NEONATAL RESUSCITATION TRAINING AND SKILL ACQUISITION:

A REALIST SYNTHESIS

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Summary

The researcher conducted a realist synthesis with the aim of uncovering mechanisms in the context of simulated neonatal resuscitation training that could influence skill acquisition. This realist synthesis developed a contextual understanding regarding Simulated neonatal resuscitation training by asking what works for whom and in what context and possibly why? (Pawson 2006). This involved uncovering relationships between simulation as context (C), their underlying mechanisms (M) and outcomes (O), and therefore the C-M-O configuration.

Purposive sampling was utilised as this provided the researcher with the opportunity to seek specific data related to neonatal resuscitation training in simulation. Data was arranged into C-M-O configurations and was divided respectively into themes and sub-themes. Theme one was related to context, with sub-themes being high and low fidelity simulation. Theme two was about the mechanisms, with sub-themes being active mentoring, leadership development, debriefing, lectures and self-efficacy evaluations. Theme three was related to outcomes, with sub-themes being short- and long-term outcomes with reference to acquisition and retention of skills.

From the findings it was concluded that skill acquisition and retention of neonatal resuscitation skills were most effectively achieved through simulation training combined with supporting mechanisms. Their configuration might equip nurses with sufficient knowledge, skills and confidence to initiate effective neonatal resuscitation.

Declaration of Authenticity

I declare that ‘Neonatal resuscitation training and skill acquisition: a realist synthesis’ is my own work and that all the sources used or quoted in the research study have been indicated and reflected by means of complete references

A Botes
Researcher’s signature: **Date: 22 January 2019**

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List of Abbreviations/Acronyms

Abbreviation/acronym	Meaning
MDG	Millennium Development Goals
SDG	Sustainable Development Goals
RAMESES	Realist and Meta-Narrative Evidence Syntheses: Evolving Standards
C-M-O	Context-Mechanism-Outcome
CARMMA	Campaign for the Accelerated Reduction of Maternal Mortality in Africa
ESMOE	Essential Steps in the Management of Obstetric Emergencies
UNICEF	United Nations' International Children's Emergency Fund

CHAPTER 1: OVERVIEW OF THE STUDY

1.1 Introduction

Le Shan (2015 n.p.) posted that “a new baby is like the beginning of all things: wonder, hope, and a dream of possibilities”, but unfortunately there are a number of babies who do not survive to let such possibilities become reality.

Neonatal mortality is defined by the World Health Organization (WHO) as those deaths that occur during the neonatal period beginning with birth and ending after 28 complete days (WHO 2013). Neonatal mortality is a global problem. At the Millennium Summit, held in September 2000, world leaders among the United Nations committed their nations to reducing these deaths in a series of time bound goals, dubbed Millennium Development Goals (MDG’s) before 2015 (UNICEF 2000, which was followed up by the Sustainable Developmen Goals (SDG) (WHO 2017).

MDG number four was set to reduce neonatal mortality, amongst others, by two–thirds from 2009 to 2015 (UNICEF 2000). According to the United Nations report, South Africa did not meet MDG four, as the South African infant mortality rates were still at 23.6 deaths per 1000 births (WHO 2015) as opposed to the goal of 18 deaths per 1000 births. As the MDG period expired, world leaders committed to a new framework – the Sustainable Development Goals (SDGs), which include ending preventable deaths of newborns and children under five years of age by 2030. The aim of the United Nations is to reduce neonatal mortality to at least 12 deaths per 1000 live births, and under-five mortality to at least 25 deaths per 1000 live births (WHO 2015).

In response to these 2015 results, the South African Department of Health committed in their 2015/2016 report to SDG three; being to ensure healthy lives and promote well-being for all people at all ages. Conscious efforts were undertaken to ensure that significant gains were made to address child morbidity and mortality in the last few years. Child mortality rates continue to remain high, and more must be done to ensure South Africa attains its child health goals in the next few years. Efforts to increase child

survival must focus on the neonatal period, as neonatal mortality contributes significantly to the under-five mortality rate.(National Department of Health 2015)

The National Perinatal Mortality and Morbidity Committee (NaPeMMCo 2015) recommended high impact interventions to address the major causes of perinatal deaths, namely prematurity, asphyxia and infection. Amongst others, these recommendations include:

a) Ensuring that labour is monitored appropriately by a skilled birth attendant and Essential Steps in the Management of Obstetric Emergencies (ESMOE)
b) Ensuring that all birth attendants are skilled at a minimum in neonatal bag and mask ventilation via projects like Helping Babies Breathe.

A study on neonatal mortality by Lloyd and de Witt (2013), made several recommendations on the reduction of neonatal mortality, listing neonatal resuscitation training as the one of the measures that is cost effective and achievable measure to in the reduction of neonatal mortality. They also recommended that education of all nurses in this regard should be awarded high priority (Lloyd & de Witt 2013).

These recommendations are corroborated by the United Nations International Children's Emergency Fund (UNICEF 2014). The UNICEF 2014 report, compiled from the WHO 2013 recommendations, advised greater focus on a healthy start to life, for example through high-impact, low-cost interventions for neonates, including effective neonatal resuscitation. These interventions require educated and equipped health care workers, especially those with midwifery skills, and the provision of essential commodities such as neonatal resuscitation education (WHO 2013).

Neonatal resuscitation has been identified as a key strategy in reducing neonatal mortality (Lee ACC, Cousens S, Wall SN, Niermeyer S, Darmstadt GL, Carlo WA, Keenan WJ, Bhutta ZA, Gill C and Lawn JE. l. 2011) ; (Kim YM, Ansari N, Kols A, Tappis H, Currie S, Zainullah P, Bailey P, Semba R, Sun K, van Roosmalen J and Stekelenburg J. 2013) .

Basic neonatal resuscitation is described by the American Association of Pediatrics (AAP) as assistance to the newborn at birth that may vary in complexity. The AAP

(2015) recommends the following four categories of of basic resuscitation actions namly :

A. Initial steps in stabilization (provide warmth, clear airway if necessary, dry, stimulate)
B. Ventilation
C. Chest compressions
D. Administration of epinephrine and/ or volume expansion.

The AAP (2015) further recommends one skilled attendant at every birth that is soly responsible for the newborn and is able to initiate resuscitation. Birth attendants need to be skilled in performing the above mentioned actions within 60 seconds (also referred to as the Golden Minute) to ensure optimal outcomes for the newborn.

The Resuscitation Council of Southern Africa (2015) provides the following algorithm:

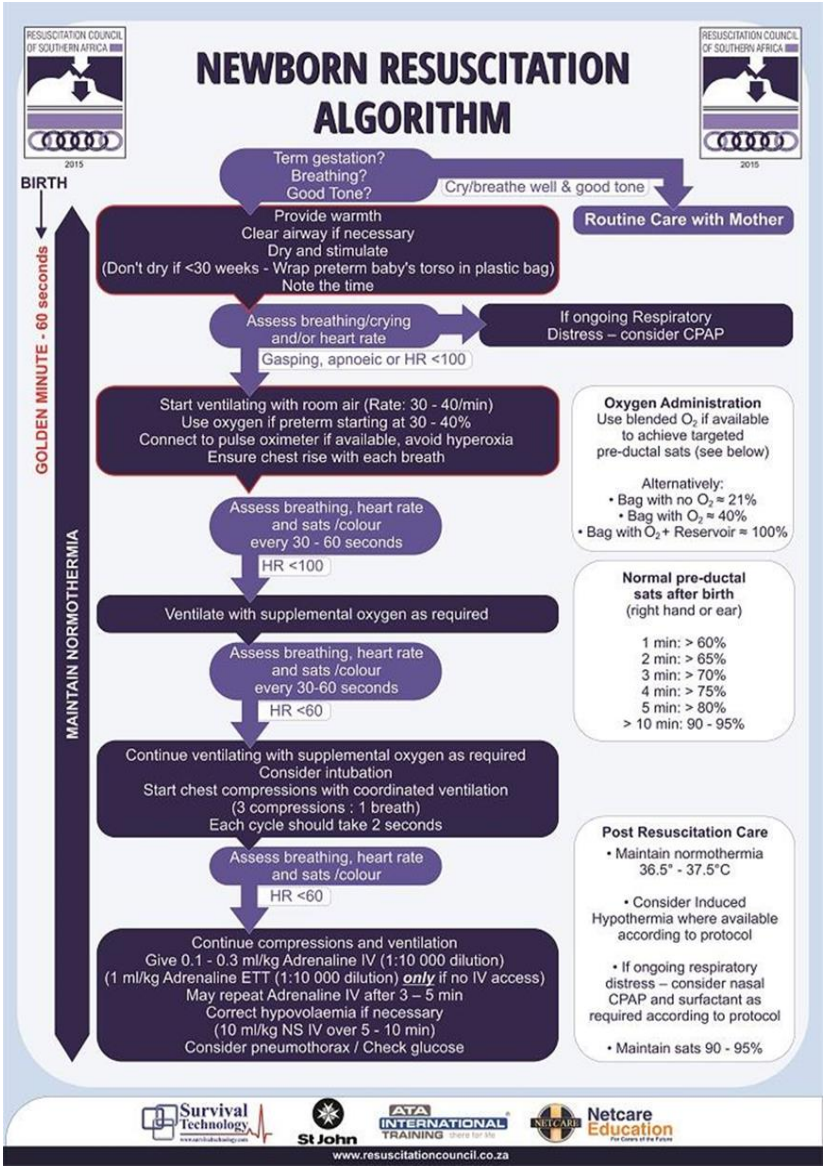

FIGURE 1: Neonatal Resuscitation Algorithm (Resuscitation Council of Southern Africa 2015)

It is recognized that there are multiple factors which influence the outcomes of neonatal resuscitation, such as availability of equipment, practical experience, learning styles in training, confidence (Kim et al. 2013), and training of all nursing personnel with emphasis placed on retention and application of acquired knowledge and skills in neonatal resuscitation (Wong G, Westhrop G, Pawson RD and Greenhalgh T. 2013).

However. training is complex and highly context-dependent. Neonatal resuscitation training interventions may not impact all learners equally, thereby increasing the complexity of such interventions. Training is further complicated in real life situations

as newborns are particularly fragile, hence the use of simulation training (Wong et al. 2013).

In this study, the researcher explored neonatal resuscitation training leading to acquiring, retention and application of resuscitation skills. The main focus is on simulation, as it is the common strategy of training resuscitation. Simulation provides a real life experience without risk to the patient and is the preferred method of clinical skill training. The researcher acknowledges that there may be multiple mechanisms leading to an array of reactions and decisions affecting the outcome but limits the focus to neonatal resuscitation training interventions as crucial mechanisms.

1.2 Rationale and significance of study

Neonatal mortality has been identified as a global problem to be addressed as the Millennium Development Goal 4 (United Nations 2000 - 2015) and a renewed commitment to Sustainable Development Goal 3 (2015 - 2030) (WHO,2017). Neonatal resuscitation has been identified as a cost-effective solution to address neonatal mortality (Lee et al. 2011). In spite of advances made in neonatal care and various neonatal resuscitation training opportunities being made available in South Africa (Perinatal Education Programme 2011; University of the Witwatersrand 2004; South African Resuscitation Council 2015; American Association of Pediatrics 2012; Gauteng Department of Health 2014), neonate mortality persists at high rate exceeding the 12/1000 deaths per year target set by the WHO (2017). The purpose of this study was therefore to explore in which context do particular mechanisms related to neonatal resuscitation training contribute to effective skill acquisition in neonatal resuscitation, ultimately improving neonatal outcomes.

Undertaking a realist synthesis is expected to contribute to the knowledge base of nursing by providing deeper understanding of “what works for whom and why, in what circumstances” (Pawson 2006), with particular reference to neonatal resuscitation training for professional nurses and other healthcare providers responsible for neonatal care. Findings are expected to contribute to strategies to improve neonatal

resuscitation training and might inform policy, and might ultimately lead to better neonatal outcomes and reduction of neonatal mortality.

1.3 Problem statement

A study by Wall et al. (Wall SN, Lee ACC, Niermeyer S, English M, Keenan WJ, Carlo W, Bhutta ZA, Bang A, Narayanan I, Ariawan I and Lawn JE. 2009) demonstrated that annually an estimated 10 million neonates do not breathe immediately at birth, and of these about 6 million require basic neonatal resuscitation. Moreover, evidence from observational studies demonstrated that 30% of neonatal deaths may be avoided by basic neonatal resuscitation.(Lee. 2011)

In order for person to provide the appropriate interventions to newborns, aquisiton of resuscitation skill is crucial (Saywer et al 2016). Simulation training is the preferred method of training as simulation provides opportunity to practise skill without jeopardising the fragile newborn. The AAP (2010) recommends the use of simulation-based learning methodologies to enhances performance in both real-life clinical situations and simulated resuscitations.

Several neonatal resuscitation training opportunities are available in South Africa. Training opportunities include the Newborn Care (PEP 2011), the Neonatal Resuscitation Training Project in Rural South Africa (University of the Witwatersrand 2004), Advanced Neonatal Life Support (South African Resuscitation Council 2008), Helping Babies Breathe South Africa (American Association of Pediatrics 2011; van Heerden 2012), and in-service-training programmes (Gauteng Department of Health 2014). Yet, in spite of these training opportunities, reduction of neonatal mortality is too slow in South Africa (WHO 2017).

This necessitated a study on neonatal resuscitation training in an attempt to consolidate which approaches work in simulation context, in order to facilitate skill acquisition that should improve neonatal survival outcomes.

1.4 Research question

The research question in this study was: What are the context, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition?

1.5 Aim and objectives

1.5.1 Aim

The aim of this study was to describe the context, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition.

1.5.2 Objectives

The first objective of this study was to describe context-mechanism-outcomes (C-M-O) configuration following a realist synthesis as described by Pawson (2006), with particular reference to the following:

- The context of neonatal resuscitation training in which skill acquisition is influenced;
- The mechanisms influencing neonatal resuscitation skill acquisition; and
- The outcomes of neonatal resuscitation skill acquisition associated with the context and/or mechanisms.

1.6 Concept clarification

Neonatal resuscitation	The neonatal period refers to the period from birth to 28 complete days after birth (WHO 2006). Neonatal resuscitation is "the intervention after a baby is born to help it breathe and to help its heart beat" (American Heart Association 2000). In this study neonatal resuscitation refers to interventions such as ventilatory support and, if needed, cardiac compressions to save an infant's life during the first 28 days after birth.
Neonatal resuscitation training	Neonatal resuscitation training includes the educational and training programmes as well as other opportunities that introduce the concepts and basic skills of neonatal resuscitation (American Association of Pediatrics 2001). In this study, the definition has been adopted as such.

Neonatal resuscitation skill acquisition	Skill acquisition is the “knowledge, skills, and abilities that students have attained as a result of their involvement in a particular set of educational experiences” (Wiley CDA, Online, 2014). In this study it includes understanding, retention of knowledge and application of skills regarding neonatal resuscitation.
Mechanisms	Mechanisms are the “underlying entities, processes, social structures which operate in a particular context to generate outcomes of interest (Astbury and 2010) or the agents of change (Connolly et al. 2007). In this study the mechanisms may refer to the aspects of neonatal resuscitation training such as opportunities / programmes, processes, teaching strategies and methods, and programme content.
Context	The context is any condition or setting that triggers and / or modifies the mechanisms to result in outcomes (Jagosh et al. 2011). In this study context refers to the simulation conditions or settings where neonatal resuscitation training opportunities took place,The focus is on simulation as context as this is the preferred condition in wich all the studies identified were set.
Outcomes	The outcome of an activity, process, or situation is the situation that exists at the end of it (Cobult Advanced Dictionary, 2018). In this study outcomes could have been positive or negative with regards to neonatal resuscitation skill acquisition and were uncovered as part of the study.

1.7 Philosophical assumptions

The study is based on philosophical assumptions underlying realist synthesis. Wong et al. (2013) explains that in realist synthesis it is assumed that social systems and structures are real with real observable effects. It is also assumed that humans respond differently to situations through their interpretation and interactions. By exploring contexts and associated triggers in human decision making we may gain understanding on why things change or not. In the following section a brief overview is provided of the study’s underlying assumptions, which are discussed in more depth in chapter two .

1.8 Ontological assumptions

Realist ontology is rooted in the writings of Bashkar (1975). The *real* (world or situation for example) according to Bashkar (1975) is made up of mechanisms and triggers that cause things to happen. As stated by Wong et al. (2013) “realism acknowledges that there is a real world, and in this real world knowledge is processed through human senses and that understanding of reality can be improved because the real world constraints the interpretation we can reasonably make of it” (BMC Medicine 2013.11: p 21). The realist ontological assumption thus focuses on the stratified reality where context, mechanisms and outcomes are interlinked.

In this study, the stratified reality formed the context in which neonatal resuscitation training can be evaluated in realist synthesis. Neonatal resuscitation training takes place in a real world to equip healthcare workers (including nurses) with knowledge and skills to improve neonatal outcomes. It is recognized that there are multiple factors present that might influence neonatal resuscitation skill acquisition. Among others, this may include social and cultural beliefs and norms, regulations and socio-economic factors, learning style preferences and interests, teaching methods and environmental factors (mechanisms) that were explored.

1.9 Epistemological assumptions

For the realist evaluator there is no final knowledge or truth, as situations and reactions to situations are ever changing, and knowledge can only be improved over time and from reasonably accepted inferences (RAMESES, 2013).

Realism as applied in a realist synthesis, enhances understanding of the social world by acknowledging the existence of an external social reality, the influence thereof on human behaviour, and how knowledge is gained (Pawson 2006), In this study, the importance of interaction as part of the social reality was acknowledged, and it was realized that many studies that would form part of the realist synthesis were based on communication from the participants, and therefore might bear a subjective component. Nevertheless, the nature of neonatal resuscitation training and skill acquisition is part of social reality.

1.10 Methodological assumptions

The methodology of realist evaluation was originally developed by Pawson and Tilly (1997-2008), and was followed for this study with refinement by the RAMESES (2013) project team .

The move from conventional evaluation methods was made to better answer the questions “what works for whom and in what context?” and also “why?” (Pawson 2006) as opposed to the oversimplification of “does an intervention work or not?”. The realist question can be answered by introducing the Context - Mechanisms – Outcomes (C-M-O) configuration. Pawson (2006) stated that underlying principles of realist approaches serve as links between contexts (C), mechanisms (M) and outcomes (O).

Wong et al. (2013) recommend that during theory formulation a researcher could “concentrate on specific outcomes and then work backward and outward to construct an initial rough theory”. The researcher followed these recommendations and only stopped this process once a coherent and plausible rough theory emerged.

This study considered learning activities or aims of neonatal resuscitation training. The researcher initially identified the outcomes that training intends to generate in neonatal resuscitation training. The researcher then considered key components that could contribute to particular outcomes,which might enhance or reduce neonatal resuscitation skill acquisition. Consideration was given to the context, the human component, and the role that individual interpretation and experience of interventions might play during acquisition of neonatal resuscitation skills and knowledge.

1.11 Delineation

The scope of this study was focused on neonatal resuscitation skill acquisition by analysis of the relationship between context, mechanisms and outcomes, based on relevant studies (quantitative and qualitative) previously done and other authoritative documents pertaining to neonatal resuscitation training. Studies needed not be limited to nurses only but included any healthcare workers exposed to neonatal resuscitation training.

1.12 Research design and methodology

1.12.1 Type of research design

The researcher pursued a realist synthesis to describe the influence of neonatal resuscitation training on neonatal resuscitation skill acquisition of healthcare workers. Realist synthesis as described by Pawson is a way to uncover the typical weak points and significant stumbling blocks in the implementation of an intervention under review (Pawson 2006).

This approach was developed by Pay Pawson and Nick Tilley (Pawson and Tilley 1997), and refined by the RAMESES project team (Wong et al. 2013), to explore underlying causal processes by which programmes achieve their outcomes. The realist synthesis is described by Wong et al. (2013) as a secondary research equivalent to realist evaluation and is a theory driven interpretive summary of findings from primary studies. Pawson (2006) indicated that it uses cross case comparisons to gain understanding of what works for whom and in what context.

The working assumption behind realist synthesis is that a particular intervention will trigger particular mechanisms differentially in different contexts. As such, the researcher seeked an understanding of the interplay between context, mechanism and outcomes in neonatal resuscitation training as it influences neonatal resuscitation skill acquisition.

1.12.2 Unit Of Analysis

For the purpose of this study the researcher did not evaluate only specific programmes, but also focused on any studies done in neonatal resuscitation training and related interventions. The researcher aimed to uncover the information of how said training interventions ought to work as programme theory. In order to attain this, documents were sought from a wide range of sources with no restrictions on document or study type to provide as much information as possible and included quantitative and qualitative studies.

Data was not decided by research type or methodological quality but was tested against:

- Relevance – would data contribute to theory building and/or testing

- Rigour – were methods used to generate said data credible and trustworthy (Wong et al. 2013).

1.12.3 Sampling methods

The researcher made use of purposive sampling in which the most typical characteristics that should be included in the dataset have been pre-determined by the researcher as described by Botma et al. (2010). Purposive sampling allowed the researcher to seek specific data related to neonatal resuscitation training opportunities to address the question of "what works for whom, in what circumstances and why" (Pawson 2006) to elucidate links between the Context – Mechanism – Outcome (C-M-O).

The inclusion criteria were as follows:

- Data must be available on one / more of the following electronic databases: Pubmed, Biomed Central (BMC), Cinhal and Google Scholar.
- Data must be available free of charge, in English, and published within the last ten years.
- Document types: any relevant and trustworthy document shedding light on these aspects of the study. (Strategies to determine trustworthiness were followed as discussed under Rigour in section 10.2.8.)
- Key words used: neonatal resuscitation training, neonatal resuscitation education, neonatal resuscitation skill acquisition, neonatal resuscitation, health education in neonatal resuscitation, neonatal resuscitation outcomes.

1.12.4 Search Process

The search process was preceded by an initial scoping of the literature. This is an important step to build understanding of the topic area. During this initial scoping provisional program theory, key authors and expert opinions were identified by means of purposive sampling. This process assisted in developing a provisional framework (Wong et al. 2013).

The search strategy was guided by quality standards developed by RAMESES (Wong et al. 2013) for realist synthesis (see discussion in Chapter 2 and Annexure B).

1.12.5. Data Selection

Wong et al. (2013) explain that realist synthesis is not a technical process following a set protocol, but rather a series of judgements about relevance of particular data for the purpose of answering a specific question in testing intervention and programme theories. Pawson (2006) states that rather than appraising and excluding publications prior to review, the reviewer examines each publication for evidence that may contribute to comprehensive development of the explanatory model of what works for whom, in what circumstances and why (Pawson 2006). Each piece of evidence was appraised for its rigour and relevance, as opposed to an entire report being evaluated against priori standards for quality appraisal. (Refer to Chapter 2 for more detailed discussion.)

1.12.6 Data Extraction

The RAMESES team describe data extraction as a process that assists analysis and synthesis. The data extraction and quality appraisal phases are combined in realist synthesis. It is recommended that data extracted support the realist logic to answer the review's questions. The data extraction process must be continually refined as the review progresses (Wong et al. 2013). The application in this study is discussed in Chapter 2.

1.12.7 Data Analysis And Synthesis

The purpose of realist synthesis as described by Wong et al. (2013) is explanatory and analytical: explanatory in that the researcher aims to explain generative causation in relation to neonatal resuscitation training opportunities and skill acquisition by means of the Context – Mechanism – Outcome (C-M-O) configuration.

The basic analytical task was to identify and align evidence relating to neonatal resuscitation training, as well as the ability to acquire the necessary skills and identify

factors that influence this process. The researcher attempted to involve iterative testing and refinement of theoretically based explanations as discussed in chapter 2.

1.13 Rigour

As a wide variety of data was considered to be used in this realist synthesis, data was not rejected nor accepted based on methodological quality. The focus was on two aspects of importance in appraisal of document suitability for use in the study, namely:

- Relevance: if data could contribute to testing or refining theory statements; and
- Rigour: if the methods used to generate said data were credible and trustworthy.

Ware (2008) defines peer review as “the process of subjecting a scholarly manuscript to the scrutiny of other experts in the same field”.

Peer review includes single-blind (identity of the author is known, and the identity of the reviewer is hidden), double-blind (identities of author and reviewer are hidden from one another) or open peer review (the author and reviewers identities are known to one another). Additionally, in open peer review the reviewers name and report may be published along with the paper (Ware 2008). For the purpose of this study, open peer review was used with reviewers purposely selected according to their field of expertise and possible contribution to the study.

Reviewers were selected from various fields with the primary aim to include experts in neonatal resuscitation education, and experts in realist synthesis. The experts were three experts in neonatal resuscitation and two experts in realist synthesis research methods who were purposively selected. A basic feedback tool was used, and reviewers were requested to give feedback and make recommendations. The rigour of the study is discussed in more detail in Chapter 2.

1.15 Ethical Considerations

Plagiarism is a major ethical concern in realist synthesis. The researcher employed methods to ensure accurate citation and respect of intellectual property by accurate referencing. Ethical considerations are discussed in Chapter 2.

1.16 Conclusion

Chapter one provided an overview of the background and problem statement, the aim of the study and the research design and method used to obtain the data in order to realize the objectives of the study.

The outlay of the chapters are as follows:

Chapter 1: Overview of the study

Chapter 2: Research methodology

Chapter 3: Discussion of findings

Chapter 4: Conclusions and recommendations

CHAPTER 2: RESEARCH METHODOLOGY

2.1 Introduction

In the previous chapter, an introduction and overview on the proposed study was given. This chapter presents a discussion of the methodology used in the study. The focus is on research design, methods used to obtain data, rigour and ethical considerations.

Neonatal resuscitation is complex and skill acquisition is crucial to reduce morbidity and mortality. Neonatal resuscitation though is complicated as it cannot be taught in real-life situations due to ethical and logistical problems. It is therefore most of the time taught in simulation. To determine what works best for whom and why to obtain skill acquisition in neonatal resuscitation, the researcher embarked on a realist synthesis.

Wong et al (2013) describes a realist synthesis as a methodology used to make sense of complex interventions.

2.2 Research Question

The research question was: What are the context, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition?

2.3 Aim

The aim of this study was to describe the context, mechanisms and associated outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition.

This realist synthesis attempted to develop a contextual understanding of program logics by asking what works for whom, in which context and possibly why (Pawson 2006). This involved elucidating relationships between the contexts (C) in which programs are implemented, their underlying mechanisms (M) and their outcomes (O).

2.4 Research Design

The process of realist synthesis was followed for the purpose of this study, as described by Pawson and Tilley (1997-2008) and refined by the RAMESES project team (RAMESES 2013).

A realist synthesis approach was selected due to its suitability to the topic of health education (Rycroft-Malone et al. 2012) referring to acquisition of neonatal resuscitation skills in this particular study. What distinguishes realist synthesis apart from other designs is that different components in a given context are separated, and the causal mechanism within these components are explored to explain the outcomes by answering what works for whom and in what context and possibly why (Pawson 2006).

Realist synthesis provides a unique approach to evaluate outcomes in complex settings, where a multitude of factors such as different contexts, mechanisms and associated outcomes, may come into play. The researcher assumed that neonatal resuscitation training, including the acquisition of neonatal resuscitation skills, form a complex intervention and are built up from different components within a specific reality. It was not possible to exhaustively uncover all such components in this study, but to focus on those that could contribute to the knowledge base of nursing and other neonatal health practices.

2.5 Philosophical Assumptions

The study was based on philosophical assumptions underlying realist synthesis, discussed under the headings ontology, epistemology and methodology.

Wong et al. (2013) describe the application of realist philosophical assumptions in realist synthesis as a philosophical science that sits between positivism (that there is a real world which we can apprehend directly through observation) and constructivism (that we cannot know for sure what the nature of reality is, given that all we know has been interpreted through human senses and the human brain). By exploring contexts (i.e. resuscitation simulation) and associated triggers (mechanisms) in human

decision-making regarding neonatal resuscitation, we may gain understanding of why change in skill acquisition is affected or not.

For Bhaskar (1975, 2007) there is a clear ontological distinction between the domains of the empirical, the actual and the real. Although these domains are apparently independent of each other, they inevitably influence one another to the point where all domains must be considered. Bhaskar's empirical domain refers to human sensory experiences and perceptions of the world. These perceptions are often misleading but offer us access to the real world. The next domain is the actual, which comprises definite occurrences that happen regardless of our perception or understanding thereof. This brings us to the third domain and closer to realist logic. The real is described by Bhaskar as comprised of those mechanisms or triggers that cause things to happen. Through generative capacity they create the order in which the world is viewed and understood. For the realist researcher, the empirical provides access to the real. The realist researcher therefore aims to identify things, mechanism triggering actions or decisions.

2.5.1 Ontological Assumptions

The core of realist ontological assumptions can be refered back to Bhaskar's (1975, 2007) argument about the real, the actual and the empirical.

According to Westhorp (2011) positivism ontology is based on the assumption that an objective reality exists independent of being known or of participation therein; constructivist ontology that a subjective reality is created; and realist ontology borrows from positivism and constructivism in that realist scholars agree on an objective observable reality, but that people interact with and interpret this reality from their own point of view which yields certain outcomes. Therefore, the realist assumption is that "the world is out there, and we can observe it but must also acknowledge that truth is observed from our own unique perspectives" (Wainwright 1997, p1262).

Reality in the realist sense is stratified, comprised of various components affecting a multitude of responses in humans. Realist ontology provides insight for this stratified reality by examining the effect that the real world has on different individuals

(RAMESES 2013). In the realist perspective, processing and retention of knowledge and skill cannot be evaluated as a linear question such as “X leads to Y”, but rather in the form “why does X lead to Y, for whom and in which context”.

Reality may include social and cultural beliefs and norms, regulations and socio-economic factors that affect acquisition of knowledge and skills in neonatal resuscitation. The researcher acknowledges that in certain contexts, i.e. hospital or clinical setting, the learner is influenced by external social realities (or mechanisms) affecting the outcome or ability to acquire knowledge and skills during neonatal resuscitation. The researcher must seek to build a degree of understanding of how and why these intervention outcomes differ and elucidate patterns of outcomes among different contexts. There was not a priori expectation that specific interventions would yield consistent results as mechanisms and contexts vary.

Westhorp (2011) explains that although it is not possible to state that one person is right and another not, the real world regulates boundaries on what is reasonably acceptable in the social world as correct. Therefore, there is an expectation for improved neonatal outcomes and reduction in mortality, as well as for improved performance of neonatal resuscitation after training interventions.

2.5.2. Epistemological Assumptions

Pawson (2006) describes that realism as applied in realist synthesis enhances understanding of the social world by acknowledging the existence of an external social reality and its influence on human behaviour. Bhaskar (2007) argues that empiricism makes reference not only to experience (the empirical), but that actions and resulting outcomes go beyond what is experienced, and that the domain of the ‘real structures’ and other generative mechanisms must be uncovered to acquire a comprehensive conceptual map of reality. By asking “what works for whom and in what context” and possibly “why” (Pawson 2006) provision is made for interpretation of the influence or effect which context has in triggering mechanisms to yield various observable outcomes.

In realist synthesis, the aim is to understand the relationship between an outcome and its context by introducing a mechanism factor. In order to answer that question, the realist evaluator aimed to identify underlying generative mechanisms that explain 'how' outcomes were caused, and the influence of context upon these outcomes. The realist evaluator assumes that there is no final knowledge or truth. Knowledge and understanding might improve over time by exploring many contexts, mechanisms and resulting outcomes for programmes to gain a better understanding of said programmes. As context and mechanisms are ever changing, knowledge is never absolute but rather ever-evolving (RAMESES,2014). Realist evaluations are designed to improve understanding of these social realities over time. For example, how can learning from one neonatal resuscitation training programme and its outcomes be applied to other programmes? The context where knowledge and skills are introduced (for example simulation settings) may trigger mechanisms that generate the predetermined intervention outcomes, yielding different outcomes for different people.

Realist research distinguishes between observable and non-observable components but does not discriminate. Thus, theories can be constructed around unobservable processes to access concepts of explanatory mechanisms and actions beneath the observable (Reddy, 2015). During the course of this study, observable behaviour such as actions during resuscitation, as well as unobservable aspects such as thought processes behind decision-making regarding resuscitation actions were included to determine explanatory mechanisms. Subsequently, any information relevant to the review question or sub sections of the study was considered.

2.5.3 Methodological Assumptions

The realist evaluator assumes that not everything works everywhere or for everyone, and that context and mechanism have notable impacts on programme outcomes. Consequently, the researcher aimed to elucidate and understand how and why programmes work and don't work among different contexts to effect change in programmes.

Wong et al. (2013) explains that programme theory is a starting point for the researcher in exploring the field of interest. Emmel (2015, p 12.) describes programme theories as “partial and fragile accounts of how something or other works in some particular context, at a particular time and why”. The realist researcher needs to relate these theories to inferences made from data collected in the literature.

The philosophical assumptions were applied in this study as described by Wong et al. (2013). Realist methodological assumptions evaluate and synthesize findings from primary studies that were applicable to the research question. The researcher attempted to identify how the context of simulation (C) triggered specific mechanisms (M) yielding certain outcomes (O). The researcher assumed efficacy of neonatal resuscitation training can be established through analysis of literature (quantitative and qualitative studies) with particular consideration given to context, human component and the role that individual interpretation and experience of interventions can play in acquisition of skills.

This, in turn, provided guidance about what policy makers or practitioners should put in place to change context or provide resources in such a way that might trigger the right mechanism(s) to produce the desired outcome in future.

2.5.4 Application of C-M-O Configuration

The researcher applied the Context-Mechanism-Outcome configuration as follows:

Context

Westhorp (2011) states that in realist synthesis the interaction between context and mechanism yields an outcome. Context may bear various attributes, and in the realist perspective, is not necessarily limited to location. For the purpose of this study, the researcher considered simulation training as the context in which neonatal resuscitation training interventions were delivered.

Mechanisms

Mechanisms in the realist perspective are causal in that they affect the way things happen, and include human behaviour or decision making for example. Mechanisms,

also referred to as “generative mechanisms” (Pawson and Tilley 1997), act to shape and describe social behaviour. Jogosh (2015) describes the relations among C-M-O where mechanism is initially dormant and is activated in a certain context. He further explained that considering mechanisms separate from context only describes the potential of the mechanisms as opposed to its actual manifestation. There may be a wide variety of mechanisms (fear, pride, confidence, cognitive ability) but only certain mechanisms may be triggered in any given context, which consequently alter the outcome. The researcher acknowledged that in realist theory there will always be multiple mechanisms. This study served as the starting point to uncover mechanisms at play in neonatal resuscitation training, for example, confidence may result after successful simulation sessions.

Outcomes

Outcomes are described by Jogosh et al. (2015) as either intended or unexpected results of an intervention. Outcomes may be negative or positive and are generated by mechanisms. To an extent, outcomes measure whether or not interventions do what they are intended for. The researcher examined the outcomes of neonatal resuscitation training interventions, as well as the results and feedback after evaluation of said interventions. Neonatal resuscitation training interventions may affect the participant’s knowledge base, however, application of acquired knowledge and skills are what elicit change in outcomes.

Based on the above, the methodological assumption was that context, mechanisms and outcomes could be retrieved from a variety of literature to answer the research question.

2.6 Research Question

The research question in this study was:
What are the mechanisms and outcomes in neonatal resuscitation training, in the context, that influence neonatal resuscitation skill acquisition?

2.7 Aim

The aim of this study was to describe the context, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition.

2.8 Methodology

The link between context, mechanism and outcome was explored by asking the question “what works for whom, in what circumstances and why?” (Pawson 2006). The researcher attempted to gain and describe C-M-O links related to neonatal resuscitation training, with particular reference to simulation training as the context, mechanisms and associated outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition.

To determine C-M-O configurations, the researcher followed a basic design with the following steps as recommended by the RAMESES project (2013):

1. Identification of emerging themes (develop of preliminary programme theories);
2. Collection of data to test the theory;
3. Analysis of data;
4. Synthesis of data to identify Context-Mechanism-Outcome configuration (C-M-O) patterns;
5. Review and refine the emerging theory.

These steps were not followed in a linear fashion, instead the review involves an iterative “zigzagging” process between these steps as described by Emmel (2015).

Pawson and Tilley (2004) explained that in realist evaluation, programmes are “theories incarnate” based on ideas and assumptions of how change might be implemented. The researcher attempted to identify emerging themes as preliminary programme theories (how the programme is supposed to work) by scoping literature. Not all literature contained explicit C-M-O configurations, but repetitive engagement with data allowed the themes to emerge.

Greenhalgh (2014) proposed a simplified template which was followed to elucidate emerging themes and form a preliminary programme theory, which are discussed in Chapter 3. The steps were as follows:

- A primary search was done to provide an overview (i.e. theory elicitation) on available neonatal resuscitation education opportunities, and how these opportunities intend to function. This was done by scoping the literature and accumulating background information on neonatal resuscitation training. During this phase, simulation training emerged as the most prevalent teaching context.
- The primary search was followed by pinpointing key processes for investigation (i.e. theory selection). Neonatal resuscitation training in simulation was identified as a dominant emerging theme.
- Studies were researched in order to test the chosen theory (i.e. theoretical sampling). Studies relevant to neonatal resuscitation training with analysable results were selected for this purpose.
- Once applicable studies were selected, quality appraisal of primary studies was done based on their theory testing potential or the potential that documents had in contributing to the study. This stood in contrast with appraisal against a hierarchy of evidence. Studies were chosen that were relevant, credible and trustworthy (determination of this rigour is discussed later in this chapter).
- Following selection of studies, data extraction commenced as confrontation of theory with evidence, instead of following a pre-defined data extraction template or matrix. This approach was in line with emerging theories discussed above. A template was used only in guiding the elucidation of context, mechanism and outcome (see Annexure B).
- From the extracted data, theory refinement or interpretation of identified C-M-O configurations were synthesized and analysed to form conclusions.

As recommended by Wong et al. (2013) the researcher concentrated on specific outcomes and then worked backwards and outwards to construct an initial theory on simulation programmes. The researcher followed RAMESES project recommendations and only stopped this process once a coherent and plausible set of themes emerged.

2.9 Sampling Methods

The researcher made use of purposive sampling by selecting literature with underlying programme theories relating to context, mechanisms and outcomes of neonatal resuscitation training which shed light on neonatal resuscitation training skill acquisition. By using this sampling method, the researcher therefore sought data clearly related to neonatal resuscitation training opportunities which lead to elucidating the relationships among what works for whom, in what circumstances and why (C-M-O links) as suggested by Pawson (2006)..

Preliminary inclusion criteria:

- Data was collected from the following electronic databases: Biomed Central (BMC), EBSCOHOST and Google Scholar.
- Data had to be available, in English, and published within the last ten years of commencement of the research (2006-2016).
- Document types: Any relevant and trustworthy document shedding light on the specific aspects of the study. This refers to peer review published articles relevant to neonatal resuscitation training (quantitative research and qualitative research).
- Strategies to determine trustworthiness were followed, as discussed under Rigour.
- Key words for the search protocol included: neonatal resuscitation training, neonatal resuscitation education, neonatal resuscitation skill acquisition, neonatal mortality reduction, neonatal resuscitation, health education in neonatal resuscitation, neonatal resuscitation outcomes. The election process is discussed in the next section.

2.10 Search Process

Following an initial scoping of the literature, simulation-based training was identified as the most frequent context of neonatal resuscitation training and very few information could be found on other contexts (see Chapter 3 for detail). Scoping the literature provided understanding of the topic and background information on current trends and practises regarding neonatal training programmes. It further clarified and

assisted in developing the provisional theory on the C-M-O configurations that contribute to skill acquisition in neonatal resuscitation training.

The search strategy was guided by quality standards developed by RAMESES (Wong et al. 2014) for realist synthesis (refer to Annexure B) with the aim to include the following components:

- The search was directed to identify, refine and test programme theories on acquisitionand retention from training in neonatal resuscitation skills.
- Data were not decided by research type but rather by relevance and contribution to theory testing in relation to neonatal resuscitation training and skill acquisition, and had to be trustworthy.
- Data had to shed light on any of the Context-Mechanisms-Outcomes aspects of skill acquisition from neonatal resuscitation training to formulate C-M-O configurations.
- Databases were searched to incorporate relevant data on neonatal resuscitation training successes or failures, and the possible reasons, based on the inclusion criteria stipulated in the previous section.
- Searching was revised iteratively in light of emerging data, and the researcher only stopped once saturation was reached and reasonable judgements could be made regarding neonatal resuscitation training interventions and skill acquisition outcomes.

2.11 Data Selection

The researcher applied a series of judgements on data relevance. This was done by seeking answers to the proposed research question: “What are the contexts, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition?”.

Selected documents were deemed relevant and contributed to testing the preliminary programme theory of neonatal resuscitation training for skill acquisition. Quantitative and qualitative data were used. Quantitative data were useful in measuring outcomes, and qualitative data proved useful in elucidating mechanisms (Westhorp 2011).

Documents were assessed for the following as described by Wong et al. (2013):

- **Relevance**: Do data provide evidence contributing to programme theory regarding the influence of neonatal resuscitation training on neonatal resuscitation skill acquisition?
- **Rigour**: Were the methods used to generate relevant data credible and trustworthy?

Articles were grouped according to their focus on neonatal resuscitation training and contribution to C-M-O configurations. Identified C-M-O's were manually colour coded according to context, mechanism and outcome. During analysis, patterns of similar context, mechanisms or outcomes were identified and grouped together as indicated in Table 1: Summary of research articles found. Selection, appraisal and analysis run concurrently.

Table 1: Summary of research articles found

EBSCOHOST:				
Search term	Results	Full text available	Articles from 2006-2016	Selected
Neonatal resuscitation training	91	13	8	7
BIO MED CENTRAL				
Search term	Results	Full text available	Articles from 2006-2016	Selected
Neonatal resuscitation training	22	22	11	5
GOOGLE SCHOLAR				
Search term	Results	Full text available	Articles from 2006-2016	Selected
Neonatal resuscitation training	7620	3950	889	The researcher opted to narrow the search due to the overwheloming quantity of data and use the articles from above mentioned data bases

2.12 Data Extraction

Quality appraisal was combined with data extraction and was continually refined as the review progressed as recommended Wong et al. (2013). Realist logic was applied to answer the review question: “What are the contexts, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition?”.

Pawson advises against standardized data extraction forms; however, a basic data arrangement form was used to categorize context, mechanisms and outcomes, with colour coding used to distinguish each. The following three steps are recommended (Pawson 2006) and were applied in this study:

- **Annotation (theory tracking mode)**: This entails extraction of primary materials by colour coding themes manually(C-M-O’s) in neonatal resuscitation training and skill acquisition. Primary information was processed by note-making, conceptualization and abstraction.
- **Collation (theory testing mode)**: This step involved purposive processing of selected evidence. Studies were included on the basis of relevance and contribution to testing the programme theory regarding neonatal resuscitation training and rival ideas. Different aspects of neonatal resuscitation training were assessed as they emerged.
- **Reportage**: During this step the researcher extracted and presented the original data to ensure the reader understands the basis upon which inferences were made.

The researcher searched data iteratively using forward and backward tracking to elucidate ideas. These were categorized according to contribution to the study, and this process continued until saturation was reached. Data were used to develop and refine the programme theory and to shed light on context, mechanisms and/or outcomes.

Table 2 : Articles extracted

DOCUMENT	CONTEXT	MECHANISM	OUTCOME/ CONCLUSION
The Genesis, Adaption, and Evolution of the Neonatal Resuscitation Programme. (Halamek LP,MD. 2008)	Simulation based training	Simulation focus on success rates, high pass scores	• Perceived learning • Focus only on success may lead to false sense of confidence and failure in real life settings
Educational Impact of the Neonatal Resuscitation Programme in Low-risk Delivery centres in a developing country (Waldemar A. e*t al.* 2009)	Theory based preparations and simulation	Written evaluations Self-efficacy evaluation	• Retention of knowledge past 6 months of training
A systematic review of the effectiveness of training in emergency obstetric care in low-risk environments. (van Lonkhuijzen.L e*t al.* 2010)	Theory based short courses Theory based courses with longer duration Self-directed learning via unscheduled courses	Written examinations Supervisory visits and on the job training	• Improved knowledge and positive patient outcomes • Positive behavioural changes and greater awareness re patient care.
Helping babies Breath: global neonatal resuscitation programme development and formative educational evaluation. (Singhal N, Lockyer J, Fidler H, Keenan W, Little G, Bucher S, Qadir M, Niermeyer S. 2012)	Train the trainer model simulation	OSCE and written or verbal multiple choice Recorded perceptions Focus groups	• High levels of satisfaction • High level of self-efficacy.
A pilot program of knowledge translation and implementation for newborn resuscitation using US Peace Corps Volunteers in rural Madagascar. (Close K, Karel M and White M. 2016)	Training by non-medical volunteers (using Helping Babies Breathe programme)	Helping Babies Breathe algorithm used by non-medical peace corps volunteers	• Improved personal and organizational practises
Inter-professional in-situ simulated team and resuscitation training for patient safety:	High realism simulation physically integrated into	Learner need based curriculum	Allow different levels of learning (individual, team based and unit based)

Description and impact of a programmatic approach. (Zimmermann K, Bachmann I, Holzinger I, Ganassi L , Esslinger P , Pilgrim S, Allen M, Burmester M and Martin S. 2015)	the clinical environment		Provides realism and rich resources to identify threats. Increased functional fidelity Decreased gaps between training and reality Leadership skills and communication highlighted as crucial
Effect of a stimulation-based workshop on multidisciplinary teamwork of newborn emergencies: an intervention study. (Rovamo L, Nurmi E , Mattila M, Suominen P and Silvennoinen M. 2015)	Simulation	Instruction of non-technical skill prior to simulation	• Higher post test scores with pre-simulation didactic lecture. • Team work unaffected by teaching style. • Teamwork dictated by team leader hence leadership training combined with skill training recommended.
Randomized control trail of high-fidelity vs low fidelity simulation for training undergraduate students in neonatal resuscitation. (Nimbalkar A , Patel D, Kungwani P , Phatak A, Vasa R and Nimbalkar S. 2015)	High fidelity simulation vs. low fidelity simulation	Lecture only, Lecture + videos, lectures + low fidelity simulation (basic mannequins), High fidelity simulation (advanced technologies)	• No significant differences between simulation fidelity. • High fidelity simulation proved no added benefit. • Recommend videotaping sessions for re view purposes, team work, leadership skill improvement and communication training.
Evaluation of an educational program for essential newborn care in resource-limited settings: Essential Care for Every Baby. (Thukral A, Lockyer J ,. Bucher SL , Berkelhamer S , Bose C , Deorari A, Esamai F , Faremo S ,. Keenan WJ ,McMillan D , Niermeyer S and Singhal N. 2015)	Skill based training	Interactive learning strategies including skill practise with simulators guided by facilitators Role play, small group discussions and skill practise	• Improved knowledge and skill • Train the trainer cascades successfully implemented post course. • Extended practise and teaching times needed was identified by learners.

Team training in obstetric and neonatal emergencies using highly realistic simulation in Mexico: impact on process indicators. (Walker D, Cohen S , Fritz J , Olvera M , Lamadrid-Figueroa H , Greenberg J, C Dolores, Hernandez G , Dettinger JC and O Fahey J. 2014)	Highly realistic, low tech simulation combined with team training PRONTO (Programa de Rescae Obstretico y Neonatal: Tratamiento Optimo y Oportuno)	Inter professional simulation training	• Improved communication habits improved skill retention • Increased self-efficacy (confidence in performing skills) • Even partial participation yielded large scale progress and improvements in care at training facilities
Simulation-based learning combined with debriefing: trainer's satisfaction with a new approach to training the trainers to teach neonatal resuscitation. (Amin JH, Aziz K , Halamek LP and Beran TN . 2013)	Simulation combined with debriefing	Simulation combined with debriefing	• Improved knowledge, skill and confidence in neonatal resuscitation • Importance of debriefing was rated highly. • Suggestions on relevant (to setting of the learners) scenarios reduced lectures and increased practise times. • Team work did not improve/ not report as improved
Acute Care of At-Risk Newborns (ACoRN): quantitative and qualitative educational evaluation of the program in a region of China. (Singhal N, Lockyer J, Fidler H, Aziz K, McMillan D, Qiu X, Ma X , Du L and Lee SK. 2012)	ACoRN adapted modified and adapted simulation (8 step evaluation and management of new-borns) programme	Preparation prior to course Case based learning Simulation	• Improved knowledge and confidence • Programmes successfully transferable from one setting (Canadian) to another (Chinese)

2.13 Data Analysis and Synthesis

"In realist synthysis the analytical and synthesis processes occur iteratively and may be sequential or parallel" (Wong et al. 2013.p5). On-going engagement with selected

articles facilitated this process. The basic analytical task was to find and align evidence relating to neonatal resuscitation training by iterative testing and refinement of theoretically based explanations to identify factors that influence this process.

In order to infer conclusions and make recommendations, this realist synthesis took an explanatory approach to describe generative causation (mechanisms) and related outcomes in various contexts regarding neonatal resuscitation training opportunities and skill acquisition by means of the Context–Mechanism–Outcome (C-M-O) configuration. Wong et al. (2013) indicate the importance of adherence to the basic explanatory structure of generative causation where an outcome is generated by relevant mechanisms (M), that are triggered in a specific context (C).

2.14 Peer Review

Ware (2008) defines peer review as “the process of subjecting a scholarly manuscript to the scrutiny of other experts in the same field”. Peer review include single-blind (identity of the author is known, and the identity of the reviewer is hidden), double-blind (identities of author and reviewer are hidden from one another) or open peer review (the author and reviewer’s identities are known to one another).(Ross-Hellauer T , 2017)

For the purpose of this study, open peer review was used. In an open peer review the reviewers’ names and reports may be published along with the paper (Ware 2008). The reviewers were purposely selected according to their field of expertise and possible contribution to the study. The peer review was done after completion of the paper and feedback was extracted to guide future reviews on neonatal resuscitation training.

Reviewers were selected from various fields. The aim was to include experts in neonatal resuscitation education and experts on realist synthesis. The inclusion criteria were specified to cover the methodological and theoretical components of the study: three experts in neonatal resuscitation were included and two experts in the

field of realist synthesis research methods were purposively selected from the RAMESSES forum according to availability and willingness to participate.

A basic feedback tool was be used, and the reviewers werel then requested to give feedback and/or make recommendations (attached as Annexures E and F).

By exposing the study to the scrutiny of these experts the researcher was aiming to strengthen the findings of the study. Feedback from experts could then also be utilised to improve and guide future reviews on neonatal resuscitation training.

2.15 Rigour

Articles were included based on relevance and rigour as opposed to methodological quality alone. The criteria for relevance was that data should contribute to test or refine theories in an on-going basis throughout the review, and that methods used to generate said data were credible and trustworthy. Wong et al. (2012) describe that in the pursuit of rigour the realist researcher draws on a combination of research methods and these may include principals of qualitative research,quantitative or mixed methods . Rigour was attained by using the framework of Klopper (2008:70) and Krefting (1991:217) as described by Botma et al. (2010) and discussed in table 3.

Table 3: Strategies for trustworthiness

CRITERION	**DESCRIPTION AND CLARIFICATION OF CRITERIA (Bothma et al.2010)**	**APPLICATION TO THIS STUDY**
Truth value	Truth value reflects the researchers knowledge and refers to the fact that the data is rich Can be obtained by – for example prolonged engagement, peer debriefing and member checking.	Prolonged engagement by allocating sufficient time to study and reflect on selected data sources publications, identifying (C-M-O) Submitting the study to experts and peers for review and comment, including neonatal experts and original authors of realist synthesis on the RAMESES forum.
Application of transferability	Findings can be transferred from one context to another where applicable; this is to be achieved by explicit	The researcher used detailed description of the process followed to make transferability amongst

	description of data, sampling and design detail.	neonatal resuscitation training programmes possible
Consistency	To ensure that the findings correlate ocross different measures the researcher should make use of data triangulation, where data elements are cross-referenced to determine integrity.	Triangulation of data sources was used in this study (various document types) and peer review of paper after completion to gain insight into methodology and consistency of findings
Neutrality and confirmability	To obtain confirmation from two or more independent people regarding the interpretation of the data by the researcher.	Review by the research supervisor and co-supervisor could provide opinions in this regard. Peer review could further strengthen the confirmability and neutrality of the study.

2.16 Ethics

The researcher also upheld ethical codes of practise and acted within her regulatory framework. The study followed the ethical principles as set out in the Declaration of Helsinki and Belmont report (1979). The study did not involve primary research, instead expert review was sought to enhance trustworthiness and strengthen the findings of the study (refer to Annexure E for the questionnaire used). Ethical approval was gained from the Ethics Committee University of Pretoria (Reference number: 243/2016). Basic and standard ethical principles were adhered to.

The researcher upheld ethical codes of practise and acted within her regulatory framework. The researcher employed ethical principles, as set out in Table 4, that include but are not limited to the following:

Table 4: Overview of Ethical Principles adhered to in the Research Process

ETHICAL PRINCIPLE	DESCRIPTION AND REFERENCE	APPLICATION IN THIS STUDY
Patient advocacy	The American Nurses Association (ANA) Code of ethics for nurses, describes advocacy as "the act of safeguarding the well-being of the client and the society". ANA (1985)	Advocacy for neonates is a priority for the researcher, which prompts the focus on neonatal resuscitation with the aim to enhance outcomes for all neonates and their families.
Protection of vulnerable groups and individuals	The declaration of Helsinki states that "some groups and individuals are particularly vulnerable and may have an increased likelihood of being wronged or of incurring additional harm. All vulnerable groups and individuals should receive specifically considered protection." Helsinki, 2013, no 19. The declaration of Helsinki further states that interest of individuals should prevail over interests of society of science.	Neonates were acknowledged as a vulnerable group and all measures were taken to ensure results of this report are accurate and truthful and wrongful reporting may harm vulnerable neonates. The study was therefore subjected to expert review.
Duty to care	"Nurses are required to demonstrate the art of nurturing by both applying professional competencies and positive emotions that will benefit both the nurse and the healthcare user with inner harmony." SANC, Code of ethics, 2013 pg. 5. Burnard and Chapman suggest that the most important elements of caring are: "knowledge, alternating rhythms in relationships and continuous changes in reactions to others, patience, honesty, trust, humility, hope and courage". Burnard P., Chapman C. 2005.	Duty to care was demonstrated towards neonates as a vulnerable group by rigorous search for evidence to optimize neonatal resuscitation skill acquisition in order to improve neonatal care.
Beneficence and non-maleficence	"Nurses are required to do good and to choose the "best option" of care under given circumstances and act with kindness at all times. It gives expression to compliance with the "duty to care" as a professional practice imperative. SANC, 2013, pg. 4.	By exploring "what works for whom and why, in what circumstances" (Pawson 2006) the best options for training are elucidated. Role players and policy makers may be advised on these findings to adjust training, ultimately leading to the best care being provided to neonates, and also preventing harm by excluding ineffective practises.

	The Belmont report (1979) describes beneficence as efforts to secure well being And beneficence is "understood in a stronger sense, as an obligation to maximize benefit and minimize harm." The report further describes two general rules that are complementary to the expressions of beneficence: 1) do not harm 2) maximize possible benefits whilst minimizing possible harms (Belmont report 1979, Section B)	Harm was minimized by accuracy and honesty in communication and reporting, objectivity by striving to avoid bias, and accurate record keeping. The Belmont report also stresses the obligation to recognize longer-term benefits and risks resulting from improved knowledge to enhance neonatal outcomes. This study might contribute to such knowledge.
Rights of autonomous individuals	Participation by individuals capable of giving informed consent, as subjects in medical research must be voluntary.	Informed consent seeks to incorporate the rights of autonomous individuals through self-determination. Expert reviewers were invited to participate and give informed consent. The aims and methodology used in the study were clearly described in the consent information document and the reviewers could choose to participate or decline. There was no apparent benefit to participants, and no compensation was offered, but there were also no risks anticipated. The protection of subjects' privacy was ensured by providing them with an option to be credited for participation or not.
Veracity and fidelity	Veracity – This principle requires the researcher to act with truthfulness and honesty and to ensure that the information provided is always in the best interest of the healthcare user. Fidelity refers to adherence to factual and truthful accounting. SANC, 2013, pg. 5.	The study was subjected to expert review. Prolonged engagement with all material further ensured honest reflection and factual representation of findings.
Prevention of plagiarism	Plagiarism is a major ethical concern in realist synthesis	The researcher employed methods to ensure accurate reporting and respect of intellectual property by accurate referencing and citation.

2.17 Conclusion

This chapter gave an explanation of the methodology as applied in this study. In Chapter 3, the findings will be discussed.

CHAPTER 3: DISCUSSION OF FINDINGS

3.1 Introduction

The focus of this study was to elucidate the mechanisms and associated outcomes that affect acquisition and retention of skills related to neonatal resuscitation. In the previous chapter, the methodology of realist synthesis was explained. This chapter will address the themes related to context, mechanism and outcome that affect neonatal resuscitation skill acquisition or attrition to discuss the findings of this realist synthesis on neonatal resuscitation.

Lee et al. (2011) defined neonatal resuscitation as the set of actions which support establishment of breathing and circulation at the time of birth. Provision of resuscitation is lifesaving in neonates and may include various interventions. For example, basic resuscitation with a bag-and-mask or more advanced measures, such as endotracheal intubation, chest compressions or medication. Failure to recognize and treat neonatal emergencies may lead to inadequate oxygen delivery to the brain, heart, lungs, and other organs resulting in seizures, cognitive impairment, cerebral palsy or death (Lee et al. 2011).

Pammi et al. (2016) described the purpose of neonatal resuscitation training to bring the science of neonatal resuscitation to the student and facilitate acquisition of relevant knowledge and clinical skills, with the aim of reducing neonatal morbidity and mortality.

3.2 Findings

The C-M-O configurations were refined by identifying contextual factors that were common across the twelve (12) papers selected (refer to Chapter 2). Associated mechanisms and outcomes were re-examined to explain successes or shortcomings of a programme where specific contextual factors were present. Themes and sub-themes identified are summarized in Table 4 , followed by a brief explanation of results from the selected studies. These are followed by discussion of the results in a separate section.

Table 5: Context-Mechanism-Outcomes (C-M-O) Configurations

Themes	Sub-themes
1: Context	High fidelity simulation
	Low fidelity simulation
2: Mechanisms	Active mentoring
	Leadership development
	Debriefing
	Lectures
	Self-efficacy evaluations
3: Outcomes	Short term outcomes
	Long term outcomes

The themes and sub-themes will be discussed in the following section.

3.2.1 Theme 1: Context

Context is any setting that triggers and/or modifies mechanisms to result in outcomes (Jagosh et al. 2011). Neonatal resuscitation training may be presented in various contexts such as lectures, self-study programmes and more, but based on studies done, the context where neonatal resuscitation training takes place turned out to be mainly simulation.

According to Shin et al. (2015) simulation aims to create a real-life experience for the student by simulating specific clinical scenarios, especially when there are moral or ethical issues related to training in real-life situations, which is the case with neonatal resuscitation. Providing simulation as an artificial environment, gives the student opportunity to practise and evaluate their understanding of real emergencies, as well as the need for management thereof.

The two sub-themes that emerged were high-fidelity simulation and low fidelity simulation.

Sub-theme 1.1: High Fidelity Simulation

High fidelity simulation has been described by Walker et al. (2015) as neonatal resuscitation simulation where advanced technologies such as computerized pre-programmable mannequins are used. Walker et al. (2015) performed a longitudinal fixed effect linear regression model to evaluate 450 trainees based on post-test questionnaires comprising 138 items. They found this method of high fidelity simulation *in situ* allowed for closing the gap between simulation and reality, and for training across different levels i.e. teams, individuals or organizations. High fidelity simulation requires a large degree of stakeholder and management support and places strain on resources, but contributes to skill acquisition (Walker et al. 2015).

Zimmermann et al. (2015) studied simulation training over a period of 2 years with 95 interdisciplinary staff members participating in 20 simulated neonatal resuscitation training sessions. Results related to skill acquisition were measured from a team monitor questionnaire. Two of the observations made were that high-fidelity simulation equipment proved costly, and specialized training is a pre-requisite, hindering spontaneous use of this training modality. Furthermore, Zimmerman et al. (2015) could not identify any advantage from advanced technologies over basic mannequins. The only recordable benefit from high fidelity simulation was reported when used in high realism *in situ* circumstances, where the simulation was integrated into clinical situations (on the spot training during emergencies).

Sub-theme 1.2: Low Fidelity Simulation

In low fidelity simulation the trainers made use of standardized basic mannequins and teaching methods like train-the-trainer models. In a randomized control trial by Nimbalkar et al. (2015), 101 undergraduate students were exposed to equal teaching strategies (lectures). Subsequently, in simulation students were divided into groups of either conventional basic resuscitation training with a basic neonatal mannequin (50 students), or training with a SimNewB® advanced mannequin (51 students) over a 3-day training period.

Evaluation comprised a written mega code prior to, and three months post training. Results reported improved self-confidence across groups, irrespective of the simulation fidelity. There was no disadvantage of low fidelity simulation over high fidelity simulation. Test scores proved skills were retained across groups after the 3-month period. From the review, it can be concluded that simulation facilitates training in a controlled environment, presenting opportunity for deliberate practice and assessment. Additionally, Nimbalkar et al. (2015) indicate that simulation is increasingly employed in healthcare education to teach cognitive, psychomotor, and affective skills to individuals and teams.

Thukral et al. (2015) demonstrated that low fidelity simulations which focus on skill-based learning, role play and group discussion, were found to yield improved knowledge and skill on neonatal resuscitation when preceded by self-study. The review made use of pre- and post-course assessment in the form of multiple choice questionnaires and structured clinical evaluations (OSCE). Eleven facilitators respectively from India and Kenya were trained, and these facilitators trained 62 providers. The findings of this study indicated that low fidelity simulation was effective based on analysis of post test scores in combination with mentoring. Self-efficacy scores were high, and most participants performed well in the OSCE.

Rovamo et al. (2015) studied ninety-nine participants from two delivery units. Learners were divided into two groups. The intervention group were exposed to crisis resource management and anesthesia non-technical skills instruction before simulated newborn emergencies scenarios, while the control groups were not exposed to instruction. Both groups were video recorded and scored by experts. They found that attendance of instruction and the simulation fidelity did not make a significant difference, but it made a difference who the team leader of the resuscitation opportunity was. Addressing issues of leadership and communication significantly improved outcomes in post test scores of skill acquisition regardless of type of simulation fidelity.

Simulation remains the preferred context for training of neonatal resuscitation skills, but there are no significant advantages of high or low fidelity simulation above the other. Importantly, post-test evaluations demonstrated retention of resuscitation skill

and knowledge when simulation is combined with supporting mechanisms, which will be discussed as the next theme.

The following section will focus on mechanisms that were triggered and their associated outcomes in neonatal resuscitation.

3.2.2 Theme 2: Mechanisms

Astbury and Leeuw (2010, p.367) define mechanisms as “underlying entities, processes, social structures which operate in a particular context to generate outcomes of interest”. In the current review, the uncovered mechanisms related to neonatal resuscitation training were categorized into the following sub-themes: self-efficacy evaluations, active mentoring, leadership development, debriefing and lectures.

Sub-theme 2.1: Active mentoring

According to the Nursing and Midwifery Council, UK (2008) a mentor is a person who is responsible for supervising learners through facilitation as well as for assesment after facilitation. Mentorship is perceived as vital to attract, train, and retain nursing faculty members, and to maintain high-quality education programmes. Noval et al. (2015) found the value of mentorship is increasingly being reported in medical training. Kristin et al. (2016) identified mentorship as a solution to ensure on-going training and practise opportunities.

Programmes that integrate mentorship with simulation training in neonatal resuscitation had improved results. For example, Kristin et al. (2016) reported effectiveness of integrated mentorship in the Helping Babies Breathe programme, which was demonstrated via training ten volunteers who subsequently trained forty-two healthcare workers in Madagascar. Pre- and post-test evaluations were done by means of theory and practical skill tests that showed significant increase in knowledge and skill of neonatal resuscitation of trainers and trainees four months post-training.

The study by Thukral et al. (2015), which demonstratee the approach of teach-the-teacher or train-the-trainer, is an approach of active mentorship. Active mentorship focused on training teachers prior to presentation of simulation programmes. This approach ensured consistency in delivery of information and provided learners with mentorship that yielded positive outcomes in terms of skill acquisition. Thukral et al. (2015) studied the effect of training a small group of fifteen trainers, which aimed to create a trainer cascade. The programme equipped this small group with sufficient knowledge and skill to train an additional one hundred and twenty learners in neonatal resuscitation. Furthermore, it was found that successful trainer cascades availed primary trainers on site, which extended on-going training opportunities for mastering skills in learners.

The study by Singhal et al. (2012) identified benefits of mentors from analysis of their pre- and post-test results: mentors can modify teaching approaches to ensure consistent delivery of information according to specific needs of learners, and thus ensure transferability of programmes. This in turn can increase skill acquisition of neonatal resuscitation skills.

Sub-theme 2.2: Leadership development

The study by Rovamo et al. (2015) mentioned that the unanticipated mechanism of experienced leaders improves outcomes in neonatal resuscitation skill acquisition. As mentioned before, the impact of exposure to crisis resource management and anesthesia non-technical skills instruction on neonatal resuscitation team work was evaluated. The results demonstrated that the instruction did not make a significant difference, but better performance in neonatal resuscitation was demonstrated by teams led by an experienced leader. Learning was demonstrated by trainees across different levels (individual, team and unit based) where leadership was included.

The Zimmerman et al. (2015) study also found unexpected mechanisms of leadership and teamwork as key factors in successful training of neonatal resuscitation. This was found irrespective of the levels of simulation, i.e. low fidelity simulation (basic mannequins) versus high fidelity simulation (using advanced technology). Furthermore, teams with experienced leaders performed better on post-test

evaluations regardless of fidelity type. These findings highlight the importance of leadership training as part of simulation programmes.

Sub-theme 2.3: Debriefing

Debriefing is described by Cho (2015) as a discussion session that revolves around sharing and analysis of information after an event has taken place. Debriefing may follow simulated or actual experiences and provides a platform for participants to review actions and reflect on their experiences.

The Zimmerman et al. (2015) study covered a two-year period observing 95 multi-disciplinary staff members and found neonatal resuscitation skills were acquired in training programmes where debriefing sessions were offered after the course. These results were based on post-training test questionnaires of trainees across different levels (individual, team and unit based).

Walker et al. (2014) also concluded from post-test questionnaires that debriefing provided opportunity for improved communication. According to Walker et al. (2014), debriefing sessions after neonatal resuscitation simulation events provide a platform for nurses to voice concerns and identify training opportunities. Interactive skill sessions and debriefing facilitate improved communication techniques and team coordination to enhance outcomes where teamwork and confidence performance improved in post-training evaluation of learners. It is suggested that even partial participation in simulations produces better results for training when combined with improved communication. Therefore they concluded that simulation is beneficial when combined with debriefing sessions to improve team communication.

Amin et al. (2013) studied participant questionnaires measuring perceptions of skills and knowledge of neonatal resuscitation training and concluded that the importance of debriefing was highly rated by participants. Debriefing proved to enhance communication and abilities of both experienced instructors and learners.

The studies discussed above confirm the importance of debriefing being integrated into simulation. Debriefing sessions afford learners an opportunity to engage in dialogue, hence improving communication between learners and trainers. Moreover, this encouraged trainers and provided them with important information regarding management of training. Debriefing sessions were highly rated and encouraged feedback from learners which yielded positive outcomes in retention and acquisition of skills in neonatal resuscitation training.

Sub-theme 2.4: Lectures

Lectures as a mechanism is one of the most widely used teaching strategies in education, and forms an important component of neonatal resuscitation courses. Traditional lectures are effective to communicate information in a non-intimidating manner to learners (Cashin 1990). Commonly, programmes that contain clinical components are taught via simulation, which include neonatal resuscitation due to its practical nature. Studies that used only lecture-based training were not identified. Instead, lectures were combined with simulation.

The study by Nimbalkar et al. (2015) involved 101 undergraduate students that received equal exposure to lectures before simulation over a 3-day period. Evaluation took the form of a pre-training test that was followed by a 3-hour didactic session comprising nine lectures. One group of 39 students received only lectures, and these students displayed good performance in the written test but did not pass the skills test.

Singhal et al. (2012) studied transferability of the ACoRN (Acute Care of the At-Risk Newborn) neonatal resuscitation programme for practitioners in China. A team of ACoRN instructors developed confidence and knowledge questionnaires for face and content validity. Bilingual Chinese instructors were trained at a tertiary perinatal center to deliver the course at 15 level II county hospitals. Hundred and twenty six participants completed pre- and post-course confidence and knowledge questionnaires, and provided feedback through post-course focus groups. The ACoRN process follows an 8-step framework that enables evaluation and management of neonates. The course content and educational material contains a large component of neonatal physiology in lecture format combined with skill practice. Although the focus of the study was on

transferability of courses, learners gave positive feedback on didactic preparation and reported the background knowledge as being useful. Confidence and knowledge related to neonatal stabilization improved significantly following these courses. However, learners did request more focus on the clinical skill component, as well as adjustments to include pre-course reading and more content related to simulation and communication skills.

The review highlighted combining lectures with other programmes as important in acquisition and retention of knowledge and skills in neonatal resuscitation, but not on its own.

Sub-theme 2.5: Self efficacy evaluations

Self-efficacy in neonatal resuscitation training is described by Bandura (1994, cited by Walker et al. 2015) as one's belief in one's ability to succeed in specific situations or to accomplish a task. A study by Walker et al. (2015) measured self-efficacy via self-assessment questionnaires of learners pre- and post-training. High self-efficacy scores were reported, but this did not translate into successful clinical resuscitation skill acquisition, because learners did not perform well in their clinical assessment.

The study by Close et al. (2016) reported that high self-efficacy scores were obtained through utilization of the train-the-trainer model in the Helping Babies Breathe programme. However, post-training assessment of learners revealed a lack of mastery in bag and mask ventilation skills. High self-efficacy scores were not a true reflection of knowledge or skill in basic neonatal resuscitation.

In a study by Amin et al. (2013), 17 participants in a neonatal resuscitation workshop based on the Neonatal Resuscitation Program completed two questionnaires (pre-and post-test) to assess their perception of their own knowledge and skills, as well as their experiences of simulation. Learners reported high self-efficacy scores, however results concluded that a perceived sense of learning and false confidence led to failure when learners were in real life settings. Additionally, the authors mentioned that making mistakes during simulation training prepared learners more effectively and helped to prevent repetition of mistakes on patients.

Carlo et al. (2009) evaluated the mechanism of self-efficacy as part of training, with the intention to evaluate the impact of educational strategies in low risk settings. The study used the content specifications of the Neonatal Resuscitation Program materials. Materials were used by 127 college educated nurse midwives working in low-risk clinics in Zambia. Assessment was done to develop performance and self-efficacy evaluations over pre-and post Neonatal Resuscitation Program training after 6 months. The course ran over a period of four days with 15 nurse midwives who became trainers, and subsequently trained an additional hundred and twelve (112) nurse midwives using the Neonatal Resuscitation Program. It was noted that Neonatal Resuscitation Program training increased test scores directly following training. Upon six-month post-training follow-up, there were high self-efficacy scores, but scores for retention of knowledge and skills had decreased significantly. Self-efficacy may therefore not be a true reflection of skill acquisition.

The Helping Babies Breathe programme was evaluated by Kirsten et al. (2016) in Zambia, based on a sample of 85% nurses and 15% clinical officers, medical licentiates, and physicians. Resuscitation knowledge and bag-mask ventilation (BMV) skills were measured using multiple-choice tests, self-efficacy scores, focus groups and OSCE's as evaluation methods. The OSCE's were performed at baseline, then again after one and three months. Although high self-efficacy scores were reported by participants, post-training assessment revealed lack of mastery in bag and mask ventilation skills without additional practise. As such, self-efficacy scores were found an unreliable measure of skill acquisition (Kristin et al. 2016).

3.2.3 Theme 3: Outcomes

In this study, outcomes refer to results obtained by post-training evaluation after completion of training programmes in neonatal resuscitation. Outcomes might be positive (demonstrating significant acquisition and retention of skills and knowledge) or negative (minimal retention of skills and knowledge). For this study, outcomes were categorized into short and long-term outcomes.

Sub-theme 3.1: Short term outcomes

Short term outcomes were taken as student performance during evaluation of theoretical and clinical neonatal resuscitation knowledge and skills in the period directly after simulation training. Carlo et al. (2008) concluded simulation proved favourable in facilitating skills acquisition directly post exposure to simulation. Written scores of knowledge evaluation and performance scores of skills evaluation were high of 127 students immediately after the training session,.

However, Close et al. (2016) concluded after their study that despite good self-efficacy scores, outcomes related to skill acquisition and retention were not positive. Learners had completed a standard programme participation post-test, yet they did not perform well. Ultimately, on-going mentorship was recommended.

Rovamo et al. (2015) found significantly improved short-term outcomes related to skill acquisition and retention when training was supported by leadership training. Findings by Nimbalkar et al. (2015) and Thukral et al. (2015) confirmed a positive influence of debriefing on communication, leading to improved theoretical and clinical outcomes such as demonstration of acquired knowledge and skill in neonatal resuscitation.

Sub-theme 3.2: Long term outcomes

Long term outcomes were taken as student performance during evaluations of theoretical and clinical neonatal resuscitation knowledge and skills at least three months after the learning opportunity.

The Carlo et al. (2009) study utilized content specifications of the Neonatal Resuscitation Program material to evaluate mechanisms of self-efficacy as part of training. The intention was to evaluate the impact of educational strategies in low risk settings. It was concluded that retention of resuscitation skill measured in a post test, declined after a six-month period in spite of improved self-efficacy.

In contrast, positive long-term outcomes were obtained by Zimmerman et al. (2015) with integration of simulation into clinical practise, as well as leadership development facilitated by debriefing.

Walker et al. (2014) found that debriefing sessions improved communication and proved valuable to ensure positive long-term outcomes from analysing the individual assessment tools six months post-training: acquisition and retention of skills and knowledge were successfully demonstrated on individual assessment tools, provided communication was on-going.

Overall simulation training is highly recommended for training and acquisition of clinical skills such as neonatal resuscitation. Although simulation proves a powerful context to facilitate acquisition and retention of skills in neonatal resuscitation training, the decisive factor for positive outcomes was a combination of mechanisms.

3.3 Discussion of findings

Successful neonatal resuscitations are a lifesaving intervention and are carried out by adult healthcare staff. To be successful requires specific skills that need to be used in often unpredicted situations and within a narrow margin of a few minutes. It is crucial for the skills to be accurately executed to save a baby's life. Clinical skills can be described as the actions taken to ensure that one can provide safe and effective care to a patient (Durham 2008).

Learners that need to acquire these neonatal resuscitation skills are adults and are established in their respective healthcare careers, hence they have a variety of pre-knowledge and specific learning needs. Schmidt and Lee (1999) define learning as those processes that is associated with repetition or experience, that might facilitate relatively permanent changes in the capability or actions. for movement. Permanent changes that occur due to learning are typically determined by testing performance on retention tests. Through retention, as described by Magill (2001), individuals are able to remember and recall. In this study, other studies were reviewed to identify which mechanisms in simulation context are likely to lead to outcomes of skill acquisition and retention in neonatal resuscitation.

The content and specific skills are stipulated in neonatal resuscitation programmes such as Helping Babies Breathe (AAP 2011), Neonatal Resuscitation Programme (American Heart Association, 2015) and Acute Care of the At-Risk Newborn (Sighal et al. 2012). The ideal is to teach these skills in real life, but it is not possible for moral and ethical reasons. It is very seldom possible to predict the time that resuscitation might be needed, as well as who mght be available at that time. The time limit to be successful is only a few minutes before the baby is at risk for morbidity or even mortality, which implies that time cannot be wasted to teach a person skills and there is not room for error. Simulations allow for training in a controlled environment with opportunity for practise and assessment that pose no risk to patients**.**

It has to be kept in mind that the persons who need to learn these skills are adult learners. In a study by Sahu and Lata (2013), key characteristics of adult learning were described as independence, self-direction in learning and internal motivation. Adult learners seek immediate application for knowledge gained and translate accumulated experience into daily practise. Expectations of adult learners can be met through hands-on practise in safe simulated health environments, which in this case is a neonate in need of resuscitation.

Adults learn faster and have greater retention of knowledge and skills when participating in interactive settings. Simulation training formulated specifically for health education provides adult learners with such opportunities. Through the creation of information technology, more realistic opportunities are available, and simulation has been suggested as an ideal tool for teaching the new generation of learners, whilst avoiding placing patients at risk. Simulation enables nurses to develop, synthesize and apply knowledge in a replica of real experience (Cooper et al. 2012).

In this realist synthesis, it was clear that simulation-based training is widely accepted as the preferred method of training neonatal resuscitation skill. Furthermore, simulation is reported as a valid teaching and learning strategy and is the most beneficial method of training given adequate context and methods are used.

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Benefits regarding skill acquisition and retention between low fidelity versus high fidelity simulation remained inconclusive with no significant differences observed (Nimbalkar et al. 2015). High fidelity simulation made use of advanced technologies to simulate events. The cost of these technologies is high and requires large stakeholder investment. In low fidelity simulation, trainers made use of standardized basic mannequins as well as mechanisms such as “train-the-trainer” models (Nimbalkar et al. 2015).

It emerged from all the papers reviewed however that, simulation alone was not sufficient to ensure skill acquisition. Similarly, associated mechanisms were unable to produce outcomes in isolation, albeit positive or negative. Mechanisms that emerged as strongest across studies were identified as active mentoring, leadership development, debriefing sessions post training, lectures and self-efficacy evaluations.

The autor found that mechanisms of importance that emerged strongly was active mentoring for acquisition and retention of knowledge and skills with emphasis on availability of mentors in the clinical area. Availability of mentors afforded learners opportunities to consolidate skills according to individual learning needs and pace. Trained mentors extended individual learning time as mentors could avail themselves as needed, and learners were able to receive feedback during clinical events. Learners may also lack confidence in group situations that hinder participation and learning. Mentors can bridge this gap by providing one on one explanation and demonstration where needed.

Programmes that integrate mentorship through train-the-trainer models (for example Helping Babies Breathe) further emphasize the importance of leadership and communication skills. It is recommended for the mentors to be available to the neonatal practitioners to support further training and support in neonatal resuscitation situations according to there needs (Kristin et al. 2016).

Leadership training emerged as pivotal for improved outcomes regarding retention of skills. This mechanism was unanticipated but emerged strongly across several studies (Rovamo. et al. 2015; Zimmerman et al. 2015; Kristin et al. 2016; Noval 2015)). Learners performed neonatal resuscitation training effectively when lead by

experienced leaders. The need for leadership training was further emphasised from participant feedback, as well as from observations on post-test performance. Equipping learners with leadership skills is expected to directly translate into confidence in emergencies where learners can take the lead during resuscitation. Rovamo et al. (2015) and Zimmerman et al. (2015) recommended incorporating leadership training in simulation programmes to improve acquisition and retention of skills and to empower learners.

Enhanced communication, a quality of good leadership, further facilitated better performance of learners in post-training evaluation (Zimmerman et al. 2015). Encouraged communication from debriefing sessions following training proved to enhance performance in resuscitation post-tests. Neonatal resuscitation skills acquisition was also demonstrated in training programmes where communication was developed. This was based on post-training questionnaires for trainees across different levels (individual, team and unit based). Communication provideds learners with opportunity to clarify concepts and gain input concerning their own performance, and, additionally, debriefing allows learners to learn from the mistakes of others. Debriefing sessions were strongly recommended by learners and instructors alike (Walker et al. 2014; Amin et al. 2013).

Lectures alone could not transfer sufficient knowledge for learners to acquire necessary skills without simulation. However, lectures did prove useful to provide background information, and learners reported better understanding of clinical instruction after exposure to physiological rationales behind actions (Singhal et al. 2012).

Self-efficacy, one's belief in one's ability to succeed in specific situations or to accomplish a task, can play a major role in how one approaches goals, tasks, and challenges (Walker et al. 2015). In neonatal resuscitation, it is important for practitioners to have confidence in their own knowledge and skills. However, it is crucial that practitioners are realistic regarding their abilities and skills. Self-efficacy that is not substantiated by acquired knowledge and skills may lead to over-confidence and potentially dangerous practises. Learners often rated their skills as sufficient, but this did not translate into positive results during post-test assessments. For example,

the Helping Babies Breath programme found clinical performance was poor, and that learners displayed potentially dangerous resuscitation practices, despite reporting high self-efficacy scores (Kirsten et al. 2016). Self-efficacy scores do not provide for identification of knowledge deficit because one does not know what one does not already know. Therefore, self-efficacy is not recommended as an accurate reflection of neonatal resuscitation knowledge or skill.

In this discussion, outcomes refer to results obtained by comparing pre- and post-training evaluations of neonatal resuscitation. They may be positive (demonstrating acquisition and retention of skills and knowledge) or negative (minimal retention of skills and knowledge). From this realist synthesis, one can conclude that simulation as a context is preferred for training clinical skills such as neonatal resuscitation. Although simulation proves a powerful context to facilitate acquisition and retention of skills in neonatal resuscitation training, the decisive factor for improved outcomes was combination of mechanisms. It is clear from all the papers selected that various mechanisms collectively contribute to positive outcomes where learners can successfully demonstrate neonatal resuscitation skill acquisition and retention. Individualized adaptions, and combined mechanisms are needed to yield positive outcomes in terms of skill acquisition and retention of neonatal resuscitation skills.

3.4 Summary

This chapter discussed findings from realist synthesis. The next chapter will discuss recommendations based on the conclusions above.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 Introduction

Neonatal mortality is a global problem. As discussed in chapter one, world leaders re-committed themselves to reduce neonatal mortality to at least 12/1000 live births by 2030 (WHO 2015).

In a report by UNICEF (2014), neonatal resuscitation training was identified as a key strategy to reduce neonatal mortality, that is simple, preventative and cost-effective. Training should take place with the emphasis on acquisition and retention of acquired knowledge and skills. However, Wong et al. (2013) stated that training is complex and highly context dependent. Neonatal resuscitation training interventions may not impact all learners equally, which increases complexity in such interventions.

4.2 Overview

The research question was “what are the contexts, mechanisms and outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition?” The aim of the study was to describe the contexts, mechanisms and associated outcomes in neonatal resuscitation training that influence neonatal resuscitation skill acquisition.

Realist synthesis developed a contextual understanding of program logic by asking “what works for whom and in what context and possibly why?” (Pawson 2006). This involved uncovering relationships between context in which programs are implemented (C), their underlying mechanisms (M) and outcomes (O).

Selected articles were scrutinized and arranged into three basic components, namely context, mechanisms and outcomes. Mechanisms and their outcomes were considered in context of simulation training. Evidence for how simulation context triggers mechanisms that result in realistic outcomes was sought.

Findings were divided into themes related to context, mechanisms and outcomes that affect neonatal resuscitation skill acquisition. For this discussion, C-M-O configurations were divided respectively into themes and sub-themes. Theme one was context, with sub-themes as high fidelity and low fidelity simulation. Theme two was mechanisms, with sub-themes as active mentoring, leadership development, debriefing, lectures and self-efficacy evaluations. Theme three was outcomes, with sub-themes as short-term and long-term outcomes.

4.2.1 Context

The context were identified as simulation with the sub-themes being high fidelity and low fidelity training. From the data reviewed, it was evident that no significant differences were observed between high fidelity and low fidelity simulation. It was though clear that simulation on its own might not lead to knowledge and skill acquisition, but that the mechanisms play a crucial role.

4.2.2 Mechanisms

Mechanisms identified were those strategies which operated in simulation as context to generate outcomes. Mechanisms refer to the aspects of neonatal resuscitation training that proved acquisition and retention of resuscitation skill. Mechanisms that emerged were identified as active mentoring, leadership development, debriefing, lectures and self-efficacy evaluations, Employing a combination of mechanisms to simulation training yielded the best results according to the studies discussed.

Mentorship was identified as crucial in acquisition and retention of knowledge and skills. Available mentors afforded learners opportunities to consolidate skills according to individual learning needs and at individual paces. Trained mentors in the clinical area extended learning time as mentors could avail themselves as needed and provide feedback to learners during clinical events.

Leadership training emerged as an unanticipated mechanism to enhance skill acquisition. Learners were able to perform neonatal resuscitation training effectively

when lead by experienced leaders and when equipped with leadership skills, they gain confidence and take the lead during resuscitation.

Debriefing sessions after training enhanced performance in resuscitation post-tests and encouraged communication among members which also improved confidence and performance. Improved neonatal resuscitation skill acquisition was demonstrated in training programmes where communication was developed. Communication provides learners with the opportunity to clarify concepts and obtain input on their performance. Debriefing allows learners to learn from their own mistakes as well as of others.

The mechanism of lectures proved to provide valuable background information to learners about neonatal resuscitation, but neonatal resuscitation skills could not be mastered by lectures alone due to the clinical nature thereof.

Self-efficacy is where learners give their opinion on their self-perceived skills regarding neonatal resuscitation. Learners generally rated their skills as sufficient, but this did not translate into positive results in post-test assessments. It rather lead to a false sense of confidence, while the actual skills were lacking. Self-efficacy is therefore not recommended as an accurate reflection of knowledge or skills.

4.2.3 Outcomes

Outcomes refer to results obtained by comparing pre- and post-training evaluation after completing a training programme in neonatal resuscitation. Outcomes may be positive (demonstrating acquisition and retention skills and knowledge) or negative (minimal retention of skills and knowledge), with regards to neonatal resuscitation skill acquisition.

Short term outcomes were measured by student performance during evaluation in the period directly after simulation training, and long-term outcomes were measured at least three months post training.

This study concluded that although simulation provides a powerful context to facilitate acquisition and retention of skill in neonatal resuscitation training, the decisive factor for improved long term outcomes were the combination of mechanisms, especially mentorship, debriefing, leadership development and lectures. These mechanisms can be used in association with either low fidelity or high fidelity simulation to enhance long term skill acquisition in neonatal resuscitation. Self-efficacy as a mechanism appeared not to contribute to skill acquisition, but rather to provide a false sense of confidence.

4.3 Recommendations for research

Nursing specific research regarding simulation, skill acquisition and retention is limited in that mechanisms have not been explicit, and outcomes have only vaguely described. Hirji (2015) suggested that expanding current study methods will provide for comparison between methods of simulation against one another, whilst also providing explicit reporting for context, mechanisms and outcomes.

The researcher therefore recommends:

- More reviews must focus on reporting specific context, mechanisms and associated outcomes of neonatal resuscitation training.
- Reviews must clearly identify demographic data to answer the question on whom does it work for.
- Studies must focus on the effects of adaptations in programmes to evaluate combinations of mechanisms to enhance neonatal resuscitation skill acquisition.
- Studies must be done to determine the association between patient outcomes and resuscitation skills of health care professionals.
- Further research must focus on instructional design, outcomes measurement, and contexts of simulation in neonatal resuscitation training.
- Future research must focus on transferring skills from simulation environments to real-life emergencies.

4.4 Recommendations for practise and training

Simulation-based health education resolves practical and ethical dilemmas related to practicing procedures on patients. Simulation-based training techniques and tools have been described by Jha et al. (2011) as a strategy that can be applied in designing structured learning experiences, and implemented as measurement tools linked to targeted teamwork competencies and learning objectives

The following is further recommended for practise and training:

Context-related recommendations:

- Simulation must be combined with additional mechanisms including but not limited to active mentoring, leadership development, debriefing and lectures to yield long term positive outcomes.
- Adaptation of neonatal resuscitation programmes must accommodate student-specific affective, cognitive and psychomotor learning needs.
- Simulation programmes can be transferred effectively if adaptations are made according to individual cultural and didactic needs. These needs must be elucidated by means of pre-simulation learning needs assessments.
- Simulation scenarios must be realistic enough and be incorporated into the clinical settings to allow errors during training as opposed to the current trend of focusing on positive outcomes alone.
- Refresher sessions or courses must be provided after three to six months, as most attrition of knowledge occurs around this period, and these must include in situ simulation.
- Evaluation of skills and knowledge must be done objectively and in conjunction with self-evaluation, as a false sense of self-efficacy often persists. Peer assessment in conjunction with self-efficacy evaluation is also recommended.
- Increased practise time must be provided during simulation with increased frequency of training updates.

Mechanism-related recommendations

- Didactic, pre-preparation and lectures must be incorporated as teaching methods along with simulation training to ensure theoretical knowledge is in place prior to simulation training.
- Leadership development and communication should be included in neonatal resuscitation training to instil confidence amongst nurse practitioners to initiate and lead resuscitation.
- Multi-disciplinary team training must be included for improved communication and building confidence, as teams with strong leadership have high overall performance.
- Debriefing sessions should be incorporated for improved communication and feedback on performance.
- Simulation of clinical situations must be under guidance of a trained mentor to observe and assist in neonatal resuscitation events.
- Learners must be involved in the design of training programmes to ensure they claim ownership of their own learning and produce positive results.

Outcome-related recommendations

- Short and long-term outcomes in terms of neonatal resuscitation skill acquisition should be assessed, as well as in combination to determine areas of knowledge attrition, possible causes and effectiveness of mechanisms.
- Outcomes of resuscitation should be assessed in practise i.e. before and after-resuscitation events. Short-term outcomes should include survival rates, and long-term outcomes should include associated co-morbidities.
- Incorporation of multiple mechanisms are strongly recommended for improved outcomes, as outcomes vary according to mechanisms employed, and not with simulation type or fidelity.

4.5 Limitations

The researcher found the lack of differentiation between context, mechanisms and outcomes in existing literature challenging. Few papers provided information on all

three aspects and had to be excluded. Whilst context and outcomes were well described, mechanisms had to be elucidated by scrutiny of appropriate data.

The iterative nature of realist review and associated value judgements required for C-M-O configurations, indicate that multiple researchers can provide a greater understanding of the studied factors as opposed to a single researcher.

4.6 Strengths

Applying realist methodology guided by the RAMESES standards, provided an opportunity to view neonatal resuscitation training from multiple points of view. The researcher was able to scrutinize data and formulate an understanding based on multiple factors involved in training neonatal resuscitation skills. This stands in contrast to simply answering a research question in a single dimension, and allows complexity of training to be addressed. The realist question of “what works for whom and in what circumstances? “(Pawson 2006) provided deeper insight into the dynamics of neonatal resuscitation training.

4.7 Conclusion

Simulation training is the preferred method for training clinical skills such as neonatal resuscitation training. This paper concluded that although simulation provides a powerful context to facilitate learning, the decisive factor for improved team work and successful resuscitation in practice, is the combination of different mechanisms to improve short and long term outcomes in skill acquisition.

LeShan (2015) said that a new baby is like the beginning of all things: wonder, hope, and a dream of possibilities. By saving the life of a neonate through effective and timeous resuscitation, the wonder, hope and dreams of possibilities may be given to parents all over the world.

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Annexure A
Declaration regarding plagiarism

DECLARATION OF ORIGINALITY

UNIVERSITY OF PRETORIA

The Department of NURSING places great emphasis upon integrity and ethical conduct in the preparation of all written work submitted for academic evaluation.

While academic staff teach you about referencing techniques and how to avoid plagiarism, you too have a responsibility in this regard. If you are at any stage uncertain as to what is required, you should speak to your lecturer before any written work is submitted.

You are guilty of plagiarism if you copy something from another author's work (eg a book, an article or a website) without acknowledging the source and pass it off as your own. In effect you are stealing something that belongs to someone else. This is not only the case when you copy work word-for-word (verbatim), but also when you submit someone else's work in a slightly altered form (paraphrase) or use a line of argument without acknowledging it. You are not allowed to use work previously produced by another student. You are also not allowed to let anybody copy your work with the intention of passing if off as his/her work.

Students who commit plagiarism will not be given any credit for plagiarised work. The matter may also be referred to the Disciplinary Committee (Students) for a ruling. Plagiarism is regarded as a serious contravention of the University's rules and can lead to expulsion from the University.

The declaration which follows must accompany all written work submitted while you are a student of the Department of NURSING No written work will be accepted unless the declaration has been completed and attached.

Full names of student: ALUCIA BOTES

Student number: 02573954

Topic of work: NEONATAL RESUSCITATION TRAINING AND SKILL ACQUISITION: A REALIST SYNTHESIS

Declaration

1. I understand what plagiarism is and am aware of the University's policy in this regard.

2. I declare that this MCUR DISSERTATION (eg essay, report, project, assignment, dissertation, thesis, etc) is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.

3. I have not used work previously produced by another student or any other person to hand in as my own.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

SIGNATURE 

Annexure B
Realist and Meta–narrative Evidence Syntheses: Evolving Standards

QUALITY STANDARDS FOR REALIST SYNTHESIS (for researchers and peer-reviewers)

1. The research problem

Realist synthesis is a theory-driven method that is firmly rooted in a realist philosophy of science and places particular emphasis on understanding causation and how causal mechanisms are shaped and constrained by social context. This makes it particularly suitable for reviews of certain topics and questions – for example, complex social programmes that involve human decisions and actions. A realist research question contains some or all of the elements of 'What works, how, why, for whom, to what extent and in what circumstances, in what respect and over what duration?' and applies realist logic to address the question. Above all a realist research seeks to answer the 'why?' question. Realist synthesis always has explanatory ambitions. It assumes that programme effectiveness will always be partial and conditional and seeks to improve understanding of the key contributions and caveats.

Criterion	Inadequate	Adequate	Good	Excellent
The research topic is appropriate for a realist approach	The research topic is: • not appropriate for secondary research; and/or • does not require understanding of how and why outcomes are generated.	The research topic is appropriate for secondary research. It requires understanding of how and why outcomes are generated and why they vary across contexts.	Adequate plus: Framing of the research topic reflects a thorough understanding of a realist philosophy of science (generative causation in contexts; mechanisms operating at other levels of reality than the outcomes they generate).	Good plus: There is a coherent argument as to why a realist approach is more appropriate for the topic than other approaches, including other theory based approaches.
The research question is constructed in such a way as to be suitable for a realist synthesis	The research question is not structured to reflect the elements of realist explanation. For example, it: • only requires description; and/or • only requires a numerical aggregation of outcomes; and/or • only requires summary of processes; and/or • specifies methods that are inadequate to generate realist understanding (e.g. 'a thematic analysis of …')	The research question includes a focus on how and why the intervention, or programme (or similar classes of interventions or programmes - where relevant) generates its outcomes, and contains at least some of the additional elements, "for whom, in what contexts, in what respects, to what extent and over what durations".	Adequate plus: The rationale for excluding any elements of 'the realist question' from the research question is explicit. The question has a narrow enough focus to be managed within a realist review.	Good plus: The research question is a model of clarity and as simple as possible.

2. Understanding and applying the underpinning principles of realist reviews				
Realist syntheses apply realist philosophy and a realist logic of enquiry. This influences everything from the type of research question to a review's processes (e.g. the construction of a realist programme theory, search, data extraction, analysis and synthesis to recommendations). The key analytic process in realist review involves iterative testing and refinement of theoretically based explanations using empirical findings in data sources. The pertinence and effectiveness of each constituent idea is then tested using relevant evidence (qualitative, quantitative, comparative, administrative, and so on) from the primary literature on that class of programmes. In this testing, the ideas within a programme theory are re-cast and conceptualised in realist terms. Reviewers may draw on any appropriate analytic techniques to undertake this testing.				
	Inadequate	**Adequate**	**Good**	**Excellent**
The review demonstrates understanding and application of realist philosophy and realist logic which underpins a realist analysis.	Significant misunderstandings of realist philosophy and/or logic of analysis are evident. Common examples include: • programme/intervention activities or strategies are confused with mechanisms • no attempts are made to uncover mechanisms • outcomes are assumed to be caused by the programme/intervention • relationship(s) between an outcome, its causal mechanism(s) and context(s) are not explained • some theory is provided but this is not explicitly linked to outcome(s)	Some misunderstandings of realist philosophy and/or logic of analysis exist, but the overall approach is consistent enough that a recognisably realist analysis results from the process.	The review's assumptions and analytic approach are consistent with a realist philosophy at all stages of the review. Where necessary a realist programme theory is developed and tested.	Good plus: Review methods, strategies or innovations used to address problems or difficulties within the review are consistent with a realist philosophy of science.

3. Focussing the review				
Because a realist review may generate a large number of avenues that might be explored and explained, and because resources and timescale are invariably finite, it may be necessary to 'contain' a review by progressively focusing both its breadth (how wide an area?) and depth (how much detail?). This important process needs to be considered from the start and may involve iterative rounds of discussion and negotiation with (for example) content experts, funders and/or users. It is typical and legitimate for the review's objectives, question and/or the breadth and depth of the review to evolve as the review progresses.				
	Inadequate	Adequate	Good	Excellent
The review question is sufficiently and appropriately focussed.	The review question is too broad to be answerable within the time and resources allocated. There is no evidence that progressive focussing occurred as the review was undertaken.	Attempts are made by the review team to progressively focus the review topic in a way that takes account of the priorities of the review and the realities of time and resource constraints. Attempts are documented so that they can be described in publications as appropriate.	Adequate plus: The focussing process is iterative. Commissioners of the review are involved in decision-making about focussing. Decisions made about which avenues are pursued and which are left open for further inquiry are recorded and made available to users of the review.	Good plus: The review team draws on external stakeholder expertise to drive the focussing process in order to achieve maximal end-user relevance.

4. Constructing and refining a realist programme theory				
Early in the review, the main ideas that went into the making of a class of interventions (the programme theory – which may or may not be realist in nature) are elicited. This initial programme theory sets out how and why a class of intervention is thought to 'work' to generate the outcome(s) of interest. This initial programme theory then needs to be 're-cast' in realist terms (a rough outline of the contexts in which, populations for which, and main mechanisms by which, particular outcomes are expected to be achieved.) This initial tentative theory will be progressively refined over the course of the review.				
	Inadequate	Adequate	Good	Excellent
An initial realist programme theory is identified and developed.	A realist programme theory is not offered or; A program theory is offered but is not converted to a realist program theory at any stage of the review.	An initial program theory is identified and described in realist terms (that is, in terms of the relationship between contexts, mechanisms and outcomes). The refined theory is consistent with the evidence provided.	Adequate plus: An initial realist programme theory is set out at the outset. The theory is refined iteratively as the review progresses.	Good plus: The relationship between the programme theory and relevant substantive theory is identified. Implications of the final theory for practice, and for refinements to substantive theory where appropriate, are described. The final realist program theory comprises multiple context-mechanism-outcome configurations (describing the ways different mechanisms fire in different contexts to generate different outcomes) and an explanation of the pattern of CMOs.

5. Developing a search strategy				
Searching in a realist review is guided by the objectives and focus of the review, and revised iteratively in the light of emerging data. Searching is directed at finding data that can be used to test theory, and may lie in a broad range of sources that may cross traditional disciplinary, programme and sector boundaries. The search phase is thus likely to involve searching for different sorts of data, or studies from different domains, with which to test different aspects of any provisional theory.				
	Inadequate	**Adequate**	**Good**	**Excellent**
The search process is such that it would identify data to enable the review team to develop, refine and test programme theory or theories.	The search is incapable of supporting a rigorous realist review. Common errors include: • The search is driven by a methodological hierarchy of evidence (e.g. privileging RCTs) rather than the need to identify data to develop, refine or test program theory/ies • The search process is not informed by the objectives and focus of the review • The database(s) selected are narrow in the subject matter that they contain (e.g. limited to specific topics rather than extending to social science, psychology etc.) • Searching is undertaken once only at the outset of the review and there is no iterative component	Searches are driven by the objectives and focus of the review. The search strategy is piloted and refined to check that it is fit for purpose. Documents are sought from a wide range of sources which are likely to contain relevant data for theory development, refinement and testing. There is no restriction on the study or documentation type that is searched for.	Adequate plus: further searches are undertaken in light of greater understanding of the topic area. These searches are designed to find additional data that would enable further theory development, refinement or testing.	Good plus: the searching deliberately seeks out data from situations outside the program under study where it can be reasonably inferred that the same mechanisms(s) might be in operation.

6. Selection and appraisal of documents				
Realist review requires a series of judgements about the relevance and robustness of particular data for the purposes of answering specific questions within the overall review question. An appraisal of the contribution of any section of data (within a document) should be made on two criteria: • *Relevance* – whether it can contribute to theory building and/or testing; and • *Rigour* – whether the method used to generate that particular piece of data is credible and trustworthy. The selection and appraisal stage may need to run in parallel with the analysis stage.				
	Inadequate	**Adequate**	**Good**	**Excellent**
The selection and appraisal process ensures that sources relevant to the review containing material of sufficient rigour to be included are identified. In particular, the sources identified allow the reviewers to make sense of the topic area; to develop, refine and test theories; and to support inferences about mechanisms.	The selection and appraisal process does not support a rigorous and complete realist review. For example: • Selection is overly driven by methodological hierarchies (e.g. the restriction of the sources to RCTs to the exclusion of other forms of evidence) • Sources are appraised using a technical checklist for a particular method (e.g. assessment of quality for an RCT) rather than by making a defensible judgement on the relevance and rigour of the source • Selection and appraisal processes are overly restrictive and exclude materials that may be useful for a realist analysis • Selection and appraisal processes are not sensitive enough to exclude irrelevant materials	Selection of a document for inclusion into the review is based on what it can contribute to the process of theory development, refinement and/or testing (i.e. relevance). Appraisals of rigour judge the plausibility and coherence of the method used to generate data.	Adequate plus: During the appraisal process limitations of the method used to generate data are identified and taken into consideration during analysis and synthesis.	Good plus: Selection and appraisal demonstrate sophisticated judgements of relevance and rigour within the domain.

7. Data extraction				
In a review, data extraction assists analysis and synthesis. Of particular interest to the realist reviewer are data that support the use of realist logic to answer the review's question(s) – e.g. data on context, mechanisms, and outcome configurations, demi-regularities, middle-range and/or programme theories.				
	Inadequate	Adequate	Good	Excellent
The data extraction process captures the necessary data to enable a realist review .	The data extraction process does not capture the necessary data to enable a realist review. For example: • Data extraction is undertaken mechanically and with no attention to how the data informs the review • No or very limited piloting has been undertaken to test aspects of the data extraction process and improve it	Data extraction focuses on identification and elucidation of context-mechanism outcome configurations and refinement of program theory. Piloting and refinement of the data extraction process has been undertaken where appropriate. Quality control processes are in place to check that all review team members apply common processes and standards in data extraction.	Adequate plus: Data extraction processes support later processes of analysis (e.g. by organising data into sets relevant for later analysis). The data extracted is comprehensive enough to identify main CMO patterns.	Good plus: The data extraction process is continually refined as the review progresses, so as to capture relevant data as the review question is focussed and/or program theory is refined.

8. Reporting				
Realist reviews may be reported in multiple formats – lengthy reports, summary reports, articles, websites and so on. Reports should be consistent with the publication standards for realist synthesis. (See RAMESES publication standards: Realist syntheses at: http://onlinelibrary.wiley.com/doi/10.1111/jan.12095/full or http://www.biomedcentral.com/1741-7015/11/21).				
	Inadequate	Adequate	Good	Excellent
The realist synthesis is reported using the items listed in the RAMESES Reporting standard for realist syntheses.	Key items are missing. For example • No defined research question • Limited or no reporting of the review's processes (i.e. methods used) • Limited or no explanations and justifications provided for any adaptations made on the realist review process • Insufficient detail is reported to enable readers to judge the plausibility and coherence of the findings	Most items reported. In particular the following items should be reported: • Rationale for review • Objectives and focus of review • All method section items (i.e. items 5 to 11 in the RAMESES publication standards: Realist syntheses)	All items are reported clearly and in sufficient detail for an external reader to understand and to judge the methods used and the plausibility and coherence of the findings.	Good plus: The report is well written and easy to understand. Additional materials are made available for external readers to investigate aspects of the review in more detail.

Annexure C
Declaration of Helsinki

Special Communication

World Medical Association Declaration of Helsinki
Ethical Principles for Medical Research Involving Human Subjects

World Medical Association

Adopted by the 18th WMA General Assembly, Helsinki, Finland, June 1964, and amended by the:
29th WMA General Assembly, Tokyo, Japan, October 1975
35th WMA General Assembly, Venice, Italy, October 1983
41st WMA General Assembly, Hong Kong, September 1989
48th WMA General Assembly, Somerset West, Republic of South Africa, October 1996
52nd WMA General Assembly, Edinburgh, Scotland, October 2000
53rd WMA General Assembly, Washington, DC, USA, October 2002 (Note of Clarification added)
55th WMA General Assembly, Tokyo, Japan, October 2004 (Note of Clarification added)
59th WMA General Assembly, Seoul, Republic of Korea, October 2008
64th WMA General Assembly, Fortaleza, Brazil, October 2013

Preamble

1. The World Medical Association (WMA) has developed the Declaration of Helsinki as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data.

   The Declaration is intended to be read as a whole and each of its constituent paragraphs should be applied with consideration of all other relevant paragraphs.

2. Consistent with the mandate of the WMA, the Declaration is addressed primarily to physicians. The WMA encourages others who are involved in medical research involving human subjects to adopt these principles.

General Principles

3. The Declaration of Geneva of the WMA binds the physician with the words, "The health of my patient will be my first consideration," and the International Code of Medical Ethics declares that, "A physician shall act in the patient's best interest when providing medical care."

4. It is the duty of the physician to promote and safeguard the health, well-being and rights of patients, including those who are involved in medical research. The physician's knowledge and conscience are dedicated to the fulfilment of this duty.

5. Medical progress is based on research that ultimately must include studies involving human subjects.

6. The primary purpose of medical research involving human subjects is to understand the causes, development and effects of diseases and improve preventive, diagnostic and therapeutic interventions (methods, procedures and treatments). Even the best proven interventions must be evaluated continually through research for their safety, effectiveness, efficiency, accessibility and quality.

7. Medical research is subject to ethical standards that promote and ensure respect for all human subjects and protect their health and rights.

8. While the primary purpose of medical research is to generate new knowledge, this goal can never take precedence over the rights and interests of individual research subjects.

9. It is the duty of physicians who are involved in medical research to protect the life, health, dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of research subjects. The responsibility for the protection of research subjects must always rest with the physician or other health care professionals and never with the research subjects, even though they have given consent.

10. Physicians must consider the ethical, legal and regulatory norms and standards for research involving human subjects in their own countries as well as applicable international norms and standards. No national or international ethical, legal or regulatory requirement should reduce or eliminate any of the protections for research subjects set forth in this Declaration.

11. Medical research should be conducted in a manner that minimises possible harm to the environment.

12. Medical research involving human subjects must be conducted only by individuals with the appropriate ethics and scientific education, training and qualifications. Research on patients or healthy volunteers requires the supervision of a competent and appropriately qualified physician or other health care professional.

may be appropriate to consult family members or community leaders, no individual capable of giving informed consent may be enrolled in a research study unless he or she freely agrees.

26. In medical research involving human subjects capable of giving informed consent, each potential subject must be adequately informed of the aims, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it may entail, post-study provisions and any other relevant aspects of the study. The potential subject must be informed of the right to refuse to participate in the study or to withdraw consent to participate at any time without reprisal. Special attention should be given to the specific information needs of individual potential subjects as well as to the methods used to deliver the information.

    After ensuring that the potential subject has understood the information, the physician or another appropriately qualified individual must then seek the potential subject's freely-given informed consent, preferably in writing. If the consent cannot be expressed in writing, the non-written consent must be formally documented and witnessed.

    All medical research subjects should be given the option of being informed about the general outcome and results of the study.

27. When seeking informed consent for participation in a research study the physician must be particularly cautious if the potential subject is in a dependent relationship with the physician or may consent under duress. In such situations the informed consent must be sought by an appropriately qualified individual who is completely independent of this relationship.

28. For a potential research subject who is incapable of giving informed consent, the physician must seek informed consent from the legally authorised representative. These individuals must not be included in a research study that has no likelihood of benefit for them unless it is intended to promote the health of the group represented by the potential subject, the research cannot instead be performed with persons capable of providing informed consent, and the research entails only minimal risk and minimal burden.

29. When a potential research subject who is deemed incapable of giving informed consent is able to give assent to decisions about participation in research, the physician must seek that assent in addition to the consent of the legally authorised representative. The potential subject's dissent should be respected.

30. Research involving subjects who are physically or mentally incapable of giving consent, for example, unconscious patients, may be done only if the physical or mental condition that prevents giving informed consent is a necessary characteristic of the research group. In such circumstances the physician must seek informed consent from the legally authorised representative. If no such representative is available and if the research cannot be delayed, the study may proceed without informed consent provided that the specific reasons for involving subjects with a condition that renders them unable to give informed consent have been stated in the research protocol and the study has been approved by a research ethics committee. Consent to remain in the research must be obtained as soon as possible from the subject or a legally authorised representative.

31. The physician must fully inform the patient which aspects of their care are related to the research. The refusal of a patient to participate in a study or the patient's decision to withdraw from the study must never adversely affect the patient-physician relationship.

32. For medical research using identifiable human material or data, such as research on material or data contained in biobanks or similar repositories, physicians must seek informed consent for its collection, storage and/or reuse. There may be exceptional situations where consent would be impossible or impracticable to obtain for such research. In such situations the research may be done only after consideration and approval of a research ethics committee.

Use of Placebo

33. The benefits, risks, burdens and effectiveness of a new intervention must be tested against those of the best proven intervention(s), except in the following circumstances:

    Where no proven intervention exists, the use of placebo, or no intervention, is acceptable; or

    Where for compelling and scientifically sound methodological reasons the use of any intervention less effective than the best proven one, the use of placebo, or no intervention is necessary to determine the efficacy or safety of an intervention

    and the patients who receive any intervention less effective than the best proven one, placebo, or no intervention will not be subject to additional risks of serious or irreversible harm as a result of not receiving the best proven intervention.

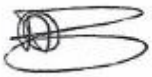
    Extreme care must be taken to avoid abuse of this option.

Post-Trial Provisions

34. In advance of a clinical trial, sponsors, researchers and host country governments should make provisions for post-trial access for all participants who still need an intervention identified as beneficial in the trial. This information must also be disclosed to participants during the informed consent process.

Research Registration and Publication and Dissemination of Results

35. Every research study involving human subjects must be registered in a publicly accessible database before recruitment of the first subject.



36. Researchers, authors, sponsors, editors and publishers all have ethical obligations with regard to the publication and dissemination of the results of research. Researchers have a duty to make publicly available the results of their research on human subjects and are accountable for the completeness and accuracy of their reports. All parties should adhere to accepted guidelines for ethical reporting. Negative and inconclusive as well as positive results must be published or otherwise made publicly available. Sources of funding, institutional affiliations and conflicts of interest must be declared in the publication. Reports of research not in accordance with the principles of this Declaration should not be accepted for publication.

Unproven Interventions in Clinical Practice

37. In the treatment of an individual patient, where proven interventions do not exist or other known interventions have been ineffective, the physician, after seeking expert advice, with informed consent from the patient or a legally authorised representative, may use an unproven intervention if in the physician's judgement it offers hope of saving life, re-establishing health or alleviating suffering. This intervention should subsequently be made the object of research, designed to evaluate its safety and efficacy. In all cases, new information must be recorded and, where appropriate, made publicly available.

ARTICLE INFORMATION

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Online-Only Content: Audio podcast is available at www.jama.com.

Annexure D
Consent and information letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences
School of Health Care Sciences
Department of Nursing Sciences

NEONATAL RESUSCITATION TRAINING AND SKILL ACUISITION: A REALIST SYNTHESIS

Research conducted by:
Ms Alucia Botes
Student number: 02573954
Cell: +27 83 7036811
E-mail:alucia.botes@gmail.com

Dear Participant

You are invited to participate in an academic research study conducted by Alucia Botes, Masters Student from the Department of Nursing, University of Pretoria, South Africa.

A realist synthesis was undertaken on neonatal resuscitation training and skill acquisition. The purpose of this study was to uncover and evaluate mechanisms in various contexts and the associated outcomes, with the overall aim of improving neonatal outcomes through ensuring acquisition of skill in neonatal resuscitation training.

Your expert opinion could advise on the accuracy of the methodology utilized and the interpretation of results, thereby strengthening the trustworthiness and credibility of this study.

- You where purposively selected based on your expertise in the field of research.
- Your participation in this study is very valuable to me. You may, however, choose not to participate and you may also stop participating at any time without any negative consequences.
- There is no apparent benefit to you.
- The measure of your contribution is entirely voluntary as you may fill the complete questionnaire or parts thereof.

- Please answer the questions in the attached questionnaire as completely and honestly as possible. This should not take more than one hour of your time (including reading of the study
- The results of the study will be used for academic purposes only and may be published in an academic journal. Recognition for your contribution will be given only with your consent.
- The Research Ethics Committee of the University of Pretoria, faculty of Health Science has granted written approval for this study.
- Please contact me or my study leader,Prof C Maree at cmaree.research@gmail.com if you have any questions or comments regarding the study.

Please sign the form to indicate that:

- You have read and understand the information provided above.
- You give your consent to participate in the study on a voluntary basis.

I, ... , herewith give voluntary consent to participation.

_____ _____

Participant's signature **Date**
(Please provide credentials)

☐ I am willing to be credited for my contribution.

☐ Do not include my details in any credits.

(Kindly indicate your preferred option by marking the appropriate box)

Annexure E
Expert review to neonatalogy experts

Kindly complete the following questionnaire

CRITERION	YES	NO	COMMENT/RECOMMENDATION
RESEARCH TOPIC: The topic of this study is relevant to current concerns in neonatology.			
RESEARCH QUESTION: Was the research question clearly illustrated and appropriately focussed to neonatal resuscitation training and skill acquisition			
METHODOLOGY: Does the realist methodology offer a new to approach to evaluating neonatal resuscitation skill acquisition			
C-M-O CONFIGURATION: Does the eliciting of context – mechanisms and associated outcomes provide you with new understanding toward neonatal resuscitation skill acquisition?			
RESULTS: In your opinion do the results of the study add to the current knowledge base?			
RECOMMENDATIONS: Should the opportunity arise, would employ any of the recommendations made by the researcher regarding neonatal resuscitation training.			
ADDITIONAL COMMENT /RECOMMENDATION			

Thanks you for your time .Your expert opinion is highly regarded.

- Alucia Botes

Annexure F
Expert review questionnaire to methodological experts

Kindly complete the following questionnaire as per RAMESES (2013) quality standards for realist review rubric:

CRITERION	YES	NO	COMMENT/RECOMMENDATION
RESEARCH TOPIC: The topic of this study is appropriate for a realist approach			
RESEARCH QUESTION: The construction of the research question is suitable for a realist synthesis			
APPLICATION OF REALIST PRINCIPALS: The review demonstrates understanding and application of realist philosophy and realist logic which underpins a realist analysis.			
FOCUS OF THE REVIEW: The review question is sufficiently and appropriately focussed.			
REALIST PROGRAMME THEORY: There is evidence of an appropriate initial realist programme theory that has been is identified and developed.			
SEARCH PROCESS: The search process identified suitable data and enabled the reviewer to develop, refine and test programme theory or theories.			
SELECTION AND APPRAISAL OF DUCUMENTS: The selection and appraisal process reflects that sources relevant to the review containing			

material of sufficient **rigour** was included. In particular, the sources identified allow the reviewer to make sense of the topic area; to develop, refine and test theories; and to support inferences about mechanisms.			
CRITERION	**YES**	**NO**	**COMMENT/RECOMMENDATION**
DATA EXTRACTION: The data extraction process captured the necessary data to enable a realist review.			
REPORTING: The realist synthesis is reported using the items listed in the RAMESES Reporting standard for realist syntheses.			

ADITIONAL COMMENT /RECOMMENDATION

Thanks, you for your time. Your expert opinion is highly regarded.
Alucia Botes

Annexure G

Article summary

MAIN FINDINGS:

DOCUMENT	CONTEXT	MECHANISM	OUTCOME/ CONCLUSION
The genesi, Adaption, and Evolution of the Neonatal Resuscitation Programme. (Louis P. Halamek,MD. 2008)	Simulation based training	Simulation focus on success rates, high pass scores	• Perceived learning • Focus only on success may lead to false sense of confidence and failure in real life settings
Educational Impact of the Neonatal Resuscitation Programme in Low-risk Delivery centres in a developing country (Waldemar A. *Et Al.* 2009)	Theory based preparations and simulation	Written evaluations Self-efficacy evaluation	• Retention of knowledge past 6 months of training
A systematic review of the effectiveness of training in emergency obstetric care in low-risk environments. (van Lonkhuijzen.L *Et Al.* 2010)	Theory based short courses Theory based courses with longer duration Self-directed learning via unscheduled courses	Written examinations Supervisory visits and on the job training	• Improved knowledge and positive patient outcomes • Positive behavioural changes and greater awareness re patient care.
Helping babies Breath: global neonatal resuscitation programme development and formative educational evaluation.	Train the trainer model simulation	OSCE and written or verbal multiple choice Recorded perceptions Focus groups	• High levels of satisfaction • High level of self-efficacy.
A pilot program of knowledge translation and implementation for newborn resuscitation using US Peace Corps Volunteers in rural Madagascar. (Kristin Close, Michele Karel and Michelle White. 2016)	Training by non-medical volunteers (using Helping Babies Breathe programme)	Helping Babies Breathe algorithm used by non-medical peace corps volunteers	• Improved personal and organizational practises
Inter-professional in-situ simulated team and resuscitation training for patient safety: Description and impact of a programmatic approach. (Katja Zimmermann, Iris Bachmann Holzinger , Lorena Ganassi , Peter Esslinger , Sina Pilgrim , Meredith Allen , Margarita	High realism simulation physically integrated into the clinical environment	Learner need based curriculum	Allow different levels of learning (individual, team based and unit based) Provides realism and rich resources to identify threats. Increased functional fidelity Decreased gaps between training and reality Leadership skills and communication highlighted as crucial

Burmester and Martin Stocker. 2015)			
Effect of a stimulation-based workshop on multidisciplinary teamwork of newborn emergencies: an intervention study. (Liisa Rovamo, Elisa Nurmi , Minna-Maria Mattila , Perttib Suominen and Minna Silvennoinen. 2015)	Simulation	Instruction of non-technical skill prior to simulation	• Higher post test scores with pre-simulation didactic lecture. • Team work unaffected by teaching style. • Teamwork dictated by team leader hence leadership training combined with skill training recommended.
Randomized control trail of high-fidelity vs low fidelity simulation for training undergraduate students in neonatal resuscitation. (Archana Nimbalkar , Dipen Patel , Amit Kungwani , Ajay Phatak , Rohitkumar Vasa and Somashekhar Nimbalkar. 2015)	High fidelity simulation vs. low fidelity simulation	Lecture only, Lecture + videos, lectures + low fidelity simulation (basic mannequins), High fidelity simulation (advanced technologies)	• No significant differences between simulation fidelity. • High fidelity simulation proved no added benefit. • Recommend videotaping sessions for re view purposes, team work, leadership skill improvement and communication training.
Evaluation of an educational program for essential newborn care in resource-limited settings: Essential Care for Every Baby. (Anu Thukral, Jocelyn Lockyer , Sherri L. Bucher , Sara Berkelhamer , Carl Bose , Ashok Deorari , Fabian Esamai , Sonia Faremo , William J. Keenan , Douglas McMillan , Suasan Niermeyer and Nalini Singhal. 2015)	Skill based training	Interactive learning strategies including skill practise with simulators guided by facilitators Role play, small group discussions and skill practise	• Improved knowledge and skill • Train the trainer cascades successfully implemented post course. • Extended practise and teaching times needed was identified by learners.
Team training in obstetric and neonatal emergencies using highly realistic simulation in Mexico: impact on process indicators. (Dilys Walker, Susanna Cohen , Jimena Fritz , Marisela Olvera , Hector Lamadrid-Figueroa , Jessica Greenberg Cowan , Dolores Gonzalez Hernandez , Julia C Dettinger and Jenifer O Fahey. 2014)	Highly realistic, low tech simulation combined with team training PRONTO (Programa de Rescae Obstretico y Neonatal: Tratamiento Optimo y Oportuno)	Inter professional simulation training	• Improved communication habits improved skill retention • Increased self-efficacy (confidence in performing skills) • Even partial participation yielded large scale progress and improvements in care at training facilities
Simulation-based learning combined with debriefing: trainer's satisfaction with a	Simulation combined with debriefing	Simulation combined with debriefing	• Improved knowledge, skill and confidence in neonatal resuscitation

new approach to training the trainers to teach neonatal resuscitation. (Harish J Amin, Khalid Aziz , Louis P Halamek and Tanya N Beran. 2013)			• Importance of debriefing was rated highly. • Suggestions on relevant (to setting of the learners) scenarios reduced lectures and increased practise times. • Team work did not improve/ not report as improved
A protocol for evaluating progressive levels of stimulation fidelity in the development of technical skills, integrated performance and women centred clinical assessment skills in undergraduate midwifery students. (Susannah Brady, Fiona Bogossian, Kristen Gibbons, Andrew Wells, Pauline Lyon, Donna Bonney, Melanie Barlow and Anne Jackson. 2013)	Simulation		No conclusion
Acute Care of At-Risk Newborns (ACoRN): quantitative and qualitative educational evaluation of the program in a region of China. (Nalini Singhal, Jocelyn Lockyer, Herta Fidler, Khalid Aziz, Douglas McMillan, Xiangming Qiu , Xiaolu Ma , Lizhong Du and Shoo K Lee. 2012)	ACoRN adapted modified and adapted simulation (8 step evaluation and management of new-borns) programme	Preparation prior to course Case based learning Simulation	• Improved knowledge and confidence • Programmes successfully transferable from one setting (Canadian) to another (Chinese)
Standardised formal resuscitation training programmes for reducing mortality and morbidity in newborn infants (Review). (Dempsey E, Pammi M, Ryan AC, Barrington KJ. 2015)			

Annexure H
Ethics consent

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.
- FWA 00002567, Approved dd 22 May 2002 and Expires 20 Oct 2016.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 22/04/2017.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee

28/07/2016

Approval Certificate
New Application

Ethics Reference No.: 243/2016

Title: NEONATAL RESUSCITATION TRAINING AND SKILL ACQUISITION: A REALIST SYNTHESIS

Dear Alucia Botes

The **New Application** as supported by documents specified in your cover letter dated 18/07/2016 for your research received on the 18/07/2016, was approved by the Faculty of Health Sciences Research Ethics Committee on its quorate meeting of 27/07/2016.

Please note the following about your ethics approval:
- Ethics Approval is valid for 3 years
- Please remember to use your protocol number (**243/2016**) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:
- The ethics approval is conditional on the receipt of **6 monthly written Progress Reports**, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

Dr R Sommers, MBChB; MMed (Int); MPharMed,PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

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