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EDITORIAL

Applying lessons learnt during Covid 19 era: hybrid ACLS training in low resource setting

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ABSTRACT

Excellence in Advanced cardiac life support and other life support metrics are key items used in measuring the competency of essential personnel. These Life support certifications enable staff to be competent and efficient in providing critical lifesaving interventions to needy patients in a safe and structured manner. While these certifications can be offered by multiple providers, most institutions stick to certain providers due to their international accreditations. While available, their prohibitive cost discourages hospital wide training programs, budgets, and schedule.

Internal capacity building has been a key solution to this ever-growing problem. First, recognizing that life support training is an essential part of all critical healthcare providers core competency, and that the competency must be maintained, through frequent training is the first hurdle. Second was developing a training curriculum based on the core skills required to provide life support at the facility, and finally a way of adequately assessing the competency as per the required level for certification. Utilizing a hybrid format of training encompassing participants undergoing an online training module as well as coming for a physical simulation case-based examination.

Participants were allowed to take exams multiple times with different case scenarios to achieve a pass mark of 75%. 97 practical examinations for 76 participants were done for both Nurses and doctors over a 3-month period with a first-time success rate of 72%. Following the completion of the training, participants were more comfortable performing life support procedures. With an 80% cost reduction per participant, more staff participation, teamwork, and timely responses to patient resuscitation emergencies, quality in-house, hybrid life support training and certification can be done.

Keywords: ACLS, hybrid training, low-resource, Simulation, cost-effectiveness.

Training and the ever-shrinking budget

Advanced cardiac Life Support (ACLS) is a structured and systematic method of resuscitation and is majorly responsible for dramatically reducing morbidity and mortality in healthcare and has such become standard of care in most hospitals and healthcare providers as a quality provision policy[1-3]. These guidelines are based on consensus of various cardiac, critical care, emergency medicine and other affiliated clinical societies which congregate and issue guidelines on best practices. When implemented, they give patients the best chances of survival while minimizing complications. ACLS is an American certification, but other societies offer similar accreditations. Although subtle differences appear between various accreditations, core principles remain the same with ACLS being the older and more prevalent certification[4,5].

For the skills to remain effective, they must be continually practiced or renewed every 2 years. Due to both the resuscitation council of Kenya and other international joint councils following similar recommendations, the guidelines and curriculum are essentially the same[6]. But due to the current job market in Kenya, more so in the private health care sector, healthcare providers are strongly encouraged to get these internationally accredited life support courses due to the need of hospitals to cater to international clients. This is further emphasized by various quality certification institutions such as ISO, JCI, Ministry of health and others that hospitals use to attract international clients.

These certifications and ACLS accreditation have been shown to improve healthcare provision and patient safety[1,3]. Many facilities therefore train and maintain the competencies of their staff in ACLS to improve their morbidity and mortality, comply with certain international health care accreditations as well as increase acceptability among potential clients[1,7]. While this is a worthwhile recurrent expenditure, current financial markets, ever rising inflation, and raised competition have narrowed business margins among many major healthcare providers[8-11]. This is compounded by the need to expand and gain market share, necessitating recruitment of staff and expansion of service provision[12].

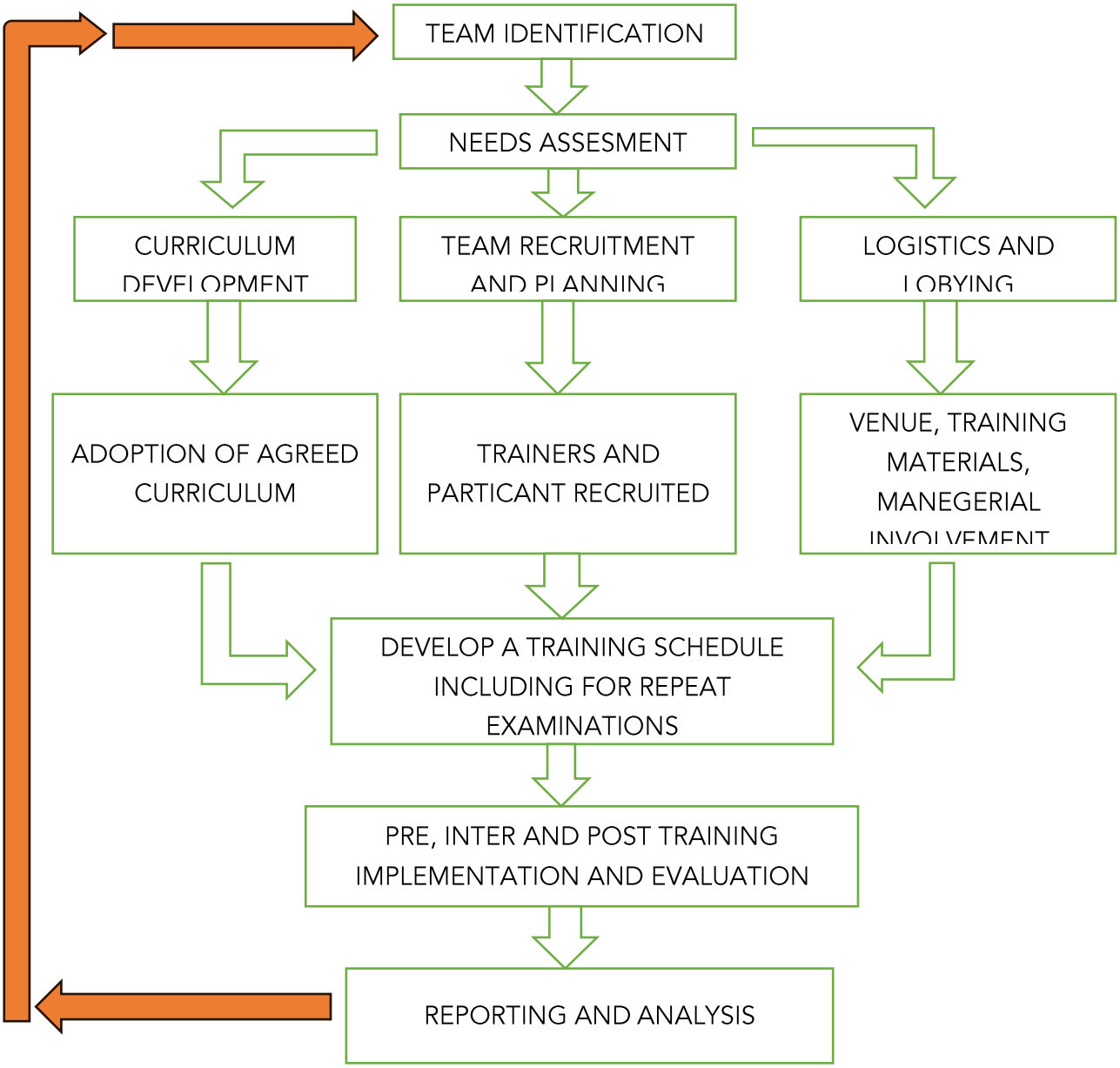
As a result, a more sustainable solution was sought to maintain competency but reduce the cost of investment[13]. Borrowing from lessons learned during the Covid 19 Pandemic, a hybrid model of training was developed based on the success of this model of training[14]. Trainers of trainers from internationally accredited firms are typically available to train and develop local talent and enable local service providers to be of similar if not better examiners and providers[12,15]. Once a critical threshold of trainers has been achieved, internal specialists and relevant stakeholders were mobilized to create multiple aspects for the life support training program. These were to be ratified by the team with a relevant curriculum developed and implemented. This was in the background of multiple online training showing similar results enabling the team to ensure quality provision with good patient outcomes[12,16-18].

The workshops and content creation

An in-house needs assessment was undertaken to measure the Advanced cardiac life support (ACLS) training requirement of the Hospital. Various unit in-charges and departmental heads were tasked to perform an ACLS check for all nurses and doctors of the outpatient departments of Mater Misericordiae Hospital. This 176-bed capacity, level 6A hospital in Nairobi Kenya, was the initial site due to its well-known cardiac excellence and availability of multiple well versed, active cardiologists, simulation and ACLS trainers.

A team of 6 highly skilled and motivated staff members were recruited to create a curriculum and deploy it. They developed a curriculum, based on the Emergency medicine Kenya foundation handbook on emergency care (2022 edition) which is based on the American heart association 2020-2025 guidelines and recommendations[6]. This was

also supplemented with the online resources found at the Karl Disque foundation, which offers an online platform that allows practitioners to get access to these materials. The curriculum was based on the principles of hybrid learning with participants being exposed to online materials for learning and coming for a small pre-examination session and the examination[16,18,19]. It was important to choose team members who have been trained in ACLS-AHA (American Heart Association) and are active trainers in the field of resuscitation or those with extensive teaching and clinical background in resuscitation. Simulation champions are key since the whole program requires extensive knowledge in simulation writing, planning, implementation and debrief procedures.



Implementation

The training schedule was formulated based on availability of participants and trainers/examiners. The schedule was also made to work around duty allocations, ensuring duties and coverage were not affected. The participants were given a minimum of 1 week notice to prepare for the examination after completion of the online modules, to which they would present proof of completion from the online module. Each department was given a month where they would be examined. They were then allocated two examiners and examined on a first come-first serve basis.

The setup included a simulation lab, the main requirement being a well-equipped resuscitation trolley[20], a chest compression mannequin, and a

defibrillator with an ECG simulator. Multiple stations can be arranged to accommodate large groups and to improve efficiency. There were multiple case scenarios designed based on the actual cases received at the facility, national patient case mix and critical conditions noted in the EMKF emergency care algorithm 6H's and T's[6].

During the examination, a pre-briefing session was done prior to the start of the examination. This included what was expected, the format of the exam including the scoring system and the pass mark and possible outcomes. Participants were examined and those who met the critical threshold of 75% pass mark (80% for critical care providers), were allowed to proceed and get a certificate of achievement. Those who did not meet the threshold were advised to redo the exam based on the examiners' committee recommendations. They were also allocated a partner to assist them in achieving the required targets.

Simulation format

All the participants underwent a simulation based, observed structured clinical examination (OSCE). This was based on a possibility of 6 possible scenarios with the core principles being the same. The exam was based on a manikin simulation with job aids and materials (such as bag valve masks, airway equipment, circulation equipment) for demonstration and use by the participant. Aids including imaging, clinical anatomic pictures and laboratory results with patient identifiers redacted were also availed. The manikin was dressed and given appropriate aids e.g., pictures of a man clutching his chest for the M.I case etc. There was no time limitation per participant, and each was allowed to manage the case to completion unless the instructors found the session unsalvageable.

Key to note, an examinee only required a maximum of 2.5hrs physical contact, while the online module required approximately 9hrs to complete. By heavily relying on the online module, this enabled us to ensure continuation of duties, minimization of costs and compliance with Covid 19 S.O.P's.

SIMULATION TRAINING

PARTICIPANT NAME: _____

DATE OF EXAMINATION: _____

Examiner 1 _____

Examiner 2 _____

Objectives

The case scenario is based on:

- Urban setup with relatively high resources
- Adequate staffing with ACLS training
- Medical officers, Specialists and ICU available for use.

The following simulation is aimed at demonstrating skills and knowledge in the following areas:

1. Ability to demonstrate leadership and teamwork.
2. Ability to delegate to team members and allocation of roles.
3. Knowledge and skills to recognize and client requiring assistance.
4. Demonstrate knowledge on the ACLS algorithm.
5. Skills in appropriate airway, breathing and circulation management.
6. Skills and knowledge in M.I management.

CASE SCENARIO

A 55 YEAR Michael was brought in by his wife with a history of Altered level of consciousness for 2 minutes and excessive chest pain right across his left arm following a strenuous activity at home as of 2 hours ago. Currently talking and giving history. He has been having on-off chest pain for 3 weeks now but they resolve with rest and taking of paracetamol. He has been also complaining of left sided toothache. It took around 30 minutes for the client to reach you.
Currently in pain

Additional history
He has no comorbid, not on any drugs and no known allergies. He is a known heavy alcoholic and smoker. No previous illnesses. No history of travel outside Nairobi History of attacks- 10/ year.
Has been dealing with obesity for 10 years.
Father died of heart failure following an M.I
Last meal was 3 hours ago

While talking to you and giving history, the patient loses consciousness.

Presentation

SYSTEM	ITEM	DERANGEMENT	INTERVENTION	SCORE (?/10)	
BLS	Secure area	Area secure	Wear appropriate PPE, gloves	1 point	
	Check for responsiveness	Patient is unconscious.	Take time to check for a pulse.	3 point	
	Check for pulse	Pulse absent	Start CPR	3 point	
	Check for respiration	No respiration	CPR	1 point	
	Call for help SKIP to algorithm	High risk client	Code red/blue	2 points	
Team work and Leadership	Leadership	Allocate roles	Staff have clear roles	5 points	
	Teamwork	Closed loop communication	Feedback and noted closed loop comm	5 points	
	Resume After ROSC				
Airway	Open the airway	Use of an NPA/OPA	Adequately size and place the airway adjunct.	3 points	
			Consideration of intubation possible if they assess GCS and note < 8 Suction PRN	5 points	
	Maintenance of airway	Use of head tilt- chin lift/ Jaw thrust to maintain airway	Maintain the airway	2 points	
Breathing	Attach monitors.	Spo2=89%,	Attach oxygen	7 points	
	Examination	RR= 21/min, equal and bilateral air entry	Noted tachypnea	3 points	
Circulation	Attach monitors	Pulse= 132/min. BP= 64/47	Attach 2 wide bore canula, take samples for- basics= FHG, U/E/C, blood cultures, blood gasses and CRP, LFT's, crossmatch, cardiac triage, coagulation profile	3 points	
	Lines and fluid management	2 wide bore canula.	Appropriately sized 2 wide bore canula	3 points	
		Apply fluid bolus to keep line patent	Adequate response	2 points	
	Vasopressor	After 2 fluid boluses, consider vasopressor support	Use of appropriate vasopressor	2 points	
Disability	Level of consciousness	GCS= 7/15	Airway protection imminent.	5 points	
	RBS	RBS= 5.9mmol/l	Normal	5 points	
Exposure	Obesity	Morbidly obese client	Difficult canulation, difficult intubation	5 points	
	Temperature	Fever of 36.3 C cold to shoulder	Cold hypovolemic shock	5 points	
TOTAL				70 points	

Clients will undergo a series of arrests after assessment.

PEA/VT is due to Possible electrolyte and cardiac conduction abnormalities.

Consideration of H's and Ts in trauma

Participant Must follow algorithm as per the above-named protocol.

Instructors are free to give both PEA and VF/VT algorithm in-order to adequately assess the quality of CPR being given.

SCORE= 100 marks

ITEM	COMMENT	MARKS
Correctly identify the right algorithm pathway	PEA/Asystole, VF/VT, Bradycardia, SVT	20
Airway	Adequately note correct placement of the BVM	10
	Correct use of Head-tilt, Chin lift	6
	Correct use of airways	4
Circulation	Correct placement on the xyphi-sternum with dominant hand first	10
	Correct rate and depth of CPR	10
	Allowing for chest recoil	4
Others	Correct rate of CPR= 30:2	10
	Use of rotation of providers after rhythm check of every 5 cycles (2 minutes)	6
Defib	Shown how to defibrillate a patient/ pad placement.	10
	Show how to safely use a defib and at the correct settings (defibrillation vs cardioversion)	10
Bonus	Immediate rhythm check after arrival of AED	5
Total		……./100

Interventions	Target	Outcome	SCORE(?/30)=20%
Hypotension	Hypovolemic shock	Replacement of crystalloids 10mls/kg boluses	5
Suction/ OPA/ Intubation	Airway	Better Oxygenation	2
ECG	Appropriate interpretation of the ECG	STEMI	3
Appropriate use of the STEMI algorithm	Drugs	Use of anticoagulants	5
		Consider fibrinolytics/ Cath lab	5
Senior review	Urgent Cardiology review	Cardiology for Cath lab	3
Medications	Pain management	Use of opioid or any other appropriate	2
	others	Nitros, ACEI, BB	2
Lab works	management	Just shows elevated D-dimers and troponin	2
Other interventions	Others	Urinary catheter ICU review	3
Bonus	Documentation	Use of cardiac chart	3
	Use of normotension	Maintain MAP around 65-70	5
		Treatment of obesity and other risk factors	5
Total			…./30. (40 bonus)

General instructor comments

Participant Comments

Participant Name……Sign……Date:……

Instructor 1 comments

Score (Pass mark = 75%)

Recommendation

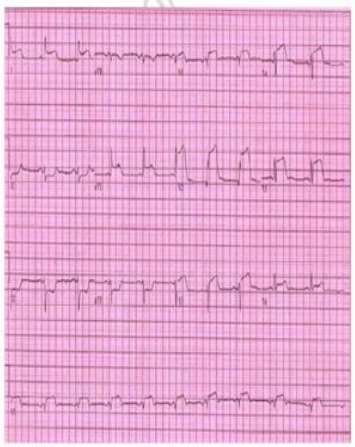
Instructor Name: ……Sign……Date:……

Instructor 2 comments

Score (Pass mark = 75%)

Recommendation

Instructor Name: ……Sign……Date:……



TEST	REPORT	REFERENCE LEVEL		CHILD<12YEAR	NEW BORN (1-28 DAYS)	DIFF COUNT %	REPORT
		MALE	FEMALE				
WBC * 10^3/L	16.6	4.0 - 10.0		6 - 17	9 - 20	Neutrophils	92
HB g/dl	14.0	14-18	12-16	11.0-16	14-24	Lymphocytes	5
RBC * 10^{12}/L	4.7	4.5-6.5	4.2-5.4	3.8-5.5	4.8-7.1	Monocytes	3
P.C.V %	42	39-52	36-46	34-45	44-62	Eosinophils	0
M.C.V fl	89	76-96	76-96	82-91	96 -108	Basophils	0
M.C.H Pg	30	26-32	26-32	27-31	32-34		
M.C.H.C	34	32-36	32-36	32-36	32-33		
Platelets * 10^9/L	253	150 - 450		150 - 450	150 - 450		

TEST	RESULTS	UNITS	REFERENCE RANGE	FLAG
Na	141.000	mmol/l	135.0 - 150.0	
K	4.550	mmol/l	3.5 - 5.5	
CL	103.000	mmol/l	95 - 115.0	
UREA	3.160	mmol/l	1.7 - 8.3	
CREAT	82.000	umol/l	53.0 - 106.0	

Test	Result	Units	Reference Range
CK-MB	10.3	ng/ml	0.0 - 4.3
Myeglobin	180	ng/ml	0.0 - 107
Troponin I	5.6	ng/ml	0.0 - 0.4
Pro BNP	25.0	ng/ml	0.0 - 100
D-Dimers	>5000	ng/ml	0.0 - 500

Method Fluorescence immunoassay

Comments: These assays were performed on the alere Triage meter using Fluorescence immunoassay. Some of the reference ranges and units may differ from the routine methods.

The Exam was scored out of 200 marks with 100 marks reserved for the resuscitation procedure and technique, 70 marks on basic life support and general principles of successful resuscitation and 30 marks on knowledge regarding the specific condition in the simulation. This was based on internal team deliberations for a more comprehensive examination. Feedback about the exam was given immediately afterwards. The score for two examiners were averaged giving a percentage mark. A score between 75% constituted a pass, 85% and above was considered a distinction. For any critical care practitioner, their pass mark was raised to 80% due to the added requirements of their station, again following internal team deliberations on examination format. Those with distinction were made aware and recommended to be resuscitation champions for their respective units. Those who failed were given extensive feedback and asked to re-evaluate, revise, and redo the exam. All received a three-phase debrief to ensure best possible outcomes (21). Participants were allowed to give their feedback on the exam and verify their results. They then proceeded to countersign the same on the examination form to ensure ownership of results.

Re-siting the exam was done based on availability of participants and the examiners, usually within one month after the initial exam to allow the participant to reassess the material, internalize and reach any of the examiners for mentorship and remedial classes.

Outcomes

In this case of 97 examinations, 76 participants showed a first-time success rate of 72% and 24% requiring retakes. A third retake was only required in 4% of all participants. 16% of all participants had distinctions and recommended to be resus champions. The success rates were comparable to industry norms around the country with most achieving 1st time success rates of between 70% and 80% against a purely online format which had approximately 60%[16].

Following the intensive training, the team noted the following from both participants and trainers. Simulation/OSCE setting was appreciated by all applicants as this provided a practical way of assessment and evaluation of their skills. Participants thought the exam was very challenging and required rigorous preparation to successfully complete the assessment. Participants were more comfortable around a resuscitation situation and were much more involved and understood the flow around patient management. Multiple participants were recruited to other specialized areas due to their competency and aptitude for advanced life support including critical care provision. The examiners noted the validity of the exams as per the similarity to most ACLS skills assessment tests done by multiple international accreditation services.

The team also realized that although this may raise challenges in terms of acceptability and inter-transferability of said skills, this presents an avenue for government legislation and oversight that may eventually reduce the barrier to training and offer accreditation of training models.

Resources and costs

With this training model, it was possible to achieve roughly 80% reduction of the training costs required to achieve similar results. The hybrid model proved to avoid most of the costly items required in training including logistics, venues, meals, printing and stationery as well as certification and trainers' costs since in-person interaction was limited. Currently, ACLS certifications cost on average 18,000KSH per participant for an AHA (American Heart Association) equivalent certified center. Even with our truncated model, the lowest AHA certified quote would have been 15,000 KSH per participant. Accounting for simply first round examinations, this would have cost us 1,140,000 KSH for critical staff and approximately 7.5 million KSH when implemented hospital wide. This would have skyrocketed if repeat examinations were required. With the described model, a certification

cost of approximately 3,600 KSH per participant is manageable by most institutions.

In Kenya, county governments spend approximately 0.5-1% of their annual budgets on training[22]. With approximately 189,932 registered healthcare workers in Kenya, 66% of which are in public service[23], the cost to implement ACLS training on a large scale would equate to at least Ksh 0.94 billion shillings annually. This when considered in totality, would take up almost half of all the training budget for all forms of training in the government of Kenya for less than 10% of all civil servants[22,24]. Using the in-house life support training model, an 80% cost reduction would enable realistic and achievable spending by most institutions.

(KEY: at the time of implementation of training, 1 US Dollar was equivalent to 142 KSH)

Conclusions

Despite multiple challenges, the successful implementation of life support skills assessment at Mater Misericordiae Hospital proved that with the right combination of examiners, willingness of participants and support from the administration, in-house, cost effective, and quality life support certification can be done. While this does not offer a direct ACLS / ALS certification replacement, it offers avenues for increased quality provision in a low resource environment while utilizing valuable lessons learned during the Covid Pandemic.

Conflict of Interest:

None

Funding Statement:

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