

Are children really different from adults in critical care settings?



School of Child and Adolescent Health, University of Cape Town

Minette Coetzee, PhD, RN, RPaedN, Associate Professor of Child Nurse Practice Development

Four years ago a Nursing Standards Generating Body (SGB) was established to gather wide input and formulate national educational standards for nursing. Possibly for the first time in South Africa this process offered a platform to consider how paediatric critical care is different from adult critical care.

During the course of the 3-year SGB process, the Critical Care Society of South Africa (CCSSA) co-ordinated an exceptional response after having garnered wide participation from South African critical care nurses, educators and clinicians. It was an excellent opportunity to contribute to the issues around the nature and length of education programmes as well as the outcomes. The recommendations were thoroughly debated and offered a unique opportunity to influence policy and standards of critical care nursing education. This debate could also challenge assumptions, and it was in this process that the often misunderstood question of the differences between adult and child critical care could be tackled.

Context

Owing to the very limited number of dedicated paediatric intensive care unit (PICU) resources most children are admitted to adult units. This does not always result in a good outcome for the child. While no comparative data exist in South Africa, data from the UK show that the risk-adjusted mortality of children cared for in adult intensive care units is double that of children cared for in a PICU.¹ In South Africa PICU resources are extremely limited. Professor Andrew Argent, paediatric intensivist and Director of the Red Cross Children's Hospital PICU, sums up the statistics in this way (personal communication): In Cape Town between 1 900 and 2 000 children receive ICU care every year (1 400 of these are admitted to the Red Cross Children's Hospital's 18-bed PICU). These patients have an average predicted PICU mortality of 10%, an indication that they do require PICU care. In other provinces the picture looks different. In Durban about 500 children are admitted per annum. In the Gauteng area, about 450 children are admitted to Chris Hani Baragwanath and Johannesburg hospitals per annum. The reported mortality and predicted mortality in these patients has been about 35%. This indicates that the resources available for children in these settings are insufficient. In the Free State about 400 children are admitted annually; Bloemfontein has two PICUs, in different hospitals.

There seems to be an assumption that a specialised PICU is an expense that cannot be justified in the current South African health care context. Argent, however, argues that the cost per year of life saved in an adult ICU versus a PICU is about 10 times higher for the adult ICU; in comparison, paediatric critical care is therefore very cost effective. He would be the first to admit that an effective service hinges on adequate nursing expertise.

Nursing expertise depends on adequate education, training, leadership, staffing and support. In all South African settings this expertise is thinly spread. The news that a child needs admission to the ICU is sometimes met with groans of dread by staff, and yet the assumption that adult-trained ICU nurses can be experts in the care of children persists. After the initial critical care submission, the SGB invited the CCSSA to motivate its proposal for a separate set of standards for adult and child critical care, especially with existing programmes in paediatric care and neonatal intensive care nursing. Could paediatric content not be covered in the normal critical care curriculum?

The present article contends that the question is not whether the 'paediatric content can be covered' in the one year being proposed for the critical care curriculum, but rather whether adult critical care and paediatric critical care are the essentially the same discipline fields. Table I includes some of the significant differences in disease processes, responses and effects between adults and children. Another question is whether the outcome should be a nurse practitioner who is best able to nurse a critically ill child in a paediatric or a predominantly adult ICU. How these fields differ as well as how they are similar is important.

The questions that could inform this deliberation

- What is the evidence base for best practice and education in the PICU?
- What is our experience and applicability of this evidence in South Africa today, and what is the nature of training and paediatric critical care settings in South Africa?
- What is the cost of *not* developing standards for paediatric critical care at this time?

Table I. An illustration of some of the differences in disease processes, responses and effects between adults and children

	Child	Adult
Cardiac conditions	<p>Compromised cardiac function may result from complex congenital malformations of the heart (requiring surgical correction)</p> <p>Infective conditions such as myocarditis, toxins (organophosphate poisoning) and rheumatic (resulting from streptococcal infections, mostly throat infections)</p>	<p>Conditions are primarily ischaemic (tissue damage related to metabolic changes)</p> <p>Arrhythmias – defective nerve conduction in the heart muscle</p> <p>Degenerative heart disease</p>
Trauma	<p>Effects of trauma differ</p> <p>Sites of injury differ (hip and femur fractures with MVAs, also head injuries differ)</p> <p>Nature of injuries differs, e.g. children tend to have more tendinous and cartilaginous injury rather than fractures</p>	<p>Effects of trauma on an adult are different (sites of injury differ, effects are different, nature of injury, e.g. fractures)</p>
Respiratory: pneumonia	<p>Develop bronchiolitis, bronchopneumonia, ARDS</p> <p>While children usually have normal lung tissue, there may be structural congenital lung abnormalities and possibly immune problems</p> <p>Very particular conditions surround the newborn infant, and perinatal respiratory problems could include:</p> <ul style="list-style-type: none"> • surfactant system and hyaline membrane disease, pneumonia, persistent pulmonary hypertension • meconium aspiration • inherited conditions such as cystic fibrosis 	<p>The adult will have lobar pneumonia, ARDS/ALI, etc.</p> <p>The adult will often have underlying chronic obstructive pulmonary disease (COPD)</p>
Metabolic	<p>Inherited metabolic problems such as galactosaemia, urea cycle defects, and mitochondrial disease. These are mostly conditions only of childhood, so add the complexity of diagnosis, care, prognosis and a child possibly dying</p>	<p>More diabetes and metabolic conditions related to other pathologies as well as lifestyle-related conditions</p>
Cancers	<p>80% of children diagnosed with cancer have disease which has already spread to distant sites in the body</p> <p>Childhood cancers are mostly those of the white blood cells (leukaemias), brain, bone, the lymphatic system, and the muscles, kidneys and nervous system</p> <p>Tumours of the brain and spinal cord are the most common types of solid tumours</p> <p>Non-Hodgkin's lymphoma (cancer of the lymph system, the body's circulatory network for filtering out impurities)</p> <p>Some types of cancer are exclusively found in children: embryonic tumours which arise from cells associated with the fetus, embryo, and early postnatal period</p>	<p>20% of adults with cancer show evidence that the disease has spread at the time of diagnosis</p> <p>Most adult cancers result from lifestyle factors</p> <p>Adult cancers are primarily those of the lung, colon, breast, prostate and pancreas</p> <p>Lymphoma in adults is more likely to be Hodgkin's disease</p>

Table I. An illustration of some of the differences in disease processes, responses and effects between adults and children (continued)

Pharmacotherapy	<p>Pharmacotherapy is a rapidly developing field, and safe administration of drugs in children includes knowledge of side-effects, problems of dilution of drugs (especially volume of fluid administration), the different pharmacodynamics of drugs in different age groups (drug dose per kg may be different depending on age group)</p> <p>An added challenge is related to persuading children to swallow a foul-tasting preparation. Child medication is often in liquid form; tablets must be crushed, as the child is developmentally unable to swallow a tablet</p> <p>Medication via injection is painful and children respond honestly, with resistance and reticence. They find it difficult not to interpret inflicted pain as punishment</p>	<p>Drug administration in adults is less complex. Doses are mostly prescribed as mg/day in divided doses</p> <p>Adults manage intravenous fluid administration more easily</p> <p>Most adults also obediently swallow a dose, whether or not taste is camouflaged in a capsule</p> <p>Most adults will also voluntarily expose a muscle for the administration of an injection</p>
------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The evidence base for best nursing practice and education in the care of the child

Achievements in high-technology care have changed the care of devastating childhood injury and disease. Rapid pharmaceutical advances have resulted in critically ill children requiring complex and *intensive care* in the truest sense of the word. Increasing numbers of babies born with life-threatening congenital abnormalities are surviving the neonatal period. This also means surviving because of, and beyond, neonatal ICUs and thus beyond the scope of the practice of specialised neonatal ICU nurses.

Highly skilled nurses have kept up with these achievements of high-technology care and have been

contributing to the evidence base of child critical care nursing. There is therefore a large body of practice-based knowledge which has resulted in established principles of care that distinguish the scope of practice for populations of children in contrast to those for adults.² This differentiation and specialisation has occurred in both medicine and nursing. The field is so broad that whole journals as well as dedicated conferences are now hosted to evaluate and share the emerging paediatric evidence base.

The very specific scope of the nurse working with a critically ill child is well described and uniquely different from the nurse caring for adults in three key aspects (Table II):

Different knowledge and skills-sets related to **physiology and disease processes in children.**

Table II. The major differences between the critical care required by adults and children

<p>1. Physiology and disease processes in children are different.</p> <p>As physiology (how the body works) is vastly different from adults, indicators and measurement norms are therefore different – ranging from vital signs and laboratory results to physiological and psychological responses to illness.²</p> <p>2. There is a vast variability of age-related differences all linked to the developmental stage and ability of children.</p> <p>This requires complex understanding and a very adaptive skill set from nurses of critically ill children. Skills from age-appropriate assessment and communication to intervention differ for different ages. A child with severe burns who is 8 months old will require very different care to one who is 4 or 14 years old. Refined techniques of assessment in typical ICU contexts, such as anxiety and/or pain, have been shown to have significant effects on morbidity.³</p> <p>3. Specialised care of children is ALWAYS interwoven with the care of their families.</p> <p>There are therefore specific challenges of participation related to attachment, family coping and function. Achievements in high-technology care have brought complex new challenges to families, e.g. grieving amid difficult decision making, complexity of information, ongoing uncertainty and prospects of complex chronicity.⁴</p>

Different and distinct care to sick **children and their families.**

Different knowledge and skills-sets related to the vast variability of responses and behaviour related to **developmental stage and ability of children.**

Cecily Lynn Betz, paediatric nurse researcher and editor of the *Journal of Pediatric Nursing*, maintains that 'Speciality of practice for adults and children requires two very different approaches to training, each with its own didactic content and clinical practica. For example, it would be highly problematic for a nurse with medical surgical expertise to rotate to a paediatric unit and provide care to acutely ill children without adequate didactic and clinical training.'² There is now sufficient evidence and a growing experience base in South Africa to persuade us to accept this view.

Our experience and applicability of this evidence in South Africa

New surgical options and advanced technology have become available in many tertiary institutions in South Africa. Increasing numbers of critically ill children are receiving highly specialised care and sophisticated life support. While strategic decisions and policies at national level emphasise primary level care, critical care facilities should be seen as inherently supporting this level of care. This policy should not distract mandated nurse leaders and decision makers from the cost effectiveness and existence of highly specialised critical care units and need for specialised training at this level. This level of training is currently validated by at least two South African Nursing Council (SANC) approved and dedicated educational programmes in Child Critical Care Nursing. The latest was submitted to and motivated by the University of Cape Town and approved in 2001.

It may be argued that critically ill children in South Africa are often cared for in adult ICU settings, and that in our setting it is therefore appropriate to incorporate child and adult ICU education into one course, with the same learning outcomes. But considering the significant differences in child and adult physiology, pathology, needs and therapeutic interventions, there are good reasons why adults stop going to paediatricians!

It may also be argued that the standards and evidence generated in the USA and Europe, as much of the published evidence base currently still is, hold little relevance for our situation. The applicability of existing evidence challenges us to look critically at the standards, design research and report on our own practice and experience in this field. The resulting work will be of significance not only in South Africa but also in a wide range of similar settings worldwide, e.g. South America and Asia. It seems that both this and the former argument should support at least the establishing of standards to ensure that institutions

that do want to invest in these courses are able to do so with exacting and well-described standards.

The cost of not constituting separate standards

The cost of choosing *not* to set a clear set of standards for the education of nurse clinicians in this highly specialised field was an important consideration at this SGB forum of nurse educators and clinicians.

The international evidence base supports a specialised role and practice for the paediatric critical child nurse specialist. If the profession omits to set the standards of education that will prepare nurse clinicians for this specialised role, medical clinicians (e.g. cardiac surgeons and intensivists) who continually express their need for increased expertise in their particular services will be obliged to offer nurses training. Without standards, this training is very likely to focus on the acquisition of technical skills rather than the professional development of nurses. In this way the children who require specialist critical care may benefit from a more technically skilled nurse, but both they and the nurses themselves will lose out on the engaged reasoning and care that are the hallmarks of best nursing practice.

Recent research in a local setting found that the majority of nurses in a PICU setting described being skilled technically, knowing the 'how to do' but lacking the 'why to do'.⁵ Such a rule-based approach contrasts with an evidence-based approach to care. The need to develop analytical thinking skills is pivotal in developing standards and therefore learning programmes.

The difference between existing standards and the Critical Care of the Child standard proposed to the SGB

There are two existing and well-recognised child/infant-related post-registration nursing programmes offered at various centres in South Africa. These are neonatal nursing and child nursing, also called paediatric nursing programmes. When the paediatric intensive care nursing standard was proposed to the Nursing SGB, another question needed to be answered: can the proposed PICU content be covered in either of these two existing programmes?

What is the ambit of neonatal intensive care?

Neonatal intensive care includes the range of care of the neonate in the perinatal and neonatal period. It can encompass the care of a baby born at 22 weeks' gestation to the end of the neonatal period (1 month of age). The scope of this discipline of nursing, and therefore educational standards, is the complex transition from intrauterine to successful extrauterine

life. This includes physiological adaptations and challenges, resultant specific pathophysiology and congenital conditions. Nursing care requires an astute knowledge of the challenges of respiration, thermo-regulation, nutrition and absorption and growth in the absence of the protective and adaptive features which the neonate will acquire in later life. Therapeutic interventions require specific methodologies not utilised in any other environment, e.g. radiant heat and exchange transfusion. The mother-infant dyad constitutes the core context of care and the nurse practitioner in this field therefore also requires an understanding of the ante-, peri- and postnatal challenges in the mother (physical, hormonal, emotional, and social).

So while care of the neonate occurs in an ICU setting, the nature of the population in the paediatric ICU is completely different. The extent of changing and different physiology and child pathology is vast. The methodologies of care and therapeutic interventions are different, too extensive and too different to include in the proposed 1-year neonatal nursing course.

What is the ambit of paediatric or child nursing?

Considering that 40% of the South African population is younger than 16, the paediatric or child nursing educational programme should prepare the nurse to practise within the context of primary health care. This includes the health and illness of children, as well as all the aspects of public health related to child health (including adolescents) and the factors influencing this, in the family and in the community. It requires competency in basic health and developmental assessment of the child and adolescent, including primary and secondary level assessment and management of childhood illness and recognition of emergencies. It requires a sound knowledge of normal growth and development. It should include health promotion and the practice of age-appropriate communication with children and their parents. This qualification should also include a sound nursing approach, to acquire and practise skills to care for the ill child in the family, and the aetiology and management of chronic illness, disability and rehabilitation of children, hospitalisation and institutional care, and primary, secondary and tertiary prevention.

The paediatric nursing standards therefore differ considerably from those for the critically ill child, which

should result in a very different competency. The assessment and care of the critically ill child would include the entire scope of paediatric surgery (general, cardiac, thoracic and neurosurgery), trauma, and multi-system involvement coupled with the different and developing physiology in children, requiring very specific skill and vigilance. Accurate assessment of a critically ill child depends on the current condition and the urgency of the situation, requiring the skill of perpetual observation and surveillance. Added aspects of care which are not part of the paediatric course are: (i) the effects of sensory alterations and stressors for critically ill children and staff; (ii) particular problems associated with the high dependency experienced by critically ill children, including anxiety and pain; (iii) loss of dignity and independence; (iv) immobility, injury and an altered body image; (v) communication in this environment; (vi) understanding the challenges, barriers and interventions that improve communication; and (vii) legal and ethical aspects, e.g. withdrawal of therapy and child/parental participation, constitutional rights of children and allocation of scarce resources.

Conclusion

When the national health policy in South Africa shifted from an emphasis on tertiary health care provision to primary care provision, the resource base needed to shift too. This shift was mirrored in nursing training programmes as these increasingly focused on community-based approaches and primary health care skills required more input. While this was a necessary shift, we do need to rebalance this weighting. We may have de-emphasised the importance of specialised tertiary level care to the detriment of the children who require this level of care. In order to return to their homes and communities in the best possible health, children with severe traumatic injury or devastating life-threatening illness clearly need the best possible critical care nursing to limit mortality and morbidity to the lowest possible levels. Well-designed and comprehensive education and practice standards for PICU nursing as well as appropriate employment recognition are certainly the key to attaining the best outcomes for critically ill children.

1. Pearson G, Shann F, Barry P, *et al.* Should paediatric intensive care be centralised? Trent versus Victoria. *Lancet* 1997; **349**: 1213-1217.
2. Betz CL. Pediatric hospitals are not appropriate for adult admissions (Editorial). *J Pediatr Nurs* 2003; **18**: 303-304.
3. Albertyn R. Non-verbal assessment of pain and anxiety in children at the burns unit, Red Cross Children's Hospital, Cape Town. PhD thesis, University of Cape Town.
4. Remple G. Technological advances in paediatrics: challenges for parents and nurses. *J Paediatr Nurs* 2004; **19**: 13-24.
5. Coetzee M, Britton M, Clow SC. Finding the voice of clinical experience: Participatory action research with registered nurses in developing a paediatric critical care nursing curriculum. *Intensive and Critical Care Nursing* 2005; 21 April (2): 110-118.