The Ability of Newly Qualified Saudi Nurses Working on Paediatric Wards to Recognise a Deteriorating Child: Can a Focused Educational Intervention Impact On This?

by

Daifallah Al-Thubaity

A thesis submitted in partial fulfilment for the requirements for the degree of Doctor of Philosophy at the University of Central Lancashire

July 2019

STUDENT DECLARATION FORM

Concurrent registration for two or more academic awards

*I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the University or other academic or professional institution

Material submitted for another award

***I** declare that no material contained in the thesis has been used in any other submission for an academic award and is solely my own work

Collaboration

Where a candidate's research programme is part of a collaborative project, the thesis must indicate in addition clearly the candidate's individual contribution and the extent of the collaboration. Please state below:

Signature of Candidate _____  _____

Type of Award _____ **Doctor of Philosophy** _____

School _____ **Nursing** _____

ABSTRACT

Background:

It is crucial that nurses are able to recognise and respond early to child deterioration in hospital wards, to avoid cardiac arrests and improve patients' outcomes. However, taking and interpreting vital signs accurately in the paediatric clinical setting is both complex and challenging. Many researchers have found that nurses working in children's wards do not always identify deterioration at an early enough point in a child's illness trajectory to respond and alert medical staff in order to avoid critical care unit admission.

Aim:

The aim of this study was to explore the ability of Saudi-educated newly qualified nurses, working in paediatric wards, to recognise children's deterioration and to determine the impact of a focused educational intervention on this ability.

Method:

A two-phased quantitative and qualitative method study was used to assess nurses' responses to three clinical vignettes (a deteriorating child, an improving child and an ambiguous scenario). The nurses' ability to correctly identify this was captured using a Think Aloud approach, and quantified using a visual analogue scale pre- and post- an educational intervention. The quantitative component of the research was supported by qualitative data from the responses to the vignettes and from semi-structured interviews.

Findings:

Twenty-seven nurses in two geographical regions in the Kingdom of Saudi Arabia (KSA) participated in the pre-intervention phase of the study, and twenty of the original twenty-seven participated in the post- intervention phase. In the pre-intervention phase, over half of newly qualified nurses working in two regions of the KSA could not identify the deteriorating child, and none of the nurses correctly identified all three vignettes. From the qualitative data three main themes were identified; experience and training, the absence of focused training and assessment, and recognition and response.

Post-intervention (12 months from phase one), there was a good proportional improvement change in correct responses of the intervention group compared to the control group. The recognition of deterioration was improved in the intervention group and the nurses showed greater confidence in making decisions, whereas the control group persisted in rationalising their lack of ability by claiming to be still "*new"*.

Conclusion:

Even in non-stressful simulated scenarios using vignettes, many newly qualified nurses working with children failed to recognise signs of child deterioration and their responsibilities during this. The culturally-adapted focused educational intervention course (called RADAR) delivered to a group of newly qualified KSA nurses was adapted from the UK RESPOND course and demonstrated a positive impact on their ability to communicate their clinical assessment and understanding of their role in the early recognition of child deterioration.

Table of Contents

List of Tables

List of Figures

List of Graphs

ACKNOWLEDGMENT

I would like to acknowledge the many individuals and groups who contributed to the development of my thesis. My deep gratitude and thankfulness go to my supervisors Dr Susan Wiliamson, Dr Ralph Leavey and Dr Lyvonne Tume. They provided invaluable support and guidance throughout the course of my PhD study.

My love and gratitude goes to my beloved family for their love, support, and patience throughout the long hard hours spent in this PhD endeavour. They have my gratitude for exploring with me the realms of life and life's intricate meanings and stood next to me every moment I was away from home.

My sincere appreciations and thankfulness go to my friends in KSA & UK, Baha University, Directorate of Health Affairs, Hospital administrations, and nursing education departments. Last but not least, participants from both regions who gave of their time generously and without whom none of this would have been possible; they endured this long process with me and for their support and assistance I will be forever grateful.

Dedications

To my caring mother, brothers and sisters for their love and sincere prayers during the many difficult times I experienced. My everlasting respect is reserved to the memory of the dear departed soul of my father who has been my life's inspiration, this one is for you.

All praise and thanks be to almighty ALLAH first and last lord.

ABBREVIATIONS

ACSQHS	Australian Commission on Safety and Quality in Health Care
AHPRA	Australian Health Practitioner Regulatory Agency
ALERT	Acute Life-threatening Events Recognition and Treatment
AVPU	Alert Verbal stimuli Pain stimuli Unresponsive
BSN	Bachelor of Science in Nursing
CBAHI	Central Board of Accreditation for Health Care Institute
CCHI	Council of Cooperative Health Insurance
CCU	Critical Care Unit
CDM	Classical Decision-making
CDSI	Central Department of Statistics
CHS	Council of Health Services
C-I	Confidence Interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DHHS	Department of Health and Human Services
ERIC	Education Resources Information Center
ESRC	Economics and Social Research Council
HDU	High Dependency Units
ICU	Intensive Care Unit
IQR	Interquartile range
KSA	Kingdom of Saudi Arabia
MEWS	Modified Early Warning Score
MOH	Ministry of Health
MOI	Ministry of Interior
MOL	Ministry of Labour
NCSBN	National Council of State Boards of Nursing
NICE	National Institute for Health and Clinical Excellence
NICU	Neonate Intensive Care Unit
NPSA	National Patient Safety Agency report
NSW	New South Wales
PECAN	Paediatric Emergency Care Applied Research Network
PEWS	Paediatric Early Warning System
PICO	Population, Intervention, Control, and Outcomes
PICU	Paediatric Intensive Care Unit
PTTS	Paediatric Track and Trigger Systems
RADAR	Recognise eArly Deterioration And Respond
RCPCH	Royal College of Paediatrics and Child Health
RCT	Randomised Control Trial
RESPOND	Recognising Signs of Paediatric hOspital iNpatients Deterioration
ROCs	Receiver Operating Characteristic Curves
SAMIRAD	Saudi Arabian Market Information Resource
SBAR	Situation Background Assessment Recommendation

TA	Think Aloud
VAS	Visual Analogue Scale
WHO	World Health Organisation

CHAPTER 1: RATIONALE FOR THE STUDY AND BACKGROUND

1.1 Thesis Structure

This thesis is divided into six chapters. Chapter 1 gives an overview of the topic, the rationale, the aims and objectives of the study, and the background to the context of paediatric nursing in the Kingdom of Saudi Arabia (KSA). Chapter 2 provides a review of the literature around the topic and describes the theoretical framework that structures this thesis. The literature review is divided into three sections, 1) Nurses' recognition of the deterioration of children in hospital, 2) The use of paediatric early warning systems (PEWS), and 3) Focused education around recognising deterioration, and communication.

Chapter 3 describes the methodology, and the rationale for adopting a two-phased methods approach, and Chapter 4 presents the quantitative findings from the research. Chapter 5 presents the qualitative findings. Finally, Chapter 6 is a discussion of the findings in relation to the literature, and to the theoretical framework, and discusses the strengths and limitations of the study. It concludes by providing key recommendations for practice, the dissemination strategy and future research plans.

1.2 Rationale

In the report of the National Patient Safety Agency (NPSA, 2009), almost 11% of adverse events occurred in children. Failure to identify the child's severity of illness and poor communication between professionals were the main reasons for these events. Nurses and health care professionals are often unable to either recognise early or react promptly to the deteriorating child (Sefton et al., 2014: Lambert et al., 2017).

It is crucial for nurses to be able to recognise early deterioration of children in hospital wards, to avoid cardiorespiratory arrests and improve patients' outcomes (Levett-Jones et al., 2010). However, taking and interpreting vital signs accurately in the paediatric clinical setting is both complex and challenging. Tume (2007), Pearson (2008), and Voepel-Lewis et al. (2013) have all found that nurses working in children's wards do not always identify deterioration at an early enough point in a child's illness to respond and alert medical staff in order to avoid critical care unit (CCU) admission, cardiorespiratory arrest or even death.

Newly qualified nurses find the interpretation of vital signs particularly difficult because they lack the experience and developed skills to sufficiently identify and react early to clinical deterioration (Purling and King, 2012; O'Leary, et al., 2014). The results of studies have elicited numerous recommendations related to health care staff and undergraduate nurse teaching programmes. All of which propose providing staff with opportunities to practice the complex thinking skills involved in recognising and reacting to patient deterioration (National Patient Safety Agency (NPSA), 2009; Pearson, 2008; Berg et al., 2008; Haines et al., 2005).

Focused educational courses around deterioration were first established for adult patients with the ALERT course (Acute Life-threatening Events Recognition and Treatment) (Smith et al., 2002). This was followed in children by a focused educational intervention in Australia (Mitchell et al., 2010), and a UK course, RESPOND (Recognising Signs of Paediatric hOspital iNpatients Deterioration) for children (Tume et al., 2014). Presently, the KSA does not have such courses. The purpose of this

study therefore was to establish the ability of newly qualified Saudi-educated nurses working in paediatric wards to recognise deterioration. A culturally-adapted and appropriate focused educational intervention around deterioration was then developed and implemented, and the nurses' ability reassessed in order to determine its impact.

1.3 Personal Engagement with the Research Area

Having worked as a nurse clinically before becoming a nurse educator, the issue of unrecognised patient deterioration was commonly seen in my practice. International literature suggests that unrecognised patient deterioration is a problem worldwide (Sefton et al., 2014), and this can be more of a problem in children in hospital (Pearson, 2008).

No published research conducted in the KSA was found when searches were undertaken in all databases in either Arabic or English language. Given that there is no empirical evidence from the KSA on the Saudi- trained nurses' ability to recognise and respond to child deterioration, this study is a vital first step to provide baseline evidence for further work. This was the rationale for undertaking the study. As a nurse educator, this topic also aligned with my personal goals of making a significant contribution to the KSA's educational nursing curriculum.

1.4 The Study Aim and Objectives

The main aim of this study was to explore the ability of both diploma and graduate level Saudi-educated newly qualified nurses (<12 months), working in children's wards, to recognise the deteriorating child in two Saudi Arabian regions: the first part of this study (the MPhil).

The second part of the study (PhD phase) used the data from the participating nurses in one geographical region in order to determine whether a focused educational intervention impacts upon their ability to recognise and respond to the deteriorating child.

The specific study objectives were:

- To explore the ability of newly qualified diploma and graduate Saudi-educated nurses working in children's wards in two regional hospitals to recognise the deteriorating child using a series of three realistic clinical scenarios (vignettes).
- To explore these nurses' perceived education and training needs around deterioration and responding to the deterioration of children in hospital.
- To compare whether there are differences in the ability to recognise the deteriorating child between the diploma- and graduate-educated Saudi nurses.
- To develop a culturally-specific focused educational intervention around recognising deterioration (based on the results of phase 1 and the nurses' perceived training needs).
- To evaluate the impact of this focused educational intervention on recognising and responding to the deteriorating child in terms of the nurses' ability to recognise deterioration.

1.5 Background

1.5.1 An Overview of the Study Context in the Kingdom of Saudi Arabia

The 13 administrative regions of the KSA occupy 850,000 square miles of the Arabian Peninsula, making it the largest country in the Middle East (Figure 1). Its land mass covers four-fifths of the peninsula and has boundaries with the Arabian Gulf, Qatar, Bahrain and the United Arab Emirates, Iraq, Jordan, Kuwait, Oman, Yemen and the

Red Sea. Arabic is its official language, although English is considered a second language and is the compulsory second language taught in high schools. Whilst English is spoken by the majority of professionals, most people in the KSA cannot speak English, especially those who do not have a tertiary education (Gazzaz, 2009).

Figure 1: Map of the Kingdom of Saudi Arabia (Ministry of Interior., 2010)

The KSA is a vastly rich, oil producing country, and as the custodian of the holy sites of Mecca and Medina occupies an important place in world economics and politics (CDSI, 2010). The KSA is ruled by the royal house of Saud, which is a traditional monarchy regime where the King is also the Prime Minister, and there is a Consultative Council. Whilst this regime has developed a modern society it has also strictly maintained the country's Islamic culture, values and social norms. The Constitution is based on the Holy Quran and a legal system enforced using the 'Al-shari'a', which

adjudicates on all aspects of life such as; banking, business, family, sexuality, hygiene, and social issues (Almutairi, 2012).

Islam is the main religion in the KSA (SAMIRAD, 2010), with 95% of the population practicing as Sunni Muslims. Islamic beliefs and practices are not only an ideology, but part of a socially constructed system that details how people should live their everyday lives. In doing so, there are said to be positive links to promoting health and wellbeing, especially for devout followers who believe in surrendering their lives voluntarily to Allah and his prophet peace be upon him (Koenig et al., 2014). Drinking alcohol, using contraception, abortion and suicide are forbidden. Over-eating and smoking are both discouraged, whilst ritual washing, oral hygiene, breastfeeding, walking, rest and relaxation are actively encouraged. Physical or emotional illness is considered as a test from a God that permits sickness and death. Therefore, illness is regarded positively as a means of purification that nullifies a person's sins and affords them the opportunity to gain rewards for handling their suffering with dignity and patience.

Muslims are encouraged to be optimistic throughout life; they should marry, rear children correctly and care for their families and wider communities (Koenig et al., 2014). Doing good deeds is considered a way to ensure they achieve both health and happiness. The traditional social networks are usually extensive, with gender-divided roles clearly delineated; men are expected to work, protect and provide for their families, whilst women are expected to care for the home, conform to a dress code and care for the children. Gender segregation and the veiling of women are seen as

ways of practising the religion, protecting women's modesty, and controlling their behaviour as a way of ensuring the good reputation of the family (Long, 2005).

Increasing westernisation influence in the KSA as a result of economic and educational development has led to tensions between those conservative factions that are determined to maintain traditional cultural practices, and the modernisers who wish to reap the benefits of economic, social and educational progress. Nowhere is the dichotomy more contentious than in the labour market where there are mixed-gendered settings, such as nursing (Al-Mutairi, 2013).

In May 2017, modernisers won a significant change when King Salman declared that women did not need the permission of their male guardian to travel, take a job or undergo surgery. This was closely followed by the Crown Prince Mohammed bin Salman lifting the ban on women driving, engaging in sports and attending concerts (Ammar, 2018).

1.5.2 An Overview of the Health Care System in the Kingdom of Saudi Arabia

Since the establishment of the Ministry of Health (MOH) in 1951, health services have expanded exponentially. Health care is regarded as a basic right for all KSA citizens under the *Basic Law of Governance*, and it is considered the responsibility of the government to provide them with a free, accessible universal health care service and a healthy environment (Al-Hanawi, 2017). The population has expanded rapidly from 3.5 million in 1956 to 33.28 million in 2018 (Worldometers, 2018), with a rise in foreign nationals to 26%. The increase in the birth rate has resulted in 30.35% of the population being children under 15 years (MOH, 2017), and a longer life span meant

health care supply costs became unsustainable when oil prices fell in the 1990s (Elachola et al., 2016). The KSA government set out a comprehensive general reform strategy to diversify the economy and reenergise the Saudisation policy. The aim was to provide employment opportunities, including nursing, for the expanding population as the revenues from the sale of oil continued to fall in the 2014 economic recession (Kinninmont, 2017).

Saudisation is the affirmative action process introduced in 1992 aimed at reducing the KSA's dependence on foreign (non-Saudi) labour, in order to create more jobs for Saudi nationals. In 2005 the King mandated that all employers ought to employ Saudi nationals and set quotas to that effect (Sadi, 2013). The replacement of expatriate workers with Saudi nationals required the creation of work environments conducive to training and development of the Saudi nationals, where they could achieve their full potential and eventually gain employment in the most appropriate positions demanded by the labour market (Ministry of Labour; MOL, 2008). The Ministry of Health (2011) announced its commitment to the Saudisation policy for all health personnel, including the determination to increase the number of Saudi-trained nurses, and end protectionism for expatriate jobs in the private sector. Although the government ruled that certain jobs in health care had to be reserved solely for Saudi nationals, they admit that the quotas have not been met, because insufficient Saudis' were trained or willing to enter the labour market (Kinninmont, 2017).

In relation to the policy of modernisation of the health care system, the government established two key specialist bodies in 2002; the Council of Cooperative Health Insurance (CCHI) and the Council of Health Services (CHS). The Council of

Cooperative Health Insurance is responsible for issuing licenses to insurance companies and participating health care providers. The laws require private employers and sponsors to purchase cooperative health insurance for their Saudi and expatriate employees and their dependents (Bureau of Experts at The Council of Ministers, 2002). The scheme was a phased implementation of a plan to introduce a health insurance system on a shared costs basis, introduce a fee-for-service medicine in all governmental hospitals, and privatise the majority of the KSA's hospitals (Almalki et al, 2011).

Health care policy remained directed by the Ministry of Health, which regulates, plans, oversees and funds all services via the Council of Health Services (CHS, 2013). The Council, established in 2002, is now accountable to the Ministry of Health by the Minister of Health, who is advised by selected officials from other government departments and private sector representatives. Healthcare in the KSA remains divided into two main sectors, governmental and private.

The Ministry of Health still controls the majority (63%) of all hospitals. The Ministry of Defence National Guard and Education controls 24% of hospitals, and the private sector in contrast controls 13% of all the hospitals (Khaliq, 2012). There are 274 hospitals (41, 985 beds), of which 17 are specifically maternity and paediatric, and there is a network of 2381 primary health care clinics (MOH, 2017). From 2007 to 2016 the Ministry of Health funded 70% of all health care costs, spending 484 billion riyal in the process (Mohammad, 2017).

A national system of quality initiatives was introduced by the MOH in 2005, via an accreditation system similar to the internationally-recognised Canadian processes

being used by some KSA hospitals (Almasabi, 2013). The Central Board of Accreditation for Health Care Institute (CBAHI) was formed to administer the national system, and in 2011 the Health Services Council in the KSA declared that all public and private institutions must obtain CBAHI's accreditation.

As Al-Hanawi (2017) asserts, the KSA provide high quality services which are internationally comparable, and even immunisation rates that are superior to other countries. Despite these assertions, population and economic growth also brought new demands for services, and although there have been strides to provide increased quality services, the government has not been able to overcome funding for developments and workforce problems. Lifestyle diseases such as diabetes, hypertension, obesity, and heart and kidney diseases, and a lower level of hospital beds and primary care provision combined with a lower ratio of health care professionals per 1,000 of the population has adverse outcomes. The KSA has a lower life expectancy of 74.8 years compared to 84 in the UK, and a higher infant mortality rate of 4.82 per 1,000 live births, compared to 3.8 in the UK (MOH, 2017).

1.5.3 Nursing in the Kingdom of Saudi Arabia

The overall number of registered nurses working in the KSA, including other governmental agencies and the private sector, is 180,821, of which 36.5% are Saudi nationals. The total number of registered nurses working under the direction of the MOH is 101,256, of which 57.6% are Saudi nationals (MOH, 2017). The Ministry of Health's statistics also show that most of those employed in nursing across the region, whether foreign or Saudi nationals, are trained to diploma level. However the result of the Saudisation policy has meant that Saudi-educated nurses tend to be

predominately female, young and have less than 5 years' work experience (Gazzaz, 2009).

The deficit between the demand and supply for registered nurses in the KSA has historically relied on recruiting a diverse non-Saudi nursing workforce from 52 different countries worldwide (AlYami & Watson, 2014). However the continued unrest in the Middle East after the Gulf Wars, combined with an international shortage of qualified nurses, has exacerbated the retention and turnover problems and resulted in most KSA hospitals experiencing a severe nursing shortage (Lamadah & Sayed, 2014).

In 2013 the MOH recorded that there were only 36 nurses per 10,000 population, which compares unfavourably with, for example, the UK at 101/10,000. The shortage of nurses in the KSA is increasing, and is expected to reach 48,000 nurses by 2020 - 21, although the World Health Organisation (WHO) in 2010 estimated that the KSA needs about 170,000 nurses. According to Falatah & Salem, (2018), the nurse shortages continue to be intensified by a high turnover related to the poor image of nursing as a profession, the rates of pay, and management and working conditions, as well as social and cultural pressures related to the suitability of the environment and type of work involved.

Attempts by the government began to reverse the nurse shortages and increase the appeal of the profession to Saudi nationals in 2002. The General Directorate of Nursing, with Regional Nursing Offices, was established under the MoH to replace the Central Nursing Committee (Alghamdi & Urden, 2016). Nevertheless, to date, the KSA has no formal nursing union, council or association to legally represent nurses and

nursing services and to monitor professional licensure, educational accreditation, clinical practice and nursing research.

In January 2005, to improve the image of the profession and general standards of nursing in the KSA, as well as meet the International Council of Nursing requirements, all nurses practising in the 13 regions of the Kingdom had to be registered with Professional Regulatory Board. The Professional Regulatory Board, an arm of the Saudi Council of Health Specialties, was established in 2002 and defines the professions and its membership. It also determines the scope of practice, develops the educational, ethical, and practice competency standards, and establishes the accountability systems and credentialing processes (Abu Zinadah, 2006).

The government made further moves in 2009 to reduce nurse turnover, improve retention, stimulate recruitment, and limit competition and mobility between hospitals. As Alghamdi & Urden (2016) describe, this involved introducing a new regulation to unify the pay scales and limit working hours to eight per day, and create social insurance or pension plans for all the health professionals in both the private and government sectors.

1.5.4 Nursing Education in the Kingdom of Saudi Arabia

Nursing education in the KSA was, until 2008, a joint remit between the Ministry of Education and the Ministry of Health. Under the Ministry of Health Department of Health Education the two year diploma and technical programmes for nurses, both male and female, began in 1967. According to Alhusaini (2006), this resulted in the growth of 46 health colleges; 21 health institutes, which included 4 male and 17 female

colleges, and trained diploma students; and 25 junior colleges that trained advanced diploma nurses, which included 15 for males and 10 for females. The Ministry of Higher Education on the other hand, established the first 5-year graduate nursing programme in 1976, with a Masters of Nursing degree in 1987, and the first externally accredited PhD programme for women in 1994.

Since 2008, when the KSA decided to align itself with international nursing standards for degree entry into the profession (WHO, 2009; Almadani, 2015), it did so mainly to negate the negative female nursing stereotype as equivalent to 'maid's work' that prevailed in Saudi society (Azim and Islam, 2018). The total responsibility for nursing education now resides with the Ministry of Higher Education, and as a result today there are 23 governmental universities and 13 private universities that offer graduate nursing programmes (Azim & Islam, 2018). Whilst the Kingdom has increased its funding of student nurses, scholarships and encourages study-abroad programmes (Alamri, 2011), private colleges continue to provide diploma or associate degree programmes.

Initially, the implementation of the Saudi policy to require degree level education for registration, had left large numbers of diploma or associate nurses' unemployable as registered nurses within Saudi Arabia. This was because of the lack of conversion programmes from Diploma to Bachelor of Science in Nursing (BSN) (Almadani, 2015). However, more recently a limited number of universities in major cities have started to provide 3-year conversion programmes (Alamri & Sharts-Hopko, 2015). But there was limited access for males, in mostly female programmes, and the high costs of tuition were demotivating factors. Nurses in Alamri & Sharts-Hopko (2015), complained about

the lack of part-time and online programmes, as well as the prohibitive financial burden of returning to full-time education.

According to Azim and Islam (2018), despite the continuing negativism, particularly for women and especially the pressure to marry, there are increasing numbers of women entering nursing programmes. But at the same time women are also becoming acutely aware of the barriers that truncate their progress; nursing education was believed to develop students' problem-solving and critical thinking, but nurses were not expected to be autonomous professionals, they were simply expected to carry out doctors' orders. Additionally, career progression via education to management positions for women was more difficult than for their male colleagues (Al-Mahmoud, 2013).

1.5.5 Paediatric Nurse Education in the Kingdom of Saudi Arabia

The KSA does not have either an undergraduate or postgraduate specialist paediatric programme for nurse registration like that in the UK (NMC, 2016). However, there are post-qualification national neonatal resuscitation programmes for nurses, accredited by the Saudi Commission for Health Specialty and provided by 6 approved centres in the KSA, that conform to international standards (Saudi Neonatology Society, 2018).

Instead the KSA nurses' undergraduate education programme is generic, and covers both paediatric and adult nursing. All KSA regions educate nurses based on the same curriculum, as dictated by the Saudi Council of Health Specialties (AbuZinadah, 2005). The undergraduate paediatric clinical practice preparation includes physiological measurements, disease management and clinical judgement skills. The assumption

is, therefore, that all Saudi nurses trained in the 13 regions have a similar level of ability upon graduation.

Currently, we do not know the level of ability of Saudi-trained nurses to recognise the deteriorating child on the paediatric wards. It is, therefore, both pertinent and timely to explore both the ability of Saudi-educated paediatric nurses to recognise clinical deterioration, and to understand their perceived educational and training needs in this area. This study was conducted in two regions in the KSA; Taif (Region 1), which has 127 paediatric beds and employs 19 Saudi-trained nurses, and AlBaha (Region 2), which has 100 paediatric beds and employs 15 Saudi-trained nurses working on paediatric wards. Both regions have universities that provide graduate nursing programmes with a common set of curriculum standards.

1.6 Summary

This chapter has provided the rationale, aims, and objectives of the study, as well as the background to the context of paediatric nursing in the KSA. The first section presents the rationale for the topic and shows the gap in knowledge. The second section provides background about the setting for the study in the KSA, and provides an overview of the social, cultural and economic context and the development of health and nursing education there. The next chapter will present the framework and integrative review of literature.

CHAPTER 2: THEORETICAL FRAMEWORK AND INTEGRATIVE REVIEW

2.1 Introduction

The aim of this chapter is to present a critical discussion of the theoretical framework guiding this study, and to deploy a detailed search strategy to locate and critically summarize the relevant international empirical literature on nurses' ability to recognise child deterioration. It commences by providing a rationale for the review and an explanation of the review strategy. A critique of the evidence reviewed is then organised into themes and subthemes for discussion separately, and the discourse summarised and articulated within the aims of the review.

2.2 Theoretical Framework

A theoretical framework for research has been described by Grant and Osanloo (2014) as the blueprint that establishes the perspective used to justify the significance of the study, explain the problem and interpret the findings. This study will explore both the ability of Saudi-educated paediatric nurses to recognise clinical deterioration and to understand their perceived educational and training needs in this area, before implementing and evaluating a culturally adapted focused educational intervention. It is therefore primarily concerned with the clinical judgement and decision-making of these newly qualified paediatric nurses in the KSA: how they recognise, interpret, respond and learn from their experiences of child deterioration.

Clinical judgement is defined as the ability of nurses to use their knowledge and experience to make decisions about patient care (NCSBN, 2005). Whilst judgements

and decisions are separate concepts, they are however linked activities, with judgement being an evaluation of a situation and involving decisions between alternative actions. In the literature, clinical judgement has often been referred to as both critical thinking and decision-making (Thompson et al., 2004; Ericsson et al., 2007). Despite the plethora of terminology used related to these concepts, Thompson (2013) explains that nurses are in key positions of making frequent decisions and judgements in practice, and either seeking more medical assistance or not, as well as determining the optimal timing of this.

Critical thinking is, according to Pongmarutai (2010), a skill that is recognised as vital when planning interventions in nursing care and that ensures a safe clinical environment. It is also crucial that nurse education prepares nurses with an acceptable ability to apply clinical knowledge in order to make appropriate clinical judgements and decisions (Thompson & Stapley, 2011; Levett-Jones et al., 2010). That critical thinking is considered essential to making appropriate judgements and decisions has its roots in philosophy, psychology and education, all of whom have different approaches (Lai, 2011). Despite evidence that many adults have poor reasoning, educationalists such as Sternberg (1986) and Ulsenheimer (1997) believe reasoning can be taught, and only requires cognitive ability, the disposition to acquire knowledge and an open-mindedness to seek reason.

Nurse educationalists Simpson and Courtney (2002) believe that critical thinking skills are necessary in order to rigorously investigate the clinical data in order to determine what actions to take. Whilst Thompson et al. (2004) claim that nurses require critical thinking skills because their decisions must be goal-directed and their judgements

evidence-based. Nurses with poor reasoning skills however, may fail to detect deterioration, which can result in failure-to-rescue situations (Clarke et al., 2003; Silber et al., 2007). Wilson et al. (1995), in a study of the Australian health care system failure to synthesise and respond to clinical information was the major cause of adverse clinical events. This was also the findings of the NSW Health Patient Safety and Clinical Quality Programme (2006), which reported that faulty clinical reasoning by graduate nurses often led to poor patient outcomes and an increase in critical incidents. In the USA, results of the Performance Based Development System, which assesses nurses' clinical reasoning, found that 70% of graduates demonstrated unsafe practice despite having adequate content and procedural knowledge (Del Bueno, 2005). The causes are reported to be multidimensional (O'Neill, 1994), and relate to the problems that novice nurses have in processing complex clinical data and being able to differentiate between situations that require immediate attention and those that do not.

This assessment of alternative decisions is, as Dowie (1993) argues, a judgement in some way about consequences. People predict the consequence of their decision-making based on an assortment of information. This is often biased in some way as it is primarily drawn from their own experience, followed by the expertise of others and/or empirical research evidence (Thompson & Dowding, 2002). Empirical studies into decision-making began in the 1950s, and the emerging theories depended on the philosophical position adopted. Classical decision-making (CDM) has often been applied to health care (Chapman & Sonnenberg, 2000). Although CDM is based on the assumption that there is a distinct problem with known consequences, from which the optimum choice can be made, it fails when faced with chaotic or critical situations.

Such criticism led to naturalistic perspectives that accepted that people have cognitive limitations (Newell & Simon, 1972). People who adopt naturalistic decision-making strategies rely on their experience to deal with complex problems where there is limited knowledge of alternatives and consequences.

An alternative notion of decision-making, by nurses in particular, is that judgements happen by intuition (Benner, 1984; Benner & Tanner, 1987; Benner et al., 1999). In examining nurses' intuition in clinical practice, they established that expert nurses display judgements not found in novice nurses. They do not rely solely on analytic principles but can take the appropriate action based on their inherent understanding of any given situation. Criticisms of the notion of intuition are that it is highly context-dependent (Dowding et al., 2003), and cannot be transferred (often gained by pattern recognition from experience of similar situations), thus it ignores the positivist patterns of problem-solving on which most health care professionals depend. But Thompson & Dowding (2002) argue that intuition is based on the nurses' expertise, which in turn is reliant on the considerable knowledge acquired as a result of their experiences. Experts therefore demonstrate their capacity to marshal intellectual resources such as propositional, professional and personal knowledge. Expert-novice theories have developed in health care to explain how expert nurses solve problems with so little error and spend time self-monitoring and using qualitative analytical skills (Crook 2001; Benner et al., 1999).

Several clinical judgements perspectives were considered but rejected because they did not meet the requirements of the study. The first was the social judgement theory (Hammond, 1996), or the Lens Model, which suggests that a person's judgement depends on the reality of their social environment, which can be viewed as a series of

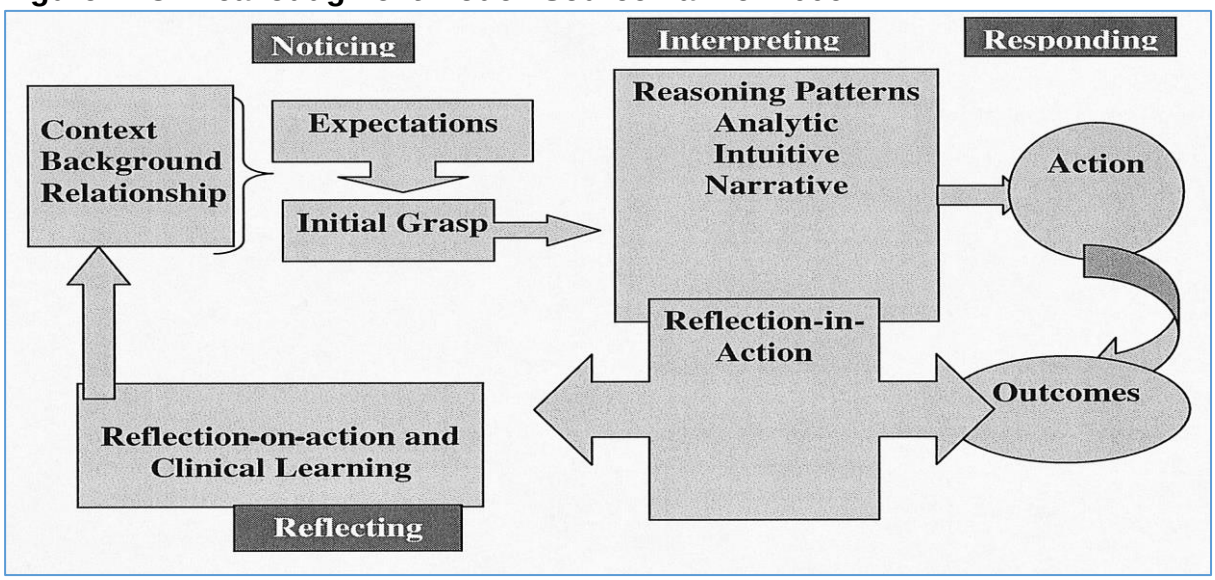
lenses. Lenses illustrate the information that comes from a situation and which can be refocused cognitively to form their judgement. Another influential model, which offers a popular but different view of how nurses form their decisions and make judgements, is that they rely on intuition or knowing something immediately without having to process their reasoning (Benner, 1984). In Benner's view of clinical judgements made by nurses there is a reliance on nurses being either novice or expert, with the latter knowing immediately the outcomes of a particular situation. Benner's model was based on the work of Dreyfus (1980), in which professional expertise is a progression of skills development along a continuum from novice to expert, with learning driven mainly by intuition rather than reason. The problem being that the clinical expertise that develops this type of intuition tends to be specifically related to a given set of clinical circumstances and cannot necessarily be applied out of context (Thompson & Dowding, 2002).

The cognitive continuum model was considered as it is an amalgamation of information processing theory and intuition (Thompson & Dowding, 2002). The information processing or analytical aspects are prescriptive and involve knowing the task structure, the clinical cues and the time-frame. Intuition is required when the analytical aspects of the situation and task is less structured. The theory is considered more appropriate for use in medical system-aided judgements rather than nursing.

But clinical reasoning is neither solely the domain of pure intuition nor solely analytical procedures; rather it is a cognitive continuum that takes into consideration the clinical situation and the information cues, as well as time pressures. The recognition of the information cues termed 'noticing' by Tanner (2006), relates to clinical assessment of the patients' physiological or psychosocial changes and philosophical beliefs. The

framework (Tanner 2006) of clinical judgement was developed based on a synthesis of over 200 robust studies (Figure 2).

Figure 2: Clinical Judgment Model. Source Tanner 2006



This framework has four elements: 1. noticing or perception of the clinical situation, 2. understanding or interpreting the clinical situation using a variety of reasoning skills, 3. responding by deciding a course of action or inaction, reflecting-in-action or noting the patients' responses, and 4. reflection-on-action by learning from experience after reviewing the clinical outcomes. The assumptions drawn from Tanner's (2006) work found that clinical judgement depends on five factors: the individual nurse, their reasoning patterns, the culture and context of the clinical situation, their knowledge of how patients respond, and reflection on these experiences that develops their knowledge in clinical reasoning.

Tanner (2006) claims that making complex clinical judgements requires nurses to have an understanding of the pathophysiology of disease processes, but also the psychosocial aspects of the experience of illness. Sound clinical judgements therefore

require the ability to correctly interpret and respond in a timely manner to what can often be a vague and infrequent clinical situation. Even though qualified nurses may be capable of competently undertaking clinical procedures and have a basic nursing content knowledge, there have been international reports that have attributed critical incidents to poor judgements related to processing complex clinical data within time-sensitive situations (NSW Health, 2006; Del Bueno, 2005; Pearson, 2008). Newly qualified nurses do not exhibit what experienced nurses appear to do instinctively and automatically (Levett- Jones et al., 2010). That is, they recognise and interpret patient data, and as a result take appropriate and immediate action; but in doing so, they are in fact not acting solely on instinct alone but relying on their experience of complex situations in clinical practice (pattern recognition), and their ongoing learning.

The work of Ericsson et al., (2007) on expert performance suggests that new professionals start to improve their confidence at making clinical judgements during their work experience. However, the research they reviewed found that these improvements were not predictable, despite the years of experience in practice. It is recognised that newly qualified nurses may lack a basic level of clinical judgement skills (Pongmarutai, 2010), nevertheless employers expect them to be competent and prepared to function when faced with complex clinical situations. Put simply, performing routine tasks and procedures cannot guarantee good clinical judgement.

The consequences of ineffective clinical judgement behaviour are, according to Facione and Facione (2008), four-fold acts; to do nothing, to rely on others to think for you, to keep on doing something that fails to address the problem, or just do anything. Whilst the first three can be considered failures in nurses' professional responsibility,

in healthcare, where lives depend on competent clinical judgements, the fourth action may be harmful.

Tanner's theoretical framework was chosen to guide this thesis and study as it was considered to have the best fit with the study aims. My systematic review focussed on nurses' recognition of deterioration and the use of PEWS and educational programs to improve this. Because I am interested in nurses' 'recognition' of deterioration, this is a complex cognitive process and because Tanner's theory is underpinned by clinical judgment, which is what is ultimately used to decide deterioration or not, therefore I felt this theoretical perspective best supported this study. My study also used complex clinical scenarios (vignettes) to assess the nurses' ability to determine deterioration or not and seek to understand their thinking and proposed actions around a scenario. Others (Van Hulle Vincent, 2009; Twycross & Powls, 2006; Goudreau et al., 2014; Göransson et al., 2008; Fonteyn and Grobe., 1993) have also successfully used this study design (clinical vignettes) to seek to understand clinicians' thinking and cognitive processes and ultimately to be able to understand their clinical judgements made. This sought to reinforce my decision to use clinical vignettes to collect this data. In addition, according to van Graan et al. (2016), it is a theoretical model whose stagfiges are aligned with the stages of the Nursing Process, which is the nursing model used extensively in the Saudi curriculum.

When nurses have developed the skill of refining or altering patient management because of what they have learnt either in practice, or in this study through a focused educational intervention, then it can be said that they are capable of transferring the knowledge from one situation to another. According to Tanner, when nurses do so in complex situations they demonstrate a link between reflection and clinical judgement

which allows them to think about their actions whilst doing them, and as a consequence change their behaviour should the need arise and respond appropriately.

2.3 Purpose of the Integrative Literature Review

An integrative review is considered to be a comprehensive method of undertaking a review of the known literature but differs from other appraisal methods such as meta-analyses or a systematic review as it combines data from a variety of selected sources such as theory, experimental, non-experimental studies and expert opinions (Whittemore & Knafl, 2005). According to Booth et al. (2016), the purpose of undertaking any review of the research literature is to increase our understanding of what evidence is in the public domain, in order to understand the main issues surrounding a particular subject and fully understand the gaps in the available knowledge.

2.3.1 Search Strategy and Methods

The aim of this integrative review is to deploy a detailed search strategy in order to locate and critically summarise the relevant international empirical literature that is available. Firstly, on both the ability of newly qualified paediatric nurses to recognise and respond to deterioration. Secondly, to examine the use of Paediatric Early Warning System (PEWS) to improve nurses' ability to recognise and respond to child deterioration. Finally, to determine the impact of a focused educational intervention on improving nurses' ability to recognise child deterioration.

Fink (2010) advises framing a precisely worded question for conducting the review. This was undertaken by using the PICO (population, intervention, control, and outcomes) format (Sackett et al. 2000). PICO was applied in the following way:

- Population: Newly qualified (< 12 months) paediatric nurses
- Intervention: Focused educational intervention on recognising deterioration in hospital
- Control: No focused educational intervention
- Outcome: Ability to recognise and respond to signs of child deterioration in hospital

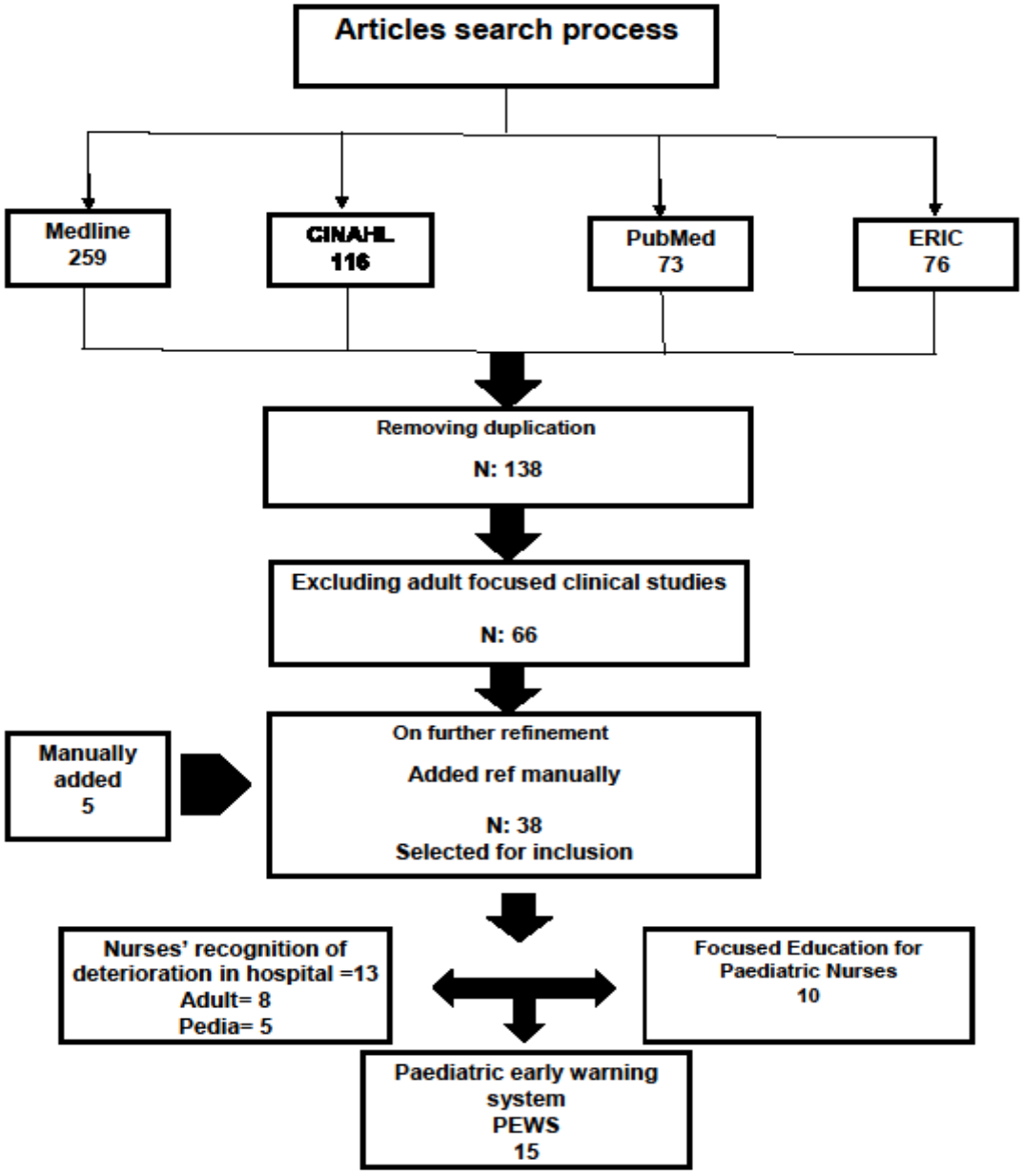
After framing the review question it is recommended (Hart, 2001) to search the literature, using the key words that originate from the question formulation, in electronic databases of PubMed, Medline, the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Education Resources Information Center (ERIC) search engines. Terms used were: paediatric; child; deterioration; failure to rescue; early warning; managing deterioration; recognising deterioration; education; training; simulation. The inclusion criteria was set to English or Arabic language full-text articles or reports, and publication from 2000-2016. Manual searches were also performed in article reference lists and journals.

The initial broad sweep of the databases for international publications related to the deteriorating child produced 524 publications, although none originated from Saudi Arabia. On further refinement, the papers were reduced to 138, which was then reduced by initially excluding adult-focused clinical studies (n=66). However, as there were so few paediatric studies around recognition of deterioration, I did include the

most relevant and key papers from the adult studies. The remaining articles considered were research papers and reports specifically associated with adults, paediatrics, nurses and clinical deterioration and education, and subjected to a final quality assessment undertaken to address the question of what counted as good evidence for this review (Nutley et al., 2012). In order to update the literature in 2018 I included the recent and relevant publications.

The appraisal tool used for this review is Hawker et al., (2002), which incorporated diverse methodologies, and was considered both usable and clear. It was therefore applied to the final included 38 publications, which gave each paper a score out of 36 on the Hawker tool (Appendix 1). This review is presented under three separate themes and respective subthemes, which emerged from the recurrent content in the literature and answered the review question. The first theme is nurses' recognition of deterioration in hospital, which has two subthemes; child deterioration and adult deterioration. The second theme is early warning systems or scores that nurses use to recognise deterioration, which has two subthemes; improved clinical recognition and evaluation. The third theme is focused education for paediatric nurses, which has two subthemes; theoretical courses and simulation programmes (Figure 3).

Figure 3: PRISMA flow Chart



PRISMA Flow Chart

2.4 Nurses' Recognition of Patient Deterioration in Hospital

The first theme that emerged from the review was nurses' inconsistencies and failures in recognising clinical deterioration. These involved failures to rescue, despite evidence of clinical signs in the hours prior to a critical event. The reasons for this were multifaceted and complex, from both a professional and an organisational context. This section of the review includes 13 publications (Appendix 2), which have been organised into two themes; recognition of child deterioration, and adult deterioration because there were insufficient child studies and the issues around clinical judgement are likely to be similar. The papers have been ranked by date of publication, and rated for the quality of their contribution by using Hawker scores out of 36 (Table 1).

Table 1: Subthemes and Quality Rating of Publications Included In Nurses' Recognition of Patient Deterioration

Subtheme		Author/s /Country	Type of study	Hawker score
1	Child Recognition	Roberts et al., (2014) USA	Qualitative study. The barriers to call medical assistance.	27
1	Child Recognition	Voepel-Lewis et al., (2013) USA	Case study. Relationship between staffing, surveillance and serious adverse events.	28
1	Child Recognition	Tume, (2007) UK	Prospective observational cohort study. A chart review of abnormal findings prior to adverse events.	30
1	Child Recognition	Tume, (2005) UK	Retrospective cohort study. 3 year review of paediatric records and observations.	26
1	Child Recognition	Gawronski et al., (2018) IT.	Qualitative study using focus groups to explore factors involved in escalation of care for deteriorating children.	25
2	Adult Deterioration	Dalton, (2018) UK	Qualitative study. Nurses' reports of their opinions when caring for the deteriorating patient.	24
2	Adult Deterioration	Van Galen et al., (2016) Netherlands	Retrospective chart observational study. To identify the factors that contribute to acute unplanned ICU admissions.	25
2	Adult Deterioration	Douw, et al., (2015) Netherlands	Systematic Review. To identify the signs and symptoms that trigger nurses' worry or concern about a patient's condition.	26
2	Adult Deterioration	Martin, J. (2015) CAN	A quantitative retrospective cohort study. To explore the nursing processes that are related to an unplanned intensive care unit admission.	20
2	Adult Deterioration	Cioffi, et al., (2010) AUS	Quantitative study. To determine the content validity of 'changes of concern' used by nurses to call emergency response teams.	30
2	Adult Deterioration	Cioffi, et al., (2009) AUS	An exploratory descriptive study. To identify cues of potential early clinical deterioration used to recognise 'a patient of concern'.	31
2	Adult Deterioration	Odell, et al. (2009) UK	A literature review. To identify and critically evaluate research investigating nursing practice in detecting and managing deterioration	26
2	Adult Deterioration	Massey, (2009) AUS	A literature review. The factors that contribute to suboptimal ward care of the acutely ill patient.	30

2.4.1 Recognition of Child Deterioration

There were five publications included in this subtheme. Two UK studies; a prospective review of observation charts (Tume, 2007), and a three-year retrospective review of paediatric observation charts (Tume, 2005). Two North American studies were included; a qualitative account of barriers to calling medical assistance (Roberts et al., 2014), and a case study on the relationship between staffing and nurse surveillance (Voepel-Lewis et al., 2013). One Italian qualitative study (Gawronski et al., 2018) explored the experiences of healthcare staff and parents with escalation of care during deterioration events.

A qualitative study by Roberts et al. (2014) used semi-structured interviews and investigated the perceived barriers to nurses and doctors calling the rapid response team using medical alerts, despite the fact that the large paediatric hospital had a rapid response system. Fifty-seven transcripts were analysed using a modified grounded theory approach. They found primarily that barriers to call were around the challenging inter-professional hierarchies that existed in the hospital, combined with the professionals' self-confidence in their abilities to manage both the clinical and interpersonal situations required in a potential emergency. However, the study was limited to one tertiary children's hospital and it is not necessarily transferable. Nevertheless, the issue of professional hierarchy and lack of self-efficacy were stronger barriers for nurses than for physicians. It may be that this is a result of selection bias, in that the physicians and nurses who participated may have held very polarized views about their abilities.

A quantitative study in the USA investigated whether nurse staffing levels impacted on paediatric outcomes such as cardiac arrest (Voepel-Lewis et al., 2013). This retrospective case control study examined the relationship between surveillance by paediatric nurses and adverse events such as cardiac arrest. Adverse events occurred in 98 children compared to the control group of 158 children. The regression analysis demonstrated that there was a negative association between higher nurse staffing and adverse outcomes ($p = 0.002$) which were dependent on the level of surveillance. In other words, it seemed that where there was lower nurse staffing levels, a higher priority was given to surveillance of children recognised to be at risk of deterioration ($p = 0.028$). They concluded that it was the heightened recognition of possible deterioration that may have accounted for the increased surveillance by paediatric nurses. Although they claim their study was the first to establish a positive correlation between nurse staffing and surveillance, its findings were based on the available documentation from two different databases in one institution and was retrospective. The surveillance measure was solely based on recorded vital signs assessments and nursing hours per patient per shift. No other factors were measured, such as fluid and oxygen uptake, nor was the nurses' experience and knowledge of how to interpret data included as a dummy variable in the regression analysis.

In 2005, Tume collected empirical data to determine if there were any vital signs of abnormalities in children 24 hours prior to unplanned Paediatric Intensive Care Unit (PICU) admission, and whether the hospital records demonstrated that the nurses recognised the signs of deterioration. Although confined to one hospital ward in a specialist cardiorespiratory centre, the findings confirmed that there were significant abnormal signs of cardiorespiratory deterioration that remained unarticulated or

understood by nurses in the 24 hours prior to the unplanned admission to the PICU. Another factor was the timing of the majority of events, which were at the weekend or out of normal 'office' hours and thus at a time when it could be assumed that fewer inexperienced personnel were available. Despite the lack of statistical analysis, and the incomplete data from this retrospective study it was believed to form a baseline from which other more robust studies could follow.

Tume (2007) undertook further prospective work in a large children's hospital in England. A prospective observational study of all unplanned PICU and high dependency units' (HDU) admissions over a 4-month period was undertaken. Of the 121 children admitted to a PICU or HDU unplanned over four months, the majority (n=36) had been attributed to a respiratory cause. This result Tume (ibid) attributes to the fact that the study took place in the winter months. Like the earlier study, she found that both units had admitted a significant number of these cases at weekends or in what was considered *out of hours*. The data demonstrated that the children's length of stay on the wards before these unplanned HDU admissions was two days, compared to four days for unplanned PICU admissions. Although the study was limited to one hospital, and despite the records relating only to those children admitted to PICU or HDU, and being hampered by some missing information, it still produced some important findings. These were, that both the nursing and medical records failed to demonstrate and articulate that they recognised the seriousness of the children's deteriorating clinical condition at an earlier point before the critical event.

These factors and more were identified in a qualitative study by Gawronski et al. (2018), carried out in Rome in two hospital sites. The study aimed to find out the

experiences of health care staff and parents during deterioration events and escalation of care. They used six focus groups with 32 participants in total; staff nurses, nurse managers, ward physicians, PICU physicians and parents. The inclusion criteria was that professionals and parent participants had to have the experience of child deterioration in the previous 12 months. Two clinical scenarios were used to stimulate their recall of possible experiences and opinions on factors involved with different levels of escalation, one of which was timely and another which required urgent admission to PICU. The participants were then asked to describe their opinion on what expedited or hindered a timely escalation of care for the child and their suggestions for improvements. The data was thematically analysed, four themes supported by 19 subthemes were developed: staff competencies and skills; relationships and leadership; identifying and responding to clinical deterioration; and organisational factors.

Doctors and nurses both agreed that differences in staff training and a lack of paediatric specialty education was a key factor, and they reported having distrust in the clinical competency of healthcare professionals who did not have baseline paediatric skills. They reported that the lack of specialist skills adversely affected multidisciplinary communications, with parents also saying that child safety was dependent on having experienced nurses on all shifts and paediatric doctors available 24 hours a day. PICU doctors believed that some ward doctors believed they could deal with a deteriorating child, when they did not have the skill or specialised equipment.

Multidisciplinary rounds which involved parents was seen as a possible strategy that could improve safety and improve teamwork. The focus groups reported that interprofessional working was affected by time pressures that left doctors and nurses not talking to each other, or nurses feeling ignored when they did speak. Parents described professional hierarchies that prevented their concerns being taken seriously, and nurses being reluctant to call for assistance, which led to parents alerting other members of the team in order to get attention for their child. When it came to recognising and responding to child deterioration, nurses considered that their monitoring of vital signs, experience and intuition were the key factors. Nurses and doctors detailed how important bedside PEWS were in identifying subtle clinical changes, but could also lead doctors to focus on one clinical aspect of the child to the detriment of signs of deterioration. All participants complained of differences between staffing and workload, at night in particular. They regarded these factors as important and that they were potentially the cause of suboptimal care.

The researchers recommended the use of experienced staffing levels with specialist multidisciplinary education, empowerment of staff and the use of escalation protocols with clear lines of accountability. This study provides a means of producing a quantitative instrument to measure the impact of the factors related to escalation of care. The limitations of the study were that there may have been some selection bias because the hospital managers had recommended the participants and parents were predominantly drawn from surgical wards. In addition there was the possibility that focus groups, however small and selective, may not be a suitable venue to discuss sensitive issues related to child deterioration and that not all the participants may have contributed equally.

2.4.2 Adult Deterioration

There were eight publications included in this subtheme. Three Australian studies; a qualitative study (Cioffi et al., 2009) which related to nurses identifying cues to deterioration, a quantitative study (Cioffi et al., 2010) to determine the content validity of nurses' concerns prior to initiating a medical alert, and a literature review by Massey (2009) on the factors that contribute to suboptimal care of the acutely ill patient. Two UK studies; a qualitative study by Dalton, et al. (2018) on nurses' opinions of caring for deteriorating patients, and a literature review by Odell et al. (2009) investigating nurses' practice in detecting and managing adult deterioration. Two studies from the Netherlands; a retrospective observational study by van Galen et al. (2016) on the factors that contribute to unplanned Intensive Care Unit (ICU) admissions, and a systematic review by Douw et al. (2015) on the clinical signs and symptoms that trigger nurses' concerns. Finally, one quantitative cohort study from Canada by Martin (2015) explored the nursing processes that were related to unplanned ICU admissions.

In order to examine the factors that influence how nurses assess and respond to patient deterioration, Dalton et al. (2018) conducted semi-structured interviews with a purposeful sample of 10 nurses from the medical and surgical wards of an acute general hospital. This study investigated nurses' opinions of caring for the deteriorating patient, by reflecting on their attitudes and beliefs. The selection criteria used for the sample was that the registered nurses (n=3 certificate, n=3 diplomas, and n=4 degree) had at least two years' experience of managing a deteriorating patient and had not attended a focused educational programme. The interviews were audio-recorded and transcribed before being thematically analysed and interpreted.

The data produced three main themes; collegial relationship with medical staff, the use of nursing intuition, and the interpretation of the physiological parameter system. Whilst the nurses reported a close working relationship with the medical staff, they nevertheless considered medical knowledge superior to their own, and therefore complied with their decision regardless of their own level of expertise. Where they were doubtful, they also felt unhappy to contradict the medical personnel and felt that by recording the decision they could negate their professional responsibility towards the patient. When it came to interpreting the physiological parameters using the adult track and trigger system (Modified Early Warning Score MEWS), they used the numerical aspects to validate their decisions. They relied on organisational policies, and in doing so, again they relinquished their immediate responsibility, rather than rely on their ability to recognise subtle changes in the patient's condition and vital signs.

The nurses described intuitive observations from which they suspected something was wrong, but with a low MEWS score also described the difficulty they faced to be able to rationalise their assessment. This particular finding raises the question as to whether nurses are using their knowledge-base to aid this intuitive understanding in the first instance or not. It highlighted the difficulties nurses have in the assessment of vital signs, and gaps in their knowledge in relation to the exhibiting signs of patient deterioration, which explains their diffidence in challenging the medical profession and instead their preference for, or overreliance on, organisational protocols.

The findings in this study may not be a true reflection of intuition, or alternatively just an example of intuition being used as a substitute for a lack of knowledge and understanding to explain deviations in patients' vital signs. Although the study used

credible self-reported events from experts, it did not examine the different educational levels of the participants.

A root cause analysis of delayed recognition of deterioration was undertaken by van Galen et al. (2016), and aimed to identify the factors that led to acute unplanned admissions to a large Dutch hospital ICU. The main goal of using a root cause analysis method was to build a database of incidents and track the deviations so that countermeasures could be implemented. Doctors, nurses and electronic files were used for a standardised abstraction of patient characteristics and vital signs. The circumstances for admission to ICU in the 48 hours before the acutely unplanned ICU admission were also systematically reviewed in a retrospective study of 49 patients. The data was analysed to produce descriptive characteristics, and calculate frequencies and percentages. Medians and ranges were used for the continuous variables as they were not normally distributed.

Both sexes were almost equally represented in the sample, with a median age of 69 years. They found 155 root causes of failures, of which almost half were attributed to health care workers (46%). The most frequent failure was related to errors in monitoring vital signs (34%). Only 40% of the patients' vital signs conformed to the medical instructions, and of the 477 sets of vital signs recorded in the 48 hours prior to admission, only 1% of the records had a correctly documented MEWS. Lack of human intervention accounted for almost one-third (27%) of the causes which were identified as faulty task planning, or where the nurse's concerns over deteriorating vital signs had been ignored. The other half of the causes were disease-related, which could be expected in any severely ill population. The study was retrospective, which

meant a reliance on recorded information instead of observation, and could potentially have led to an underestimation of the factors that led to delayed recognition.

Another quantitative retrospective cohort examination of 144 charts of unplanned admissions to an acute hospital ICU was undertaken by Martin (2015). It was designed to study how nurses documented communication and recognised deterioration in the 12-hour period prior to admission. A convenience sample was obtained by using the first 12 adults admitted from medical or surgical wards per month for a year. Data was extracted from 79 patient charts from people with an age range of 20-91 and an average age of 59. It was collected using a specifically designed auditing tool and descriptive analysis used to identify patterns and outliers. Statistical tests such as Chi Square tests and Spearman correlation were used to determine if there were any significant associations or correlations between the variables.

The researchers found that the vital signs were recorded on average 3.4 times, with vital sign documentation missing in 12 of the charts reviewed. Whilst the most common reason for admission was respiratory distress (52.7%), the least recorded vital sign was the respiratory rate, which was missing from 74% of all records. Despite this, there was no significant correlation found between the number of vital signs recorded and ICU admissions ($p= 0.460$).

Recordings of communication with the responsible doctor were documented in 119 (82.6%) charts, and even less, 97 (67.3%) with the critical care response team. There was a medium negative correlation between the number of times vital signs were taken and communication with the most responsible doctor ($p = <0.001$) and the critical care

response team (p= 0.002). This was interpreted as a reduction associated with the increased doctors' involvement and possible treatment, but comes with the caveat that the study did not evaluate whether any medical intervention was actually prescribed.

Whilst the use of retrospective chart reviews can describe the relationship between events and compare groups, the limitations of this study was that the convenience sample only used a proportion of the actual unplanned admissions to the ICU. Even though the sample was tested to ensure sufficient power it nevertheless could limit the generalizability of the findings. Vital signs, whilst significant clinical indicators, may not be the only factors or cues that nurses use to assist them in recognising patient deterioration. Communication was also limited to nurses who communicated with doctors, and not with other colleagues, nor did it consider the appropriateness or the style of communication.

The concerns and cues that nurses used for recognising early clinical deterioration in patients before calling medical assistance was studied by Cioffi et al. (2009). They used interviews with a purposeful sample of 17 experienced registered nurses (> 10 years) who volunteered from four acute care hospitals in Sydney and could recall incidences of calling for medical assistance. A descriptive exploration was used to produce a detailed description of the criteria nurses used to call for medical intervention. They were almost equally divided between graduate nurses and those that had postgraduate qualifications. The transcribed tapes were coded to identify changes in cues or causes for concern.

They found 10 causes of concern used by nurses to determine clinical deterioration, six of which involved specific physiological changes, and two involved mediating neurological factors such as agitation and impaired mental functioning. Three of the main changes were associated with noisy breathing which rendered the patients unable to effectively communicate, and who did not respond when nurses increased their oxygen therapy. As 46% of emergency assistance calls are the result of nurses' concerns there is a need for them to objectively address this area of their practice in order to expand the criteria used for initiating medical intervention. Despite the study only interviewing experienced nurses, the ten changes related to nurses' concerns have the potential to be used as early clinical indicators of patient deterioration. The authors recommend studying other health professionals who may have similar experiences, and that the validity for recognizing possible early clinical deterioration ought to be investigated further.

That said, Cioffi et al. (2010) went on to validate the nurses' concerns prior to calling for medical intervention. They used ten nurses with over five years' experience in caring for deteriorating patients to form an expert group to examine the content validity of their concerns used in detecting potential patient deterioration. There were 189 concerns about patients that did not have changes in physiological parameters prior to initiating medical intervention, although changes in respiration were the main concern. A questionnaire was used to assess the content validity criteria, based on necessity and sufficiency to evaluate the criterion related to changes of concern used by nurses when calling emergency response teams.

Data were summarized using descriptive statistics, such as frequencies and percentages for ‘yes’ and ‘no’ responses for each assessment item for both necessity and sufficiency scores. They found that 100% of respondents considered respiration factors such as noisy respirations, inability to speak and the need for increased oxygenation were necessary, and 67% considered it sufficient, for an emergency response. For the circulatory criterion, 100% of respondents agreed that impaired circulation was a necessary criterion, whilst 70% considered sites of cutaneous perfusion such as hands, feet and finger nails required assessing; only 20% suggested these were sufficient. 70% of the respondents also indicated a reduction in urinary output as an intervention criterion, and 100% of them that agreed that impairment was a necessary criterion.

But in determining the neurological criterion for an alert, impairment alone dropped to 67%, suggesting further neurological assessments were needed such as agitation, restlessness and decreasing mental ability. Content analysis of the comments found that signs of bleeding and infection were suggested for inclusion, in addition to intensifying pain. In addition, subtle nonspecific changes associated with deterioration that are not clear, such as restlessness, agitation or just not right are clinically important in early detection of deterioration. Despite the subjectivity of nurses’ concerns over the subtle changes in the patient’s behaviour, they should be recognised as valid early indicators that reflect the reality of clinical practice and optimise the nursing assessment of the patient’s overall condition. It also clarifies the knowledge required by nurses to make clinical judgements, and the education required prior to clinical practice in the acute sector. In addition to the problems related to the reliability of the questionnaire, which used a limited number of indictors, the study used a small sample of volunteers. Nevertheless the areas explored have the potential to

guide nurses though a comprehensive assessment of clinical deterioration and articulate their concerns in a manner that can be clearly understood and acted upon.

The first of the three literature reviews was a systematic review by Douw et al. (2015), which also considered the signs and symptoms that caused nurses to be concerned about a patient's deteriorating condition before they called for medical assistance. The authors searched PubMed, CINAHL, Psychinfo and Cochrane Library (Clinical Trials) databases for original studies up to 2014. 4006 publications were extracted of which 3,937 were excluded, and the remainder subjected to quality assurance procedures. 18 studies were finally selected for review and initially found 170 signs and symptoms. When alternative words were applied these were reduced to 37 signs and symptoms in which ten factors were involved.

These were related to changes in respiration and circulation, rigors or agitation and expressed pain, as well as patients' complaints of being unwell. Finally, there were the intuitive factors such as subjective nurse observation, when the nurse is convinced that something is wrong but is unable to give an explanation. They found that the majority of these studies report worry or concern based on minor changes in vital signs such as respirations, the reduction in peripheral circulation and the reduction in mental alertness. However, seven of 18 studies reported intuitive concern before any vital signs worsened, which suggests that nurses' intuitive concerns about a patient's behaviour may be because experienced nurses are often unaware of the clinical cues that guide their judgement. These unconscious cues that something was wrong is nevertheless an important part of their clinical decision-making and only develops over time. Therefore the study concluded that inexperienced nurses may not recognise the

subtle signs of changes in behaviour that are seen by experienced nurses and which help them articulate their concerns.

Despite the limitations of the review, because of methodological weaknesses and the lack of rigour in exploratory, evaluation and retrospective studies included in the review, the authors recommended that nurses' concerns provide a significant early indicator of recognising and responding to deterioration. However, they also maintain that nurses would benefit from being able to articulate their concerns in an objective manner. If nurses could include these cues in their assessment and the decision to call for assistance before vital signs have significantly changed, then this has the potential for improving treatment outcomes.

A systematic review by Odell et al. (2009) was conducted to investigate nursing practice in detecting and managing deteriorating general ward patients. The review utilised electronic databases, references, key reports and expert opinions published between 1990 and 2007 using broad search terms. From an initial total of 740 articles, 14 studies met the inclusion and quality criteria of nursing observations, deteriorating patients and hospital wards. They were then grouped into four main themes: recognition; recording and reviewing; reporting; and responding and rescuing.

From the evidence reviewed, the authors found that the most common way nurses recognise deterioration is by using their intuition; the feeling that something is wrong, which they attribute to knowing the patient and from clinical experience. It is described as being attuned to differences or deviations from normal patterns of patient behaviour. Given that the nurses suspect that something is wrong, the literature

suggests they may then go on to take standalone recordings of the patient's vital signs to confirm their suspicions. Routine vital sign recordings were reported to be tasks that have been delegated to health care assistants who do not necessarily have the requisite skill or knowledge, which leads to absent or infrequent recordings.

Whilst there was a lack of agreement about the frequency of the recording of vital signs, it was regarded as the nurses' responsibility to determine. Problems with the type of measuring equipment was another issue related to recording the patient's condition; it was reported as either limited, not maintained effectively or relied upon to the detriment of other factors. For instance, there was no evidence of recordings of physical assessments by nurses, which was regarded as requiring additional training and time to perform. When it came to responding to deterioration, nurses reported that they may initiate oxygen therapy or increase IV fluids prior to requesting medical assistance, but in doing so also risk conflict with junior doctors. They also report problems with the implementation of 'Do Not Resuscitate' protocols that led to some nurses using the emergency medical teams rather than the ward medical teams in order to ensure their decision-making would be regarded as appropriate.

They conclude that understanding of the situation in which recognising deterioration is reported will result in more effective education and organisational support for nurses. The main limitations of the review were that the weaker studies lacked sufficient detail, and data collection methods and withdrawals and drop-outs form studies were common issues. A number of studies used small samples in narrow areas of clinical practice which would benefit from more in-depth research.

An earlier review of the literature by Massey et al. (2009) aimed to analyse the factors that contributed to suboptimal ward care of acutely ill patients. Evidence from MEDLINE, CINAHL, and EMBASE databases and Cochrane databases published in English between 1995-2007 were included, using the search terms; suboptimal ward care, critically ill ward patients, acutely ill ward patients and adverse events. Of the 110 potential papers, 39 were included in the review, although it was argued that many of the articles included were not contemporary and contained significant methodological flaws. The review was presented in five themes for discussion: failure to appreciate clinical urgency, failure to seek advice, failure of organisation, a lack of knowledge and a lack of supervision.

The authors concluded that the evidence suggested that most adverse events occur after a period of clinical deterioration or physiological instability, which ward nurses fail to recognise or act upon. Furthermore, it was highlighted that nurses were considered to lack the confidence to make clinical decisions, and delayed making judgements about seeking medical interventions. The main argument associated with nurses' lack of knowledge was related to a lack of biological sciences within the pre-registration nursing curriculum, and as a result they are not equipped to relate or communicate this type of theory to their practice. In addition, they found evidence to suggest that nurses are oblivious to this lack of knowledge and therefore do not understand their educational needs. Moreover, the suggestion that effective supervision was a means of improving nursing practice in identifying and responding to suboptimal care and identifying learning needs was not supported by the empirical evidence. Whilst there is a lack of robust empirical evidence associating suboptimal care to failure of the organisations, the authors concluded there were some workforce indicators that

adversely affect patient outcomes, such as a high nurse-to-patient ratio, increased mortality rates and likelihood of a critical incident. The impact on patient outcomes however remains inconclusive, and most of the factors influencing suboptimal care by nurses continues to be under-researched.

2.5 Paediatric Early Warning Systems (PEWS)

The second theme to emerge from the review concerned early warning scoring tools and how they assist nurses in the early identification of deteriorating patients. Paediatric early warning systems, or PEWS as they have become commonly referred to, are a set of predefined physiological alert criteria, usually embedded within an observation chart, which although not proven, are assumed to improve clinical outcomes by triggering earlier recognition and necessitating earlier nursing and medical intervention. PEWS often assign a numerical score to predetermined physiological criteria, which are calculated with an algorithm and mandate interventions. This section of the review includes 15 publications (Appendix 3) and has been organised into two subthemes of Clinical Performance and Evaluation, ranked by date of publication and rated for quality of contribution using the Hawker tool, which gives a maximum score of 36. Table 2.

Table 2: Subthemes and Quality Rating of Publications Included In Paediatric Early Warning Systems (PEWS)

Subtheme		Author/s /Country	Type of study	Hawker score
1	Clinical Performance	Lambert et al. (2017) Ireland	Systematic review: 90 papers. Evidence PEWS improved team work, communication and confidence in recognising, reporting and decisions.	29
1	Clinical Performance	Chapman et al. (2016) UK	Systematic review: To identify and describe the number and nature of Paediatric Track and Trigger Systems.	30
1	Clinical Performance	Chapman et al. (2010) UK	Systematic review: To identify the number and nature of published paediatric alert criteria.	29
1	Clinical Performance	Sefton et al. (2014) UK	A before-and-after observational study: Patients required fewer PICU interventions and had a shorter length of stay after PEWS adopted.	25
1	Clinical Performance	Roland et al. (2013) UK	Cross sectional survey of all In-patient paediatric services: Implementation inconsistent and variation in systems used.	26
1	Clinical Performance	Kaul et al. (2014) USA	Descriptive, cross-sectional study: 35 nurses and 17 physicians using PEWS are more likely to recognize risk for deterioration and respond	24
1	Clinical Performance	Skaletzky et al. (2012) USA	Retrospective, case–control study: Predicts children at risk of CPA.	17
2	Evaluation	Murray, (2015) USA	Integrative review: 28 papers. Nurse ought to decide which tool of early warning system scores with paediatric patients.	24
2	Evaluation	Parshuram et al. (2018) Canada, UK, Ireland. Italy, NZ, Belgium, Netherlands.	A cluster randomized clinical trial to determine effect of PEWs on all mortality found they could not predict all deaths.	32
2	Evaluation	Fuijkschot et al. (2014) Netherlands	Validated PEWS: Identification of patients at risk for unplanned PICU admission is possible,	20
2	Evaluation	Robson et al. (2013) USA	A retrospective case-control of 3 PEWS.	23
2	Evaluation	Parshuram et al. (2011). Canada & UK	International, multi-center, case-control study of 2074 patients' records.	19
2	Evaluation	Edwards et al (2010). Wales	Prospective cohort study: 1000 patients. PEWS predicted adverse events.	22
2	Evaluation	Parshuram et al. (2009) Canada	A case-control design using 11 candidate items and identify a pragmatic score for routine bedside use.	21
2	Evaluation	Tucker et al. (2009). USA	Evaluation of the use of the Paediatric Early Warning Score: 2,979 patients a reliable tool.	25

2.5.1 PEWS Improve Clinical Performance

There were seven publications in this subtheme: Four UK studies: A systematic review of paediatric track and trigger systems (PTTS) (Chapman et al., 2016), and another about physiological parameters for paediatrics (Chapman et al., 2010). A cross-sectional survey of service implementation (Roland et al., 2013), and a before-and-after implementation observational study (Sefton et al., 2014). Two USA studies: A descriptive cross-sectional study of predictability (Kaul et al., 2014), a retrospective, case–control study of predictability (Skaletzky et al., 2012), and a systematic review of effectiveness (Lambert et al., 2017).

A systematic review of the use of PEWS for the early detection and responses to child deterioration in the acute hospital setting was conducted by Lambert et al. (2017). Using *Centre for Reviews and Dissemination Systematic Reviews Guidance For Undertaking Reviews in Health Care* (2008), 90 papers were included in the review up to August 2016. The search was guided by the PICO parameters set, had no study design restrictions and was carried out in two phases; phase 1 involved the screening of titles and abstracts, phase 2 involved full text screening by two independent academics of 126 potential articles. Prior to inclusion they also appraised and classified the level of evidence provided by the studies. However, they found assessing comparative quality difficult because of the disparate nature of the research methodologies and the diversity of the PEWS adopted. Most of the studies that were included by Lambert et al. (2017) were from countries such as USA, Canada, Australia, and the UK. Considerably fewer contributions emanated from the Netherlands, Ireland, Norway, and Sweden, whilst there were few from Asia and

Africa; and there were none from the Middle East which confirmed the findings from this review.

The reviewers found that there were multiple non-validated PEWS scoring systems in use internationally, which had either been developed locally, or modified or adapted in order to provide simplicity and clinical utility. The variety of physiological parameters used made any agreed national and international standards difficult to compare in order to contrast clinical performance outcomes. The conclusion drawn from the findings is that there remain challenges in establishing a common understanding and agreement among professionals of the factors involved in recognising and responding to child deterioration. The authors also draw attention to the lack of robust evaluation studies and the complexity of the non-physiological factors involved, such as communication, multidisciplinary team-working, staff education and parental involvement.

Chapman et al. (2016) conducted a systematic review in order to describe the characteristics of 35 out of the 55 published Paediatric Track and Trigger Systems (PTTS). They considered the evidence on their importance to patient outcomes and found a considerable variation in the quantity and type of parameters used. The evidence to support the use of PTTS was weak, with the majority of outcomes not being of statistical significance. They conclude that more robust evidence is required, particularly around the thresholds for the vital signs included. In a similar vein, Chapman et al. (2010) undertook a systematic review of the reliability of the alert criteria to predict adverse clinical events. From the ten alert criteria examined, they found significant variability, including the number and type of parameters applied. They

concluded that the evidence of reliability was poor and that more evidence was required to determine which physiological parameters were valid and offered the most effective clinical utility.

The cross-sectional survey used by Roland et al. (2013) was sent to 157 medical directors throughout the UK by email between 2011and 2012, to ascertain the use of PEWS in their unit. The response rate was only 61.7%, so the non-responders were contacted by telephone to complete the survey the following year. The final response rate was 94.9%, from which the results were tabulated and analysed descriptively in Excel software using numbers and percentages. Of the 26 units that reported using PEWS, there were seven different published systems in use, with the Brighton PEWS and the Institute of Innovation and Improvement's PEWS being the two most common. The monitoring of respiratory rate, breathing effort and heart rate were the physiological signs that were generally relied upon by the clinician. These were followed by loss of consciousness and oxygen saturation, whereas only six took capillary refill time into account, and only one considered parental concerns. The variation in the systems used and inconsistency of the PEWS criteria adopted has no rational explanation other than clinician- or local preferences. The authors suggest that the use of PEWS is purely based on the notion that they are effective without any evidence to the contrary, and general recommendations emerging from national safety reports.

The effectiveness of PEWS in the prevention of paediatric emergency admissions to PICU was considered by an observational cohort study conducted August 2005 - July 2007 by Sefton et al. (2014). It was a before-and-after comparison of the impact on

PICU admissions in-house, by a hospital that utilised PEWS, compared with admissions from a transferring hospital (that did not use PEWS), pre-implementation of PEWS admissions, and the post-PEWS implementation admissions. The PICU was situated in a large UK tertiary children's hospital which collected audit data for a national data set, so that reliable specific patient data related to emergency and elective admission cancellations was accessible to the researchers with the approved permissions. A total of 958 unplanned admissions were reviewed over two years, one in the period prior to the introduction of the modified Bristol PEWS, and one year afterwards.

Although the overall number of in-house cohort of emergency admissions was not reduced by using PEWS, there were nevertheless some significant findings. The median mortality score was reduced to 0.44 from 0.60 ($p < 0.001$); only 62% ($p = 0.015$) compared to 75% of the external admissions which required invasive ventilation, and the median length of stay dropped to three days from five ($p = 0.002$). Therefore, the unplanned admissions of children post-PEWS were less sick and stayed fewer days in the PICU, compared to the external admissions. The number of emergency admissions from the external cohort was the same over both time periods, although the type of admissions in the first year was younger (median age of 3 months) and more likely to die on admission. There was a marginal improvement in mortality rates in the second year, down from 10.6% to 8.2%, which the researchers attributed to the size of the study population.

However, Sefton et al. (2014) also suggest that these improved mortality rates may be the result of natural improvements over time, or organisational factors in the in-house

group, where there was easier access to the PICU and experienced clinicians. Whilst the study did not address the performance of the Bristol PEW criteria, nor staff's compliance with the locally agreed PEW triggering process, it did provide additional training for an external cohort of paediatric staff, was considered liable to impact, and had begun to improve patient outcome.

A small, descriptive cross-sectional survey of 35 paediatric nurses and 17 physicians was carried out by Kaul et al. (2014). The survey was designed and validated by the researchers, was based on self-efficacy theory and focused specifically on nurses' perceptions of their abilities to detect and manage signs of deterioration, as well as to effectively communicate their concerns with medical staff. The nursing population surveyed (n=76) had a low response rate of 46% and therefore could not be regarded as a representative group. Additionally, eight of the 35 respondents had no experience of using bedside PEWS. However, the physicians surveyed were a smaller group (n=21) and had a very high response rate of 87%, but six of the 17 responders had no experience of bedside PEWS. The researchers used a Likert scale and closed/open questions in the survey, and analysed the scale using SPSS software. Mann-Whitney tests were applied to the Likert scales to test for significant differences in responses. The other responses were examined to see any frequencies or trends in the nurses' ability to detect and manage child deterioration.

Those nurses who had experience of using PEWS reported a significantly greater ability to identify child deterioration ($p = <0.04$), as well as an ability to initiate early interventions ($p = <0.01$) using the predetermined physiological indicators and protocols. The nurses without PEWS experience reported that they were more likely

to rely instead on parental concerns. In addition, their responses to signs of deterioration were skewed towards interventions that corresponded with their monitoring focus, for example encouraging fluids. 90% of doctors considered nurses' assessment of physiological status was accurate; however they differed in what physiological signs they relied upon as measures of risk of deterioration. Interestingly, they concurred with those monitored by the nurse, so that where physicians and nurses used PEWS, then heart rate, respiratory rate, oxygen saturation and blood pressure were identified as important measures of deterioration; whereas the doctors who did not use PEWS focused on temperature, urine output and parental concern as their measures of deterioration.

A significant number of doctors with experience of using bedside PEWS reported that nurses could communicate a child's condition effectively ($p=0<.05$), compared to those doctors who worked on units that did not employ PEWS. All the doctors and two-thirds of the nurses who used PEWS reported that they found it helped their practice. The use of PEWS provided the nurses with the raw data that doctors could understand and that improved all their communications. Whereas for almost half of the physicians, improvement in team communications was equally divided between their ability to monitor trends using PEWS, or the nurse's use of the data. Whilst these results are interesting, they are self-reported findings that are not generalizable. In addition to the small scale and wide variations in the response rates, there are also some design flaws. The authors suggest that there were problems in controlling the inclusion criteria of the populations studied that may have impacted on the results, for example, the experience levels of both doctors and nurses and the variation in educational levels between both nursing groups.

A retrospective, case-control study was conducted Skaletzky, et al. (2012) of all children admitted to a USA hospital who had a critical event and then transferred to a PICU over 30 months. Controls (n=250) who did not have a critical incident were matched to each incident case (n=100), taking into account age, admission area and diagnosis. Data were collected from nursing electronic records from transferred cases during the 48 hours prior to admission to the PICU and similar data from the control group for 48 hours after admission to the ward. The maximum score (from a potential maximum of 9) using a modified Brighton PEWS score, which included behaviour as well as physiological signs, was calculated for each case and used as a comparison of both groups. The data were analysed using descriptive statistics, using the mean, standard deviation or median with interquartile range (IQR). The Mann-Whitney U test was applied to the age, length of hospital stay, and maximum PEWS scores. The chi-square test categorical data and the receiver operating characteristic curves (ROCs) were constructed for those cases sent to PICU.

The critical incident group had a significantly longer length of stay ($p =< 0.001$), and PEWS scores ($p =< 0.0001$) than the control group, and the sensitivity and specificity of the PEWS score were 62% and 89% respectively. The researchers therefore concluded that the ease of use of these routine measurements and score results has the potential to improve clinical performance. The score alerts preventative measures to identify deterioration early enough to reduce the incidence of adverse events, thereby reducing the need for transfers to PICU and preventable deaths. Whilst the design of the study was robust, there were acknowledged limitations because it was

retrospective, and because the subjective nature of the behavioural aspects of the modified PEWS had not been validated.

2.5.2 Evaluation of PEWS Effectiveness

There were eight publications in this subtheme: Three Canadian studies: an international multi-centre randomised clinical trial (Parshuram et al., 2018), an international, multicentre case-control (Parshuram et al., 2011), and an initial evaluation development (Parshuram et al., 2009). One UK prospective cohort study by Edwards et al. (2010). Three studies from the USA: An integrative review (Murray et al., 2015); A retrospective case-control of three systems (Robson et al., 2013), and an evaluation of a simplified PEWS score (Tucker et al., 2009). There was also one paper included from the Netherlands (Fuijkschot et al., 2014), which involved validating PEWS criteria scoring sensitivity.

An integrative review of PEWS systems was conducted by Murray et al. (2015) and considered 28 publications which included empirical evidence, clinical practice articles and conference abstracts. The appraisal for inclusion was ranked from the highest being Randomised Control Trial (RCT), with the lowest rating given to expert opinion, which was nevertheless considered important as it reflected current clinical practice. Five concepts emerged from the analysis, they were: PEWS scoring systems, benefits of using the scoring system, facilitators of successful use, barriers to PEWS implementation, and the requirements for further research.

The authors conclude that of the 23,288 hours studied, only 5.1% had measurements on all seven items, indicating that incomplete data were very common. What was

required from a PEWS scoring system is a standardised assessment tool that provides consistent results and can be used by all members of the healthcare team to identify children at risk of deterioration. Similarly to the adult PEWS algorithm, the paediatric system should result in empowered nurses making improved decisions and contributing to effective multidisciplinary team communication and collaboration. Their advice says that the inclusion of nurses in the development and implementation early in the process was critical to success, as was the timely multi-modal training approach on how to use the tools and interpret the algorithm to ensure the earliest possible response to child deterioration. Unsystematic child assessment, failure to monitor children or to take parental concerns into account and document a full set of vital signs were found to be the major obstacles to the success of PEWS. The lack of multi-centre robust prospective studies continues to undermine the results and recommendations that PEWS improve the quality of paediatric services.

The work of Parshuram et al. began in 2009, with the development and evaluation of what they describe as a simple bedside PEWS score to quantify the seriousness of the deterioration in hospitalized children. They deployed a case-control design to evaluate seven clinical items for bedside use, after they had been reduced from 11 after taking into account the expert views of therapists, nurses and doctors. Data was collected from three sources; a survey of nurses' rating of risk of cardiac arrest, and the comparison of two retrospective datasets; 60 cases that were admitted to the PICU after urgent medical assistance but not a critical incident, and 120 control group children who had an uncomplicated stay. Using a range of 0-26 the mean scores of the cases was 10.1, whereas in the control group the mean was 3.4. The principal statistical analysis compared case-control status with nurse to patient ratio and their

rating of risk, and used a multivariable model to evaluate PEWS score for the 12 hours, using only a p= < 0.05 level variable. They found that the PEWS score could identify more than 80% of patients who needed urgent medical attention with a minimum of one hour notice. Scores were consistently higher in children admitted to the PICU than children who were not admitted (p= < 0.0001).

The data provides evidence that the combination of objective PEWS rating and nurses' situational knowledge provides improved clinical decisions and response strategies that mitigate against child deterioration. The researchers acknowledged that this study was limited to a single site and that a number of datasets contained missing values. They also omitted children who had a critical incident and suggest that were they to have been included this may have impacted on those studied, because they may have been systematically different and effects ought to be evaluated before the findings were generalizable.

To address the weakness of a single-site study, Parshuram et al. (2011) repeated the study using an international multi-centre evaluation. They used three Canadian and one UK paediatric hospital, which was reported on separately by Duncan et al. (2006). They again used the seven physiological PEWS items: heart rate, systolic blood pressure, capillary refill time, respiratory rate, respiratory effort, transcutaneous oxygen saturation and oxygen therapy. They hypothesised that the PEWS scores could identify children at risk in a timely manner and that these scores would be superior to any nurse assessment. Study protocols and data collection methods were similar to the previous single-site study but this time included critical incident cases. They studied 2,074 children from 0 to 227 months, had a median age range of 12

months, and included 686 cases (305 critical incidents) who were urgently admitted to the PICU, and 1,388 control patients who remained on the wards. Again the PEWS scores were significantly higher ($p<0.0001$) for the children admitted to PICU (5-12) compared to the control groups (1-4). The AUCROC curve was 0.87 (95% Confidence Interval (CI) 0.85 to 0.89) and a score of 7 as the threshold with a sensitivity of 0.64 and specificity of 0.91.

All four hospitals found that the PEWS rating scales could discriminate and identify within age and disease those children at risk of deterioration. Furthermore the scores increased significantly ($p= <0.0001$) for each hour leading to the need for medical intervention. For example, rising from 5.3 to 20 in 24 hours, and 8.4 to 0 in the 4 hours prior to requiring urgent medical attention. The effectiveness of the retrospective nurse ratings 12 hours before a clinical incident were evaluated in 63.8% of the cases and found that 74.8% of nurses' ratings were able to discriminate ($p=<0.0001$) cases from the control group patients.

The cases also suffered from incomplete measurements, with only 5.1% of the seven items completed, with some lower PEWS results in some children that had experienced a critical incident. This may have been the result of differences in nurse monitoring as the timings were not specified or controlled as part of the study protocol. In addition, the PEWS scores were calculated electronically without input from clinical staff, and the results could not, therefore, be reliably verified by the researchers. Therefore, in 2015 Parshuram et al. (2018) conducted a cluster-randomised trial of PEWS in 21 hospitals across seven countries. They aimed to determine whether the bedside PEWS could predict all causes of mortality. All the hospitals were randomised

on a 1:1 ratio to either the bedside PEWS intervention or usual care, resulting in 10 hospitals implementing the routine use of PEWS documentation and recommendations for care, dependent on their scores for 52 weeks. There were 11 hospitals in the control group that continued usual care

The outcome measures were all causes of mortality and a significant clinical deterioration event requiring late PICU admission. 144,539 children completed the trial and regression analysis was used to determine baseline rates. All causes of mortality were 1.93 per 1000 children (244 deaths) for the intervention hospitals, and 1.56 per 1000 children (155 deaths) in the control hospitals. Significant clinical deterioration events occurred during 0.50 per 1000 (127) children in the intervention hospitals, and 0.84 per 1000 (259) children in the control hospitals. Significant clinical events occurred in 15.3% of referrals to PICU in the implementation hospitals compared to 22.0% in the control hospitals, and included 59 cardiac arrests and 8 deaths before transfer. Although the trial did not find that the use of PEWS significantly reduced mortality in children, it did find PEWS significantly reduced adverse clinical events leading to late PICU admissions. This was the case even though the overall mortality rates were lower than predicted at the outset, as they had excluded high risk groups that may have higher mortality rates, in addition to not blinding the study. The RCT design, size, international diversity and robust processes make this study a major contribution to paediatric research.

The predictability of other PEWS scores, the Melbourne criteria for alerting medical attention, was the subject of a year-long prospective cohort study by Edwards et al. (2010) at the University Hospital Wales. Following a retrospective audit of physiological indictors prior to PICU admissions, the hospital developed the Cardiff

and Vale Paediatric Early Warning System as a means of predicting children at risk of a critical incident. This study was an evaluation of the PEWS score criteria matched against data on 9075 sets of recordings from 1000 children admitted to hospital wards. This study did not involve the implementation of the PEWS score. Whilst there were no deaths, three of the 16 children that had a critical incident did not have any abnormal physiological recordings.

Nevertheless, they found that all children admitted had at least one abnormal set of vital signs recordings. Of the eight criteria used in the PEW score, 56% of data were incomplete; even for those criteria considered to be crucial they found missing data, for example in heart rate it was 13.5%, for respiratory rate 20.7% and 92% for airways threat. The sensitivity analysis found a single abnormal parameter was sensitive but had low specificity, which resulted in false positives. The optimum score out of 2 was 70% sensitive and had a 6% positive predictive value, which the researchers conclude would result in the majority of emergency alerts being unnecessary. The flaws in the evaluation were the single centre, theoretical application of the score to prospectively collected vital signs. Whilst acknowledging the need for more robust studies, they were able to use more than one site to demonstrate that this PEWS score could potentially identify children at risk of a critical incident in sufficient time to initiate medical intervention.

An American study by Tucker et al. (2009) considered the use of a multiple items PEWS score that had been developed in Canada, but it was impractical for use in a busy 24-inpatient paediatric medical unit. Instead, they opted to adapt Monaghan's (2005) score, which involved three components of behaviour, cardiovascular and

respiratory status as the basis for monitoring deterioration, as “it only took 30 seconds to complete”. They conducted a year-long prospective, descriptive study of 2,979 children after they had trained nurses in the use of the simplified scoring system.
The nurses undertook an assessment which was recorded electronically on each child every four hours. An algorithm was developed which incorporated minimum required responses to the findings from their assessment range, from no action to activating the medical emergency team. The decisions made to transfer children to the PICU were made by the clinician without reference to the PEWS scores, but such transfers were considered as a proxy for child deterioration. During the study period, the nurses recorded the PEWS for each shift of the data, amounting to 40,000 individual scores which were then collected, anonymized and stored securely.

The results produced a range of scores between 0-9 and mean of 2.2 which was unrelated to the age of the children, with 73.2% of children scoring between 0-2 and only 1.2% of children scoring 7 or above. Inter-rater reliability was found to be high ($p =< .001$) between the nurses’ recordings and the researchers. They found that using PEWS scores, they could significantly discriminate between cases that required transfer to PICU and those that did not. The statistically significant association ($p =< 0.001$) between PEWS and transfer to the PICU indicated that each 1-point PEWS score led to a twofold increase in the child’s likely transfer to the PICU, with the highest PEWS of 9. There were five cases that were transferred with a PEWS score of 0-2, but when investigated turned out to be because of pre-existing and overriding hospital protocols that the researchers claimed also reduced the sensitivity finding. This was a limited single site study on a simplified version of PEWS. Its strength lies in the fact that all the nurses had undergone training prior to the introduction of the PEWS, but

there is no indication of what the results would be if they had not been prepared appropriately. It also required that data would be produced by four-hourly monitoring by all nurses who had been assessed for inter-ratter reliability, but there were significant workload implications for the clinician that were not factored in initially and caused some organisational adjustments.

The retrospective case-control study was carried out to evaluate three validated PEWS tools (Robson et al. 2013): one UK tool, a Canadian tool, and the tool used in the UK arm of the Canadian international evaluation study. They conducted a retrospective case-control study to compare the PEWS' effectiveness of identifying children at risk of deterioration. Cases (n=96) were matched with control cases (n=96) based on their age, diagnosis, gender, residing patient care unit and month of occurrence. Each of the cases had their PEWS calculated every six hours during the defined 24-hour period. The highest score for each of the tools was recorded and missing data were assumed to be normal and scored as a zero. Whilst the objective data was extracted from the medical records the subjective data is more difficult to interpret, for example the terms *worrying* and *tiring.* Different variables within each of the tools evaluated meant scores ranged from 0-32, or from 0-1, making comparisons meaningless. They overcame the difficulties by using a single measure of emergency medical intervention for actual or impending cardiac arrest.

The authors described similarities and differences between the cases and control groups. 77% of the children had a critical incident primary diagnosis of respiratory distress and were under four years old. Whilst all the tools evaluated identified clinical deterioration in children, the results of the ROC curve found that the UK arm (Duncan

et al., 2006) of the Canadian study (Parshuram et al., 2011) produced the clearest balance between sensitivity (86.6%) and specificity (72.2%), and a significantly greater accuracy (p=<0.05). The Canadian PEWS system with seven variables was seen as relatively simple to use with the potential to induce compliance but was less sensitive. However, missing data, which was considered as normal risks bias, in addition to the small sample size and the rarity of critical incidents, could have affected the results and the ability to generalise them. To implement PEWS successfully in clinical settings, the authors recommend using a response algorithm and all health-care staff education.

The evaluation of PEWS to identify sick children at different outcome end points was the aim of the Fuijkschot et al. (2014) case study in the Netherlands. A modified PEWS system was implemented based on the Canadian scoring system (Parshuram et al. 2011), adapted to include a variable for temperature. Staff procedures were defined for using the system and resulted in a PEWS with eight components and a possible score of 0-28 points. Of the 14,000 admissions the hospital deals with in a year, three cohorts were identified to study the sensitivity of the modified PEWS. Cohorts 1 and 2 focused on the timely identification of children at risk and cohort 3 was those children requiring emergency medical interventions.

In cohort 1 only 59% of the 199 admissions were included in the study, and provided a score of <4 for 77%, which was 1,115 recordings and resulted in 87% of cases (n=103) with a threshold score <8 although there were no cardiac arrests or PICU admissions. In cohort 2 there were 36 children who had unplanned admissions to PICU, but in 24 of the cases it was not possible to reconstruct their condition prior to admission from the recorded data, which showed the median PEWS in the 2-6 hours

prior to admission at 8.5. Cohort 3 consisted of 17 cases with a median score of 10 at the time of intervention, which indicated a high sensitivity to detecting child deterioration at an earlier time in the child's illness trajectory.

The researchers claim that most of the evaluations used critical incidents or unplanned PICU admission as the patient outcome and that their study demonstrates that they have the sensitivity to identify children at risk earlier. Not only was this a small, single-site study but it also suffered from missing, insufficient data, and below-standard recordings and unsecured data severely impacted on the results. Whilst nurses reacted positively to the PEWS system and protocol, the lack of user-friendliness and additional work made its acceptability to nursing and medical staff a problem for implementation. Safety and adherence to accurate monitoring of the children was an additional organisational concern. The researchers also recommend that PEWS are implemented as part of the safety culture, with professional team education focused on both technical and non-technical skills.

2.6 Focused Education around Recognising Deterioration and Communication

The third theme to emerge from the review addressed the question of the need for focused education related to child deterioration. Education for health care staff has been recommended as a means of increasing their clinical skills and thereby improving paediatric outcomes by preventing 'failure to rescue' situations (Pearson, 2008; Berg et al., 2008; Haines et al., 2005). It is also regarded as a means of counteracting the human factors found to be compounding issues leading up to critical incidents, such as inexperience and ineffective communication. There were 10 publications in this

theme included in the review (Appendix 4), presented in two subthemes: theoretical courses and simulation courses, as in Table 3.

Table 3: Summary of publications included in Focused Paediatric Education

Subtheme		Author/s /Country	Type of study	Hawker score
1	Deterioration-focused theoretical courses	Tume et al. (2014) UK	Post-test Evaluation Survey: Multidisciplinary RESPOND Training.	32
1	Deterioration-focused theoretical courses	McKay et al. (2013) Australia	Pre- and Post-intervention of COMPASS course.	32
1	Deterioration-focused theoretical courses	Smith & Poplett, (2004) UK	Pre- and post-test doctors' knowledge post ALERT course.	30
2	Simulation Courses	O'Leary et al. (2016) Australia	A pre-test/post-test control-group design. Standard instruction versus simulation on paediatric deterioration.	33
2	Simulation Courses	Clerihew et al. (2016) UK	A review of simulation training.	18
2	Simulation Courses	Bultas et al. (2014) USA	A pre-test post-test control group design.	29
2	Simulation Courses	O'Leary et al. (2014) Australia	Prospective study of 73 simulations to identify causes of suboptimal paediatric care.	32
2	Simulation Courses	Theilen et al. (2013) UK	Pre- and post-evaluation of the impact of team training.	27
2	Simulation Courses	Straka et al. (2012) USA	Pilot study is to determine if the use of high-fidelity simulation is effective with novice nurses.	29
2	Simulation Courses	Linder & Pulsipher (2008). USA	Simulation introduced in undergraduate education to prepare nurses to respond to child deterioration.	22

2.6.1 Deterioration Focused Theoretical Courses

There are three publications on an educational intervention included in the review: Two were UK studies; a multidisciplinary survey post-RESPOND Training (Tume et al., 2014), and a pre- and post-test of an ALERT course (Smith & Poplett, 2004). One Australian study is included: A pre- and post-intervention of the COMPASS course (McKay et al. 2013).

The first educational programme developed to focus specifically on deterioration and not resuscitation was in the UK. It was a one-day multiprofessional ALERT course (*Adult Acute Life-threatening Events – Recognition and Treatment)* (Smith & Poplett, 2004), designed to improve the confidence of newly qualified doctors and nurses to recognise and manage critically ill adults. It consisted of pre-course information, seminars and demonstrations and clinically-based scenarios. It focused interprofessional communication and incorporated reversal of roles during the clinical scenarios as a means of improving team-working. The authors found that the average score for knowledge significantly improved for course attendees compared to those who had not attended (9.44±1.63 points versus 7.45±2.32 points; $P<0.05$). In clinical skills attendees improved their understanding of such factors as signs of airway obstruction and normal capillary refill time, urinary output expectations and the use of oxygen equipment. They also improved their knowledge related to survival after in-hospital cardiac arrest, and consent arrangements for the unconscious person. Although making recommendations for adoption and claiming to apply the principles of multiprofessional education, there was no rigorous post-course evaluation.

The ability to measure vital signs, document them and track children's clinical progress in order to trigger communications between professionals and initiate appropriate actions would, according to the Australian researchers McKay et al. (2013), be enhanced by a multifaceted intervention programme (COMPASS). They undertook a pre- and post-evaluated intervention around detection of abnormal vital signs and recognising deterioration. It consisted of an e-learning package followed by a half-day low-fidelity simulation exercise aimed at improving health workers' understanding and

measurement of physiological vital signs, and the use of structured communication techniques. The study then examined clinical events for most of the patients in two paediatric wards at an Australian hospital. It included 1,159 children in the pre-intervention phase and 899 in a post-intervention phase.

Approximately 25% of patients were then randomly selected as a subgroup for an in-depth analysis of vital sign documentation and associated communication. The researchers undertook surveys pre- and post-intervention to measure the staff's perceptions of child deterioration and their confidence levels. They measured the frequency of documentation of vital signs, quality of professional communication and medical reviews following the clinical deterioration of 262 children in the pre-intervention and 221 children in the post-intervention phase. Post-intervention they found significant increases ($p= 0<0.001$) for communication and documentation related to the effort required to breathe, capillary refill and the AVPU scale (Alert Verbal stimuli Pain stimuli Unresponsive) between teams. There was a reduction in the numbers of children requiring emergency medical treatment, but the small sample size could not detect differences in outcomes such as unexpected mortality. The main limitation of this study was the short follow-up time and that the impact may not be sustained over time because of the Hawthorne effect (1949).

This was not the same when the ALERT course was adapted for use in paediatrics by a UK team (Tume et al, 2014), who developed and evaluated a one-day multiprofessional course (based on the ALERT adult programme) at a specialist children's hospital. The practical course, called the RESPOND course, was specifically designed by a multiprofessional team around preventing PICU admissions by

improving children's ward based teams' ability to recognise and respond to the deteriorating child. A total of 65 multidisciplinary paediatric staff, the majority of which were nurses, attended the course. It was evaluated using an open-ended questionnaire completed on the day, and three months later via an emailed survey. There was a 95% response rate on the day of the course, but this was reduced to 18% at the three-month follow-up period, severely limiting the comparisons.

Results from the initial evaluation found that 87% of the attendees learnt new material, with 89% believing the Situation Background Assessment Recommendation (SBAR) method of communication would improve their practice. Participants appreciated the multidisciplinary approach and it afforded nurses and doctors the opportunity to articulate their disparate perspectives, but with junior doctors emphasising their need for nurses to be succinct about their clinical concerns. Whilst the response to the follow-up survey was poor, they did produce some interesting detail. Nine out of the 12 nurses (75%) had experienced a critical event, and most believed that the course had helped a lot; just one said it only helped a little. The main benefits of the course were seen as; thinking differently about their clinical work, and improved team communications. The limitations were that it was a single-centre study using small numbers. The response to the follow-up survey was so limited that the results about the effects on clinical practice could not be generalised, and relied on assumptions. These were mainly that the reduction in the overall number of cardiac arrests in the intervening year was an indicator that the course had made a positive impact.

2.6.2 Simulation Courses

There were seven publications related to the use of simulation to improve the effectiveness of staff in the recognition of and response to the deteriorating child. Three were based on work undertaken in the USA: A pre-test post-test design using simulation (Bultas et al., 2014), a pilot study to determine if the high-fidelity simulation is effective (Straka et al., 2012), the use of simulation in undergraduate education (Linder & Pulsipher, 2008). Two Australian studies: A pre-test/post-test control-group design of standard instruction versus simulation (O'Leary et al., 2016), and a prospective study of 73 simulations (O'Leary et al., 2014). Two UK studies: A pre- and post-evaluation study (Theilen et al., 2013), and a literature review (Clerihew et al., 2016)

The first Australian study by O' Leary et al. (2016), related to simulation training with paediatric nurses, was undertaken to see if the positive impact on adult nurses' learning with regard to recognition and management of deteriorating patients could be replicated. They used a quasi-experimental design to undertake a pre-test/post-test control-group with 30 participants who were non-randomly assigned to one of two learning experiences: Either a high-fidelity patient simulation or standard didactic instruction, both of which were followed by semi-structured interviews. The pre- and post-learning was tested by using questionnaires; a multiple choice questionnaire using five items related to knowledge, and a 14-item self-efficacy questionnaire, both of which were analysed using descriptive statistics. The intervention group demonstrated significant improvements in their perceived self-efficacy ($p = 0<0.01$) and knowledge ($p =0<0.01$). Only 10 nurses took part in the semi-structured interviews, but what proportion came from which group was unclear.

The themes of self-awareness, hands-on learning, teamwork, and maximising learning emerged from the interviews. These qualitative results found that participants valued the practical aspect of the simulation and working as a team, but were concerned about the fact that the training highlighted the gaps in their knowledge and abilities which initially reduced their self-confidence. The participants from the control group were found to be less self-aware and concentrated on the knowledge aspects of the experience. Although the sample size was small, which limits its generalisability, the methodology was rigorous, particularly in relation to the statistical outcomes.

In the second Australian study by O'Leary, et al. (2014), using a prospective mixed-methods study of simulation training found suboptimal paediatric care among multiprofessional groups. They recorded 194 incidents during 73 training events over a nine-month period. The majority of suboptimal care incidents found were categorised as communication (84) and knowledge deficits (76). Next came deficits recorded in relation to poor clinical skill (39) and loss of situational awareness (47). Finally, the remainder concerned leadership issues, and resource and planning failures. The major criticism of the study relates to validity concerns around the scenarios used in the simulated training events, and whether the patients' conditions and the clinical environment were realistic enough.

Physiological instability leading to clinical deterioration, which often precedes cardiopulmonary arrest, is considered more likely to be recognised by nurses who have the most frequent contact and responsibility for the ongoing monitoring of hospital children. However, as O'Leary, et al. (2014) stress, although it is a necessary

skill it remains more challenging in paediatric nursing, as children's compensatory physiological mechanisms may mask vital indicators of deterioration. They therefore wanted to compare two types of educational intervention; standard instruction versus simulation, to investigate if there was any difference in knowledge and perceived self-efficacy between the methods.

They used a mixed methodology combining a pre- and post- quasi-experimental design with semi-structured interviews. Thirty paediatric nurses took part in the study, with half being assigned to undertake simulation training and the other half to receive standard classroom instruction. However, only 10 took part in the interviews. Although the learning outcomes were common to both types of experiences, the researchers found that the knowledge and self–efficacy scores for simulation were higher than for standard instruction. The major perceived benefits experienced by the paediatric nurse participants was the practical hands-on element of the instruction and the team-working. The researchers claim this type of instruction helps improve patient outcomes through increased knowledge and confidence in team-work.

Simulation training to prepare university undergraduate nurses was reported by Linder & Pulsipher (2008). A combination of didactic and simulated learning was used with electronic patient records in order to improve students' confidence in assessing, recording, responding and communicating acute changes in children's clinical condition. Whilst student feedback was positive it was subjective, rather than an objective measurement.

In an attempt to determine the effectiveness of simulation training, Straka et al. (2012) conducted a small three-month pilot study. They used a convenience sample of 26 novice nurses in paediatric crisis recognition using high fidelity simulation training. Identical pre- and post- tests were used to assess their knowledge of signs and symptom recognition. They found the average score on the pre-test was 71.15%, compared to post–test 87.69%. They reported a 7% increase in assumed ability and a 23% increase in recognising a deteriorating condition. Although statistically significant, the result was more likely to be the effect of nurses becoming familiar with the test and the lack of any means of conducting a legitimate assessment, rather than the result of any improvement in nurses' understanding.

Regular in situ team training using simulation is however considered to improve staff recognition and response to deteriorating children. The claim by Theilen et al. (2013) was that the results of a prospective before-and-after hospital cohort study demonstrated that patients were identified more promptly, and seen by consultants and transferred to high dependency or PICU care more quickly. They also assert that this training resulted in significantly reduced hospital mortality ($p = < 0.001$). The limitations of this small single-site study were that there were too many uncontrolled variables, as well as that children not requiring intensive care were not included. So, these factors could have influenced the outcomes, meaning that the reduction in mortality could not be attributed to the training. However, it was noted that the training produced changes in clinical performance over the following year, leading to assumptions that the improved performance was related to the ongoing training.

Another small single-site study by Bultas et al. (2014) compared high-fidelity simulation used in nurse education with traditional didactic teaching methods in recognising child deterioration. They used a pre- and post-test methodology with 33 ward nurses in a paediatric Magnet® hospital. The results were analysed using the non-parametric test to compare the changes in written exams, skill performance measures and the Mayo High-Performance Teamwork Scale in the experimental group. The study was limited by the fact that the measurement tools were not validated, and the same scenarios were used in the pre- and post-test. Not only was there a higher percentage of nurses in the experimental group that worked in medical units, but the clinical scenarios used in the study would also have been more common situations for them than for the nurses working in surgical wards.

A review of simulation training by medical educationalists Clerihew et al. (2016) claims that simulation does not necessarily lead to better education but provides a real situation scenario to which the learner can relate. The benefits are an experiential learning experience which allows learnable chunks of generic competencies to be explored and communication skills to be refined. The disadvantages were again considered to be mainly centred on staff time and equipment cost.

2.7 Relevance of the Evidence to the Kingdom of Saudi Arabia

The evidence from the literature demonstrates that nurses, at times, fail to recognise subtle nonspecific changes associated with deterioration prior to a critical incident, or to be skilled at articulating the significant abnormal signs of deterioration in children (Cioffi et al., 2009 & 2010; Odell et al., 2009). Of the 10 signs and symptoms of deterioration identified by van Galen et al. (2016), the main early sign of deterioration

was associated with respiration; it was also the most frequently missed vital sign record made by both adult and paediatric nurses. This may be in part the result of the lack of agreement on the value of vital signs that can be attributed to the measurement, and the frequency of monitoring required. On the other hand, there is some important progress on understanding what the reliable predictors are of the probability of adverse events, and unanimous agreement that early recognition is essential for initiating treatment for shock and the prevention of respiratory failure. More encouraging is that regardless of the staffing levels, or the time of day or week, when nurses increase surveillance and are worried enough to seek medical help, it is believed that mortality rates can be reduced.

Whilst many hospitals internationally have implemented various forms of PEWS (Fuijkschot et al. 2014; Bonafide et al., 2013.) to improve the recognition of deterioration, they are not in use within KSA at present. Yet in the findings of studies in countries where they have been implemented, both doctors and nurses agree that they were useful for monitoring the child and improving multidisciplinary communication. Whilst there are a number of disparate PEWS in current use (Lambert et al., 2017), in an international RCT in seven countries, researchers found that hospitals who use Bedside PEWS significantly reduced clinical deterioration events and late admissions to PICU (Parshuram et al., 2018). In some countries there is a move to develop a standardised national PEWS tool (Lambert et al., 2017; Clerihew, 2016). Future work in the KSA may involve implementing a standardised observation chart (with graphical display) with a PEWS for recording vital signs, combined with an escalation algorithm.

The need for training of paediatric professionals is a recurring narrative in all the evidence reviewed and is the subject of the next section. The evidence linked to the impact of education on the paediatric nurse's ability to recognise and respond to the deteriorating child is expanding. Despite this, the studies from both the UK and Australia have provided a valuable baseline on which other studies can build and expand. The evidence for this comprehensive review was sourced from international and national publications from Australia, the United Kingdom and America, and focused specifically on the deteriorating child and the nurse's ability to recognise and respond. Clearly there was significantly more national information pertaining to adult patients, and nurses' failure to deliver optimum services (McQuillan et al. 1998; NICE, 2007), as well as 'failure to rescue' studies in the USA (Silber et al., 2007; Clarke & Aiken, 2003), but none within the Middle East.

The surveillance of vital signs by nurses is considered essential to the early recognition of the deteriorating child, and whilst all the literature reviewed supported the need for training, so did a significant number of international agencies involved in maintaining quality and safety in patient care (NPSA, 2009; DHHS, 2006; ACSQHS, 2010). However, even two main reviews on adult nurses' education, by Liaw et al. (2011) and Purling and King (2012), found evidence to suggest that there was a significant deficit in their abilities. Graduate nurses reported inadequate knowledge and skill but more importantly a lack of clinical experience. A lack of clinical exposure was said to lead to feelings of uncertainty of how to respond to patients' deterioration. They call for a specific module in nurses' pre-qualifying programmes to help them overcome their fears and anxieties when faced with adverse clinical events.

2.8 Summary

Although focused educational interventions around paediatric deterioration, as described by McKay et al. (2013) in Australia, and Tume et al. (2014) in the UK, have been implemented successfully and subsequently adapted for use in other countries, they have not been implemented in the KSA. Therefore, the purpose of this review was to explore the existing evidence related to the ability of trained paediatric nurses to recognise deterioration, before embarking on research in the Saudi Arabian context to determine what impact a focused educational intervention can have on nurses' ability to recognise and respond to the deteriorating child. This review has explored the evidence base relating to the ability of nurses to recognise and respond to the deteriorating child. It provided a rationale for the review as well as a detailed account of the review strategy. It then presented a summary of the evidence organised into three themes; in-hospital recognition and response to the deteriorating child, the implementation of PEWS, and focused education aimed at improving nurses' ability to detect the physiological signs leading to deterioration. Finally, it provides a discussion focusing on the relevance of the findings to the proposed study in Saudi Arabia. It is evident from this review that research is needed within the KSA context, which this PhD study aims to address.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The aim of this chapter is to describe the methods chosen for this research. In this, the rationale for adopting a two-stage design and a justification for using both qualitative and quantitative data collection methods by means of using the Think Aloud (TA) process around clinical vignettes will be provided. The quantitative data was collected by means of a Likert-type visual analogue scale (VAS), as participants responded to three specifically designed clinical vignettes associated with the recognition of a potentially deteriorating or improving child in hospital. The qualitative data was collected during the administration of the vignettes, and by a post-vignette semi-structured interview. A description of the participants, their recruitment and the cultural and ethical issues involved in the study will be provided prior to addressing how data obtained was analysed and interpreted.

3.2 Methodology

The methodological approach adopted in this study not only contributes to the general understanding of how the research was conducted but, as Bryman (2015) claims, the strategy deployed to generate the data. It explains the philosophical stance that reflects the researcher's epistemological and ontological values and opinions, which forms the basis for the overall plan of when, where, what and how that data is collected and analysed. Cohen et al. (2013) describe ontology as the essence of the social reality being investigated, and epistemology as the foundation of how knowledge is formed.

The ontological perspective suggests that there is a particular element of objective reality that exists, which is discoverable without being dependent upon the researcher (Crotty, 2003). In the case of this study, it is the subjective reality of the graduate paediatric nurses' ability in response to the three clinical vignettes, and the objective reality of the scientific measurements derived from them. As Kvale (2007) explains, this knowledge will not be dependent on the researcher alone but rather is equivalent to discovering the reality that already exists.

The epistemological paradigm is, on the other hand, what Rose et al. (2015) describe as contrasting views between the quantitative (objectivism) and qualitative (subjectivism) data. It requires the researcher's involvement in order to uncover what can be known (Cohen et al. 2013). This is equivalent to Kvale's (2007) view of the researcher using interviews to *mine* for knowledge that can be justified across cultures, and based on the understanding of the truths, beliefs as they exist. The question that needs to be mined for understanding here is what can be known about the Saudi paediatric nurses' cognitive processes and thinking, and the meanings they have for them when undertaking the vignettes that test their ability, and when being interviewed afterwards.

In the context of this study, an understanding of the major research paradigm enables the different stages of the research process to be identified, so that the practicalities of how the participant sample can be obtained and the data then collected and analysed. Bryman (2015) suggests there are two major paradigms; positivist and interpretive in widespread use among researchers. The positivist research paradigm is based on scientific methods of measurement and analysis of objective reality. As Johnson and Onwuegbuzie (2004) state, positivist research relies on quantitative data

which focuses on deduction, tests theory or hypothesis to predict outcomes, and uses centralised data collection methods and statistical analysis. The interpretive research paradigm on the other hand, holds a constructivist viewpoint about the world, in which social context and the subjective experiences of individuals play important roles. The interpretive paradigm relies on data, which qualitative research focuses on discovery and exploration to generate a theory or a hypothesis, with the researcher as the main data collector and qualitative analyst (Thorne, 2000).

Although the quantitative and qualitative research methods have distinct differences, some researchers (Lund, 2005; Bryman, 2015) argue that these two approaches can be used in one study, and in doing so, can answer a complex research questions effectively. Therefore, this study will adopt a pragmatic approach (Onwuegbuzie, 2005) which uses the empirical lens of both quantitative and qualitative approaches. Although Kuhn (1970) considered that pragmatism was not an easy term to define because of its multiplicity of usages, nevertheless according to Crotty (2003) and Lincoln & Guba, (2000:2011) it is simply a basic set of beliefs that guide the researchers' choice of research methods. It is an approach that stems directly from the aims of the research questions (Creswell 2003), and should be evaluated in reference to the research outcomes instead of abstract principles. It is also a tactic that facilitates the researchers' prolonged engagement with the data that enables them to address multiple stances and values rather than be restricted to results from a narrow mono-methodological approach (Fendt et al., 2008; Onwuegbuzie, 2005).

According to Johnson and Onwuegbuzie (2004); Tashakkori & Teddlie, (2003); Johnson et al., (2007) the philosophical consideration of pragmatic research is that it rejects any difference between realism (positivism) and anti-realism, realism

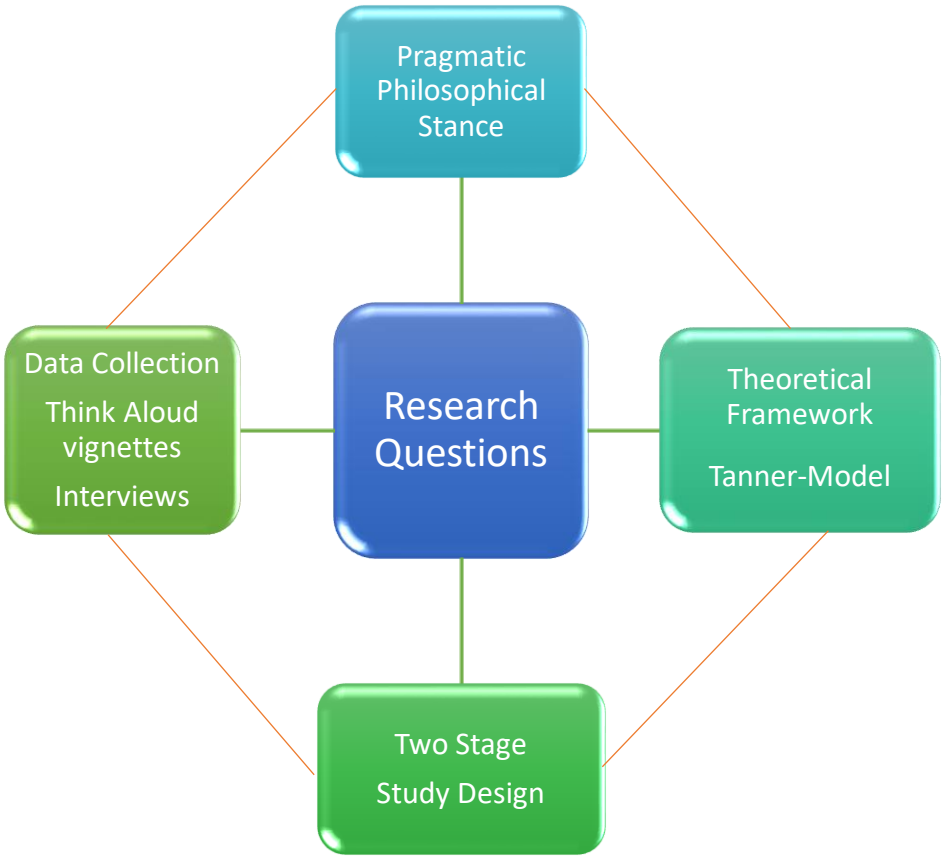
(interpretism) because no theory can fulfil its demands for objectivity, and anti-realism because almost any theory could fulfil them. It is an approach which offers a useful outcome-orientated means of inquiry which is flexible and adaptable leading to actions that helps elimination of doubt by evaluating the study by its aims, procedures and results (Patton, 2002).

The aforementioned philosophical assumptions that guide the direction of the study and the methods used focus on collecting, analysing and using both quantitative and qualitative data in a single study. The triangulation of data sources through the collection of quantitative vignette data, complemented by qualitative semi-structured interviews, provides a means of explaining and improving the quality of the scientific data (Thorne 2000, Creswell et al., 2014).

Qualitative data obtained from verbal prompts by the researcher try to capture the paediatric nurses' decision-making and thinking during the clinical vignette, which aimed to determine their ability to recognize the deteriorating child, in a theoretical but clinically relevant scenario (interview guide, Appendix 5). Secondly, semi-structured interviews following these vignettes were a means of validating the accuracy of the vignette data and exploring the perceptions and perceived ability of the paediatric nurses to recognise the deteriorating child in hospital. This also enabled exploration of their perceived training needs at baseline. The research design used in this study was pragmatic in its use of both quantitative and qualitative methods consecutively, underpinned by the Think Aloud theoretical perspective (Charters, 2003). In doing so, the researcher believes it provides a more comprehensive representation of all the paediatric nurses' clinical ability and tries to capture their thinking around this issue.

In using data to explore the differences between the groups, it is argued that the integration of disparate forms of data fits the purpose of the study and justifies its use in the interest of design completeness (Tuli, 2011). The central premise is that the use of both data collection approaches provides a better understanding of the research problems than either approach alone. Additionally, Gerrish et al. (2015) claim that using both methods in research is a means of improving the overall quality by overcoming the intrinsic bias of a single method or source, to confirm one's results and conclusions. This pragmatic approach also fits with the theoretical framework chosen to underpin this study, to capture the thinking and cognitive processes of these nurses when making decisions about clinical deterioration. The diagram (Figure 4) summaries the study elements that were informed the choice methodology, theoretical framework, and study design and data collection methods.

Figure 4: The connection between study elements



3.3 Study Design: Two Phased Quasi-Experimental

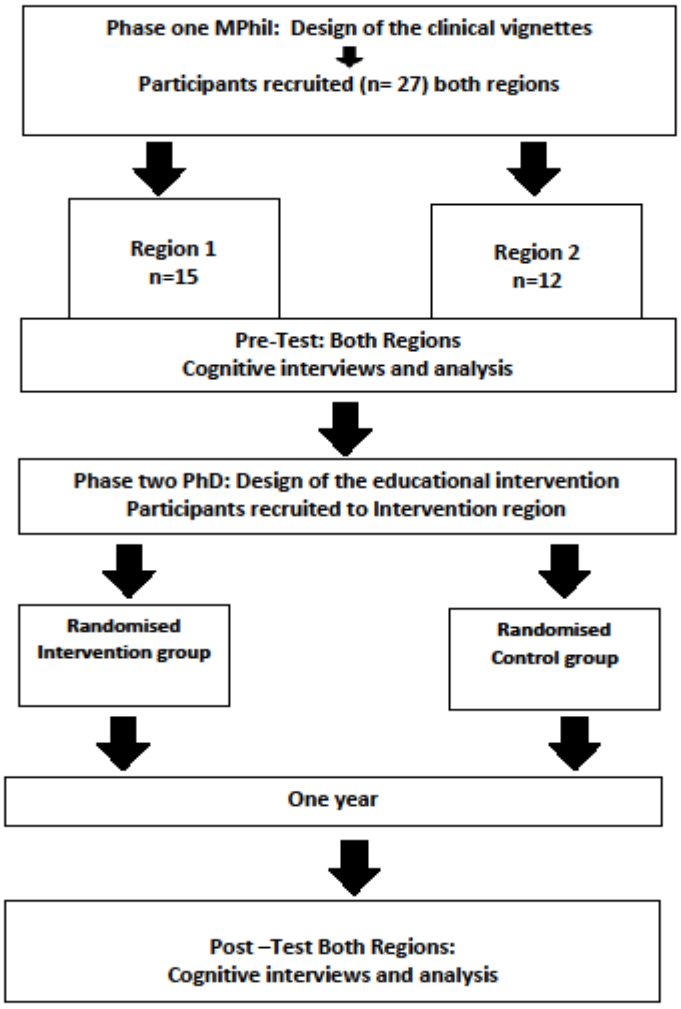
According to (Creswell, 2014) the design of a study is a specific plan that enables the researcher to achieve their objectives. Since the data was collected using two methodological approaches within and between two groups both pre- and post-intervention within one study, Gravetter & Forzano (2015) categorise the design as a two-phased quasi- experimental non-equivalent control group pre-test-post-test.

This design enables a comparison between graduate and diploma-educated nurses within two regions, or two non-equivalent groups, where both groups are measured twice; both before the proposed educational intervention and again afterwards. As Dimitrov & Rumrill (2003) argue, the changes can then be assessed by comparing the pre- and post-test results in the groups, post- the educational intervention. The changes are assumed to provide an explanation and understanding of the complexity of the factors involved in the paediatric nurses' cognitive processes when making clinical decisions.

Selection bias, which is associated with all non-equivalent group research, occurs by comparing participants' scores before the intervention to determine the degree of equivalence of the two groups. If the groups are similar before treatment, the threat of selection bias is reduced, although not eliminated (Gravetter & Forzano, 2015). Pre-test post-test research designs are most commonly used to assess the short-term effects of an intervention conducted within a limited timeframe, and are considered to be a special type of repeated measures design. The repeated measures with the same individuals were used in this study to focus primarily on those measurable learning changes that could be reasonably attributed to an educational intervention (Shadish et al., 2002). The administration of the vignettes, semi-structured interviews and an

educational intervention were conducted over a specific time-frame, as shown in the flow chart (Figure 5) below.

Figure 5: Study Flowchart



After phase one data collection in both regions, a one-day focused educational intervention was devised. This was based broadly on the effective models others have used (Avard et al., 2008; McKay et al., 2013; Tume et al., 2014) but adapted to the cultural context and needs of Saudi-Arabian nurses. One region was randomised to receive the focused educational programme (the intervention group). Three months after delivery of the educational intervention and 12 months after the first data collection, both groups were re-tested using the same vignettes and a post-vignette semi-structured interview. Ethically, and to maximise nurse recruitment and reduce attrition, the researcher committed to delivering the same focused educational intervention to the control group after the study had been completed.

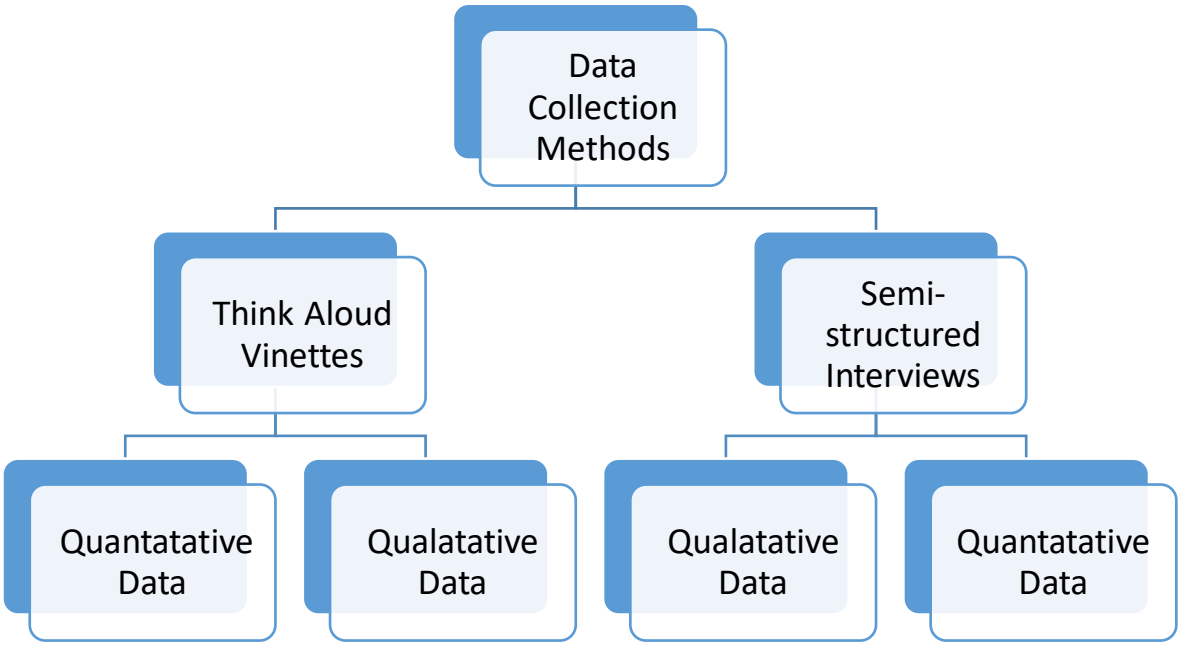
The vignettes and semi-structured interviews administered tested the ability of the nurses to both recognise changes in hospitalised children's physiological status, and gauged their confidence in dealing with their interpretation and the consequences of their findings. Given that the use of quasi-experimentation in this study is based on multiple and varied sources of evidence, in doing so it also produced a diversity of information with regard to the paediatric nurses' reality. It is therefore argued that this pilot study was an appropriate design that enabled the aims of the study to be realised.

Pilot studies do not need to be a scale model of the planned study; rather they are meant to examine the key factors, which in this study related to child deterioration identified during development of the design (Craig et al 2013). Results should be interpreted thoughtfully however, especially the assumptions made about the nurses' prior education and the number of participants that would be required if the study was rolled out across the remaining Saudi regions.

3.4 Data Collection Methods

This section is presented in three parts. First is the theoretical discussion associated with the Think Aloud approach employed in this study, which is followed by a critical discourse and justification of the clinical vignettes and the quantitative data collection methods and finally the semi-structured interviews and the qualitative methods determined by the philosophical stance adopted by the study as shown in the diagram (figure 6) below.

Figure 6: Data collection methods for phase one and two



3.4.1 Think Aloud Method of Data Collection

Think Aloud (TA) is a research method that utilises through collection and analysis the verbal reports of the participants' thoughts as they occur to them in their immediate short-term memory during an activity. It has its roots in cognitive psychology, and has been refined to be used in research since the 1980s (Ericsson & Simon, 1980). It assumes that accessible verbal protocols can be used as an objective research data collection method for both qualitative and quantitative data whist participant were engaged in a practical activity. It was originally developed as a technique for collecting data from information processing theory by the educationalists Newell and Simon in 1972.

The goal of the Think Aloud method is to give the researcher insight into the cognitive processes of working memory when solving problems (Charters 2003). There are two protocols used in TA data collection methods, namely concurrent (whilst completing an activity), and retrospective (on completion of the activity), which are combined to allow inferences to be made about both the qualitative and quantitative cognitive processes during problem-solving activities (Young, 2005).

However, van Someren (1994) suggests the method presents two validity difficulties for this study that need considering. First, the use of the clinical vignettes may interfere or slow the nurses' performance and prolong their reasoning reaction time (reactivity). Secondly, it might lead to forgetting or fabrication of some clinical information during the post-task semi-structured interviews (nonveridicality). This, as Altuntaç (2015) explains, is because the working memory has a limited capacity; information is only briefly held in it, and can rapidly fade as soon as new thought patterns replace it. Thus,

only verbal data that immediately follow a thought process can be assumed to be an accurate reflection of the nurses' conscious thoughts. Whilst Think Aloud procedures do not alter participants' performance per se, Fox et al. (2011) found in a meta-analysis of 94 studies that they do lead to prolonged reaction time. However, they also established that participants' performance was better when they were asked to explain their reasons whilst undertaking a complex task, as in this study.

Despite the aforementioned caveats, nursing educationalists saw the advantages of using this Information Processing Theory to describe how nurses adapt to the limitations of their short-term memory in order to make judgements and come to decisions (Thompson & Dowding, 2002) and thus the TA method of collecting data has been used in health care research since the late 20th century. Others have demonstrated that expert health care practitioners organise their procedural knowledge so that it can be readily accessible (Offredy & Meerabeau, 2005; Joseph & Patel, 1990; Putzier et al., 1985). They did this by using techniques that they had learned through their experiences, but significantly, they use pattern matching to determine the significance of clinical data. Whilst nurses' clinical expertise in detecting deterioration in adult patients has been researched previously (Kyriacos et al., 2011; Odell et al., 2009; Tower & Chaboyer, 2014), it has not been in paediatrics (Oliver, et al. 2010).

Since information held in the working memory can disappear as a new thought appears, Charters (2003) suggests that researchers should not only focus on the immediacy of securing the Think Aloud data but should also use an exit- or post-task interview to support analysis. The data were therefore collected in both phases of the study by audio recording elements of the decision that are spoken out loud by

participants' during their responses to the clinical vignettes and the post-task interviews; all the audio data was then transcribed verbatim for analysis.

The use of Think Aloud techniques to collect nursing clinical data specifically via clinical vignettes (real life scenarios) has been used since the 1990s, when two American researchers, Fonteyn and Grobe (1993), studied ten experienced nurses using a patient scenario. They used Think Aloud techniques to collect data on the nurses' clinical reasoning and care planning when considering an evolving set of scenarios involving a critically ill elderly patient who deteriorated over time. This enabled the researchers to understand how patient problems were characterised, and consequently the rationale used to formulate care plans to prevent further deterioration. There was however, no reported evaluation of the study, nor any recommendations made for further studies using these scenarios.

This was also the case when UK researchers Offredy & Meerabeau (2005) reported a scenario study comparing general practitioners' and nurse practitioners' diagnostic skills. Whilst the data was collected using Think Aloud techniques, using six clinical scenarios, there was an implicit acceptance that the method would allow researchers to gain an understanding of the clinicians' expertise by analysing transcripts of their tape-recorded verbalisations.

In contrast, a Swedish study by Göransson et al. (2008) explored the ability of 16 experienced registered nurses to undertake the emergency department triage process. Not only did they give a detailed justification of the use of the scenarios but they also gave a brief review of the Think Aloud process before a full description of how they were implemented. A larger study by Canadian researchers Goudreau et al.

(2014) provides a more expansive theoretical justification of the use of scenarios and the Think Aloud method, as well as developing a cognitive learning model. They used five validated patient scenarios to collect data from 41 undergraduate participants and 25 graduate nurses. Most importantly, they found that new graduates relied mostly on routines and protocols to justify their interventions, whereas the experienced nurses could also offer some form of explanation for their actions.

One UK study (Twycross & Powls, 2006) was the first study of paediatric decision - making to use both clinical scenarios and Think Aloud techniques. Twenty-seven registered nurses from a Scottish children's hospital, both experienced and newly qualified, were asked to Think Aloud whilst considering clinical scenarios in order to determine how they arrived at their decisions. Three scenarios from clinical cases were adapted for use in the research and additional information was available on request. The researchers found that there were no differences in the information used by graduate and non-graduate nurses, but that they all used non-expert decision-making strategies.

The Think Aloud method may be criticised because the use of clinical scenarios could be regarded as a contrived situation and that prompting people to continue talking may positively affect the results (van Someren, 1994). However, there is evidence that accurate data can be obtained about nurses' cognitive processes using Think Aloud techniques (Fonteyn & Fisher, 1995; Corcoran-Perry et al., 1999).

There is a growing body of evidence from international nursing research where TA techniques were successfully used to identify the cognitive process of qualified nurses in thinking, recognising and responding in various adult clinical settings (Simmons et al., 2003; Offerdy & Meerabeau., 2005; Funkesson et al., 2007; Banning, 2008; Aitken

et al., 2009; Göransson et al., 2008; MacNeela et al., 2010; Falan & Han, 2013; Tower & Chaboyer, 2014; Burbach, 2015.). The Think Aloud technique was used by Craske et al (2017) in cognitive interviews, using 'real life' clinical vignettes (based on real life cases) with children's nurses (Twycross & Powls, 2006; Greenwood, et al., 2000), justifying its use as a valid and appropriate method for this study.

It is argued therefore, that the use of concurrent TA methods to collect data whilst the paediatric nurses undertake disparate clinical vignettes is a well-recognised method and will provide evidence of the nurses' ability to interpret clinical data associated with the deteriorating child. In addition, the retrospective TA clarifies and amplifies both actions and thinking patterns used in the nurses' clinical reasoning. The paediatric nurses will therefore be asked to Think Aloud as they make their decisions about their score on the VAS, and to report only on the clinical information being considered on each vignette and their response intentions as they actually occurred to them (Payne, 1994).

The use of alternative means of collecting Think Aloud data such as simulation (Lavoie et al., 2015: Burbach et al., 2015) was discounted because of the lack of equipment. Similarly direct observation (Eisenhauer et al., 2007: Aitken et al., 2011: Greenwood et al., 2000) or video recording (Anderson-Lister, and Treharne, 2014) were rejected on the grounds of cultural concerns. However the Arabic context and specific focus of child deterioration in this study adds a new dimension to paediatric research using these techniques, and can contribute significantly to the understanding of how clinical judgements and decisions are being made by newly qualified Saudi-trained nurses working with children in hospital.

3.4.2 Positivist Approach & Design of the Clinical Vignettes

The use of positivist philosophy is the notion that it is possible that the graduate paediatric nurses' behaviour, patterns and different facets of reality can be explained in terms of facts and numbers (Lincoln & Guba, 1985). As Johnson and Onwuegbuzie (2004, p. 18) explain, positivist research relies on collecting quantitative data, which concentrates on "deduction, confirmation, theory/hypothesis testing, explanation, prediction, centralized data collection and statistical analysis". Despite its long history of scientific use and wide appeal because of its generalisability to the wider population, it is not without its critics. It is considered by many contemporary thinkers as deficient when there is a need to explore not only human behaviours but also where people's associated perceptions and feelings are considered important factors to be uncovered (Cohen et al., 2013).

This study requires graduate paediatric nurses to be objectively evaluated or measured initially, so that the results will function as a baseline for further assessments. According to Marceau and McKinlay (2013), using real patients, or in this case children, would be logistically difficult and potentially unethical. The advantages of using clinical vignettes are that they are cost-efficient, but despite this, they are open to criticism because of the fact that they are contrived. Vignettes which is a brief literary sketch of a clinical situations have been used since the 1950s. They are to simulate real events to elicit knowledge and opinions from people, including nurses, based on their responses to hypothetical clinical situations (Gould, 1996). They have not only been used extensively to evaluate the effects of general education (Lodico et al., 2010), but also medical (Peabody, 2000) and nursing education and have included paediatric nurses (Van Hulle Vincent, 2009). The first nursing

researcher to use vignettes was Flaskerud in 1979, who studied ethnic minority groups. She suggested a three-pronged approach to overcome the major criticism of internal validity. Vignettes should be developed from existing clinical case histories, submitted to a panel of experts for review, and amended if they are found to contain any vague statements.

Three clinical vignettes used here were designed for this study by the PhD student (DaifAllah Al-Thubaity) and his supervisor (Lyvonne Tume), after the student attended the RESPOND course. After review by the supervisory team, these vignettes were then sent to an independent expert clinical nurse panel consisting of an advanced nurse practitioner, PICU research nurse and paediatric staff nurse. They possessed the clinical knowledge of the clinical issues surrounding child deterioration that enabled them to critique the vignettes with reference to clarity, relevance, feasibility and appropriateness. They made suggestions for minor modifications. The vignettes were then amended to take into account these recommendations made by experts (Appendix 6).The final three vignettes reflect distinct clinical situations that paediatric nurses may experience, and were administered in the same order to all the nurses to collect the Think Aloud data. They were: Vignette 1 - Improving Child Scenario; Vignette 2 - Deteriorating Child Scenario, and; Vignette 3 - Ambiguous Scenario (where the child could be improving or deteriorating, but this was not obvious).

Before data collection, the study team and expert panel defined and categorised the three ‘correct’ results from the vignette’s ratings on a Visual Analogue Scale (VAS) (McCormack et al., 1988). The vignettes were tested with a paediatric nurse volunteer who had not been involved in their development. This also provided an opportunity for

the student researcher to practice the application of the TA technique. Another VAS was constructed to measure the nurses' confidence in their ability to recognise and respond to deteriorating children. The scales were designed to measure the nurses' opinions across a continuum of values that could not be otherwise measured (Gould et al., 2001). Each VAS was constructed to collect ordinal data on a horizontal line with a scale of 1-10 and fixed by word descriptors at each end (Appendix 7).

The nurse-perceived confidence scale was administered in an attempt to quantify their perceptions of their confidence in their decision during the semi-structured interviews, and this VAS scored was determined by measuring from the left to right hand of the line to the point that the nurses indicated. The findings to the responses to each vignette VAS are contained in the next chapter (Chapter 4).

3.4.3 Interpretive Approach & Design of the Semi-structured Interview

Following the vignettes, the nurses were interviewed using a brief semi-structured schedule (Appendix 8) to explore their perceived training needs, method of training preferred, experiences of dealing with a critical incident/deteriorating child and initiating a medical review. The interpretive approach used in this study both recognises the subjectivity of the paediatric nurses' perspectives within their social and cultural background, but also acknowledges the fact that the researcher needs to remain objective when interpreting the data (Creswell, 2013).

Adopting a qualitative method of data collection is expected to generate rich data and complement the data generated from the positivist approach, and in doing so improve the overall quality of research. The strength of this equally important data is that it is

conducted in the paediatric nurses' natural setting, immediately post-activity, and can therefore be expected to produce rich contextual descriptions of how they found the experience. It is a data collection method which is considered by both Pope and Mays (2013) and Gerrish and Lacey (2010) to lend itself naturally to nursing research.

The most widely used data collection method in qualitative studies is interviews, which can be structured along a continuum of formal to informal unstructured questions (Fielding, 2008). The semi-structured form of interview was chosen because the researcher can set up a general structure for the interview. It lets the interviewer ask the questions in the same way each time, yet gives them the flexibility to alter the sequence of the questions and prompts the interviewee to clarify their feelings about the activity.

The validity and reliability however is not dependent on the use of repeated words in the same order, but on the equivalence of meaning (Denzin & Lincoln, 2013). This ensures that the difference in answers are due to the paediatric nurses' disparate views rather than the result of the questions. The use of the semi-structured format allows the interviewer to rescue the participants from fatigue or confusion that would not be possible if any other method was being used. The role of the interviewer is not to control the interview, but offer gentle guidance to probe further for understanding when the paediatric nurses' responses are unclear.

The method may well be criticised because bias could also arise, either from within the interview process because of the expectations of those involved, or inadvertently by omitting a question. However, bias is omnipresent, not only in interviews but as

Kvale (2007) has claimed, is a function of all research methods. In addition, the interview process requires a high degree of skill on the part of the researcher. First, in being able to establish social rapport in order to facilitate a flexible, adaptable face-to-face encounter. It requires a socially, and in this case culturally and religiously, sensitive person to elicit the value-laden data (Koenig et al., 2014).

3.5 The Educational Intervention

After the phase one data collection in both regions, and dependent on the results of this, a one-day focused educational intervention was intended to be devised. This was based broadly on the models others have used (Tume et al., 2014) but adapted to the cultural context and needs of these Saudi-Arabian nurses. It was called RADAR (Appendix 9).

The one-day RADAR course had a mixed format of short lectures and scenario-based learning, and aimed to improve the ability of new Saudi graduate nurses to recognise and respond to a deteriorating child. The anticipated outcomes were to improve the recognition of “at risk” patients, to enhance the recognition of critical illness, to improve communication, to prompt earlier recognition of need for assistance, and to provide greater confidence supported by understanding and improve record-keeping and handover.

This was then delivered to the nurses (the intervention group) in one of the regions, which was randomly selected by the toss of a coin 12 months after the first data collection. Following this, both groups (three months post-intervention) were re-tested using vignettes and semi-structured interviews. The participants’ identity was assigned

a code at baseline interviews so that participants could be matched for comparison in the phase two data collection.

3.6 Description of Participants and Inclusion Criteria

The study population describes the people, objects and events that the researcher wishes to understand. The sample used in this study is a subset of that population, in other words, the paediatric nurses used here could be used to make reasoned assumptions about the whole population (Teddlie & Yu, 2007). The sampling procedure used in this study not only depended on the mixed methodology but the ease of access to sufficient Saudi-trained paediatric nurses. There are usually two approaches to sampling; probability, where people have an equal chance of being included, and non-probability as in this research, where participants are selected on the basis of availability and access. The sampling methods and the voluntary but adequate response to the researcher's request for participants, whilst necessary, did not preclude the need to also collect sufficient quality data for a realistic and reliable study.

The inclusion criteria for this study was Saudi-educated newly qualified (less than 12 months experience as a registered nurse) nurses working in children's hospital wards in two regions of Saudi Arabia. Feasibility work showed that a maximum of 34 nurses met the inclusion criteria for this study, after I contacted the nursing administration in these two regions. Participants were recruited by advertising on the staff notice boards of hospitals in both regions, and gaining permission from MOH and hospital authorities to talk to staff about the study during their regular ward meetings.

3.7 A Consideration of Ethical and Cultural Issues

The moral imperative for all researchers is that they ought to ensure that the risks to research participants should be minimized, whilst the benefits in respect to autonomy, beneficence, non-maleficence and justice are maximized (Beauchamp & Childress, 2001). Formal approvals were achieved from The University Ethics Committee (STEMH441; 12/04/2016, Appendix 10), the Saudi Ministry of Health, and their Hospital Authorities (Appendix 11, 12). Whilst the researcher received guidance and supervision from the University, the two region's health affairs administrations and the hospital authorities do not have ethics committees to consult. Despite this, the ultimate responsibility to ensure the ethical conduct of the research within the KSA remains with the researcher (Saudi Commission for Health Specialties, 2014; Hesse-Biber and Leavy, 2010). The two principles that remain the most contentious issues to address are associated with gaining informed consent and maintaining participant confidentiality. A third area of concern unique to this study, is in respect to the consideration of the Islamic cultural norms in which the study takes place (RCN, 2013).

The World Health Organisation (2009) recommends obtaining informed consent from participants that is based on an honest information-sharing process rather than merely obtaining a token signature on a consent form. Informed consent is non-coercive and ensures that consent is given freely to participation in the study (Orb *et al.* 2001). This meant the preparation and use of detailed information sheets, one for each region, which ensured the participants received sufficient and accurate information on which to base their decision to participate (Appendix 13, 14). The information sheets were designed to emphasise the voluntary nature and value of their contribution as well as clarifying the aims and objective of the study, but also highlighted their right to withdraw

from the study at any point without negative consequences. The consent form contains a number of statements that confirm that the participants understand the study and agree to take part voluntarily in the audio recorded interviews (Appendix 15, 16). Finally, separate written informed consent forms were obtained from all participants prior to both interviews. These forms were brought back to the UK and stored in a locked cabinet in a secure office, in accordance with the university policy.

Having gained consent, the participants' confidentiality was assured by guaranteeing that their identity and personal details would not be disclosed at any point during the study. Whilst personal details are necessary for the purpose of identifying the participants, once recruited they were allocated a unique code for the duration of the study (Appendix 17). The code was assigned at the baseline interviews so that participants could be matched for comparison in the phase two data collection. Any personal details were then kept separate from data, and will be stored for five years after completion of the study in accordance with the university policy (ESRC, 2015). The audio recordings were deleted once transcribed to ensure anonymity, and the transcripts stored in a password protected secure drive on the UCLan network; all the data were encrypted as per UCLan policy (Appendix 18).

In considering the unique ethical aspects of undertaking a research study in the KSA, all health care professionals are guided by the Islamic unanimity of the Code of Ethics for Healthcare Practitioners (Saudi Commission for Health Specialties, 2014). Al Aqeel (2007) was the first medical professional to establish her own Islamic framework for conducting medical research in Saudi Arabia. Similarly to the Code of Ethics, she

advises Islamic researchers to be cognisant of their participants' rights, and be attentive to *maslaha* (public interest) and *urf* (local customary precedent).

Care must be taken to prevent any explicit or implicit possibility of coercion, or to give the impression that there might be adverse consequence as a result of nurses deciding to not participate in a study. The potential for participants to mistakenly believe that they were obliged to participate in a study that had the approval of their managers exists because of the Arabic hierarchical and patriarchal culture (Hofstede, 2003). Since all the respondents in the study were female, it was incumbent on the researcher as a male to respect the cultural norms related to gender separation in Islam (Almutairi & McCarthy, 2012). Accordingly, specific arrangements were made with the nursing departments concerned to interview the nurses in the education centre. Interviews were therefore conducted in a large open unlocked classroom that provided confidentiality could be observed whilst maintaining convention rules regarding mixing in public spaces, and propriety.

3.8 Analysis of the Data

The use of the correct data analysis techniques are crucial considerations for ensuring the quality of the findings. The Think Aloud data collected by using the clinical vignettes to test the paediatric nurses' ability to recognise clinical deterioration, and the post-test interviews, were transcribed and subjected to two forms of analysis. Quantitative data was analysed using descriptive statistics and inferential statistics data, and a framework approach developed for the qualitative data.

3.8.1 Quantitative Data Analysis

The paediatric nurse sample was categorised by hospital region, qualification, age, and months of paediatric experience. Descriptive statistics were used to compare the characteristics of the respondents from the two regions. Of interest here was any marked difference between the regional samples in terms of experience and qualification level.

Data on nurse responses to the three clinical vignettes were then summarised as correct, incorrect or indeterminate. The quantitative data obtained from measuring the participants' responses to the three clinical vignettes was cross-tabulated by region and by qualification and by both.

Given that the sample sizes were small and not distributed equally either between regions or qualifications, the results are presented using mainly descriptive statistics to show both central tendencies and dispersion: percentages, dot plot diagrams and median scores (Boslaugh, 2012). These compared differences in responses between the two regions and also between qualification levels. Inferential statistics were used to further explore the nature of the differences found. Non-parametric statistics (Mann-Whitney U-test) were used to test the hypothesis that there was no difference between median scores for correct or incorrect response to the three vignettes. Confidence intervals were calculated to explore all differences between the pre-intervention proportions of correct and incorrect vignette responses and comparable results post-intervention. Analysis was carried out using IBM SPSS (v23). The pre- and post-intervention results and comparisons of the pre-post results are presented in Chapter 4.

When collecting the data indicating responses to the clinical vignettes, all nurses were asked to complete both scales in the same way. After viewing the vignette, they were asked to indicate a point from 1-10 on the scale that corresponded to how likely they thought it was that the child was improving or deteriorating. The possible score between 1-10 was then condensed into a “1” “2” “3” score which was used in the analyses as “correct” “indeterminate” “incorrect”. This transformed the score into an ordinal measure.

In the first scenario (Improving Child Scenario), the lower range 1-3 was categorised as correct and the higher range of 7-10 as incorrect. This was reversed for the second vignette (Deteriorating Child Scenario). The indeterminate responses to both these vignettes were in the 4-6 range and categorised as such. In the third vignette (Ambiguous Scenario), the 4-6 range was categorised as correct and both the lower or higher ranges were categorised as incorrect.

3.8.2 Qualitative Data Analysis

In order to analyse the semi-structured interviews and generate themes a framework approach was considered appropriate, principally because it provides the novice qualitative researcher with a structured guide to effectively manage the data (Smith & Firth, 2011). The verbatim transcripts of the interviews were organised using Nvivo 11 software, allowing the data to be interrogated and described in detail to interpret the responses the nurses gave during the semi-structured interviews (Green & Thorogood, 2014). The approach uses a series of interconnected stages until a coherent account emerges from the constant refinement of themes (Ritchie & Lewis, 2003). The advantage of the flexibility of using the framework method is that it allowed

the linking of the nurses' data to be compared pre- and post-intervention (Alhojailan, 2012). More importantly, as Patton (2002) asserts, the data produced this way presents believable accounts of the paediatric nurses' ability in relation to detecting clinical deterioration. Therefore, the data obtained from the semi-structured interview questions administered at the end of the clinical vignettes were analysed using this coding system. The findings identified the trends and cues which are apparent in the work of the newly qualified nurse working on a paediatric ward.

3.8.3 The approach to The Qualitative Data Analysis

All the data collected using the Think Aloud (Van Someren et al., 1994) technique during the administration of the three clinical vignettes and the semi-structured interviews was transcribed. Those interviews conducted in English were transcribed verbatim, whilst those conducted in Arabic were translated into English and then back to Arabic to ensure meaning was preserved. The transcripts were then imported into an NVivo 11 pro computer programme to facilitate the datum management (Green & Thorogood, 2014) and to facilitate analysis using a Framework Approach *(*Ritchie & Spencer, 2001*).* This is a strategy which Pope and May (2013) consider appropriate when analysing interview data when the objectives of the interviews are predetermined and, as in this study, linked to quantitative data. Although inductive, Ritchie & Spencer (2001) describe the strengths of the approach as comprehensive and open to change, but also systematic in establishing the significant connections, in this study, between the nurses' opinions. The purpose of this type of analysis was to establish the similarities and disparate views in order to confirm their meaning and importance (Smith & Firth, 2011).

The Framework Approach was first developed in the 1980s by the UK National Centre for Social Research from the matrix-based method of qualitative analysis as described by Miles and Huberman (1994). It shares some similarities with thematic analyis in the intital phase of identifying themes, but requires the researcher to interrogate the original transcripts, continually moving between different levels of data abstraction throughout five distinct but interconnected stages: *Familiarisation, Identifying a thematic framework, Indexing, Charting and Mapping, and Interpretation*. The structured framework approach recommended by Ritchie & Spencer (2001) is a method of qualitative analysis which healthcare researchers have found particularly invaluable in giving them a means of demonstrating rigour by improving transparency (Smith & Firth, 2011). The findings from the analysis of the semi-structured interviews allowed the nurses' data to be compared between regions and between graduate and diploma nurses. In addition, the qualitative Think Aloud data from the three vignettes supports and illuminates the quantitative findings from the three vignettes.

Whilst the NVivo pro software program maximizes efficiency by facilitating ideas to be linked to nodes, the researcher determines cases and sources, the interpretation of the data and decisions on the coding. The main advantage of using NVivo software was the ability to view the density of the coding and relationships between categories and cases (King, 2004, p. 263). However, identifying themes across the data is only reliable if the data is organised into the relevant nodes. These can then be searched using hyperlinks between sources and summarised to find connections that would be time-consuming if done manually.

For clarity, the three vignettes presented to the nurses were; the Improving Child Scenario, the Deteriorating Child Scenario, and an Ambiguous Scenario, and they were administered consistently in this order to all participants (Appendix 6).

3.8.3.1 Familiarisation

The accuracy of the transcripts was checked with the audio tapes prior to adopting the structured analysis. The administration of the vignettes and interviews were undertaken in two regions in Saudi Arabia, and then transcribed on site ready for analysis on return to the UK. The memory of what transpired, as Pope et al. (2013) indicates, can only be partially recalled. Consequently, the first stage in the analysis was to become reacquainted with both the audio recordings and the transcripts for each nurse participant. Then the transcript data were copied and sorted electronically into NVivo nodes pertaining to all three vignettes and the interview questions for each nurse participant. Once organised, the transcripts were re-read to decide the meaning of the phrases, particular sentences and paragraphs.

3.8.3.2 Thematic Framework

The Framework Method sits within a general set of qualitative analysis methods often termed thematic framework or content analysis (Gale et al. 2013), its essential attribute is the use of rows and columns that divide and summarise how the researcher structured and systematically reduced the data. The method relies on identifying the common and different data, prior to centring on the relationships in different parts in order to illustrate and interpret the data around themes.

Once the transcripts had been examined in detail, the process of identifying themes and subthemes was undertaken; the purpose of which was to elicit the substance of the nurses' opinions and ability. Themes in this study were the concepts derived from the ideas that emerged from the researcher's initial thoughts; these arose from the predetermined codes which derived from the vignettes and semi-structured interviews (Vaismoradi, 2016). The use of some common words and phrases became apparent from the researcher's immersion in the transcripts. The initial themes, subthemes and index were developed and refined and used to organise the data. An example of which is outlined in Table 4.

Table 4: Development of Theme from Transcripts

Interview Transcript	Code	Initial thoughts	Theme	Subthemes
T21: "---if the colour becomes different, lips become blue, or the eyes, in these situations I'll recognise , --- I don't have enough experience, I'm still new and afraid of mistakes."	Ability to Respond	Aware of not having enough experience and again new	Experience and Training	Passive Bystanders
B50: "--- because I'm still new , but sometimes by inspection of the skin colour, vital signs, because he can't talk so these signs will tell me about him, also the sucking of the newborn if active or not, but I feel I'm still not expert."	Ability to Recognise	New as rationale and not feeling an expert.		

3.8.3.3 Indexing

Indexing involved a process that highlighted the descriptive data that the three themes and five subthemes referred to in much the same way that a subject index does in a book. The index illuminated key parts of text, and the meaning of the words applied to the participant's data was constructed (Ritchie & Lewis, 2003).

Applying the index (Table 5) involved not only deciding on the meaning but also making judgements of the significance of that meaning within the response to the particular semi-structured question in the context of the interview (Pope & Mays, 2013).

Table 5: Applying Indexing

Transcript	Themes	Subthemes
"Aaaa because I feel still I'm not expert in my work, still I didn't work in many departments, I worked only in one department."	Experience and Training	Passive bystanders
"I want and I'm afraid of that moment when I am alone...		Absence of training and experience
critical case and nobody around me, then I'll not be able to help the child, but I'm trying to learn by myself on you tube.		
If I am worried and no solution yes I will call him.		Deference to the doctor.
I cannot do anything without the doctor's order."		

3.8.3.4 Charting

The next step is to construct a set of thematic matrices (Smith & Firth, 2011). The three themes and five subthemes were collated into a separate thematic chart generated by the study (Table 6). The level of nurses' training to be compared were allocated a column on the chart, and each region assigned a particular row on the chart. The main characteristics of their responses were used in selecting the sample for inclusion so that the analysis developed. The chart then contains the distilled summaries of views and opinions of the nurses for abstraction and synthesis.

Table 6: Example of Charting

Theme 2 An absence of focused training on paediatric deterioration		
Level	Graduate Nurses	Diploma
Region 1	"No only in university in the module of paediatric nursing" T19	"--at work, only I have CPR training".T17
Region 2		"No only CPR training" B62

3.8.3.5 Mapping and Interpreting

The final phase is the process of mapping and interpretation and is influenced not only by the themes and subthemes that emerged but also by the original research aim. The charts were reviewed; the patterns in the data were then pulled together. The researcher examined the transcripts again in order to find associations between themes so that explanations could be included in the findings that follow (Silverman, 2013).

3.9 Ensuring Validity, Reliability and Rigour

The validity of any research depends on the extent to which the inferences made from the researcher's interpretation of the results are sound. According to Goodwin and Leech (2003), validity is viewed as a single concept, with construct validity as the central theme. It indicates the degree to which the results of the clinical vignette scores actually relate to the nurses' ability to recognise clinical deterioration. To judge the soundness of the results, the researcher must gather usable evidence. An evaluation of construct validity may rely on content-related evidence obtained not only from the

integrative literature review presented in Chapter 2, but also by careful population sampling.

Access to the population in this study was agreed by the Saudi Ministry of Health Affairs and their Hospital Authorities, and it could be argued this resulted in an intervention bias. This type of bias, according to Larzelere et al. (2004), may be a significant but not normally a recognised threat to internal validity if controlled by adhering to rigorous ethical procedures. Reliability concerns the extent to which the clinical vignettes will produce consistent measurements of the paediatric nurses' ability over time. The vignettes and the interviewing technique must be stable over time so that the participants' experience broadly the same experiences if they undertake the test at another time. Equivalence is intended to be tested by using the two forms of interviewing along a qualitative and quantitative continuum administered to the same paediatric nurses. The clinical vignettes and the post-test semi-structured questions were developed and verified by independent clinical experts and were pilot-tested on one UK nurse.

Reliability in scoring and coding the data is not sufficient evidence for validity in using a two phased methodology. The positivist position assumes that there is a physical reality which exists independent of experience. It assumes objective knowledge that can be assessed for its veracity by direct testing and can be generalisable (Cohen, Monion & Morrison, 2013). The interpretivists take a contrary view of knowledge derived from research, acknowledging that it can only ever be the representation of one particular point of view, and use a different set of criterion (Patton 2002). Internal validity is instead considered as the credibility or trustworthiness of the interview

account of the nurses' experiences of completing the clinical vignettes. External validity is the applicability of the paediatric nurses' descriptive accounts of their abilities compared to others, whereas dependability is the term used to explain reliability of the method in the choices made by the researcher during data analysis. The final criterion used concerns the neutrality of the evidence. This is demonstrated by how the researcher demonstrates that the findings are fully grounded in the data, and where the findings from the integrative literature review inform the analysis rather than direct it.

The procedures described by Braun & Clarke (2006, p. 96) for the qualitative data were used to produce the findings and are discussed in the next chapter. However, they advise careful transcription and checking to produce a coherent and consistent description of the data to ensure rigour. Qualitative researchers sometimes keep a reflexive diary when undertaking the interviews, coded and then sent to an expert external reviewer for checking of identified themes from the transcripts. This ensures reliability of interpretation and presenting quotations as supporting evidence, to validate that interpretation (Patton, 2002). In some studies, the transcripts and themes are reviewed by the participants for verification of interpretation. However, this was not regarded as appropriate in this situation as it would have interfered with and created participant bias for the second phase of the study.

3.10 Summary

This chapter has discussed the appropriateness of using a two-phased quantitative and qualitative methodology and a Think Aloud approach to collecting both quantitative and qualitative data associated with Saudi-trained paediatric nurses'

ability to recognise clinical deterioration. It also provided a description of the sample and a critique of the complex ethical and cultural issues of undertaking the study in the KSA with a very small, purposeful sample of participants.

CHAPTER 4: RESULTS I; QUANTITATIVE FINDINGS

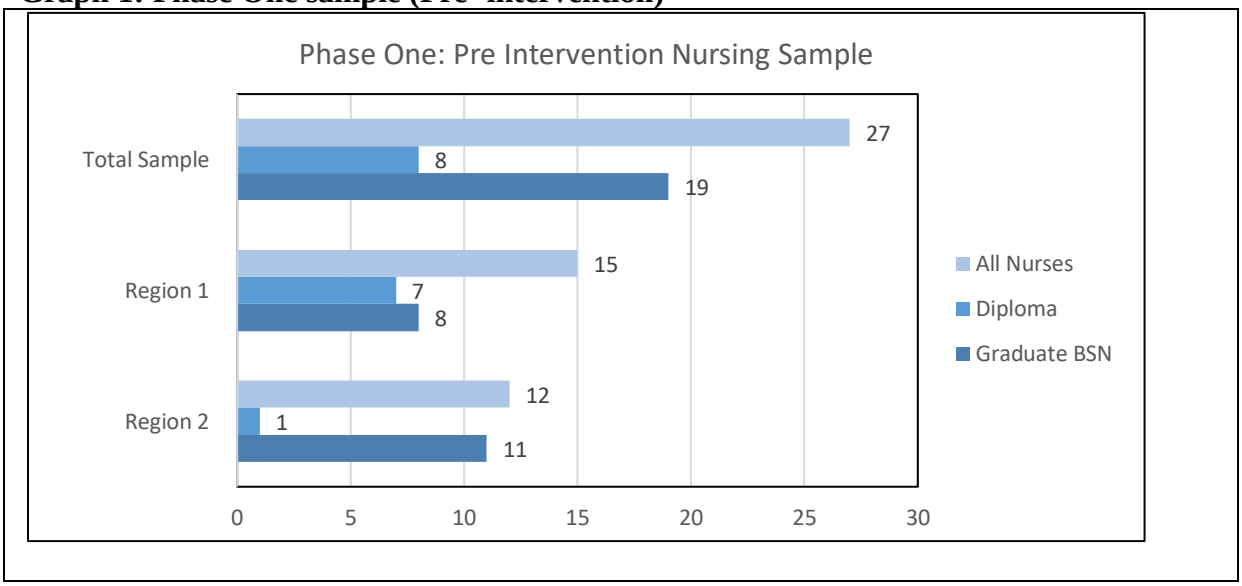
4.1 Introduction

The aim of this chapter is to present the findings from the administration of three clinical vignettes using the Think Aloud technique to collect the quantitative data for this part of the study. The participants took part in an audio tape-recorded vignette interview, which gave the researcher insights into the participant's cognitive processes during the task performance. In phase one, the participants' responses to the Visual Analogue Scale (VAS) were analysed to determine a baseline assessment of their current ability to differentiate between the disparate clinical scenarios. In phase two (post-intervention), the responses from the two groups (intervention and control) were again analysed to determine the changes in the nurses' ability.

4.2 Phase One (Pre-Intervention) Results

Twenty-seven newly qualified paediatric nurses from both regions participated between March and April 2016. All were female, between 23-30 years of age and had between 1-12 months experience post qualifying. Of those, 15 were from Region 1 and 12 were from Region 2. The sample was further divided by qualification, so that comparisons could be made between diploma and graduate Saudi-trained nurses. There were 19 graduate-educated nurses of which eight were from Region 1 and 11 were from Region 2; of the eight diploma-educated nurses, seven were from Region 1 and one was from Region 2 (Graph 1).

Graph 1: Phase One sample (Pre- intervention)



Each of the three vignettes (scenarios) asked the nurses to complete two VAS (McCormack et al., 1988 (Appendix 7). As previously described, the nurses were shown each of the scales and asked to indicate a point on the scale that corresponded to their perceptions of both how likely they thought the child was to deteriorate, and how confident they were in recognising and responding to a deteriorating child.

4.2.1 Results from Both Regions

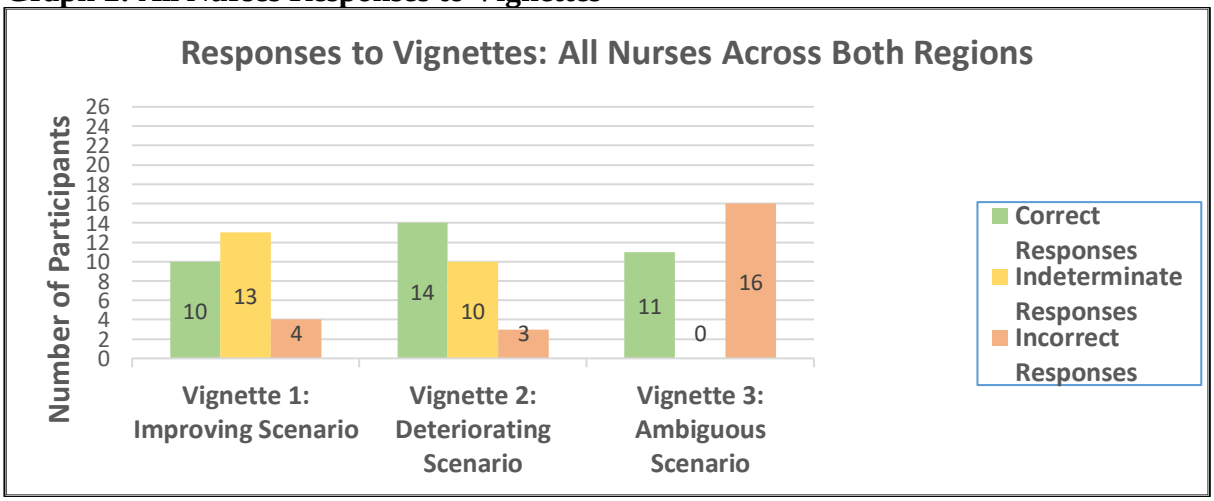
When the results of the VAS scores from all the nurses were analysed they were categorised into one of three response groups: correct, indeterminate or incorrect, as explained on page 114 (Chapter 3). Table 7 shows the responses from all the nurses to the three vignettes.

Table 7: Responses to Vignette Scenarios: All nurses across both regions.

	Correct Responses	Indeterminate Responses	Incorrect Responses	Totals
Vignette 1: Improving Child Scenario Correct VAS 1-3	10 (37%)	13 (48%)	4 (15%)	27 (100%)
Vignette 2: Deteriorating Child Scenario Correct VAS 7-10	14 (52%)	10 (37%)	3 (11%)	27 (100%)
Vignette 3: Ambiguous Scenario Correct VAS 4-6	11 (41%)	0%	16 (59%)	27 (100%)
Total possible responses	**Total Correct**	**Total Indeterminate**	**Total Incorrect**	**Total Responses**
All Vignettes	35 (43%)	23 (28%)	23 (28%)	81 (100%)

The results demonstrate that out of 81 overall possible responses, there were more correct responses than either indeterminate or incorrect responses to the three scenarios. However, none of the nurses correctly responded to all three vignettes, and four nurses responded incorrectly to all three vignettes. Overall, the nurses performed better on the Deteriorating Child Scenario compared to the other two. The worst responses were to the Improving Child Scenario and the Ambiguous Scenario (Graph 2).

Graph 2: All Nurses Responses to Vignettes



4.2.2 Results from Both Regions and by Nurse Qualification

When the results for the regions were tabulated (Table 8) it can be seen that overall, nurses in both Region 1 and Region 2 produced their best results in the Deteriorating Child Scenario, with n=9 (60%) and n5 (42%) respectively. Overall, nurses in Region 2 gave more incorrect n=12 (33%) and indeterminate n=13 (36%) answers than nurses in Region 1, whose incorrect scores were n=11 (24%) and indeterminate scores were n=10 (22%).

Table 8: Comparison Between Regions in Responses to Vignette Scenarios.

	Correct Responses		**Indeterminate Responses**		**Incorrect Responses**	
	Region 1	**Region 2**	**Region 1**	**Region 2**	**Region 1**	**Region 2**
Vignette 1: Improving Child Scenario VAS 1-3	7/15 (47%)	3/12 (25%)	4/15 (27%)	9/12 (75%)	4/15 (27%)	0 (0%)
Vignette 2: Deteriorating Child Scenario VAS 7-10	9/15 (60%)	5/12 (42%)	6/15 (40%)	4/12 (33.3%)	0 (0%)	3/12 (25%)
Vignette 3: Ambiguous Scenario VAS 4-6	8/15 (53%)	3/12 (25%)	0 (0%)	0 (0%)	7/15 (47%)	9/12 (75%)
Total possible responses	**Total Correct**		**Total Indeterminate**		**Total Incorrect**	
All Vignettes	**24/45 (53%)**	**11/36 (31%)**	**10 (22%)**	**13/36 (36%)**	**11/45 (24%)**	**12/36 (33%)**

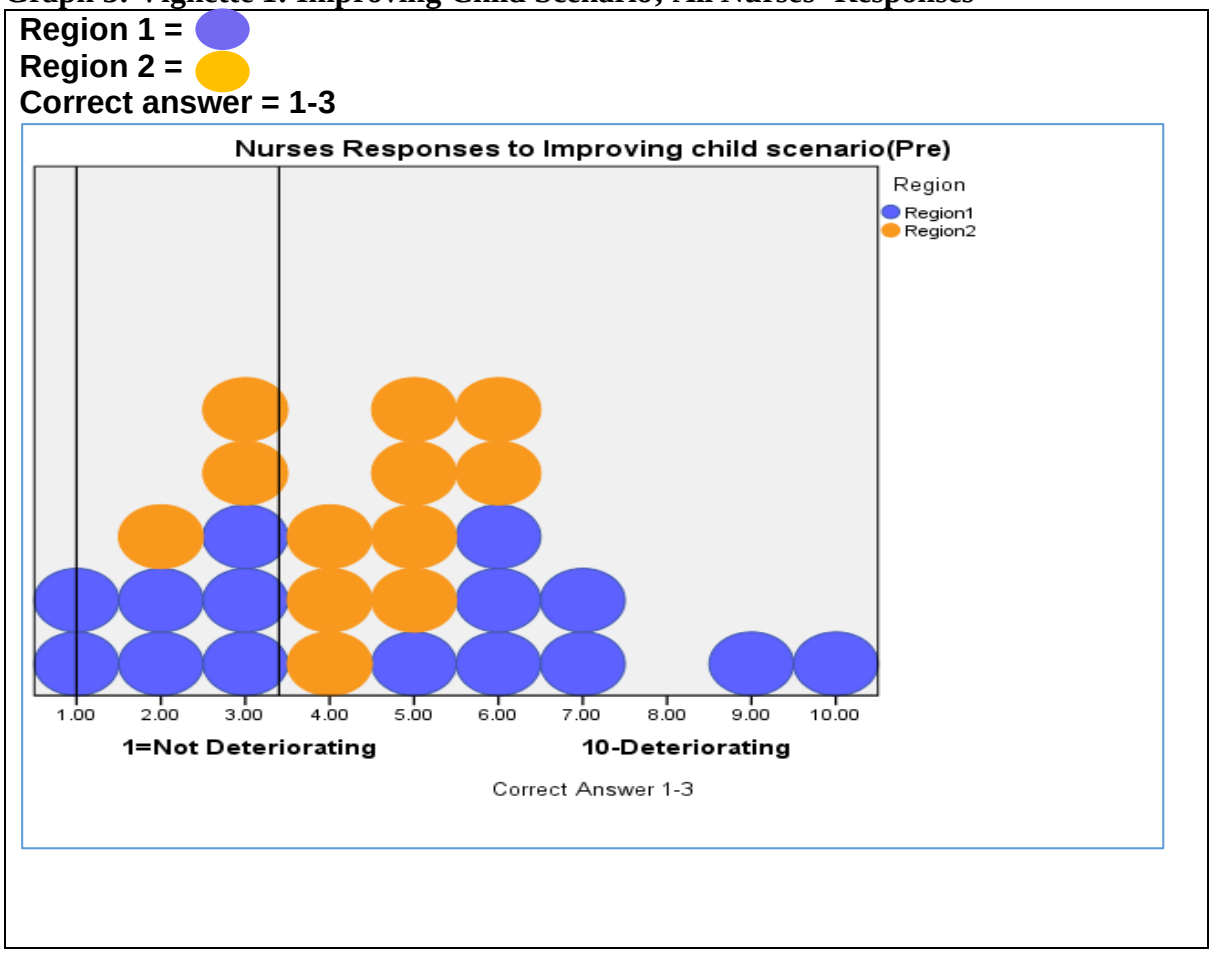
The distribution of the nurses' scores were plotted, and are displayed in dot plots, to provide a more detailed comparison of the results for each of the three vignettes.

4.2.2.1 Vignette 1: The Improving Child Scenario

In Table 8, it can be seen that nurses in Region 1 (n=7) achieved 47% of correct responses and in Region 2 (n=3) only 25% of correct answers. Of the remaining responses, incorrect and indeterminate results were seen in 53% of Region 1 nurses (n=8) and 75% (n=9) of Region 2 nurses.

In the dot plot (Graph 3), the correct response to vignette one (the Improving Child Scenario) was in the range of 1-3. When the results of vignette one were plotted, the range of responses for both regions was 1-10 with a median score of 5. The majority n=13 (48%) of incorrect scores were located in the indeterminate range of 4-6, with Region 2 accounting for n=9 (75%) of the incorrect responses. Differences between median scores were tested using the Mann-Whitney Test (Mann-Whitney test; p=0.792).

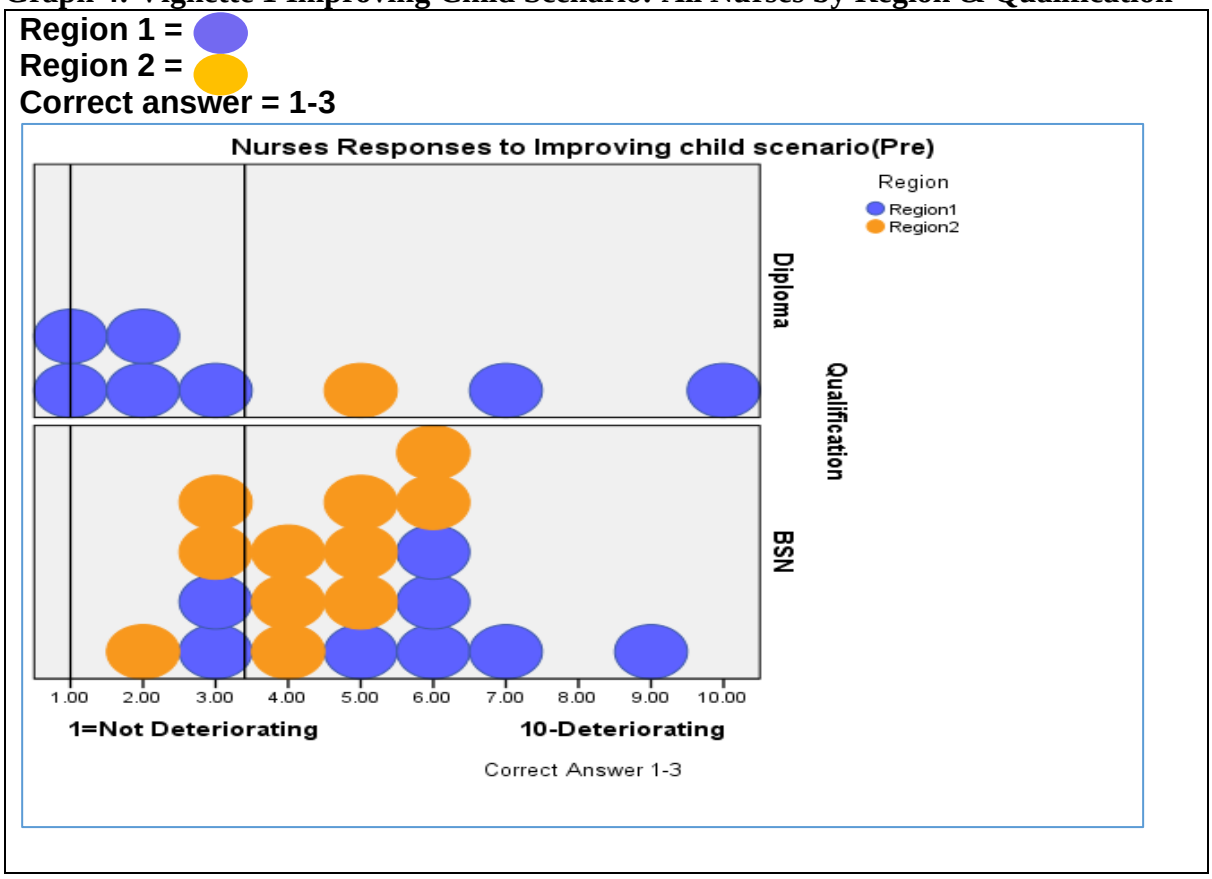
Graph 3: Vignette 1: Improving Child Scenario; All Nurses' Responses



A dot plot was constructed to compare the responses to vignette one (Improving Child Scenario). Graph 4 sub-divides region samples by nurse qualification; the diploma nurses' responses ranged from 1-10 with a median of 2.5, compared to the graduate nurses with a response range from 2- 9 and a median of 5.

The majority n=5 (71%) of the diploma nurses correctly responded to the first scenario, with n=2 (29%) responding incorrectly. The majority of graduates n=14 (74%) from both regions responded incorrectly to this scenario, but overall Region 2 performed marginally better than Region 1 and had fewer outliers. Of the n=11 graduates in Region 2, only three (27%) gave the correct response, and Region 1 also underperformed with only two (25%) of the eight graduates in the sample responding correctly.

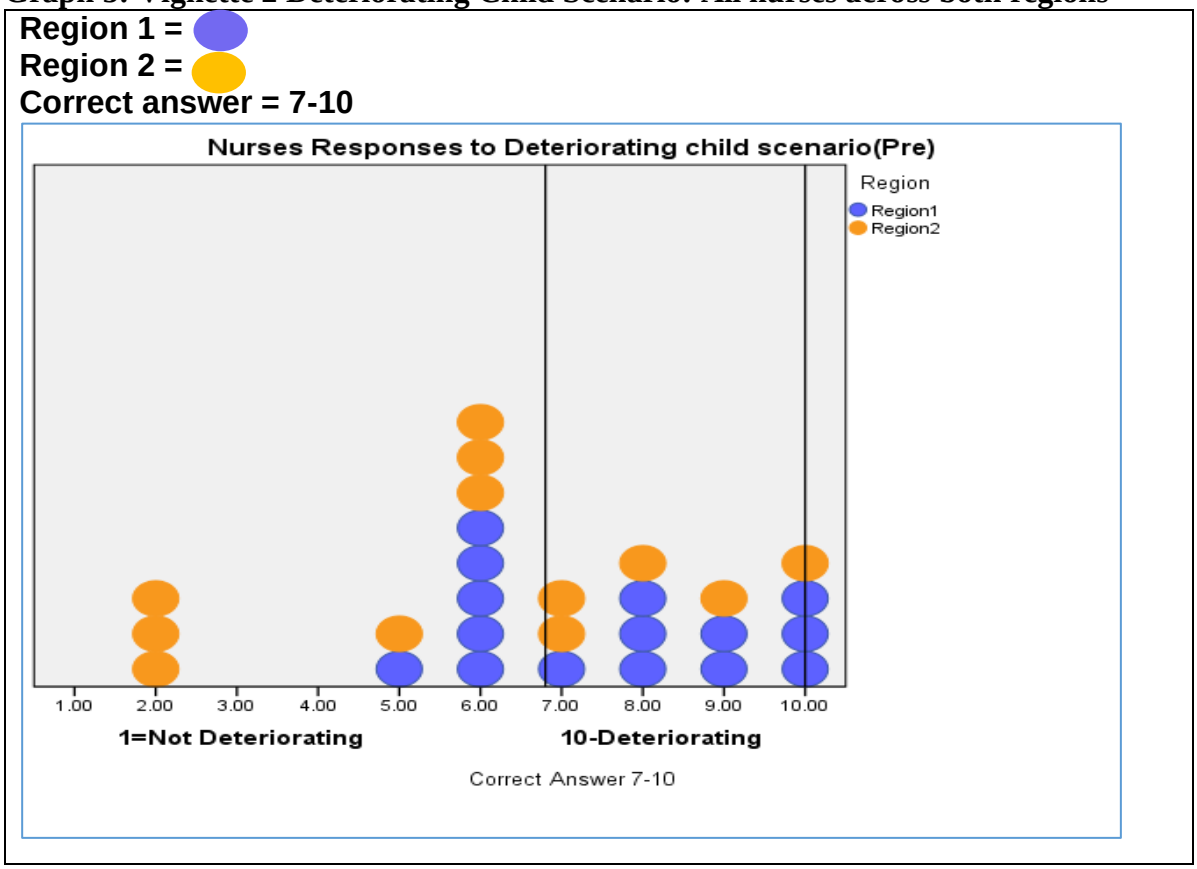
Graph 4: Vignette 1 Improving Child Scenario: All Nurses by Region & Qualification



4.2.2.2 Vignette 2: The Deteriorating Child Scenario

In vignette two the correct response was in the 7-10 range (Graph 5 and 6). Just over half of the nurses (52%) responded correctly across both regions. The range of responses were between 2-10 with a median of 7. The dispersion of the nurses' responses was concentrated around the correct scores for the majority (60%) of the Region 1 nurses, with a median of 8. This was compared to the majority of the Region 2 nurses where 58% responded incorrectly with a median score of 5.

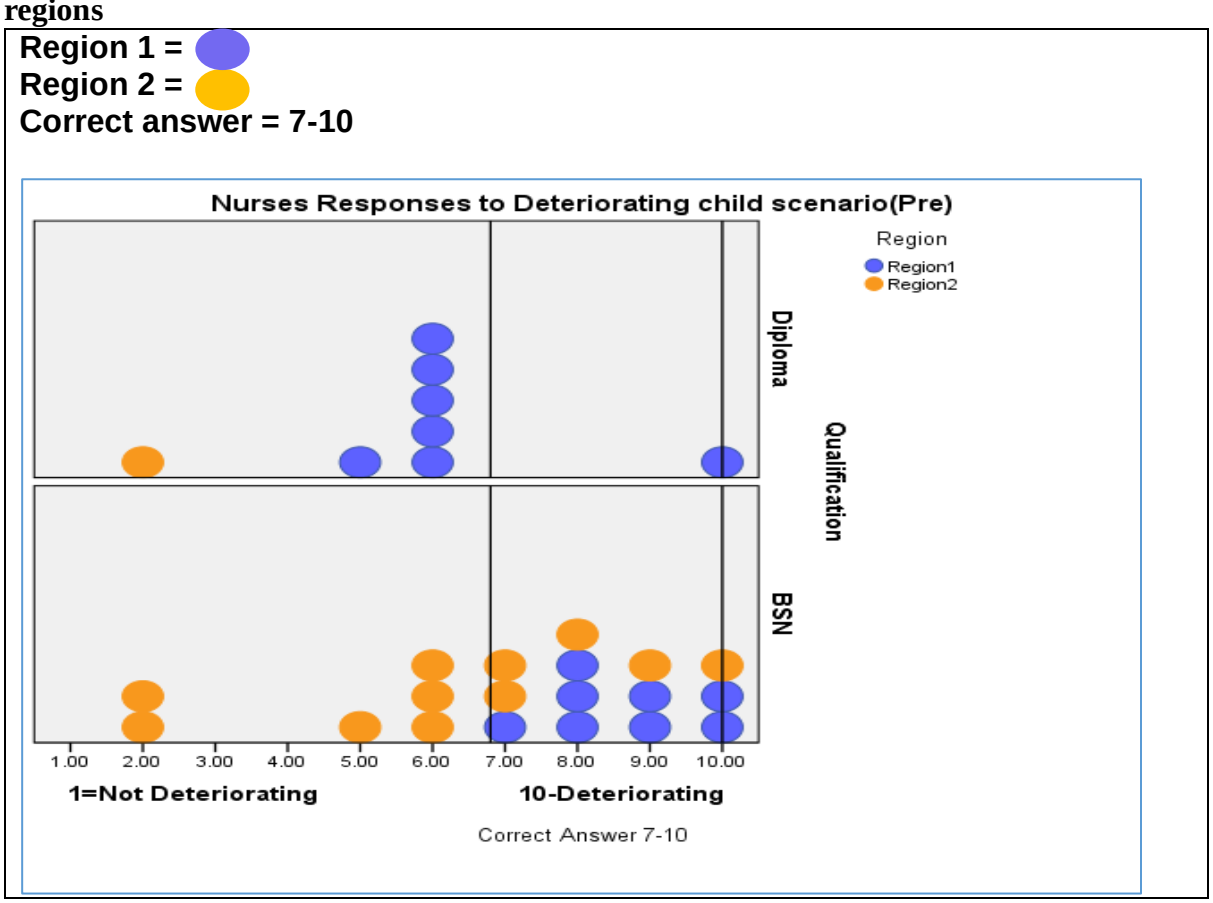
Graph 5: Vignette 2 Deteriorating Child Scenario: All nurses across both regions



The graduate nurses' responses were more widely dispersed in the Deteriorating Child Scenario, with a range of 2-10 but were more accurate with a median of 8. This is

compared to that of the diploma-level trained nurses of which (87%) were from Region 1 and whom had a range of responses concentrated around a median of 6. Only one (13%) diploma-level nurse from Region 1 responded correctly to this scenario compared to eight (53%) graduates from the same region and three (25%) from Region 2. Graduates from Region 2 underperformed compared to Region 1 with six (55%) responding incorrectly to suspected deterioration. Differences between median scores were tested (Mann-Whitney test; p=0.114).

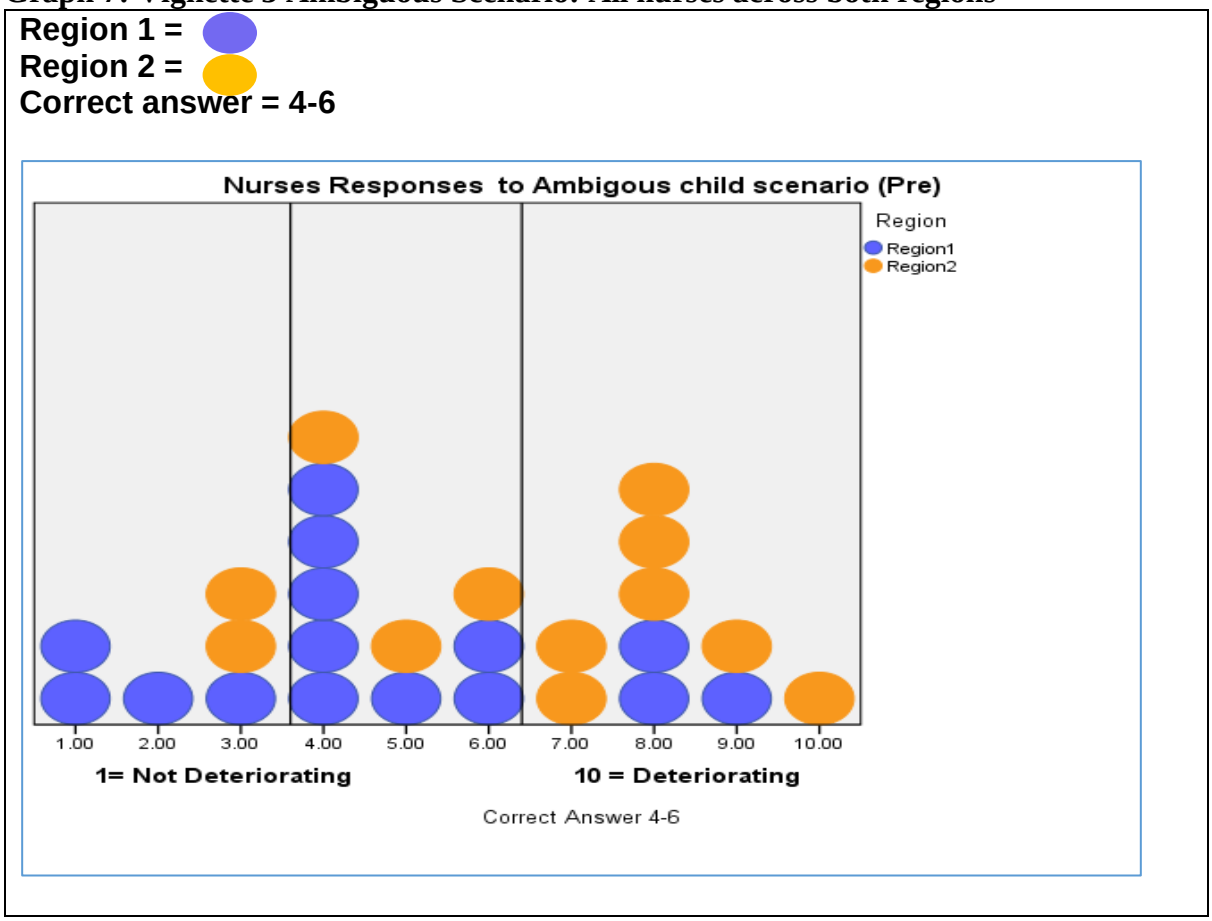
Graph 6: Vignette 2 Deteriorating Child Scenario: All nurses by qualifications & by regions



4.2.2.3 Vignette 3: The Ambiguous Scenario (the child might be either improving or deteriorating; intentionally ambiguous)

For vignette 3, the correct response was in the 4-6 range. The dispersion in the nurses' responses (Graph 7 and 8) across both regions had a median of 7 and a range of 1-10. It can been seen that in the Ambiguous Scenario the majority of nurses across both regions (60%) answered incorrectly. The nurses from Region 1 that correctly responded to this scenario (30%) were in a range of 1-9 with a median of 5. This is compared to three (10%) from Region 2 with the correct scores and a range of responses from 3 -10 with a median score of 7 (Mann-Whitney test; p=0.075).

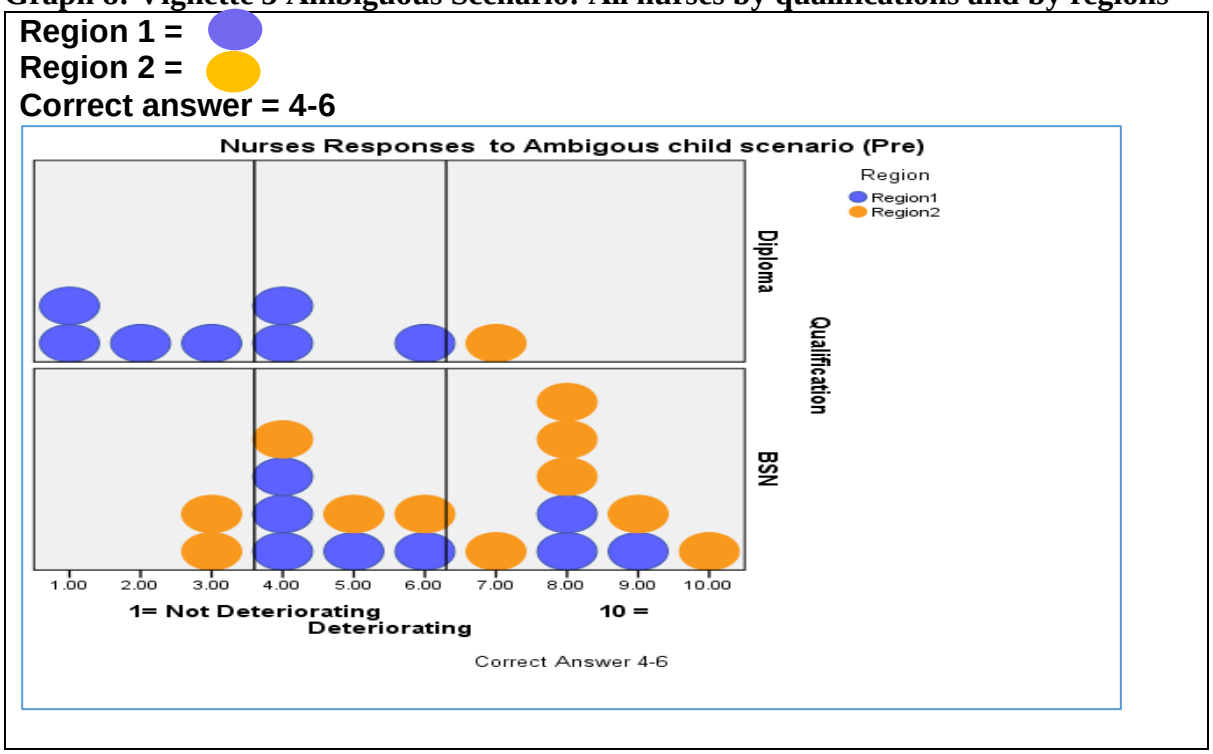
Graph 7: Vignette 3 Ambiguous Scenario: All nurses across both regions



When the regional differences in nurse qualifications were examined, there were marginally more graduates (33%) from Region 1 providing the correct response within

a range of scores from 4-9 and a median of 6. This is compared to Region 2 where only (25 %) graduate nurses provided the correct responses within a range of scores from 3-10 with a median score of 6.

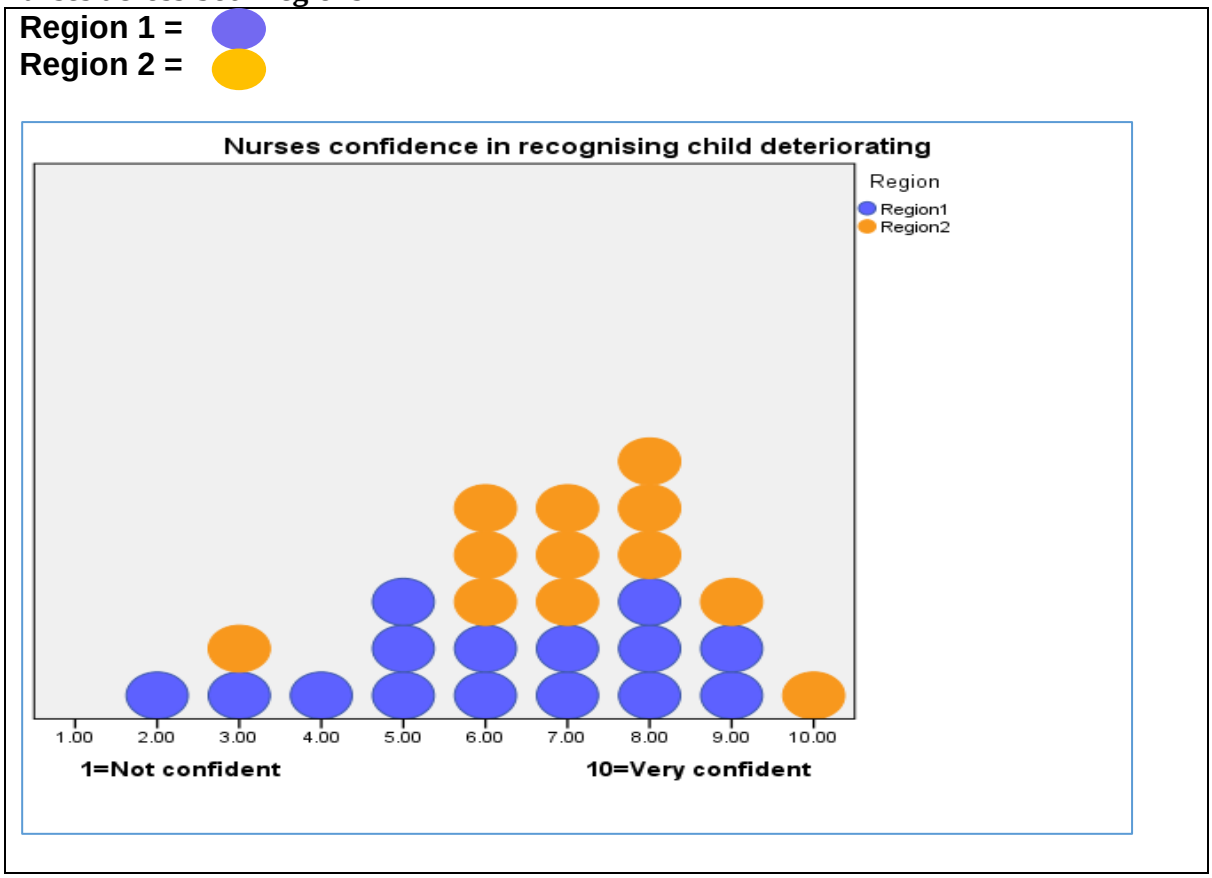
Graph 8: Vignette 3 Ambiguous Scenario: All nurses by qualifications and by regions



4.2.2.4 Nurses' Perceived Confidence Level in Recognising and Responding to Deteriorating Child Scenario

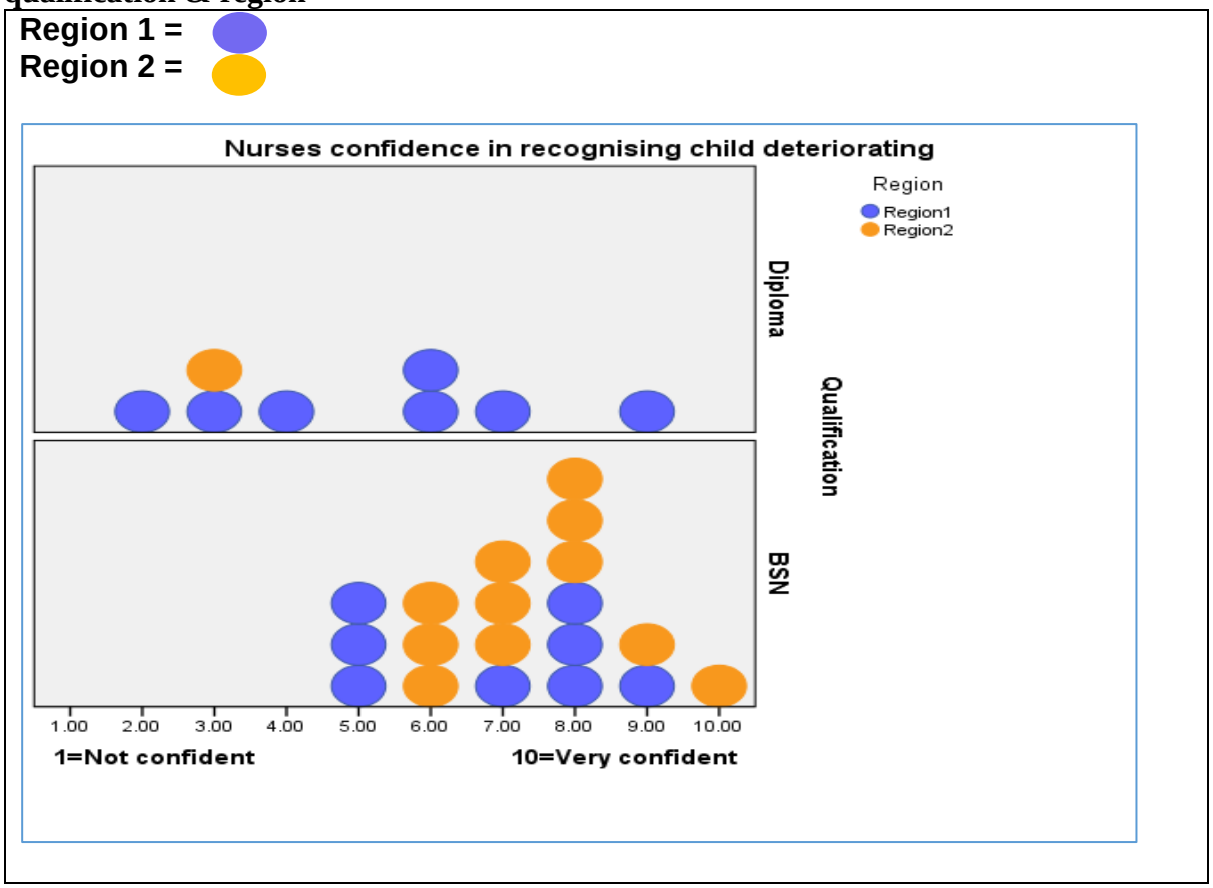
The nurses were asked to rate how confident they were about their decision to recognise the deteriorating child in the scenario [1] and then how confident they were in being able to respond to this scenario [2] . Both these confidence levels were captured and measured using a VAS with a range of 1-10, with one being the least confident and 10 being the most confident. In the dot plot of both regions (Graph 9), produced to measure the results from their decision to respond, it can be seen that the responses from Region 1 were in the range of 2-9 with a median of 6, and for Region 2 the range was slightly higher at 3-10 with a median of 7.

Graph 9: Nurses' perceived confidence level in recognition of deteriorating child: All nurses across both regions



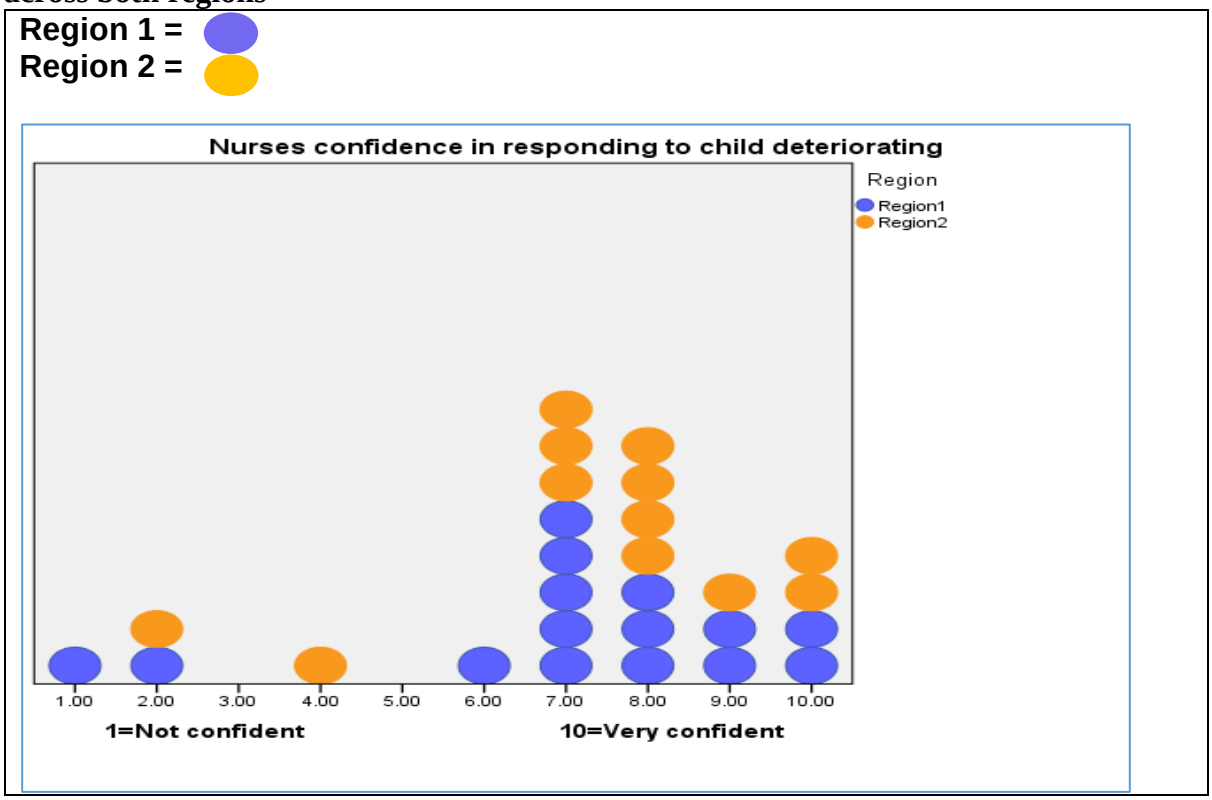
When the VAS recognition of child deterioration confidence levels were plotted for comparison by nurse qualification (Graph 10), the graduates were more confident than diploma nurses overall. Diploma-level nurses in Region 1 also had the widest dispersion of results in a range of 2-9, with 3/7 (42%) nurses scoring below 4. Graduates in Region 2 were the more confident than nurses from Region 1, with a range of 6-10 compared with a wider dispersion of results ranging from 2-9.

Graph 10: Nurses' perceived confidence level in recognition of deteriorating child: By qualification & region



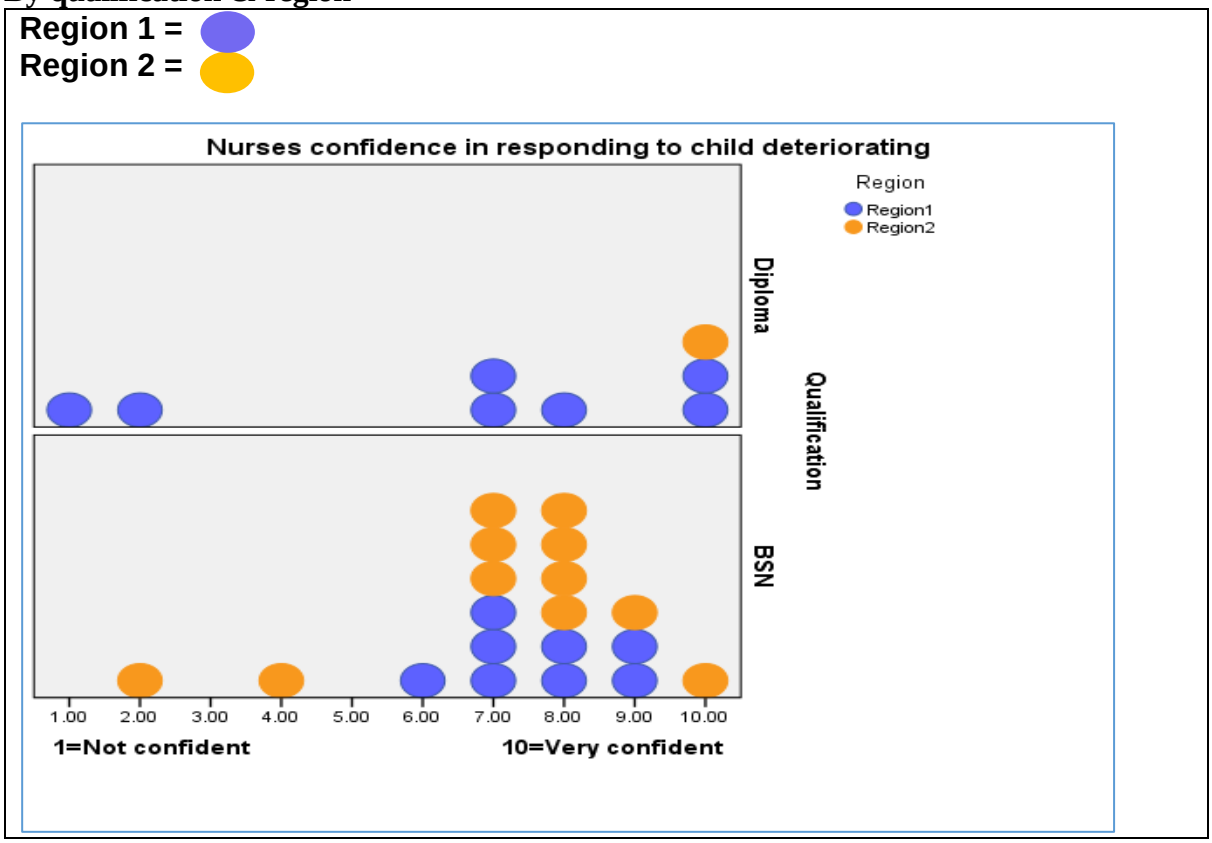
However, when all the nurses from both regions were asked to indicate their level of confidence in being able to respond to the deteriorating child, their plotted scores were more widely dispersed (Graph 11). In Region 1 scores ranged from 1-10, and in Region 2 from 2-10. Across both regions the majority of nurses' responses were in the high confidence range (7-8) (53%) for Region 1 (58%) with only a few being very confident and a few very under-confident in their ability.

Graph 11: Nurses' perceived confidence in responding to deteriorating child: All nurses across both regions



The widest dispersion of scores and the nurses who were least confident at responding to deterioration were the diploma-level nurses in Region 1, with the graduates from Regions 1 and 2 displaying the most confidence in their ability to respond (Graph 12).

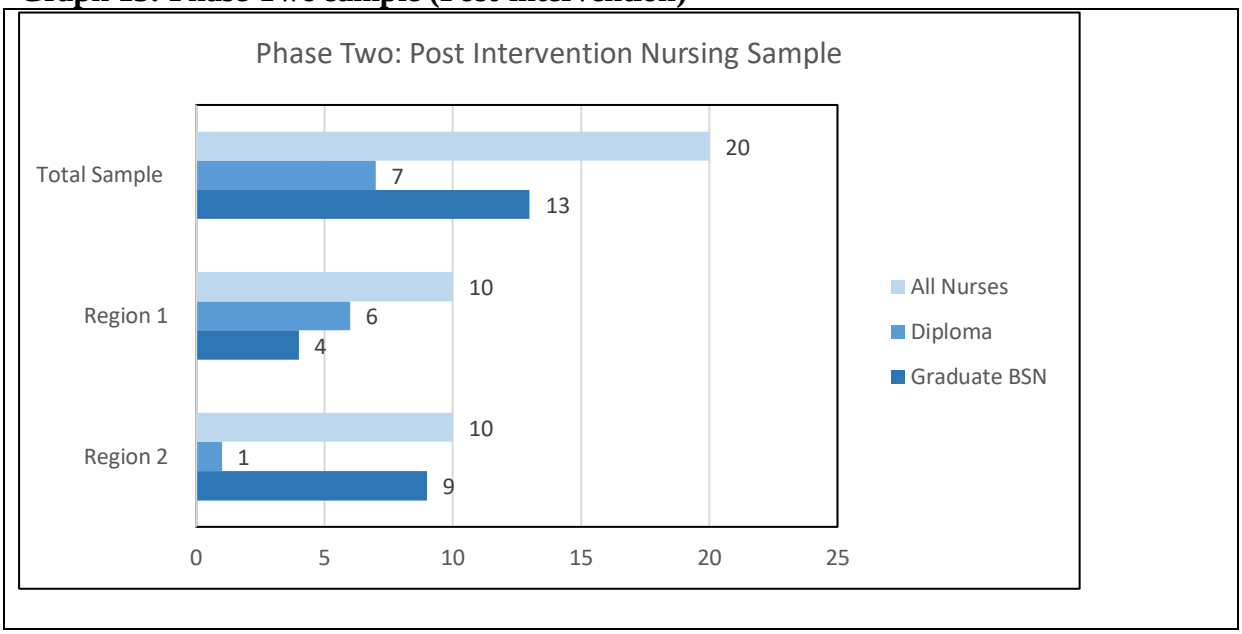
Graph 12: Nurses' perceived confidence in responding to the deteriorating child: By qualification & region



4.3 Phase Two: (Post-Educational Intervention) Results

Three months after the educational intervention in Region 1, the same nurses were re-tested using the same vignettes and the same questions. Only 20 of the original 27 nurses (74%) completed phase two (Graph 13). Compared to phase one (baseline) those nurses that were unavailable to take part in phase two were 18% (n=5) from Region 1 (the intervention group) and 7% (n=2) from Region 2 (the control group). Whilst this did not alter the balance between diploma level and graduate nurses in Region 2, it did alter the balance of the intervention group (Region1) by reducing the graduate population by 21% (n=4) and the diploma nurses by 12% (n=1).

Graph 13: Phase Two sample (Post-intervention)



Twenty newly qualified paediatric nurses from both regions participated in August 2017. Of those, 10 were from Region 1 (the intervention group) and 10 were from Region 2 (the control group).The sample was divided further by qualification so that comparisons could be made between diploma and graduate Saudi-trained nurses. There were 13 graduate-educated nurses of whom nine were from Region 2 and four were from Region 1; of the seven diploma-educated nurses, one was from Region 2 and six were from Region 1.

4.3.1 Results Post-intervention: Both Regions

The results are again presented in two parts: first, comparing all nurses across both regions, followed by comparison between graduate and diploma nurses.

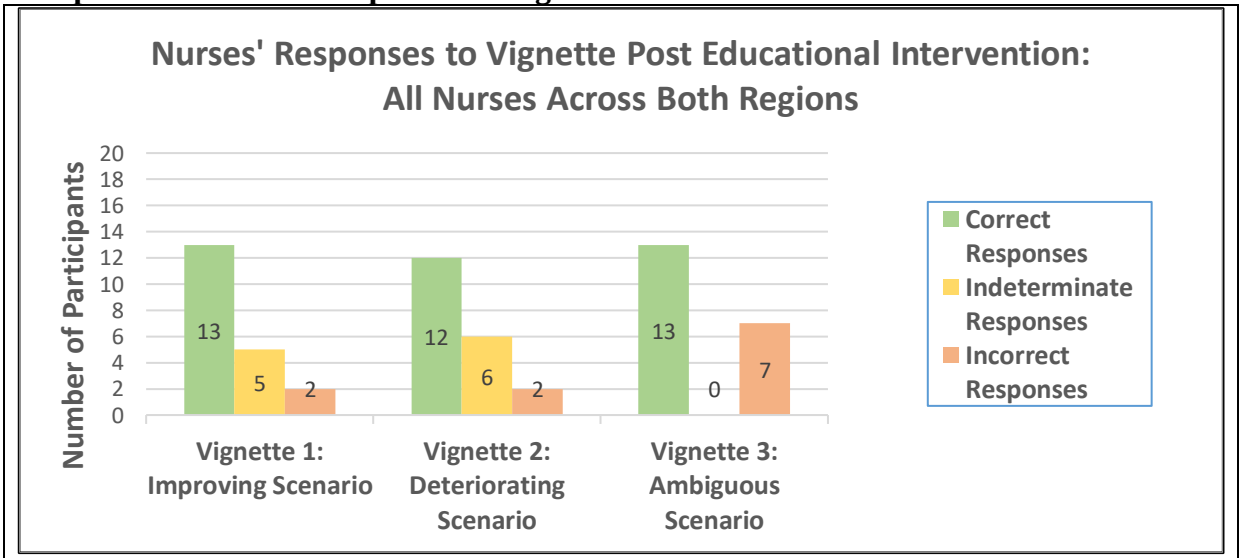
When the results of the scores to the vignette VAS' from all the nurses were analysed and tabulated (Table 9 and Graph 14), they were then categorised as correct, indeterminate and incorrect in order to be analysed.

Table 9: Responses to Vignette Scenarios Post-intervention: Across both regions.

	Correct Responses	Indeterminate Responses	Incorrect Responses	All Nurses Both Regions
Vignette 1: Improving Child Scenario	13 (65%)	5 (25%)	2 (10%)	20 (100%)
Vignette 2: Deteriorating Child Scenario	12 (60%)	6 (30%)	2 (10%)	20 (100%)
Vignette 3: Ambiguous Scenario	13 (65%)	0 (0.0%)	7 (35%)	20 (100%)
Type of response	**Total Correct responses**	**Total Indeterminate**	**Total Incorrect**	**Total possible responses**
Total Responses	38 (63%)	11 (18.5%)	11 (18.5%)	60 (100%)

The results demonstrate that overall, out of 60 possible responses more nurses (63%) responded correctly (38/60) to the three scenarios. The remaining nurses (37%) were equally divided between the indeterminate and incorrect responses. Two nurses from Region 2 (the control group) failed to correctly respond to all three scenarios.

Graph 14: All Nurses Responses to Vignettes Post-intervention



When the results for each region were tabulated (Table 10) it can be seen that the intervention groups' correct answers (87%) were significantly better than the control

groups' (40%) and they had no incorrect responses to vignette 1 (Improving Child Scenario) or 2 (Deteriorating Child Scenario). This contrasts to the control group, 50% of who gave incorrect answers to vignette 3, the Ambiguous Scenario. They also had a similar percentage of indeterminate responses to the Deteriorating Child Scenario and 40% indeterminate response to the Improving Child scenario.

Table 10: Comparison Between the Two Regions: Nurses' Responses

	Correct Responses		Indeterminate Responses:		Incorrect Responses:		All Nurses
	Region 1 Intervention Group	Region 2 Control Group	Region 1 Intervention Group	Region 2 Control Group	Region 1 Intervention Group	Region 2 Control Group	Both Regions
Vignette 1: Improving Child Scenario	9 (90%)	4 (40%)	1 (10%)	4 (40%)	0 (0%)	2 (20%)	20
Vignette 2: Deteriorating Child Scenario	9 (90%)	3 (30%)	1 (10%)	5 (50%)	0 (0%)	2 (20%)	20
Vignette 3: Ambiguous Scenario	8 (80%)	5 (50%)	0 (0%)	0 (0%)	2 (20%)	5 (50%)	20
TOTAL	**Total Correct**		**Total Indeterminate**		**Total Incorrect**		**Total possible responses**
Total Responses	26 (87%)	12 (40%)	2 (7%)	9 (30%)	2 (7%)	9 (30%)	60

4.3.2 Results Post-intervention: Both Regions by Vignette and by Qualifications

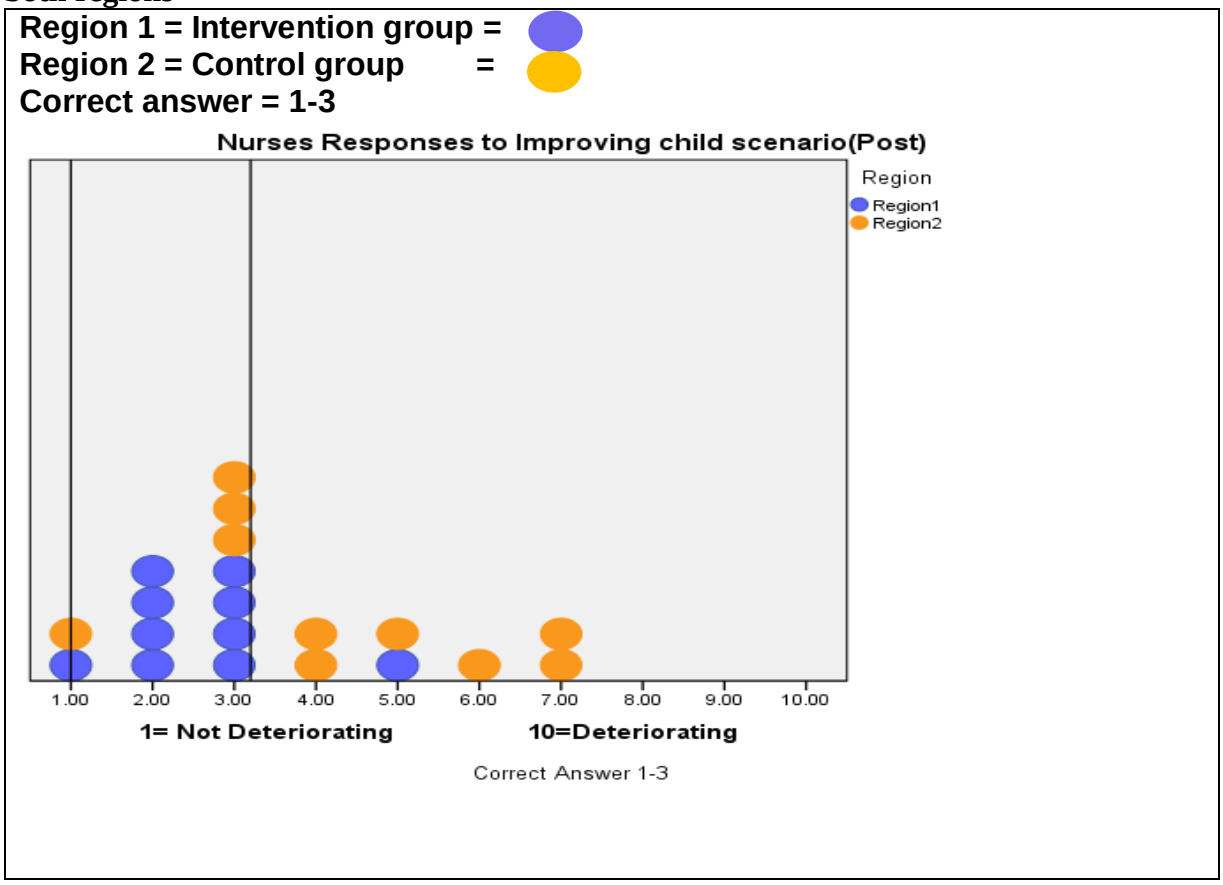
The distribution of nurses' scores were then plotted in dot plot graphs in order to provide a more detailed comparison of the results for each of the three vignettes and tested inferentially in the following sections.

4.3.2.1 Vignette 1: The Improving Child Scenario (Post-intervention)

In vignette 1, in which the correct response was in the range of 1-3, the dispersion of scores for all nurses across both regions was in the range of 1-7 with a median of 3 (Graph 15). Nine out of ten (90%) of the intervention group had correct scores with only one (10%) outlier and with a median score of 2.5 compared to the control group (Mann-Whitney test; p=0.029).

The control group scores were more widely dispersed, with a range of 1-7 with a median of 4. The dot graph shows that whilst four (40%) of nurses gave the correct responses, six (60%) gave the incorrect response for this scenario.

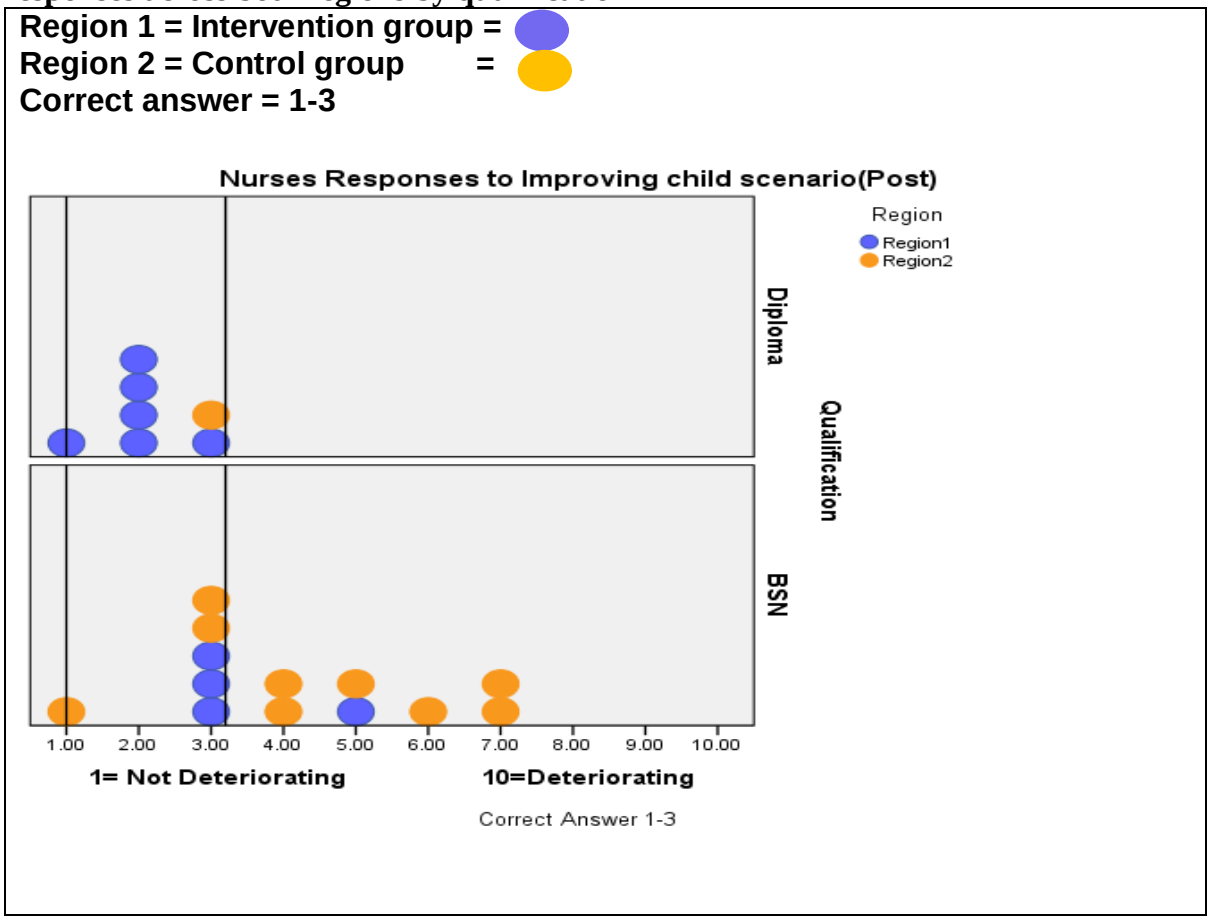
Graph 15: Improving Child Scenario. Post-intervention: All nurses' responses across both regions



When comparing responses by nurse qualification, half the diploma nurses, five (50%) in Region 1 gave the correct responses to the Improving Child Scenario, as did the one diploma-level nurse from Region 2 in the control group. The range of responses was in the correct range (of 1-3) with a median score of 2 (Graph 16).

The scores were more widely dispersed in the graduates' results from both regions with a range of scores from 1-7, although the majority 3/4 of graduates from the intervention group in Region 1 gave the correct response with a median of 3. The graduates' scores in Region 2 (the control group) ranged from 1-7 with a median of 4 and with only three (23%) of graduate nurses giving the correct response.

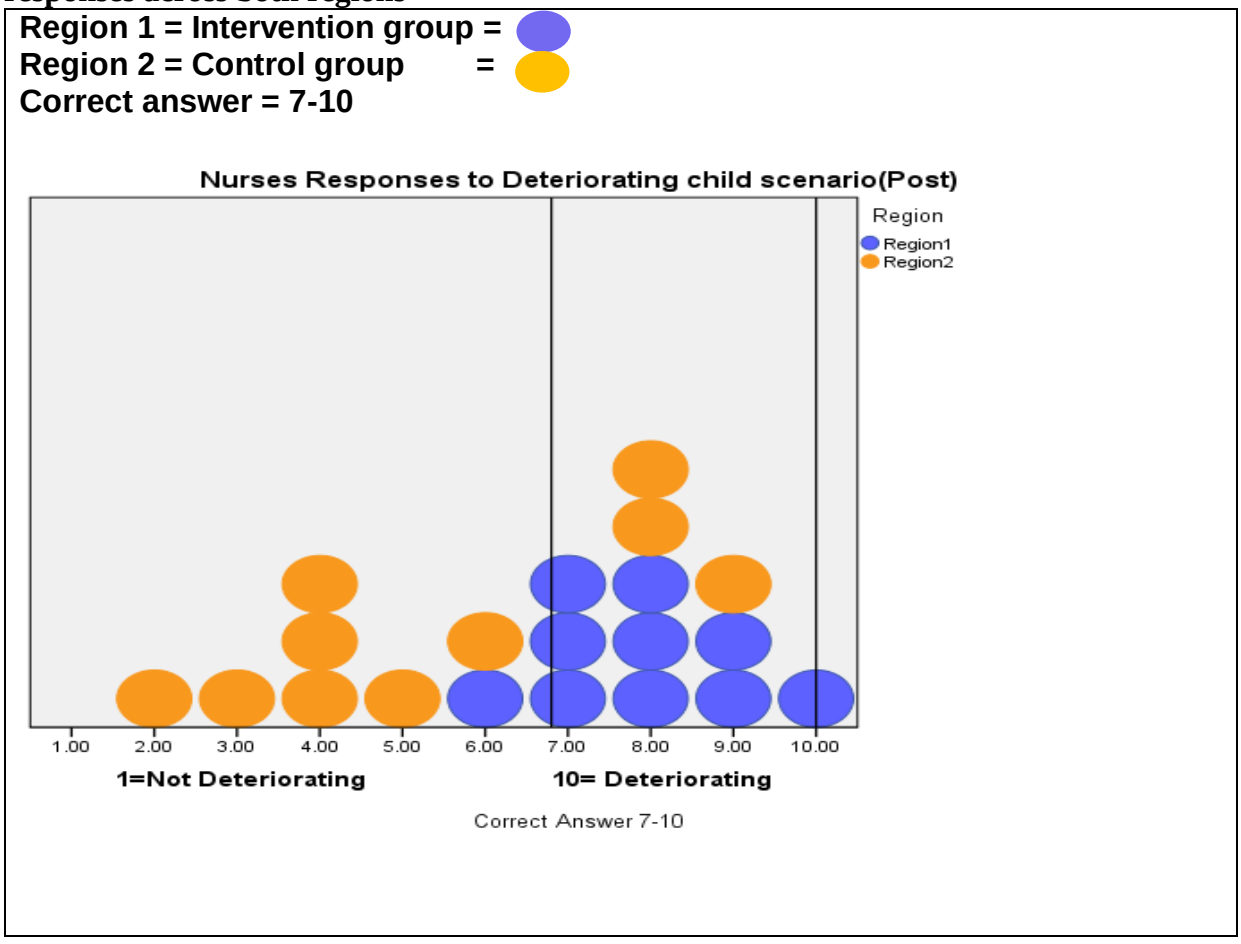
Graph 16: Improving Child Scenario. Post-educational intervention: All nurses' responses across both regions by qualification



4.3.2.2 Vignette 2: The Deteriorating Child Scenario (Post-intervention)

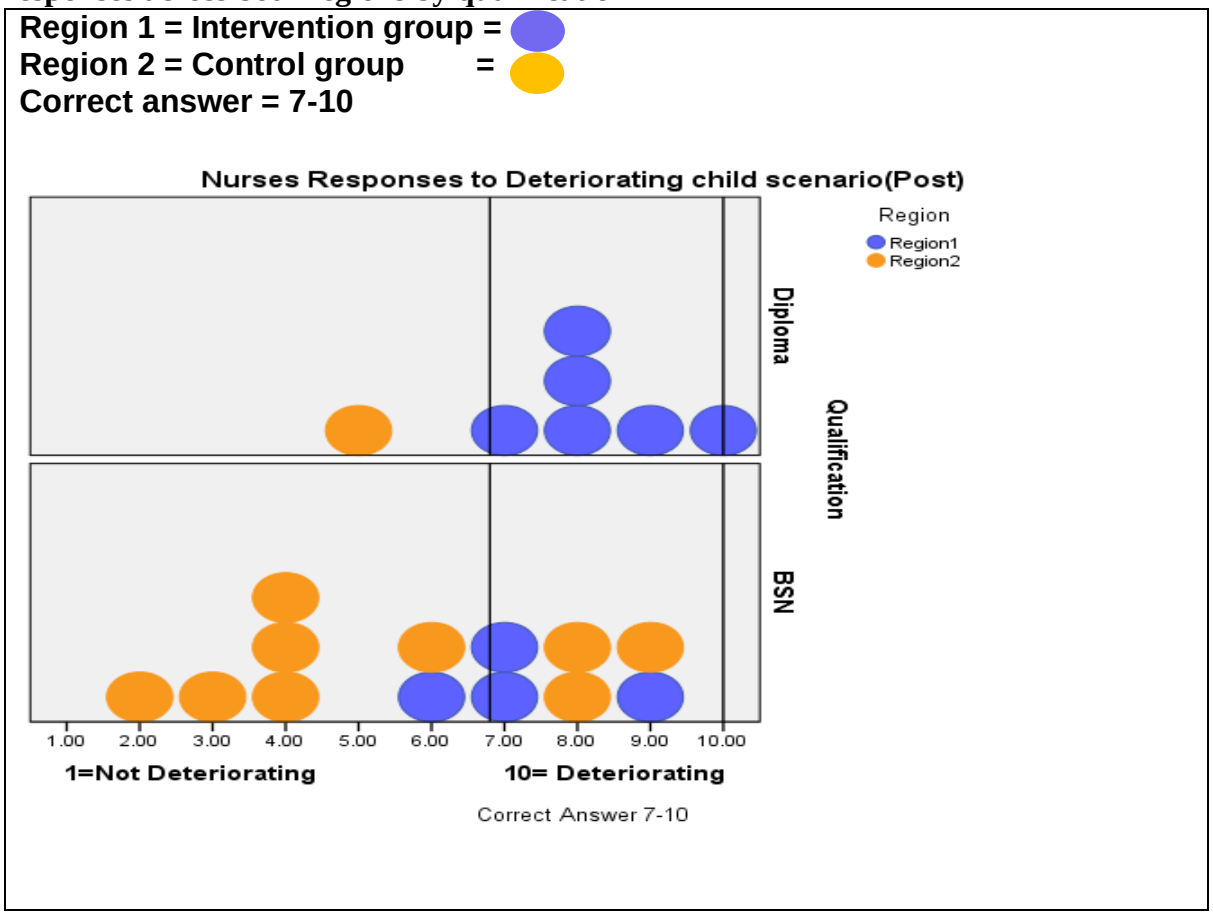
In vignette 2 the correct responses were in the 7-10 range, the dispersion of results across both regions were in the range of 2-10 with a median of 7 (Graph 17). In Region 1, the intervention groups' scores were in the range of 6-10 with a median of 8. The majority nine (90%) of the scores were within the correct range with only one outlier, compared to only three (30%) of nurses from the control group who gave the correct responses. The control groups' responses ranged from 2-10 with a median of 4.5. The majority of the control group in Region 2 (7/70%) failed to detect child deterioration in this scenario (Mann-Whitney test; p=0.019).

Graph 17: Deteriorating Child Scenario. Post-educational intervention: All nurses' responses across both regions



When comparing responses to the Deteriorating Child Scenario (Graph 18), the one diploma nurse in the control group answered incorrectly. Whereas all the other six (85%) diploma-level nurses in the intervention group responded correctly. Their scores were in a range of 7-10 with a median of 8. The graduates' scores in the intervention group were slightly more dispersed in a range of 6-9 and a median of 7 with one outlier. In the control group the graduates' responses ranged from 2-9 with a median of 4, with only three (30%) responding correctly to this scenario.

Graph 18: Deteriorating Child Scenario. Post-educational intervention: All nurses' responses across both regions by qualification

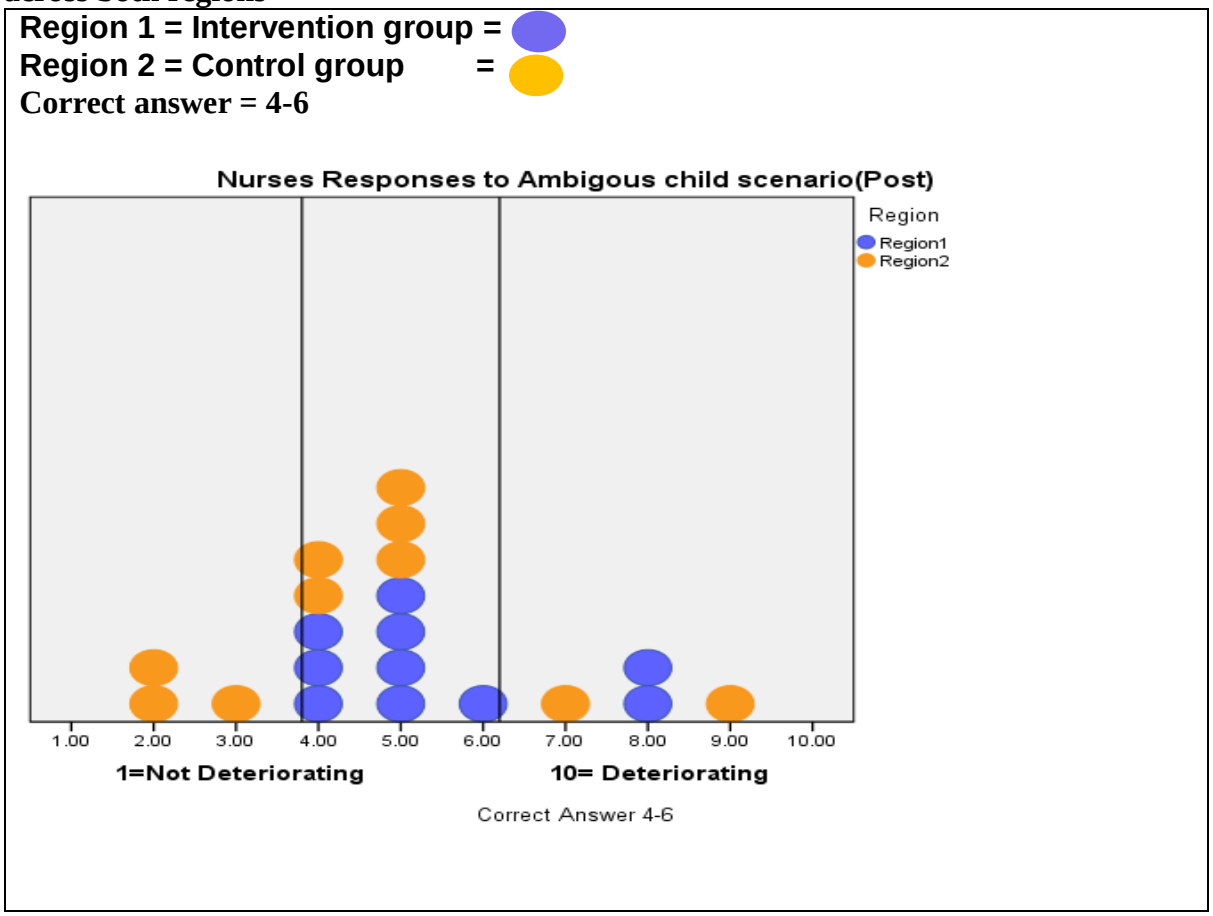


4.3.2.3 Vignette 3: The Ambiguous Scenario (Post-intervention)

In vignette 3, the Ambiguous Scenario where the correct response was in the 4-6 range, the dispersion of results across both regions (Graph 19) was from 2-9 with a

median of 5. In the intervention group, the range of scores was lower 4-8 but had a median of 5. In the intervention group, eight (80%) of the nurses gave the correct responses with only two (20%) outliers who gave incorrect responses. On the other hand, control group nurses' responses were more widely dispersed, with a range of 2-9 with a median of 4.5, and only half of the nurses, five (50%) responded correctly (Mann-Whitney test; p=0.315).

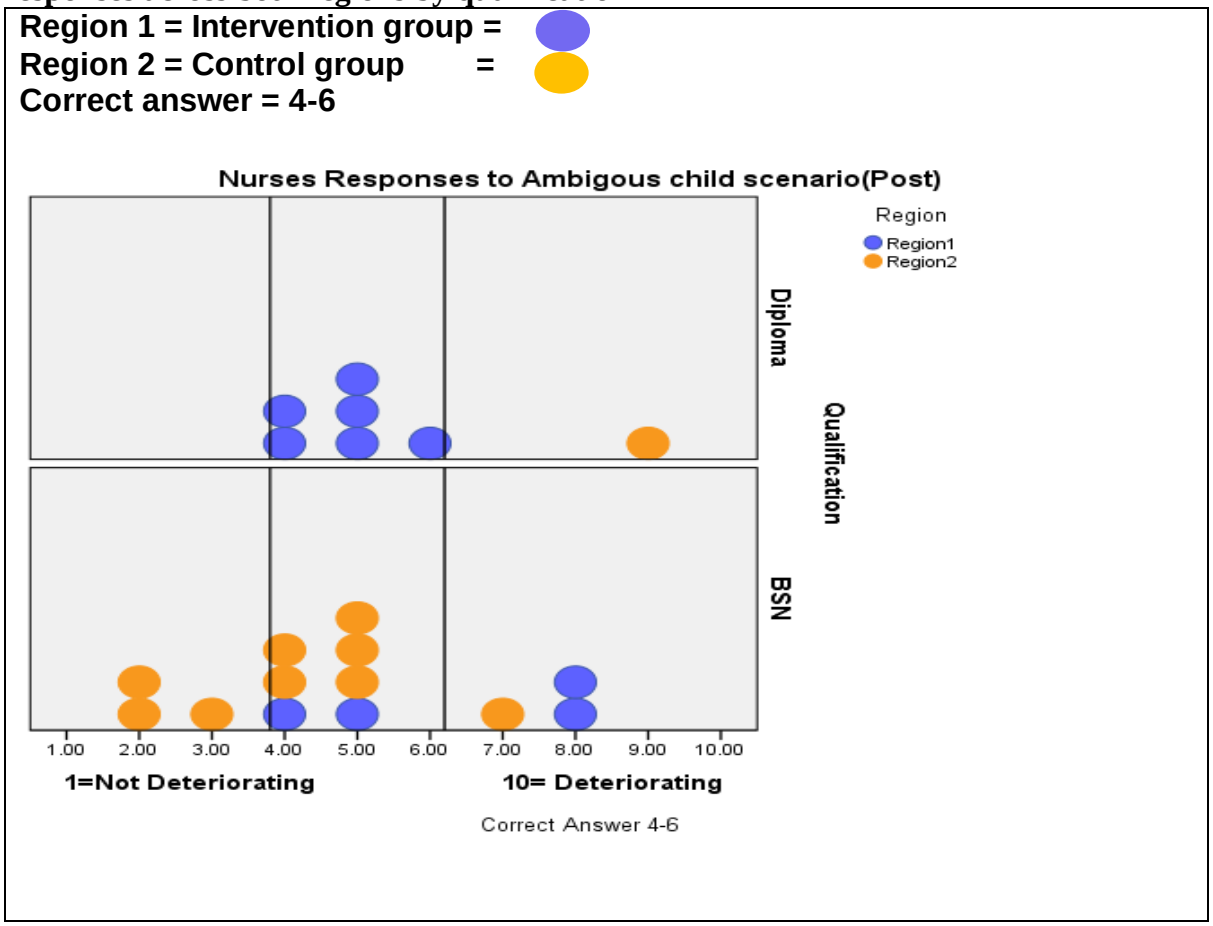
Graph 19: Ambiguous Scenario. Post-educational intervention: All nurses' responses across both regions



When comparing responses in the Ambiguous Scenario (Graph 20), by qualification, the one diploma nurse in Region 2 (the control group), gave an incorrect answer. All the intervention group diploma nurses however answered correctly within a range of 4-6 and a median of 5. The graduates in the intervention group n=4 scores were

slightly more dispersed with a range of 6-9 with a median score of 6.5. In the control group the graduates' responses ranged from 2-7 with a median score of 4 with half (five) responding correctly to this scenario.

Graph 20: Ambiguous Child Scenario: Post-educational intervention; All nurses' responses across both regions by qualification



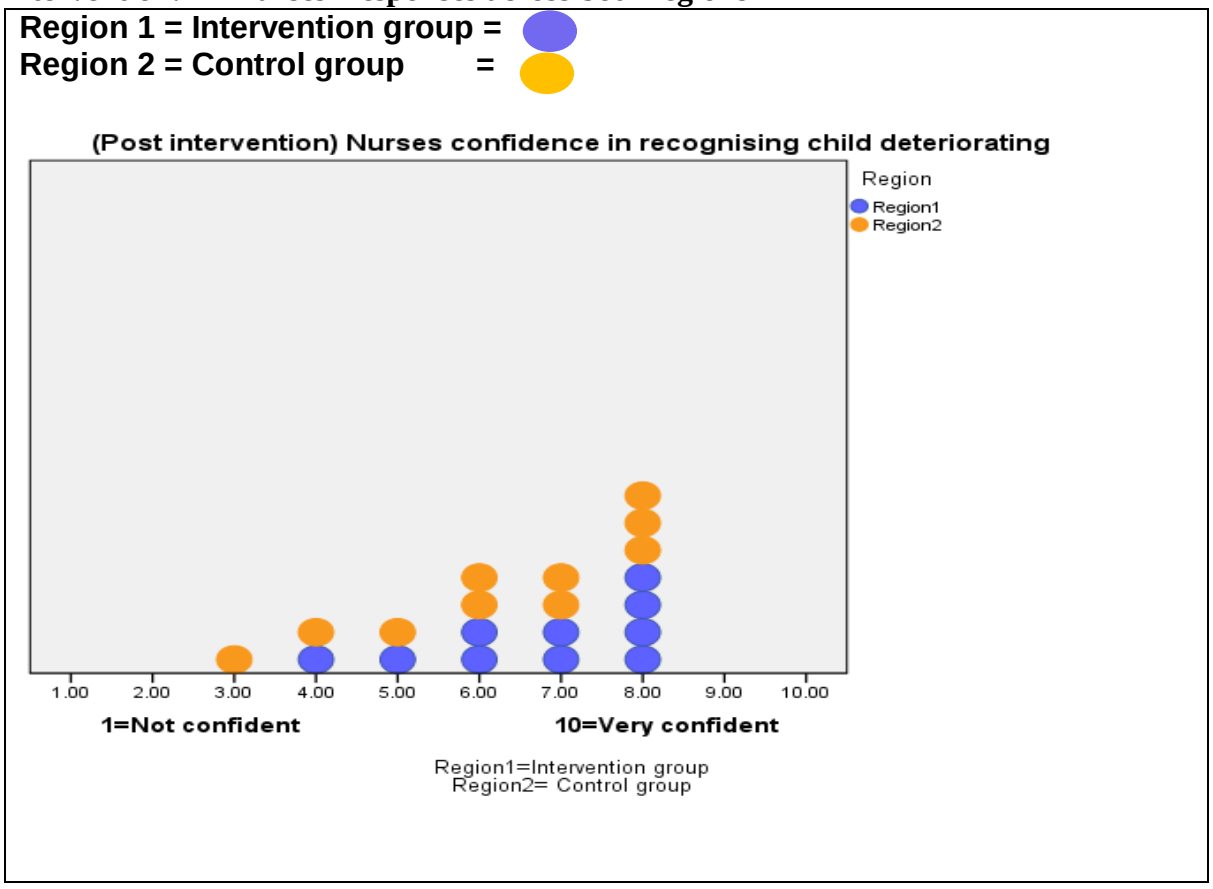
4.3.2.4 Post-intervention: Nurses' Perceived Confidence Level in Recognising and Responding to Deteriorating Child:

The nurses' confidence levels of their ability to recognise [1] and respond [2] to deterioration were reassessed in both groups after the educational intervention. The same VAS was used as in phase one, in which nurses indicated from a range of 1-10 their ability and dot plots were produced for them (Graphs 21 and 22).

Nurses' confidence to recognise deterioration for all nurses across both regions ranged from 3-8 with a median score of 7. Of the 11 nurses (55%) who felt the most confident in their ability to recognise deterioration, six (54%) of them were from the intervention group, and five (45%) nurses were from the control group.

The nurses least confident in their ability to recognise deterioration were fairly evenly divided between both groups.

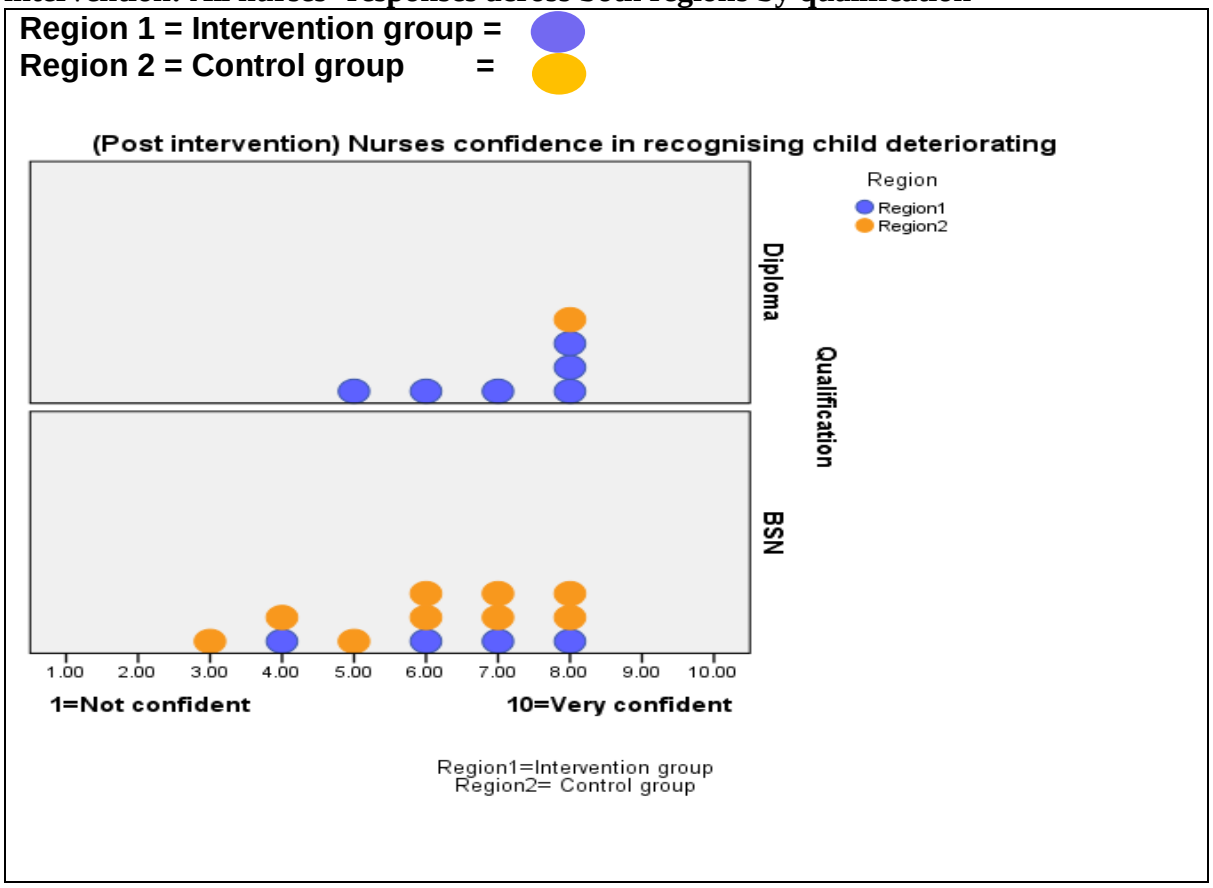
Graph 21: Nurses' perceived confidence to recognise deterioration post-educational intervention: All nurses' responses across both regions



When the results were dot plotted by region (intervention group) and qualification, six (85%) diploma nurses' responses in the intervention group were in the 5 – 8 range

with a median score of 7.5. This was a modest assessment on behalf of all the diploma nurses as they had responded correctly to all three clinical scenarios.

Graph 22: Nurses' perceived confidence to recognise deterioration post-educational intervention: All nurses' responses across both regions by qualification

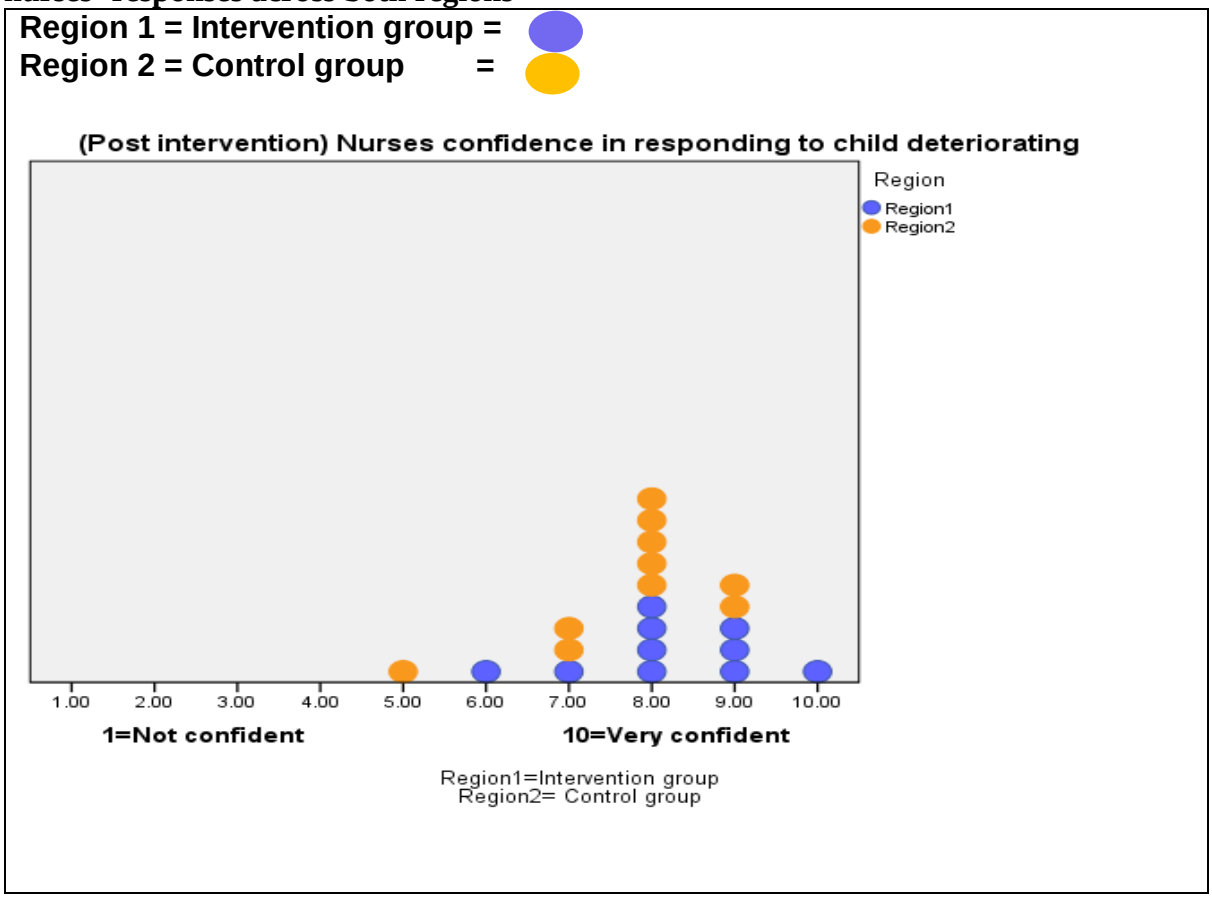


The graduates from both regions had a wider dispersion of confidence responses overall, in the range of 3-8 and a median score of 6. The majority of the control group had a range of responses from 3-8, with a median score of 6. In the intervention group, graduates' confidence levels ranged from 4-8 with a median score of 6.5.

The dot charts produced for the confidence level of all the nurses, showed a range of responses from 5-10 with a median of 8 across both regions (Graph 23). This shows that the majority of nurses were very confident in their ability to respond to

deterioration. This was particularly evident in the intervention group, whose responses were in the range of 6-10 with a median score of 8. This would seem appropriate as the majority of these nurses nine (90%) correctly responded to the clinical scenarios. This is in contrast to the control group, whose confidence levels were in the range of 5-9 with a median score of 8, which appeared unrealistic where the majority of these nurses responded incorrectly to the three clinical scenarios.

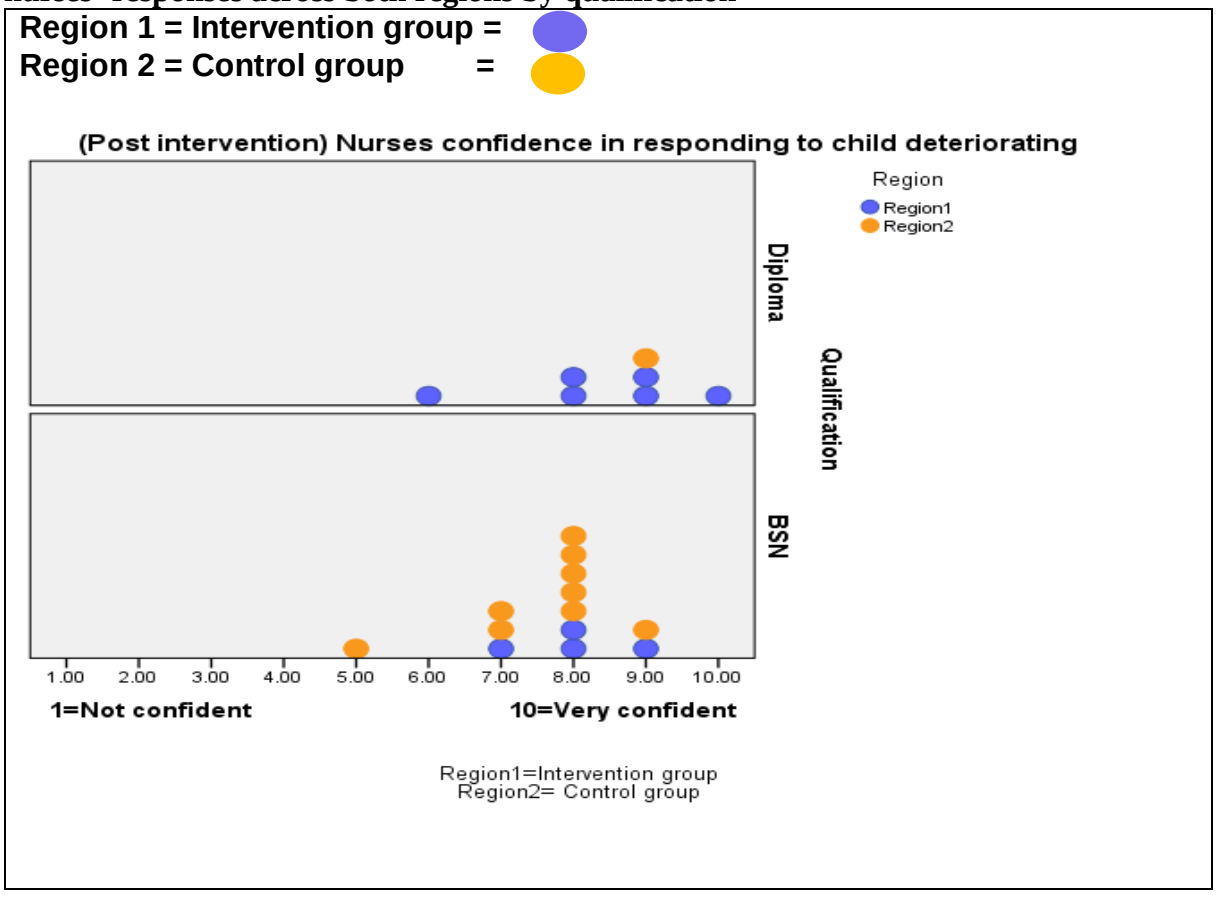
Graph 23: Nurses' perceived confidence of responding to child deterioration: All nurses' responses across both regions



When the regional findings are compared by qualification (Graph 24), the one diploma nurse was overtly confident at responding with a confidence level of 9. However, six (85%) diploma nurses from the intervention group were more appropriately confident in their ability to respond with a range of scores from 6-10 and a median score of 8.5,

since they had all correctly responded to all three scenarios. In the intervention group, graduates (30%) were even more confident in their ability to respond to deterioration with a range of 7-9 and a median score of 8. The majority of control group graduate nurses eight (80%) were equally as confident, but had one outlier whose assessment of her ability was more realistic given that she failed to respond correctly to the Deteriorating Child Scenario.

Graph 24: Nurses' perceived confidence of responding to child deterioration: All nurses' responses across both regions by qualification



4.4 Comparison of pre-post results

These findings relating to the differences between scores before the RADAR intervention and after the intervention are presented in two parts. First is the level of

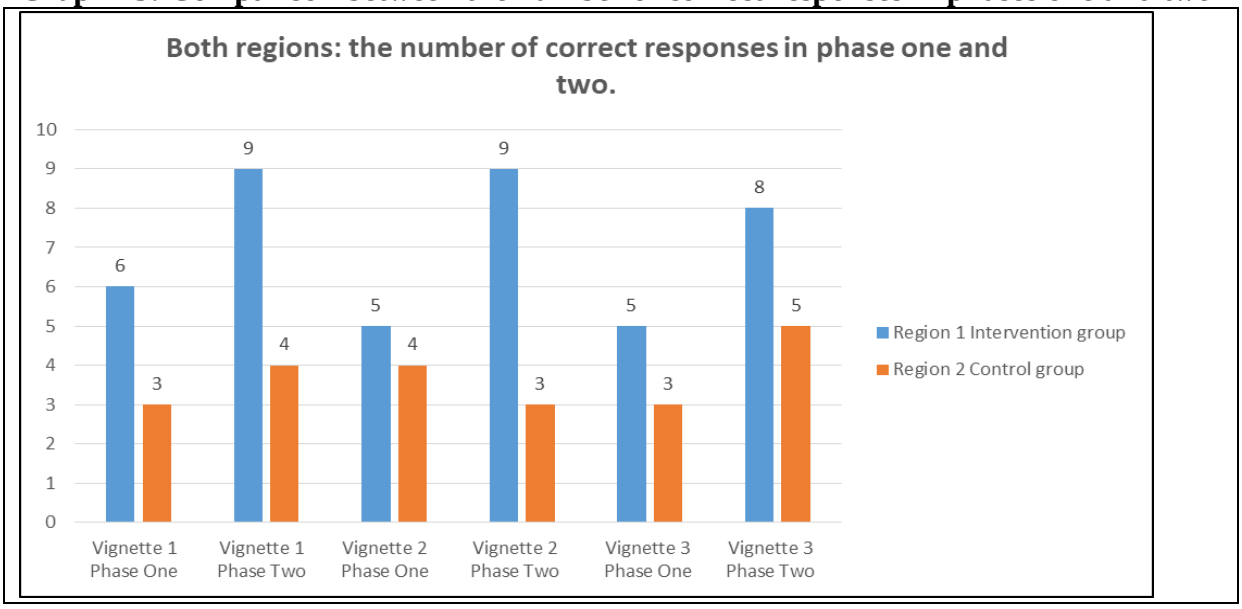
correct results in each vignette across both regions, and then by the intervention group and the control group. This is followed by comparing the differences in the median changes to the nurses' confidence levels.

Three clinical vignettes (improving, deteriorating and ambiguous clinical condition scenarios) were administered using the same techniques to the same nurses following a 3-month interval after one of the regions had attended a one-day RADAR course (Appendix 9). All the 20 nurses' ability and confidence levels were reassessed using the quantified data captured on the same VAS that were used in phase one of the study.

4.4.1 Results Across Both Regions

Even though the intervention group outperformed the control group in phase one, their results also demonstrate a further improvement in correctly identifying the deteriorating child responses after the focused educational programme (Graph 25).

Graph 25: Comparison between the number of correct responses in phases one and two



It can be seen (Table 11) that there was an overall proportional change in correct responses to all the vignettes across both regions post-intervention.

The proportion who were 'correct' in the post-RADAR phase was compared to the proportion 'correct' in the pre-RADAR phase and this is shown in column 4 'difference between the 2 proportions'; a confidence interval (C-I) for this difference was also calculated according to Newcombe (1998).

Table 11: Post-intervention Changes to Correct Scores

	Pre-Phase1	**Post -Phase2**	**Difference Between The Proportion Correct Pre- And Post-RADAR Course**	**Confidence Interval Of Proportion Difference (95% confidence level)**
Region 1 (Intervention group)				
Vignette 1	7/15	9/10	0.43*	0.0093 0.695
Vignette 2	9/15	9/10	0.30	-0.1238 0.5872
Vignette 3	8/15	8/10	0.27	-0.1664 0.5736
All vignettes	24/45	26/30	0.33	0.0983 0.5107
Region 2 (Control group)				
Vignette 1	3/12	4/10	0.15	-0.2655 0.5242
Vignette 2	5/12	3/10	0.11	-0.3114 0.486
Vignette 3	3/12	5/10	0.25	-0.1889 0.6002
All vignettes	11/36	12/30	0.10	-0.1495 0.3303
Total Both Regions				
Total	**35/81**	**38/60**	**0.20**	**0.0243 0.3611**

* This means that 43% *more* were correct in post- than in pre-intervention phase; if negative proportion, it means that *fewer* were correct post- than pre-intervention.

Here, in (Table 11) showing the intervention region [Region 1], the proportional improvement for vignette 1 was 0.43 (95% C-I =0.0093- 0.695). This means that 43% more gave correct responses in the post-intervention than in the pre-intervention phase (if a negative proportion it means that fewer were correct post- than pre-). The C-I is positive, meaning that there was a 95% probability of some positive change in scores for the intervention group even given the small samples involved. In Region 2 [control] for vignette 1 the C-I for the difference in proportions giving a correct response ranged from negative to positive [-0.2655 0.5242]; from this it cannot be concluded that there was any overall improvement in scores 'correct'. Overall, that is combining results of the responses to all 3 vignettes, the intervention group showed positive improvement in all vignettes compared to the control group (C-I 0.0983 0.5107 vs -0.1495 0.3303).

4.4.2 Post-intervention: Change in Nurses' Perceived Confidence Levels

The nurses were all asked to rate their confidence in recognising and responding to child deterioration on a scale of 1-10. The median was calculated and tabulated for phase one and two comparisons Table 12. There was a small increase in confidence for the intervention group and a small decrease or no change for the control group. There were also marginal increases in the intervention group for the diploma nurses but a small decrease for the graduates in their confidence levels to recognise child deterioration. However, both groups had an increase in their confidence levels to respond to child deterioration.

Table 12: Median Changes in Confidence Levels.

Confidence Levels 1-10 to Recognise deteriorating children	Confidence to Recognise Pre-	Confidence to Recognise Post-
Region 1: Intervention group	6	7
Region 2: Control group	7	6.5
Confidence Levels 1-10 to Respond to deteriorating children	**Confidence to Respond Pre-**	**Confidence to Respond Post-**
Region 1: Intervention group	7.5	8
Region 2: Control group	8	8

4.5 Summary

Overall, the findings confirm previous work, that recognition of the deteriorating child is complex. Even using relatively non-stressful simulated scenarios, over half of newly qualified nurses working in two regions of the KSA could not identify the deteriorating child in phase one. However, the delivery of a culturally adapted focused educational intervention demonstrated a positive impact on the nurses' ability to recognise the deteriorating child. When the educational levels of Saudi-trained nurses were compared, there was an improvement in graduate nurses but a greater improvement in diploma nurses.

CHAPTER 5: RESULTS II; QUALITATIVE FINDINGS

5.1 Introduction

The purpose of this chapter is to present the approach to the qualitative data analysis and the findings from that analysis as described in the Framework Approach explained on page 115 (Chapter 3). The three main themes and five subthemes emerged from that analysis of the three vignettes and the semi-structured interviews. The results have been used to present the qualitative findings from the pre- and post- intervention phases of the study.

Twenty-seven nurses participated in this part of the study. Fifteen from Region 1 and 12 from Region 2. The Think Aloud data collection and the post-task semi-structured interviews took between 40 and 50 minutes. The results of the analysis produced findings from both; the Think Aloud data collection approach used during the administration of the three clinical vignettes explained the quantitative results, and the data collected regarding the perceptions of the nurses during semi-structured interviews post-administration of the vignettes.

5.2 The Pre-intervention Themes.

The sample for this phase of the study consisted of n=27 nurses comprised of n=8 diploma nurses and n=19 graduates. Region 1 had n=7 diploma nurses and n=8 graduates, and Region 2 had n=1 diploma nurse and n=11 graduates.

Three main themes were identified from the data. Firstly; Experience and training, supported by three subthemes; Passive bystanders, Absence of experience, and Deference to the doctor. Secondly: Absence of focused training, and lastly: from

vignettes (Assessment, recognition & response) which were supported by two subthemes; Understanding clinical data, and Types of responses.

5.2.1 Theme 1: Experience and Training (from Semi-structured Questions)

The majority of the paediatric nurses interviewed reported that they had little or no experience in dealing with patient deterioration. Although they felt confident that they could recognise child deterioration, even those with some experience deferred their clinical decision-making to medical staff, claiming to be "new". There was a unanimous expressed need from the interviewees for practical training as none had received any instruction on recognising and responding to child deterioration prior to or whilst in employment

Subtheme 1: Passive Bystanders

The nurses were aware of their lack of clinical experience and skill with sick children, and phrases that were repeated were, "I am new", or "I am still new, and seemed to be used to dismiss or offer a justifiable rationale for their lack of ability in both recognising and responding to the Deteriorating Child Scenario. The majority of Region1 nurses used this phrase to justify not making a decision in case it was wrong, or because they had not had the clinical experience of nursing deteriorating children.

"*I'm still new and afraid of mistakes*" [$_{T21}$ Diploma 4 months experience].

"I am still new, and still didn't see cases" [$_{T33}$ Graduate 3 months experience].

In addition, more graduate nurses from Region 1 than diploma nurses from Region 2 used the phrase, and in doing so seemed more willing to distance themselves from their inherent responsibility in the clinical decision-making process.

"...*because I'm still new in the work*" [$_{B52}$ Graduate 6 months experience].

"...because I'm still new to this cases and new to ward" [T19 Graduate 6 months experience].

"I feel still I'm not expert in my work" [B40 Graduate 12 months experience].

"*I'm not expert, I'm still new, I don't have that experience*" [T13 Diploma 11 months experience].

The majority of respondents from both regions did not want any further clinical information before coming to a decision. They seemed either reluctant to ask questions, or did not know what questions they ought to ask in each scenario to help them form an opinion. Some seemed unaware that they might not have sufficient information about the case in order to make a reasoned clinical decision.

Subtheme 2: Absence of Experience

This theme emerged when nurses were asked to describe their experience and ability to recognise deterioration in children. Most of the nurses confirmed that they had not experienced a child deteriorating during their time in practice. Those who had some clinical experience of a deteriorating child situation to draw upon described mixed outcomes. These ranged from transfers to the PICU, to cardiac arrest and death. The experiences of arrest and deaths were common to nurses of both regions:

"*One baby was with difficult breathing, his pulse was low in the ECG. It was during delivery, he came with blue colour, he is not crying, and no respiration, we just called the NICU team and handed it to them, and they open the airway and do suction, give oxygen with ambo-bag, they put him in incubator and they transferred him*" [B46 Diploma 12 months experience].

"*One patient one month old came to our ward with sepsis, the SpO2 was low. Then suddenly after admission he arrested, aaa pale. No pulse, no respiration, then we call for the team, they give adrenalin and started medication but after 30 minutes, he survive and has a pulse, we started compression in CPR process*" [T29 Graduate 8 months experience].

Despite the nurses witnessing critical incidents during their employment, they did not feel that these incidents prepared them with the clinical skills to enable them to

recognise a deteriorating child. In addition, they did not feel confident in their ability to implement procedures for responding to a deteriorating child scenario. These were clinical skills that could have helped them to deal with a critical incident of a deteriorating child. The nurses also said they could draw on their experiences with adults to assist them when nursing a sick child:

> "*I have experience and I saw a patient like that when I have worked in adult ICU and it is almost the same with children"* [$_{T31}$ Graduate 12 months experience].

> "*Unfortunately he deteriorated very fast and died, it was adult in medical ward with cardiac problems, then suddenly his pulse increased and then deteriorate and dead, we were in training period and we have no experience just observing the staff and learning*" [$_{B52}$ Diploma 6 months experience].

There were a few nurses who said they had some experience of dealing with child deterioration; one graduate nurse from Region 2 and some graduates from Region 1, who mentioned considering the child's vital signs before making any clinical decisions, had correctly answered the Deteriorating Child Scenario [vignette 2].

> "...*because it will be clear from the vital signs, the appearance, so I will respond directly"* [$_{B40}$ Diploma 12 months experience].

> "...*so I'll stay close observation*" [$_{T33}$ Diploma 6 months experience].

Other nurses who also answered the Deteriorating Child Scenario correctly said they would initiate some form of treatment, which ranged from the most common which was to administer oxygen and combined that with giving medication, suction, reposition,

> "*I still know what will I do to prevent the arrest by giving oxygen*" [$_{T29}$ Diploma 8 months experience].

However, there were nurses in this study who suggested treating all deteriorating children with oxygen and a gastric lavage, whilst another [$_{T15}$] with a similar amount of experience [$_{B42}$] suggested first aid. These nurses who also said they lacked experience of dealing with child deterioration were confident in their ability to respond

to the Deteriorating Child Scenario, even though they were clearly out of their depth. The nurses from one region that all reported high levels of confidence in their ability to respond [B44, B48, B56,] had answered all the vignettes incorrectly. This was evidence that they had an incorrect and over-inflated perception of their level of competence in recognising deterioration.

Subtheme 3: Deference to the Doctor

This theme emerged because many of the nurses seemed quite scared and emotional about having to deal with a deteriorating child and seemed to want to defer to the doctors' guidance as the norm rather than relying on their own clinical assessment. The nurses appeared to be diffident towards medical staff and when asked about the availability of doctors they unanimously replied that they were available 24 hours seven days per week. What was not expected was the consistent use of the phrase *following orders*. The majority of nurses perceived they could not make any decision without medical permission and thus their role was restricted to just following orders:

> "...*with the doctor orders, yes we as nurses can't do anything without order but I'll be ready for every order*" [B58 Diploma 12 months experience].

> "*My response will be very simple, I'll be following the doctor's order*" [B42 Graduate 12 months experience].

> "...*still I need the decision of the physician"* [T25 Graduate 8 months experience].

When asked about their ability to respond to deterioration the nurses did not describe their ability, instead they said that they would call a doctor, although some reported that they would seek help from senior nurses.

> "*I'll call somebody who knows more than me and let him act, and I learn from*

them" [T13 Graduate 11 months experience].

"*I'll be there and the case in front of me, if I feel it's deteriorating I'll ask the help from other nurses to call the team*" [B46 Diploma 12 months experience].

The nurses in this study also described enlisting the experience and authority of the charge nurse to overcome their hesitancy and summon the doctor on their behalf. The term '*doctors' orders'* clearly remains in common use and in doing so, it affirmed the power imbalance expressed by the paediatric nurses, even though they did not express this directly.

5.2.2 Theme 2: An Absence of Focused Training

This theme arose from two findings; the first that none of the nurses reported receiving any paediatric in service training or pre-registration education preparation specifically focused on clinical deterioration in children. The second was that the nurses' overwhelming choice of method of learning was to have practical experience. There were a few nurses from both regions who mentioned receiving some education and in-service training:

"...at work, only I have CPR training" [T17 Diploma 6 months experiences].

"*No only CPR training*" [B62 Diploma 1 month training].

A few graduate nurses from Region 1 referred to their university general paediatric lectures:

"*No only in university in the module of paediatric nursing*" [T19.Graduate 6 months experience].

Whilst the nurses unanimously realised they needed training in recognising and responding to child deterioration, they were overwhelmingly in favour of practical teaching methods:

> "*So I would like practical training, in real cases, or in different departments with instructors to take the case step by step*" [$_{T19}$ Diploma 6 months experience].
>
> "*I want practical ---real cases yes. Classroom & lecture no, want to be in the situation with scenario, this make me understand more"* [$_{T23}$ Graduate 6 months experience].

There was a unanimous expressed need from the interviewees in both regions for practical training to help them with recognising and responding to deterioration in children.

5.2.3 Theme 3: Assessment, Recognition & Response (from Vignettes)

There were two subthemes that emerged from the vignettes under the theme: Assessment, recognition & response.

1. Understanding clinical data
2. Types of responses

It was evident from the paediatric nurses' responses to all the clinical scenarios that the vast majority felt more confident responding to a deteriorating child situation than they did to actually recognising the clinical signs. When talking aloud about their planned responses to all the scenarios the majority reported that they would be involved in delivering some form of medical treatment and monitoring vital signs. Whilst these responses would appear appropriate the reality was that there was neither uniformity nor precision to most of their clinical explanations and decision-making.

Subtheme 1: Understanding Clinical Data

Making sense of the clinical data presented in the vignette scenarios involved the paediatric nurses being able to reason and form conclusions about the children's

physiological information. This required both knowledge and experience to enable them to assess and interpret the data.

Most of the nurses requested additional information to clarify their assessment in relation to the Improving Child Scenario (Vignette 1). However, the majority of the questions that were asked were completely irrelevant and demonstrated that both graduate and diploma nurses were unable to interpret the data appropriately. Examples of the irrelevant questions raised by the nurses were:

> *"What aaaaaa I don't know, anything. HR 150 is good? not bad is it? Aaa*" [$_{T13}$ Diploma 11 months experience].
>
> *"Yes? If he had aspiration before? --- so if no aspiration he is ok? Because if aspiration or apnoea happens that will be problem and may develop to other issues and lead to other investigation"* [$_{T23}$ Graduate 6 months experience].

Nevertheless, there were a few examples of the nurses analysing this scenario's clinical data:

> *"If he has cyanosis or not? The vital signs is not enough; there should be a physical examination for this case. And the diagnosis of rising the chest. And also if it's fasting that means that their child is deteriorating. So we cannot depend on the vital signs. We should do inspection for the patient and do examination for the patient, the whole body. If there is any cyanosis over the colour of skin---"* [$_{T11}$ Graduate 6 months experience].
>
> *"Yes, I want to know, why his oxygen is 92 why it's low? So the SpO2 =90 because he has respiration problem, but it is not severe like pneumonia or asthma, only he came because of fever, but here is temp is not high, right? If it is 38 or 39 we could say he has infection in his chest or if he has chest pain, only*" [$_{T19}$ Diploma 6 months experience].

Substantially fewer nurses asked for clarification related to the clinical data when formulating their responses to the Deteriorating Child Scenario (Vignette 2) and the Ambiguous Scenario (Vignette 3). It was not clear whether this was because scenario 1 (Improving Child Scenario) was the initial test and they could have been more hesitant. The few nurses who did ask for clarification to the other two scenarios were

mainly graduates, and although the questions asked relating to the Deteriorating Child Scenario were brief, they were relevant and ultimately led to the correct response.

> *"The respiration rate 48 and still the chest quiet, I think he will use the accessory muscle to breath, is he??"* [$_{T25}$ Graduate 8 months experience].
>
> *"Yes when they give oxygen, did they give Ventolin nebuliser with it or only oxygen?" [*$_{B46}$ Graduate 12 months experience]*.*

Similarly, the few nurses who requested additional clinical information prior to making a decision related to the Ambiguous Scenario were mostly graduates. However, whilst they also asked brief but probing questions to this scenario their questions were based on incorrect interpretation of the data they had been given. When they were provided with more information, they still misinterpreted it and provided an incorrect decision on how to treat the Ambiguous Scenario.

> *"Has she had blood investigation? I want to know what is white blood cells count in blood test and if there is blood culture? Stool analysis and urine analysis? Did they do dressing for her there is any pain?"* [$_{T37}$ Diploma 6 months experience].
>
> *"I don't know if the temperature is increasing now or decreasing, I would check how was the temperature, if you have information I would ask about it and if she has any other problem? How the surgery site was, does she have other health problem?"* [$_{B44}$ Graduate 1 month experience].

A mix of graduates and diploma nurses provided the correct assessment of the clinical data in the scenario. Although, when asked to express their concerns during the Improving Child Scenario (Vignette 1) most of the nurses who provided incorrect responses were graduates. However, the majority of nurses frequently provided convoluted and confused reasoning which demonstrated a lack of precision when discussing the physiological parameters. There was also an absence of any clear method or systematic reporting of their conclusions.

"...well I see the heart rate 150 is in normal range. SpO2 is 92 is ok. 45 for breathing I feel it's a bit high. The temperature looks he has fever, and the BP is low, I expect aaa. We as nurses care more about the cardiac and oxygen. These the most things take our attention ,when I see these signs, it's ok but the temperature and the BP and the respiration , I don't feel he is good as has fever and with low BP, sure I'll inform the doctor about all these" [$_{B58}$ Graduate 12 months experience].

"...he has difficult in respiration, patient needed suction, this is unstable, because of respiratory, if it is difficult, and SpO2 is 92% ,maybe the patient need suction, oxygen via mask or oxygen direct. Also he needs change his position, of course the position of semi-fowler. Also, if patient needs nebuliser, will need Ventolin or steam inhalation" [$_{T17}$ Graduate 6 months experience].

On the other hand, the few nurses that gave self-assured responses, identified the child's problems and potential problems depicted by the scenario used a succinct although somewhat vague summary.

"...aaa only he needed oxygen because aaaa saturation is low, everything stable, heart rate aaa...only like that, maybe respiratory rate is high little only. No, because all vital signs are stable, only saturation 92%. I see his case is stable, does not need more." [$_{B40}$ Graduate 12 months experience].

Nevertheless, despite what seemed to be self-assured interpretation and reporting of the assessments by both diploma nurses and graduates, their interpretation of the child's condition was frequently incorrect.

"He was having fever but now his vital signs ok, only a bit of fever, his SpO2 is ok, heart rate a bit high, only" [$_{B46}$ Graduate 12 months experience].

"...so he is improving as long as the mother said he is better... as long as the SpO2 is 92%. So I'm not worried much about him, the mother said he is better and here the oxygen level is good also, RR also good" [$_{T37}$ Diploma 6 months experience].

Reasoned and clearer accounts appeared to come from the graduates and diploma nurses from different regions who gave correct responses to the three vignettes. However, the confused and convoluted assessment accounts continued in relation to the Deteriorating Child Scenario from both graduates and diplomats whose responses to the vignettes were incorrect. In addition, these seemingly confident reports

disguised the underlying fact that the nurses' interpretations of some important clinical measurements were incorrect.

> *"His condition is not good, deteriorating little because SpO2 87 is low. You know the normal is from 90 and above, aaa 48 for respiration is low, heart rate and temperature are aaa normal, aaa needs monitoring his condition until improve*" [B52 Graduate 6 month experience].

> *"SpO2 =87% on 40% oxygen via facemask. Heart rate 120 this good, better, temperature 37 he has fever. BP is high 120/80, but 14 years old...no it is good, blood gases aaa 4 hours ago done it's not good. So I'm worried about SpO2 level, if this level without oxygen connected won't be a problem, but now connected to oxygen and desaturation, too much problem, there is something here"* [T31 Diploma 3 months experience].

This lack of understanding of clinical measurements from both graduates and diploma nurses continued to be a feature of some nurses' responses to the Ambiguous Scenario.

> *"She is good. She is not bad but temperature is 38, maybe will lead to convulsion. Heart rate 120, RR 45, SpO2 98, its good, BP is 105/70 is good only the temperature is very high 38 is more than normal, maybe will have convulsion, high temp isn't good for the child"* [T31 Diploma 3 months experience].

> "*There is improving, but the temperature is 38 is high, the BP is also high, 105/60*" [B56 Graduate 1 month experience].

However, the vast majority of responses to this scenario from graduates and diploma nurses from both regions were notably vague and imprecise. This may have been used to disguise their lack of understanding about the situation.

> *"This high temperature might be due to inflammation or anything at the surgery because there is treatment but still high temperature, sure there is problem, or there is another reason aaaa. Now I am trying to connect this situation. There is surgery, there is antibiotics it supposed to be no inflammation, but there is high temperature and the baby is crying. So there is a problem which I don't know"* [B42 Graduate 1 month experience].

> *"Sure she got infection, because body temperature is high. Blood pressure high also, aaa she got infection. Maybe in the site of appendectomy, inside, aaaaa she has pain, irritable because of pain, but about the temperature she has*

infection. We will first cover the infection site then by cleaning in septic technique" [T29 Graduate 8 months experience].

What becomes clear from the qualitative data with regard to assessment skills is that the quantitative scores did not reliably predict that the paediatric nurses actually understood the significance of all the clinical measurements used in all three scenarios. The imprecision in reporting their findings also indicated that the vast majority of nurses failed to use a systematic method of analysis to assist them to consistently interpret data. The value of this Think Aloud data is that it also provides an explanation of why none of the nurses correctly assessed all three scenarios, and raises the prospect that many may simply have made a lucky choice.

Subtheme 2: Types of Responses

This was evidence that most nurses were unclear as to what were the correct interventions, which vital signs would be required to monitor the child's condition and the frequency with which they should be undertaken in each scenario. More concerning was the dearth of responses concerning parental involvement or opinions in all the scenarios, when they are, as the main carer the most knowledgeable about their child's condition.

In the Improving Child Scenario, involving a child with bronchiolitis, not all of the graduate or diploma nurses planned to continue administering the prescribed drugs and oxygen. One diploma with 3 months experience [T31] suggested increasing the oxygen rate to 5 litres without giving any rationale for doing so. A few other nurses, mainly graduates from Region 2, wanted to commence oral feeding, and another

graduate [T23 6 months experience] from Region 1 suggested that a nasogastric tube might even be necessary.

Most of the graduate nurses from both regions were vague about what vital signs they would actually monitor, and concentrated on respiratory rates. More concerning was the fact that there was only a limited mention of considering the child's temperature. Those few graduates who were mainly from Region 2 that suggested a frequency for monitoring vital signs all suggested widely different timings, suggesting a failure of a coherent strategy for their actions.

> *"...little only, we need to observe him, his vital signs are normal, not too bad, need to be checked every some time, observe the baby, only monitoring for the vital signs every one or two hours*" [B50:Graduate 8 months experience].
>
> *"He needs monitoring for vital signs regularly. His breathing to be noticed every now and then check the breathing and the SpO2 level even I will monitor that also*" [B52 Graduate 8 months experience].
>
> *"Check vital signs after 15 minutes, only*" [B60. Graduate 6 moths experience]
>
> "*To decrease the temperature first then will check after 30 minutes, then if Decreased and RR still high we need to give oxygen and medication*" [T29 Graduate 8 months experience].

A few nurses wanted to carry out investigations, with some citing chest x-rays and a number of blood tests without stating why. In addition to some nurses wanting to report everything to the doctor, a graduate from Region 2 thought the child should go home [B56 Graduate 1 month experience], whilst another from Region 1 considered he should be transferred to PICU.

The predominate response from the mix of graduate and diploma nurses from both regions to the Deteriorating Child Scenario involving an asthmatic child was again to concentrate on the administration of oxygen and Salbutamol. However, it should be noted that a few graduates from Region 1 that scored correctly to the quantitative question nevertheless considered the use of mechanical ventilation was appropriate at the deteriorating stage. Significantly, there was no justification for ventilator use either from the content of the scenario, or provided by the nurses themselves during the Think Aloud data.

> *"The patient might turn to ventilator if the SpO2 87 and connected to oxygen"* [T17 Graduate 6 months experience].

> *"...because I'm worrying about SpO2 and respiratory rate, still and ABG result, maybe he needs ventilation, to be connected to mechanical ventilator, may be aaaa only*" [T25 Graduate 8 months experience].

> *"...this baby maybe aaaa will have complications leads to the need of mechanical ventilation"* [T27 Graduate 4 months experience].

In addition to administering the prescribed medication (Salbutamol) and consulting the doctor they would also monitor the child's vital signs. They were again mostly imprecise, choosing to focus only on the measurements in the scenario and not considering a full range of clinical data and what they may mean. Whilst most suggested they would *closely* monitor the child's condition, again the frequency and rationale was omitted from their consideration.

> *"I will try to measure the SpO2 more frequently. And I will aaaa assess the patient response to the medication; if he isn't improved with this medication I'll try ask the physician to change the medication or the medical plan. aaaa if the patient make effort during the respiration I'll help him to be comfortable. I will put him in the upright position to improve the air entry, and also I still monitor the blood gases to see if it improve the oxygen or not, this is my plan. I'll increase the oxygen according to the physician order, otherwise I'll make humidity air in the room, it will improve, by putting water with oxygen, steam inhalation also. That is all"* [T25 Graduate 8 months experience].

> "*First thing connect oxygen to him, check the vital signs, if notice any change I will inform the doctor, I am worried about this case, I will ask the doctor to increase the oxygen, because I cannot do anything without doctor's order*" [$_{B42}$ Graduate 1 month experience].

Again some graduates from Region 1 felt that the plan ought to include transfer to the intensive care unit rather than be treated on the ward.

> "*My plan would be to transfer this patient to ICU. This patient when admitted to ward was given medication, Ventolin and corticosteroid started in ER then aaaa respiratory rate 48 aaaaa ---No, No just close observation because after given medication the chest improved, not too much but little, so close observation, if this patient didn't improve within 24 hrs might transfer him*" [$_{T27}$ Graduate 4 months experience].

> "...*he has asthma history, this needs a special care, this considered sick, should a nurse stay close and connected to oxygen, Ventolin, aaaa a close nurse to check him if any progress, this transfer to HDU, sure to transfer to HDU, won't stay in the ward*" [$_{T35}$ Diploma 6 months experience].

Reponses to the Ambiguous Scenario followed the same pattern as the other scenarios. The majority of nurses' responses from both regions, and graduate and diploma nurses to this post-surgical pyrexia scenario revolved around monitoring vital signs, consulting the doctor, administering analgesia and antibiotics as well as employing methods to reduce the child's temperature, which all seemed appropriate responses.

> "*Sure she got infection, because body temperature is high. Blood pressure high also aaa she got infection. Maybe in the site of appendectomy, inside, aaaaa she has pain, irritable because of pain, but about the temperature she has infection. We will first cover the infection site then by cleaning in septic technique, do blood culture aaa coz she got infection, only this"* [$_{T29}$ Graduate 8 months experience].

However, when it came to methods of reducing the temperature a few nurses from Region 1 completely contraindicated themselves, demonstrating a lack of understanding of the physiological responses and the impact of their suggested actions.

"Try to decrease the temperature by applying warm compression and also I'll try to do bath for the baby" [$_{T25}$ Graduate 8 months experience].

"...*aaa this patient received antibiotics then this the temperature increased to 38, I'll stop the medication then inform the doctor for this one for observation. I'll do cold compression and I'll remove all the cloths, aaa and I'll do shower, bath then inform the doctor*" [T31 Diploma 3 months experience].

"Here only temperature is high and need only medication to reduce it. Here RR is 35 might need oxygen with nebuliser of normal saline, because she might have difficulty in breathing .And check her every 10 minutes to see how the condition, normal saline as nebuliser with oxygen because everyone come from surgery can't breathe, so this is normal" [$_{T15}$ Diploma 1 month experience].

The nurses' responses to monitoring vital signs mainly focused only on the child's temperature rather than a consideration of other signs that would be affected by this condition. Again similarly to the Improving Child Scenario the nurses were again inconsistent in their opinions of how frequently the vital signs should be monitored. There again vague responses with the use of the term *check regularly*. Those that did attempt to provide a frequency showed no consistency either, with timings ranging from every 10 to 30 minutes through to every 1-2 hours. These results reinforce the findings from the other two scenarios and a total lack of a systematic approach to reporting their findings.

5.3 The Post-intervention Findings:

Three months after the educational intervention in Region 1, the same nurses were re-tested using the same vignettes. Only 20 of the original 27 nurses (74%) completed phase two. Compared to phase one (baseline) those nurses that were unavailable to take part in phase two were 18% (n=5) from Region 1 (the intervention group) and 7% (n=2) from Region 2 (the control group). Whilst this did not alter the balance between diploma level and graduate nurses in Region 2, it did alter the balance of the

intervention group (Region1) by reducing the graduate population by 21% (n=4) and the diploma nurses by 12% (n1).

5.3.1 Theme: Experience and Training

The same themes emerged from the analysis of the data collected during the Think Aloud administration of the vignettes and the post-administration semi-structured interviews.

Subtheme 1: Passive Bystanders

Despite the additional clinical experience there appeared to be little improvement in most of the control group graduates' acceptance of their clinical responsibilities. They continued to distance themselves, persisting in claiming a lack of experience and feeling new.

> "...*because still feeling new...I don't have enough experience in all the Children's department*" [B52].

> "*I don't have enough experience with all the cases*" [B48].

> "*I feel still not expert, need more time*" [B44].

Although some graduates and diploma nurses in the intervention group also laid claim to being new and lacking experience, there were notable exceptions in the form of a graduate and a diploma nurse that demonstrated their improved involvement in clinical decisions.

> "*I have experience now and I know the normal range of vital signs and I know from appearance and I can see the mother complains and comments, also I look to the investigation*" [T33 Graduate].

> "...*we check everything and it is normal and sometimes the mom didn't tell us the full history and complain like vomiting and losing fluids*" [T35 Diploma].

Subtheme 2: Absence of Experience

Despite the additional clinical experience, most of the nurses in both groups had still not experienced cases of a child deteriorating during their time in practice. Nurses from both groups who had some prior experience of deterioration described a range of clinical conditions which resulted in PICU or Neonate Intensive Care Unit (NICU) admissions.

> *"I was with case he was ok then suddenly when I came to his room he became blue and difficult breath, his lips blue and his eyes aaa so I called for help, we give oxygen and called the doctor, after we give medication ---- we transferred him to ICU*" [T19 Diploma].
>
> *"I have case neonate and was not crying, the doctor was there, so started giving breath through the ambo bag, it was cyanosed, no pulse, so we intubated the baby and sent it in the incubator to NICU*" [B44 Graduate].

There were some noticeable differences in the descriptions given between the groups' responses. The nurses from the control group who had answered the vignettes incorrectly in phase one and whose confidence levels were over-inflated remained over-confident and continued to respond incorrectly to the vignettes. On the other hand, overall there was an improved confidence level in the intervention group as all the diploma nurses and most of the graduates responded correctly to all three vignettes.

The intervention groups were expansive in their descriptions of their clinical knowledge and experience, whereas the control group were less so and more concerned to emphasise that they did not experience any incidents of cardiac arrest.

> "L*ast week I have case DKA transferred to ICU, the blood sugar was very high. PH was 7.1 and ketones, protein were in urine, we started IV fluids of normal saline*" [T33 Graduate].

> *"Yes but not cardiac arrest, we have poor sucking or yellow faeces then will transfer them to NICU"* [B48 Graduate].
>
> *"...we have some cases but not cardiac arrest, like cases of tachypnea, in these cases keep observing the child and monitor vital signs every 15 minutes*" [B52 Diplomat].

Not only did the majority of the intervention group nurses feel more confident in recognising and responding to child deterioration, but they also described the assessment skills they used to arrive at their clinical decisions and correctly answered the Deteriorating Child Scenario.

> *"...first thing I do when I receive the case I'll do full assessment and check vital signs. Any abnormality I'll call the doctor and I start give oxygen, connect the monitor, and keep observation* [T23 Graduate].
>
> *"Some cases are clear from the general look and appearance, sometimes when we take vital signs we find out its serious so we respond immediately by calling for help*" [T35 Diploma].

The majority of the control group showed a complete lack of descriptions of using clinical skills to arrive at their decision to act. Instead, they reiterated their lack of confidence and experience in dealing with child deterioration. This was also verified by most of the nurses' inability to correctly identify the Deteriorating Child Scenario, but also their complete lack of training for this type of clinical situation.

> *"...because I must respond immediately to the case according to the case and my knowledge*" [B62 Graduate].
>
> "*I don't have enough experience in all the children's department*" [B52 Graduate].

Subtheme 3: Deference to the Doctor

As in phase one, both groups reported that they had easy access to medical support, however there were clear differences in the groups' responses to how they communicated with the doctors.

In the control group, there was evidence that the emotional aspects of their responses to the idea of deterioration in children and the apparent deference to the doctor by just *following orders* persisted.

> *"I will call him and tell him my worries"* [B50 Graduate].
>
> *"...when I'm worried about any case I will call him"* [B44 Graduate].
>
> "*I can react and have courage to react and follow the order*" [B56 Graduate].

However, there was a notable change in the nurses' responses in the intervention group, with a lack of emotional responses and what appears to be less deference to the medical staff. They described a proactive approach and an apparent acceptance of their professional responsibility towards both the assessment of the child's condition and in communicating their concerns effectively. Some nurse also suggested using a particular technique reflecting that they had not only found the RADAR course content valuable and had already found it clinically applicable.

> *"...confident in me to deal with the cases and analyse the signs and how to act instead of depending on the doctor before...I'll call the doctor, aaa using the SBAR technique, situation assessment background and recommendation"* [T11 Graduate].
>
> *"First I'll assess the case and do investigation and then will call him*" [T15 Diploma].

5.3.2 Theme: An absence of Focused Training

The control group were unanimous in declaring that they had not received any training in the recognition and response to child deterioration, although a few had attended an in-service neonatal resuscitation session. Some nurses even expressed their

eagerness to attend the promised training which would be provided after this study had been completed.

Both a graduate and a diplomat attempted to minimise this lack development and training by suggesting instead that they had gained clinical skills solely by the time spent in practice, although their high confidence levels were again misplaced as they had both failed to respond correctly to the deteriorating scenario.

> *"No, and sure if there is I will join (the course) but also with the experience everyone will gain a lot of skills"* [B52 Graduate].
>
> *"No, only I have my experience only in the hospital*" [B58 Diploma].

None of the nurses in the intervention group had attended any in-service programmes since phase one, but they were unanimously positive about the perceived professional and clinical benefits they had derived from the RADAR course. In addition, their improved confidence levels did not seem either over-inflated or misplaced, as they had without exception improved in all their responses to the three clinical scenarios, especially the diploma nurses.

> "*Yes many benefits, I was not able to read ECG and this course added to me by 70 % especially the lecture of cardiac and respiration and situation awareness"* [T13 Diploma].
>
> "Yes it was very useful, especially the assessment process I was aaa in many cases of cardiac and respiration problems, and the communication skills and SBAR technique, it was very good" [T19 Diploma].
>
> "Aaa I got benefits especially the workshop with the real cases discussing the cases with the team and the doctor" [T21 Diploma].

There did seem to be a few anomalies in the graduates' performance between phases one and two. One nurse claimed that the course had "refreshed" their understanding of child deterioration [T39], nevertheless they responded incorrectly to the Deteriorating

Child Scenario and the Ambiguous Scenario. Whilst others claimed they had improved their understanding of communications and assessment skills and had responded correctly to the Deteriorating Child Scenario, they made errors of judgement in the other clinical scenarios; the Improving Child Scenario [T23] and the Ambiguous Scenario [T33].

5.3.3 Theme: Assessment, Recognition & Response

Subtheme 1: Understanding Clinical Data

Compared to phase one, where some nurses in the control group asked for clarification during the assessment of the scenarios, none of them did so during phase two. In addition, when it came to the Deteriorating Child Scenario, the majority of the control group nurses confirmed that they lacked the clinical knowledge, and so it was not surprising that some made the wrong assessment of the child's condition, whilst one completely abdicated the assessment to the medical staff.

> "*Aaa I don't have enough information about blood gases, but overall, the case is started to improve*" [B48 Graduate all vignettes incorrect].
>
> "*The case is in between not good not bad*" [B44 Graduate, all vignettes incorrect].
>
> *"The RR is 48 isn't normal, I guess it is high, SpO2 is 87 is low even he is connected to oxygen but still low. HR is 120 is good, temp is normal, BP is good, aaa blood gases aaa I honestly don't know, usually doctor read it and tell us*" [B52 Graduate Vignette 2 incorrect].

This deficit of knowledge and some abdication of responsibility also continued in response to the Improving Child and Ambiguous Scenarios.

> *"The vital signs are good except this BP I don't know the normal range*" [B44 Graduate Vignette 1 but all incorrect].

> *"I never worked in the surgery department it would be hard for me now, but aaa we should in all cases before doing anything we should inform the doctor about the case, and I will not take any procedure. In this case temp is little high, other signs are ok, the temp 38 it means there is something but I don't know what is it"* [B46 Graduate Vignette 3].

It was also noticeable that as well as incorrect assessments in the Improving Child and Ambiguous scenarios that the nurses were more hesitant when it came to recognising deterioration, resorting to using a vague word such as "*maybe*" [B46,B52,B56, B60, B62].

It was used to avoid reaching a conclusion when asked about the child's condition. This hesitation, predominantly from Region 2, demonstrated a reluctance on behalf of the nurses to be decisive in interpreting the scenario clinical data.

> "...*maybe from the side of oxygen and respiration*" [B56 Vignette 3 incorrect].
>
> "...*maybe because RR 45 and here it's written he has fever history, so might temp increase again or has difficulty breathing*" [B46 Vignette 1 incorrect].

Whilst some of the intervention group nurses also used the word "*maybe*" in the Ambiguous Scenario, it was used twice by one nurse in the group, who incorrectly interpreted the clinical data [T39].

But where "*maybe*" was used by other nurses [T11, T21], it was used to predicate a comparative outcome [T11, T21] before arriving at their final correct decision.

> "...maybe he has inflammation, he has had appendectomy if only a fever it won't deteriorate" [T11 Diploma Vignette 3 correct response].

The intervention group also made a number of requests for clarification in all three scenarios, which were not solely confined to any particular nurse or qualification level. However, more nurses asked for additional information whilst considering the Deteriorating Child Scenario compared to either the Ambiguous or the Improving Child

Scenarios. Nevertheless, all the additional information was used to assist them in both recognising and affirming their correct interpretation of the clinical situations and reach appropriate decisions.

> "*I want to ask how the SpO2 was last time?"* [T31].
> *"The SpO2 was 93%"* [Researcher].
>
> "*...was 93 and now 87%, so he needs to be seen by doctor to shift him to ICU for more care and observation"* [T31 Graduate, Vignette 2].

> *"I want to see the vital signs when he came first, how was the SpO2?* [T33].
> *"It was 93 on room air*" [Researcher].
> "*!Aaa and how was the RR?* [T33].
> *"It was 40"* [Researcher].
> *"Aaa this is deteriorating because the SpO2 is going down, and the chest ...has wheezing...aaa blood gases isn't good and he is distressed"* [T33 Graduate, Vignette 2].

> *"...what is his age?"* [T35].
> *"3 months*" [Researcher].
> "*Aaa his case isn't bad, ok stable*" [T35 Diploma Vignette 1].

> "*I want ask how the temp was last time*" [T21].
> "*It was 37.5, 6 hours ago*" [Researcher].
> "*...because she had fever after surgery, maybe there is bacteria infection*" [T21 Diploma, Vignette 3].

Despite these positive changes within the intervention group there remained a few worrying assessments, where nurses who correctly assessed the Deteriorating Child Scenario lost their precision in reasoning in the Ambiguous Scenario.

> *"...heart rate maybe low, I forgot the normal range but I think it's ok, and the case is deteriorating*" [T33 Graduate, Vignette 3 incorrect response].
>
> "*This patient aaa I think has allergy from antibiotic, he took antibiotic after operation but he is irritable, and crying, temp is 38 but maybe normal"* [T31 Graduate, Vignette 3 incorrect response].

What becomes clear from phase two of the study with regard to assessment skills and the ability to quickly recognise the clinical situation was that the intervention group were considerably improved, and that they used inquiry and feedback to inform and support their analysis of the clinical data.

Subtheme 2: Types of Responses

The vast majority of the control group and the intervention group continued to be confident that they would respond to child deterioration. In the case of the control group, their responses to all three vignettes were predominantly associated with solely expecting the doctor to determine how they should react to any of the given clinical situations. They describe being dependent on medical staff for the appropriate actions, and were in the main unable to articulate any precise plan of actions they alone ought to take as a result of their assessment, even when they correctly responded to the vignette.

> "*I will call the doctor to come and solve the problem...for sure the doctor will find out a solution for this problem and he will tell me what to do*" [B48 Vignette 1 incorrect response].

> "*I call the doctor, he should be near to us and sure he will plan to increase the O2, so I will follow his order*" [B44 Vignette 2 incorrect response].

> "*I will see the doctor and find out the reasons then follow the order, I will not do anything before asking expert person had experience more than me as I am less than two years of experience and this case is difficult*" [B62 Vignette 3 correct response].

Fewer of the intervention group nurses reported informing the doctor, and they were more confident in their decision-making. Rather than being reliant on the doctor to determine what actions to take, they described more of a consultation with them in response to the clinical situation, even though again they may have given an incorrect response on the VAS.

"*...give her paracetamol, maybe clean the surgery site, we should find out the reason of high temp if it's sepsis or infection. Because we might increase the antibiotic or change it, so we will call the doctor for the advice*" [T19 Vignette 3 correct response].

"*My plan is to keep him on facemask all the time, aaa also keep him on monitor to observe the SpO2, give him nebuliser and atrovent, give him fluids to prevent anything might happen. Give the antibiotics, also call the doctor and tell the observation especially if there is cyanosis, only and if not improving we should transfer him to HDU or ICU"* [T13 Vignette 3 correct response].

"...connect oxygen, give medication for the asthma, take blood gas again, and call the doctor to review it" [T39 Vignette 2 incorrect response].

What remains consistent with phase one planned responses is that the majority of nurses from both the control and intervention groups reported that they would be involved in delivering some form of medical treatment, investigation and measurements.

"Oxygen is important and when he is in this position of difficult breathing he should be under supervision and care to take the nebuliser and medication" [B62 Vignette 2 incorrect response].

"We will increase the oxygen via facemask, sure should increase it and stay observing his status...also observe his appearance and his lips if become blue" [B50 Vignette 2 correct response].

The intervention group's explanations were considerably more detailed compared to the majority of the control group. Some also suggested the frequency of the vital signs measurement, but even so, the intervals they suggested varied widely, ranging from 15 minutes, 30 minutes, and 60 minutes to 4 hours. Most did not give time intervals for the vital sign measurements that were necessary to monitor, even though they had correctly identified that the child was deteriorating on the VAS scale.

"Ventolin nebuliser and again do investigation for ABG...aaa should be putting the patient under observation...our concern is vital signs...we might do X-ray" [T11 Vignette 2 correct response].

"...keep him with oxygen, give him nebuliser, under observation all

the time, if there is medication from the doctor we will give" [T19 Vignette 2 correct response].

"...*close observation, monitor SpO2 all the time, give him oxygen and Ventolin, and check the RR*" [T35 Vignette 2 correct response].

There was also more emphasis on seeking the parents' opinions in the assessment of the child's condition, which was more frequently commented upon in intervention group responses to the Ambiguous Scenario [T11, T13, T33 and T39].

As in phase one there was no concern for the level of oxygen used in asthmatic conditions by either group of nurses. There was a strange unexplained suggestion for investigations such as tests for Malaria and bone marrow from an intervention group diploma nurse [T13]. There was one concerning pharmaceutical suggestions from a control group graduate [B62], that they should either not give paracetamol, or alternatively over-dosing this drug by increasing the time interval for administration of the drug from 6 hours to 4.

5.4 Conclusion

This chapter provided the results of the qualitative data obtained from a semi-structured interview and the administration of three clinical scenarios with newly qualified paediatric nurses working in hospitals in two regions of Saudi Arabia.

A sample of 27 nurses were recruited in phase one (the pre-intervention stage) which reduced to 20 in phase two (the post-intervention stage), when they became unavailable owing to other unavoidable work commitment. Three themes and five subthemes emerged from the analysis of the data. Three subthemes developed from the semi-structured interview theme; experience and training. Two subthemes

developed from the analysis of the vignettes theme: assessment, recognition and response. The regional comparisons of the findings in both phases of the study allowed the differences to become apparent, as well as enabling the differences between graduate and diploma trained nurses to become clear.

Chapter 6: DISCUSSION

6.1 Introduction

Identifying the deteriorating child is both a challenging and necessary role of the paediatric nurse, yet there is an accepted lack of paediatric research internationally and a dearth of any studies from Saudi Arabia. This is therefore the first study to examine the ability of Saudi-trained nurses working in paediatric wards to recognise clinical deterioration, and to determine whether a focused culturally-adapted educational intervention can impact on this ability.

The quasi-experimental design of this pilot study is novel, as it uses vignettes to explore this and adds to the international knowledge base on the topic. This chapter is a discussion of the findings of the study. It will both discuss and summarise the main aspects of the thesis, addressing the research questions and aims of the study, the results and their relation to published literature, along with a discussion of the strengths and weaknesses of the study. It will conclude with recommendations for practice, a dissemination plan and areas for future research.

6.2 Research Question 1: What is the ability of Saudi-educated nurses working on paediatric wards to recognise deterioration?

I found in newly qualified nurses working on paediatric wards in KSA, that 15% incorrectly responded to all three vignettes, and that overall around half (48%) could not identify the deteriorating child. Given that the importance of early recognition of deterioration in children is vital in order to improve patient outcomes (Tume, 2007; Pearson, 2008; Wolfe et al., 2014), this is concerning. Avoidable deaths in hospitalised children have been studied extensively in developed countries in an effort to

understand the patterns and factors contributing to child deaths and recommend preventive measures (Pearson, 2008; Pearson et al., 2010; Sidebotham et al., 2014; Fraser et al., 2014; Wolfe et al,. 2014; Penk et al., 2015).

Despite the substantial fall in children's deaths in the UK, there was nevertheless a continued professional concern linked to those deaths that were regarded as potentially preventable, and measures such as early recognition of the severity of the illness, and improved communication between professionals were recommended. 'Failure to rescue' hospital incidents are described by Silber et al. (2007) as adverse events where there are clear signs of physiological deterioration that have preceded the event. They claim that they are often the result of inadequate staffing, equipment problems, and ineffectual clinical reasoning. It is clear from these studies that the paediatric nurses' ability to recognise cues and changes in children's physiological status ought to be regarded as an essential clinical competency for which they are prepared, if avoidable deaths are to be eliminated in the future.

The assumption made by the researcher that nurses in all KSA regions have a similar level of ability to recognise deterioration at graduation, was not evident in this study (AlYami and Watson, 2014). Despite apparently the same educational input at undergraduate level, nurses working in Region 1 outperformed the nurses in Region 2. Although it is not clear why Region 1 performed better, it is possible that it is related to the type of clinical experience after qualifying, or the culture within the ward of the hospital. However, overall, graduate nurses appeared to perform better than diploma nurses in recognising the Deteriorating Child Scenario. Similar results from adult nursing studies have been found (Wheatley, 2006; McDonnell et al., 2015). These studies also reported that a graduate level of education made a difference to the

nurses' ability to recognise and respond appropriately to deterioration (Purling & King, 2012; Pantazopoulos et al., 2012; Massey, 2017). However, the differences may also be affected by the length of undergraduate education. In the KSA, graduate nurses undertake five years of undergraduate education, whereas diploma nurses only undertake 2.5 years. This is different to other countries where the standard registered nurse education at degree level is 3 years (AHPRA, 2017; NCSBN, 2012; NMC, 2016) and may in part explain the findings.

Making sense of the clinical data presented in the vignette scenarios involved the paediatric nurses being able to reason and form conclusions about the children's pathophysiological information. This required both knowledge and experience to enable them to assess and interpret the data. When the overall responses to the three vignettes from both regions were examined, the majority of nurses gave incorrect responses, although the responses were more evenly distributed in the Deteriorating Child Scenario. Some nurses also asserted that they could draw on their experiences with adults to assist them when nursing a sick child, but the findings from this study undermine this belief, and confirm the views expressed about the lack of clear agreement on the values attributed to vital signs (Duncan, 2006; Van Kuiken et al., 2013; Sefton et al., 2014). In addition, this lack of rigour in the assessment and interpretation of paediatric observations is, according to Aylott's review of practice (2006), alarming. She states that by the time vital signs change in a child they may be in uncompensated shock and require immediate specific medical intervention.

Data from the PECAN (Paediatric Emergency Care Applied Research Network) centre (Meert et al., 2009) found that survivors were more likely to have treatable respiratory

distress compared to non-survivors. Some of the nurses in this study were feeling confused and nervous in explaining what they would do if they had a deteriorating child, or even a child in cardiorespiratory arrest. Although survival rates in children were said to be dire post-critical incidents, they were nevertheless found to be better than for adults (Berg et al., 2008; Nadkarni et al., 2006; Tibballs et al., 2009).

Furthermore, the majority of nurses in this study suggested delivering some form of medical treatment as well as monitoring vital signs, such as giving all deteriorating children oxygen, a gastric lavage or first aid. These novice nurses also remained confident in their ability to respond to the Deteriorating Child Scenario, and while some of their responses (e.g. giving oxygen) appear appropriate, others did not. These nurses were clearly out of their depth, as there was neither uniformity nor precision to most of their clinical explanations and decision-making. They frequently provided convoluted and confused reasoning when discussing the physiological parameters, suggested widely different monitoring intervals, and lacked a clear method or systematic way of reporting their conclusions.

In spite of the overall inadequate responses by the nurses to all three clinical vignettes, the confidence levels reported by both graduates and diploma nurses were unrealistically high. This was more evident when it came to responding to clinical signs, compared to their ability to respond to critical events. This may be characterised as an over-inflated perception of their level of competence in recognising deterioration. Although this seems counterintuitive, this over-inflation of their ability is an example of what Vancouver et al. (2002) found in people with high levels of self-efficacy. Moore

and Healy (2008) confirm this finding but clarify that it is a feature of the task. In other words, the more difficult the task, the more people overestimate their ability.

The majority of respondents from both regions did not ask for any additional clinical information about the vignettes, seemingly unaware that they may not have sufficient information before coming to a decision. This may be, as O'Leary and Mhaolrúnaigh (2012) suggest, because they viewed the decision they were making as routine. They suggest that because the situation described in the vignette is similar to their routine, it made them confident and did not trigger information-seeking behaviours. But of more concern were those graduate and diploma nurses who did ask questions when formulating their responses, yet asked for completely irrelevant information, which demonstrated their inability to interpret the data appropriately.

In addition, despite a number of nurses witnessing critical incidents, the nurses in this study described an overall failure to prepare them with skills in recognition and responding to a deteriorating child. These skills could have helped them to deal with a critical incident of a deteriorating child, and as Chapman et al. (2010) suggest, an understanding of the combination of physiological parameters could reliably predict serious adverse events and thereby alert the medical staff for timely intervention.

However, the nurses dismissed their inability to recognise and respond to deterioration by claiming to be '*new',* even though many had over 6 months clinical experience. According to Hollywood (2011), and Jackson (2005), the most significant reality shock facing newly qualified paediatric nurses was coming to terms with accepting their professional responsibility. The distancing of themselves from accountability may be

a means of reducing anxiety, but conflicts with their need to establish their professional credibility when taking on the qualified nurse's role.

Studies of transition from adult student to employee have repeatedly highlighted that stress associated with clinical skills deficits is a typical finding (Gerrish, 2000; O'Shea & Kelly, 2007). This is a finding that was replicated in the paediatric literature (Oermann & Lukomski, 2001), and the high levels of fear and distress found in this study were attributed to the vulnerability of this patient group. The more positive aspect of these findings is that the nurses in this study reported support they received from their senior nurse colleagues and the unlimited availability of the Saudi doctors on call.

The passive role of the nurse described in the findings as '*just following doctors' orders'*, may well stem from what Pijl-Zieber (2013) refers to as a historically obsolete socio-political healthcare perspective. Despite this, the term '*doctors' orders*' clearly remains in common use in the KSA, and clearly affirmed the power imbalance expressed by the paediatric nurses. Since all the participants in this study were female and there is a predominance of male doctors in Saudi Arabia, then gender factors clearly maintained a particular subservient power arrangement that has adverse consequences for patient safety per se (Ceci, 2004).

This perceived power imbalance could be considered particularly important given that it is known that hierarchies are known to lead to communication failures and delays in the care of children who are deteriorating (Leonard et al., 2004). As Roberts et al. (2014) found in their study, the nurses in this study also described enlisting the experience and authority of the charge nurse to overcome their hesitancy and summon

the doctor on their behalf. They claim that the barriers to alerting rapid response teams were an issue of professional hierarchy and lack of self-efficacy, and that these were stronger for nurses than for physicians (Roberts et al., 2014).

6.3 Research Question 2: What were the nurses' perceived education and training needs around deterioration?

At times, some nurses had an over-inflated level of confidence in their ability; however all the nurses expressed the need for practical training to help them to recognise and respond to deteriorating children. This was not a surprising result given that this was a major assumption driving the aims of this research, based on the recurring narrative in the international literature pertaining to the lack of training (Pearson, 2008; NPSA, 2009; ACSQHS, 2010; Wolfe et al., 2014). Indeed, the interviews confirmed unequivocally that the same situation pertains to the two regions in the KSA.

In phase two although some nurses had witnessed critical incidents during their employment, they did not think that these incidents had prepared them with the clinical skills to enable them to recognise a deteriorating child. In addition, they did not feel confident in their ability to implement procedures for responding to a Deteriorating Child Scenario. These clinical skills could have helped them to deal with a critical incident of a deteriorating child. This situation was not helped by none of the nurses receiving any paediatric in-service training, or pre-registration education preparation, specifically focused on clinical deterioration in children.

When asked to consider what methods of learning they preferred, the nurses' overwhelming choice of method of learning was to have practical experience. Whilst the nurses unanimously realised they needed training in recognising and responding

to child deterioration, they were overwhelmingly in favour of practical teaching methods. This was not a surprising finding as a systematic review of educational interventions to improve clinical decision-making and judgement in nurses found only limited evidence that existing strategies might be effective (Thompson & Stapley, 2011). According to Bultas et al. (2014), didactic teaching may not be as effective or as motivating as simulating events of real clinical situations. This type of 'safe learning environment' helps novice nurses learn from a stressful experience, but in a safe context (Chan, 2004; Elliott, 2002) through positive experiences. As Levett-Jones et al. (2008) contend, positive learning environments promote both personal and professional development.

Nurses' imprecision in reporting/communicating their findings indicated that the vast majority of nurses failed to use a systematic method of assessment to assist them to consistently collect and interpret patient data. Most nurses were also unclear about the correct interventions, which vital signs would be required to monitor the child's condition, and the frequency with which they should be undertaken in each scenario. Most of the graduate nurses from both regions were vague about what vital signs they would actually monitor, and concentrated on respiratory rates. Of concern was the fact that there was only a limited mention of considering the child's temperature, and they did not demonstrate any understanding of the issues involving oxygen administration. All of these are measurement- and essential skills for all healthcare practitioners working with children (NHS England, 2015; NICE, 2016).

More concerning was the dearth of responses concerning parental involvement or opinions in all the scenarios. Parents are, as the main carers, the most knowledgeable about their child's condition and are usually present at the child's bedside (Carter,

2015). To ignore their contribution results in further diminishing the nurses' confidence in their clinical judgement. It is beneficial that parents are fully involved in decision-making about their child and allowed to adequately act as an advocate for their child (RCN, 2017; RCPCH, 2014).

6.4 Research Question 3: What was the impact of the focused educational intervention on nurses' ability to recognise deterioration? Did this intervention meet the nurses' perceived training needs?

Overall, in this pilot study in two regions of KSA, the focused educational intervention (RADAR course) improved the ability of the newly qualified nurses to recognise child deterioration in the vignettes. What is interesting is that in the control group (which had more graduates), even with 12 months additional clinical experience, the scores did not improve.

Nurses are required to make key decisions around every 10 minutes in acute care, but approximately every 30 seconds in an emergency situation (Bucknall, 2000). These findings undermine the argument that experience alone improves clinical performance, without some form of education (Ignatavicius, 2001). As Ingram (2008) and Tanner (2006) propose, improved clinical performance and thinking develops over the longer term and is based on a foundation of basic science knowledge and the ability to collect, analyse and communicate that data effectively. To be able to think critically and make sound clinical judgements when assessing the deteriorating child, requires reflective reasoning (Facione, 2008; Tanner, 2006). Yildirim (2011) outline the skills of critical thinking as:

> "[Habitually inquisitive, self-informed, trustful of reason, open-minded, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex

> matters, diligent in seeking relevant information, focused in inquiry and persistent in decisions" (p. 258).

As he states, this process involves reflective and reasoned thinking about nursing problems, without a single solution, and is focused on deciding what to believe and do.

Consequently, this supports the numerous policy and research recommendations made for providing focused education to staff as a means of improving the safety of children in hospital (Hawkins et al., 2018; Frazer et al., 2014). The effects of this were particularly evident in the intervention group, where diploma nurses significantly outperformed graduate nurses, principally in the deteriorating clinical scenario. However, in this study, none of the nurses had experienced a critical incident/deterioration event since the original study phase one.

Changes to the nurses' confidence levels however, were marginal, with the intervention group being slightly more confident than before the intervention and the control group unrealistically overconfident. However, importantly, the information-seeking behaviours (O'Leary & Mhaolrúnaigh, 2012) in the intervention group changed, in that they asked for far more relevant clinical information and demonstrated their assessment skills related to the scenarios, prior to forming their clinical decisions and correctly answering the scenarios. Their responses appeared to have less deference to the medical staff and were more proactive, accepting their professional responsibility towards both the assessment of the child's condition and in communicating their concerns effectively.

The majority of the control group nurses, by contrast, did not provide coherent descriptions of how they arrived at their clinical decisions. Instead, they reiterated their lack of confidence and experience in dealing with child deterioration and reiterated their lack of training for dealing with this type of clinical situation. They also persisted in excusing their lack of ability by claiming to be still '*new*' and continuing to defer to the doctor and '*following doctors' orders*'.

Some of the intervention group nurses also suggested using a recognised technique (SBAR, which was taught in the RADAR course) helpful, and indicated that they had not only found the RADAR course content valuable, but that they had already found it clinically applicable. This was significant, as one of the key factors in failures to rescue was the inability of staff to effectively communicative their concerns in a timely manner (Pearson, 2008; NPSA, 2009). As the National Patient Safety Agency report of 2009 claims, and international views (Gillman et al., 2006) confirm, when adverse events occur in children in hospital, the two most common causes were a failure to recognise the severity of the patient's illness and poor communication between professionals. My findings suggest that these factors are also a concern for KSA-trained paediatric nurses, whatever their level of education.

Another means of addressing the problem of the nurses' inability to recognise the signs of clinical deterioration could be to adopt a Paediatric Early Warning Score (PEWS) and system. (Chapman et al., 2016; Roland, 2012). The various PEWS used internationally have some positive impact on multidisciplinary team work, communication between staff, and making decisions about the child's clinical deterioration (Lambert, 2017; Fuijkschot et al., 2015; Bonafide et al., 2012; Edwards

et al., 2010). This is despite the most recent international trial of PEWS (EPOCH), which demonstrated no difference in mortality. One caveat from the recent international study of PEWS by Parshuram et al. (2018) was that introducing PEWS without educational input (such as the focused paediatric training of the type used in this study), would not provide a means of decreasing all-causes of in-hospital mortality in children. So it is logical to assume that an educational component must be an essential part of any safe system approach, whether a PEWS is used or not.

Whilst there are a number of disparate PEWS in current use (Lambert et al., 2017), and there have been evaluations (Parshuram et al., 2015), in some countries there is a move to develop a standardised national PEWS tool (Thomas-Jones et al., 2018; Lambert et al., 2017; Clerihew, 2016). The use of PEWs may need to be considered within the KSA, as this may improve the Saudi-trained nurses' ability to recognise deterioration, communicate this effectively and necessitate an appropriate escalation response.

It is argued that the results from the ongoing mixed-method study in the UK to establish the key components of a PEWS system in order to standardise monitoring of children in hospital (Thomas-Jones et al., 2018) would provide further evidence around this. What PEWs may do is provide a standardised method of communicating clinical concerns to all members of staff, and provide nurses with the baseline physiological parameters that would be a timely alert to an impending critical incident (Sefton et al., 2015).

Clearly, the focused educational course in this study (even without the use of PEWS) demonstrated an improvement in these nurses' ability to consider relevant aspects around deterioration and improve recognition, and this was particularly so for the diploma nurses. RADAR course was welcomed by those nurses who attended the course, and is eagerly awaited by those who did not. More importantly, the course demonstrated that the nurses in this study, as well as others, found they appreciated the other professionals' perspectives in dealing with clinical problems, and learnt to become less deferential to medical staff by clarifying their role in recognising and responding to deterioration (O'Leary et al., 2016; McKay et al., 2013; Tume et al., 2014).

The ability of the nurses to improve how they communicate their concerns regarding patients to medical staff, was vitally important. Ensuring medical staff really listen to nurses' concerns has been shown to be a significant finding in preventing clinical incidents (Cioffi, 2000; Cioffi et al., 2009; Endacott et al., 2010). Even experienced nurses continue to find it daunting to be confident in their assessment of the subtle changes in a patient's condition when dealing with medical staff (van Galen et al., 2015; Dalton et al., 2018), and report medical staff distrusting and ignoring junior staff (Gawronski et al., 2018). Some systems allow experienced nurses to escalate care and prevent harm by calling rapid response teams, thereby circumventing their ward doctors' disregard for their concerns (Douglas et al., 2016).

As Tanner (2006) outlines, nurses develop their thinking and practice in situations that are influenced by the prevailing culture, which in Saudi Arabia is particularly potent, and permeates all activities in every organisation (Azim & Islam, 2018). The impact of

social status, gender and power are issues known to affect not only the recruitment and education of nurses, but also the retention and careers of female nurses (Alroqi, 2017; Alghamdi & Urden, 2016; Lamadah & Sayed, 2014). Providing Saudi nurses with a culturally appropriate educational programme related to child deterioration was one way to improve communication, but introducing PEWS into the ward situation could enhance the nurses' ability even further.

6.5 Strengths and Limitations of the Study

The main strength of this study is the use of both methods, consisting of two separate components of data collection and analysis but integrated within a single study (Creswell, 2013). It involved one quantitative method with structured data collection using Think Aloud methodology, with a series of three clinical vignettes that were measured on three visual analogue scales (VAS) and statistically analysed. The second method was to use the Think Aloud recordings and a post-task semi-structured interview to collect data on the nurses' perceptions of their ability to recognise and respond to child deterioration, and their education and training needs, all of which was analysed using a Framework Approach.

There were some limitations of the pilot study that warrant consideration. The sample was small and opportunistic. It was also unevenly distributed across two regions of a country with 13 regions, and was what Kemper et al. (2003) call a pragmatic choice. It did however allow for an efficient but limited comparison between the two regions, and between diploma and graduate nurses, and gives preliminary but credible explanations of the changes in outcomes as a result of the educational programme.

So although the sample size was small, the study was representative when regarded as a pilot study. For this PhD project it was a pragmatic choice, because both the study sites were within reach of the researcher's home base, and access to their staff was provided by the service managers.

The researcher believes the use of clinical vignettes, designed with the support of paediatric clinical experts, depicted and replicated a range of real-life clinical scenarios relevant to the novice nurses (Goudreau et al., 2014; Peabody et al., 2000; Gould, 1996). However, despite the best efforts, the non-clinical nature of the data collection method can never reproduce what the participants would do in real life. In addition, as Rafferty et al. (2001) indicate, the choice of three vignettes and the order in which they were delivered may have affected the nurses' responses. Finally, the researcher is male, and all participants were female. To undertake the study testing and the interviews required some adaptation so as not to conflict with the cultural norms of Saudi society. The study was therefore conducted by the researcher in the hospital and in a large unlocked classroom that provided confidentiality, but was visually observable, thereby maintaining the rules regarding the mixing of genders in public spaces. Despite these limitations, I believe that this study has produced some very important new knowledge around this topic and has added to the knowledge-base in this field.

6.6 Recommendations for Practice

This study confirms that the lack of specialist paediatric education and training for nurses can have negative effects when combined with an attitude of complete deference to medical staff. These safety outcomes are further complicated by

expected cultural norms in the KSA, which results in the low status of nursing and a persistent shortage of nurses. It also highlights the improvements that can be produced by providing paediatric nurses with specific clinical knowledge and the means of communicating effectively with colleagues and parents when they have concerns. The study highlights the inadequacy of the current undergraduate nursing curricula and the lack of ongoing continuing professional education for nurses in the KSA. In light of evidence from two regions of KSA, the generic nursing curricula across KSA should be evaluated with regards the impact of training on recognition and intervention relating to paediatric deterioration.

Implications for Practice may involve implementing a standardised observation chart (with graphical display) for recording vital signs, and PEWS score combined with an escalation algorithm in the KSA. The following are more detailed recommendations for practice:

- To implement an evidence-based PEWS system supplemented by a culturally-specific focused education course (RADAR) for nurses who work in paediatrics in KSA.
- To modify the internship period of BSN nurses to be parallel with the theoretical modules yearly to reduce the current lack of practice experience.
- To recommend to the Private and MOH employing healthcare organisations to consider employing paediatric-qualified nurses in paediatric units throughout KSA.

6.7 Recommendations for Future Research Areas.

It is clear that further research is required in this area. The most pressing of which is to further refine the RADAR course and evaluate it, prior to embarking on a larger study across other Saudi regions, as well as to explore methods to empower Saudi educated nurses in their communication with medical staff. Other work within the KSA

context could explore factors impairing nurses' communication within the team, and investigating strategies that may improve this within the cultural context of the KSA to improve the safety of children in hospital.

6.8 Plan for Dissemination of the Findings

According to Mfutso-Bengo et al. (2008), researchers help to build the intellectual capacity of the countries and organisations where they conducted the research, and have a responsibility to contribute to the overall development needs of their discipline. Most nursing research projects are acknowledged and expected to make an important contribution to the knowledge-base (Schober et al., 2009). Novice researchers often underestimate the value of their work and fail to adapt their study for effective dissemination of their findings to local and/or national audiences (Gerrish et al., 2015). They require the support and encouragement of experienced supervisors to ensure that they ensure the results of their empirical research efforts reach the widest possible audiences. The following summarises the ongoing work undertaken, and the plans for the dissemination of this study, locally, nationally and internationally.

Locally (KSA), health service and university colleagues, managers and contributors to the study are expected to be interested in work that has been undertaken in their regions (many of whom already are aware of it as they were involved in the approvals process). They will not only be provided with an adapted summary of the study findings, but the researcher (D Al-Thubaity) will provide the hospital authorities with a study report, along with his recommendations and a presentation to facilitate a discussion of the implications and recommendations for practice. In addition, the

RADAR course developed for this study will be delivered to the control group participants as promised.

Nationally, the Ministry of Health and Education will also be provided with the adapted study findings summary, in addition to the full report, as well as current and subsequent publications arising from the thesis. Offers to present the findings and discussions will be made. Abstracts will also be submitted to present the study findings at key national conferences in the Arabian Peninsula in 2019.

During the PhD, two abstracts were accepted at international conferences. This resulted in the successful presentation of the initial baseline findings of the research. The first was the 25th World Congress in Nursing Care in Melbourne, Australia in July 2017, and the second (which presented the almost final results of the study) was at the 9th Congress of the World Federation of Paediatric Intensive & Critical Care Societies, in Singapore in June 2018. The second conference abstract was published in Paediatric Critical Care Medicine Journal (June 2018 - Volume 19 - Issue 6S – p. 62).

By far the most successful and yet challenging form of disseminating of the initial quantitative results was published in the Nursing in Critical Care Journal (Al-Thubaity et al., 2018) (Appendix 19). The process of writing, editing from inception and revisions through the peer review process, required a more succinct style of writing. The learning, albeit by trial and error, is expected to be immensely valuable in shortening the process of writing the proposed additional series of articles planned for the future.

A further publication of the results of the educational intervention is also planned for the same journal in 2019.

6.9 Conclusions

My study found that prior to the intervention, over half of newly qualified nurses working in two regions of the KSA could not identify the deteriorating child in a clinical vignette. This confirms the results of research conducted in other contexts, and reminds us that the recognition of deterioration is a complex process, for which newly qualified nurses may be ill-prepared. Even in these non-stressful simulated scenarios, many of the participants working with children failed to recognise clear signs of the deteriorating child. Post-intervention however, the changes in nurses who attended the RADAR course demonstrated a significantly improved ability. These results justify the development of a culturally-adapted specific focused educational multiprofessional course on recognising children's deterioration for the KSA. It also recommends, in the short term, the introduction of an adapted PEWS observation system combined with this focused education course in order to address the gaps in knowledge around recognising deterioration of children in hospital. In the long term, the recommendation is that the KSA introduces the requirement that all nurses wishing to practice in this field of nursing have a specific post-qualifying paediatric qualification.

APPENDICES

Appendix 1: Hawker, S, Tool "Appraising the Evidence

This checklist is from Hawker, S., S. Payne, et al. (2002). "Appraising the Evidence: Reviewing Disparate Data Systematically." Qualitative Health Research 12(9): 1284-1299.
Please assess each paper on the following criteria. For scoring please refer to notes below.
Good=4
Fair=3
Poor=2
Very poor=1
Lower scores =poor quality
Notes for appraising the quality of each paper:

1. Abstract and title:

Did they provide a clear description of the study?
Good Structured abstract with full information and clear title.
Fair Abstract with most of the information.
Poor Inadequate abstract.
Very Poor No abstract.

2. Introduction and aims:

Was there a good background and clear statement of the aims of the research?
Good Full but concise background to discussion/study containing up-to date literature review and highlighting gaps in knowledge. Clear statement of aim AND objectives including research questions.
Fair Some background and literature review. Research questions outlined.
Poor Some background but no aim/objectives/questions, OR Aims/objectives but inadequate background.
Very Poor No mention of aims/objectives. No background or literature review.

3. Method and data:

Is the method appropriate and clearly explained?
Good Method is appropriate and described clearly (e.g., questionnaires included). Clear details of the data collection and recording.
Fair Method appropriate, description could be better. Data described.
Poor Questionable whether method is appropriate. Method described inadequately. Little description of data.
Very Poor No mention of method, AND/OR Method inappropriate, AND/OR No details of data.

4. Sampling:

Was the sampling strategy appropriate to address the aims?
Good Details (age/gender/race/context) of who was studied and how they were recruited. Why this group was targeted. The sample size was justified for the study. Response rates shown and explained.
Fair Sample size justified. Most information given, but some missing.
Poor Sampling mentioned but few descriptive details.
Very Poor No details of sample.

5. Data analysis:

Was the description of the data analysis sufficiently rigorous?
Good Clear description of how analysis was done. Qualitative studies: Description of how themes derived/ respondent validation or triangulation. Quantitative studies: Reasons for tests selected hypothesis driven/ numbers add up/statistical significance discussed.
Fair Qualitative: Descriptive discussion of analysis. Quantitative.
Poor Minimal details about analysis.
Very Poor No discussion of analysis.

6. Ethics and bias:

Have ethical issues been addressed, and what has necessary ethical approval gained? Has the relationship between researchers and participants been adequately considered?

Good Ethics: Where necessary issues of confidentiality, sensitivity, and consent were addressed. Bias: Researcher was reflexive and/or aware of own bias.
Fair Lip service was paid to above (i.e., these issues were acknowledged).
Poor Brief mention of issues.
Very Poor No mention of issues.

7. Results:

Is there a clear statement of the findings?
Good Findings explicit, easy to understand, and in logical progression. Tables, if present, are explained in text. Results relate directly to aims. Sufficient data are presented to support findings.
Fair Findings mentioned but more explanation could be given. Data presented relate directly to results.
Poor Findings presented haphazardly, not explained, and do not progress logically from results.
Very Poor Findings not mentioned or do not relate to aims.

8. **Transferability or generalizability:**

Are the findings of this study transferable (generalizable) to a wider population?
Good Context and setting of the study is described sufficiently to allow comparison with other contexts and settings, plus high score in Question 4 (sampling).
Fair Some context and setting described, but more needed to replicate or compare the study with others, PLUS fair score or higher in Question 4.Poor Minimal description of context/setting.
Very Poor No description of context/setting.

9. **Implications and usefulness: How important are these findings to policy and practice?**

Good Contributes something new and/or different in terms of understanding/insight or perspective. Suggests ideas for further research. Suggests implications for policy and/or practice.
Fair Two of the above (state what is missing in comments).
Poor Only one of the above.
Very Poor None of the above.

Appendix 2: Literature on Recognising Deterioration:

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
1 UK	Dalton, M., Harrison, J., Malin, A., & Leavey, C. (2018). Factors that influence nurses' assessment of patient acuity and response to acute deterioration. British Journal of Nursing, 27(4), 212-218.	The aim of this study was to discover what factors influence how nurses assess adult patient acuity and their response to acute deterioration.	Qualitative investigation of nurses' reports of their opinions when caring for the deteriorating patient.	Individual semi-structured interviews asking for accounts of experiences. Ethical approval by Trust and University .	Purposeful sample of 10 (n3 cert – n3 diplomas and 4 degree) .	Audio taped interviews transcribed content thematically analysis.	When it came to knowledge base and academic achievement, most felt the doctors were superior to them and in this area (i.e. medical knowledge), they were 'the authority', and so the nurses would not be happy to contradict them. Intuition played a significant part of the first stage of their assessment of deterioration.	This study questions whether nurses hold the knowledge to aid this understanding in the first instance. Is there an assumption that nurses are using a knowledge base or merely their intuition? Small scale self-reported events but no examination of different educational levels and no mention of limitations.
2 Netherlands	van Galen, L.S., Struik, P.W., Driesen, B.E., Merten, H., Ludikhuize, J., van der Spoel, J.I., Kramer, M.H. and Nanayakkara, P.W. (2016). Delayed recognition of deterioration of patients in general wards is mostly caused by human related monitoring failures: a root cause analysis of unplanned ICU admissions.	To identify the healthcare worker-, organisational-, technical,- disease- and patient- related causes that contribute to acute unplanned ICU admissions from general wards using a Root-Cause Analysis Tool called PRISMA-medical.	Retrospective chart observational study. The Ethics committee of VU University Medical Center, approved study.	Assessment of protocol adherence to the early warning score. A retrospective, record review study included unplanned ICU admissions from general wards in the VU University.	49 consecutive adult patients admitted to ICU.	For analysis doctors' charts, nurses' charts and electronic patient files including all test results were available. Using IBM SPSS Statistics, descriptive characteristics and frequencies were calculated.	The most frequent root causes were healthcare worker related (46%), which were mainly failures in monitoring the patient. Followed by disease-related (45%), patient-related causes (7, 5%), and organisational root causes (3%). In only 40% of the patients, vital parameters were monitored as was instructed by the doctor. 477 vital parameter sets were found in the 48 hours before ICU admission, in only 1% a correct MEWS was explicitly documented in the record.	The causes predominantly included human monitoring and intervention failures, indicating flaws in monitoring the patients' progress or condition and faulty task planning or performance. The results show that the implementation of MEWS at the time of the study was insufficient. The protocol did not require the MEWS to be taken daily on set times to identify deterioration early.
3 Netherlands	Douw, G., Schoonhoven, L., Holwerda, T., van Zanten, A. R., van Achterberg, T., & van der Hoeven, J. G. (2015). Nurses' worry or concern and early recognition of deteriorating patients on general wards in acute care hospitals: a systematic review. Critical Care, 19(1), 230.	To identify the signs and symptoms that trigger nurses' worry or concern about a patient's condition.	Literature Review	Databases search using synonyms related to the three concepts: 'nurses', 'worry/concern' and 'deterioration'.	18 studies: five quantitative, nine qualitative and four mixed-methods designs were included in the review.	Systematic review, which excluded studies that focused solely on specialized wards.	A total of 37 signs and symptoms reflecting the nature of the criterion worry or concern emerged from the data and were summarized in 10 general indicators. change in respiration, change in circulation, rigors, change in mentation, agitation, pain, unexpected trajectory, patient indicating they are feeling unwell, subjective nurse observation and nurse convinced that something is wrong without a rationale.	The signs and symptoms we found in the literature reflect the nature of nurses' worry or concern, and nurses may incorporate these signs in their assessment of the patient and their decision to call for assistance. The fact that it is present before changes in vital signs suggests potential for improving care in an early stage of deterioration. The evidence found in this review was merely from retrospective research, which might have biased the results.

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
4 Canada	Martin, J. (2015). Nursing processes related to unplanned intensive care unit admissions. (Doctoral dissertation, Laurentian University of Sudbury).	To explore the nursing processes that are related to an unplanned intensive care unit admission.	Descriptive retrospective cohort design.	A retrospective audit.	140 patients' charts.	Descriptive statistics.	In the 12 hours prior to ICU admission vital signs were collected 3.4 times. The most common reason for unplanned intensive care unit admission was respiratory distress (52.7%), even though the respiratory rate was the least documented vital sign. Prior to ICU admission communication with the most responsible physician was documented 82.6% of the time and with the critical care response team 67.4% of the time.	Documentation and recognition of patient deterioration are key components of nursing practice where we can improve patient care outcomes. Strengthening these aspects of nursing care will improve patient outcomes and in turn help to prevent the need for unplanned intensive care unit admissions.
5 USA	Roberts, K., Bonafide, C., Weirich Paine, C., Paciotti., B., Tibbetts, K., Keren, R., Barge, F., Holmes, J. (2014). Barriers to Calling for Urgent Assistance Despite A Comprehensive Pediatric Rapid Response System. American Journal of Critical Care.	Identify barriers to calling for urgent assistance that exist despite recent implementation of a comprehensive RRS in a children's hospital.	Qualitative study.	Open-ended, semi-structured interviews.	27 nurses and 30 physicians caring for patients in general medical and surgical care areas. Tertiary care paediatric hospital with 530 beds,	Transcripts modified grounded theory approach. Thematic Analysis.	3 Findings (1) Self-efficacy in recognizing deteriorating conditions and activating the medical emergency team (MET) were considered strong determinants in a deteriorating condition. (2) Intra-professional and inter-professional hierarchies were sometimes challenging. (3) Expectations of adverse interpersonal or clinical outcomes from MET activations and intensive care unit transfers could strongly shape escalation-of-care behaviour.	Hierarchy and lack of self-efficacy were strong barriers for nurses and inexperienced clinicians than for others. This study has several limitations. First, it is possible that the physicians and nurses held more polarized opinions than did those who did not participate, creating selection bias. Second, participants worked in a tertiary-care pediatric hospital, and our results may not be generalizable to all hospital settings.
6 USA	Voepel-Lewis, T., Pechlavanidis, E., Burke, C., Talsma, AN. (2013). Nursing surveillance moderates the relationship between staffing levels and pediatric postoperative serious adverse events: A nested case–control study. International Journal of Nursing Studies 50: pp 905–913.	Examined the relationship between surveillance, staffing, and serious adverse events in children on general care ward postoperative.	Retrospective, case–control study.	Demographics, co-morbidities, perioperative information, frequency of postoperative monitoring and assessments (i.e., surveillance), and registered nurse hours per patient per shift (i.e., staffing) were recorded.	Two-hundred and twenty-eight children were included, children with serious adverse events on a general care unit were identified from institutional event databases,	Regression models were used to test the hypotheses of the relationship between surveillance, staffing, and serious adverse events in children.	The Event Group included 98 children and the Control Group, 158. Registered nurse hours per patient per shift were lower for the Event Group (2.99 _ 0.59) compared to Controls (3.38 _ 1.23, $p = 0.002$). The number of assessments/shift was higher for the Event Group (4.27 _ 2.8) compared to Controls (2.85 _ 1.9; $p < 0.001$), as was use of continuous pulse oximetry (78% vs. 58%, respectively; $p = 0.001$). Staffing moderated the relationship between comorbidity and surveillance ($r2 = 0.192$, $p < 0.001$) revealing a significant relationship at lower staffing but not higher.	Nurse staffing levels moderated the relationship between patient factors and surveillance demonstrating that this association is dependent on staffing levels. The association between staffing and adverse outcomes was dependent on the level of surveillance. Increased surveillance based on recognition of deterioration may have facilitated rescue of children in this setting, even during times of lower staffing.

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
7 Australia	Cioffi, J., Conway, R., Everist, L., Scott, J., & Senior, J. (2010). 'Changes of concern' for detecting potential early clinical deterioration: a validation study. Australian Critical Care, 23(4), 188-196.	This study aimed to determine the content validity of 'changes of concern' used by nurses to call emergency response teams.	Quantitative.	A questionnaire based on Bausell's content validity criteria of necessity and sufficiency.	Ten nurses who had 5 years or more experience with emergency response teams formed an expert group.	Data were summarized using descriptive statistics.	Assessment underpinned by these changes of concern (indicators) can provide more complete clinical information for clinicians to recognise possible early deterioration of patients and to coach others so building capacity to appropriately call emergency response teams resulting in increased patient safety.	The availability of these validated 'changes of concern' has the potential to guide a more comprehensive assessment for recognising potential early clinical deterioration and for making a decision to call or not call the emergency response team. The potential exists that assessment underpinned by these 'changes of concern' and their associated factors can provide more complete clinical information for best practice decisions that may result in improved predictive ability of criteria.
8 Australia	Cioffi, J., Conway, R., Everist, L., Scott, J., & Senior, J. (2009). 'Patients of concern' to nurses in acute care settings: a descriptive study. Australian Critical Care, 22(4), 178-186.	To identify cues of potential early clinical deterioration used to recognise 'a patient of concern' who is not meeting the current objective physiologic emergency response team calling criteria.	An exploratory descriptive approach.	Interviews with nurses who recalled incidences of calling the team to adult patients based on the criterion, 'concerned about patient'.	A purposive sample of 17 experienced registered nurses.	The transcribed audio tapes of interviews were coded to identify cues.	Main findings are ten identified changes of concern (cues): noisy breathing, inability to talk in sentences, increasing supplemental O2 requirements to maintain SaO2, agitation, impaired mentation, impaired cutaneous perfusion, not expected trajectory, new or increasing pain, new symptom, and new observation that nurses used to recognise potential early clinical deterioration.	This study only interviewed experienced nurses about potential early clinical deterioration in adult patients who were recognised as needing emergency assistance to be called using the criterion, 'concerned about patient'. Other health professionals who might be familiar with clinical deterioration in the early stages, for example experienced medical officers should be interviewed in a similar manner to identify other possible precursors.
9 UK	Odell, M., Victor, C., & Oliver, D. (2009). Nurses' role in detecting deterioration in ward patients: systematic literature review. Journal of advanced nursing, 65(10), 1992-2006.	This paper is a report of a review conducted to identify and critically evaluate research investigating nursing practice in detecting and managing deteriorating general ward patients.	The literature review between 1990 and 2007.	Three broad search categories were used: nursing observations, physiological deterioration and general ward patients.	Fourteen studies met the inclusion and quality criteria	Systematic review of all research designs describing nursing observations (vital signs) on deteriorating adult patients in general hospital wards were included.	The findings were grouped into four main themes: recognition; recording and reviewing; reporting; and responding and rescuing. The main findings suggest that intuition plays an important part in nurses' detection of deterioration, and vital signs are used to validate intuitive feelings. The process is highly complex and influenced by many factors, including the experience and education of bedside nurses and their relationship with medical staff.	Greater understanding of the context within which deterioration is detected and reported will facilitate the design of more effective education and support systems. The main limitations of the four weaker studies were their lack of reporting of study processes in sufficient detail, making it difficult to assess study quality. Data collection methods and withdrawals and dropouts were the areas with least detail reported, Issues were common to a number of studies, such as poor observation recording, lack of skill in recognizing deterioration and non-compliance with calling criteria protocols.
10 Australia	Massey, D., Aitken, L. M., & Wendy, C. (2009). What factors influence suboptimal ward care in	The factors that contribute to suboptimal ward care of the acutely ill patient.	Literature review.	Search terms that were used included suboptimal ward care, critically ill	Following this critical review 39 papers met the inclusion criteria.	Critical review.	Patients who are inpatients have more complex problems and a greater number of co-morbidities and are therefore more likely to suffer physiological deterioration. Procedures requiring inpatient stays	Suboptimal care implies a lack of knowledge regarding the significance of clinical findings relating to dysfunction of airway, breathing and circulation. Many of the papers analysed are outdated and have significant methodological flaws

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
	the acutely ill ward patient?. Australian Critical Care, 21(3), 127-140.			ward patients, acutely ill wards patients and adverse events.			are often more complex and associated with higher rates of mortality and morbidity. As patient acuity has increased, research has highlighted that the care of the acutely ill ward patient is suboptimal.	The literature consistently argues that the root of suboptimal ward care lies in the five distinct area: airway, breathing, circulation, oxygen therapy and monitoring in severely ill patients before admission to intensive care units may frequently be suboptimal.
11 UK	Tume, L. (2007). The deterioration of children in ward areas in a specialist children's hospital. Nursing in critical care, 12(1), 12-19.	• to evaluate any abnormalities in the physiological data in the 24 h preceding admission; • to examine whether the nursing and medical documentation reflected • to determine whether a PEW tool would have been triggered.	4 Month Audit to describe the characteristics of the emergency admissions from the ward areas and their observations and interventions in the ward areas;	A prospective chart review of clinical observations.	341 children were admitted to the PICU, of which 65 19% were unplanned from wards. Of these, the largest 40% (n =26), were aged 1–12 months. In 55% of cases (n = 36), the main reason for PICU admission was respiratory distress,	A descriptive analysis of the patient data was made, and the children's physiological data were retrospectively matched against two PEW tools (the Bristol Children's tool and Australia tool).	The majority of children admitted to HDU were not previous PICU or HDU patients [only 17% (n = 9) were previous HDU patients]. With regard to the interventions required on HDU, 50% (n = 26) of the children just required a greater amount of observation /monitoring, with only 11.5% (n = 6) requiring NIV. The median LOS on HDU was 3 days (range 2 h–23 days). The mortality of this group was 6%. In terms of HDU discharge, 83% (n = 43) of patients were transferred back to a ward, with only 6% (n = 3) coming to ICU and 6% (n = 3) going to theatre and then to ICU.	In total, 121 children required unplanned critical care unit (HDU or ICU) admission over the 4-month winter period of 2004–2005 in this specialist children's hospital. Of these, most (55%) were admitted because of respiratory distress, which predominantly occurred during out of office hours or at weekends (59%). Certain wards were at higher risk for ICU (cardiac, neonatal surgical and oncology), and general medical and surgical wards were at higher risk for the HDU. Nearly half of all unplanned ICU admissions were previous ICU patients, hence the importance of ICU follow up particularly in the first 24 h post discharge.
12 UK	Tume, L. (2005). A 3-year review of emergency PICU admissions from the ward in a specialist cardio-respiratory centre. Care of The Criticality Ill 21(1): pp 4-7.	To determine the characteristics of these admissions and to see if there were any Changes, Abnormalities in their vital signs in the 24 hours prior to emergency PICU admission.	Retrospective review of Paediatric Vital Signs.	Chart Review using a detailed data collection tool to ensure consistent and accurate data collection.	166 patients with primary Cardiac diagnosis.	Median values were calculated for each "vital sign" which were then stratified according to age group (again defined by APLS guidelines).	Clear signs of deterioration of cardio-respiratory children it became clear that the 'normal' APLS guidelines for vital signs do not reflect 'normal in cardio-respiratory children as their baseline observation often fell outside the 'normal' range.	Empower and educate the multidisciplinary ward team in managing more acutely ill children. Rotations to high dependency and to gain more skills and experience in assessing and managing sicker children.
13 Italy	Gawronski Orsola. Et al. (2018). Qualitative study exploring factors influencing escalation of care of deteriorating children in a children's hospital	This study explores the experiences of parents and healthcare professionals of in-hospital paediatric clinical deterioration events to identify factors associated with escalation of care.	A qualitative research design using focus groups.	Semi-structured focus groups.	6 focus groups with 32 participants were conducted with parents (n=9) and healthcare professionals (n=23)	Independent thematic analysis.	Four themes and 19 subthemes: (1) impact of staff competencies and skills, including personal judgement of clinical efficacy (self-efficacy), (2) impact of relationships in care focusing on communication and teamwork; (3) processes identifying and responding to clinical deterioration,; and (4) influences of	Findings emphasise the considerable influence of social processes such as teamwork, communication, models of staff organisation and staff education. Further studies are needed to better understand how modification of these factors can be used Limitation: results may not be generalisable to other hospitals. The study was conducted in a tertiary care paediatric hospital.

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
	BMJ paediatrics open						organisational factors on escalation of care, such as staffing,	Participants' selection was performed through the ward nurse managers,

Appendix 3: Literature on PEWS

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
1 Ireland	Veronica Lambert, Anne Matthews, Rachel MacDonell, John Fitzsimons (Accepted 2 February 2017). Paediatric early warning systems for detecting and responding to clinical deterioration in children: a systematic review BMJ open	To systematically review the available evidence on paediatric early warning systems (PEWS) for use in acute paediatric healthcare settings for the detection of, and timely response to, clinical deterioration in children.	Systematic review.	The electronic databases PubMed, MEDLINE, CINAHL, EMBASE and Cochrane were searched systematically from inception up to August 2016.	From a total screening of 2742 papers, 90 papers, of varied designs.	Systematic review.	Findings revealed that PEWS are extensively used internationally in paediatric inpatient hospital settings. However, robust empirical evidence on which PEWS is most effective was limited. The studies examined did highlight some evidence of positive directional trends in improving clinical and process-based outcomes for clinically deteriorating children. Favourable outcomes were also identified for enhanced multidisciplinary teamwork.	Despite many studies reporting on the complexity and multifaceted nature of PEWS, no evidence was sourced which examined PEWS as a complex healthcare intervention. Future research needs to investigate PEWS as a complex multifaceted sociotechnical system that is embedded in a wider safety culture influenced by many organisational and human factors. PEWS should be embraced as a part of a larger multifaceted safety framework that will develop and grow over time with strong governance and leadership, targeted training, ongoing support and continuous improvement.
2 UK	G. Sefton, C. McGratha, L. Tume, S. Laneb, P.J.G. Lisboac, E.D. Carrolba PICU (Jan 2014). What impact did a Paediatric Early Warning system have on emergency admissions to the paediatric intensive care unit? An observational cohort Intensive and Critical Care Nursing	To explore how the introduction of PEWS at a tertiary children's hospital affects emergency admissions to the Paediatric Intensive Care Unit (PICU) and the impact on service delivery.	Observational cohort study.	A before-and-after observational study August 2005—July 2006 (pre), August 2006—July2007 (post) implementation of PEWs at the tertiary children's hospital.	Total of 958 unplanned PICU admissions over two years were reviewed, for one year before PEWs introduction and one year afterwards.	Descriptive analysis: percentages, median and interquartile range(IQR)-inferential data analysis: Categorical data was analysed using the chi-squared test SPSS 18.0-.	The median Paediatric Index of Mortality (PIM2) reduced; 0.44 vs 0.60 ($p < 0.001$). Fewer admissions required invasive ventilation 62.7% vs 75.2% ($p = 0.015$) for a shorter median duration; four to two days. The median length of PICU stay reduced; five to three days ($p = 0.002$). There was a non-significant reduction in mortality ($p = 0.47$). There was no comparable improvement in outcome seen in external emergency admissions to PICU.	Following introduction of PEWS at a tertiary children's hospital PIM2 was reduced, patients required less PICU interventions and had a shorter length of stay. PICU service delivery improved. Limitation: small before-and-after observational study under-taken at a single centre.
3 UK	D Roland, A Oliver, E D Edwards, B W Mason, C V E Powell (August 2013). Use of paediatric early warning systems in Great Britain: has there been a change of practice in the last 7 years? Archives of disease in childhood	To determine the use of paediatric early warning systems (PEWS) and rapid response teams (RRTs) in paediatric units in Great Britain.	Cross-sectional survey.	An electronic survey was created in Survey Monkey which included questions in the 2005 PEWS. A shorter telephone survey.	All hospitals with inpatient paediatric services in Great Britain.		The response rate was 95% (149/157). 85% of units were using PEWS and 18% had an RRT in place. Tertiary units were more likely than district general hospital to have implemented PEWS, 90% versus 83%, and an RRT, 52% versus 10%. A large number of PEWS were in use, the majority of which were unpublished and unvalidated systems.	Despite the inconclusive evidence of effectiveness, the use of PEWS has increased since 2005. The implementation has been inconsistent with large variation in the PEWS used, the activation criteria used, availability of an RRT and the membership of the RRT. There must be a coordinated national evaluation of the implementation, impact and effectiveness of a standardised PEWS programme in the various environments where acutely sick children are managed.

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
4 USA	Molly Kaul, Julia Snethen, Sheryl T. Kelber, Kim Zimmanck, Kristin Maletta, and Michael Meyer (Sep 2014). Implementation of the Bedside Paediatric Early Warning System (Bedside PEWS) for nurse identification of deteriorating patients. Journal for Specialists in Pediatric Nursing	To explore nurses' and physicians' recognition of signs of deterioration and management of symptoms	Descriptive, cross-sectional study used an electronic survey with 35 nurses and 17 physicians	An electronic survey	35 nurses and 17 physicians	Data were analysed using SPSS version 8 (SPSS Inc. 2009). Descriptive statistics were obtained, including The frequencies of responses to each question	Nurses using the (Bedside PEWS) were significantly more likely to recognize risk for deterioration and respond with appropriate interventions. Physicians incorporating Bedside PEWS were more likely to choose reliable indicators of deterioration and reported significantly more effective communication from nurses to identify deterioration.	Bedside PEWS may improve nurses' and physicians' abilities to recognize early signs of patient deterioration, communicate findings to providers, and plan interventions. One challenge was that due to the limited number of available . limited number of interns who were familiar with the use of Bedside PEWS. The design was another limitation of this study
5 USA	Sharon M. Skaletzky, Andre Raszynski,, and Balagangadhar R. Totapally (2012). Validation of a Modified Pediatric Early Warning System Score: A Retrospective Case–Control Study Clinical pediatrics	To validate the modified version of Brighton PEWS tool for the assessment of at-risk children in less acute care areas of the hospital.	Retrospective, case–control study.	The chart review.	The study population included 100 cases and 250 controls.	The descriptive data are presented as either mean • } standard deviation (mean • } SD) or median with interquartile range (IQR).	There was no difference in the age of cases and controls (6.3 vs 6.3 years). The length of hospital stay (18.09 ± 32 vs 3.93 ± 2.9 days; P < .001) and the maximum PEWS score (2.95 ± 1.5 vs 1.4 ± 0.8) were significantly higher for the cases (P < .0001).	The use of the modified PEWS score can help identify patients on wards who are at risk for deterioration.
6 Canada	Parshuram et al. (2011.) Multi-centre validation of the bedside paediatric early warning system score: a severity of illness score to detect evolving critical illness in hospitalised children Critical Care 15	To validate the Bedside PEWS score in a large patient population at multiple hospitals.	An international, multicentre, case-control study.	Clinical documentation.		Logistic regression. Repeated measures linear regression.	2,074 patients were evaluated at 4 participating hospitals. The median (interquartile range) maximum Bedside PEWS scores for the 12 hours ending 1 hour before the clinical deterioration event were 8 (5 to 12) in case patients and 2 (1 to 4) in control patients (P < 0.0001). The AUCROC curve (95% confidence interval) was 0.87 (0.85 to 0.89). In case patients, mean scores were 5.3 at 20 to 24 hours and 8.4 at 0 to 4 hours before the event (P < 0.0001).	The Bedside PEWS score identified children at risk for cardiopulmonary arrest. Scores were elevated and continued to increase in the 24 hours before the clinical deterioration event. Prospective clinical evaluation is needed to determine whether this score will improve the quality of care and patient outcomes. The categorisation of children into clinical groups reflected a pragmatic decision. Second, we relied upon observed data rather than specifying the frequency and nature of clinical observations.
7 Canada	Christopher S Parshuram, James Hutchison and Kristen Middaugh (2009).	To develop and validate a simple bedside score to quantify severity of illness in hospitalized children.	A case-control design.	A survey of nurses caring for the patients in the case-control study, and prospectively	Candidate items and scores were evaluated in clinical data	Data was entered into an Oracle Database. correlation analysis was used	Data from 60 case and 120 control-patients was obtained. Four out of eleven candidate-items were removed. The Seven-item Bedside Paediatric Early Warning System (PEWS)	We developed and performed the initial validation of the Bedside PEWS score. This 7-item score can quantify severity of illness in hospitalized children and identify critically ill children with at least one hours notice. Prospective validation in other

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
	Development and initial validation of the Bedside Paediatric Early Warning System score. Critical Care			collected data from patients seen by the CCRT.	from 60 urgent ICU admissions and 120 well control patients.	to evaluate the relation between the maximum Bedside PEWS.	score ranges from 0–26. The mean maximum scores were 10.1 in case-patients and 3.4 in control-patients. The area under the receiver operating characteristics curve was 0.91, compared with 0.84 for the retrospective nurse rating of patient risk for near or actual cardiopulmonary arrest.	populations is required before clinical application. Limitation : First, the results of his single-centre study may not generalise to other settings. Second, the clinical data contained many missing values.
8 UK	E D Edwards, B W Mason, A Oliver, C V E Powell (Oct 2010). Cohort study to test the predictability of the Melbourne criteria for activation of the medical emergency team. Archives of disease in childhood	To test the predictability of the Melbourne criteria for activation of the medical emergency team (MET). To identify children at risk of developing critical illness.	Cohort study.	Data were collected on patients admitted in the 12-month period between 1 December 2005 and 30 November 2006.	Admissions to all paediatric wards at the University Hospital of Wales.	Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated.	Data were collected on 1000 patients. A single abnormal observation determined by the Melbourne Activation Criteria (MAC) had a sensitivity of 68.3% specificity 83.2%, positive predictive value (PPV) 3.6% and negative predictive value 99.7% for an adverse outcome. Four hundred and sixty-nine of the 984 children (47.7%) who did not have an adverse outcome would have transgressed the MAC at least once during the admission.	The MAC has a low PPV and its full implementation would result in a large number of false positive triggers. Further research is required to determine the relative contribution of the components of this complex intervention (Paediatric Early Warning System, education and MET) on patient outcome.
9 USA	John S. Murray, Lee Ann Williams, Shelly Pignataro, and Diana Volpe (August 2015). An Integrative Review of Pediatric Early Warning System Scores. Pediatric nursing	What is known about early warning system scores with paediatric patients. To explore the literature about the use of early warning system scores with paediatric patients.	Integrative review.	Several key words were used to search for research and clinical practice publications and conference abstracts on pediatric early warning system scores.	28 articles.	Thematic analysis.	Twenty-eight publications, including research, clinical practice articles, and conference abstracts, were identified. Five major concepts emerged from analysis of retrieved documents: overview of paediatric early warning system scores, supplementary benefits, facilitators to successful implementation, barriers to successful implementation, and needed research.	Although still in its infancy, initial data on the use of PEWS scores suggest that this assessment tool has the potential to quantify severity of illness in children, In turn, it is hoped this results in facilitating early identification of patients at risk for clinical deterioration and prompt intervention to avoid the need for transfer to a higher level of care.
10 USA	Mary-Ann J. Robson et al. (2013). Comparison of Three Acute Care Pediatric Early Warning Scoring Tools. Journal of pediatric nursing	The study compared the predictability of three previously validated PEW scoring tools.	A retrospective case-control design.	Retrospective medical record review.	101 cases from occurrence reports submitted between January 1, 2004 and December 31, 2008.	PEWS score comparison.	The PEW System Score (H. Duncan, J. Hutchison, & C. Parshuram, 2006) demonstrated a greater sensitivity (86.6%) and specificity (72.9%) at a score of five. The PEW System Score (H. Duncan, J. Hutchison, & C. Parshuram, 2006) could benefit healthcare providers in potentially averting CPA.	The effectiveness of the PEW System Score (Duncan et al., 2006) to identify 86.6% of children with signs of deterioration prior to a CPA. This suggests the use of the PEW SystemScore could benefit both nurses and physicians in identifying deteriorating children before a CPA. The implementation of the PEW System Score into practice could decrease the rate of acute care CPA in this

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
								organization and potentially avert the significant mortality.
11 USA	Tucker, Karen et al. (2009). Prospective evaluation of pediatric inpatient early warning scoring system. Journal for Specialists in Pediatric Nursing	To evaluate the PEWS in the clinical setting of a busy pediatric inpatient unit.	Prospective descriptive study.	Charge nurse for each shift record all PEWS for the patients.	2979 patients.	Sensitivity and specificity.	Patients highest pews ranged from 0-9 (M=2.22, SD=1.38). The majority of the patient 73% scored 0-2 throughout their entire hospitalization.	The PEWS tool provides highly reliable and valid clinical scoring data. High PEWS are predictive of patients who will require transfer to PICU.
12 Netherlands	Joris Fuijkschot & Bastiaan Vernhout & Joris Lemson & Jos M. T. Draaisma & Jan L. C. M. Loeffen (2014). Validation of a Paediatric Early Warning Score: first results and implications of usage. European journal of pediatrics	The aim of this study is to show the additional value of PEWS systems in clinical practice towards patient safety and healthcare quality.	Performed three different case cohort studies focusing on both the timely identification of 'sick' patients.	PEWS Scoring system.	Study 1: In 118/199 (59 %) admissions. Study 2: Out of 36 patients who had an unplanned admission to the PICU. Study 3: A total of 17 cases.	Descriptive.	A sensitivity of 0.67 and specificity of 0.88 to timely recognise patients. This proves that earlier identification is possible without a loss of sensitivity compared to other PEWS systems. When determining the corresponding clinical condition in patients with an elevated PEWS dichotomously as 'sick' or 'well', this resulted in 27 % false-positive scores. This can cause motivational problems for caregivers to use the system.	These data show the effectiveness of a modified PEWS in identifying critically ill patients in an early phase making early interventions possible and hopefully reduce mortality Limitation : In both studies 1 and 2, there is a substantial rate of false positive scores. Due to small patient numbers, considerations are to be made when interpreting our data.
13 Canada and 6 countries	Parshuram et al. (2018). Effect of a Paediatric Early Warning System on All-Cause Mortality in Hospitalized Paediatric Patients. The EPOCH Randomized Clinical Trial Jama	To determine the effect of the Bedside Paediatric Early Warning System (Bedside PEWS) on all-cause hospital mortality and late admission to the intensive care unit (ICU), cardiac arrest, and ICU resource use.	A multicentre cluster randomized trial.	Clinical documentation. The Bedside PEWS documentation record and the score-matched care recommendations for all patients admitted to eligible inpatient unit beds.	21 hospitals located in 7 countries (Belgium, Canada, England, Ireland, Italy, New Zealand, and the Netherlands).	Demographic and unadjusted outcomes data are reported using descriptive statistics, medians with interquartile ranges, means and SDs, as proportions with 95%CIs, and as rate differences with 95% CIs.	Among 144 539 patient discharges at 21 randomized hospitals, there were 559 443 patient-days and 144 539 patients (100%) completed the trial. All-cause hospital mortality was 1.93 per 1000 patient discharges at hospitals with Bedside PEWS and 1.56 per 1000 patient discharges at hospitals with usual care. Significant clinical deterioration events occurred during 0.50 per 1000 patient-days at hospitals with Bedside PEWS.	Implementation of the Bedside Paediatric early Warning System compared with usual care did not significantly decrease all-cause mortality among hospitalized paediatric patients. These findings do not support the use of this system to reduce mortality.
14 UK	Chapman et al. (2016) Systematic review of paediatric track and trigger systems for hospitalised children , Resuscitation	To describe the number and nature of published PTTS and appraise the evidence on their validity, calibration, and effect on important patient outcomes.	Systematic review; GRADE methodology.	Through electronic database and citation searching.	Thirty-three PTTS were identified from 55 studies.	Using QUADAS 2 (Supplemental data.) Remaining quantitative studies were assessed against criteria in the	There was considerable variety in the number and type of parameters, although all contained one or more vital signs. The evidence to support PTTS implementation was very low. After implementation, the evidence was moderate to low but	There is now some limited evidence for the validity and clinical utility of PTTS scores. The high (and increasing) number of systems is a significant confounder. Further research is needed particularly around the thresholds for the vital signs and the reliability,

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
						GRADE handbook.	there was some evidence of a statistically significant improvement in outcome.	accuracy and calibration of PTTS in different settings.
15 UK	Chapman S., Grocott, M P. Franck, L S. (2010). Systematic review of paediatric alert criteria for identifying hospitalised children at risk of critical deterioration. Intensive Care Med 36: pp. 600–611	To identify the number and nature of published paediatric alert criteria and evaluate their validity, reliability, clinical effectiveness and clinical utility.	Systematic review of studies identified from electronic and citation searching and expert informants.	Secondary Sources.	Eleven studies.	Fulfilled the inclusion criteria and described ten paediatric alert criteria.	There was marked variability across all aspects of the paediatric alert criteria, including the method of development, and the number and type of component parameters. Five studies explored the predictive validity of the paediatric alert criteria, but only three reported appropriate methodology. Only one study evaluated reliability, and none evaluated clinical utility of paediatric alert criteria.	Evidence supporting the validity, reliability and utility of paediatric alert criteria is weak. Studies are needed to determine which physiological parameters or combinations of parameters, best predict serious adverse events. Prospective evaluation of validity, reliability and utility is then needed before widespread adoption into clinical practice can be recommended.

Appendix 4: Literature on Focused Education in Paediatric Nursing:

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
1 Australia	O'Leary, J., Nash, R., Lewis, P., (2016). Nurse Education Today 36: pp. 287–292 Standard instruction versus simulation: Educating registered nurses in the early recognition of patient deterioration in paediatric critical care.	To investigate the effect of HFPS on nurses' self-efficacy and knowledge for recognising and managing paediatric deterioration. Further, participants' perceptions of the learning experiences specific to the identification and management of a deteriorating child were also explored.	Quasi-experimental design combined with semi-structured interviews to examine the aforementioned research questions.	Using a pre-test/post-test control-group design, participants were assigned to one of two learning experiences: Following the learning experience, nurses were also invited to participate in semi-structured interviews.	30 nurses participated in the study (control n = 15, experiment n = 15) Ten nurses participated in semi-structured interviews.	Likert scale was utilised as the scale to rate their degree of confidence on a scale between zero and ten. Thematic analysis of the interview data.	Participants demonstrate an increase in both perceived self-efficacy (p = b0.01) and knowledge (p =b0.01). No statistically significant change was observed in control group scores. The mean difference in self-efficacy gain score between the two groups was 5.67 score units higher for the experiment group compared to the control. HFPS also yielded higher follow-up knowledge scores (p=0.01) compared to standard instruction.	The results of this study suggest that HFPS can positively influence nurses' self-efficacy and knowledge test scores specific to the recognition and management of paediatric deterioration.
2 Australia	O'Leary, F., McGarvey, K., Christoff, A., Major, J., Lockie, F., Chayen, G., & Wharton, S. (2014). Resuscitation, 85(3): pp 431-436. Identifying incidents of suboptimal care during paediatric emergencies–an observational study utilising in situ and simulation centre scenarios.	To identify suboptimal care during standardised simulated scenarios and to identify the potential causation factors. Both the in situ and centre based standardised, with specific medical and nursing learning objectives, deemed reliable and valid by expert clinical faculty.	Prospective study utilised a combination of quantitative (cross sectional, observational) and qualitative research methods.	73 simulations occurred over 9 month period 2011.	Participants were emergency department and operating theatre staff 270 doctors, 235 nurses and 11 students participated.	Thematic qualitative assessment methods.	194 incidents of suboptimal care were observed and attributed to 325 causation factors. There were 76 knowledge deficits, 39 clinical skill deficits, 36 leadership problems, 84 communication failures, 20 poor resource utilisations, 23 preparation and planning failures and 47 incidents of a loss of situational awareness.	During standardised paediatric simulations, multiple incidents of suboptimal care have been identified and multiple causation factors attributed to these. Educators should use this information to adapt current training programs to encompass these factors. Concerns around validity of the scenario and open to open to observer bias
3 UK	Tume, L., Sefton, G., Arrowsmith, P. (2014). Nursing In Critical Care 19(4): pp.196–203. Teaching paediatric ward teams to recognise and manage the deteriorating child	To describe the development of the RESPOND course and present a preliminary evaluation of the first four courses.	Evaluation Survey. Hospital Junior doctors, medical students, and nurses in the North West of England.	A written post completed by immediately after the course and an electronic survey completed three months later.	Sixty-five participants undertook the RESPOND course over four separate days health care assistants in a large children's hospital	Data were analysed descriptively and by simple thematic analysis of free text responses.	Overwhelmingly participants found the course positive, with the most frequently cited benefit being improved multidisciplinary communication. Despite a poor response to the second survey, 18% (12 of 65) of respondents remained positive about the impact of the course.	This preliminary evaluation combined with a reduction in hospital cardiac arrest rates suggest that the multi professional RESPOND course (in conjunction with an early warning tool and response system) is successful as part of a targeted strategy to promote patient safety within a children's hospital.

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
4 Australia	McKay, H., Mitchell, I., Sinn, K., Mugridge, H., Lafferty, T., Van Leuvan, C., Mamootil, S, Abdel-Latif, M. (2103). J Paediatr Child Health 49 (1): pp. 48-56. Effect of a multifaceted intervention on documentation of vital signs and staff communication regarding deteriorating paediatric patients.	To evaluate the impact of newly designed Paediatric Early Warning Scores and an accompanying education package, COMPASS, on the frequency of documentation of vital signs and communication between health professionals and associated medical review in deteriorating paediatric patients.	Document and Incident Reviews The study design was a prospective, controlled before-and-after intervention trial.	The daily frequency of documentation of vital sign measurement, incidence of health professional communication and related medical reviews following clinical deterioration.	One thousand fifty-nine patients in the pre-intervention phase and 899 in the post-intervention phase were studied of a random subgroup of 262 pre-intervention and 221 post-intervention patients were studied in detail.	Statistical.	There were no significant differences in hospital mortality, medical emergency team reviews or unplanned admissions to critical care areas between the pre-intervention and post-intervention groups. There were significant increases in the post-intervention group for the median daily frequency of documentation of respiratory effort .There was a significant reduction in the number of children fulfilling the medical emergency team criteria.	A multifaceted intervention for the early recognition and response to clinical deterioration in children significantly improved documentation of vital signs, communication and time to medical review.
5 USA	Bultas, M. W., Hassler, M., Ercole, P. M., & Rea, G. (2014). Pediatric nursing, 40(1): pp. 27-33. Effectiveness of high-fidelity simulation for pediatric staff nurse education.	To determine if HFS, as compared with traditional static mannequin teaching methods, would improve the paediatric staff nurses' ability to recognize and intervene for a deteriorating paediatric Patient. To compare the effectiveness (HFS).	A pre-test post-test control group design.	Written, Behavioural measures. Evaluation knowledge retention, skill performance, and team confidence during the (PEARS) course.	Thirty-three ward nurses from a metropolitan paediatric Magnet® hospital.	Non Parametric Stats and the Mayo High Performance Teamwork Scale (MHPTS) were used to compare the outcomes between the two groups.	Results indicated that knowledge retention was maintained, skill performance improved, and teamwork performance scores increased in the experimental group although both groups showed a relative decline over time it was less for the experimental.	This study provides a foundation supporting the use of HFS as an effective teaching modality when educating pediatric staff nurses in the identification and intervention of the deteriorating pediatric patient. The study was small and some measurement tools had not been validated. The same scenarios were used and a higher % of nurses in experimental group were from medical unit and may be more used the clinical scenarios.
6 UK	Clerihew, L., Rowney, D., & Ker, J. (2016). Archives of disease in childhood. Education and practice edition, 101(1): pp. 8-14. Simulation in paediatric training.	This review shares some of the issues related to learning in the paediatric service environment and demonstrates how simulation can add benefit and value to both the educational process and clinical service.	General review of simulation in Paediatrics.	Literature Search.	General Review.	Series of questions, which will be of relevance to all those using simulation for paediatric training.	Advantages and Disadvantages Table 2 Simulation enables a critical event to be deconstructed into learnable chunks so that generic competences such as leadership, prioritisation and communication can be explored and refined Barriers to its widespread adoption. The most commonly cited reasons are costs resource constraints due to time, finance or an inability to access simulation centres.	Fundamentally, the role of simulation in paediatrics is to support quality improvement both of training and patient safety and as such we encourage rapid dissemination and widespread sharing of good practice; we support the use of free open access medical education resources and the use of social media, we encourage peer support, review and learning from each other.

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
7 UK	Theilen, U., Leonard, P., Jones, P., Ardill, R., Weitz, J., Agrawal, D., & Simpson, D. (2013). Resuscitation, 84(2): pp 218-222. Regular in situ simulation training of paediatric medical emergency team improves hospital response to deteriorating patients.	To evaluate the impact of regular team training on the hospital response to deteriorating in-patients and subsequent patient outcome.	Prospective cohort study of all deteriorating in-patients of a tertiary paediatric hospital requiring admission to paediatric intensive care (PICU) the year before, and after, the introduction of pMET.	All unplanned admissions of paediatric hospital in-patients to the Paediatric Intensive Care Unit (PICU) were prospectively audited for 1 year. weekly training for pMET was commenced.	All team members staffing pMET on a rotational basis were required to attend training.	Statistical analysis was performed using Fischer's Exact test and Mann-Whitney U tests to detect statistical significance ($p < 0.05$; PAWS, Version 17.0.1, 2009).	Deteriorating patients were recognised more promptly (before/after pMET: More often transferred to high dependency care (18%/37%, $p=0.021$) and more rapidly escalated to intensive. These improved responses by ward staff extended beyond direct involvement of pMET. There was a trend towards fewer PICU admissions, reduced level of sickness at the time of PICU admission, reduced length of PICU stay and reduced PICU mortality.	These results indicate that lessons learnt by ward staff during regular in situ team training led to significantly improved recognition and management of deteriorating in-patients with evolving critical illness. Integration of in situ simulation team training in clinical care has potential applications beyond paediatrics.
8 USA	Linder, L. A., & Pulsipher, N. (2008). Clinical Simulation in Nursing, 4(3): pp. 41-47. Implementation of simulated learning experiences for baccalaureate pediatric nursing students.	To present the implementation of simulated learning experiences for baccalaureate pediatric nursing students at the University College of Nursing.	Course include use of simulated human paediatric patients and a simulated electronic medical record and are included in both didactic and clinical courses.	Informal student feedback.	Traditional and second-degree students are admitted in separate cohorts of 72 students each.	nursing skills, synthesis of assessment findings, prioritization of nursing interventions, documentation, and multidisciplinary communication.	Feedback indicates improved confidence when approaching pediatric patients and better preparation to respond to acute changes in the patient's condition.	Student feedback indicates improved confidence when approaching pediatric patients and better preparation to respond to acute changes in the patient's condition. Plans include ongoing refinement of simulated learning experiences and the linking of actual clinical outcomes to simulation-based learning.
9 USA	Gary B. Smith, Nicola Poplett (accepted 2 January 2004) Impact of attending a 1-day multi-professional course (ALERTTM) on the knowledge of acute care in trainee doctors Resuscitation	To determine if, and how the ALERT course Had influenced the knowledge of acute care in trainees.	Development of a 1-day multi-professional course in acute care for newly qualified doctors and nurses, ALERTTM. Using a questionnaire,	Questionnaire.	118 senior house officers, 36 of whom had previously attended an ALERTTM course.	The average (±S.D.) knowledge score, Summing the individual marks allocated for each of the questions above, with a maximum score of 14.	The average (±S.D.) knowledge score was higher for those who had completed an ALERTTM course (9.44±1.63 points versus 7.45 ± 2.32 points; $P < 0.05$). In addition, those in the post-ALERTTM group also showed significantly better knowledge of the signs of complete airway obstruction, normal capillary refill time, percentage survival after in-hospital cardiac arrest,.	This study again highlights gaps in the acute care knowledge of doctors, even in those who have completed an ALERTTM course. Although there is significant improvement, we were disappointed to see that some areas of acute care continued to be poorly understood or remembered even after ALERTTM training, e.g. signs of airway obstruction. demonstrated evidence that doctors' knowledge of acute care can be improved by attending courses such as these.
10 USA	Straka, K., Burkett, M., Capan, M., Eswein, J. (2012).	To determine if the use of high-fidelity simulation is effective.	Pilot study.	Paediatric crisis recognition and management	Convenience sample of 26 novice nurses	Post-test data scores from the 3-month	The average score on the pretest was 71.15%; whereas the	A 7%increase in participant's knowledge post course in recognizing clinical signs of decreased perfusion and a 23% increase in

No. Country	Author Journal Date Title of publication	Aim	Methodology/ Perspective	*Data Collection Method*	*Population*	*Data Analysis*	*Finding*	*Conclusion & Limitations*
	The impact of education and simulation on pediatric novice nurses' response and recognition to deteriorating. Journal for Nurses in Professional Development			course occurred over a 3-month time period Pretest assessing his or her knowledge related to symptom management and recognition. Post-test and an evaluation in the computer laboratory on the website.	(within 6 months of hire).	implementation period were compared to the same sample's pretest scores to determine the effect of the intervention. .	average score on the post-test was 87.69% (see Table 2). A paired sample t test was conducted to compare the test results. Statistical significance was achieved at a value of p e .0001.	their ability to identify the first sign of deterioration in pediatric patients. By increasing knowledge of appropriate intervention, the novice nurse potentially enhances his or her ability to respond and intervene. Limitations of this project included the time frame, small number of participants, and the lack of a standardized assessment tool. Despite these limitations, the project was able to affect the novice nurse's ability to recognize and respond to a paediatric crisis situation.

Appendix 5: Nurses Interview Guide

Nurses Interview Guide

After welcome and brief introductions, written consent will be taken for the interview and audio recording. Brief demographic details of the participants will be taken Such as education, gender, age, years or months of paediatric nursing experience prior to commencing the audio recording of the vignette.

Interview

Phase 1

The Vignettes (See Appendix)

After explaining to the nurses what is meant by 'thinking aloud' The nurses will be given three vignettes (case study) and asked to "Think Aloud" when completing the questions involved in the cases providing information on the:

- The information being considered
- Their decisions and intentions as they occur to them

Any questions from the participant about the history of the case will be answered with available information.

Phase 2

Open-ended semi-structured questions

The nurses will be asked some questions about their understanding of deteriorating child and how they recognise it:

- Have you ever been involved in a case where a child suffered a cardiac or respiratory arrest on the ward or deteriorated and was admitted to ICU?
- If so, can you tell me about this experience?
- On a scale of 1-10 where 10 is very confident and 1 is not confident at all, how confident are you that you would recognise a deteriorating child on your ward?
- Can you describe why you gave this number?
- How confident do you feel about responding to a deteriorating child if you recognised they were? Scale 1-10. Why this number?
- How confident are you in talking to and getting a doctor to review a child you are worried about?
- Please explain ... What normally happens when you seek an urgent medical review? Does this process differ at night compared to in the day? How?
- Have you ever been taught in your nurse training about recognising and responding to children who deteriorate in hospital? If so, what/ where you taught and how was this taught to you?
- If not, would you have liked to have been taught? And what would you have liked to have been taught or shown?
- How do you think would this be best taught?
    - In a classroom - Whist working on the ward
    - Using role-play - Using simulation with high-fidelity
    - Using real life case studies - Other? please

At the end of the interview, the nurse will be thanked for participating in the study and if they have any immediate questions, these will be addressed. However, answers to the vignettes will not be given to avoid any bias to other participants

A follow up letter of thanks will be sent to all the participants and in the offer of being involved in the educational programme will be added in the Region selected for this intervention.

Appendix 6: Vignettes

Vignette 1

A 3/12 old boy was admitted to your children's ward after one day history of fever, poor feeding and respiratory symptoms with a diagnosis of suspected bronchiolitis.

You are looking after him the day after he was admitted and after doing his observations you find:

HR 150 **Spo2** 92% on 2 l/min oxygen

RR 45 with mild subcostal recession **Temp** 37.6 **BP**: 70/50

AVPU: awake and irritable at times

The mother is present and says, "I think he is looking a bit better "

ONLY provide the information below if they ask:

If they ask how his observations have changed since he was admitted.

His RR was 70 yesterday with moderate effort of breathing, his spo2 was 90% on 4l/min oxygen, HR was 165.

Correct answers: keep observing him 4-6 hourly, keep giving him prescribed meds and fluids. He looks like he is improving, but still needs to be in hospital and monitored.

This child appears to be improving

Vignette 2

You are caring for a 14 year old boy with history of asthma who has been admitted onto your ward 4 hours ago.

He was admitted with sudden onset of shortness of breath at school, which did not resolve with use of his asthma pump.

Nebulized salbutamol and oral corticosteroids were started in the emergency department.

You do his observations and they are:

Respiratory rate 48, with some expiratory wheeze present but his chest is actually very quiet. His father is with him and is very worried.

SaO2 of 87% on 40% oxygen via a facemask

HR120 **TEMP** 37.5 **BP**120/80

Blood gas results done 4 hours ago in ED were **pH** =7.5, **PaCO2** = 30 mmHg and **PaO2** =65 mmHg

If they ask: he cannot speak a whole sentence and can only say a few words and his work of breathing seems very high. He is now requiring almost continuous nebulizers.

What were his previous observations in ED: His RR was 40 and HR 100 with Spo2 of 93% in room air

He now looks quite tired and exhausted and is using a lot of accessory muscles to breathe.

Answer: This child appears to be deteriorating, he is exhausted and is not really moving much air into his chest and is at real risk of respiratory arrest.

Vignette 3

In the children's surgical ward, you are looking after a 3-year-old girl 1 day after an appendectomy. The appendix was ruptured when they got into theatre and she has been started on IV antibiotics post-op. When you go to do her observations, her mother says she seems worse and is irritable and crying.

Temp = 38.0 **HR=**120

RR=35 Spo2 98% on room air **BP**=105/60

ONLY if they ask: Her pain score is 7/10 and she last had an analgesic 6 hours ago. 6 hours ago her observations were: Temp 37.8, HR 110, RR 32, BP 95/60, pain score 2/10, wound obs – wound intact

Answer: She might be deteriorating and is at risk of sepsis but also is clearly in pain and this may be contributing to her irritation.
She needs to be given an analgesic immediately (it is due now) and then once settled in about 30 minutes her observations need to be re-checked, she may also need a doctor to review her pain medications to ensure they are adequate.

Abbreviations: HR Heart rate;**Spo2** Saturation of peripheral oxygen ;**RR** Respiration rate;**Temp** Temperature; **BP** Blood pressure; **AVPU** Alert Verbal stimuli Pain stimuli Unresponsive; **ED** emergency department; **Paco2** partial pressure of carbon dioxide in blood; **Pao2** partial pressure of oxygen in arterial blood; **IV** intra venous;

Appendix 7: Visual Analogue Scale (VAS) and Questions

Questions:

Tell me what you think about this child's condition?
Are you worried he is deteriorating or at risk of deteriorating?
On a scale of 1-10 how likely do you think he is to deteriorate and require ICU admission (10 very likely 1 not likely at all)

Not deteriorating Deteriorating
[1……2……..3……..4……5……..6……..7……..8……9……10]

Is there anything else you want to know?
Ask them now: what is your plan what will you do for this child?

Appendix 8: Semi-Structured Questions

The nurses will be asked some questions about their understanding of deteriorating child and how they recognise it:

- Have you ever been involved in a case where a child suffered a cardiac or respiratory arrest on the ward or deteriorated and was admitted to ICU?
- If so, can you tell me about this experience?
- On a scale of 1-10 where 10 is very confident and 1 is not confident at all, how confident are you that you would recognise a deteriorating child on your ward?

Not confident very confident

[1… . ….2… … ...3… ……4…. ….5. ….. ..6…. ….7. ……..8….. ….9…. … .10]

- Can you describe why you gave this number?
- How confident do you feel about responding to a deteriorating child if you recognised they were? Scale 1-10. Why this number?

Not confident very confident

[1… . ….2… … ...3… ……4…. ….5. ….. ..6…. ….7. ……..8….. ….9…. … .10]

- How confident are you in talking to and getting a doctor to review a child you are worried about?
- Please explain ... What normally happens when you seek an urgent medical review? Does this process differ at night compared to in the day? How?
- Have you ever been taught in your nurse training about recognising and responding to children who deteriorate in hospital? If so, what/ where you taught and how was this taught to you?
- If not, would you have liked to have been taught? And what would you have liked to have been taught or shown?
- How do you think would this be best taught?
  - In a classroom
  - Whist working on the ward
  - Using role-play
  - Using simulation with high-fidelity manikins
  - Using real life case studies
  - Other? please describe

Appendix 9: The RADAR Course

The RADAR course

Recognise eArly Deterioration And Respond

Adopted from RESPOND course

Aim:

To improve the ability of newly Saudi graduate nurses' recognition and responding to deteriorating child.

Objectives:

1- To develop the knowledge and understanding of the identification and management of deteriorating ward children.
2- To improve the new Nurse's recognition skills of deteriorating children.
3- To enable the proper timely responses, assessment and supervision of the acutely ill child on a general ward
4- To identify and deliver early treatment to any child whose condition is deteriorating
5- To prepare nurses When to call for help
6- To Explore strategies for effective communication

Expected outcomes

1- Greater recognition of "at risk" patients
2- Enhanced recognition of critical illness
3- Improved communication
4- Earlier recognition of need for assistance
5- Greater confidence supported by understanding
6- Improved record keeping and handover

Structure:

One-day course with mixed format of lectures and scenario based learning

VENUE:

Taif children Hospital

Date

April 12th 2017

Time

08:30 – 15:30

The RADAR course
Recognise eArly Deterioration And Respond

VENUE: Taif children Hospital

08:30	**Registration**	
9:00	**Introduction to the RADAR course** Background / Why are you here?	DAIFALLAH
9:30	**Improving Communication in healthcare**	DAIF
10:00	**Children assessment tool in TAIF, Forms, policy**	**Miss.**SHORROQ
10.30	**Identification of children at high risk of deterioration**	Miss.Ameera
10.55	Break	
11.15	**Caring for a child with cardiovascular compromise**	DR.GhormAllah
11:45	**Group work: Discussion case**	ALL
12:30	Lunch & Prayer	
13.15	**Situational awareness**	DAIF
13.45	**Caring for a child with respiratory difficulty**	Dr.Hamdan
14.15	**Group work: discussion case**	ALL
15.30	**Evaluations & Close**	DAIF

Appendix 10: Ethical Approval from the University

12th April 2016

Lyvonne Nicole Tume/Daifallah Dakhl D Al-thubaity
School of Nursing
University of Central Lancashire

Dear Lyvonne/Daifallah,

Re: STEMH Ethics Committee Application
Unique Reference Number: STEMH 441

The STEMH ethics committee has granted approval of your proposal application 'What is the newly graduated Saudi paediatric nurses' ability to recognise the deteriorating child? Can a focused educational intervention affect this?'. Approval is granted up to the end of project date* or for 5 years from the date of this letter, whichever is the longer. It is your responsibility to ensure that

- the project is carried out in line with the information provided in the forms you have submitted
- you regularly re-consider the ethical issues that may be raised in generating and analysing your data
- any proposed amendments/changes to the project are raised with, and approved, by Committee
- you notify roffice@uclan.ac.uk if the end date changes or the project does not start
- serious adverse events that occur from the project are reported to Committee
- a closure report is submitted to complete the ethics governance procedures (Existing paperwork can be used for this purposes e.g. funder's end of grant report; abstract for student award or NRES final report. If none of these are available use e-Ethics Closure Report Proforma).

Additionally, STEMH Ethics Committee has listed the following recommendation(s) which it would prefer to be addressed. Please note, however, that the above decision will not be affected should you decide not to address any of these recommendation(s).

Should you decide to make any of these recommended amendments, please forward the amended documentation to roffice@uclan.ac.uk for its records and indicate, by completing the attached grid, which recommendations you have adopted. Please do not resubmit any documentation which you have not amended.

Yours sincerely,

Kevin Butt
Vice Chair
STEMH Ethics Committee

Appendix 11: Region 1 Approval

KINGDOM OF SAUDI ARABIA
Ministry of Health
Directorate of Health Affairs Taif
Training & Scholarship, Dept.
الموضوع/ الموافقة على إجراء بحث

المملكة العربية السعودية
وزارة الصحة
مديرية الشؤون الصحية بمحافظة الطائف
إدارة التدريب و الابتعاث

وزارة الصحة
Ministry of Health

الاسم	الدرجة العلمية	الجامعة
ضيف الله الثبيتي	دكتوراه	سنترال لانكشاير ببريطانيا

المحترم سعادة مدير مستشفى الأطفال بمحافظة الطائف

السلام عليكم ورحمة الله وبركاته ...

إشارة إلى الطلب المقدم من الموضح اسمه أعلاه المتضمن إعداد دراسة على مدى قدرة التمريض السعودي العاملين بأقسام الأطفال على معرفة تدهور صحة الأطفال في مراحلها المبكرة من اجل عمل اللازم لتفاديها ومعالجتها وانقاذ حياة الطفل بإذن الله.

وبعد الاطلاع على منهجيات البحث وجد انه لا مانع لدينا من إجراء البحث.

نأمل من سعادتكم التكرم بتسهيل مهمتهن في إجراء البحث مع مراعاة الآتي :

١. إتباع القوانين اللجنة الوطنية للأخلاقيات الحيوية والطبية.
٢. في حال أي تغيير في خطة البحث يجب الحصول على موافقة إدارة الأبحاث.
٣. المحافظة على حقوق الأشخاص الخاضعين للبحث وخصوصياتهم.
٤. استخدام المعلومات لأغراض البحث العلمي فقط.
٥. تقديم تقرير عن سير الدراسة لإدارة البحوث
٦. إخضاع البحث للسياسات المتبعة.

ولكم أطيب تحياتي ...

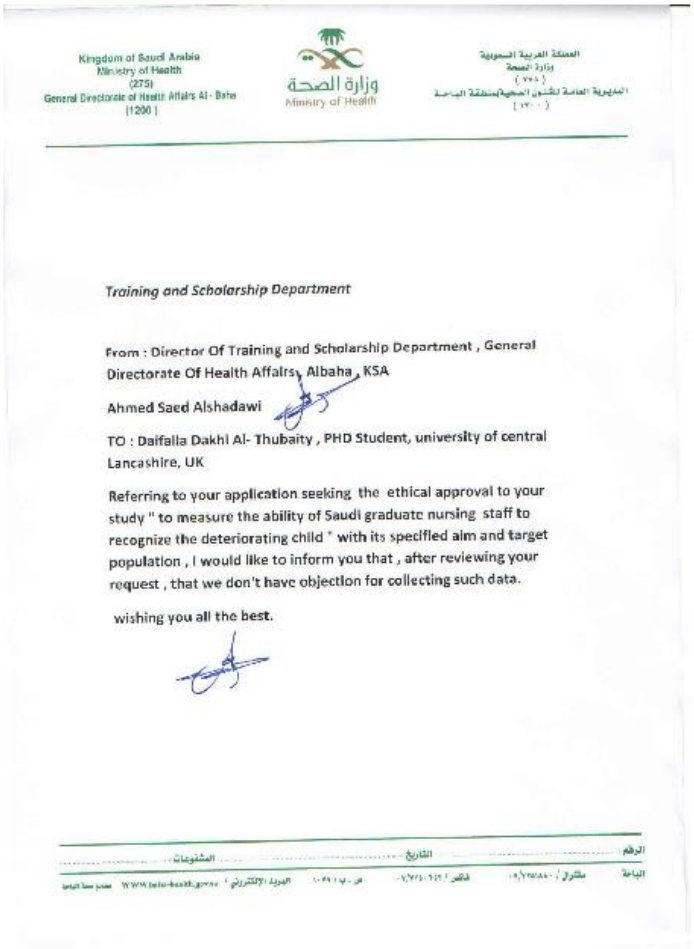
مدير ادارة التدريب والابتعاث

الدكتور / ماجد بن خلف الحارثي

الرقم: التاريخ: المشفوعات:

هاتف ٠١٢/٧٣٨٠٦٢٦ - فاكس ٠١٢/٧٣٣٣٧١٧ - بريد إلكتروني train-taif@moh.gov.sa
Tel.: 012/7380626 - Fax: 012/7333717 - E.mail: train-taif@moh.gov.sa

Appendix 12: Region 2 Approval



Kingdom of Saudi Arabia
Ministry of Health
(275)
General Directorate of Health Affairs Al - Baha
(1200)

وزارة الصحة
Ministry of Health

المملكة العربية السعودية
وزارة الصحة
(٢٧٥)
المديرية العامة لشئون الصحية بمنطقة الباحة
(١٢٠٠)

Training and Scholarship Department

From : Director Of Training and Scholarship Department , General Directorate Of Health Affairs, Albaha , KSA

Ahmed Saed Alshadawi

TO : Daifalla Dakhl Al- Thubaity , PHD Student, university of central Lancashire, UK

Referring to your application seeking the ethical approval to your study " to measure the ability of Saudi graduate nursing staff to recognize the deteriorating child " with its specified aim and target population , I would like to inform you that , after reviewing your request , that we don't have objection for collecting such data.

wishing you all the best.

المشفوعات ..... التاريخ ..... الرقم .....

الباحة مكتوب / ١٤٣٧/٥٨٠ فاكس / ٠٧٧٢١٠٦١٢ ص . ب / ١٠٤٩ البريد الإلكتروني / www.baha-health.gov.sa

Appendix 13: Participant Information Sheet (Region 1)

Participant information sheet
Region 1

Study title: What is the newly graduated Saudi paediatric nurses' ability to recognise the deteriorating child? Can a focused educational intervention affect this?

Invitation to participate in a research study

Newly qualified nurses working on children's wards are invited to participate in a research study as part of a PhD degree for Mr Daifallah Al-thubaity at the University of Central Lancashire. This information sheet explains in detail what the study involves so that you can decide if you want to participate.

What is the purpose of the research study?

The study aims to explore the newly qualified Saudi-educated nurses' ability to recognise and respond to the deteriorating child and whether a targeted educational programme can impact on this.

Why am I invited to participate in the research study?

You are a Saudi-trained nurse working on a children's ward in Taif region who has qualified in the last 12 months.

Do I have to agree to take part?

No, taking part in the research study is entirely voluntary. If you decide to take part after reading this leaflet, you will be asked to sign a consent form before each interview. If you decide to participate in the research study, you are still free to withdraw at any time and without giving a reason and this will not affect your work.

What does the study involve?

If you agree to participate, you will be asked to take part in two interviews lasting for approximately 50 minutes and *arranged at a mutually convenient time and place.* No identifiable information will be collected and participants will be given a unique code number at the first interview so that we can identify you only by the code only for the second interview.

Consent will be sought from you prior to these interviews which will all be audio-recorded. This is to help the researcher to remember what was said. The interview information will then be transcribed as soon as possible after the interviews and the audio recording destroyed.

The first interview consist of your thoughts on three case studies and some open ended questions. After the first interview (within 12 months), you will be assigned to take part in a new one-day educational course focusing on paediatric deterioration. Then between 3-6 months after this course, you will be invited for another interview, similar to the first one.

How do I withdraw from the study?

You can withdraw at any time during the research period without giving a reason up until the second interview is undertaken. If you wish to withdraw simply inform the researcher whose contact details are on the Participant Information Sheet and your

interview data will then be identified via a code and deleted immediately. After the second interviews all the data will be anonymised or de-coded and therefore withdrawal is not possible.

What are the benefits of taking part in the study?

There are no direct benefits to anyone taking part. However, your participation may help to develop specific recommendations regarding educational developments around paediatric nursing of the deteriorating child in a Saudi Arabian context.

What are the possible risks of taking part in the study?

There are no risks or disadvantage involved in agreeing to participate in the research study except the time it takes to complete both interviews.

What will happen to results of the research study?

The data will be analysed and used in the student's PhD submission and will be published in an academic journal. All the data will be anonymised and will be fed back into the Saudi nurses' educational system to improve nursing education.

Who is organising and funding the research?

The research is part of Mr Daifallah Al-Thubaity's PhD studies at the University of Central Lancashire, Preston, England. His study is being supervised by Dr Lyvonne Tume and Dr Ralph Leavey.

Who has reviewed the study?

The research has been approved by the University Research Ethics Committee, the nursing and hospital administration and the training & scholarship in Ministry of health.

What if I am not happy about the way I have been treated in the study and wish to make a complaint?

If you are not happy about the way they have been treated and wish to make a complaint, you should contact either of the research supervisors: (Dr.Lyvonne Tume ltume@uclan.ac.uk or Dr.Ralph: Rleavey@uclan.ac.uk) or the Officer for Ethics at UCLan to OfficerforEthics@uclan.ac.uk

Contact for Further Information

Researcher contact details:
Daifallah Al-Thubaity
Address: University of Central Lancashire
Tel: +966506721182, +447341580110
E-mail:dddal-thubaity1@uclan.ac.uk
Researcher supervisor: Dr L Tume
ltume@uclan.ac.uk
Research Office,
University of Central Lancashire
Preston, UK PR1 2HE
Tel: +44 (0) 1772 201 201

Thank you for taking time to read the information sheet.

Appendix 14: Participant Information Sheet (Region 2)

Participant information sheet
Region 2

Study title: What is the newly graduated Saudi paediatric nurses' ability to recognise the deteriorating child? Can a focused educational intervention affect this?

Invitation to participate in a research study

Newly qualified nurses working on children's wards are invited to participate in a research study as part of a PhD degree for Mr Daifallah Al-thubaity at the University of Central Lancashire. This information sheet explains in detail what the study involves so that you can decide if you want to participate.

What is the purpose of the research study?

The study aims to explore the newly qualified Saudi-educated nurses' ability to recognise and respond to the deteriorating child and whether a targeted educational programme can impact on this.

Why am I invited to participate in the research study?

You are a Saudi-trained nurse working on a children's ward in Baha region who has qualified in the last 12 months.

Do I have to agree to take part?

No, taking part in the research study is entirely voluntary. If you decide to take part after reading this leaflet, you will be asked to sign a consent form before each interview. If you decide to participate in the research study, you are still free to withdraw at any time and without giving a reason and this will not affect your work.

What does the study involve?

If you agree to participate, you will be asked to take part in two interviews lasting for approximately 50 minutes and *arranged at a mutually convenient time and place.* No identifiable information will be collected and participants will be given a unique code number at the first interview so that we can identify you only by the code only for the second interview.

Consent will be sought from you prior to these interviews, which will all be audio-recorded. This is to help the researcher to remember what was said. The interview information will then be transcribed as soon as possible after the interviews and the audio recording destroyed.

The first interview consist of your thoughts on three case studies and some open ended questions. After the first interview (within 12-15 months), you will be invited for another interview, similar to the first one.

How do I withdraw from the study?

You can withdraw at any time during the research period without giving a reason up until the second interview is undertaken. If you wish to withdraw simply inform the researcher whose contact details are on the Participant Information Sheet and your

interview data will then be identified via a code and deleted immediately. After the second interviews all the data will be anonymised or de-coded and therefore withdrawal is not possible.

What are the benefits of taking part in the study?

There are no direct benefits to anyone taking part. However, your participation may help to develop specific recommendations regarding educational developments around paediatric nursing of the deteriorating child in a Saudi Arabian context.

What are the possible risks of taking part in the study?

There are no risks or disadvantage involved in agreeing to participate in the research study except the time it takes to complete both interviews.

What will happen to results of the research study?

The data will be analysed and used in the student's PhD submission and will be published in an academic journal. All the data will be anonymised and will also be fed back into the Saudi nurses' educational system to improve nursing education.

Who is organising and funding the research?

The research is part of Mr Daifallah Al-Thubaity's PhD studies at the University of Central Lancashire, Preston, England. His study is being supervised by Dr Lyvonne Tume and Dr Ralph Leavey.

Who has reviewed the study?

The research has been approved by the University Research Ethics Committee, the nursing and hospital administration and the training & scholarship in Ministry of health.

What if I am not happy about the way I have been treated in the study and wish to make a complaint?

If you are not happy about the way they have been treated and wish to make a complaint, you should contact either of the research supervisors: (Dr.Lyvonne Tume lntume@uclan.ac.uk or Dr.Ralph: Rleavey@uclan.ac.uk) or the Officer for Ethics at UCLan to OfficerforEthics@uclan.ac.uk

Contact for Further Information

Researcher contact details:

Daifallah Al-Thubaity
Address: University of Central Lancashire
Tel: +966506721182, +447341580110
E-mail:dddal-thubaity1@uclan.ac.uk

Researcher supervisor: Dr L Tume
lntume@uclan.ac.uk
Research Office,
University of Central Lancashire
Preston, UK PR1 2HE
Tel: +44 (0) 1772 201 201

Thank you for taking time to read the information sheet.

Appendix 15: Consent Form (Region1)

CONSENT FORM (Region 1)

Full title of Project: What is the newly graduated Saudi paediatric nurses' ability to recognise the deteriorating child? Can a focused educational intervention affect this?

Name, position and contact address of Researcher:
Daifallah Al-Thubaity- PhD student
University of Central Lancashire
Email: dddal-thubaity1@uclan.ac.uk
Mobile: 00966506721182
Name of Supervisor :
Dr. Lyvonne Tume
ltume@uclan.ac.uk

Please read the following statements and initial the boxes to indicate your agreement

	Please initial box
I confirm that I have read and understand the information sheet, dated ..... For the above study and have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	☐
I agree to take part in this study (first interviews) and (education course)	☐
I agree that my data gathered in this study may be stored (after it has been anonymised) in a password protected secure drive on the UCLan network	☐
I understand that it will not be possible to withdraw my data from the study after final analysis has been undertaken	☐
I agree to the interview being audio recorded	☐
I agree to the use of anonymised quotes in publications	☐

I would/ would not like to receive a feedback about the study on email:.....

Name of Participant	Date	Signature
RE CONSENT FOR SECON INTERVIEW	Date	Signature
Daifallah Al-Thubaity		
Name of Researcher	Date	Signature

Appendix 16: Consent Form (Region 2)

CONSENT FORM (Region 2)

Full title of Project: What is the newly graduated Saudi paediatric nurses' ability to recognise the deteriorating child? Can a focused educational intervention affect this?

Name, position and contact address of Researcher:
Daifallah Al-Thubaity- PhD student University of Central Lancashire
Email: dddal-thubaity1@uclan.ac.uk
Mobile: 00966506721182
Name of Supervisor :
Dr. Lyvonne Tume
ltume@uclan.ac.uk

Please read the following statements and initial the boxes to indicate your agreement

	Please initial box
I confirm that I have read and understand the information sheet, dated ..... For the above study and have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	☐
I agree to take part in this study (first interview)	☐
I agree that my data gathered in this study may be stored (after it has been anonymised) in a password protected secure drive on the UCLan network	☐
I understand that it will not be possible to withdraw my data from the study after final analysis has been undertaken	☐
I agree to the interview being audio recorded	☐
I agree to the use of anonymised quotes in publications	☐

I would/ would not like to receive a feedback about the study on email:.....

Name of Participant	Date	Signature
RE CONSENT FOR SECON INTERVIEW	Date	Signature
Daifallah Al-Thubaity		
Name of Researcher	Date	Signature

Appendix 17: Coding Form

University of Central Lancashire

Coding form

Full title of Project: What is the newly graduated Saudi paediatric nurses' ability to recognise the deteriorating child? Can a focused educational intervention affect this?

Name of Researcher:
Daifallah Al-Thubaity- PhD student University of Central Lancashire
Email: dddal-thubaity1@uclan.ac.uk
Name of Supervisor :
Dr. Lyvonne Tume
lntume@uclan.ac.uk

#	Participant name	Code	Region
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

Appendix 18: Data Protection Checklist

Data protection checklist: Teaching, research, knowledge transfer, consultancy and related activities

All activities which involve personal data of any kind, in any way, must comply with the Data Protection Act 1998 (DPA). This checklist will outline the requirements of the DPA and the measures you must take when processing personal data; it will also provide a mechanism for recording the steps you will take to ensure the personal data you are using are safeguarded and the reputation of the University is upheld.

Ensuring personal data are processed fairly and lawfully with due regard for individuals' privacy and ensuring that personal data remain secure are paramount. Demonstrating that we have considered the requirements of the DPA when conducting our activities will provide assurances to students, employees and business partners that their personal data is protected at UCLan. Organisations can be fined up to £500,000 for breaches of the DPA which are considered to be as a result of negligence or recklessness; therefore it is important that we get it right from the outset. If it is possible to use anonymised data so that individuals cannot be identified from it and still achieve your aims, this is always the preferred method of operating. Truly anonymised data (which cannot be reconstructed or linked to any other data you hold or may hold in the future to enable you to identify individuals from it) does not constitute personal data because it cannot be used to identify individuals.

What is *personal data*?

Personal data are data relating to a living individual who can be identified from those data (or from those data and other information in our possession or likely to come into our possession). Personal data can be factual (such as name, address, date of birth) or can be an opinion (such as a professional opinion as to the causes of an individual's behavioural problems). Information can be personal data even if it does not include a person's name or other obvious identifiers; for example, a paragraph describing a specific event involving an individual or a set of characteristics relating to a particular individual may not include their name, but would clearly identify them from the set of circumstances or characteristics being described or represented. If you are unsure whether or not your activity involves personal data, please contact the Information Governance Officer to discuss on DPFOIA@uclan.ac.uk.

What is *processing*?

The DPA is concerned with the processing of personal data. Processing means obtaining, recording or holding the information or data or carrying out any operation or set of operations on the information or data, including –

(a) organisation, adaptation or alteration of the information or data,
(b) retrieval, consultation or use of the information or data,
(c) disclosure of the information or data by transmission, dissemination or otherwise making available, or
(d) alignment, combination, blocking, erasure or destruction of the information or data.

Appendix 19: Result Publication

RESEARCH
doi: 10.1111/nicc.123

Newly qualified Saudi nurses' ability to recognize the deteriorating child in hospital

Daifallah Al-Thubaity, Susan Williamson, Ralph Leavey and Lyvonne N Tume

ABSTRACT

Background: It is recognized that nurses' failure to recognize and respond promptly to deterioration in children's physiological status can result in increased morbidity and mortality.

Aim: The aim of this study was to explore the ability of Saudi-educated, newly qualified nurses, working in paediatric wards, to recognize children's deterioration.

Methods: A pilot study was carried out to assess nurses' responses to three clinical vignettes (deteriorating child, improving child and ambiguous scenarios). The nurses' ability to make a correct identification was captured using a 'Think Aloud' approach and quantified using a visual analogue scale.

Results: Twenty-seven nurses in two geographical regions in Saudi Arabia participated. Only half the nurses (51·8%) correctly identified the deteriorating child vignette. Of those who could not, 37% were unsure and 11% responded incorrectly. No nurses correctly identified all three vignettes, and four nurses (15%) responded incorrectly to all vignettes.

Conclusions: The recognition of the deteriorating child is complex, and even in non-stressful simulated scenarios using vignettes, many newly qualified nurses working with children failed to recognize clear signs of deterioration. A focused (culturally specific) educational intervention is being developed to target this, taking into account Saudi nurses' perceived education and training needs.

Relevance to clinical practice: Newly qualified nurses working in paediatric wards frequently find it difficult to identify the deteriorating child.

Key words: Clinical vignettes • Deterioration • Early recognition skills • Monitoring • Paediatrics

INTRODUCTION

There is increasing evidence that health care professionals are frequently unable to recognize and respond appropriately to the deteriorating child (Sefton *et al.*, 2014: Lambert *et al.*, 2017). In 2009, the National Patient Safety Agency (NPSA) report found adverse events in children ranged from 2% to almost 11%. The two most common problems were: a failure to recognize the child's severity of illness and poor communication between the professionals involved.

Identifying early deterioration of patients in the hospital is crucial to preventing cardiac and respiratory arrests and improving patient outcomes, and the ability to recognize cues and changes is a necessary and fundamental nursing skill (Levett-Jones *et al.*, 2010). However, it can be a challenging and complex process involving taking observations and interpreting these in the context of the child's condition and trends over time. There is evidence (Pearson, 2008; Tume, 2007; Voepel-Lewis *et al.*, 2013) that paediatric nurses do not always recognize deterioration at an early enough stage in a child's illness to intervene and alert medical staff in order to prevent critical care unit (CCU) admission, cardiopulmonary arrest and even death.

This may be even worse in newly qualified nurses because of their lack of experience, and developing skills to adequately detect and respond early to deterioration (O'Leary *et al.*, 2014; Purling and King, 2012). These findings have resulted in numerous recommendations that health care staff and undergraduate nursing students should be provided with opportunities to practice the complex reasoning skills involved in recognition and responding to patient deterioration (Berg *et al.*, 2008; Haines, 2005; NPSA, 2009; Pearson, 2008).

Focused educational programmes around deterioration were first developed for adult patients with the ALERT course (Acute Life-threatening Events Recognition and Treatment) (Smith *et al.*, 2002). This was followed by programmes around deterioration in children by a focused educational intervention in Australia (Mitchell *et al.*, 2010) and a UK course RESPOND (Recognizing Signs of Paediatric hOspital iNpatients Deterioration) (Tume *et al.*, 2014). However, currently, no such courses exist in the Kingdom of Saudi Arabia (KSA). Saudi undergraduate nurse education is generic and covers both paediatrics and adults. All KSA regions educate nurses based on the same curriculum as dictated by the Saudi Council of Health Specialties (AbuZinadah, 2005). This undergraduate paediatric clinical practice preparation includes physiological measurements, disease management and clinical judgement skills. The assumption is, therefore, that all Saudi regions have a similar level of ability upon graduation. Currently, we do not know the level of ability of Saudi trained nurses to recognize the deteriorating child on the paediatric wards. It is, therefore, both pertinent and timely to explore both the ability of Saudi-educated paediatric nurses to recognize clinical deterioration and to understand their perceived educational and training needs in this area. Consequently, the aim of this study was to explore the ability of Saudi-educated newly qualified nurses, working in paediatric wards, to recognize children's deterioration.

Authors: D Al-Thubaity, PhD student, University of Central Lancashire, Preston, UK; S Williamson, PhD, Senior Research Fellow, University of Central Lancashire, Preston, UK; R Leavey, PhD, Senior Research Fellow, University of Central Lancashire, Preston, UK; L Tume, PhD supervisor, RN, BNurs, MSc, PGDE, PhD, Associate Professor in Child Health, University of West of England, Bristol, UK
Address for correspondence: D Al-Thubaity, University of Central Lancashire, Preston PR12HE, UK
E-mail: ddalthubaity1@uclan.ac.uk

REFERENCES

Abu-Zinadah, S. (2006). Nursing situation in Saudi Arabia. Riyadh*: Saudi Nursing Board, Saudi Commission for Health Specialties*.

AbuZinadah, S. (2005). The inception of nursing regulation in Saudi Arabia. Regulation and globalisation. In 7th International Regulation Conference 20 - 21st May, Taipei Taiwan.

Aitken, L. M., Marshall, A., Elliott, R., & McKinley, S. (2011). Comparison of 'think aloud' and observation as data collection methods in the study of decision making regarding sedation in intensive care patients. *International Journal of Nursing Studies*, *48*(3), 318-325.

Aitken, L. M., Marshall, A. P., Elliott, R., & McKinley, S. (2009). Critical care nurses' decision making: sedation assessment and management in intensive care. *Journal of Clinical Nursing*, *18*(1), 36-45.

Alamri, M. (2011). Higher education in Saudi Arabia. *Journal of Higher Education Theory and Practice*, 11(4), 88-91.

Alamri, M., & Sharts-Hopko, N. C. (2015). Motivational Factors and Barriers Related to Saudi Arabian Nurses' Pursuit of a Bachelor of Science in Nursing Degree. *Nursing Education Perspective*, 36(3), 157-162.

Al Aqeel, AI. (2007) Islamic ethical framework for research into and prevention of genetic diseases. *Nature Genetics* 39 (11): pp1293-1298.

Alghamdi, M. G., & Urden, L. D. (2016). Transforming the nursing profession in Saudi Arabia. *Journal of nursing management*, *24*(1), E95-E100.

Al-Hanawi, M. K. (2017). The healthcare system in Saudi Arabia: How can we best move forward with funding to protect equitable and accessible care for all? *International Journal of Healthcare*, 3(2), 78.

Alhojailan, M. I. (2012). Thematic analysis: A critical review of its process and evaluation. *West East Journal of Social Sciences*, 1(1), pp39-47.

Alhusaini, H. A. (2006). Obstacles to the efficiency and performance of Saudi nurses at the Ministry of Health, *study field Analytical: Region Riyadh. Riyadh: Ministry of Health.*

AlMadani, N. A. (2015). Degree education as an entry requirement for qualified nurses in Saudi Arabia: An overview. *The Journal of Macro Trends in Health and Medicine*, 3, 142-155.

Al-Mahmoud, S., & Mullen, P. M. (2013). The commitment of Saudi nursing students to nursing as a profession and as a career*. Life Science Journal*, 10(2), 591-603.

Almalki M, Fitzgerald G, Clark M. (2011). Health care system in Saudi Arabia: an overview. *East Mediterr Health* J 2011; 17:784–93.

Almasabi, M. H. (2013). An overview of quality and accreditation in the health sector within Saudi Arabia.

Al-Mutairi, E. (2013). Healthcare Workforce Challenges in Saudi Arabia (A Brief Overview). Available online: File: ///F:/Nursing/ksa/Healthcare%20Workforce%20Gap%20in%20Saudi%20Arabia.pdf[accessed on 28 June 2018].

Almutairi, A., & McCarthy, A. L. (2012). A multicultural nursing workforce and cultural perspectives in Saudi Arabia: An overview. *The Health*, 3(3), pp71-74.

Alroqi, H. M. (2017). Perceptions of the community toward the nursing profession and its impact on the local nursing workforce shortage in Riyadh (Doctoral dissertation, Anglia Ruskin University).

Altuntaç, P. (2015). The Comparison of Concurrent and Retrospective Think Aloud Methods in Unmoderated Remote Usability Testing. Unpublished MA Thesis: Netherlands: Leiden University.

AlYami, M.S. & Watson, R. (2014) An overview of nursing in Saudi Arabia. *Journal of Health Specialties*, 2(1), 10.

Ammar, H (2018) Six things women in Saudi Arabia still can't do. *The Week* Available on: http://www.theweek.co.uk/60339/things-women-cant-do-in-saudi-arabia [accessed on 28 June 2018].

Anderson-Lister, G., & Treharne, G. J. (2014). 'Healthy' individuals' perceptions of type 1 and type 2 diabetes cause and management: A 'think-aloud', mixed-methods study using video-based vignettes. *Journal of health psychology*, *19*(11), 1371-1381.

Australian College of Nursing. (2016). Paediatric Nursing. Retrieved from https://www.acn.edu.au/paediatric-nursing [accessed on 25 April 2018].

Australian Commission on Safety and Quality in Health Care (ACSQHS). (2010) National Consensus Statement: Essential Elements for Recognising and Responding to Clinical Deterioration. Sydney. ACSQHC.

Australian Health Practitioner Regulatory Agency (AHPRA, 2017). Retrieved from http://www.ahpra.gov.au/Education/Approved-Programs-of Study.aspx?ref=Nurse&type=General&div=Registered%20Nurse%20%28Division%201%29 [Accessed 8 October 2017].

Avard, B., McKay, H., Slater, N., Daveson, K., Lamberth, P., Lafferty, T., Chen, S., Darvill, J., Mitchell, I. (2008) Pointing you in the right direction. *Australian Capital Territory*: ACT Health.

Aylott, M. (2006). Observing the sick child: Part 2a Respiratory assessment. *Paediatric Care*, 18(9), 38-44.

Azim, M. T., & Islam, M. M. (2018). Social Support, Religious Endorsement, and Career Commitment: A Study on Saudi Nurses. *Behavioral Sciences*, 8(1), 8.

Banning, M. (2008). Clinical reasoning and its application to nursing: concepts and research studies. *Nurse education in practice*, *8*(3), 177-183.

Beauchamp, T. L.; Childress, J. F. (2001). *Principles of biomedical ethics*. 5th ed Oxford: Oxford University Press. USA.

Benner P. (1984) From Novice to Expert. Excellence and Power in Clinical Nursing Practice. Addison Wesley, Menlo Park.

Benner, P., Hooper-Kyriakidis, P., & Stannard, D. (1999). Clinical wisdom in critical care: A thinking-in-action approach.

Benner P., Tanner C.A. & Chesla C.A. (1996) Expertise in Nursing Practice. Caring, Clinical Judgement and Ethics. Springer Publishing Co., New York.

Berg, M D., Nadkarni, V M., Zuercher, M., Berg, R A. (2008) In-hospital pediatric cardiac arrest. *Pediatric Clinics of North America* 55(3), pp 589-604.

Bonafide, C. P., Brady, P. W., Keren, R., Conway, P. H., Marsolo, K., & Daymont, C. (2013). Development of heart and respiratory rate percentile curves for hospitalized children*. Pediatrics*, peds-2012.

Bonafide, C. P., Roberts, K. E., Priestley, M. A., Tibbetts, K. M., Huang, E., Nadkarni, V. M., & Keren, R. (2012). Development of a pragmatic measure for evaluating and optimizing rapid response systems*. Pediatrics*, peds-2011.

Booth, A., Sutton, A., & Papaioannou, D. (2016). *Systematic approaches to a successful literature review*. London: SAGE Publications.

Boslaugh, S. (2012). *Statistics in a nutshell: A desktop quick reference*. " O'Reilly Media, Inc.".

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology*. Qualitative research in psychology*, 3(2), pp77-101.

Bryman, A. (2015) *Social Research Methods*. Oxford: OUP.

Bucknall, T. K. (2000). Critical care nurses' decision-making activities in the natural clinical setting. *Journal of clinical nursing*, 9(1), 25-36.

Bultas, M. W., Hassler, M., Ercole, P. M., & Rea, G. (2014). Effectiveness of high-fidelity simulation for pediatric staff nurse education. *Pediatric nursing*,40(1), pp27.

Burbach, B., Barnason, S., & Thompson, S. A. (2015). Using "think aloud" to capture clinical reasoning during patient simulation. *International journal of nursing education scholarship*, *12*(1), 1-7.

Bureau of Experts at The Council of Ministers (2002) Health Law Royal Decree No. M/11 23/3/1423H Riyadh. Available on: https://www.boe.gov.sa/ViewSystemDetails.aspx?lang=en&SystemID=158&VersionID=172 [Date of access 25th June 2018].

Carter, B. (2015). 'If you see something, say something': Reducing the incidence of deterioration in children. *Journal of Child Health Care*, 19(2), 133-135.

Ceci, C. (2004). Gender, power, nursing: a case analysis. Nursing Inquiry, 11(2), pp 72-81.

Central department of statistics and information CDSI, (2010). *Central department of statistics and information*. Kingdom of Saudi Arabia https://www.stats.gov.sa/en [accessed on 15 June 2018].

Centre for Reviews and Dissemination (2008) *Systematic Reviews: CRD's guidance for undertaking reviews in health care*. York: University of York.

Chan, D. S. (2004). The relationship between student learning outcomes from their clinical placement and their perceptions of the social climate of the clinical learning environment. *Contemporary Nurse*, 17(1-2), 149-158.

Chapman, G. B., & Sonnenberg, F. A. (2000). Decision Making in Health Care: Theory, Psychology, and Applications.

Chapman, S. M., Grocott, M. P., & Franck, L. S. (2010). Systematic review of paediatric alert criteria for identifying hospitalised children at risk of critical deterioration. *Intensive care medicine*, 36(4), pp600-611.

Chapman, S. M., Wray, J., Oulton, K., & Peters, M. J. (2016). Systematic review of paediatric track and trigger systems for hospitalised children. *Resuscitation*, 109, 87-109.

Charters, E. (2003). The use of think-aloud methods in qualitative research an introduction to think-aloud methods. *Brock Education Journal*, 12(2): pp 68-82.

Cioffi, J., Conway, R., Everist, L., Scott, J., & Senior, J. (2010). 'Changes of concern' for detecting potential early clinical deterioration: A validation study. *Australian Critical Care*, 23(4), 188-196.

Cioffi, J., Conway, R., Everist, L., Scott, J., & Senior, J. (2009). 'Patients of concern' to nurses in acute care settings: a descriptive study. *Australian Critical Care*, 22(4), 178-186.

Clarke, S.P., Aiken, L.H. (2003) Failure to rescue: needless deaths are prime examples of the need for more nurses at the bedside. *American Journal of Nursing*. 103: pp 42–47.

Clerihew, L., Rowney, D., & Ker, J. (2016). Simulation in paediatric training. Archives of disease in childhood. *Education and practice*, 101(1), p8.

Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education 7th edn*. Oxford: Routledge.

Corcoran-Perry, S., Narayan, S., & Cochrane, S. (1999). Coronary care nurses' clinical decision making. *Nursing & health sciences*, *1*(1), 49-61.

Council of Health Services CHS (2013) Vision and Mission. Available at: http://www.chs.gov.sa/En/Council/Pages/VisionAndMission. Aspx, [accessed 19 April 2018].

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2013). Developing and evaluating complex interventions: the new Medical Research Council guidance. *International journal of nursing studies*, 50(5), 587-592.

Craske, J., Carter, B., Jarman, I. H., & Tume, L. N. (2017). Nursing judgement and decision-making using the Sedation Withdrawal Score (SWS) in children. *Journal of advanced nursing*, *73*(10), 2327-2338.

Creswell, J. (2014) *Research Design*. 4th ed., London: Sage.

Creswell, J. (2013) Research Design: *Qualitative, Quantitative, and Mixed Methods Approaches, 4th edn*. California: SAGE Publications.

Crook, J. A. (2001). How do expert mental health nurses make on-the-spot clinical decisions? A review of the literature. *Journal of Psychiatric and Mental Health Nursing*, *8*(1), 1-5.

Crotty, M. (2003) *The Foundations of Social Research: Meaning and Perspectives in the Research Process, 3rd edn*. London: Sage Publications.

Dalton, M., Harrison, J., Malin, A., & Leavey, C. (2018). Factors that influence nurses' assessment of patient acuity and response to acute deterioration. *British Journal of Nursing*, 27(4), 212-218.

Del Bueno, D. (2005). A crisis in critical thinking. *Nursing education perspectives*, 26(5), 278-282.

Denzin NK & Lincoln SK (2013) *The SAGE Handbook of Qualitative Research, 4 edn*. Thousand Oaks CA: Sage Publications.

Department of Health and Human Services DHHS. (2006) *Guide to Patient Safety Indicators*. Rockville, MD: Agency for Healthcare Research and Quality.

Dimitrov, D. M., & Rumrill Jr, P. D. (2003). Pretest-posttest designs and measurement of change. *Work*, 20(2), pp159-165.

Douglas, C., Osborne, S., Windsor, C., Fox, R., Booker, C., Jones, L., & Gardner, G. (2016). Nursing and Medical Perceptions of a Hospital Rapid Response System. *Journal of nursing care quality*, 31(2), E1-E10.

Douw, G., Schoonhoven, L., Holwerda, T., van Zanten, A.R., van Achterberg, T. and van der Hoeven, J.G., 2015. Nurses' worry or concern and early recognition of

deteriorating patients on general wards in acute care hospitals: a systematic review. *Critical Care*, 19(1), p.230.

Dowding, D., & Thompson, C. (2003). Measuring the quality of judgement and decision-making in nursing. *Journal of Advanced Nursing*, *44*(1), 49-57.

Dowie, J. (1993). Clinical decision analysis: background and introduction. *Analyzing how we reach clinical decisions. RCP Publications*, 7-25.

Duncan, H., Hutchison, J., & Parshuram, C. S. (2006). The Pediatric Early Warning System score: a severity of illness score to predict urgent medical need in hospitalized children. *Journal of critical care*, 21(3), 271-278.

Economics and Social Research Council ESRC (2015). *Framework for Research Ethics*. Online at: http://www.esrc.ac.uk/files/funding/guidance-for-applicants/esrc-framework-for-research-ethics-2015/ [Accessed 1st July 2016].

Edwards, E. D., Mason, B. W., Oliver, A., & Powell, C. V. E. (2010). Cohort study to test the predictability of the Melbourne criteria for activation of the medical emergency team. *Archives of disease in childhood*, archdischild187617.

Eisenhauer, L. A., Hurley, A. C., & Dolan, N. (2007). Nurses' reported thinking during medication administration. *Journal of Nursing Scholarship*, *39*(1), 82-87.

Elachola H, Memish ZA. (2016) Oil prices, climate change-health challenges in Saudi Arabia*. Lancet*. 2016; 387: 827-829.

Elliott, M. (2002). Clinical environment: a source of stress for undergraduate nurses. *Australian Journal of Advanced Nursing*, 20(1), 34-38.

Endacott, R., Scholes, J., Buykx, P., Cooper, S., Kinsman, L., & McConnell-Henry, T. (2010). Final-year nursing students' ability to assess, detect and act on clinical cues of deterioration in a simulated environment. *Journal of advanced nursing*, 66(12), 2722-2731.

Ericsson, K. A., & Simon, H. A. (1980). Verbal reports as data. *Psychological review*, 87(3), pp215-251.

Ericsson, K. A., Whyte IV, J., & Ward, P. (2007). Expert performance in nursing: Reviewing research on expertise in nursing within the framework of the expert-performance approach. *Advances in Nursing Science*, 30(1), E58-E71.

Facione, N. C., & Facione, P. A. (2008). *Critical thinking and clinical judgment. Critical thinking and clinical reasoning in the health sciences: A teaching anthology*, The California Academic Press Llc, Millbrae, Ca1-13.

Falan, S. L., & Han, B. T. (2013). Did we interpret the same thing?. *International journal of nursing knowledge*, *24*(1), 2-14.

Falatah, R., & Salem, O. A. (2018). Nurse turnover in the Kingdom of Saudi Arabia: An integrative review. *Journal of nursing management*.

Fendt, J., Kaminska-Labbé, R., & Sachs, W. M. (2008). Producing and socializing relevant management knowledge: re-turn to pragmatism. *European Business Review*, *20*(6), 471-491.

Fielding, N. (2008). *Interviewing*. London: SAGE Publications.

Fink, A. (2010) *Conducting Research Literature Reviews: From the Internet to Paper*. SAGE Publications: Thousand Oaks CA.

Flaskerud, J. H. (1979). Use of vignettes to elicit responses toward broad concepts. *Nursing Research*, 28(4): pp 210-211.

Fonteyn, M., & Fisher, A. (1995). Use of think aloud method to study nurses' reasoning and decision making in clinical practice settings. *The Journal of neuroscience nursing: journal of the American Association of Neuroscience Nurses*, *27*(2), 124-128.

Fonteyn, M. E., Kuipers, B., & Grobe, S. J. (1993). A description of think aloud method and protocol analysis. *Qualitative health research*, *3*(4), 430-441.

Fox, M. C., Ericsson, K. A., & Best, R. (2011). Do procedures for verbal reporting of thinking have to be reactive? A meta-analysis and recommendations for best reporting methods. *Psychological bulletin*, *137*(2), 316.

Fraser, J., Sidebotham, P., Frederick, J., Covington, T., & Mitchell, E. A. (2014). Learning from child death review in the USA, England, Australia, and New Zealand. *The Lancet*, 384(9946), 894-903.

Fuijkschot, J., Vernhout, B., Lemson, J., Draaisma, J. M., & Loeffen, J. L. (2014). Validation of a Paediatric Early Warning Score: first results and implications of usage. *European journal of pediatrics*, 174(1), 15-21.

Funkesson, K. H., Anbäcken, E. M., & Ek, A. C. (2007). Nurses' reasoning process during care planning taking pressure ulcer prevention as an example. A think-aloud study. *International journal of nursing studies*, *44*(7), 1109-1119.

Gale, N. K., Heath, G., Cameron, E., Rashid, S., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology*, *13*(1), 117.

Gawronski, O., Parshuram, C., Cecchetti, C., Tiozzo, E., degli Atti, M. L. C., Dall'Oglio, I., & Latour, J. M. (2018). Qualitative study exploring factors influencing escalation of care of deteriorating children in a children's hospital. *BMJ paediatrics open*, 2(1).

Gazzaz, Lamya Asaad (2009) *Saudi nurses' perceptions of nursing as an occupational choice: a qualitative interview study*. PhD thesis, University of Nottingham.

Gerrish, K. (2000). Still fumbling along? A comparative study of the newly qualified nurse's perception of the transition from student to qualified nurse. *Journal of advanced Nursing*, 32(2), 473-480.

Gerrish, K., & Lacey, A. (2010). *The research process in nursing Oxford*: Wiley-Blackwell, sixth Ed.

Gerrish, K., Lathlean, J. (2015) *The Research Process in Nursing*. London: Wiley & Sons.

Gillman, L., Leslie, G., Williams, T., Fawcett, K., Bell, R., & McGibbon, V. (2006). Adverse events experienced while transferring the critically ill patient from the emergency department to the intensive care unit. *Emergency medicine journal*, 23(11), 858-861.

Goodwin, L. D., and Leech, N. L. (2003). The meaning of validity in the new standards for educational and psychological testing: Implications for measurement courses. *Measurement and evaluation in Counseling and Development*, 36(3): pp 181-192.

Göransson, K. E., Ehnfors, M., Fonteyn, M. E., & Ehrenberg, A. (2008). Thinking strategies used by Registered Nurses during emergency department triage. *Journal of Advanced Nursing*, 61(2): pp163-172.

Goudreau, J., Boyer, L., & Létourneau, D. (2014). Clinical nursing reasoning in nursing practice: A cognitive learning model based on a think aloud methodology. *Quality Advancement in Nursing Education-Avancées en formation infirmière*, 1(1): 4. DOI: http://dx.doi.org/10.17483/2368-6669.1009

Gould, D. (1996). Using vignettes to collect data for nursing research studies: how valid are the findings?. *Journal of clinical nursing*, 5(4): pp 207-212.

Gould, D., Kelly, D., Goldstone, L., & Gammon, J. (2001). Examining the validity of pressure ulcer risk assessment scales: developing and using illustrated patient simulations to collect the data INFORMATION POINT: Visual Analogue Scale. *Journal of clinical nursing*, 10(5), pp 697-706.

Grant, C., & Osanloo, A. (2014). Understanding, Selecting, and Integrating a Theoretical Framework in Dissertation Research: Creating the Blueprint for Your "House". *Administrative Issues Journal: Education Practice, and Research*, 4(2), 12-26.

Gravetter, F. J., & Forzano, L. A. B. (2015). Research methods for the behavioral sciences. *Nelson Education*.

Green, J., Thorogood, N. (2014) *Qualitative Methods for Health Research. 3rd Edition*. London: Sage.

Guba, E. G., & Lincoln, Y. S. (2001). Guidelines and checklist for constructivist (aka fourth generation) evaluation. *Retrieved January*, *23*, 2010.

Haines, C. (2005). Acutely ill children within ward areas–care provision and possible development strategies. *Nursing in Critical Care*, 10(2), pp98-104.

Hammond, K. R. (1996). *Human Judgment and Social Policy: Irreducible Uncertainty, Inevitable Error, Unavoidable Injustice*. Oxford University Press.

Hart, C. (2001) *Doing a Literature Search: SA Comprehensive Guide for the Social Sciences*. SAGE Publications: London.

Hawker, S., Payne, S., Kerr, C., Hardey, M., & Powell, J. (2002). Appraising the evidence: reviewing disparate data systematically. *Qualitative Health Research*, 12(9), pp1284-1299.

Hawkins O (2018) *Briefing paper: Number CBP8281, Mortality in the UK*. House of Commons Library. London.

Hesse-Biber, SN. and Leavy, P. (2010) *The Practice of Qualitative Research, 2 edn*. Thousand Oaks CA: SAGE Publications.

Hofstede, G. 2003. *Culture's consequences, comparing values, behaviours, institutions, and organizations across nations, 2nd ed*. Newbury Park, CA: Sage.

Hollywood, E. (2011). The lived experiences of newly qualified children's nurses. *British Journal of Nursing*, 20(11), pp661-671.

Ignatavicius, D.D. (2001). Critical thinking skills for at-the-bedside success. *Nursing Management*, 32(1), 37-39.

Ingram, M. (2008). *Critical thinking in nursing: experience vs. education (Doctoral dissertation*, University of Phoenix).

Jackson, K. (2005). The roles and responsibilities of newly qualified children's nurses. *Paediatric nursing*, 17(6), pp26-30.

Johnson, R. B., and Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come*. Educational researcher*, 33(7): pp 14-26.

Joseph, G-M, & Patel, V. (1990). Domain Knowledge and Hypothesis Generation in Diagnostic Reasoning. *Medical Decision Making*, 10(1): pp 31-46.

Kaul, M., Snethen, J., Kelber, S. T., Zimmanck, K., Maletta, K., & Meyer, M. (2014). Implementation of the Bedside Paediatric Early Warning System (BedsidePEWS) for nurse identification of deteriorating patients. *Journal for Specialists in Pediatric Nursing*, 19(4), 339-349.

Kemper, E. A., Stringfield, S., & Teddlie, C. (2003). Mixed methods sampling strategies in social science research*. Handbook of mixed methods in social and behavioral research*, 273-296.

Khaliq AA. (2012) The Saudi health care system: A view from the minaret*. World Health Popul*. 13:52–64.

King, N. (2004). Using templates in the thematic analysis of texts. In C. Cassell & G. Symon (Eds.), *Essential guide to qualitative methods in organizational research*. London: Sage. pp. 256–270

Kinninmont, J (2017) "*Vision 2030 and Saudi Arabia's Social Contract: Austerity and Transformation." Research Paper*. London: Middle East and North African Programme, Royal Institute of International Affairs.

Koenig, H.G. & Shohaib, S.A. (2014*) Health and Well-Being in Islamic Societies: Background, Research, and Applications*, New York Springer International Publishing.

Kuhn, T. S. (1970). Logic of discovery or psychology of research. *Criticism and the Growth of Knowledge*, 1-23.

Kvale, S (2007) *Doing Interviews*. London: Sage Publications.

Kyriacos, U., Jelsma, J., Jordan, S. (2011). Monitoring vital signs using early warning scoring systems: a review of the literature. *Journal of nursing management,* 19(3): pp 311-330.

Lai, E. R. (2011). Critical thinking: A literature review. *Pearson's Research Reports*, *6*, 40-41.

Lamadah, S.M. & Sayed, H.Y. (2014) Challenges facing nursing profession in Saudi Arabia. *Journal of Biology, Agriculture and Healthcare*, 4(7), 20-25.

Lambert, V., Matthews, A., MacDonell, R., & Fitzsimons, J. (2017). Paediatric early warning systems for detecting and responding to clinical deterioration in children: a systematic review. *BMJ open*, 7(3), e014497.

Larzelere, R. E., Kuhn, B. R., Johnson, B. (2004). The intervention selection bias: an underrecognized confound in intervention research. *Psychological bulletin*, 130(2): pp 289- 303.

Lavoie, P., Pepin, J., & Cossette, S. (2015). Development of a post-simulation debriefing intervention to prepare nurses and nursing students to care for deteriorating patients. *Nurse Education in Practice*, *15*(3), 181-191.

Leonard, M., Graham, S. and Bonacum, D., (2004). The human factor: the critical importance of effective teamwork and communication in providing safe care. *Quality and Safety in Health Care*, 13(suppl 1), pp.i85-i90.

Levett-Jones, T., Hoffman, K., Dempsey, J., Jeong, SY-S., Noble, D., Norton, CA., Roche, J., Hickey, N. (2010). The five rights of clinical reasoning: An educational model to enhance nursing students' ability to identify and manage clinically at risk patients. *Nurse Education Today* 30 (6): pp 515- 520.

Liaw, S. Y., Scherpbier, A., Klainin-Yobas, P., & Rethans, J. J. (2011). A review of educational strategies to improve nurses' roles in recognizing and responding to deteriorating patients*. International Nursing Review*, 58(3), pp296-303.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry (Vol. 75). London: Sage Publications.

Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. The Sage handbook of qualitative research, 4, 97-128.

Linder, L. A., & Pulsipher, N. (2008). Implementation of simulated learning experiences for baccalaureate pediatric nursing students. *Clinical Simulation in Nursing*, 4(3), pp41-47.

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). Methods in educational research: From theory to practice (Vol. 28). *San Francisco CA: John Wiley & Sons.*

Long, D. (2005*) Culture and Customs of Saudi Arabia*. USA: Greenwood Publishing Group.

Long, T., & Johnson, M. (2007). Research ethics in the real world: issues and solutions for health and social care. *Elsevier Health Sciences*.

Lund, T. (2005). The qualitative–quantitative distinction: Some comments. *Scandinavian journal of educational research*, *49*(2), 115-132.

MacNeela, P., Clinton, G., Place, C., Scott, A., Treacy, P., Hyde, A., & Dowd, H. (2010). Psychosocial care in mental health nursing: A think aloud study. *Journal of Advanced Nursing*, *66*(6), 1297-1307.

Marceau and McKinlay (2013) Clinical Vignettes in Health Services Research: Advantages and Limitations of Different Formats. MA: *The New England Research Institutes*.

Martin, J. (2015). Nursing Processes Related to Unplanned Intensive Care Unit Admissions. *Canadian Journal of Critical Care Nursing*, 27(2), 41.

Massey, D., Aitken, L. M., & Chaboyer, W. (2009). What factors influence suboptimal ward care in the acutely ill ward patient?. *Intensive and Critical Care Nursing*, 25(4), 169-180.

Massey, D., Chaboyer, W. and Anderson, V., 2017. What factors influence ward nurses' recognition of and response to patient deterioration? An integrative review of the literature. *Nursing open*, 4(1), pp.6-23.

McCormack, H. M., David, J. D. L., & Sheather, S. (1988). Clinical applications of visual analogue scales: a critical review. *Psychological medicine*, 18(04), pp 1007-1019.

McDonnell, A., Goodwin, E., Kennedy, F., Hawley, K., Gerrish, K., & Smith, C. (2015). An evaluation of the implementation of Advanced Nurse Practitioner (ANP) roles in an acute hospital setting. *Journal of advanced nursing*, 71(4), 789-799.

McKay, H., Mitchell, IA., Sinn, K., Mugridge, H., Lafferty, T., Van Leuvan, C., Mamootil, S., Abdel-Latif, ME. (2013) Effect of a multifaceted intervention on

documentation of vital signs and staff communication regarding deteriorating paediatric patients. *Journal of Paediatrics and Child Health* 49 (1): pp 48-56.

McQuillan, P., Pilkington, S., Allan, A., Taylor, B., Short, A., and Morgan, G. (1998) Confidential Inquiry into Quality of Care Before Admission to Intensive Care, *British Medical Journal*, 316 (7148): pp 1853 – 1858.

Meert, K. L., Donaldson, A., Nadkarni, V., Tieves, K. S., Schleien, C. L., Brilli, R. J., ... & Dalton, H. J. (2009). Multicenter cohort study of in-hospital pediatric cardiac arrest. *Pediatric critical care medicine: a journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies*, 10(5), 544.

Mfutso-Bengo, J., Ndebele, P., & Masiye, F. (2008). Disseminating research results to research participants and their communities. *Malawi Medical Journal*, 20(2), 64-66.

Miles, M. B., Huberman, A. M., Huberman, M. A., & Huberman, M. (1994). *Qualitative data analysis*: An expanded sourcebook. Sage.

Ministry of Health (2017). *Health Statistical Year Book; Statistical Division, MOH:* Riyadh, Saudi Arabia, Available at: https://www.moh.gov.sa/Ministry/Statistics/book/Pages/default.aspx [Accessed 18 June 2018].

Ministry of Health (2014) *Annual Statistics Book*. Available at: http://www.moh.gov.sa/Ministry/Statistics/book/Documents/1435.pdf, [Accessed 22 May 2016].

Ministry of Interior MOI, (2010). *Map of the Kingdom of Saudi Arabia*. Ministry of Interior. Riyadh.

Ministry of Labour MOL (2008). *Ministry of Labour Report Government of Saudi Arabia, Riyadh.*

Mitchell IA, McKay H, Van Leuvan C, Berry R, McCutcheon C, Avard B, Slater N, Neeman T & Lamberth P A (2010) Prospective controlled trial of the effect of a multifaceted intervention on early recognition and intervention in deteriorating hospital patients. *Resuscitation* 81 (6): pp 658-666.

Mohammad H M (2017) Strategies of Improving the Nursing Practice in Saudi Arabia*. J Health Educ Res Dev* 5 (2) : 221- 225.

Monaghan, A. (2005). Detecting and managing deterioration in children. *Paediatric Nursing* 17, 32–35.

Moore, D. A., & Healy, P. J. (2008). The trouble with overconfidence. *Psychological review*, 115(2), p 502.

Murray, JS., Williams, LA., Pignataro, S., Volpe, D. (2015) An Integrative Review of Pediatric Early Warning System Scores*. Pediatric nursing* Jul-Aug; 41(4): pp165-74.

Nadkarni, V. M., Larkin, G. L., Peberdy, M. A., Carey, S. M., Kaye, W., Mancini, M. E., & Berg, R. A. (2006). First documented rhythm and clinical outcome from in-hospital cardiac arrest among children and adults. *Jama*, 295(1), 50-57.

National Council of State Boards of Nursing NCSBN (2005). *Annual Meeting, NCSBN Organization*, https://www.ncsbn.org/index.htm [Accessed 10 May 2016].

National Institute for Health and Clinical Excellence NICE (2007) Acutely Ill Patients in Hospital - *NICE Guidelines* 50. London: HMSO.

National Patient Safety Agency NPSA. (2009) *Review of patient safety for children and young people*. London: National Reporting and Learning Service.

National South Wales Health NSW (2006) Patient Safety and Clinical Quality Program: Third report on incident management in the NSW Public Health System 2005-2006, *NSW Department of Health*. Sydney.

Newcombe, R. G. (1998). Interval estimation for the difference between independent proportions: comparison of eleven methods. *Statistics in medicine*, 17(8), 873-890.

Newell, A., Simon, N A. (1972) *Human problem solving*, New York: Prentice-Hall.

Nursing & Midwifery Council NMC (2016). *Children's nursing*. https://www.nmc.org.uk/registration/joining-the-register/trained-outside-the-eueea/childrens-nursing/ [Accessed 20 September 2016].

Nutley, S. M., Powell, A. E., & Davies, H. T. O. (2012). *What counts as good evidence?* St Andrews: University of St Andrews.

Odell, M., Victor, C., & Oliver, D. (2009). Nurses' role in detecting deterioration in ward patients: systematic literature review. *Journal of advanced nursing*, 65(10): pp 1992-2006.

Oermann, M. H., & Lukomski, A. P. (2001). Experiences of students in pediatric nursing clinical courses. *Journal for Specialists in Pediatric Nursing*, 6(2), pp65-72.

Offredy, M., & Meerabeau, E. (2005). The use of 'think aloud' technique, information processing theory and schema theory to explain decision-making processes of general practitioners and nurse practitioners using patient scenarios. *Primary Health Care Research and Development*, 6(01): pp 46-59.

O'Leary, F., McGarvey, K., Christoff, A., Major, J., Lockie, F., Chayen, G., Wharton, S. (2014). Identifying incidents of suboptimal care during paediatric emergencies–an observational study utilising in situ and simulation centre scenarios. *Resuscitation*, 85(3): pp 431-436.

O'Leary, D. F., & Mhaolrúnaigh, S. N. (2012). Information-seeking behaviour of nurses: where is information sought and what processes are followed?. *Journal of Advanced Nursing*, 68(2), 379-390.

O'Leary, J.; Nash, R.; Lewis, P. (2016) Standard instruction versus simulation: Educating registered nurses in the early recognition of patient deterioration in paediatric critical care. *Nurse Education Today* 36: pp 287-292.

Oliver, A., Powell, C., Edwards, D., & Mason, B. (2010). Observations and monitoring: routine practices on the ward. *Paediatric Care*, 22(4): pp 28-32.

O'Neill, E. S. (1994). The influence of experience on community health nurses' use of the similarity heuristic in diagnostic reasoning. *Scholarly Inquiry for Nursing Practice*, *8*(3), 261-272.

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International journal of social research methodology*, *8*(5), 375-387.

Orb, A., Eisenhauer, L. & Wynaden, D. (2001) Ethics in qualitative research. *Journal of nursing scholarship* 33 (1): pp93-96.

O'Shea, M., & Kelly, B. (2007). The lived experiences of newly qualified nurses on clinical placement during the first six months following registration in the Republic of Ireland. *Journal of Clinical Nursing*, 16(8), 1534-1542.

Paediatric Nursing Certification Board (2018) https://www.pncb.org/ [Accessed 22 June 2018].

Pantazopoulos, I., Tsoni, A., Kouskouni, E., Papadimitriou, L., Johnson, E. O., & Xanthos, T. (2012). Factors influencing nurses' decisions to activate medical emergency teams. *Journal of clinical nursing*, 21(17-18), 2668-2678.

Parshuram, C. S., Dryden-Palmer, K., Farrell, C., Gottesman, R., Gray, M., Hutchison, J. S., ... & Moga, M. A. (2018). Effect of a pediatric early warning system on all-cause mortality in hospitalized pediatric patients: the EPOCH randomized clinical trial. *Jama,* 319(10), 1002-1012.

Parshuram, C.S., Dryden-Palmer, K., Farrell, C., Gottesman, R., Gray, M., Hutchison, J.S., Helfaer, M., Hunt, E., Joffe, A., Lacroix, J. and Nadkarni, V., (2015). Evaluating processes of care and outcomes of children in hospital (EPOCH): *study protocol for a randomized controlled trial. Trials*, 16(1), p.245.

Parshuram, Christopher S., Heather P. Duncan, Ari R. Joffe, Catherine A. Farrell, Jacques R. Lacroix, Kristen L. Middaugh, James S. Hutchison J.S., Wensley, D., Blanchard, N., Beyene, J. and Parkin, P.C. (2011) "Multicentre validation of the bedside paediatric early warning system score: a severity of illness score to detect evolving critical illness in hospitalised children*". Critical Care* 15, no. 4 R184.

Parshuram, C. S., Hutchison, J., & Middaugh, K. (2009). Development and initial validation of the Bedside Paediatric Early Warning System score. *Critical care,* 13(4), R135.

Patton, M. Q. (2002*). Qualitative research and evaluation methods (3rd ed.).* Thousand Oaks, California: Sage Publications.

Payne, J. W. (1994). Thinking Aloud: Insights into Information Processing. *Psychological Science*, 5(5), pp241-248.

Peabody JW, Luck J, Glassman P, Dresselhaus TR, Lee M. (2000) Comparison of vignettes, standardized patients, and chart abstraction. *JAMA* 283: pp1715-22.

Pearson, G. A. (2008). Why children die: a pilot study 2006; England (South West, North East and West Midlands), Wales and Northern Ireland. London: *Confidential Enquiry into Maternal and Child Health. CEMACH*, 65.

Pearson, G. A., Ward-Platt, M., Harnden, A., & Kelly, D. (2010). Why children die: avoidable factors associated with child deaths. Archives of disease in childhood, *archdischild*177071.

Penk, J. S., Loke, Y. H., Waloff, K. R., Frank, L. H., Stockwell, D. C., Spaeder, M. C., & Berger, J. T. (2015). Unplanned admissions to a pediatric cardiac critical care unit: a review of 2 years' experience. *Pediatric Critical Care Medicine*, 16(2), 155-160.

Pijl-Zieber, E. M. (2013). Doctors' orders and the language of representation. *Nursing philosophy*, 14(2), pp139-147.

Pongmarutai, T. (2010). *Application of a judgment model toward measurement of clinical judgment in senior nursing students*. University of Nevada, Las Vegas.

Pope, C., & Mays, N. (Eds.). (2013). Qualitative research in health care. 4th ed *Malden, Mass: John Wiley & Sons.*

Purling, A., and King, L. (2012). A literature review: Graduate nurses' preparedness for recognising and responding to the deteriorating patient. *Journal of Clinical Nursing*, 21(23): pp 3451-3465 15p. doi:10.1111/j.1365-2702.2012.04348.x

Putzier, D., Padrick, K. Westfall, U., & Tanner, C. (1985). Diagnostic Reasoning in Critical Care Nursing. *Heart and Lung*, 14(5), pp 430-436.

Rafferty, A. M., Ball, J., & Aiken, L. H. (2001). Are teamwork and professional autonomy compatible, and do they result in improved hospital care?. *BMJ Quality & Safety*, 10(suppl 2), ii32-ii37.

Ritchie, J. and Lewis, J. (2003) *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. London: Sage.

Roberts, K.E., Bonafide, C.P., Paine, C.W., Paciotti, B., Tibbetts, K.M., Keren, R., Barg, F.K. and Holmes, J.H., (2014). Barriers to calling for urgent assistance despite a comprehensive pediatric rapid response system. *American Journal of Critical Care*, 23(3), pp.223-229.

Robson, M. A. J., Cooper, C. L., Medicus, L. A., Quintero, M. J., & Zuniga, S. A. (2013). Comparison of three acute care pediatric early warning scoring tools. *Journal of pediatric nursing*, 28(6), e33-e41.

Roland, D., Oliver, A., Edwards, E. D., Mason, B. W., & Powell, C. V. E. (2013). Use of paediatric early warning systems in Great Britain: has there been a change of practice in the last 7 years?. *Archives of disease in childhood*, 99(1), 26-29.

Rose, S.; Spinks, N.; Canhoto, A. I. (2015) *Management Research–Applying the Principles Oxon*: Routledge.

Royal College of Nursing RCN (2017). *Standards for Assessing, Measuring and Monitoring Vital Signs in Infants, Children and Young People*. London.

Royal College of Nursing RCN (2013). *Standards for assessing, measuring and monitoring vital signs in infants, children and young people*. London.

Royal College of Paediatrics and Child Health RCPCH (2014) *Spotting the Sick Child.* Available at: https://spottingthesickchild.com/?#showreelvid [Accessed April 24th, 2016].

Sackett, D L.; Richardson, W S.; Rosenberg, W.; Haynes, R B. (2000).Evidence Based Medicine: How to practice and teach evidence based medicine. New York*: Churchill Livingstone*.

Sadi, M. A. (2013). The implementation process of nationalization of workforce in Saudi Arabian private sector: A review of “Nitaqat Scheme”. *American Journal of Business and management,* 2(1), 37-45.

Saudi Arabian Market Information Resource SAMIRAD, (2010) Islam, *The Faith on which The Kingdom is Founded*: http://www.saudinf.com/main/b6.htm. [Accessed June 2017].

Saudi Commission for Health Specialties. (2014). Code of Ethics for Healthcare Practitioners*. King Fahd National Library*. Riyadh.

Saudi Neonatology Society, (2018). *Neonatal Resuscitation Programme* http://www.sns.med.sa/ [Accessed 22 July 2016].

Schober, J. E., Farrington, A., & Lacey, A. (2009). Presenting and disseminating research. *NHS Executive, Trent*.

Sefton,G., Lauren Sorce, and Martha AQ Curley. (2015) "Pediatric critical care nursing research priorities—Initiating international dialogue." *Pediatric Critical Care Medicine* 16, no. 6: pp174-182.

Sefton, G.; Lane, S.; Carrol, E. D. (2014) Performance of Individual Predictors of Deterioration Used in a Paediatric Early Warning Score. *Pediatric Critical Care Medicine*. 15(4): pp 29-30.

Sefton, G., McGrath, C., Tume, L., Lane, S., Lisboa, P. J. G., & Carrol, E. D. (2015). What impact did a Paediatric Early Warning system have on emergency

admissions to the paediatric intensive care unit? An observational cohort study. *Intensive and Critical Care Nursing*, 31(2), 91-99.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Experimental and quasi-experimental designs for generalized causal inference. *Houghton, Mifflin and Company.*

Sidebotham, P., Fraser, J., Fleming, P., Ward-Platt, M., & Hain, R. (2014). Patterns of child death in England and Wales. *The Lancet*, 384(9946), 904-914.

Silber, J.H., Romano, P.S., Rosen, A.K., Wang, Y., Even-Shoshan, O., Volpp, K.G. (2007) Failure-to-rescue: comparing definitions to measure quality of care. *Medical Care*. 45: pp 918–925.

Silverman, D. (2013). *Doing qualitative research: A practical handbook*. SAGE Publications Limited.

Simmons, B., Lanuza, D., Fonteyn, M., Hicks, F., & Holm, K. (2003). Clinical reasoning in experienced nurses. *Western Journal of Nursing Research*, *25*(6), 701-719.

Simpson, E., & Courtney, M. D. (2002). Critical thinking in nursing education: Literature review. *International journal of nursing practice*, *8*(April), 89-98.

Skaletzky, S. M., Raszynski, A., & Totapally, B. R. (2012). Validation of a modified pediatric early warning system score: a retrospective case–control study. *Clinical pediatrics*, 51(5), 431-435.

Smith, G. B., Osgood, V. M., & Crane, S. (2002). ALERT™—a multiprofessional training course in the care of the acutely ill adult patient. *Resuscitation*, 52(3), 281-286.

Smith, G. B., & Poplett, N. (2004). Impact of attending a 1-day multi- professional course (ALERT™) on the knowledge of acute care in trainee doctors. *Resuscitation,* 61(2), 117-122.

Smith J & Firth J (2011) Qualitative data analysis: the framework approach. *Nurse Researcher* 18 (2): pp 52-62.

Spencer, L., Ritchie, J., Lewis, J., & Dillon, L. (2003). *Quality in qualitative evaluation*: a framework for assessing research evidence.

Sternberg, R. J. (1986). Inside Intelligence: Cognitive science enables us to go beyond intelligence tests and understand how the human mind solves problems. *American scientist*, *74*(2), 137-143.

Straka, K., Burkett, M., Capan, M., & Eswein, J. (2012). The impact of education and simulation on pediatric novice nurses' response and recognition to deteriorating. *Journal for Nurses in Professional Development*,28(6), pp 5-8.

Tanner, C. A. (2006). Thinking like a nurse: A research-based model of clinical judgment in nursing. *Journal of nursing education*, 45(6), 204-211.

Tashakkori, A., & Teddlie, C. (2003). Handbook on mixed methods in the behavioral and social sciences. *Thousand Oaks*, CA: Sage

Teddlie, C., & Yu, F. (2007). Mixed methods sampling a typology with examples. *Journal of mixed methods research*, 1(1): pp 77-100.

Theilen, U., Leonard, P., Jones, P., Ardill, R., Weitz, J., Agrawal, D., & Simpson, D. (2013). Regular in situ simulation training of paediatric medical emergency team improves hospital response to deteriorating patients. *Resuscitation*, 84(2), pp218-222.

Thomas-Jones, E., Lloyd, A., Roland, D., Sefton, G., Tume, L., Hood, K., ... & Lacy, D. (2018). A prospective, mixed-methods, before and after study to identify the evidence base for the core components of an effective Paediatric Early Warning System and the development of an implementation package containing those core recommendations for use in the UK: Paediatric early warning system–utilisation and mortality avoidance–the PUMA study protocol. *BMC pediatrics*, 18(1), 244.

Thompson, C., Aitken, L., Doran, D., & Dowding, D. (2013). An agenda for clinical decision making and judgement in nursing research and education. *International Journal of Nursing Studies*, 50(12), 1720-1726.

Thompson, C., Cullum, N., McCaughan, D., Sheldon, T., & Raynor, P. (2004). Nurses, information use, and clinical decision making—the real world potential for evidence-based decisions in nursing. *Evidence-Based Nursing*, 7(3), 68-72.

Thompson C. & Dowding D., eds (2002) Decision-making and judgement in nursing - an introduction. In Clinical Decision- Making and Judgement in Nursing. *Churchill Livingstone*, London: pp. 8–124.

Thompson, C., & Stapley, S. (2011). Do educational interventions improve nurses' clinical decision making and judgement? A systematic review. *International journal of nursing studies,* 48(7), 881-893.

Thorne, S. (2000). Data analysis in qualitative research. *Evidence-based nursing*, *3*(3), 68-70.

Tibballs, J., & Kinney, S. (2009). Reduction of hospital mortality and of preventable cardiac arrest and death on introduction of a pediatric medical emergency team. *Pediatric Critical Care Medicine*, 10(3), 306-312.

Tower, M., & Chaboyer, W. (2014). Situation awareness and documentation of changes that affect patient outcomes in progress notes. *Journal of clinical nursing*, 23(9-10): pp 1403-1410.

Tucker, K. M., Brewer, T. L., Baker, R. B., Demeritt, B., & Vossmeyer, M. T. (2009). Prospective evaluation of a pediatric inpatient early warning scoring system. *Journal for Specialists in Pediatric Nursing*, 14(2), 79-85.

Tuli, F. (2011). The basis of distinction between qualitative and quantitative research in social science: reflection on ontological, epistemological and methodological perspectives. *Ethiopian Journal of Education and Sciences*, 6(1): pp 97-108.

Tume, L. (2005) A 3-year review of emergency PICU admissions from the ward in a specialist cardio- respiratory centre. *Care of the Criticality* lll. 21(1): pp 4-7.

Tume, L. (2007). The deterioration of children in ward areas in a specialist children's hospital. *Nursing in critical care*, 12(1), pp12-19.

Tume, L., & Bullock, I. (2004). Early warning tools to identify children at risk of deterioration: A discussion. *Paediatric Nursing*, 16(8): pp 20-23.

Tume, L. N., Coetzee, M., Dryden-Palmer, K., Hickey, P. A., Kinney, S., Latour, J. M., ... & Curley, M. A. (2015). Pediatric critical care nursing research priorities—Initiating international dialogue. *Pediatric Critical Care Medicine*, 16(6), e174-e182.

Tume, L. N., Sefton, G., Arrowsmith, P. (2014). Teaching paediatric ward teams to recognise and manage the deteriorating child*. Nursing in Critical Care*, 19(4): pp196-203 8p. doi:10.1111/nicc.12050.

Twycross, A., & Powls, L. (2006). How do children's nurses make clinical decisions? Two preliminary studies. *Journal of Clinical Nursing*, *15*(10), 1324-1335.

Ulsenheimer, J. H., Bailey, D. W., McCullough, E. M., Thornton, S. E., & Warden, E. W. (1997). Thinking about thinking. *The Journal of Continuing Education in Nursing*, *28*(4), 150-156.

Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S. (2016). Theme development in qualitative content analysis and thematic analysis.

Vancouver, J. B., Thompson, C. M., Tischner, E. C., & Putka, D. J. (2002). Two studies examining the negative effect of self-efficacy on performance. *Journal of Applied Psychology*, 87(3), pp506.

Van Galen, L. S., Struik, P. W., Driesen, B. M., Merten, H., Ludikhuize, J., van der Spoel, J. I., & ... Nanayakkara, P. B. (2016). Delayed Recognition of Deterioration of Patients in General Wards Is Mostly Caused by Human Related Monitoring Failures: A Root Cause Analysis of Unplanned ICU Admissions*. Plos One*, 11(8), e0161393. doi:10.1371/journal.pone.0161393

Van Graan, A. C., Williams, M. J., & Koen, M. P. (2016). Professional nurses' understanding of clinical judgement: A contextual inquiry. *health sa gesondheid*, *21*(1), 280-293.

Van Hulle Vincent, C., Gaddy, E. J. (2009). Pediatric nurses' thinking in response to vignettes on administering analgesics. *Research in nursing & health*, 32(5): pp 530-539.

Van Kuiken, D. and Martz Huth, M. (2013). What is 'normal?' Evaluating vital signs. *Pediatric nursing*. 9 (5): pp 216.

Van Someren, M. W., Barnard, Y. F., & Sandberg, J. A. (1994). *The think aloud method: A practical guide to modelling cognitive processes* (Vol. 2). London: Academic Press.

Voepel-Lewis, T., Pechlavanidis, E., Burke, C., & Talsma, A. N. (2013). Nursing surveillance moderates the relationship between staffing levels and pediatric postoperative serious adverse events: A nested case–control study. *International journal of nursing studies*. 50 (7): pp 905-913.

Wheatley, I. (2006). The nursing practice of taking level 1 patient observations. *Intensive and Critical Care Nursing*, 22(2), 115-121.

Whittemore, R and Knafl, K. (2005) The integrative review: updated methodology. *Journal of Advanced Nursing* 52 (5): pp546-553.

Wilson, R. M., Runciman, W. B., Gibberd, R. W., Harrison, B. T., Newby, L., & Hamilton, J. D. (1995). The quality in Australian health care study. *Medical journal of Australia*, *163*(9), 458-471.

Wolfe, A. Macfarlane, A. Donkin, M. Marmot, and R. Viner. (2014) Why children die: death in infants, children and young people in the UK. London: *Royal College of Paediatrics and Child Health.*

World Health Organisation WHO. (2010) *Global Health Observatory* (GHO) [Online]. Geneva: World Health Organisation.

World Health Organisation. (2009) *Global standards for initial education of professional nurses and midwives.* Geneva: World Health Organisation.

WHO (2009) *Research Ethics Review Committee: The Process of Obtaining Informed Consent*. Geneva: World Health Organisation.

Worldometers (2018) *Saudi Arabia Population* (1950 – 2018) http://www.worldometers.info/world-population/saudi-arabia-population/ [accessed on 28 June 2018].

Yildirim, B., & Ozkahraman, S. (2011). Critical thinking in nursing process and education. *International journal of humanities and social science*, 1(13), 257-262.

Young, K. A. (2005). Direct from the source: the value of think-aloud data in understanding learning. *The Journal of Educational Enquiry*, 6(1): pp 19.