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Pediatric Critical Care Nursing Research Priorities – Initiating International Dialogue

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ABSTRACT

Objective: To identify and prioritize research questions of concern to the practice of pediatric critical care nursing practice.

Design: One-day consensus conference. Using Benner's conceptual framework describing domains of practice in critical care nursing, nine international nurse researchers presented state-of-the-art lectures. Each identified knowledge gaps in their assigned practice domain then posed three research questions to fill that gap. Meeting participants then prioritized the proposed research questions using an interactive multi-voting process.

Setting: 7th World Congress on Pediatric Intensive and Critical Care in Istanbul, Turkey.

Participants: Pediatric critical care nurses and nurse scientists attending the open consensus meeting.

Interventions: Systematic review, gap analysis and interactive multi-voting.

Measurements and Main Results: The participants prioritised 27 nursing research questions in nine content domains. The top four research questions were: (1) identifying nursing interventions that directly impact the child and family's experience during the withdrawal of life support; (2) evaluating the long-term psycho-social impact of a child's critical illness on family outcomes; (3) articulating core nursing competencies that prevent unstable situations from deteriorating into a crises and (4) describing the level of nursing education and experience in pediatric critical care that has a protective effect on the mortality and morbidity of critically ill children.

Conclusions: The consensus meeting was effective in organizing pediatric critical care nursing knowledge, identifying knowledge gaps and in prioritizing nursing research initiatives that could be used to advance nursing science across world regions.

Introduction

The World Federation of Pediatric and Critical care Societies (WFPICCS) was formed to bring together international expertise, experience and influence with an aim of improving the outcomes of critically ill children across the world.¹ One of the key objectives of the World Federation is to encourage research in the field of pediatric critical care, and more specifically, to prioritize critical care research agendas and develop critical care research networks. With this in mind, nurse scientists in the field of pediatric critical care nursing across the globe have met informally at each World Congress since 1996. At its most recent meeting at PICC2014 in Istanbul Turkey, a nursing science preconference was organized with the aim of engaging nurse scientists in the field of pediatric critical care to summarize nursing research topics in the field. Our primary goal was to create a prioritized list of nursing research topics of concern to the practice of pediatric critical care nursing. This paper presents the process, findings and recommendations from this meeting.

Background

Previously two other studies have specifically defined pediatric critical care nursing research priorities.^{2,3} These were both undertaken using a modified Delphi method without the use of a conceptual framework. In these cases predominately clinical bedside nurses generated their own research priorities which were subsequently refined. In the 2012 European Delphi study, their seven highest ranking statements were related to end-of-life care, decision making around forgoing and sustaining treatment, prevention of pain, education and competencies for PICU nurses, reducing healthcare-associated infections, identifying appropriate nurse staffing levels, and implementing evidence into nursing practice.² The Australian College of Critical Care Nurses conducted a Delphi study on PICU nursing research priorities in Australia and New Zealand.³ Their top priorities included patient issues related to neurological care, pain/sedation/comfort, best practice at the end of life, and ventilation strategies, as well as two priorities related to professional issues about nurses' stress/burnout and professional development needs.³

Method

The nursing science preconference was a one-day program. Lectures were organized around the nine domains of practice in critical care nursing described by Benner et. al. in their peer-reviewed book *Clinical Wisdom and Interventions in Acute and Critical Care*.⁴ This framework for understanding nursing knowledge and practice is unique because it was generated through an ethnographic study of critical care nursing practice that included staff and advanced practice nurses from novice to expert (see Table 1). The framework was selected because it was generated from leaders in the field of qualitative nursing research,

was comprehensive in scope, and uniquely described common clinical goals and concerns of nurses practicing in the field of critical care.

Table 1: Benner's Domains of Practice ⁴

Domain	Description of domain
1. Diagnosing and managing life-sustaining physiologic functions in acutely ill and unstable patients	This domain centres on crisis management, titrating instantaneous interventions in unstable patients, coordinating and managing multiple instantaneous interventions, and weaning patients from life-support technologies.
2. Skilled know how of managing a crisis	This domain includes exhibiting leadership in setting up the environment and managing multiple therapies in response to a crisis.
3. Providing comfort measures for the acute and critically ill	as a domain this includes caring for the body as a source of comfort, creating a comforting milieu in a technologically rich ICU environment, and providing comfort through presence, connection and relationships
4. Caring for patient's families	This domain centres around family presence at the bedside, information given to families and family involvement in the care of their child.
5. Preventing hazards in a technological environment	This, as a domain focuses on nurses' engagement in safety work and effective performance of technical tasks and use of devices.
6. Facing death: end of life care and decision-making	This domain focuses on the changing communication and transition from curative to palliative care and providing effective palliative care for the dying child and family.
7. Making a case: communicating clinical assessments and improving teamwork	This domain is primarily focused on communication between and among professionals and improving collaborative team working
8. Patient Safety: Monitoring quality, preventing and managing breakdown	This, as a domain is centred around monitoring and management of practice breakdowns, resolving conflict, resolving system failures and providing intensive care with inadequate resources
9. Skilled know how of clinical and moral leadership and the coaching and mentoring of others	This domain focuses on facilitating the development of others, coaching, resolving conflict between families and staff and transforming healthcare systems.

All presenters were PhD-prepared or doctoral students in pediatric critical care. Most had attended previous nursing science gatherings held informally at World Federation meetings. To the extent possible, care was taken to ensure a balanced representation of nurse scientists from across the globe. Program descriptions were inclusive and invited all Pediatric Intensive Care Unit (PICU) nurses interested in evidence-based practice and clinical researchers interested in developing programs of research in PICU to attend.

Each presenter was assigned one of the nine domains of practice within their field of research expertise. They were asked to first re-familiarize themselves with the domain by reviewing the associated chapter in *Clinical Wisdom and Interventions in Acute and Critical Care*, provide a summary of the strengths and limitations of the literature in their assigned

domain and end their session with at least one, but no more than three recommendations for future research in their assigned domain. Presenters were instructed to focus their review on pediatric intensive care-specific studies and to include neonatal or adult critical care papers when relevant and applicable. Search topics and methodologies were not prescribed.

At the end of each presentation, participants were asked to refine the three recommendations then rank order the recommendations from most to least important using an audience response system. To narrow the choices, participants were asked to prioritize the top ranked items from each presentation at the end of the morning and afternoon sessions. The results of each voting round were visible in real time to all the participants after voting, but no discussion took place around these results. Furthermore, at the conclusion of the program, participants ended the day by prioritizing the top items from the morning and afternoon sessions. A summary of each presentation follows and their recommendations for future research are noted in Table Two.

Domain 1: Diagnosing and managing life-sustaining physiologic functions (Lauren Sorce, United States)

Bedside critical care nurses have a constant and crucial role in responding to unstable physiology and adjusting and managing multiple interventions and in seeing opportunities to wean patients from life-support technologies. Research supports pediatric critical care nurses management of insulin titration and weaning patients from mechanical ventilation.⁵⁻⁸ A variety of studies evaluate and support nursing's role in providing improved nutritional support in critically ill children; specifically, time to first feeding and titrating enteral feeding to meet nutritional and caloric needs.⁹⁻¹¹ Although it is well-known that critically ill patients require nursing care that intervenes quickly to avert or respond to rapidly deteriorating clinical conditions, there are little data describing this core nursing activity. Research in this domain is specifically lacking in terms of effective educational strategies and defining core competencies to prepare nurses to respond to the rapidly deteriorating child.

Domain 2: Skilled know how of managing a crisis (Gerri Sefton, United Kingdom)

In critically ill children, physiologic crises are often inevitable. What constitutes a "crisis" may be different for individual nurses based on their clinical expertise. Much of the skill in managing crises lies in hazard perception and preparedness to mitigate risk. This includes knowing one's PICU, knowing which patients are at risk for life-threatening events and knowing the capabilities of one's staff so that resources can be allocated to optimise patient outcomes. The ability to manage a crisis is recognised as the principal attribute required for safe clinicians.¹² Personnel and unit factors can impact outcomes after cardiac arrest.¹³ Nurses with high emotional intelligence scores experience less stress and burnout in their

professional lives.¹⁴ Critical thinking and care delivery may be influenced by cultural factors within a clinical system.¹⁵ Although crisis resource management (CRM) simulation has improved survival following pediatric cardiac arrest,¹⁶ there is mixed opinion on the ideal frequency and format of CRM training.¹⁷⁻²¹ Despite increasing research in this domain, there is no evidence on the best CRM format to improve nursing competence, nor on other factors such as crisis preparedness that may improve nurse confidence.

Domain 3: Providing comfort measures (Minette Coetzee, South Africa)

A fundamental nursing role is the provision of comfort for patients and their families. The literature was reviewed around two core themes from a phenomenological study of the comfort and discomfort of critically ill children '*embodiment*' and '*aloneness and being with*'.²² What children experience as pain and discomfort is well researched, including assessing comfort in infants and children,²³⁻²⁶ assessment of pain^{27,28} and sedation titration and its effects.²⁹ Research in human biology and neuroscience reveals a clear link between autonomic regulation in infants and children and the presence of the mother.³⁰⁻³² Studies in neonates have confirmed the validity of utilizing objective autonomic nervous systems (ANS) parameters to assess stress.^{33,34} In PICU, measuring heart rate variability as a stress indicator confirms that mothers' intervention during procedures results in a faster recovery.³⁵ Some aspects of this domain have been studied far more extensively than other domains, but gaps still exist specifically with regard to implementation of pain, sedation and comfort scoring tools into nursing practice.

Domain 4: Caring for patient's families (Jos M. Latour, Netherlands)

In pediatric critical care, the parents are central to the child's recovery and for the provision of psychosocial support. Evidence is available on the general practice of ensuring parents presence with their child in the PICU.³⁶ The gold standard in most Northern European, Antipodean and North American PICUs, is to welcome parents without restrictions and give the parents the choice to participate in the care of their critically ill child. However, this is not standard practice across the world.^{37,38} More specifically, there is a trend towards allowing parents during medical and nursing rounds³⁹⁻⁴³ and, when requested, witnessing a resuscitation of their child.^{44,45} The provision of information and support to parents has mainly been studied by explorative research. Differences of information required and support preferences between parents and PICU staff has been documented.⁴⁶ Most interventions are related to overall guidance of parents,^{47,48} or in the area of end-of-life care.⁴⁹ In encouraging parental empowerment and involvement in the care, several studies have documented a wide variety in practices. Parental involvement in end-of-life decisions is improving by including parents at an early stage.⁵⁰⁻⁵⁵ Overall, parents experience high

satisfaction of the care and their ability to be involved in the care, but areas of improvement still exist.^{56,57} Although gaps in the literature remain, this domain is well researched in comparison to the other domains, what is lacking however is evidence of the long-term psychosocial impact of a PICU admission on the child and family.

Domain 5: Preventing hazards in a technological environment (Lyvonne Tume, UK)

Nurses are vital in both preventing actual and potential hazards in the critical care environment. Numerous iatrogenic hazards exist,⁵⁸ yet nurses place a high level of trust in the technology/equipment which can lead to a phenomenon of '*automation-induced complacency*'.⁵⁹ This occurs when the capabilities of a device are overestimated, people can fail to adequately check the system, this has been cited a specific cause of adverse events in healthcare. Considering the huge annual costs spent on new technology, the way it is implemented within a PICU remains chaotic.⁶⁰ An effective method of implementation may reduce hazards but more work is needed in this area. Furthermore, the impact of the PICU environment on both staff and patients can also be profound, with noise and light particularly problematic.^{61,62} Whereas PICU nurses have used and manipulated technology to make the PICU safer for patients,^{63,64} this needs to be extended to the environment itself in relation to both staff and patients. The domain requires further research, as pediatric-specific evidence is limited and the impact of environmental factors and interventions to manipulate these to affect staff and patients outcomes is not known.

Domain 6: Facing death: end of life care and decision-making (Karen Dryden-Palmer, Canada)

Despite our best efforts, critically ill children do not always survive. Dying children in the ICU have increasingly complex clinical needs.⁶⁵ The majority of deaths in hospitalized children occur in the intensive care unit where the tone and culture of care is curative.⁶⁶ End of life care often results from a change in the direction of care and radically shifted outcome expectations.⁶⁷ Withdrawal of life sustaining therapy is increasingly common mode of death, although practices vary widely.^{68,69} Descriptions of how nurses operationalize compassionate end of life care are incomplete. Questions remain as to what constitutes quality end-of -life care and which nursing interventions achieve best outcomes.⁵⁴ The experience of childhood death deeply impacts family members and can be life altering.⁵⁵ The provision of evidence-informed end of life nursing care can potentially alleviate suffering in the child and improve the dying process, strengthen decision-making and communication, and positively impact the ongoing health and wellbeing of the surviving family and of health care providers. The domain requires further research, as work around what constitutes best

practice in end of life care is limited as is work on family members' experiences of the process.

Domain 7: Making a case: communicating clinical assessments and improving teamwork (Sharon Kinney, Australia)

The PICU is a complex environment involving many professionals involved in the care of a child, and effective communication between and among professionals is essential for optimal outcomes. Structured communication tools such as SBAR (**S**ituation, **B**ackground, **A**ssessment, **R**ecommendation) have been shown to improve expression of clinical reasoning and information transfer by junior medical staff in pediatric critical care.^{70,71} Similarly, studies have demonstrated better quality of handovers⁷² and reduced medical errors and improved teamwork⁷³ with standardised handover processes for cardiac surgical patients transitioning from the operating room to the PICU. The use of daily goals sheets has resulted in improved nursing perception of communication⁷⁴ medical and nursing understanding of patient goals⁷⁵ and increased team agreement with the stated goals.⁷⁶ These approaches to improving communication may be less suitable for patients with an uncertain clinical course and outcome. One recent qualitative study has highlighted that physicians and nurses in PICU have inadequately developed or shared mental models about such complex patients.⁷⁷ Common expectations must be built and more open and collaborative approaches may allow for better mental model formation. The domain requires further research as little is known about the role of patients and families in team communication models.

Domain 8: Patient Safety: Monitoring quality, preventing and managing breakdown (Mavilde LG Pedreira, Brazil)

The PICU is a highly technical and complex environment, with inherent risks involving conflicts, practice breakdowns and system failures. A systemic approach to safety and quality improvement in PICU should focus on promoting a suitable environment for nursing practice and increasing nurses' cognitive capacity to deliver safe complex patient care.^{4,78} Strategies to promote patient safety in PICU must include the identification and control of nursing care practice breakdown. Intrinsic demographic, developmental, dependence and disease-related characteristics of children put them at greater risk of harm during healthcare. The presence of an adverse event during hospitalization can increase the mortality rate from 2 to 18 fold, with the hospital length of stay 2 to 6 fold longer and hospital costs 2 to 20 fold higher.^{79,80} Severe adverse events occur more often in critical care environments, and are three times more frequent in children than adults, placing PICU as environments fertile with the potential for risk, error, and harm.^{81,82} Medication errors, healthcare acquired-infections,

errors or delays in diagnosis and treatment, misidentifications or errors during invasive procedures place patient safety as a complex and multidimensional phenomena in this setting.⁸³ Type, frequency and sources of adverse events show wide variation in PICUs internationally. Studies have shown that as consequence of preventable adverse events the PICU mortality rate in developing countries (30%) can be much higher than in developed countries (2%).^{83,84} Such epidemiological variations can reflect possible global disparities on nursing capability to protect patients and families and promote safety in PICU. The domain requires further research to determine which nursing factors have a protective effect on patient clinical outcomes.

Domain 9: Skilled know how of clinical and moral leadership and the coaching and mentoring of others (Patricia Hickey, United States)

Effective nursing leadership is crucial to promote a safe and capable PICU workforce, which facilitates staff development. Clinical and moral leadership skills are demonstrated by the leader while facilitating the clinical development of others in the following ways: achievement of a high quality workforce; provision of experiential learning to foster the skill of know-how; support of collaborative relations and customized teaching, coaching and mentoring to each situation^{4,85} Expert nurse leaders demonstrate compassionate, knowledgeable and responsive ways of care delivery and use practical means and a logical approach in sharing knowledge and skill principles. While bridging the gaps in patient care, leadership and coaching skills are used to guide improvement of quality and safety of patient care as well as supporting activities to close gaps in knowledge, ability and resources.⁸⁶ Together these skills enable coaching others in interpreting, forecasting, and responding to patient transitions; and envisioning the direction for future development and system change in care delivery.⁸⁷ Although there is some work in this domain, further research needs to be focus on determining the impact of nursing leadership on healthy work environments and advancing nursing science.

Results

Program participants included 33 nurses working an average of 19 years (SD 9.65) in pediatric critical care. Most (82%) participants were female. The majority identified research as their primary role (58%), followed by clinical practice as bedside nurses, nurse specialists or nurse practitioners (21%), and nurse managers (9%). Ten countries were represented: Australia (9%), Brazil (3%) Canada (9%), Denmark (6%), Netherlands (3%); South Africa (6%); Switzerland (6%); Turkey (6%), UK (21%) and USA (27%). Voting generated a priority topic from each domain (Table 2) and the final voting identified four priority research topics (Table 3).

Table 2: Research Recommendations with first round voting results

Domain with three research recommendations	Mean score¹	No. votes²
Diagnosing and managing life-sustaining physiologic functions		
1. Articulate core nursing competencies that prevent unstable situations from deteriorating into crises in pediatric critical care.	8.08	28
2. Can nurse-led bundled interventions improve the clinical outcomes of pediatric critically ill patients?	8.03	26
3. What educational strategies best prepare pediatric critical care nurses to intuitively respond to the emerging needs of the critically unstable child?	7.93	26
Skilled know how of managing a crisis		
1. Does frequency and format of SIM/CRM training affect nurse confidence and competence to manage crisis situations?	7.23	25
2. Does local healthcare hierarchy & culture impact team performance during crisis situations?	7.07	25
3. Does shared responsibility for continuous quality improvement and crisis preparedness improve junior nurse confidence and job satisfaction?	7.03	24
Providing comfort measures		
1. Using objective ANS parameters to assess stress and to increase awareness of comfort and discomfort in PICU.	7.77	25
2. Exploring ways of decreasing allostatic load in children in PICU, particularly by mediating connecting relationships with patients' family and peers.	7.57	25
3. Implementation research to refine pain and sedation protocols to anticipate pain and discomfort in PICU.	6.73	25
Caring for patient's families		
1. Evaluate the long-term psycho-social impact of a child's critical illness on family outcomes.	9.0	25
2. Develop, implement and test interventions that facilitate parent involvement in the PICU.	8.04	25
3. Develop and test parent reported outcome measures that are sensitive to the quality and safety of PICU care.	7.96	25
Preventing hazards in a technological environment		
1. What is the most effective method for implementing and evaluating a new technology in the PICU?	7.81	28
2. Can manipulations of the PICU environment optimize a critically-ill patient's recovery?	7.70	28
3. What new technologies are needed to enhance our capacity to more effectively evaluate a patient's response to PICU therapy?	7.67	28
Facing death: end of life care and decision-making		
1. What nursing interventions directly impact the child and family's experience during the withdrawal of life-sustaining therapy in the PICU?	8.80	25
2. How can nurses' best help families cope with the impending death of a child?	8.00	25
3. What models of ICU communication impact child and family support during end of life decision making?	6.84	25
Making a case: communication clinical assessments and improving teamwork		
1. Can effective team communication models improve patient and family outcomes in pediatric critical care?	8.33	26
2. What team communication models facilitate a shared clinical understanding of the critically ill child?	7.22	26
3. How best can pediatric critical care nurses communicate their clinical understanding and judgments in the critically ill child?	6.64	26

Patient Safety: Monitoring quality, preventing and managing breakdown		
1. Determine what level of nursing education and experience in pediatric critical care has a protective effect on mortality and morbidity of critically ill children.	7.76	23
2. What models or standards of nursing care practice enhance pediatric critical care nurses' capacity to prevent and manage practice breakdowns?	7.72	23
3. What new tools and technologies can be developed to drive nurses' cognitive capacity to deliver safer care?	7.44	23
Skilled know how of clinical and moral leadership and the coaching and mentoring of others		
1. Does authentic pediatric nursing leadership create healthy work environments that optimize patient and family outcomes?	7.41	22
2. Does a formal organizational structure with dedicated mentors impact the advancement of critical care nursing science?	7.35	22
3. How best can nurse leaders build and disseminate critical care nursing science beyond their home institution?	6.25	22

¹Participants were asked "How important is the statement in the field of pediatric critical care nursing?" using a 0-10 scale where 0 is not important and 10 is extremely important. Highest-ranking scores were advanced to the next round of voting.

²Sample size reflects participant participation throughout the day.

Table 3: Final round voting results identifying the four top research priorities in order of ranking

Domain and research recommendations	Mean score¹	No. votes
Domain 8: Facing death: end of life care and decision-making: What nursing interventions directly impact the child and family's experience during the withdrawal of support in the PICU?	8.69	27
Domain 4: Caring for patient's families: Evaluate the long-term psycho-social impact of a child's critical illness on family outcomes.	8.48	27
Domain 7: Making a case: communication clinical assessments and improving teamwork: Can effective team communication models improve patient and family outcomes in pediatric critical care?	8.33	26
Domain 1: Diagnosing and managing life-sustaining physiologic functions: Articulate core nursing competencies that prevent unstable situations from deteriorating into crises in pediatric critical care.	7.96	27

¹Participants were asked "How important is the statement in the field of pediatric critical care nursing?" using a 0-10 scale where 0 is not important and 10 is extremely important. Highest-ranking scores were advanced to this final round of voting.

Discussion

The meeting was effective in consolidating pediatric critical care nursing knowledge and in producing a roadmap for future nursing research priorities in the field. Two other studies have defined pediatric critical care nursing research priorities.^{2,3} In the 2012 European Delphi study, only one of the four priority areas was consistent with our results: issues around improving end of life care.² A further priority was around pediatric critical care nursing education, but they focussed on improving nurse competency rather than in ours, which asked whether nurse educational level, and if so what, had protective effect on the mortality and morbidity of critically ill children.² A large number of their research statements

however related to clinical nursing care practices, which we did not find, perhaps because our workshop participants were very experienced, the majority of whom were nurse scientists developing programs of research. This may have generated a more strategic vision for PICU nursing rather than a focus on clinical skills.

The Australian College of Critical Care Nurses study³ did contain some similarities to our work, specifically around pain/sedation/comfort and best practice at the end of life.³ All three studies have prioritized end of life care as a research topic. It is apparent that this is one of the most significant issues affecting PICU nurses and thus despite some research in this area, more is urgently required to define and test best practice and nursing interventions that impact on the family's experience.

Collectively, these data are useful in describing the evidence supporting the practice of pediatric critical care nursing and in assisting new nurse investigators in selecting fertile areas of inquiry on which to build a program of research. These data can also be used by local, national and global funding agencies to develop a strategic plan and fund competitive applications that directly impact the care provided to critically ill children and their families.

Limitations

There are a number of limitations that need to be acknowledged when interpreting these results. First, we used an opportunistic sample that included 33 workshop participants, which represented only 10 countries, so the results may not be generalizable. We anticipate that nursing research priorities will differ internationally. In addition the use of a conceptual framework developed from clinical practice may not allow strategic planning for future research priorities. Nevertheless this was the first international meeting to attempt to discuss and define international pediatric critical care nursing research priorities. This paper provides a first step in stimulating local, national and global discussion.

Conclusions

Nursing science supporting the practice of pediatric critical care has developed largely over the past two decades. The meeting was effective in consolidating pediatric critical care nursing knowledge and in producing a roadmap for nursing research priorities in this field. This list of priority topics (based around Benner et al's domains) may provide a guide for future postgraduate nursing research students and their supervisors. Future work should explore a more multidisciplinary angle of research priorities and involve parents and children to ensure our work is relevant to our patient group. We will evaluate our progress at PICC 2016 in Toronto, Canada.

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