure, mechanical ventilator modes, oscillation and oscillation takeover.	Ventilation Bag valve mask CPAP Heated circuits Humidification Neopuff O2 Blending Oscillation takeover Ventilators	Participants discussed ventilation considerations in the neonate as an important inclusion. Basic emergency ventilation techniques were discussed. “ <i>... BVM (Bag valve mask ventilation) the patient if something goes wrong</i> ” Expert no. 2 (Paediatrician) . Participants further discussed more advanced ventilation considerations such as “ <i>something like CPAP, how do we go about doing that?</i> ” and “ <i>The humidification, how the devices work, the limitations in the pre-hospital field and so forth</i> ” Expert no. 1 (ECP) . Participants further described a NEOPUFF device as an important inclusion under ventilation. “ <i>...doesn’t help you running around with a NEOPUFF and you don’t know how to set it up safely</i> ” Expert no. 3 (ECP/Nursing sister) . Specific neonatal interventions such as “ <i>How to use your specialized ventilators... methods of ventilation and the air mixtures</i> ” Expert no. 1 (ECP) were also discussed by participants. The learners also explained that ventilation should be included. “ <i>...how to use the ventilator, ventilation settings</i> ” and specifically equipment like the “ <i>neopuff</i> ” Learner no. 6 (ECP) .

Appendix S2: Coding tree for proposed curriculum structure and assessment methods

Sub-category	Code	Participant quote
Course Duration	<ul style="list-style-type: none"> Part time post graduate diploma (Proposed by learner and expert group) or,] Part time master’s degree (Proposed by expert group) 	Participants also felt that “ <i>There is enough content to learn to justify a full master’s degree</i> ” Expert no. 3 (ECP/Nursing sister) for such a specialty. The learner group did disagree on the Masters exit level as it will exclude ANT scope ALS providers. “ <i>It should be one year part-time course. It should be a post graduate diploma and not a Master’s degree as the ANTs do not qualify to do the Master’s degree</i> ” Learner no. 3 (ECP) . The learner group of participants reflected on the expert group’s suggested duration of

		<p>education and felt that a post graduate diploma would be ideal. <i>"I do agree about maybe going about a year or longer"</i> Learner 7 (ECP). Participants also felt like it should be completed on a part time basis. <i>"I don't have a problem with it following directly after your bachelors because it wouldn't be a full time thing"</i> Expert no. 3 (ECP/Nursing sister) and <i>"...a part time course for those people that are still working operationally and would like to increase their knowledge when it comes to neonatal specialized units"</i> Learner no. 7 (ECP) would be the best solution to make attending possible.</p>
<p>Course Model</p>	<ul style="list-style-type: none"> • Blended course – Online/Workplace/Simulation-Based Teaching Learning & Assessments • Mentorship programme 	<p>Participants gave their opinion on the methods of education they perceive would best suit this kind of course. Participants said that it needs to be interactive. <i>"It needs something that has opportunity for people to ask questions"</i> Expert no. 5 (Neonatologist) and <i>"I would say that there needs to be contact time with the learner"</i> Expert no. 6 (CCA). Mentorship was mentioned as vital in this kind of education. <i>"...actual observation and discussion with somebody who has more experience in the world of neonatal transport"</i> Expert no. 2 (Paediatrician). Participants also felt that <i>"There needs to be theory content but a lot of that can be done online as part of adult learning"</i> Expert no. 4 (CCA/Nursing Sister). Learner participants also felt that a theory component should be included. <i>"... just to level out knowledge across the board, it would be beneficial to have a theory component"</i> Learner no. 6 (ECP). It was perceived as best to <i>"get a specialist to come in and discuss specific topics"</i> Expert no. 1 (ECP) for complex and specialized topics.</p> <p>Work integrated learning and clinical placement was perceived as very important in this type of education. <i>"So, in that course I would put, practical time.....on a neonatal ICU transfer vehicle, so that they can get this practical exposure"</i> Expert no. 6 (CCA) and <i>"The guys need to work on a critical care retrieval service for hands on experience"</i> Expert no. 3 (ECP/Nursing sister). Participants felt that an understanding of the control room processes would also benefit learners. <i>"...and then rotate to the different control rooms, so that they can see the information that they're getting in from hospitals to request transfers, they can see the different resources, understand all those limitations and the decision making there"</i> Expert no. 1 (ECP). Neonatal ICU's are a limited resource and where these are not available for learners to work in <i>"neonatal units or casualty"</i></p>

		<p>with doctors and nurses....certainly units where babies are being born” Expert no. 2 (Paediatrician) would be a suitable alternative. “With our setting, working with specialised teams (CCR) might not be that practical so we might want to look at in hospital exposure to neonates in NICU” Expert no. 3 (ECP/Nursing sister) was an opinion on how to increase learner exposure to more neonates.</p> <p>The preferred methods of education were discussed by the participants. They felt that mentorship should play an important role in this education. “...internship program post qualification ... where as you are placed with experienced practitioners for a year, or maybe two years, before you are allowed to make these important decisions on your own” Learner no. 4 (ECP). Online learning was also expressed as a practical solution to learners who will be working full time. “... a part time course where they will be able to go in and also have online classes, if they can't go in at school” Learner no. 7 (ECP).</p>
Resources	<ul style="list-style-type: none"> • Electronic Devices • Specialist supervision • Cost: self/employer funded 	<p>It is important to find out if learners will have resources available before developing a course. Participants also felt that electronic devices and internet access to participate in online teaching was not such a barrier any more. “People, kids in the rural areas have tablets, we have cell phones, like I'm currently using my cell phone” Learner no. 7 (ECP). From a cost perspective, participants felt that employer buy in is very important. “I think it's imperative for the employer to support this kind of program, because it's going to be beneficial for both practitioners and their employer” Learner no. 2 (CCA). Participants also felt that some learners will be able to pay for themselves. “But if it's something that you personally feel like you will be doing, you can also try and pay for yourself” Learner no. 7 (ECP).</p>
Targeted Student Group	The course should be inclusive for all Advanced Life Support providers	The learner group felt that this kind of education should be inclusive for all ALS providers “So, I think a course like this, if then allowed afterwards for the CCA and the short courses to have access to, those qualifications where they can now do these transfers (change scope) would be such a huge help” Learner no. 6 (ECP) .
Suggested scope of the course	<ul style="list-style-type: none"> • Scope of practice should change after course • The course should be considered as an elective speciality for ALS providers in South Africa 	The course was also expressed as “...this should be a specialized field. We're not looking at a one month or two months short course” Expert no. 4 (CCA/Nursing sister) . It was also suggested to be a specialty for qualified pre-hospital providers. “It should be as a standalone course for a specialized team” Learner no. 5 (CCA) . The learner group felt

		<p>that this kind of education should be inclusive for all ALS providers and that it should change the current scope of practice limitations. <i>“So, I think a course like this, if then allowed afterwards for the CCA and the short courses to have access to, those qualifications where they can now do these transfers (change scope) would be such a huge help”</i> Learner no. 6 (ECP).</p>
<p>Formative assessments Continuous summative assessments</p>	<ul style="list-style-type: none"> • Work-Based Assessments • Simulation-Based Assessments • Written Assessments 	<p>The participants gave their opinion on the methods of assessment. In their experience they <i>“feel quite strong about continuous learning and continuous assessments”</i> Expert no. 1 (ECP). Discussions around patients were also mentioned as a valuable assessment tool. <i>“You do need to practically put a baby on a ventilator and move them in an incubator, but for the complex cases you can in hospital go to a patient with transposition (of the great arteries) for example and then discuss how you would move them”</i> Expert no. 3 (ECP/Nursing sister). Participants added on to methods of assessment with oral examinations. <i>“...you can gauge understanding and insight a whole lot more (with oral exams) when compared to answers from a written test. You can engage with the learner and elaborate on the scenario”</i> Expert no. 3 (ECP/Nursing sister). Practically assessing skills were described as <i>“I would bring in an OSCE station. I mean, this practitioner should be actually very much knowledgeable on using say, an infusion pump or a syringe driver”</i> Expert no. 6 (CCA). Patient simulations were perceived as valuable assessment tool but consideration for the risk on a real patient needs to be considered. <i>“Another way might be to give them a simulated patient transfer of a real baby in hospital and then you discuss it with them without moving the patient. Then the learner can give you his plan. So a combination of simulated and real life stuff”</i> Expert no. 3 (ECP/Nursing sister). Finally, written assessments were described as <i>“the theoretical written paper needs to be done... for the theory and base knowledge”</i> Expert no. 6 (CCA).</p> <p>The learner group of participants shared their opinion on the assessment. <i>“I think a more physical approach, your OSCE skills, your actual simulation could prove to show if the knowledge was impacted”</i> Learner no. 1 (CCA). The learner group also felt that oral assessments add value as an assessment tool. <i>“... should be more clinical reasoning assessments so that that can maybe be done in form of an oral assessment, a learner’s</i></p>

		<p><i>capability of reasoning, different topics with regards to treatment, and also problem solving” Learner no. 4 (ECP). They felt that written assessments should be included during the foundations phase of this course. “I think we can begin with written assessments” Learner no. 3 (ECP). Continuous assessments by a mentor was also discussed by participants. “... maybe employ or contract like honorary lecturers, or people that can give feedback regarding the learners or to the university” Learner no. 4 (ECP).</i></p>
Summative assessments	Portfolio of Evidence	<p>Participants also suggested that the practical component will have to be signed off before completion. <i>“Which skills are required to qualify for this course...which then you need to demonstrate a portfolio of evidence” Expert no. 5 (Neonatologist).</i></p>

PART C

Proposal

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL
CRITICAL CARE TRANSFERS

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This study is in partial fulfilment of the requirements for a Masters in Philosophy:

Clinical Emergency Care

Initiating the development of a South African curriculum for education in neonatal critical care transfers

INTRODUCTION

Owing to limited neonatal care resources, the transfer of neonates to district and tertiary facilities is inevitable in low- to middle-income countries like South Africa. These transfers do not come without risk, and this is why the transfer of neonatal patients is reserved to specialised retrieval teams, internationally. For the most part, this is not the case in South Africa where neonatal transportation is on the scope of every prehospital provider registered with the Health Professions Council of South Africa. These prehospital providers have limited neonatal-specific training. In order to minimise the risk of adverse events that can lead to poorer outcome, it is important for pre-hospital providers who transfer neonates to demonstrate a sound knowledge of neonatal critical care. There are currently no courses dedicated to neonatal critical care transfer in South Africa. The transfer of neonates from one medical facility to another is high risk in nature, especially in the critically ill patient requiring intensive care (1). This service in South Africa is provided by various prehospital emergency services, with varied personnel qualifications and experience (2). Early identification of potential harmful events during transfer can help reduce risk of adverse events (1). Training and education are vital in reducing adverse events in neonatal transfers (1).

The service of neonatal transfers has changed over years in many respects. From an ad hoc function provided by emergency services to the development of full-time inter-hospital transfer units with specialised equipment to match the needs of this patient group (1). The introduction of such specialised medical equipment in the form of heated high flow humidified nasal oxygen and heated humidified CPAP via nasal prongs or mask has eliminated the need for all neonates that require respiratory support to be intubated before transport (3). Understanding the need for specialised equipment in specific patients come with knowledge. It is important for prehospital providers who transfer neonates to be able to identify the special needs patient and to apply the equipment, or refer the case to a team that can provide the level of care. A South African study, "Preparedness of Western Cape ALS providers to provide clinical stabilisation and intensive care for neonates during the patient journey", assessed the prehospital provider's subjective opinion on the level of knowledge and equipment they require to manage a neonate during transfer (4). The study found that prehospital providers perceived that they were greatly under-equipped and required additional standardised training to close the knowledge gap (4). Expert opinion also suggest that prehospital providers who perform critical care transfers lack training and knowledge which can result in adverse events (AE's) (5, 6).

SAQA is a South African statutory body mandated to develop and implement the national qualifications framework (NQF). This framework sets the boundaries and guidelines for South African qualifications and all forms of education fits into this framework. The SAQA online register for qualifications provide information regarding course outcomes and assessment criteria. Qualifications that form the basis of the prehospital sector were found under the search term “Emergency Medical Care”. All of these qualifications make none or very limited mention of neonates with none making mention of neonatal transfers or critical care (7). The level of care and scope of practice of prehospital personnel is regulated by the Health Professions Council of South Africa (HPCSA). The HPCSA have published a list of prehospital personnel capabilities. The capability of inter-facility transfers have been assigned to all levels of care with no distinction made for neonates (8). Some specific neonatal skills have been assigned to Emergency Care Providers (ECP) only, namely needle thoracentesis and mechanical ventilation (8). The skill of managing a neonate in cardiac arrest have been assigned to all levels of care with only the drugs separating the qualifications in scope of practice (8). With both SAQA and HPCSA providing limited guidance on education content in neonatal critical care transfers, the content delivered will be dictated by the various tertiary institutions and vary between qualifications.

It is recommended that the transfer of neonates warrant additional training over and above that of current offerings. The management of an acutely ill neonate requires a level of advanced knowledge and skill from the provider. Expertise in a field such as this does not automatically develop as a result of experience and traditional education (9). Training opportunities must be created where deliberate practice can be applied at specific levels to develop an expert in a field (9).

The aim of this project is to initiate the development of a South African curriculum in neonatal critical care transfers. To this end, a general and targeted needs assessment will be conducted to derive broad course outcomes. These are fundamental in the construct of a robust curriculum if it is to contribute towards the development of competent practitioners in the transfer of neonates nationally.

AIM

The aim of this project is to perform a general and targeted needs assessment to derive broad course outcomes, which will inform the next steps in curriculum development for education in neonatal critical care transfers.

OBJECTIVES

1. To describe the neonatal patient population that is currently being transferred in South Africa.
2. To perform a literature review on international neonatal training and to describe the curricula.
3. To assess the specific needs of prehospital students as it pertains to the teaching, learning and assessment (TLA) of a curriculum in neonatal critical care transfers.
4. To assess the needs of, and understand the current limitations to training in neonatal critical care transfers within academic and health institutions in South Africa.
5. To derive the goals of a curriculum in prehospital practitioner training in critical care transfer of the neonate.

PARADIGM

This study will be conducted within the inductive interpretivist paradigm. The paradigm's assumptions of relativist ontology are that reality is subjectively based on the understanding of social and experimental levels. The researcher intends to describe the experience of the participants in neonatal critical care transfers in South Africa.

Epistemologically, the researcher intends to gain an understanding of the participant's opinion and knowledge. The axiology has relation to why the researcher values research. I value research as it will produce knowledge that will help solve real-world problems. The insight gained into this research topic will assist in the development of the curriculum in neonatal critical care transfers in South Africa.

CONCEPTUAL FRAMEWORK

KERN'S CURRICULUM DEVELOPMENT

To help identify the nature of the problem in medical education, it is important to adopt a conceptual framework. Conceptual frameworks provide guidance on study designs and how to interpret study results (10). These also help clarify the nature of the problem and guide us towards well-grounded solutions (10). Kern et al. provides such a framework in six steps to facilitate analysis of the problem within curriculum development as shown in figure 1 below;

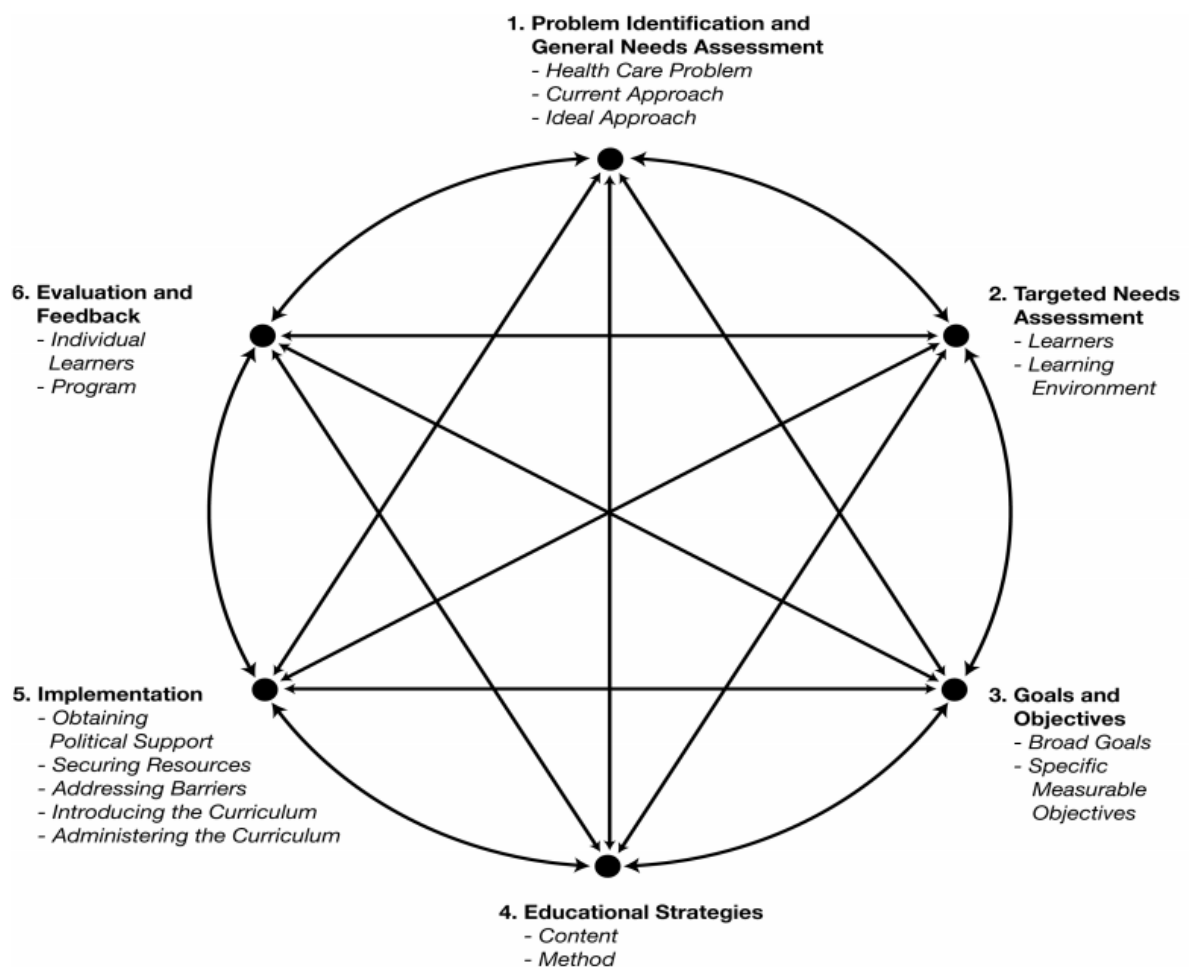


Figure 1; Kern et al. Six-step approach to curriculum development (11)

This study will explore the first three steps in the design of neonatal critical care transfer curriculum. The next steps namely: educational strategies, implementation, evaluation and feedback are beyond the scope of this study. In these steps it will be necessary to further consult with the different stakeholders and then undertake a consensus process (such as Delphi or nominal group technique) in order to finalise the work. During these phases, a broader and more systematic consultation with neonatology and other expert groups will be necessary.

Kern describes the steps that need to be followed during curriculum development (11). In the first step, the general needs assessment needs to clearly define the problem which will help focus the curriculum's goals and objectives (11). This comprehensive definition of the problem must describe the impact that it has on health care professionals and their patients. The second step of targeted needs assessment identify the group of learners and guide the educational intervention will solve the problem identified (11). Information obtained from learners include perceptions of previous learning experiences, perceived deficiencies, learning preferences, barriers and available resources. In step three the identified needs are addressed by defining goals and objectives. The goals describe the overall purposes of the curriculum and the objectives are more specific measurable directives (11). In step four, the educational strategies develop the content and the methods in which it will be delivered to the group of learners. Step five is implementation and identifies the resources that will be needed to deliver the curriculum (11). The final step of evaluation and feedback creates a continuous cycle of development and improvement for the curriculum.

THEORY OF SITUATED LEARNING

Learning does not only originate from a single source or institution but occurs rather as a result of the community that these providers find themselves in. The community that these providers will learn from are not limited to the prehospital environment either, but will include the EC and ICU settings as well. Essential knowledge is shared between these individuals and form part of the learning process. It is thus important to include all the role-players that form part of this community when developing a new curriculum. Community of practice falls within the theory of situated learning and forms part of a conceptual framework in education (12). The inclusive process of communities of practice helps with the identification of outcomes during curriculum design as the participation in input by all parties are essential (12).

It is important to understand how teaching-learning occurs in the pre-hospital context. The field of pre-hospital emergency care cannot be taught in a classroom alone, but must include aspects of active learning in the form of skills lab and workplace-based learning. This, when included in the curriculum, facilitates authentic and deeper learning. (13, 14)

CURRICULUM

The term curriculum originates from the Latin word *currere* which means “to run”. A curriculum provides a template for learning. It provides a definition of the learning that is expected to take place during a course in terms of knowledge and skills. The curriculum must also define the methods that will be used for teaching and assessment and what resources will be needed for effective delivery. A curriculum is more than a syllabus, where a syllabus forms part of the curriculum and only focusses on the content of learning. The formal published curriculum of a course must be delivered as a functional curriculum and there must be no mismatch as development turns into implementation (15).

The shortfall of neonatal critical care education in the pre-hospital environment has already been described in this document. There is a need for additional neonatal critical care education for pre-hospital providers but no guidance from the regulatory bodies on what the educational content for such training should be. Tertiary institutions are thus left to decide what the relevant content should be. This content and duration of delivery will vary between institutions. It is the aim of this study to initiate the curriculum development of education in neonatal critical care transfers for ALS providers in South Africa.

PRE-HOSPITAL CARE PROVIDERS

Neonatal critical care transfers are reserved for specialised teams in developed countries and are often staffed by a combination of doctors, pre-hospital providers and nursing staff. In a low and middle income country (LMIC) like South Africa, this function is performed by advanced pre-hospital providers. The HPCSA have changed the way that education is conducted in the pre-hospital setting by discontinuing all forms of short courses. The current offerings are presented at tertiary institutions and qualifications now fit into the NQF. This transformation process is slow however and the need for these providers are higher than the current education system can produce. A secondary problem to this is that advanced pre-hospital providers often leave the country in pursuit of greater remuneration. The reality of neonatal critical care transfers in South Africa are that it is being performed by a mix of pre-hospital providers with varying duration of education and scope of practice. These qualifications

which are often described in the industry under the term Advanced Life Support (ALS) consist of: ECP (Emergency Care Practitioner)(Hons degree in EMC), ECT (New National Diploma in EMC), Paramedic (certificate in EMC, Old National Diploma in AET). This study will focus on the group of ALS providers as the level of care described is that of critical care.

NEONATAL CRITICAL CARE TRANSFERS

The patient population that this study will focus on are those that require critical care. These patients are critically ill and have life threatening conditions that require life support, invasive monitoring techniques and potentially resuscitation. To narrow this field down even more the study focusses on neonates only. The neonatal patient population have special needs during transfer which include the monitoring and regulation of all haemodynamic parameters. Specialised equipment like humidification, CPAP and high flow therapy are available on select critical care transfer units but this is not the norm in a LMIC like South Africa. The development of this curriculum will be based on the critical care needs of the neonates during transfer.

An understanding of the patient characteristics of the neonatal population that requires critical care transfer in South Africa will enable us to identify the particular training needs of emergency care practitioners within this setting. Phase 1 of this study will therefore inform Phase 2 in that it will indicate the specific areas of focus to be included when designing a curriculum for a new neonatal critical care transfer course.

METHODS

Phase 1

Phase 1 will consist of two subsections aimed at describing the patient population that is currently being transferred in South Africa. First, the patient population will be described using the results from a retrospective chart review conducted in South Africa between 01 January 2017 and 31 December 2017. Second, a literature review will be conducted on international neonatal training programs to describe the curricula. This information will be used to inform the discussion during expert interviews.

Retrospective chart review:

Sampling

A retrospective chart review that was conducted by M. Venter determined the national patient population of critical care transfers in South Africa. These transfers were conducted by private and government pre-hospital providers and the number of transfers were in excess of 2000. Permission to use the data is granted by the student and the primary supervisor of this study.

Study Population

The neonatal population will be separated from the rest of the patient population. A neonate is defined as a patient that is not older than 28 days/4 weeks. If the patient was born premature, the corrected gestational age will be used. The corrected age is calculated by subtracting the weeks of life from the number of weeks of prematurity. Full term is 40 weeks.

Data Collection

The data is already in an Excel spreadsheet. To separate the neonates from the rest of the patients, the column for age will be selected and the range sorted from low to high. The patients that fall under 28 days old will be selected and the rest hidden. The data has already been cleaned by M. Venter, but it will be performed by the researcher again. All columns will undergo range checking by sorting them from small to large if numeric to identify any mistakes of outliers during entry. All decimal places must be the same and set at one decimal place. For example a weight recorded as 1350g will be 1.4kg. Alphabetical entries will be sorted from A to Z and outliers identified and corrected for example the gender column of male and female must all be in the same case with no spelling mistakes or spaces. The study population will be described under the following groups: Demographics (age, weight, gestational age and gender), primary diagnosis (respiratory, cardiovascular, GIT and other), attachments and clinical interventions. Based on these groups, the researcher can give a rich description of the patient population's underlying pathologies and needs during transfer.

Data Management

The data will already be anonymised by M. Venter. As the data will not contain any patient names, hospital information or service provider details, there will be no way to identify the patients and it will not be in contravention of the South African PoPI Act. The data will be stored on a personal password protected computer only accessible by the researcher and primary supervisor. Backup of the data will be in secure cloud storage provided by the UCT.

Data Analysis

Descriptive measures of the column variables will be conducted. Measures of centrality will include mean, median or mode. Measures of dispersion will include standard deviation (SD), variance and range. Data will be identified by type as categorical or numeric. Following the description of the variables, the most appropriate statistical test will be selected from a guidance table (16).

Literature review

A literature search will be conducted using Google scholar and Pubmed. The following search terms will be used to extract information related to neonatal training programmes: neonate, training, education, courses, critical care, transfers, curriculum". Literature that contains data about curriculum objectives for neonatal transfers, that were published in the past ten years and are in English will be included in the review. Curriculum objectives extracted from the literature will be used to inform the discussions during expert interviews.

Phase 2

In the second phase, objectives three, four and five will be explored by semi-structured and focus group interviews.

Sampling

The proposed study will make use of purposive sampling to recruit participants.

Experts

In order to ensure that course goals are reflective of expert views, six to eight experts in neonatal care and critical care retrieval will be invited to individual one-on-one interviews. In order to establish the panel of experts, the Paediatric Emergency Care South Africa (PECSA), Emergency Care Society of South Africa (ECSSA) as well as USANA (neonatal association) will be contacted and requested to extend the invitation to the study to members of their Special Interest Groups (SIG) related to neonatal care or transport. Experts will include: doctors specialised and currently working in the fields of neonatology, neonatal intensive care or neonatal retrieval, registered nurses working in neonatal ICU and advanced life support paramedics or emergency care practitioners working in the field of critical care retrieval. All experts should have greater than 5 years' experience in their field.

Students

Careflight Group hosts a privately administered database of advanced life support providers who have voluntarily supplied their details to be entered into the database. The aim of this list of providers is to distribute interesting news, vacancies and research opportunities/requests. The database currently has just over 600 South African paramedics included. The owner of this database, Mr Patrick Wallett, will be approached to distribute a call for participants to contact us to partake in the study. The sample of operational ALS providers will be selected based on their experience in neonatal critical care. The term “student” in this context is any individual that will potentially enrol in the neonatal critical care transfer course in future. The researcher will aim to obtain a total of four to eight participants from both the government and private sectors and invite them to a focus group discussion. The ALS providers must be registered with the HPCSA on the ANT or ECP registers. They are more likely to be involved with critical care neonatal transfers than the lower scopes of practice would. These practitioners should be actively involved in the transfer of at least one neonate per month. The exclusion criteria would be ALS providers that do not perform at least one neonatal transfer per month.

The individuals will be contacted with a brief description of the study by the researcher. If these individuals that qualify for the inclusion criteria show their willingness in participating in the study, they will be provided with the discussion details. These details will comprise of a meeting time, date and venue. The discussions will take place at a time and venue convenient for the participants. Considering the current COVID-19 pandemic, national guidelines regarding social distancing will be adhered to at the time of data collection. Should it be necessary at the time of data collection, a web based communications platform will be used to conduct the interviews and focus group discussions. The discussions will be led by the primary researcher.

Data Collection

The one on one interviews with the experts will be conducted first. The discussion will be informed by the first phase of this study namely the description of the neonatal transfers that are being conducted in South Africa and the literature review on international neonatal training. The discussion schedule (Appendix A) will contain the questions to be followed by the facilitator.

The student focus group discussion will be conducted next. The discussion will be informed by the interviews with the experts and provide information on suggested course content and methods of delivery and assessment. The questions can also be found in (Appendix A).

The participants in the study will share their opinion on the subject in their private capacities and not those of their employer or organization. If the participants refer to their employers or organizations this will be anonymized during the transcription phase of the data.

The interviews will depend on the use of formulated questions but does not require strict adherence to these. Some new questions might arise and improvisation is encouraged. The researcher will listen and encourage participants to speak freely about the topic. The discussions are estimated to last no longer than an hour. The interviews will be recorded and transcribed for data analysis. Interviews will be conducted up to the point where data saturation has been achieved. Data saturation is described as the point where further data collection will be counterproductive and new data does not add any more value (17). If saturation is not achieved, additional experts in neonatal critical care will be added. Following the interview the researcher will ask the participant if the captured information was interpreted correctly for member checking purposes.

Data Management

To ensure data safety, audio recordings will be downloaded from the recording device onto the researcher's password protected computer. The files on the computer will be coded and the original files deleted from the recording device. The transcriptions of the audio recordings will be de-identified and saved for a minimum of five years to which only the researcher and main supervisor will have access to. Backup of the data will be in the form of secure UCT provided cloud storage.

Data Analysis

Data will be analysed using content analysis to the manifest level. The steps of content analysis will be based on the methods described by Erlingson et al in 2017 (18). These steps are;

1. Transcription of the discussions into text
2. Read and re-reading the discussions to get a sense of it all
3. Dividing text into smaller parts known as meaning units
4. Condense these units while maintaining the core meaning
5. Label of condensed meaning units by formulating codes
6. These codes must then be grouped into categories to the manifest level

Steps one to four will be conducted by the primary researcher independently with the Nvivo programme (19). The research supervisors will oversee the process to ensure that due process is followed. The coded categories defined in step five and six will be in consensus with the supervisors. Results will be reported based on these categories.

TRUSTWORTHINESS

Credibility deals with how believable the research findings are. Investigator triangulation will be utilised during the analysis of the data. To correct the subjective views of the interpreters, the researcher and the supervisors will analyse the data collectively (20). Multiple points of view will balance out the subjective influences of individuals (20). As the researcher will be collecting and interpreting the data, there is a potential for bias. It is important to have alternative perspectives during the coding process. Peer debriefing sessions with the study supervisors will provide valuable second opinions on the meaning of the data (21). During the interview process, the researcher will summarize the information provided by the participant. Following the interview the researcher will ask the participant if the captured information was interpreted correctly. This process of member checking is important as a quality control measure to ensure accuracy (22).

To achieve transferability and dependability, rich descriptions of the data will be provided and triangulated between researchers for comparative interpretation. It is the responsibility of the researcher to ensure that enough contextual information about the study is provided so that the reader can come to the conclusion of transferability (23). The data will be described in such detail that the reader can decide whether it is applicable to their own context. Description of data analysis and the interpretation of findings will be described in detail in the final paper. The researcher will present the deductive methodology of code generation to the reader through a coding tree.

Confirmability will be ensured through a transparent and reflexive process of data description and interpretation. The researcher will admit to his own predispositions on the topic (23). A detailed description of the methodology will help the reader's decision to accept or reject the presented findings. The supervisors of the study will act as secondary data analysers to prevent researcher bias.

ETHICAL CONSIDERATIONS

Risk and benefits

This is a low risk study and the risks involved for the participants are minimal. The curriculum content identified in this study will be the foundation for further research in the field with the end goal of a South African designed course in neonatal critical care transfers.

Informed consent process

Anonymised neonatal data will be obtained for the general needs assessment and will adhere to the South African PoPI act. Stakeholder participation is voluntary and confidentiality will be ensured. Consent for participation will be obtained by signature on the research information document (Appendix B). The researcher will explain the research information to the participant and answer all questions to ensure that it is understood. The participants may withdraw from the study up until the point of data analysis.

Privacy and confidentiality

On the day of the discussion, the participants will be allowed enough time to ask questions about the study. They will be provided with a participation and indemnity form. Following formal consent, the participants will also be asked to provide consent for audio recording of the session. The participants will be informed that consent may be withdrawn at any point during the discussion. The participants will be ensured that during the transcription phase all identifying content to individuals or groups will be anonymised. This will ensure complete confidentiality of the participants. The list of individuals that will take part in the study and the data obtained will only be accessible to the researcher and kept on a password protected laptop and in UCT provided secure cloud storage. Participation in the study will not be shared with any employer, organisation or other third party unless if divulged by the participants themselves.

Reimbursement for participation

The participation in the study will be voluntary. The interviews will be held at a venue most suitable for the participants so that no extra cost has to be incurred. There will be no form of reimbursement to the participants.

STRENGTHS AND LIMITATIONS

The strength of this study is that it is the first of its kind in South Africa. It seeks to solve a real-world problem, identified by this study as a need for additional training in neonatal critical care transfers. The outcome of additional training for ALS providers can potentially decrease adverse event rates and

risk to the fragile neonatal population during transfers. The limitation of the study is that the entire process in curriculum design as described by Kern is beyond the scope of this study.

CONFLICT OF INTEREST

There are no conflicts of interest.

DISSEMINATION OF FINDINGS

The dissertation will be submitted to the UCT for peer review and publication on the Open UCT repository and potentially in an open access scientific journal. The findings will be made available to research supervisor Dr. Willem Stassen for the use in the development of the critical care neonatal course and future research.

PROJECT TIMELINE

Descriptor	2020					2021	
	Feb	Apr	May	June- July	Aug-Dec	Jan	Feb
Research Summary	X						
Protocol EMDRC approval		X					
Ethics				X			
Data collection				X			
Data analysis					X		
Final report						X	X

Table 1

RESOURCES UTILISATION AND BUDGET

Item	Description	Total cost
Consumables	Stationary, internet data	R2000
Travel costs	Travel to various cities for focus group discussions	R8000
Total		R10 000

Table 2

FUNDING

The study will be self-funded by the student

REFERENCES

1. Ratnavel N. Safety and governance issues for neonatal transport services. *Early Human Development*. 2009;85(8):483-6.
2. Vincent-Lambert C, Wade G. Challenges relating to the inter-facility transport of high acuity paediatric cases. *African Journal of Emergency Medicine*. 2018;8(1):29-33.
3. Boyle MA, Dhar A, Chaudhary R, Kent S, O'Hare SS, Dassios T, et al. Introducing high-flow nasal cannula to the neonatal transport environment. *Acta Paediatrica*. 2017;106(3):509-12.
4. Ismail E. Preparedness of Western Cape ALS providers to provide clinical stabilisation and intensive care for neonates during the patient journey. <https://openscholar.dut.ac.za/handle/10321/12>: Durban University of Technology; 2018.
5. Venter M, Stassen W. The capabilities and scope-of-practice requirements of advanced life support practitioners undertaking critical care transfers: A Delphi study. *Southern African Journal of Critical Care*. 2016;32(2):58.
6. Royal C, McKerrow NH. A retrospective review of the transfer of critically ill children to tertiary care in KwaZulu-Natal, South Africa. 2015;9(4):112.
7. SAQA. SAQA qualification database. 2020.
8. HPCSA. HPCSA Policy and guidelines. 2020.
9. Anders Ericsson K. Deliberate Practice and Acquisition of Expert Performance: A General Overview. *Academic Emergency Medicine*. 2008;15(11):988-94.
10. Bordage G. Conceptual frameworks to illuminate and magnify. *Medical education*. 2009;43(4):312-9.
11. Kern DE. A six-step approach to curriculum development. P Thomas, D Kern, M, Hughes, & B Chen, *Curriculum development for medical education*. 2016:5-9.
12. Lave J. *Situating learning in communities of practice*. 1991.
13. Werner JM, Scovotti C, Cummings RG, Bronson JW. Building a Case for Active Learning: The Use of Lecture vs. Other Classroom Activities at LMBC. *Journal of Learning in Higher Education*. 2018;14(1):7-15.
14. Reime MH, Johnsgaard T, Kvam FI, Aarflot M, Engeberg JM, Breivik M, et al. Learning by viewing versus learning by doing: A comparative study of observer and participant experiences during an interprofessional simulation training. *Journal of Interprofessional Care*. 2017;31(1):51-8.
15. McKimm J. *Curriculum design and development*. Imperial College Centre for Educational Development. 2007.
16. BMJ. Choosing statistical tests. *the BMJ*. 2020.

17. Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & quantity*. 2018;52(4):1893-907.
18. Erlingsson C, Brysiewicz P. A hands-on guide to doing content analysis. *African Journal of Emergency Medicine*. 2017;7(3):93-9.
19. Bazeley P, Jackson K. *Qualitative data analysis with NVivo*: SAGE publications limited; 2013.
20. Flick U. Triangulation in qualitative research. *A companion to qualitative research*. 2004;3:178-83.
21. Barber JP, Walczak KK, editors. *Conscience and critic: Peer debriefing strategies in grounded theory research*. American Educational Research Association (AERA) Conference, 13-17 April; 2009.
22. Birt L, Scott S, Cavers D, Campbell C, Walter F. Member checking: a tool to enhance trustworthiness or merely a nod to validation? *Qualitative health research*. 2016;26(13):1802-11.
23. Shenton AK. Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*. 2004;22(2):63-75.

Retrospective Chart Review

Aim

The aim of this retrospective chart review was to describe the patient population that is currently being transferred in South Africa. The description of these neonatal critical care transfers informed the expert interviews as part of the curriculum design.

Method

This observational cohort study by Venter et al. (1) retrospectively described the patient population of critical care transfers that was conducted in South Africa between 01 January 2017 and 31 December 2017. These transfers were conducted by dedicated CCR teams from the two largest private national emergency medical services. Permission to use the data was granted by the author of this study.

Summary of findings

A total of 444 neonates were transferred by dedicated CCR teams. An average of two diagnoses were recorded per patient. Of the 760 diagnoses, the most prevalent were respiratory distress (139), with congenital heart defects (123) as the second highest and prematurity (81) as the third. The study further described the indwelling devices and attachments. An average of four attachments or indwelling devices per patient were recorded. Of the 1982 attachments, patient monitoring (677) was the most prevalent with pulse oximetry as the most common modality. Vascular access (398) was the second most recorded indwelling device, with peripheral venous access (292) as the most common form. A total of 182 patients required ventilatory support. The medications administered were also described. An average of one medication was administered or infused per patient. Of the 422 medications, maintenance fluid (199) was the most prevalent, with Neonatalyte (85) as the most utilised fluid. This was followed by sedation (57), with Midazolam (46) as the most popular drug of choice. One in ten neonates also required inotropic support (33) with Dobutamine (16) as the most commonly used medication.

Informed discussions

The findings of the study were presented in table form to the expert group participants in a pre-reading document that informed the semi-structured interviews. The participants were asked if they agreed with the findings of the study as it relates to the patients that they managed in their setting.

Limitations

There were some important limitations to the study that has to be mentioned. The study design was retrospective in nature, and the diagnosis recorded on the patient report forms used during data collection were unconfirmed. The data was also collected from private services only, but it is worth mentioning that it compares with similar studies in the state sector of neonates transferred by non-dedicated teams.

References

1. Venter M, Theron E, Williams W, Khan W, Stassen W. A national retrospective review of neonatal critical care transfers in dedicated critical care transport services in the private sector. South African Medical Journal. 2021;111(10):981-4.

Appendices

Appendix 1: Ethics Clearance Letter



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

26 October 2020

HREC REF: 474/2020

Dr W Stassen

Division of Emergency Medicine
F51 OMB
Email: - willem.stassen@uct.ac.za
Student: wilwes004@myuct.ac.za

Dear Dr Stassen

PROJECT TITLE: INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL CRITICAL CARE TRANSFERS (MPHIL DEGREE - MR WEST WILLIAMS)

Thank you for your response letter addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 October 2021.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: Mr West Williams will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate Institutional approval, where necessary, before the research may occur.

HREC/REF:474/2020sa

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE



Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Appendix 2: Participant Consent Form

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL CRITICAL CARE TRANSFERS

This informed consent form is for English-speaking experts in neonatal care and critical care retrieval who are participating in a one-on-one interview. The same form will be used for a focus group discussion with students in neonatal critical care transfers. The experts and students will be discussing and describing their perceptions regarding education in neonatal critical care transfers in South Africa.

Name of Primary Researcher: West Williams

Name of Affiliations: University of Cape Town

Name of Research Supervisor: Dr Willem Stassen

Name of Research Co-supervisors: Elzarie Theron and Dr Waseela Khan

This informed consent form has two parts:

- Information Sheet (to share information about the research study with you as the prospective participant)
- Certificate of Consent (to be signed if you agree to participate)

You will be provided with a full copy of the informed consent form.

PART 1: Information Sheet

Introduction

I, West Williams, the primary researcher, am currently doing my master's in philosophy: Emergency Medical Care at the University of Cape Town. I am conducting research with the aim of initiating the development of a curriculum for education in neonatal critical care transfers. I will be approaching experts in South Africa to participate in a one-on-one participant interview as well as a group of students to take part in a focus group discussion. This document will provide you with information about the study and it will invite you to be part of the research. If there is anything you do not understand or if you have any questions about the research, please feel free to ask. You may also call or email me and I will respond to any questions that you may have.

Voluntary Participation

Being part of this research is entirely your choice and voluntary. Whether you decide to participate in the research or not – there will be no consequences to you. You may also decide to change your mind and may withdraw from participating in the research, even if you agreed to it at an earlier stage.

Description of the Process

During the research the following will happen:

Experts:

- You will be interviewed in an online format with only the primary researcher and possibly one supervisor present at a time that is convenient to you.
- A total of six to eight people will be interviewed.

Students:

- You will take part in a focus group discussion with four to six other advanced life support providers that are currently conducting neonatal transfers in South Africa. The term student is based on your potential future participation in a course in neonatal critical care transfers.

All participants:

- The interview/discussion should take approximately one hour.
- The interview/discussion will be audio-recorded so that it can be transcribed at a later stage.
- You will be contacted at a later stage of the research process to confirm the interpretation of your interview/discussion.

Risks or Benefits

There are no foreseen risks to your participation in this research project. You will not benefit from participation and will not be compensated for your participation in any way.

Confidentiality

The information that is gathered during the study will be kept confidential. As the participant, your identity will remain anonymous during the transcription, analysis and reporting of the data. The audio recordings and transcribed interviews will be kept on a password protected computer to which only the primary researcher has access. All of the audio recordings will be destroyed (deleted) after the transcription of the interviews. Auditors might require access to the anonymised transcribed for quality assurance purposes; however, at no stage will your identity, as the participant be revealed.

Right to Refuse or Withdraw

You are not obliged to participate in this research study if you do not want to do so. You may withdraw your participation during the research study at any stage before the audio recording transcription. The transcriptions will be completely anonymised and thus the researcher will have no way of identifying the participant after this. It is entirely your choice; no negative consequences will be incurred if you should choose not to participate or withdraw. In order to withdraw the participant can contact the primary researcher with the information provided below.

Ethics Clearance and Approval

This proposal has been reviewed and approved by the University of Cape Town's Human Research and Ethics Committee who's task it is to ensure that research participants are protected from any research-related harm. The research complies with the ethical codes of the Helsinki Declaration and the South African Good Clinical Practice Guidelines.

Who to Contact

If you have any question you can ask them now or later. If you want to ask questions at a later stage, you may contact West Williams on his mobile number: +2765 903 9271 or email address WLLWES004@myuct.ac.za

Part 2: Certificate of Consent

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL
CRITICAL CARE TRANSFERS

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have had has been answered to my satisfaction. I consent voluntarily to participate as a participant in this research study.

The purpose of the recording and the details of its storage and eventual destruction has been described to me. I have been offered to have any questions that I may have on the recording of the interview – answered and explained. I am giving consent voluntarily and I have been given a copy of this consent form.

Print Name of Participant: _____

Signature of Participant: _____

Date: _____

Statement by the researcher/person taking consent:

I have accurately read the information of the research to the potential participant. To the best of my ability I have made sure that the participant understands that the following will be completed:

Experts:

- You will be interviewed in an online format with only the primary researcher and possibly one supervisor present at a time that is convenient to you.
- A total of six to eight people will be interviewed.

Students:

- You will take part in a focus group discussion with four to six other advanced life support providers that are currently conducting neonatal transfers in South Africa. The term student is based on your potential future participation in a course in neonatal critical care transfers.

All participants:

- The interview/discussion should take approximately one hour.
- The interview/discussion will be audio-recorded so that it can be transcribed at a later stage.
- You will be contacted at a later stage of the research process to confirm the interpretation of your interview/discussion.

I confirm that the participant was given an opportunity to ask questions regarding the research study; all the questions asked have been answered correctly and to the best of my ability. I confirm that the research participant has not been coerced into giving consent for this research study and that consent has been given freely and voluntarily.

A copy of this informed consent form has been provided to the participant.

Print Name of Researcher: _____

Signature of Researcher: _____

Date: _____

Appendix 3: Expert group pre-reading document

Background reading

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL CRITICAL CARE TRANSFERS

Introduction

I would firstly like to thank you for sparing the time to participate in the study “Initiating the development of a South African curriculum for education in neonatal critical care transfers”. Loosely, the transfer of neonates in South Africa is performed by advanced life support (ALS) providers. This high risk service is reserved for specialist teams internationally. Adverse events during these transfers have been associated with the providers’ level of knowledge. There is currently no specific course in neonatal critical care transfers offered in South Africa. The practitioners that fall under ALS providers have variable education backgrounds. There is no guidance from South African governing bodies on the methods and content of education in this specialised field. The purpose of these interviews are to establish your opinion on education in neonatal critical care transfers in South Africa.

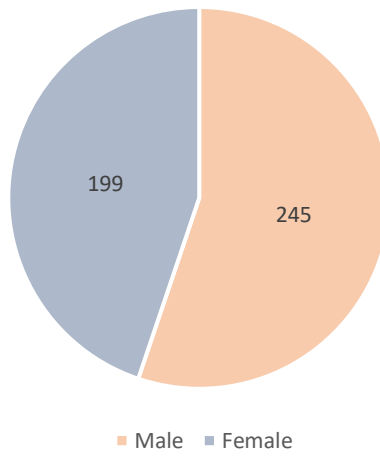
To inform our discussion, please review the following information:

What type of neonatal transfers are being conducted in South Africa?

Please keep the following information confidential until we have published

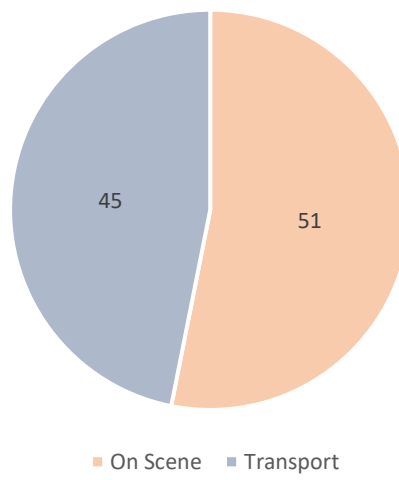
A retrospective chart review that was conducted by M. Venter determined the national patient population of critical care transfers between 01 January 2017 and 31 December 2017 in South Africa. Below is an overview of the data from the n=444 transfers.

Gender



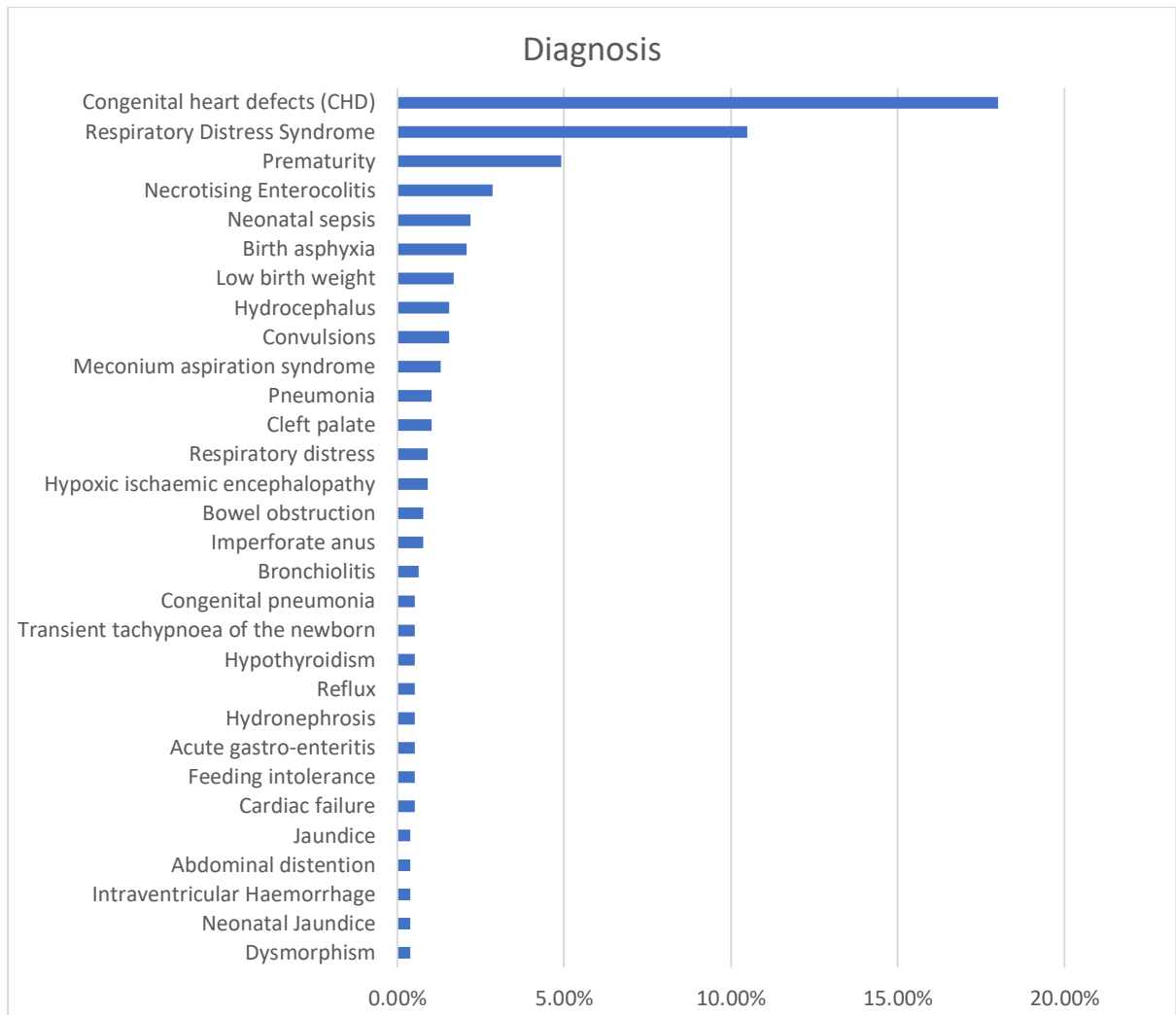
Gender distribution

Time in Minutes

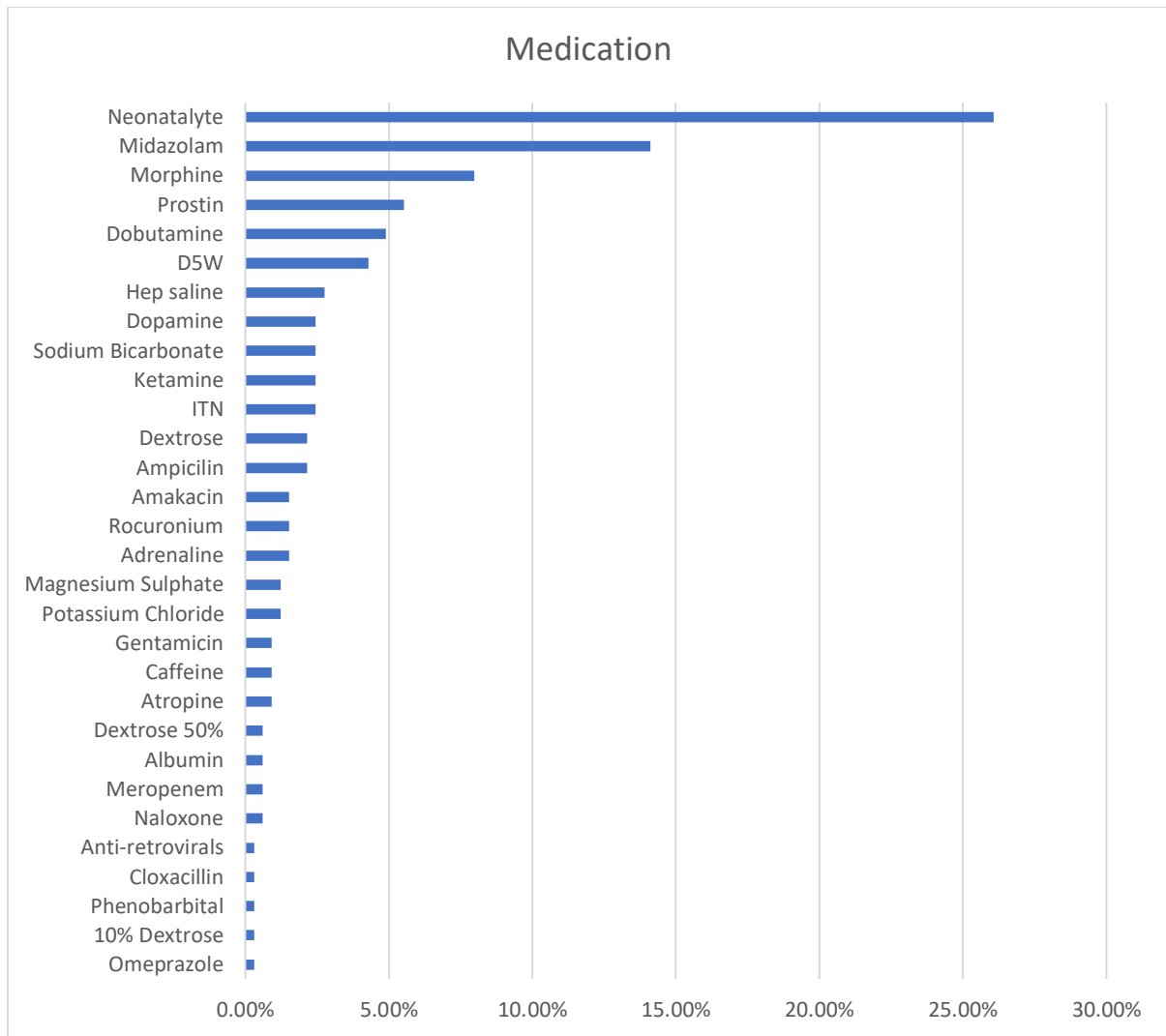


Time spent with patient

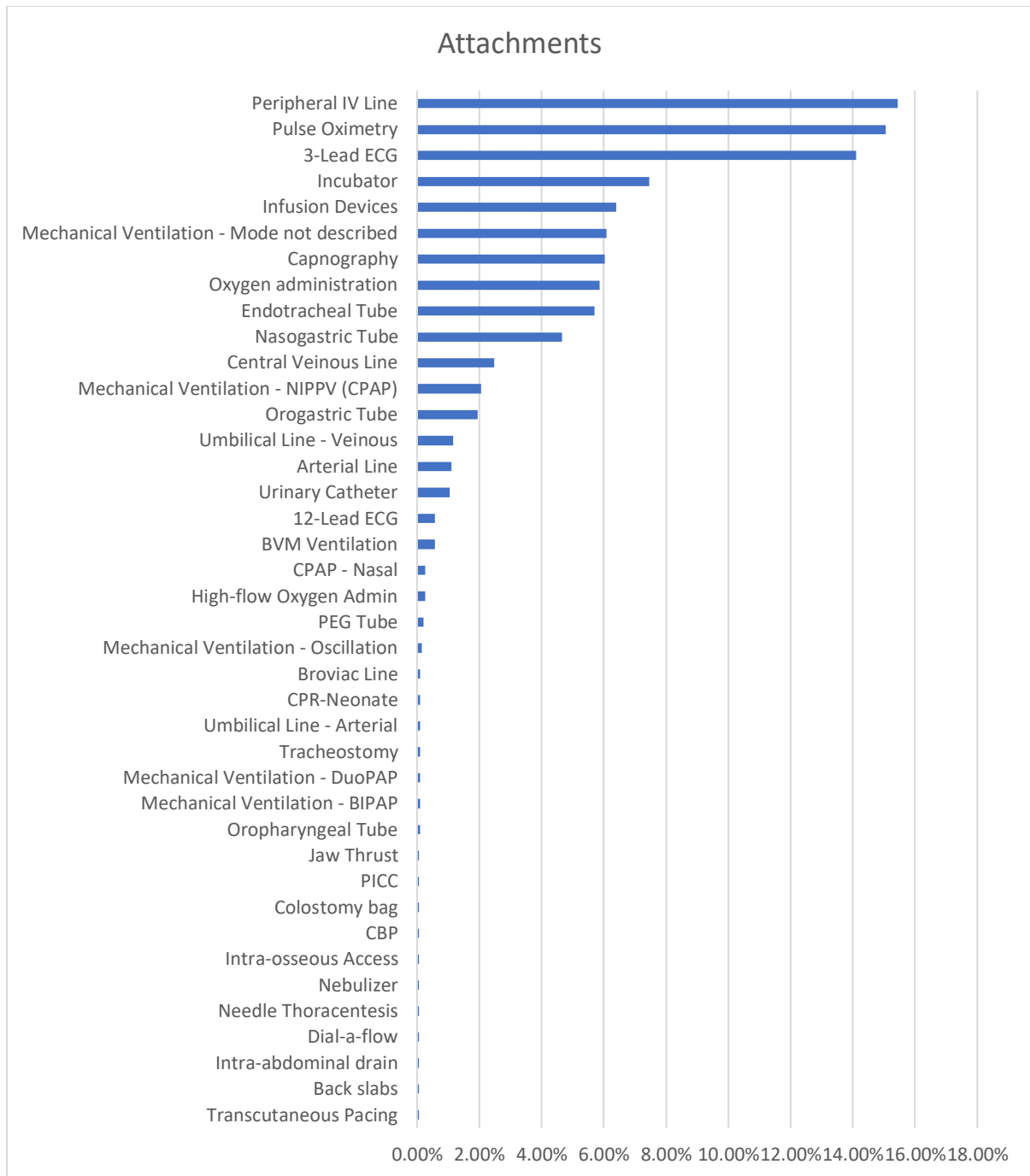
Average number of attachments per patient n=4



Top 30 diagnosis distribution for this group



Top 30 medications administered

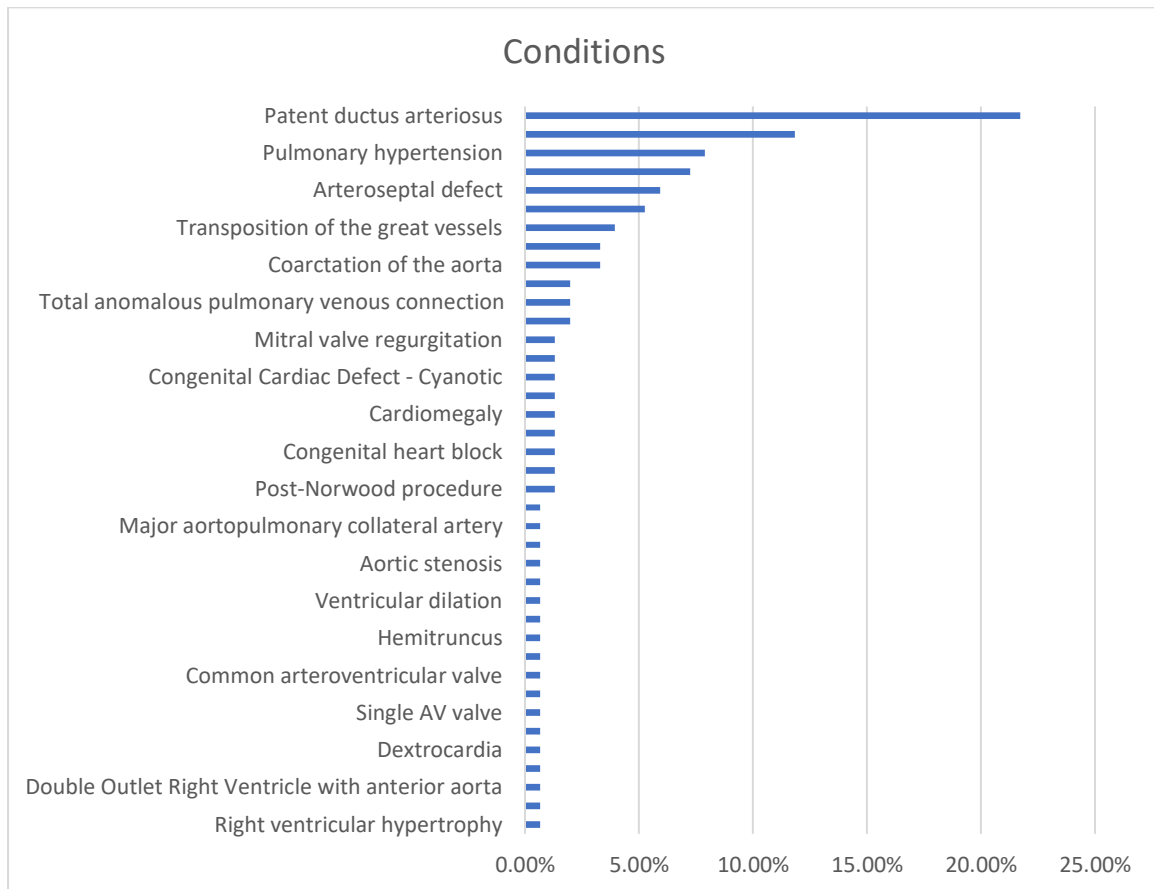
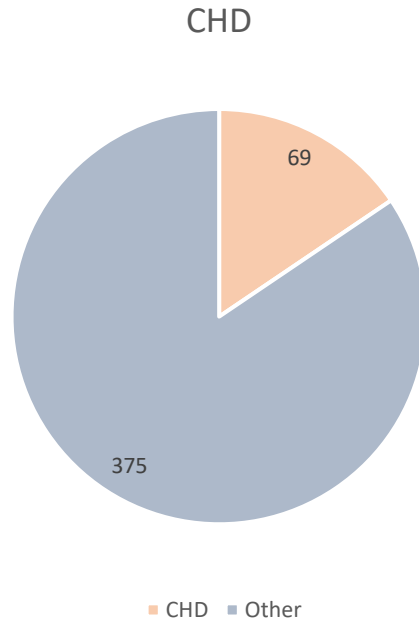


Attachments and/or interventions

Special group sub-analysis

Neonates with congenital heart defects (CHDs) are complex cases that justify separate analysis.

When we group the CHD cases together we have the following findings:



Distribution of CHD conditions

Demonstration of some complex cases

The following tables are cases that were extracted from the cohort of neonates. The aim is to demonstrate the complexity of some of these CHD transfers.

Case 1

Diagnosis	Transposition of great vessels
Medications	<ul style="list-style-type: none"> • Dopamine • Dobutamine • Adrenaline • Prostin • Hep-Saline • Neonatelite
Attachments	<ul style="list-style-type: none"> • ET Tube • Ventilated • Umbilical line • IV • Urine catheter • 3 Lead ECG • Incubator • Infusions

Case 2

Diagnosis	<ul style="list-style-type: none"> • Persistent pulmonary hypertension • Right Ventricular Hypertrophy
Medications	<ul style="list-style-type: none"> • Milrinone • Dopamine • Hep Saline • Sodium Bicarbonate
Attachments	<ul style="list-style-type: none"> • Ventilated • IV • 3 Lead ECG • O2 Saturation • Urinary Catheter • Infusions • NT Tube

	<ul style="list-style-type: none"> • Umbilical arterial and venous line
--	--

Case 3

Diagnosis	Coarctation of Aorta
Medications	<ul style="list-style-type: none"> • Dobutamine • Sodium Bicarbonate • Midazolam • Insulin • Prostin
Attachments	<ul style="list-style-type: none"> • Nasotracheal tube • Mechanical ventilation • Nasogastric tube • Central Venous Line

Literature review findings regarding local and international neonatal critical care transfer education

The aim of the literature review was to find and critically appraise current literature in the field of neonatal critical care transfer education. The first strategy included searches on the Google Scholar and PubMed platforms for peer reviewed literature. The second strategy included grey literature searches on the Google platform to include neonatal courses and their curricula. The peer reviewed literature was assessed for reliability and validity during the appraisal process. The search strategy was narrowed down to literature from the past decade (2010 – 2020) which were published in English. This literature review found that there is a paucity of literature in the field of neonatal critical care transfer education especially within the South African context. The following section is a summary of the curricula that can be associated with neonatal critical care transfer education in the local and international context.

South African curricula

The current curricula in critical care presented by three of the South African universities in BEMC were compared in a study by Conradie et al. The study found that one of the universities differed largely from the other two in its curriculum design. The theme of critical care presented by these Universities include neonatal transfer content. The curricula are described in the following table:

Content or competency descriptors

General

Under the general section some of the functions in the ICU setting are described such as the management of pressure ulcers and care of inter costal drains.

Ventilation

Various aspects of ventilation are discussed under this heading. Broad categories are mentioned, from when to ventilate, modes of ventilation, use of equipment and what parameters to monitor.

Patient monitoring

This section describes the monitoring aspects to consider for a patient in ICU with a focus on ventilation.

Arterial blood gas

Method of obtaining an Arterial Blood Gas (ABG) sample and how to interpret ABG readings are discussed in this section.

Monitoring

The general haemodynamic parameters that require monitoring in an ICU environment are listed here such as temperature and non-invasive blood pressure for example.

Infusions

The various applications and use of infusion devices in an ICU setting is discussed here. How to troubleshoot the device and calculate infusion rates as well as nasogastric feeds and total parenteral nutrition.

Fluid balance

This section describes considerations of how to choose the correct fluid for specific conditions and how to monitor the balance.

Imaging

The interpretation of chest x-rays are listed as an outcome under this heading.

Preparation for transfer, transfer and handover

This section describes various considerations that have to be made before transporting a patient in a CCR environment. This included documentation, how to package the patient, the negative effects that transport may have on the patient and what to hand over at the receiving facility.

Special populations

This section describes special populations which included neonates. The neonatal content was covered in the different sections and some specific neonatal content covered under this heading.

Obstetrics and gynaecology emergencies

This section describes the entire process from conception through to birth and includes the foetal circulation and transition post birth. Other general obstetric emergencies are also covered in this section.
Program structure (subjects, units etc.)
The modules of critical care consisted of intensive care, thrombolytics, aeromedical transportation and dive emergencies. It is interesting that neonatal critical care transfers were not a stand-alone discipline. The one university opted to incorporate the critical care curricula with other modules and the other two universities present it as a stand-alone module.
Learning activities (Lectures, workshops etc.)
Lectures were the main platform with some online content delivered as a supplement. The online content varied from pre-reading material to videos and tutorials. Information technology used by the universities were the Blackboard and Moodle platforms to deliver online content (2). Work integrated learning was another form of acquiring knowledge and skills in the field of critical care. The learning sites did include Neonatal ICU for all three universities.
Assessments (Tests, clinical examinations)
The assessment component was divided into practical and theory. Practical assessments consisted of patient simulations and Objective Structured Clinical Examination (OSCE). The theory evaluations were divided into different sub-components with different weightings. The weightings and sub-components varied widely between the universities. The theoretical assessments consisted of assignments, written tests, simulations, orals and OSCE (2).
Schedules (Date, time, location)
Full time study as part of the BEMC qualification. The critical care curricula are presented over either a full year or semester period.
People (Students, faculty etc.)
The first university employed four staff members (2 x PhD in EMC, 1 x BEMC, 1 x Prof. Nurse), the second 1 x PhD in EMC and the third 1 x BEMC. One could interpret this as a different importance weighting per university on the subject of critical care
Resources (Teaching materials, equipment etc.)
Not described
Course evaluations (By students, faculty and external bodies)
Not described
Learning portfolios
Assessment for the integrated learning was in the form of case studies, oral presentations, reflective journals and patient report forms (2).

Financial information
Cost not specified as it forms part of the 4-year BEMC programme.

International neonatal critical care curricula

Paediatric and neonatal critical care transport is a book published by BMJ books and cited as the only manual of neonatal and paediatric transport practice for the UK. This book only provides content and not a full curriculum, which will be specified by the training institution.

Paediatric And Neonatal Critical Care Transport

Content or competency descriptors
<p>Planning for safe and effective transport</p> <p>This section describes what the principles of safe transport are and what kind of equipment the ambulance environment will have. The physiological considerations of patients during transport especially children during flight are also listed.</p> <p>Practical transport management</p> <p>This section lists some important considerations for management of a critically ill neonate in the back of the ambulance. This included resuscitation, how to manage an airway, pharmacological intervention, documentation and some drug calculations.</p>
Financial information
Book cost \$64-50

NAPSTaR (Neonatal, Adult and Paediatric Safe Transfer and Retrieval) is a short course for medical professionals involved in transfers, presented by the Advanced Life Support Group in the UK. The curriculum is described in the following table:

NAPSTaR (Neonatal, Adult and Paediatric Safe Transfer and Retrieval)

Content or competency descriptors
<p>This curriculum starts off with an introduction to neonatal transfers. Communication is a prominent feature under the content which spans from the call centre to accepting and final handover stages. The methods of preparing your patient for transfer and the various equipment used, safety and adverse events are also discussed.</p>
Program structure (subjects, units etc.)

Single unit short course
Learning activities (Lectures, workshops etc.)
Lectures taught in class with practical workshops, skill stations and simulations
Assessments (Tests, clinical examinations)
Continuous assessment during course but methods not specified
Schedules (Date, time, location)
Two-day face to face course presented in the UK
People (Students, faculty etc.)
Students from medical, nursing and paramedic backgrounds. Faculty not specified.
Resources (Teaching materials, equipment etc.)
Not specified
Course evaluations (By students, faculty and external bodies)
Not specified
Learning portfolios
None
Financial information
Unknown

This course appears to be more of an introduction into neonatal transfers but does cover some essential topics.

Advanced Paediatric Life Support (APLS) is a short course that has been adopted by the European resuscitation council as its prescribed training for medical professionals that manage paediatric patients.

Advanced Paediatric Life Support

Content or competency descriptors
Broad course outcomes are listed and outlines a general approach to the ill child. How to recognise the seriously ill child and different presentations of different pathologies. The conditions discussed include both trauma and medical and how to manage these children under the various conditions including resuscitation and stabilisation.
Program structure (subjects, units etc.)
Single short course with no subjects
Learning activities (Lectures, workshops etc.)

<ul style="list-style-type: none"> • Lectures • online pre-preparation • skill stations • workshops • scenarios
Assessments (Tests, clinical examinations)
<ul style="list-style-type: none"> • Multiple choice questions • Basic Life Support • Airway management • Scenario
Schedules (Date, time, location)
One day online and two-day face to face training course
People (Students, faculty etc.)
Faculty not specified. Student candidates from medical and nursing backgrounds.
Resources (Teaching materials, equipment etc.)
Not specified
Course evaluations (By students, faculty and external bodies)
Student feedback required Supervisory visits at training institutions
Learning portfolios
None
Financial information
450 GBP for the two-day course

This course does cover some essential content for neonatal critical care transfer education but is more structured for in hospital users with emphasis placed on resuscitation and trauma.

The Paediatric advanced life support for experienced providers (PALS) course is a two-day short course by the American heart association presented by training centres world-wide.

Paediatric advanced life support (PALS)

Content or competency descriptors

The content of this course focusses on a systematic approach to the sick or injured paediatric patients. The focus is recognition and management of life-threatening presentations including resuscitation.
Program structure (subjects, units etc.)
Short course
Learning activities (Lectures, workshops etc.)
Two-day face to face course with online pre-course preparation
Assessments (Tests, clinical examinations)
<ul style="list-style-type: none"> • Online pre-course assessment • Multiple choice test in class • Simulations • Skills stations
Schedules (Date, time, location)
Two-day course presented across the world
People (Students, faculty etc.)
All medical professionals interested in paediatric care
Resources (Teaching materials, equipment etc.)
Online content Videos Books Practical scenarios with medical dolls and training aids
Course evaluations (By students, faculty and external bodies)
By students after course (questionnaire)
Learning portfolios
None
Financial information
R3300

This course covers essential information that can relate to neonatal critical care transfer education, but it does not cover in depth content and specialised equipment often used in these transfers.

The Essentials in neonatal critical care orientation (ENCCO) course is an online course offered by the American Association of Critical Care Nurses (AACN). The course is aimed at the nursing environment

and has a more in-depth approach to neonatal critical care compared to some of the short courses reviewed.

Essentials in neonatal critical care orientation (ENCCO)

Content or competency descriptors
<p>Patient Care</p> <p>This module discusses various topics that range from the transition from foetal to neonatal circulation to how to assess the neonate comprehensively. The care of the neonate in an ICU setting is discussed with considerations for the inclusion of family members. Neonatal pain management, nutrition and skin care are some of the topics included under this section.</p> <p>Respiratory Care</p> <p>Respiratory system conditions in the neonate are covered under this section including prematurity, those that present at birth and complications that arise due to invasive ventilation.</p> <p>Infectious Diseases</p> <p>Severe neonatal infection that progresses to septic shock is covered in this section.</p> <p>Neurology</p> <p>This section covers intracranial bleeds and seizure activity in the neonate.</p> <p>Metabolic Function and Disorders</p> <p>Blood sugar and bilirubin regulation are some of the topics included</p> <p>Neonatal Vascular Access</p> <p>Vascular access including central lines are covered in this section.</p>
Program structure (subjects, units etc.)
<p>Six units:</p> <ul style="list-style-type: none"> • Patient Care • Respiratory Care • Infectious Diseases and Management • Neurology • Endocrine • Neonatal Vascular Access.
Learning activities (Lectures, workshops etc.)
Online content in the form of videos and lessons
Assessments (Tests, clinical examinations)
Online tests

Schedules (Date, time, location)
One year
People (Students, faculty etc.)
Nurses that want to work in the NICU
Resources (Teaching materials, equipment etc.)
Online content
Course evaluations (By students, faculty and external bodies)
Not specified
Learning portfolios
None
Financial information
\$468-00

Conclusion

This concludes the essential reading section that will inform our discussion on neonatal critical care transfer education in South Africa. We look forward to your participation and valued input as an expert in the field.

Appendix 4: Learner group pre-reading document

Background reading

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL CRITICAL CARE TRANSFERS

Introduction

I would firstly like to thank you for sparing the time to participate in the study “Initiating the development of a South African curriculum for education in neonatal critical care transfers”. Loosely, the transfer of neonates in South Africa is performed by advanced life support (ALS) providers. This high risk service is reserved for specialist teams internationally. Adverse events during these transfers have been associated with the providers’ level of knowledge. There is currently no specific course in neonatal critical care transfers offered in South Africa. The practitioners that fall under ALS providers have variable education backgrounds. There is no guidance from South African governing bodies on the methods and content of education in this specialised field. The purpose of these interviews are to establish your opinion on education in neonatal critical care transfers in South Africa.

To inform our discussion, please review the following information:

Experts in the field of neonatal critical care retrieval in South Africa were asked to give their opinion on what **learning objectives** should be included in a new neonatal critical care retrieval course curriculum.

Learning objectives	
Anatomy and physiology	Neonatal specific
CCR Systems	Adverse events Appropriate receiving facility Escalation pathways Network limitations Patient criteria for transfer
Conditions	Conditions from study Congenital heart defects

	<p>Infection</p> <p>Prematurity</p> <p>Respiratory:</p> <p>Bronchopneumonia</p> <p>Diaphragmatic hernia</p> <p>Meconium aspiration</p> <p>Persistent pulmonary hypertension</p> <p>Surgical emergencies</p> <p>Gastroschisis</p> <p>NEC</p>
Continuity of care	<p>Feeding</p> <p>Skincare</p>
Documentation	Referral and handover specific
Emergency Procedures	<p>Airway management</p> <p>Chest decompression</p> <p>Resuscitate</p>
Equipment	<p>Incubator</p> <p>Ventilators</p> <p>Infusion devices</p> <p>Troubleshooting</p>
Indwelling attachments	Colostomy bags
Medication	Neonatal CCR specific
Pathophysiology	Neonatal specific
Patient assessment	Neonatal assessment
Patient monitoring	<p>ABG</p> <p>ECG</p> <p>ETCO2</p> <p>Fluid balance</p> <p>Glucose management</p> <p>Perfusion</p> <p>Thermal regulation</p>

Transport considerations	Acceleration deceleration Modes Movement and sound Patient packaging
Vascular access	Arterial Lines Central Line IO access IV peripheral Umbilical
Ventilation	Bag valve mask CPAP Heated circuits Humidification Neopuff O2 Blending Oscillation takeover

Experts in the field of neonatal critical care retrieval in South Africa were asked to give their opinion on what the **duration** should be for such a neonatal critical care retrieval course.

Duration of education	
Suggestions by expert participants regarding duration	Continuous education Determine outcomes before timeline Introductory course (Lead and secondary members) Master's degree (Lead members) Not short course Part time Post graduate diploma (Lead members) Unknown duration

Experts in the field of neonatal critical care retrieval in South Africa were asked to give their opinion on what the **method of education** should be for such a neonatal critical care retrieval course.

Method of education	
Methods of education	Interactive Mentorship Online learning Specialists discuss topics Work-integrated learning and clinical placement CCRS vehicle Control room EC that receives neonates NICU Theatre

Experts in the field of neonatal critical care retrieval in South Africa were asked to give their opinion on what the **method of assessment** should be for such a neonatal critical care retrieval course.

Method of assessment	
Methods of assessment	Continuous assessment Discussions Oral assessment OSCE Skills assessment Portfolio of evidence Simulation Written assessment

Appendix 5: Discussion Schedule

Discussion schedule for:

INITIATING THE DEVELOPMENT OF A SOUTH AFRICAN CURRICULUM FOR EDUCATION IN NEONATAL CRITICAL CARE TRANSFERS

FACILITATION

Before the interview/discussion, please refer back to these notes to ensure familiarity with the content. All interviews/discussions should be run by a facilitator. The facilitator is to lead the discussion while taking notes and operates the recording equipment. Each discussion should lead to some conclusions.

PREPARATION

Test the recording equipment and its sensitivity. The participant consent forms should also be available and ready. Offer the participants refreshment. Make sure that participants are comfortable before the start of the discussion. Ensure that the participants have signed the consent form and that she/he consents to being audio recorded.

Read out the statement on confidentiality:

There are no right or wrong opinions to any of the topics of discussion. I am here to establish your individual views. Any opinions expressed will be treated in confidence.

INTRODUCTION TO THE SESSION

Briefly introduce the session. Start by introducing yourself. You may start the session by:

I would firstly like to thank you for sparing the time to come and talk about initiating the development of a South African curriculum for education in neonatal critical care transfers. Loosely, the transfer of neonates in South Africa is performed by advanced life support (ALS) providers. This high-risk service is reserved for specialist teams internationally. Adverse events during these transfers have been associated with the providers' level of knowledge. There is currently no specific course in neonatal critical care transfers offered in South Africa. The practitioners that fall under ALS providers have variable education backgrounds. There is no guidance from South African governing bodies on the methods and content of education in this specialised field. The purpose of these interviews and focus group discussions are to establish your opinion on education in neonatal critical care transfers in South Africa. There are no right or wrong opinions, I would like you to feel comfortable saying what you really think and how you really feel.

ONE ON ONE INTERVIEWS WITH EXPERT GROUP:

Please could you start by introducing yourself and giving a bit of career background.

<i>PROBES AND PROMPTS</i>
Demographic data: Age, Gender, Qualification, Location, Position
Private versus provincial Neonatal care and/or critical care transfer experience

Understanding the current limitations to training in neonatal critical care transfers within academic and health institutions in South Africa?

<i>PROBES AND PROMPTS</i>
<ul style="list-style-type: none">• Did the training you received at university or college prepare you for the neonatal critical care transfers that you are currently performing?• What gaps, if any, did you see in the program's structure or outcomes?• How did you close the gap in education of neonatal critical care transfers if any?• What changes would you recommend in the curriculum that are currently being presented by Universities and colleges?

To derive the goals of a curriculum in prehospital practitioner training in critical care transfers of neonates?

<i>PROBES AND PROMPTS</i>
<ul style="list-style-type: none">• Do you think additional training in neonatal critical care transfers are needed for pre-hospital providers?• How long should such training be?• What method of training would you advise?• What core competencies i.e.: knowledge, skills, and attitudes should a neonatal critical transfer practitioner graduate with?

What would you say are the specific needs to teaching, learning and assessment (TLA) as an expert in neonatal critical care transfer education?

<i>PROBES AND PROMPTS</i>
<ul style="list-style-type: none">• Refer to neonatal data presented in background reading document• Do you agree with the patient presentations from Venter’s study when compared to the patients that you manage?• What knowledge, skills both clinical and non-clinical necessary for TLA of these patient categories?• Any broad categories you would include in addition to these findings?• The literature review yielded the following core modules that should be included in the curriculum. Do you agree?• Refer to core modules presented in background reading documents• In your opinion, what are the best strategies for assessment in achieving the competencies you outlined above?

Final Reflection

- What is the most important thing you would like to tell the curriculum committee as they work towards developing a curriculum in neonatal critical care transfers?

FOCUS GROUP DISCUSSION WITH LEARNERS:

Please could you start by introducing yourselves and giving a bit of career background.

<i>PROBES AND PROMPTS</i>
Demographic data: Age, Gender, Qualification, Location, Position
Private versus provincial Neonatal transfer experience

Understanding the current limitations to training in neonatal critical care transfers within academic and health institutions in South Africa?

<i>PROBES AND PROMPTS</i>
<ul style="list-style-type: none"> • How much time was spent on the topic of neonatal transfers during your training at university or college? • Did this training prepare you for the neonatal transfers that you are currently performing? • How did you close the gap in education of neonatal transfers if any? • What changes would you recommend in the curriculum that are currently being presented by Universities and colleges in neonatal transfers?

What would you say your specific needs are in learning and assessment (TLA) as a learner in neonatal critical care transfer education?

<i>PROBES AND PROMPTS</i>
<ul style="list-style-type: none">• Do you need additional training in neonatal critical care transfers?• If so, which specific areas of knowledge, clinical and non-clinical skills would you like further training on?• How much time could you spare for such training?• Do you have financial support to pay for additional training?• What method of training do you prefer?• Would you be able to travel to another city for such training?• Do you have access to a computer and an internet connection?• Do you have specific needs as it pertains to language, religion or culture that will have to be considered during training?

To derive the goals of a curriculum in prehospital practitioner training in critical care transfers of neonates?

<i>PROBES AND PROMPTS</i>
<ul style="list-style-type: none">• Experts in the field of neonatal care and critical care transfers have suggested the following core topics to be included in a new neonatal critical care course.

- INSERT SUGGESTED CONTENT BY EXPERTS
- Experts have suggested the following methods and duration of education and assessment for this course:
- INSERT SUGGESTED METHODS AND DURATION OF EDUCATION AND EXAMINATION BY EXPERTS
- Do you agree with the suggested methods and duration of education and examination for such a course?
- What would be a reasonable cost of such training?
- Would you travel for such training?

Final Reflection

- What is the most important thing you would like to tell the curriculum committee as they work towards developing a curriculum in neonatal critical care transfers?