Paediatric emergency and acute care in resource poor settings

* Professor Trevor Duke, MD FRACP
Centre for International Child Health
Department of Paediatrics, University of Melbourne
Royal Children's Hospital, Melbourne
Adjunct Professor of Child Health, University of PNG

Email: trevor.duke@rch.org.au
Telephone: +61 3 9345 5968

* Corresponding author

Dr. Baljit Cheema
Paediatric Emergency Specialist
Emergency Medical Services
Western Cape Health
Senior Lecturer, Division of Emergency Medicine
University of Cape Town

Word count 2254
Review article

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/jpc.13105

Paediatric acute care in resource poor settings

Acute care of seriously ill children is a global public health issue, and there is much scope for improving quality of care in hospitals at all levels in many developing countries. We describe the current state of paediatric emergency and acute care in the least developed regions of low and middle income countries and identify gaps and requirements for improving quality. Approaches are needed which span the continuum of care: from triage and emergency treatment, the diagnostic process, identification of comorbidities, treatment, monitoring and supportive care, discharge planning and follow-up. Improvements require support and training for health workers and quality processes. Effective training is that which is ongoing, combining good technical training in under-graduate courses, and continuing professional development. Quality processes combine evidence-based guidelines, essential medicines, appropriate technology, appropriate financing of services, standards and assessment tools and training resources. While initial emergency treatment is based on common clinical syndromes, early differentiation is required for specific treatment, and this can usually be done clinically without expensive tests. While global strategies are important, it is what happens locally that makes a difference and is too often neglected. In rural areas in the poorest countries in the world, public doctors and nurses who provide emergency and acute care for children are revered by their communities, and demonstrate daily that much can be done with little.

Keywords

Developing countries

Emergency paediatrics

Acute paediatric care

Rural health

Hospital care for children

Key points

1. The quality of emergency and acute care for children in health facilities in developing countries is a global and local public health issue
2. Management of common clinical paediatric emergency syndromes, and early clinical differentiation of some specific diagnoses are needed to improve care and reduce mortality
3. Improvements in quality of care should be holistic, addressing the common deficiencies in care and covering all the stages of management, but improvements do not need to be expensive.

Introduction

The challenges of emergency and acute paediatric care vary between and within low and middle income countries, varying as much as the differences in health resources and disease epidemiology. At one end of a spectrum are well-resourced hospitals in large cities in China, India, South America and the Middle East, where the ambitions for emergency and intensive care are similar to those in Western Europe, Australia or North America. In these settings, facilities and equipment are afforded, and many of the current challenges are related to capacity and "developing the specialty" of emergency or intensive care medicine in post-graduate medical and nursing training programs. At the other end of the spectrum are rural hospitals or clinics in the *least developed* countries, countries characterised by Paul Collier as 'The Bottom Billion",[1] where even the basics of emergency care – a system of triage, guidelines for the management of common illnesses, oxygen and emergency drugs, basic equipment and appropriately trained staff are rarely available. Many of the least-developed settings are in rural Africa, but similar environments exist in the poorer areas of developing countries in Asia and the Pacific region. These regions are characterised by high child mortality, high neonatal mortality, a predominance of infectious diseases, difficulty accessing healthcare, and traditionally rural populations. Within remote or rural areas of low-middle income countries, health services have remained undeveloped, there is difficulty retaining staff and many of the ingredients of basic emergency care and quality processes are also not present or not working. The urbanisation of the 21st century means such environments now also exist in many cities and towns.

Paediatric emergency care does not need to be expensive, nor overly reliant on high technology. Emergency care is about early recognition of serious illness or injury, and timely intervention, and as much about prevention of harm as it is about treatment of disease. It can be holistic even if the

focus is on saving lives. And emergency care begins in the community, with the recognition of serious illness and prompt care seeking, referral and safe transport.

At least 10% of children assessed in primary care using the World Health Organization's Integrated Management of Childhood Illness (IMCI) strategy need referral for a higher level of care,[2] so good quality primary care services *and* first referral-level are essential for curative health services to have an optimal impact on population health.

The World Health Organization has an approach to paediatric emergency care called ETAT (Emergency Triage, Assessment and Treatment). This is embedded in an overall approach outlined in the Pocket Book of Hospital Care for Children; it is a quality improvement approach based on evidence-based guidelines, essential medicines, appropriate technology, standards and assessment tools and training resources.[3]

The stages of Hospital Care for Children, common to all serious illnesses, are: triage, emergency treatment, history, examination, laboratory and radiological investigations if required, diagnoses and differential diagnoses, treatment, monitoring and supportive care, discharge planning, and follow up. Reviews of the quality of paediatric care in many developing countries have highlighted major deficiencies in each of these areas, with much scope for improvement in district-level hospitals.[4-8]

As many hospital deaths occur in the first 24 hours, emergency care will be taken to mean all the acute care that is given in the first 24 hours after presentation, in emergency departments, children's outpatients departments, children's wards and high dependency areas. We describe practical and systems aspects, a detailed discussion of other aspects of acute paediatric conditions is beyond the scope of this paper. Studies from Malawi, Kenya, Papua New Guinea and elsewhere show that improving the systems and training in emergency aspects of care can reduce in-hospital

mortality.[9-11] Common problems associated with provision of acute care in these settings are listed in Table 1.

Common acute emergency clinical syndromes in low and middle income countries

Emergency care initially applies generic approaches to acute clinical syndromes. The commonest of these among children in developing countries are:

- cough and difficult breathing (acute respiratory distress)
- diarrhoeal disease and severe dehydration
- acute (often febrile) encephalopathy
- shock
- severe malnutrition
- poisoning or accidental ingestion
- trauma, burns and injuries

There is overlap between these clinical syndromes: e.g. severe dehydration often presents with tachypnoea from metabolic acidosis, which can be misinterpreted as respiratory distress from pneumonia; severe malaria also presents with tachypnoea.[12] Furthermore, children often have more than one disease process: pneumonia *and* diarrhoea; diarrhoea *and* malnutrition; malaria *and* severe anaemia. Children with co-morbidities are the most likely to die, partly because of the increased severity of illness and partly because co-morbidities are often missed.

Each of the common clinical syndromes can be expanded to a number of more specific diagnoses. Severe respiratory distress and hypoxaemia is most commonly due to severe pneumonia or severe bronchiolitis, but depending on local epidemiology, asthma, tuberculosis with complications, and HIV with pneumocystis pneumonia may also be common causes. These require generic emergency

therapies (such as oxygen), but also some differentiation for more specific initial therapy (whether to give bronchodilators or not, whether to start treatment for pneumocystis or not, etc).

Using shock as a more complex example (Table 2), it is possible to understand some of the reasons why generic treatment alone, such as just giving boluses of fluid, are insufficient, and why these may cause harm to some patients.[13] Although a common reason for shock is severe dehydration from diarrhoeal disease (requiring additional fluid), training and guidelines for the differentiation of the clinical syndrome of shock to needed to enable specific treatments to be given.[3] While some therapies for shock (such as inotropes or mechanical ventilation) are rarely available in small hospitals in developing countries, others can be given safely in most first-level referral hospitals and are life-saving. Some examples of therapies (beyond fluids and oxygen) for conditions causing shock that are within the WHO Essential Medicines list and WHO clinical guidelines are listed in the text-box. While generic approaches to clinical syndromes are important, identification of co-morbidities and early differentiation of clinical syndromes are often required to save the lives of seriously ill children.

Pre-hospital emergency care and transport services

Emergency care starts in the community, with care seeking by parents, community health workers recognising severe illness, and first-responders. Training of community health workers in the recognition of serious illness in children can lead to more rapid care seeking and prompt referral. This can substantially reduce mortality from pneumonia and diarrhoea.[14]

Safe transport is required by many sick children seen in primary care facilities to rural and district hospitals. However, this is not always feasible and this need has to be balanced against risk of transport, distance to referral hospital, costs and the needs of other patients.

Development of a reliable pre-hospital emergency management system (EMS) is part of the evolution of the overall emergency care system. An EMS must be carefully planned with the involvement of the relevant national ministries and sub-national health authorities, and incrementally introduced. The WHO Pre-Hospital Trauma Systems report outlines an approach, encompassing: design, administration, disaster planning, communications, quality improvement, and ethical and legal aspects. A tiered-approach is recommended: Tier 1: care by first responders: basic first-aid providers, and then advanced first-aid providers; Tier 2: basic pre-hospital trauma care and Tier 3: advanced pre-hospital trauma care.[18]

In some countries, transport from primary care to hospitals is even more difficult and other modes of emergency transport are employed: in Tanzania these included bicycles with trailers, tricycles with platforms, motorboats, and ox-carts.[15] In Ghana, where most pre-hospital transport of trauma victims occurs by taxis and buses, a training course for commercial drivers in airway management, control of external bleeding, splinting of fractures, spinal precautions and triage lead to reported improvements in emergency care.[16] In Malawi motorcycle ambulances reduced referral delays from remote rural health centres by 2-4 hrs while being far cheaper to purchase and with minimal annual running costs, compared to car ambulances.[17]

Where referral is not feasible, primary care staff should be trained in acute care (such as the WHO Hospital Care for Children course) and communication technology. Using high frequency radio or mobile phones can mean that consultation with a paediatrician can take place remotely.

High dependency care

It is rare to have paediatric intensive care units in district or rural hospitals. In most hospitals the first 24 hours of acute or critical care is provided in emergency or outpatients departments, then in a children's ward. For critically ill children, triage, assessment and emergency care should be continuous with specific treatment, supportive care and close monitoring. Meticulous attention to detail, particularly the prevention of complications is needed in the first 24 hours and beyond. An example of this is in Table 3, which describes some elements of the care of children in coma. Care of such children and those with other acute clinical syndromes (listed above) can be best done by nursing children in a high dependency area within a children's ward.

Where a high dependency area is located depends on organisational issues for a given hospital. In most small hospitals this can be within the children's ward, as there will be a necessary flow of children from the high-dependency area to a non-high-dependency area or general beds, and some children in the general beds will deteriorate, needing oxygen or a higher level of monitoring. Some components of a paediatric high dependency area are listed in Table 4.

In many hospitals it is appropriate to consider higher level respiratory support, such as a method for continuous positive airway pressure (CPAP) or high-flow nasal cannula oxygen therapy.[19] Simple technologies exist to do this, but require guidelines, training and equipment maintenance. *Intensive* care, including intubation, mechanical ventilation and inotrope infusions require additional resources, facilities, quality systems, clinical skills, judgement of prognosis and disease reversibility, and an understanding of ethics.

Some common clinical pitfalls in acute care of children

- Not differentiating the problem early enough
- Giving too much intravenous fluid or the wrong fluid to children
- Not detecting and treating hypoxaemia
- Not detecting and treating hypoglycaemia
- Inadequate care of the child in coma
- Not recognising and treating co-morbidities

Staffing and training

The International Labour Organization recently estimated a shortfall of 10.3 million health workers worldwide, with 70% of this deficit in rural locations.[20] For many rural health staff ongoing professional development is absent. There are programs to train staff in comprehensive acute care for seriously ill children, including the WHO training program 'Hospital Care for Children', based on the 10 stages of management listed above. This training program has accompanied the implementation of WHO's Hospital Care for Children guidelines in many countries .[21] Other training initiatives such as Emergency Triage and Treatment (ETAT) [22] and "ETAT-Plus" [23] have been successful in several countries, as has the Advanced Paediatric Life Support course in some countries.[24]

Other tools

Newer mobile device technologies are increasingly relevant as phone coverage and tablet technology extends in many developing countries. There are numerous apps for paediatric

emergency medicine. Some of these are summarised at http://www.ecinsw.com.au/paediatric-apps. Others include Palm-EM: http://www.palm-er.com/ and The Open Medicine Project South Africa (http://www.openmedicineproject.org/photo-gallery/emergency-medicine-guidance-app/). Many of these link calculators for drug doses. Many of the drugs and treatments recommended in such apps are not available in developing countries, however such apps are widely used by post-graduate trainees and students in the increasingly connected world. There are also several MOOCS (massive online open-access courses) run by several universities on paediatric emergency topics, including Pediatric Advanced Life Support and paediatric first aid.

Conclusion

There is much scope for improvement in paediatric emergency care in developing countries. The obstacles are many, but improvement in service and outcomes for seriously ill children can occur with systematic quality approaches that include training in acute holistic clinical care, use of treatment guidelines, appropriate technology, essential medicines, and audit and reporting. Improvements can occur even where health care resources are very limited, and new technologies can help bridge gaps in health worker training and access to training materials, guidelines and consultation.

Item	Common considerations
Oxygen therapy	Often unavailable in smaller health facilities Cylinders need to be replaced or refilled regularly; costly and transport is logistically difficult especially in remote facilities For cylinder oxygen other equipment –flow meters and regulators required Higher flow rates (10-15 L/min for resuscitation or 6-8 L/min for nebulisation) deplete cylinder stock faster Concentrators are most efficient and cheaper sources of oxygen, but need maintenance, spare parts, replacement, and staff training Concentrators give maximum of 10 L/min, with effective flow-splitter can deliver oxygen to more than one patient Pulse oximetry often not available, but cheaper reliable oximeters now available
Monitoring	Need for appropriate sized blood pressure cuffs Automated BP measurement advantageous Charts of normal blood pressure for different ages needed for interpretation Monitoring charts needed
Equipment procurement and maintenance	Need for standardisation of equipment as different brands often require different consumables and maintenance requirements Need for regular maintenance, and stock of replacement parts Humidity, heat, dust mean that equipment may have shorter life-span Hospital engineer or technicians with familiarity with equipment, or equipment service contracts needed
Medications	Lack of paediatric formulations, many drugs often only available in adult-dose tablet form, rather than liquid preparations Tablet-splitting by hand can result in uneven portions and inaccurate dosing. Cut tablet then crush and mix with water. Fixed dose combination drugs (for tuberculosis or HIV) sometimes only available as adult dosages Up to date paediatric formularies should be available in paediatric areas Calculators should be available, ideally solar-powered so not to be battery dependent Staff training should encompass drug dose calculation and safe drug administration Ideally a second member of staff must check certain drugs before administration, but difficult in small facilities
Intravenous equipment	Paediatric burettes or infusion pumps needed for accurate titration of volume and rate, otherwise high risk of volume errors Paediatric and neonatal intravenous cannulae often unavailable Home-made splints (e.g. from cardboard, tongue depressors) can be uncomfortable or lead to pressure areas if not checked Appropriate intraosseous needles and training in how to insert them are required
Intravenous fluids	Low sodium containing fluid can lead to hyponatraemia in common febrile illnesses, better to use isotonic solutions (such as Hartmann's solution) Many hospitals cannot measure serum sodium or other electrolytes, so electrolyte derangements are hard to detect Fluid overload a major problem, giving "100%" of maintenance fluids" IV will often lead to over-hydration in common febrile illness. Bolus intravenous fluids are dangerous in children with common febrile illnesses (pneumonia, severe malaria, severe anaemia, meningitis) who don't have hypovolaemia or shock
Analgesia	Often inadequate use of non-pharmacological means, such as distraction or play

	Analgesia not administered early Topical local anaesthesia insufficiently used Procedural sedation often not used. Procedural sedation needs sufficient monitoring and observation to avoid complications Need to teach staff to use standardized pain scoring, and have charts at point of care
Guidelines	Often not available at the point of care An example of evidence-based guidelines for emergency and ongoing care in resource poor settings: WHO's Pocket Book of Hospital Care for Children Need job aids (posters, checklists) based on guidelines for prompting decision making Smart-phone or tablet-based guidelines increasingly relevant
Lack of training	Need for post-graduate paediatric training for nurses Need for continuing education in paediatrics and paediatric emergencies for all cadres of health workers
Infection control	Hospital-acquired infections common problem Alcohol based hand rub disinfection or other hand hygiene facilities essential close to the points of care Increase staff awareness of cross-infection and how to prevent it Multi-faceted approaches (antibiotic stewardship and hand-hygiene) can reduce hospital-acquired infections even in resource-limited settings, and reduce mortality Lack of bacteriology means many hospital acquired infections are undetected
Health facility infrastructure	Electricity supplies often not reliable, power surges and outages may be common, leading to equipment failure or surge-related damage Power back-up and alternative power supply sources needed, solar power untapped resource Water Beds Communication – mobile phone technology increasingly relevant
Emergency Management Services (EMS)	Under-developed EMS is common, graded approaches to development of EMS needed Having clear alert criteria (based on clinical signs, such as a MET or Early Warning System) for escalation important Clear referral criteria needed

Table 1. Common considerations in systems for paediatric emergency care

Hypovolaemia
Severe dehydration
Burns
Haemorrhage / trauma
Septic shock (WHO defines as: fever or history of fever with tachycardia and weak pulse, capillary refill >3 seconds and cold peripheries +/- low blood pressure)
Malaria
Bacteraemia
Dengue
Cardiac
Congenital heart disease
Myocarditis or cardiomyopathy
Severe anaemia with cardiac failure
Rheumatic valvular heart disease (severe AR, MR)
Tachyarrhythmias (e.g. SVT)
Pericardial disease (e.g. tuberculosis pericardial effusion with tamponade)
Poisons / ingestion - mushrooms, other plants, drugs
"Distributive shock" (vasodilatation)
Anaphylaxis
Spinal shock
Snake bite and other envenomation

Table 2. Causes of paediatric shock in developing countries

Snakebite – antivenom
Anaphylaxis – adrenaline given intramuscularly or IV
SVT – vagal manoevers, digoxin, other anti-arrhythmic drugs
Poisoning - activated charcoal, gastric lavage in some cases
Severe anaemia - blood, diuretics
Haemorrhage - blood, tranexamic acid
Cardiogenic shock - inotropes
Pericardial tamponade – drainage

Textbox. Examples of specific therapy within the WHO Essential Medicines list and WHO clinical guidelines, for causes of paediatric shock

Complications and considerations for the child in coma	Management considerations
Airway compromise	Positioning Suctioning Guedel airway
Pulmonary aspiration	Positioning Nasogastric feeding
Malnutrition	Regular NG feeding Micronutrients
Intracranial hypertension	Nurse at incline 30° head up Careful use of mannitol
Contractures and wasting	Teach parent physiotherapy Nutrition
Electrolyte imbalance	Avoid prolonged IV fluids Avoid hypotonic solutions Regular checking of serum Na+
Nosocomial infection	Alcohol based hand rub disinfection IV site care (remove IVs when not needed) Pulmonary suctioning Avoid prolonged urinary catheterisation Avoid unnecessary antibiotics
Seizure control	Anticonvulsants: phenobarbitone / valproate / levetiracetam
Pressure areas	Regular turning, massage
Constipation	Regular lactulose
Gastric ulceration	Ranitidine Feeding protection
Urinary retention	Intermittent catheterisation
Monitoring	Glasgow Coma Scale Pulse oximetry Temperature
Diagnostic issues / imaging	When to change treatment Bacterial, TB, Cryptococcus, Encephalitis Non-infectious (stroke, tumor) When to do a CT scan
Adverse treatment effects	e.g. TB drug side effects
Communicating with parents	Prognosis Expected duration of hospitalization Milestones required to be reached before discharge

Table 3. Care of the child in coma – details that require consideration in the first 24 hours and beyond

Oxygen to all beds (concentrators, cylinders)
Pulse oximeters and sensor probes for all ages
A method of giving CPAP
Monitoring charts
Intravenous fluid administration sets (IV poles, fluid, paediatric giving sets, intravenous cannulae, infusion pumps, syringe pumps, etc)
Guidelines for: 1. which children should be nursed in the HDU 2. clinical management of common diseases: *Pocketbook of Hospital Care for Children* 3. use of pulse oximetry, oxygen concentrators, CPAP, e.g. WHO's *Clinical Use of Oxygen* 4. safe administration of blood products 5. management of severe acute malnutrition 6. emergency drugs list
Blood glucose monitors
Sphygmomanometer / automated blood pressure machine
Equipment cupboard
Book shelf for reference books
Electricity outlets
Alcohol based hand rub disinfection, hand basins, tap and soap, visual reminders about hand hygiene
Personal protective equipment: gloves, glasses, gowns as needed
Resuscitation trolley
Sharps disposal containers
Suction machines
Signs: 1. "No Smoking" 2. "Use alcohol hand rub or wash your hands before and after touching patients"
Ward admission, audit book, computer, Paediatric Hospital Reporting Program

Table 4. Components of a high-dependency area in a children's ward

Reference List

(1) Collier P. The Bottom Billion. 1 ed. New York: Oxford University Press; 2007.

(2) Kalter HD, Schillinger JA, Hossain M, Burnham G, Saha S, de Wit V et al. Identifying sick children requiring referral to hospital in Bangladesh. *Bull World Health Organ* 1997; 75(Suppl 1):65-75.

(3) World Health Organization. Hospital Care for Children: guidelines for the management of common illnesses with limited resources. 2nd ed. Geneva: WHO, ISBN 789241548373; http://www.who.int/maternal_child_adolescent/documents/child_hospital_care/en/; 2013.

(4) Nolan T, Angos P, Cunha AJLA, Muhe L, Qazi S, Simoes EAF et al. Quality of hospital care for seriously ill children in less developed countries. *Lancet* 2001; 357:106-110.

(5) English M, Esamai F, wasunna A, Were F, Ogutu B, wamae A et al. Assessment of inpatient paediatric care in first referral level hospitals in 13 districts in Kenya. *Lancet* 2004; 363:1948-1953.

(6) Duke T, Keshishiyan E, Kuttumuratova A, Ostergren M, Ryumina I, Stasii E et al. The quality of hospital care for children in Kazakhstan, Republic of Moldova and Russia. *Lancet* 2006; 367:919-925.

(7) Sa'avu M, Duke T, Matai S. Improving paediatric and neonatal care in rural district hospitals in the highlands of Papua New Guinea: a quality improvement approach. *Paediatrics and International Child Health* 2013; Dec 6:2046905513Y0000000081 [Epub ahead of print].

(8) Auto J, Nasi T, Ogaoga D, Kelly J, Duke T. Hospital services for children in Solomon Islands: rebuilding after the civil conflict. *J Paeds Child Health* 2006; 42:680-687.

(9) Molyneux E, Ahmad S, Robertson A. Improved triage and emergency care for children reduces inpatient mortality in a resource-constrained setting. *Bull World Health Organ* 2006; 84(314):319.

(10) Molyneux E. Paediatric emergency care in developing countries. *Lancet* 2001; 357:86-87.

(11) Duke T, Wandi F, Jonathan M, Matai S, Kaupa M, Sa'avu M et al. Improved oxygen systems for childhood pneumonia: a multihospital effectiveness study in Papua New Guinea. *Lancet* 2008; 372:1328-1333.

(12) English M, Punt J, Mwangi I, McHugh K, Marsh K. Clinical overlap between malaria and severe pneumonia in African children in hospital. *Trans R Soc Trop Med Hyg* 1996; 90(6):658-662.

(13) Maitland K, Kiguli S, Opoka RO, Engoru C, Olupot-Olupot P, Okech SO et al. Mortality after fluid bolus in African children with severe infection. *N Eng J Med* 2011; 10.1056/NEJMoa1101549, published at www.NEJM.org, accessed June 5th 2011.

(14) Guiscafré H, Martínez H, Palafox M, Villa S, Espinosa P, Bojalil R et al. The impact of a clinical training unit on integrated child health care in Mexico. *Bull World Health Organ* 2001; 79(5):434-441.

(15) Razzak JA, Kellermann AL. Emergency medical care in developing countries: is it worthwhile? *Bull World Health Organ* 2002; 80:900-905.

(16) Mock CN, Tiska M, Adu-Ampofo M, Boakye G. Improvements in prehospital trauma care in an African country with no formal emergency medical services. *J Trauma Inj Infect Crit Care* 2002; 53:90-97.

(17) Hofmann JJ, Dzimadzi C, Lunga K, Ratsma EY, Hussein J. Motorcycle ambulances for referral of obstetric emergencies in rural Malawi: do they reduce delay and what do they cost? *Int J Obstet Gynaecol* 2008; 102:191-197.

(18) Sassar S, Varghese M, Kellerman A, Lormand JD. Prehospital trauma care systems. 1. 2005. Geneva, World Health Organization.
Ref Type: Report

(19) Duke T. CPAP: a guide for clinicians in developing countries. *Paediatrics and International Child Health* 2014; 34(1):3-11.

(20) United Nations International Labour Organization. Global estimate of health worker deficits in rural and urban areas. 1. 2015. Geneva, ILO.
Ref Type: Report

(21) Li MY, Kelly J, Subhi R, were W, Duke T. Global use of the WHO Pocket Book of Hospital Care for Children: a systematic survey. *Paediatrics and International Child Health* 2012; 32:E-pub July 2012; DOI 10.1179/2046905512Y.0000000017.

(22) World Health Organization. Emergency Triage Assessment and Treatment. 2014. Geneva, WHO. ISBN: 9241546875 http://www.who.int/maternal_child_adolescent/documents/9241546875/en/ accessed December 2nd 2014.
Ref Type: Online Source

(23) Ayieko P, Ntoburi S, Wagai J, Opondo C, Opiyo N, Migiro S et al. A multifaceted intervention to implement guidelines and improve admission paediatric care in Kenyan district hospitals: a cluster randomised trial. *PLoS Med* 2011; 8(e1001018. doi: 10.1371/journal.pmed.1001018. Epub 2011 Apr 5).

(24) Young S, Hutchinson A, Nguyen VT, Le TH, Nguyen DV, Vo TK. Teaching paediatric resuscitation skills in a developing country: introduction of the Advanced Paediatric Life Support course into Vietnam. *Emerg Med Australas* 2008; 20(271):275.