Lectures and Training in essentials of Emergency Medicine in a rural Health centre in Kenya

J. Bydzovsky (Jan Bydzovsky), K. Mulama (Katarina Mulama), E. Kea (Edwin Kea)

The Institute of St. J. N. Neumann University of St. Elizabeth, Pribram, CZ.

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E-mail address:

bydzovsky@vszsp.cz

Reprint address:

Jan Bydzovsky
The Institute of St. J. N. Neumann University of St. Elizabeth
Jiráskovy sady 240
261 01 Pribram
Czech Republic

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Reviewers:

Vitalis Okoth Odero
Catholic university of Eastern Africa, Nairobi, KE
Johnson Nzau Mavole
Catholic university of Eastern Africa, Nairobi, KE

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Abstract:

Kenya is a developing African country offering much worse access to healthcare in comparison with European countries, mainly in rural areas where there is a greater emphasis on community health workers who provide basic health services. This paper briefly describes 6-day lectures and training in essentials of emergency medicine that were organised for a rural health centre in Kenyan West Pokot County for its personnel in October 2022. The chosen expert level was similar to that of lectures for Czech student paramedics in a university bachelors' study programme and the training was completed by a final comprehensive test with an overall score of the participants of 46 %. This may serve as a clue for similar education in other low-resource settings.

This paper is dedicated as a tribute to his magnificence, founder and rector emeritus of St. Elizabeth University of Healthcare and Social Work in Bratislava, Slovakia, prof. Vladimír Krčméry, a physician, scientist, humanist and philanthropist and a great supporter of Dr. David Roden Mission Tikit Health Centre.

Background

Kenya (exactly Republic of Kenya) is a developing country in East Africa with its population of 56 million citizens distributed at 580 thousand square kilometres; its climate varies from tropical to arid in northern parts. Half of the Kenyans live in poverty and their life expectancy at birth was 63 years for males and 68 years for females in 2019. The neonatal mortality rate is 2.0 % as only 42 % of births are attended by a healthcare professional; the mortality rate for infants was 3.1 % and for under-five-year 4.2 % in 2020 (1). These average numbers would be even much worse in rural areas. The healthcare is provided in both state and private facilities of six levels of Kenya Essential Package for Health (KEPH) system described in Tab. 1 (2, 3), 37 % of the facilities are private, 11 % faith-based and 52 % public. In 2015 the expenditures were covered by direct out of pocket payments (32 %), through the Government by taxes (31 %), donors (26 %) and health insurance (13 %) (4). Patients who seek medical services in Kenya are covered by the National Health Insurance Fund (NHIF) where patients pay a minimum of Kenya Shillings 500 (approx. EUR 3.36) monthly, however pregnant women do not pay this amount during pregnancy because it‘s paid by the Kenyan government under “Linda Mama” initiative, but this does not cater for all medical bills, for example CT scan have to be paid extra out-of-pocket or by private insurance.

The primary care is provided mainly by nurses followed by more educated clinical officers, but there are still many traditional healers consulted and trusted by lay people. Nurses, laboratory technicians and clinical officers are trained at diploma and degree level. Diploma in nursing takes three and a half years, while the degree programme takes 4 years plus 1 year of compulsory internship. There are masters and PhD programs in nursing and specialisation in

Tab. 1 Levels of healthcare in Kenya

level	type of facility	leader of providers	features of provided care
1	community health service	community health worker (community health volunteer, CHV)	taking BP and blood sugar, treating minor ailments (diarrhoea), malaria and HIV testing, vaccination, health promotion and education
2	dispensary	nurse	outpatient services (uncomplicated malaria, flu, skin conditions), counselling services
3	health centre	clinical officer	laboratory, maternity theatre, antenatal and postnatal care, minor surgical procedures, pharmacy
4	Sub-county (primary) hospital	clinical officer / medical officer	in-patient wards, wider range of surgical services, Caesarean section, ultrasound, X-ray
5	county (secondary) referral hospital	medical officer / medical practitioner (doctor)	more than 100 beds for inpatients, including intensive care, CT scan, orthopaedics, physiotherapy
6	national referral hospital	medical practitioner (doctor)	full services, teaching and research (there are 5 such hospitals in Kenya)

various medical fields, e.g. ICU nurse. Clinical officers are trained at diploma and degree level. Diploma in clinical medicine and surgery takes 3 years plus one year compulsory internship. Bachelor degree in clinical medicine and community health takes 4 years plus one year of internship. There are various specialisations for clinical officers with diploma, e.g. higher national diploma in clinical medicine, paediatrics, anaesthesia, reproductive health and gynaecology, skin and lung diseases, oncology, emergency medicine and mental health. There are also various masters degrees for those who qualify with a bachelor's degree. Medical officers are trained at degree level, bachelor's in medicine and surgery takes 5 years plus one year of compulsory internship. Specialisation by doing a masters degree in various fields takes 5 years.

Anyway, almost anyone with any degree of medical education and knowledge, including first responders with just a course, are often called „daktari" (a doctor in Kiswahili) by rural lay people who are not aware about the differences between particular levels of the providers. The healthcare system faces many challenges like diseases from poverty (infectious diseases: malaria, diarrhoea, pneumonia, HIV/AIDS, malnutrition), lack of adequately educated healthcare providers and corruption. Among most frequent causes of death there is HIV/AIDS, pneumonia, diarrhoea, neonatal disorders, stroke, TB, ischemic heart disease, cirrhosis, malaria and diabetes. (5)

West Pokot County is one of 47 semi-autonomous counties of Kenya located in western part of Kenya with about 621 thousand inhabitants at 9 169 square kilometres. There are 252 community healthcare units, 95 dispensaries, 8 health centres, 4 county hospitals and no facilities of level 5 and 6. (3, 6) One of level 3 facilities (believed to be level 4) is Dr. David Mission Health Centre Tikit has run since 2019 and serves a community of about 5.000 people. Dr. David Roden was a British founder of the Tikit hospital in 2005 who did not accomplish his plan due to a tragic road accident. After some years, the catholic congregation Evangelising sisters of Mary in Nairobi took over the development of the hospital in the state of buildings without equipment. Especially Sr. Clementine Yego, Pokot's religious sister and midwife, felt that her people needed proper health care. Together with a doctor from Slovakia who was sent by St. Elizabeth University in Bratislava developed and opened a dispensary in 2019. Two years later Two-colour World organisation supported by Slovak Aid, the health facility reached level 3B equipped with diagnostic machines and minor theatre, delivery room and a newborn unit with incubator. It is staffed by five full-time employees at that time: a clinical officer, two nurses, a midwife and a laboratory technician and a Slovak medical doctor (a gynaecologist/obstetrician) that is also a manager of the health centre that is operated as a humanitarian project because only few patients can pay for provided care, only laboratory tests and medicines respectively. This project is sponsored by Slovak Agency for International Development Cooperation – SlovakAid and St. Elizabeth University of Healthcare and Social Work in Bratislava, Slovakia. To support childbirths at the healthcare facilities and testing for HIV, these are provided for free.

Methods

The lectures and training were carried out in October 2022 by two Czech healthcare professionals: an emergency physician working at an emergency department and emergency medical service, a university professor being a teacher and a guarantor of bachelors' study programme for paramedics, and his student paramedic being already a nurse. Their mission comprised not only the training for the personnel but bringing approx. 90 kilograms of medical equipment, devices, instruments and disposables. Therefore there was a demand to acquaint the personnel with them as well. The lectures and training consisted of 48 interactive lessons as shown in Tab. 2 supported by a projection of PowerPoint presentation and practical trainings focused mainly on ABCDE approach to emergencies, basic CPR using bag-valve-mask, recognizing basic ECG rhythms and using a manual defibrillator, application of a cervical collar and a pelvic sling, using a syringe driver etc. The skills in cardiopulmonary resuscitation were trained using adult and baby low-fidelity, low-cost manikins by Laerdal that were also brought and donated to the health centre. Nevertheless even these simple mannequins are able to provide simple feedback of sufficient compression depth using a clicking

sound, sufficient tidal volume by a chest rise and appropriate compression rate using a smartphone application measuring it using a smartphone camera.

The lessons were distributed into 6 teaching days interleaved by days off, mainly during a weekend as demanded by the participants. It is important to remark that the lectures and training were conducted concurrently with the regular service of the health centre when the participants had to leave and return back occasionally to fulfil their duties. After finishing the lectures the participants were given the printed hand-outs to be able to prepare for the final exam planned 3 days later. The first part was a written test with 46 (55 %) single best answer questions with four distractors and 37 (45 %) open questions to be finished within 60 minutes. All the questions were based on the lectures only. The second part demanded each single participant to carry out a CPR on an adult manikin including bag-valve-mask ventilation for 5 minutes to prove they are able to perform this basic procedure in a good quality. Moreover all the participants demonstrated a 20-minute team CPR in a simulated scenario. Each participant was issued a certificate of attendance during a "graduation and bye-bye party" the evening before the lecturers left. The classes and final exam are shown in Fig. 1 through Fig. 7.

Results

Only 4 out of 5 participants of the lectures and training sat the exam, the last one did not take part without an excuse. The overall success was 42 % on average and varied from 27 % by the laboratory technician, 31 % by the midwife and 47 % by the nurse up to 63 % achieved by the clinical officer. The average success in single best answer questions was 53 % and only 28 % in open questions. These lessons corresponded to lecturer's lessons and covered the most important topics of subject Emergency Medicine II (part 2 out of 4) in the 2nd year of the 3-year bachelors' study programme for paramedics and a result of 60 % and above would be acceptable for passing the exam. The participants scored the best in questions on general approach, IV access and airway management, acute respiratory distress, burns or intoxications or palliative care. The overall success for each topic is shown in Fig. 8. The questions that turned out to be the easiest (everyone succeeded in 6 out of 83 questions) and the most difficult (nobody succeeded in 17 out of 83 questions) are listed in Tab. 3 and Tab. 4 to give an impression of difficulty of the final test.

Fig. 1 The team having a lecture

Fig. 2 Training of CPR in adults

Fig. 3 Training of CPR in children

Fig. 4 Training of application of cervical collar

Fig. 5 Training of application of pelvic sling

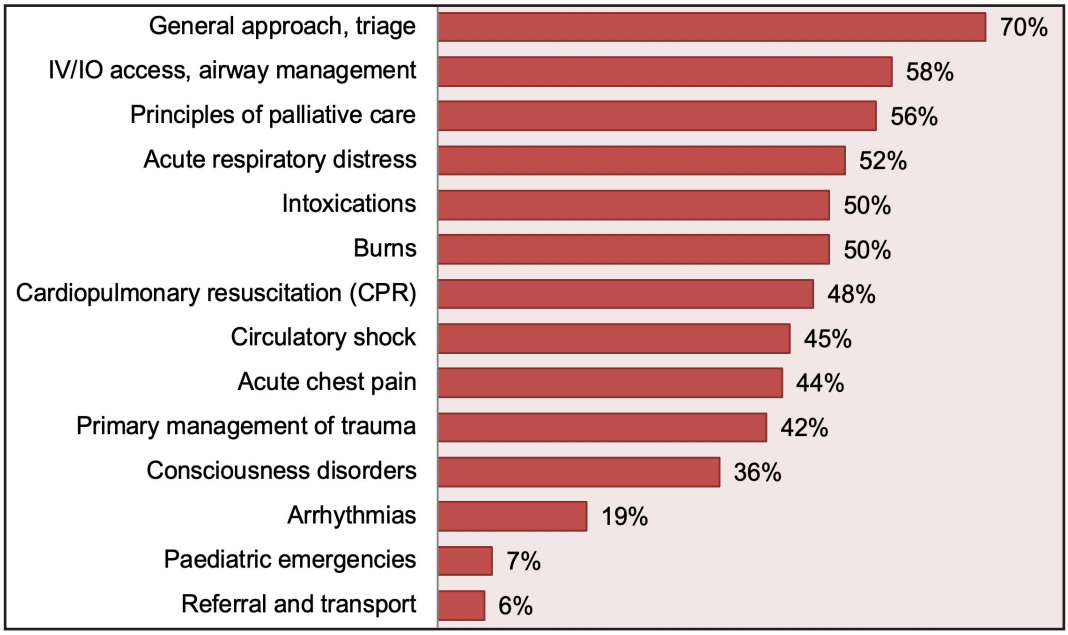
Fig. 6 Participants writing the final test

Fig. 7 Participants performing CPR in the team

Tab. 2 List of topics for the lectures and training

- **Legal Background for Treating Emergencies in Kenya**
- **ABCDE Approach to Emergencies**
- **Triage**
  - Pre-hospital Triage (START)
  - In-hospital Triage (Interagency Integrated Triage Tool)
- **Cardiopulmonary Resuscitation**
  - Basic Life Support
  - Advanced Life Support
  - Airway Management (Positioning Head, OPA, NPA, LMA, Cricothyroidotomy)
  - IV/IO Access
  - Intranasal Route
  - CPR in Children and Pregnant Women and Neonates
- **Consciousness Disorders**
  - Assessment and Management
  - Epilepsy and Other Convulsions
  - Stroke
  - Emergencies in Diabetes (Hypoglycaemia, DKA, HONK)
- **Circulatory Shock**
  - Signs, Mechanisms and Classification
  - Hypovolemic and Hemorrhagic Shock
  - Anaphylactic Shock
  - Septic Shock
  - Neurogenic Shock
- **Acute Respiratory Distress**
  - Causes and Signs, History, Examination and Management
  - Administering of Oxygen
  - Most Common Causes (Acute Heart Failure, Asthma, COPD, Pneumonia, Pulmonary Embolism, Foreign Body Airway Obstruction, Pneumothorax, Anaemia, Pleural Effusion, Psychogenic Hyperventilation)
- **Acute Chest Pain**
  - History and Examination
  - Most Common Causes (ACS, Pericarditis, Aortic Dissection, Pulmonary Embolism, Pleuritis, Musculoskeletal, Pneumothorax, GERD, Biliary, Tracheitis, Psychogenic, Herpes Zoster)
  - Ischaemic Heart Disease (Chronic and Acute Forms, AMI: STEMI/NSTEMI)
- **Arrhythmias**
  - Causes, Pathophysiology, Severity, Treatment
- **Paediatric Emergencies**
  - Clinical Features and Vital Signs in Children
  - Croup, Epiglottitis, Bronchiolitis, Febrile Convulsions, Child Abuse and Neglect
- **Primary Management of Trauma**
  - Major Incidents and Triage
  - Advanced Trauma Life Support (ATLS)
  - Focused Abdominal Sonography in Trauma (FAST) Scan
- **Burns**
  - Classification and Treatment, Circumferential Burns
- **Poisoning**
  - Causes and Management, Major Antidotes
- **Principles of Palliative (End-of-Life) Care**
  - Symptom Management
  - Total Pain Concept and Treatment of Chronic Pain
- **Referral and Transport to Another Hospital**

Fig. 8 Success in particular parts of the final test



Tab. 3 The questions with 100 % right answers

Which of these is the largest IV cannula?			
a) yellow	b) blue	c) pink	d) green
As a source of energy and water without electrolytes we use:			
a) 5% dextrose	b) normal saline	c) lactated Ringer's	d) any of these can be used
What cardiac rhythm shall be defibrillated:			
a) VFib and pulseless VTach	b) pulseless electrical activity	c) all of them	d) none
If we use a sphygmomanometer (BP monitor) cuff as a tourniquet in major bleeding we set the pressure:			
a) 20 mmHg above SPB	b) 20 mmHg above DPB	c) to systolic BP	d) to diastolic BP
Crackles (bubbling sounds) over lungs are a sign of:			
a) bronchial obstruction	b) fluid in alveoli	c) swelling of larynx	d) pneumothorax
What is true about chest pain in acute myocardial infarction:			
a) is of stabbing or tearing character	b) is well localised	c) is of colicky character	d) none of them

Tab. 4 The questions without any right answer

The chest compressions should be interrupted for rescue breaths for:			
a) as little time as possible	b) for 2 seconds	c) for 10 seconds	d) never
First-line treatment of anaphylactic shock in an adult is …0,5… **mg of** …adrenaline… **by** …IM… **route.**			
If the pulse oximeter is switched on but showing no values we shall:			
a) check the batteries	b) administer oxygen	c) check the probe and pulse	d) measure BP
What should be the flow of oxygen when using a face mask?			
a) no more than 5 Lpm	b) at least 3 Lpm	c) 5-10 Lpm	d) 10-15 Lpm
Where do we find the ischaemic changes on ECG in STEMI/NSTEMI:			
a) P waves	b) QRS complexes	c) ST segments and T waves	d) all of them
If the RR-interval in normal ECG is 2 cm (= 4 big squares), the ventricular rate is …75… **bpm.**			
An atrial fibrillation may cause …stroke… **and we prevent it by giving** …anticoagulants…			
The maximum daily dose of paracetamol for children is …60… **mg per kg divided into** …4… **doses.**			
Daily need of fluids for a 20 kg child is approx. …1500… **ml. We must add** …15… **% more for every °C of fever.**			
Acute subglottic laryngitis (croup) is typical with barking cough in preschool children. We treat it with:			
a) nebulized adrenaline	b) dexamethasone 0.6 mg/kg	c) antitussives	d) all of them
What are the parts of „MIST message" during handover when referring a patient (what all do we report)?			
M = …mechanism…, I = …injury/illness…, S = …signs…, T = …treatment…			

Discussion

Although the questions are not and cannot be of equal difficulty there was an effort to at least use the number of questions appropriately to the extent of the topic and its importance. Of course, the reporting value is very limited due to only four participants sitting the exam. It is clear that the participants were most familiar with topics they had encountered the most, i.e. IV access, respiratory distress or burns in contrast to arrhythmias in which they were trained for the very first time. Surprisingly they scored low in paediatric emergencies or referral and transport. This knowledge will be taken into account before repeating these lectures. We can also observe that open questions are roughly twice as difficult to be answered correctly as single best answer questions with four distractors.

From the participants' point of view the opinion was overwhelmingly positive valuing the expertise and engaging teaching style with hands-on training that have left a lasting impression on the participants making the lectures both educational and enjoyable. Nonetheless some of them suggested implementing more interactive exercises (scenarios and role plays) and incorporating dedicated time for questions during the lectures that would further improve the learning environment.

From the manager's point of view the medical staff were ready to receive the lecturer from

abroad full heartedly. Though they didn't know the seriousness of doctor Jan, he was expecting punctuality in time schedule, activity and even exam and awarding by certificate was not only for presence at training. This experience surely convinced local medics working in the facility that their job with NGO is not only about donations but also about the results and being a part of it. They realised that permanent education and self development are required for provision of quality services that are needed to raise the good name of the hospital, bring more trusting patients and this can lead to higher economic stability of the facility. I must highlight that it was my very first experience having training with a lecturer from abroad and it helped to differentiate the workers, recognise their aim to work in Tikit hospital. One of them was not allowed to extend the contract due to his poor knowledge and unpreparedness to improve.

Conclusion

This was probably the first experience with such a formalised training in an European format (lectures, hands-on trainings and a comprehensive written and practical final exam) for most of the personnel. Anyway they were more motivated and cooperative than Czech university students. Even this minimal sample acknowledged the best knowledge of clinical officers and nurses in comparison to midwives and laboratory technicians who had obtained less medical training.

As the personnel in Tikit has changed and the health centre is still developing towards level 4 – sub-county hospital – we are planning to repeat this mission in autumn 2023, extended according to actual needs, e.g. by basic anaesthetic techniques. In the meantime we would like to run a new website of the health centre that would enable e-learning activities and remote lectures using video calls (webinars). We are planning to repeat not only the post-testing but also pre-testing of the participants' knowledge as well and to respond to the valuable feedback from the participants.

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