Emergency Care in sub-Saharan Africa: Innovations and Challenges

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University of Colorado, Anschutz Medical Center
Conflicts/Disclosures

• I have no conflicts of interest
• No financial conflicts of interest
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    • Emergency Medicine Foundation
    • National Medical Association/Mylan Inc.
Why should you care?

University student passes away in car crash while studying abroad

By WILL GREENBERG, Daily News Editor
Published April 8, 2014

A University student died in a car accident Monday while studying abroad in South Africa.

MORE LIKE THIS
- Scholarships announced to commemorate student's life
- African countries unpopular with study abroad students
- Fire in Alpha Gamma Delta sorority house leaves damage but no injuries
- Study abroad fair

University spokesman Rick Fitzgerald confirmed the passing of LSA junior Rachel Smylie in a statement Tuesday. Smylie was in a car with members of her study abroad group while on a spring break trip to a national park in northern Namibia at the time. He said there are no other reports of fatalities from the incident and no other University students were in her group.

Smylie had been studying in Cape Town, South Africa with the Council on International Educational Exchange. While the program is run outside the University, Fitzgerald said many University students participate in it.
Why should you care?
Objectives

1) To review the burden of (acute) disease in sub-Saharan Africa

2) To discuss challenges in sub-Saharan African emergency care systems

3) To describe a 3-tier model of integrated emergency care in sub-Saharan Africa

4) To review innovations in sub-Saharan Africa emergency care at all 3 tiers
Burden of Disease in SSA
Burden of Disease in SSA
# Burden of Disease in SSA

<table>
<thead>
<tr>
<th>CAUSE OF DEATH</th>
<th>TOTAL DEATHS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 HIV/AIDS</td>
<td>28.4</td>
</tr>
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Burden of Disease in SSA

• “Double Burden of Disease” – W.H.O.
  – Communicable diseases
    • HIV & STI’s
    • Emerging diseases (Ebola, MERS)
    • Lower respiratory infections
    • Meningitis

• 41% of the 56.5 million deaths
• 54% of the global burden of dz
Burden of Disease in SSA

• “Double Burden of Disease” – W.H.O.
  – Non-communicable
    • Cardiovascular diseases
    • Diabetes
    • Cancers
    • Obesity-related conditions

• 59% of the 56.5 million deaths globally/year
• 46% of the global burden of disease/year
Burden of Disease in SSA

• “Double Burden of Disease” – W.H.O.
  – Non-communicable
Burden of Disease in SSA

• SSA has Disproportionately Worse Outcomes
Burden of Disease in SSA

- Population
Burden of Disease in SSA

- Global Poverty
Burden of Disease in SSA

- Tuberculosis cases
Burden of Disease in SSA

- Malaria deaths
Burden of Disease in SSA

• Affected by disasters
Burden of Disease in SSA

• Killed by disasters
Burden of Disease in SSA

- Total births
Burden of Disease in SSA

- Maternal mortality
Burden of Disease in SSA

• Total births
Burden of Disease in SSA

• Under 5 mortality
Burden of Disease in SSA

- Road vehicles
Burden of Disease in SSA

- Road deaths
Burden of Disease in SSA

- Road deaths

<table>
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<tr>
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The Burden of Acute Disease
The Burden of *Acute* Disease

AFEM
African Federation for Emergency Medicine
Fédération Africaine de Médecine d'Urgence
Prehospital Research in Sub-Saharan Africa: Establishing Research Tenets

Nee-Kofi Mould-Millman, MD, Scott M. Sasser, MD, and Lee A. Wallis, MBChB

Abstract

Prehospital care constitutes an important link in the continuum of emergency care and confers a survival benefit to injured and ill persons. As development of acute and emergency care in sub-Saharan Africa expands, there is a strong need to improve the delivery of prehospital care to help relieve the overwhelming regional morbidity and mortality attributable to time-sensitive, life-threatening conditions. Effective research is integral to prehospital care development, as it helps quantify the need for prehospital care and tests effective solutions. Unfortunately, there is limited consensus guiding such research in the low-resource nations of sub-Saharan Africa that face unique challenges. This article aims to assimilate the current pertinent literature to demonstrate research success stories and challenges, and ultimately to build on previous efforts to establish prehospital research priorities for sub-Saharan Africa. Region-specific obstacles hindering prehospital research include the lack of epidemiologic data on emergency conditions, the underdevelopment of in-hospital emergency care, confusing prehospital terminology, poorly defined prehospital research priorities, the lack of qualified prehospital researchers, and a poor understanding of local prehospital care systems. Solutions are offered to overcome each challenge by building on previous recommendations, by proposing new guiding principles, and by identifying areas where further consensus-building is needed. These guiding principles and suggestions are designed to steer discussions and output from future global health meetings targeted at improving prehospital research and development in sub-Saharan Africa.
The Burden of Acute Disease

OTHER MATTERS OF INTEREST

AFEM consensus conference 2013 summary: Emergency care in Africa – Where are we now?

Résumé sur la Conférence de consensus de l’AFEM 2013: Les soins d’urgence en Afrique – Où en sommes-nous à l’heure actuelle?

Teri A. Reynolds a,b, Emilie J.B. Calvello c, Morgan C. Broccoli d, Hendry R. Sawe a, Nee-Kofi Mould-Millman c, Sisay Teklu f, Lee A. Wallis g

a Emergency Medicine Department, Muhimbili National Hospital, Dar Es Salaam, Tanzania
b Emergency Medicine and Global Health Sciences, University of California, San Francisco (UCSF), San Francisco, CA, United States
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e Department of Emergency Medicine, University of Colorado, Anschutz Medical Campus, Aurora, CO, United States
f Department of Emergency Medicine, Addis Ababa University, Addis Ababa, Ethiopia
g Division of Emergency Medicine, University of Cape Town and Stellenbosch University, Cape Town, South Africa

Received 9 July 2014; accepted 11 July 2014; available online 4 August 2014
## The Burden of Acute Disease

### Sentinel Conditions

<table>
<thead>
<tr>
<th>Sentinel condition</th>
<th>Signal function</th>
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<tbody>
<tr>
<td>Respiratory failure</td>
<td>Insertion of oral airway</td>
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<tr>
<td></td>
<td>Bag valve mask ventilation</td>
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<tr>
<td></td>
<td>Needle decompression</td>
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<tr>
<td></td>
<td>Non-definitive advanced airway with supraglottic device</td>
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<tr>
<td></td>
<td>Administration of critical therapeutics</td>
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<td></td>
<td>Oxygen administration</td>
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<td></td>
<td>Use of suction</td>
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<td></td>
<td>Definitive advanced airway</td>
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<tr>
<td>General shock</td>
<td>Peripheral percutaneous intravenous access</td>
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<td></td>
<td>Intraosseous access</td>
</tr>
<tr>
<td></td>
<td>Venous cutdown</td>
</tr>
<tr>
<td></td>
<td>IV fluid and medication administration capability</td>
</tr>
<tr>
<td></td>
<td>Administration of critical therapeutics</td>
</tr>
<tr>
<td>Haemorrhagic/hypovolemic</td>
<td>Packing and suturing for haemorrhage</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>Automated external defibrillation</td>
</tr>
<tr>
<td></td>
<td>ECG interpretation</td>
</tr>
<tr>
<td>Obstructive shock</td>
<td>Needle decompression of tension pneumothorax</td>
</tr>
<tr>
<td>Distributive shock</td>
<td>Parenteral antibiotics/antimalarials</td>
</tr>
<tr>
<td></td>
<td>Administer IM adrenaline</td>
</tr>
<tr>
<td>General Altered Mental Status (AMS)</td>
<td>Check electrolytes</td>
</tr>
<tr>
<td>AMS with seizure</td>
<td>Administer parenteral benzodiazepines</td>
</tr>
</tbody>
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Acute care needs in a rural Sub-Saharan African Emergency Centre: A retrospective analysis

Les besoins en soins aigus dans un service d’urgence en zone rurale en Afrique sub-saharienne: une analyse rétrospective

Usha Periyavayagam a,1, Brad Dreifuss b,2, Heather Hammerstedt c,4, Stacey Chamberlain c,5, Sara Nelson c,6, Kamugisha Jon Bosco a,6, Kosha Pellone c,6, Mark Bisanzo c,6

---

**Table 4** Diagnosis made.

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<td>0.8</td>
</tr>
<tr>
<td>Oncologic complaints</td>
<td>2</td>
<td>0.4</td>
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<tr>
<td>Lacked documentation</td>
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<td>1.0</td>
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*Northwestern University, 211 E Ontario St, Suite 600, Chicago 60611, IL, USA*
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*Michigan Emergency Physicians, 2603 East Copper Point Drive, Mount Sinai, FL, USA*
*University of Illinois at Chicago, Center for Global Health, 1440 West Taylor Street, Second Floor, Chicago 60612, IL, USA*
*Mount Olive Medical, 220 West Monroe, Portland 01020, MA, USA*
*University of Massachusetts, 53 Lake Avenue North, Worcester 01655, MA, USA*
*Kariuk Luwage Hospital, P.O. Box 31, Nyakabale Road, Kiteka, Kariuk, Uganda*

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Botswana

Epidemiology of patients presenting to the emergency centre of Princess Marina Hospital in Gaborone, Botswana

Introduction: Emergency medicine is a newly recognized specialty in Botswana and the country launched its emergency medicine residency in January 2011. Data regarding the profile of emergency medicine in Botswana are limited. This study assesses the nature of patients presenting to the emergency centre of Princess Marina Hospital, the country’s national referral hospital located in the capital city, Gaborone.

Methods: A prospective study was conducted for 6 months in 2012. All patients presenting to the emergency centre were consecutively included in a database. The diagnosis of each patient was based on a combination of clinical assessment and any available investigations. The database was designed to be similar to the Clinical Directorates Between (CCB) system used in the UK. For ease of analysis, each 

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Zambia

- Fall: 26.2% (919)
- Road Traffic Accident: 25.5% (894)
- Assault: 19.9% (698)
- Home Accident: 5.8% (206)
- Burns: 5.8% (203)
- Work Injuries: 4.1% (146)
- Stab/Gun Shot Wound: 3.4% (122)
- Missing: 3.4% (119)
- Blunt Injuries: 2.7% (96)
- Other: 2.7% (95)
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Enormous BoD = an opportunity
Objectives

1) To review the burden of (acute) disease in sub-Saharan Africa

2) To discuss challenges in sub-Saharan African emergency care systems

3) To describe a 3-tier model of integrated emergency care in sub-Saharan Africa

4) To review innovations in sub-Saharan Africa emergency care at all 3 tiers
“...still today, over 40% of people living in sub-Saharan Africa live in absolute poverty.”
Emergency Care-Specific Issues?

• Culture of acute/emergency care
• Silo-style medicine (med vs surg vs OB)
• Poor models for African emergency care
• Lack of professionalization of EM
• Lack of professional bodies & advocacy
Emergency Care-Specific Issues?

• Limited prehospital transport/care
• Limited emergency nurses/mid-level providers
• Retention of providers in A&E units
• Limited career development opportunities
• Supply chain-issues
Emergency Care-Specific Issues?

• The case of road traffic injuries
Emergency Care-Specific Issues?

• The case of infectious diseases (Ebola)
• The case of emergency obstetric care
• The case of acute ischemic disease
• The case of interfacility transports
Emergency Care-Specific Issues?

• The solution: “Afro-centric” emergency care systems
Emergency Care-Specific Issues?

• The solution: “Afro-centric” emergency care systems
  – Education/training
  – Human resources
  – Infrastructure
  – Change in medical culture
  – Supply chain reinforcement
  – Community engagement & systems integration
  – Sustainability
  – Locally-appropriate matter
Objectives

1) To review the burden of (acute) disease in sub-Saharan Africa

2) To discuss challenges in sub-Sahara African emergency care systems

3) To describe a 3-tier model of integrated emergency care in sub-Saharan Africa

4) To review innovations in sub-Saharan Africa emergency care at all 3 tiers
Model for Emergency Care


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e University of Cape Town, Division of Emergency Medicine, Western Cape Province, South Africa

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Model for Emergency Care

- EMS / AMBULANCE SERVICE
- Safe Referral

1. Community members: First Aid level A (1 per street)
2. Community members: First Aid level B (1 per block)
3. Transport (Taxi / truck drivers; Police / Fire): First Aid level C
4. Nurses / Clinical Officers: Basic emergency and disaster care
5. MOs, Senior Nurses: Advanced emergency care
6. MOs, Nurses: advanced emergency care
7. EPs

Governance

Central or Regional Hospital
Regional Hospital
District Hospital
Clinic
Community

Needs assessment
Surveillance
Prevention

EP = specialist Emergency Physician
Model for Emergency Care

• Out-of-Hospital
  – Tier-1 ➔ community-based systems
  – Tier-2 ➔ formal prehospital system

• In-hospital
  – Tier-3 ➔ emergency & critical care systems
Model for Emergency Care

• Out-of-Hospital
  – Tier-1 → community-based systems
  – Tier-2 → formal prehospital system

• In-hospital
  – Tier-3 → emergency & critical care systems
    ▪ Community health centers
    ▪ Sub-District Hospitals
    ▪ District Hospitals
    ▪ Regional/Referral Centers
Objectives

1) To review the burden of (acute) disease in sub-Saharan Africa
2) To discuss challenges in sub-Sahara African emergency care systems
3) To describe a 3-tier model of integrated emergency care in sub-Saharan Africa
4) To review innovations in sub-Saharan Africa emergency care at all 3 tiers
Be part of the solution.
Model for Emergency Care

• Out-of-Hospital
  – Tier-1 → community-based systems
  – Tier-2 → formal prehospital system

• In-hospital
  – Tier-3 → emergency & critical care systems
Tier-One (community-based)
Tier-One (community-based)

- Why advocate for these?
  - Limited EMS systems
  - EMS overwhelmed
  - Geographically isolated
  - Basic prehospital interventions effective
  - Cheap, sustainable, effective, locally-appropriate
Tier-One (community-based)
Tier-One (community-based)

Ghana

Madagascar
• Knowledge & Skills:
  – Scene management
  – Triage
  – Universal Precautions
  – Extrication & moving
  – Primary survey
  – Hemorrhage control
  – Splinting
  – Transport
  – First aid kit

• Outcomes (n=330):
  – Cost-effective ($3/person)
  – >75% skills retention
  – >50% used in the field
Tier-One (community-based)

South Africa

Uganda
Emergency First Aid Responder (EFAR) System

- Intentional injury
- Limited EMS resources
- 1000+ CBO volunteers
- Advanced first aid
- Basic trauma care
- Communication
- Interface with EMS

A strategy to implement and support pre-hospital emergency medical systems in developing, resource-constrained areas of South Africa

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* University of Cape Town School of Public Health, South Africa
* University of Cape Town School of Medicine, South Africa

ABSTRACT

Resource-constrained countries are in urgent need of pre-hospital emergency care systems. However, current popular strategies to provide pre-hospital emergency care are inappropriate for and beyond the means of a resources-constrained country, and so new ones are needed---ones that can both function in an under-developed area’s particular context and be done with the area’s limited resources. In this study, we used a two-location pilot and consensus approach to develop a strategy to implement and support pre-hospital emergency care in one such developing, resource-constrained area: the Western Cape province of South Africa. Local community members are trained to be emergency first aid responders who can provide immediate, on-scene care until a Taxi can take the patient to the hospital. Management of the system is done through local Community Based Organizations, which can adapt the model to their communities as needed to meet local appropriateness and feasibility. Within a community, the system is implemented in a graduated manner based on available resources, and is designed to not rely on the whole system being implemented first to provide partial function. The University of Cape Town’s Division of Emergency Medicine and the Western Cape’s provincial METRO EMS intend to follow this model, along with sharing it with other South African provinces.
Tier-One (community-based)

• Outcomes are promising
  – Cost effective
  – Sustainable
  – Locally-appropriate
  – Good skills retention

• Next steps:
  – Patient-centered outcomes**
  – Testing in other low-resource settings
  – Developing more models
Tier-Two (formal prehospital)
Tier-Two (formal prehospital)
Tier-Two (formal prehospital)
Tier-Two (formal prehospital)

Morocco — Libya
Tunisia — Egypt
Algeria — Ethiopia
Ghana — Uganda
Nigeria — Rwanda
Cameroon
Botswana
South Africa
ORIGINAL RESEARCH

Ambulance or taxi? High acuity prehospital transports in the Ashanti region of Ghana

Ambulance ou Taxi? Le transport préhospitalier des patients gravement malades dans la région d’Ashanti au Ghana

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Introduction: African emergency medical services (EMS) systems are inadequate, thereby necessitating its selective use. This study aimed to investigate differences in mode of arrival to the Emergency Centre (EC) at Komfo Anokye Teaching Hospital in Kumasi, Ghana by acuity, injury and referral status.

Methods: A cross-sectional survey was conducted in the EC at the Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana, in 2011. A survey was administered to all patients triaged to the EC. Patients were excluded if they were under 18 years of age, unable to communicate in English, Twi, or Fante, had altered mental status, or were deceased. Data were inputted into an excel spreadsheet and uploaded to SPSS. Descriptive statistics were computed. Inferential statistics were performed test-
SUSTAINABLE EMERGENCY REFERRAL CARE (SERC) MANUAL FOR DHMTs & SD LEADERS

Builsa North & South
2013 - 2014
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Tier-three (facility-based care)
Tier-three (facility-based care)

- Innovations in:
  - Emergency nursing training
  - Mid-level provider training
  - Emergency Physician training
  - “East-West” educational partnerships
  - Triage tools/implementation
  - Remodeling institutional culture
  - Improvements in critical care
  - Improvement in trauma care
Development of an emergency nursing training curriculum in Ghana

Sue Anne Bell RN, FNP, MSN, Research Associate\textsuperscript{a,b,*}, Rockefeller Oteng MD, Clinical Instructor\textsuperscript{b,c}, Richard Redman PhD, RN, Professor\textsuperscript{d}, Jeremy Lapham RN, MSN, Research Associate\textsuperscript{a,b}, Victoria Bam RN, PhD, Head of Department\textsuperscript{d}, Veronica Dzomeku RN, MPhil, Instructor\textsuperscript{d}, Jamila Yakubu MPH, Program Manager\textsuperscript{b}, Nadia Tagoe MS, PMP, Program Manager\textsuperscript{d}, Peter Donkor MD, MS, Professor\textsuperscript{d}
Tier-three (mid-level providers)

Ghana

Botswana

Ethiopia

Uganda
Task shifting: Meeting the human resources needs for acute and emergency care in Africa

Transfert de tâches : Répondre aux besoins en ressources humaines pour les soins de courte durée et d’urgence en Afrique

Benjamin Terry a,b, Mark Bisanzo a,b, Mariah McNamara a,b, Bradley Dreifuss a,b, Stacey Chamberlain a,b, Sara W. Nelson a,b, Kyle Tiemeier a,b, Ty Waters a,b, Heather Hamnerstedt a,b

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Tier-three (physician training)

Morocco
Tunisia
Algeria
Ghana
Angola
Botswana
South Africa
Libya
Egypt
Sudan
Ethiopia
Tanzania
Rwanda
The state of emergency medicine in the United Republic of Tanzania

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Received 8 March 2012; revised 8 May 2012; accepted 9 June 2012
Available online 20 July 2012
The evolution and current state of emergency care in Ghana

L’évolution et le statut actuel des soins d’urgence au Ghana

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Received 4 November 2011; revised 11 October 2012; accepted 24 November 2012
Available online 25 December 2012
Other In-Hospital Innovations

- Emergency Triage
- Critical Care
- Emergency Centre operations & flow
- Emergency Centre management
- Disease surveillance
- Disaster preparedness & response
ORIGINAL RESEARCH

The implementation of the South African Triage Score (SATS) in an urban teaching hospital, Ghana

L’efficacité de la mise en œuvre de l’échelle de triage sud-africaine (SATS, South African Triage Score) dans un hôpital universitaire urbain au Ghana

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Received 8 September 2013; revised 30 October 2013; accepted 19 November 2013; available online 17 January 2014

Introduction: Triage is the process of sorting patients based on the level of acuity to ensure that the most severely injured and ill patients receive timely care before their condition worsens. The South African Triage Scale (SATS) was developed out of a need for an accurate and objective measure of urgency based on physiological parameters and clinical discriminators that is easily implemented in low resource settings. SATS was introduced in the emergency centre (EC) of Korle-Bu Teaching Hospital (KATH) in January 2010. This study seeks to evaluate the accuracy of the SATS by nurses at KATH.

Methods: This cross-sectional study was conducted in the EC at KATH in Kumasi-Ghana. Patients 12 years and over with complete triage information were included in the study. Each component of SATS was calculated (i.e. for heart rate of 41–60, a score of 1 was given and summed. The score was compared to the original triage score. When scores did not equal the total, the entire triage score was reviewed by an emergency physician and an advanced-practice emergency nurse separately to determine if the triage was appropriate. These reviews were compared and consensus reached.

Results: 52 of 903 adult patients (5.8%) were judged to have been mis-triaged by expert review; 49 under-triaged (sent to a lower acuity level than they should have been, based on their vital signs and 3 over-triaged. Of the 49 patients who were under-triaged, 34 were under-triaged by one category and 7 by two categories.

Conclusion: Undertriage is a concern to patient care and safety, and while the under-triage rate of 5.8% in this sample falls within the 5–10% range considered unacceptable by the American College of Surgeons Committee on Trauma, concerted efforts to regularly train triage nurses to ensure no patient is under-triaged have been undertaken. Overall though, SATS has been implemented successfully within the EC at KATH by triage nurses.
A Randomized Clinical Trial Evaluating Nasal Continuous Positive Airway Pressure for Acute Respiratory Distress in a Developing Country

Patrick T. Wilson, MD, MPH1, Marilyn C. Morris, MD, MPH1, Katherine V. Biagas, MD1,
Easmon Otupiri, PhD, DVM, MSc, MPH2, and Rachel T. Moresky, MD, MPH3

Objective Invasive mechanical ventilation is often not an option for children with acute respiratory infections in developing countries. An alternative is continuous positive airway pressure (CPAP). The authors evaluated the effectiveness of CPAP in children presenting with acute respiratory distress in a developing country.

Study design A randomized, controlled trial was conducted in 4 rural hospitals in Ghana. Children, 3 months to 5 years of age, presenting with tachypnea and intercostal or subcostal retractions or nasal flaring were randomly assigned to receive CPAP immediately or 1 hour after presentation. CPAP was applied by locally trained nurses. The primary outcome measure was change in respiratory rate at 1 hour.

Results The study was stopped after the enrollment of 70 subjects because of a predetermined stop value of $P < .001$. Mean respiratory rate of children who received immediate CPAP fell by 16 breaths/min (95% CI 10-21) in the first hour compared with no change in children who had CPAP delayed by 1 hour (95% CI −2 to +5). Thirty-five of the patients had a positive malaria blood smear. There were 3 deaths as a result of severe malaria. No major complications of CPAP use were noted.

Conclusions CPAP decreases respiratory rate in children with respiratory distress compared with children not receiving CPAP. The technology was successfully used by local nurses. No complications were associated with its use. CPAP is a relatively low-cost, low-technology that is a safe method to decrease respiratory rate with nonspecific respiratory distress. (J Pediatr 2013;162:988-92).

See editorial, p 892

Acute respiratory infections remain a leading cause of mortality in children throughout the world, with ~2 million deaths per year in the under-5 age group. In developing countries with limited resources, the use of invasive mechanical ventilation for respiratory distress or insufficiency is often not an option. One alternative to support children with respiratory distress is nasal continuous positive airway pressure (CPAP). The use of CPAP may increase lung volume and improve ventilation-perfusion matching and pulmonary compliance, resulting in increased oxygenation and decreased work of breathing.
Other science

• Fluid resuscitation in pediatrics
• Sepsis guidelines for sub-Saharan Africa
• Lactate clearance in African populations
• IO blood transfusions in pediatric critical care
• Trauma care by non-emergency practitioners
• Knowledge and skills of emergency nurses
Measuring Success

• More prehospital care systems/models
• Increase in emergency care training programs
• Growth of equitable partnerships
• Operational and systems improvements
• Formation of professional societies
• Increased research and publications
• Improving morbidity and mortality
$\sum > f$ (individual parts)
Thank you