

Paediatric critical care during the COVID-19 pandemic

The COVID-19 pandemic has resulted in careful review of patients affected and resource distribution, with particular emphasis on intensive care unit (ICU) facilities. In comparison with adults, evidence from China, Canada and the USA suggests a lesser COVID-19 burden on children, as well as improved outcomes.^[1-4] Less than 5% of all positive SARS-CoV-2 cases are <19 years old, as described in a systematic review of 45 studies.^[5]

It is estimated that 5% of infected adults will need ICU admission, whereas ~10% of infants and 5% of older children will only require supplemental oxygen. Around 0.6% of children are expected to develop acute respiratory distress syndrome (ARDS).^[4] Furthermore, a review of all SARS-CoV-2 infected paediatric ICU (PICU) admissions in 46 Canadian and USA PICUs described 48 admissions with a median length of PICU stay of 5 days and mortality rate of 4%. Of the cohort, the need for invasive ventilation, multi-organ failure support and extracorporeal life support was 38%, 23% and 2%, respectively.^[6]

Currently, there are no data on PICU COVID-19 admissions in low- and middle-income countries (LMICs), nor on the effect on immunosuppressed or malnourished children. Given the under-5 pneumonia mortality rate of LMICs compared with high-income countries (200 v. 3 per 100 000), concerns exist that COVID-19 pneumonia may have a larger impact on children in LMICs.^[7]

Several paediatric critical care COVID-19-related concerns have developed in the South African (SA) context. Firstly, PICU bed capacity is underrepresented. In 2007, a national audit demonstrated that only 19.6% of the total ICU beds in SA were for children.^[8] Since the audit, there has been very little increase in the number of PICU beds nationally. The inequity of paediatric critical care resources is highlighted when considering that the paediatric population constitutes 34% of the total population.^[9] Moreover, under-5 mortality in SA is ~42 deaths per 1 000 live births, and remains higher than other middle-income countries such as Brazil and Cuba.^[10,11]

The seasonal winter surge period increases PICU bed pressure owing to increased burden of viral and bacterial pneumonias. During this period, elective surgeries are often cancelled to accommodate emergency admissions. Currently, the surge period coincides with the COVID-19 pandemic, and the anticipated increase of 0.6% of COVID-19-related ARDS admissions will overrun the SA paediatric critical care capacity. Given the limited PICU resources and the overall good prognosis of paediatric patients, including those with severe COVID-19, it is imperative that PICU beds remain ring-fenced for children, and not redistributed to adult critical care services.

A second discussion point is triage and resource allocation for critically ill paediatric patients. The guidelines in the 'Allocation of scarce critical care resources during the COVID-19 public health emergency in South Africa' document from the Critical Care Society of Southern Africa (CCSSA) are not applicable to children, as the clinical frailty scale and sequential organ failure assessment (SOFA) score are not validated in children.^[12] Considering the special needs of children during this pandemic, a SA Paediatric Critical Care working group was established. Given the good outcomes of children, the group's consensus statement^[13] is that triage and resource allocation during the COVID-19 pandemic should continue as per usual local PICU practice. We support the principle of paediatric critical care resource allocation to children

who have the best long-term prognoses and will benefit from PICU treatment. Thus, the majority of SARS-CoV-2-infected children will unequivocally meet PICU admission criteria.

Thirdly, some controversy exists around the use of non-invasive ventilation (NIV) and high-flow nasal cannula (HFNC) in patients with COVID-19. NIV and HFNC are discouraged in the CCSSA document 'Critical care management of patients confirmed with COVID-19' as well as the Department of Health's guide on 'Management of children with suspected or confirmed COVID-19 infection'.^[14,15] Many children presenting with severe respiratory symptoms during the winter season will have viral pneumonia other than COVID-19 pneumonia. It is impossible to distinguish between different pneumonia aetiologies on clinical grounds alone. NIV and HFNC reduce the need for intubation and PICU admission.^[16] To deny NIV and HFNC to children in respiratory distress while waiting for confirmatory tests will have disastrous consequences. SA simply does not have the PICU capacity to admit all children with severe respiratory distress, as suggested in the above documents.

Concerns about NIV and HFNC are based on the potential for aerosolisation and subsequent risk to staff. Internationally, many adult and paediatric critical care societies, as well as the World Health Organization (WHO), recommend all forms of NIV and HFNC for SARS-CoV-2-infected patients, provided the staff wear appropriate personal protective equipment (PPE) and patients are isolated.^[17-20] In children, NIV and HFNC flow rates are low compared with adults. Aerosolisation risks are therefore lower, with estimated dispersion of only a few centimetres.^[21,22] Furthermore, there is no conclusive evidence to suggest that HFNC poses a greater risk than other forms of NIV, and wearing a surgical mask over the interface limits aerosol dispersion.^[23]

The updated National Institute for Communicable Diseases' 'Clinical management of suspected or confirmed COVID-19 disease' guideline (version 4) recommends HFNC and NIV only in PICU. This should be provided in an isolation room, ideally with negative pressure and with a barrier device over the child such as a perspex box.^[24] SA does not have the PICU capacity to admit all children on HFNC or NIV, and has very limited PICU isolation facilities. The consensus statement from the SA Paediatric Critical Care working group^[13] is to offer NIV to all children in severe respiratory distress, if available. Children on NIV and HFNC should be isolated in single rooms and, if not available, cohorted into open wards with surgical masks over the interface. Limited staff should be allowed in these areas and should wear appropriate PPE.

Most importantly, children have the right to a parent at their bedside during a hospital admission. The WHO advocates against separating parent and child during a COVID-19 illness, in order to minimise adverse emotional implications for the child.^[18,25] Children should furthermore be cared for in a child-friendly environment, by staff who are knowledgeable and well trained in holistic paediatric care. The SA Paediatric Critical Care Working Group supports this principle, and does not recommend cohorting COVID-19-positive children together with adult patients.^[13]

Optimal primary child healthcare is essential, especially in the face of a health pandemic: food security, routine immunisations and follow-up clinics for children with chronic medical conditions should continue

in order to prevent the development of complications. Failing this, many children will potentially come to harm during this COVID-19 pandemic, even without acquiring the infection.

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