UNIVERSITY OF CAPE TOWN

A DECADE OF FUNDAMENTALS OF EMERGENCY CARE (FEC) COURSE EVALUATION: UPDATE FROM THE LAST TWO YEARS.

STUDENT: Ilunga Kamembela
MBCHB(UNILU)
University of Cape Town
Supervisor: Ass Prof Peter Hodkinson
PHD EM (UCT)
University of Cape Town
Co-Supervisor: Monique Venter
BTECH EMC (UJ) MPHIL (UCT)
University of Cape Town

This study is in partial fulfilment of the MPHIL EM Degree

DECLARATION

I, ILUNGA KAMEMBELA, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.
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12 February 2024

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FOREWORD

Upon the suggestion of Professor Peter Hodkinson for my dissertation, I delved into the topic of evaluating the Fundamentals of Emergency Care (FEC) course. Initially, I was not keen on exploring this subject matter, but I followed his advice and started reading an article he recommended, which served as a guideline for my research. During that time, there was no published literature available on FEC, even in the grey literature. However, my interest in the subject matter grew as I progressed and learned more about evaluating Advanced Life Support (ALS) courses in developing countries. I realized the need to assess the impact of alternative courses to international ALS on improving emergency care provision in under-equipped countries. What's more, I came to understand that all of the research done so far on evaluating these ASL courses follows the Kirkpatrick model. This realization helped me choose the direction to take for my literature search.

During my research journey, I had the privilege of receiving help and support from many amazing people. To all of them, I would like to express my heartfelt gratitude. Although I can't mention everyone, there are a few people who played a significant role in making this possible. First and foremost, my supervisor, Professor Hodkinson, whose scientific rigor and guidance have been valuable to me. Working with someone of such a high caliber has been a real pleasure, and I believe that if this work will be of some good value, it is largely due to his strict standards. I must also give a special thanks to my co-director, Monique Venter, who showed a remarkable level of commitment and interest in my project. Her contribution, especially regarding the fine-tuning of my research protocol, was truly commendable. Both of them will always have my deepest gratitude. I would like to express my heartfelt appreciation to my younger brother, Marcel Kanda, and my brother-in-law, Papy Kabwe. Despite being outside South Africa, they have served as the two pillars of support that have sustained me financially. I am deeply grateful for their unwavering assistance. Throughout my journey, my wife and children have been an indispensable source of emotional support, akin to the soothing effects of music on the soul. I hold their unwavering support in the highest regard, and I would like to express my sincerest gratitude to them.

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LIST OF ACRONYMS

ABCD	Airway Breathing Circulation
ACLS	Advanced Cardiac Life Support
ACSCOT	American College of Surgeon Committee on Trauma
AEM	American Emergency Medicine (AEM Education and Training)
AHA	American Heart Association
ALS	Advanced Life Support
ALSO	Advanced Life Support in Obstetric
ASSET	Advanced Surgical Skills for Exposure in Trauma
ATAM	AIIM Trauma Assessment and Management
ATLS	Advanced Trauma Life Support
ATOM	Advanced Trauma Operative Management
BEC	Basic Emergency Care
BLS	Basic Life Support
BVM	Bag Valve Mask
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COSESCA	College of Surgeons of Eastern, Central and Southern Africa
CPR	Cardiopulmonary resuscitation
ED	Emergency Department
EFAR	Emergency First Aid Responder
EMS	Emergency Medical Services
EMWT	Emergency Ward Management of Trauma
FEC	Fundamentals of Emergency Care
HBB	Helping Babies Breath
ILICOR	International Liaison Committee on Resuscitation
ILS	Immediate Life Support
KATC	Kampala Advanced Trauma Course
LMIC	Low Middle-Income Country
MBBS	Bachelor of Medicine, Bachelor of Surgery
MCQ	Multiple Choice Question

MIMMS	Major Incident Management and Support
NRP	Neonatal Resuscitation Program
OJT	On-Job Training
OSCE	Objective Structured Clinical Examination
PALS	Paediatric Advanced Life Support
PICO	Population Intervention Control Outcome
PRISMA-ScR	Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
PTC	Primary Trauma Care
RCSA	Resuscitation Council of South Africa
STARTLE	Surgical Techniques and Repairs in Trauma for Low-resource Environment
STEPS	Sequential Trauma Education Program
TEAM	Trauma Evaluation And management
TTT	Trauma Team Training

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PART A. EVALUATIONS OF ALTERNATIVE LIFE SUPPORT COURSES IN LOW AND MIDDLE-INCOME COUNTRIES: A LITERATURE REVIEW

BACKGROUND:

The global burden of disease is disproportionately skewed toward low-middle-income countries (LMICs) (1). Avoidable deaths and disability in this setting often occur due to inappropriate triage, delayed access to emergency care, and referral to dedicated facility (2) . Improved delivery of emergency care in LMICs can be achieved without exorbitant financial investment (3). By implementing simple resuscitation training relevant to LMIC resource availability, it is possible to reduce the mortality and morbidity of critically ill patients in a cost-effective manner (3). Training of health professionals is one of the most significant steps towards achieving improved health outcomes in LMICs (4).

Since the development of life support training courses such as Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), Paediatric Advanced Life Support (PALS), and Advanced Trauma Life Support (ATLS), they have been rapidly adopted by medical organizations as a form of continuing medical education (5). A review of their effectiveness was conducted in 1996 by Jabbour and peers (5). They studied articles published between 1975-1992 and evaluated the impact of such training on patient mortality and morbidity, cognitive and skills gain, and changes in practice behavior among participants (5).

At present, BLS, ACLS, PALS, APLS and ATLS are recognized as global benchmarks for training in resuscitation for adults, children, and trauma cases. These standards are regularly reviewed and updated based on evidence from reputable scientific organizations such as the International Liaison Committee On Resuscitation (ILCOR) and the American Heart Association (AHA).

The implementation of international life support courses in LMICs is hindered by several challenges (6). Firstly, the high cost associated with such courses. Secondly, these courses were designed by and for high income country (HIC) settings and, as such, the applicability of these courses may not be relevant to the differing demographics and resources found in LMICs. Thirdly, due to the differing demographic and setting for which these courses were designed, there may again be poor translation into the LMIC settings in relation to access to healthcare and burden of disease disparities. Lastly, the proprietary nature of international courses requires certified instructors, making them inaccessible to many providers in remote areas of LMICs (6). LMICs can manage this situation by providing adapted emergency care training to equip frontline providers with life-saving skills and help them make the most of available resources (6).

Evaluation of current alternative life support courses that are available and specific to LMICs, and that show similarity in training outcomes to current international courses, may give insight into how improved access to continual medical training can be achieved in order to better equip healthcare workers in low resource settings.

Alternative life support programs for LMICs offer resuscitation training for patients of different ages (adult, child, neonate) and specialized groups such as trauma and obstetric patients. Many such programs are designed based on corresponding international curricula such as: ACLS, PALS, Neonatal Resuscitation Program (NRP) ATLS, and Advanced Life Support in Obstetrics (ALSO). Comprehensive courses like the Fundamentals of Emergency Care (FEC) and Basics of Emergency Care (BEC) have also been developed in LMICs to address all resuscitation fields in one curriculum.

When assessing alternative life support courses, studies can take various approaches. Some may concentrate on participants or facilitators to evaluate knowledge or skill gain or gather recipients' opinions on the course. These assessments can be done before, after, or at a follow-up stage. Other studies may focus on patient outcomes, assessing whether the training course reduces mortality or morbidity. A comprehensive study would ideally include multiple evaluations.

SEARCH STRATEGY

This literature search was guided by a research question formulated using PICO: ” Concerning the evaluations of life support courses in low and middle-income countries, are alternative courses as effective as international standards for emergency care?”. The search was done following the PRISMA-ScR guidelines for systematic reviews. Several databases including Web of Sciences, PubMed, and CINAHL were searched to find articles related to evaluation of alternative life support courses/training in LMICs, as well as Emergency Medicine publications like the African Journal of Emergency Medicine, American Journal of Emergency Medicine, International Journal of Emergency Medicine, AEM Education and Training, and Journal of Education & Teaching in Emergency Medicine. Additionally, the author searched the grey literature using PROQUEST and OPEN UCT to find any unpublished dissertation or report on FEC. The search was conducted for any study published after January 2000 until August 2023.

In order to conduct a comprehensive search for relevant literature, specific search terms were utilized. A Boolean search was conducted in esteemed databases and journals mentioned above (Web of Sciences, PubMed, African Journal of Emergency Medicine, etc.) using the search terms "(Advanced Life support OR resuscitation training) AND (alternative course OR modified training) AND (Low and Middle-Income Country OR Developing country)" This initial search yielded a wealth of works on alternative life support courses in LMICs including BEC and PTC. However, due to the absence of specific works addressing the FEC course in these conventional sources, an additional search was conducted in Grey literature (PROQUEST & OPEN UCT) using the keywords "Fundamentals of Emergency Care OR FEC" to ensure that no FEC publication was overlooked

An initial title review was performed, with relevant articles, that met the inclusion criteria, saved for abstract review. Duplicate entries were removed prior to performing the abstract review.

After that, articles were categorized into different groups based on their research focus (such as knowledge gain, skill gain, patient outcomes, etc.) before proceeding with a thorough full-text reading. Both English and French articles that relate to the evaluation of alternative life support training in a LMIC (as classified by the World Bank's 2018 income level report) were included. Studies that focused on cost-effectiveness or need assessment, as well as studies evaluating training lasting more than 7 days, were excluded. Additionally, any records that did not provide access to full-text were not considered for evaluation. The search was led from February 2023 to August 2023.

A total of 7484 articles, of which 5317 articles were found to be duplicates and subsequently excluded prior to the title review, were identified. A title review was performed on the remaining 2167 articles, of which 57 articles were found to be relevant and were included for abstract review. After further review for relevancy, a further 21 articles were excluded. A total of 36 studies were included in our review.

QUALITY OF SUPPORTING EVIDENCE

In the realm of healthcare, the efficacy of an intervention is assessed based on the type of research that underpins it (7). The Cochrane guideline advocates for the use of Grading of Recommendations, Assessment, Development and Evaluation (GRADE) as a tool to evaluate the robustness of the evidence provided by a given intervention (7). This tool sorts research types in descending order of strength as follows: systematic reviews, randomized studies, non-randomized studies, case report studies, qualitative studies, and expert opinions.

When it comes to educational/training interventions in LMICs, it is exceedingly difficult to identify research organized as randomized trials with a control group. The majority of the studies enumerated in this review are non-randomized and predominantly retrospective studies. For this type of assessment, Kirkpatrick (8) devised a model for level of evidence with four options of evaluation (see Table 1) .

Tab 1 Level of evidence on Kirkpatrick model

Kirkpatrick Level	Evaluation of alternative courses	Measure	Level of evidence
Level 1: reaction	Self-reported appraisal (providers)	Survey	Very Low
Level 2: Learning	Cognitive/knowledge (providers)	MCQ	Low
Level 3: behavior	Psychomotor/skills (providers)	OSCE	Moderate
Levels 4: results	-Outcomes (patients) -Combined evaluation (e.g. cognitive + skills)	-Mortality rate - MCQ+OSCE	Strong

The model is adopted in this review to evaluate the strength of evidence presented in each study. Studies that measured changes in participants' perceptions are classified as level 1 and have very low evidence. Studies that measured changes in knowledge of participants are classified as level 2 and bear low evidence. Level 3 studies evaluate changes in psychomotor skills and are considered moderate evidence. Level 4 studies evaluate changes in outcomes and provide strong evidence. Studies are also considered of strong evidence when they combine two or more options of Kirkpatrick model irrespective of the level of evidence of each singular option.

This review found that a significant number of studies (n=17, 61.2%) used combined evaluations of the Kirkpatrick model to support the effectiveness of these courses in developing countries. These evaluations provide level 4 evidence, which is beneficial. Four studies were identified that evaluated patient outcomes (level 4 of evidence).Only three studies focused on cognitive gain alone (level 2 of evidence). On the other hand, six studies evaluated the psychomotor benefit of alternative life support courses (level 3 of evidence), and eight studies conducted self-reported evaluations (level 1 of evidence).

The size of the sample is another crucial factor that indicates the strength of the evidence presented. This review revealed that a majority of the studies were single-centered and featured a sample size of fewer than 250 participants. Nonetheless, a few multicenter or multinational studies were identified that showcased a considerable number of participants.

Lastly, the profile of the population under study is another important factor in determining the generalizability of research outcomes. This review revealed that hospital-based studies were the norm, with few investigations conducted on the impact of alternative life support courses on prehospital practice. This limitation impedes the generalizability of findings to other settings. Nevertheless, the studies included a diverse range of healthcare professionals, from medical trainees to resident specialists, nurses, and medical assistants. Only a minority of the studies focused on a single category of professionals.

Table 2 A Summary of the review

Study	Type of study	Type of evaluation	Participants/Providers	Measured outcomes	Results
Hashmi et al. 2013	Before-and- after Intervention study.	Patient outcome (Adults with blunt or penetrating injury)	Unknown (retrospective study)	Mortality rate, occurrence of any complication.	Reduction of deaths and complications after intervention.
Elbaih et al.2022	Before and-after intervention study	Patient outcomes (polytrauma cases)	Unknown (retrospective study)	Incidence of missed injuries	Clinically significant (but not statistically) reduction of the incidence of missed injuries
Sodhi et al.2011	Before-and-after Intervention study	Patient outcomes(Patients with cardiac arrest)	Unknown (retrospective study)	Rate of ROSC, number of survival at discharge	Improvement of the rate of ROSC and survival at discharge after ACLS training after intervention of ACLS.
Petroze et al. 2015	Before-and-after Intervention study	Patient outcomes (injured patients)	Faculty surgeons, nurses, and residents (prospective study)	Mortality rate	Statistically significant reduction of mortality after interventions
Nilsson et al. 2014	Controlled trial	Skills acquisition (management of post-partum hemorrhage)	None Specified	A score of skills performance based on structured observation of a standard scenario.	No difference was noted in the improvement of the scores of performance in post-partum hemorrhagemanagement between participants trained using formal interactive hand-on training and those trained by mean of non-interactive video-based training
Sankar et al. 2019	Controlled trial	Skill acquisition	PALS certified VS non-PALS certified providers	Incidence of medication fallacies during CPR	Reduction of the incidence of medication fallacies duringCP after the implementation of structured training.
Meaney et al. 2012	Prospective randomized trial	Skill acquisition and retention.	None Specified.	Rate of high-quality CPR	Excellent skills acquisitionwith both instruction strategies with no significant different between the CPR-instructor led groups, the limited-instructor group with manikin and the self-learning group . Skill attrition over time.
Kong et al. 2015	Prospective observational study	Skill acquisition (simulation evaluation)	Junior doctors (ATLS certified VS non-ATLS certified)	Rate of safeselection of the insertion of the intercostal chest drain	Improved rate of selection of the safe area to insertthe tube after the training.
Kong et al.2018	Prospective observational study	Skill acquisition (simulation evaluation)	Junior doctors (ATLS certified VS non-ATLS certified)	Rate of safeselection of the insertion of the Central Catheter Vein	Improved rate of selection of the safe area to insertcatheter after the training.
Lima et al.2009	Cross-sectional study	Impact of participants' background on knowledge acquisition	Nursing professionals	Pre and post-training scores of MCQ test, analysis of subgroups based on demographic, social and educational background)	Gain in CPR knowledge was noted in all professional categoriesafter training with limited influence of educationaland social background.
Ali et al.1994	Observational study	Combined evaluation of knowledge acquisition and self-reported impact of the course.	Unspecified	Pre and post- training scores of MCQ test, post-course survey.	Knowledge incrementafter the course & positiveappraisal of the course.
Alenyo etal. 2018	Observational study	Knowledge acquisition in Triage SIEVE.	Paramedics of different level(BLS,ILS & ALS).	Vignettes MCQ(pre and post-training scores). Analysis of subgroups (BLS, ILS & ALS).	Increased knowledge in SIEVE triage of mass casualtiesafter the MIMMS training with better uptakeamong paramedics with ATLS background.
Berndtson et al. 2019	Cases report study	Combined evaluation of knowledge acquisition & Retention, and self-reported relevance.	Medical trainees (Ghana vs USA).	Scores of MCQ at pre, immediate post-training period and at 6-month intervals,post-course survey.	Substantial knowledge gain immediately after the courses in both groups with better retention forthe Ghanian group atfollow up stage. Positive appraisal of the course relevance by both groups but with divergent reported barriers.
Sun et al.2012	Observational study	Evaluation of cognitive and competence gain.	First aid bystanders	None specified?	Competency gained bybystanders after the training with good knowledge retention.
Ben-Abram et al. 2000	Observational study	Evaluation of self-reported impact of the course	General pediatricians	Post-training survey	Feeling of enhancement of knowledge and skills by participants.
Ullrich et al. 2020	Observational study	Evaluation of self-reported impact of the course		Post-training survey	The majority of participants gained more confidence in execution and teaching critical skills.
Anderson et al. 2018	Observational study	Combined evaluation of cognitive and self-reported perception of course impact	Intern (first tiers) and middle-level surgical trainee(second tiers)	Pre and post-training MCQ survey immediately and after an interval of time.	Post-training cognitive gain as compared to the pre-training baseline forboth participants to the ED tiers and surgical tiers. Positive self-reported confidence and competence after the course in both the tiers.
Ologunde et al. 2017	Observational study	Evaluation of self-reported perceptionof course impact	Providers of all levels (doctors, nurses, medicalofficers, medical students)	Post-trainingsurvey immediately after and at 6-months follow up	Participants had positive perception of the impact of the course in their practice.
Wanjiku et al. 2017	Observational study	Combined evaluation before, immediately after, and at 9-month follow-up of cognitive,skills and self-reported impact.	Unspecified	MCQ, Simulation test and survey	Significant improvement of knowledge, skills and self-rated confidence after the training and sustained over time.
Tenner et al. 2019	Observational study	Combined evaluation of cognitive and self-reported appraisal	Facilitators and providers of all qualifications	Pre and post-training MCQ and post-training Survey.	Knowledge gain Increase confidence in emergency care Respondents found the course appropriate to their settings
Babu et al.2021	Observational study	Combined evaluation of cognitive and self-reported appraisal	Doctors, nurses, and paramedics.	Pre and post-training MCQ test and self-rated acquisition of knowledge, skill and confidence	Increased knowledge score after training. Positive appraisal of the course
Soomro et al. 2020	Observational study	Combined evaluation of cognitive and self-reported appraisal of the course presentation, content, and relevance.	MCQ test at different point-time Post-training survey (dispensed to participants and instructors)		
Hill et al. 2018	Observational study	Combined evaluation of cognitive and self-reported appraisal	Final-year medical students	Pre and post-training MCQ test Post-course formative survey consisting of narrative feedback administered to participants and instructors)	Knowledge gained in post-training and positive appraisal of the course
Saramma et al. 2016	Observational study	Combined evaluation of	Nurses	Biphasic: phase 1: pre and post-training knowledge test	Both sections, ED & operative, demonstrated cognitive gain andhad

Study	Type of study	Type of evaluation	Participants/Providers	Measured outcomes	Results
		cognitive and skills retention/attrition		(objective-type items) of the studied population + skillsperformance test (using a checklist to score observed demonstration) Phase 2: semi-structured interview done 6 months late to evaluate knowledge retention and self-reported performance of available certifiednurses from the first phase versus a control group made of uncertified experimented nurses.	positive appraisal of the training course.
Muzzammil et al. 2021	Observational study	Combined evaluation of cognitive and self-reported matrix rating	Medical students, doctors, house officers, residents, and paramedics.	Pre and post-training MCQ test and Matrix Confidence Rating.	Increased knowledge score and confidence matrix after the training course.
Aboutanos et al. 2007	Observational study	Combined evaluation of cognitive and skills gain	Unspecified participants	Pre and post-training MCQ test Post-training OSCE	Improved knowledge andskills after the training
Tollpa et al.2020	Observational study	Combined evaluation of Knowledge, matrix confidence gain and retention, Self-reported impact	Nurses & doctors	Pre, post-training and follow up (at 12, 16 and 24 months) MCQ test,confidence matrix test. Structured questionnaire administered at follow up.	Knowledge gained after training with a certain degree of attrition overtime & increased confidence in trauma care after training.
Plessis et al. 2022	Observational study	Combined evaluation of self-reported confidence& knowledge (correlation with qualification background and CPR training exposure)	Mostly registrars/consultants	MCQ & Survey	The study detected that most providers had poor background in CPR training and low exposure to refresher with lower baseline knowledge.
Mock et al. 2005	Observation study	Combined evaluation of Skill acquisition and self-reported course rating.	General practitioners	Pre and post- training MCQ, post-training survey, interview follow up at 1 year interval(foravailable participants)	Cognitive gain after the course. Feeling comfortable in number of surgical procedures with few area Requiring reinforcement.
Umuhoza et al. 2021	Observational study	Combined evaluation of knowledge and skills acquisition and attrition overtime,Self-reported appraisal	Paediatric nurses	MCQ test at Pre,post- and follow up training period. Observation of skills performance at pre, post and follow up training period.	Attrition of knowledge and skills gained in CPR after training was demonstrated.
Delgado et al. 2016	Observational study	Combined evaluation of knowledge and self-reported satisfaction.	Medical trainee (basic students versus clinical students).	Pre and post-training MCQ test. Post-course survey.	Increased knowledge scoreafter the training with basic students being better off than the clinical students. Positive appraisalof the course by the majority of students.
Bhat et al.1993	Observational study	Combined evaluation of Knowledge, skillsgain and self-reported appraisal	Final-year undergraduate students (shorten training versus formal 3-days courses).	Pre and post-training MCQ test, skills demonstration on manikin and Post-course survey.	No difference in the score of knowledge gained between participants exposed to a one-day neonatal resuscitation course and the formal 3- day training. Good skills acquisition in the two groups. Participants reported as the most relevant aspect of the courses, the recognition of high risk neonates, the correct resuscitation technique and the appropriate selection of drugs.
WA Carlo et al. 2010	Before-and-after study	Evaluation of patient outcomes (7 days mortality of newborns, perinatal mortality rate, rateof neurologic abnormality, rate of APGAR less than 4 at1 and 5 minutes)	Rural communities' birth attendants (traditional birth attendants, midwives, nurses and physicians).	Phase 1: pre and post-ENC patient outcomes Phase 2: patients outcomes for NRP-clusters VS control-clusters (random allocation)	No significant change in the reduction of 7-daysmortality rate of newborn after the implementation of ENC but reduction of rate of stillbirths, decrease of the proportion of neurologic sequella and ofbabies with APGAR<4 at 5 minutes. The implementation of NRP did not add value to ENC in term of patient outcomes.
M. Drake et al. 2019	Observational study	Evaluation of skill retention (immediate post- training to 4-6 week follow up): initialapproach (with self- initiated practice for skills maintenance) versus modified approach (with OJT implemented at the workplace to maintain skill)	Nurses/midwives, medical attendants (semi- trained) Clinicians (medical officers, clinical officers, assistant medical officers).	Immediate post-training and 3-4 weeks follow up OSCE.	After HBB training, better long term retention of skills was observed among participants exposed to an On-Job skills maintenance through practice on mannequin utilising a user friend guide than the group encouraged to a self-initiated skills maintenance throughpractice on mannequin without user guide
Hoban et al. 2013	Observational study	Combined evaluation of cognitive, skills and self-reported feedback.	Physicians, Nurses & Midwives.	Pre and post-training MCQ Post-training BVM skill assessment using a 7-items checklist. Survey questionnaire	Cognitive gain in post-training period withoutsignificant difference between professional categories. Skills gained did not correlate with the cognitive gain Positive self-reports of the course.
Kurdin et al. 2017	Observational study	Self-reported opinions evaluation.	Physicians, Nurses, Emergency medical technician, medical trainees.	Post-training survey	Satisfaction of participants.

Note: ***Most studies examining alternative life support courses for low- and middle-income countries have been observational. They have involved participants from various medical professions and have mostly looked at the effectiveness of these courses using combined elements of evaluation as pertained to the Kirkpatrick model***.

TREND OF STUDIES EVALUATING ALTERNATIVE LIFE SUPPORT COURSES IN LMICs

The majority (n=23, 62%) of studies published on the evaluation of alternative life support courses in LMICs, addressed trauma resuscitation (ATLS-like courses). Second to this were studies on adult resuscitation (ACLS-like) courses(n=5, 13.5%). The remaining studies looked at paediatric (PALS-like)courses (n=2, 5.4%) and neonatal resuscitation (NRP-like) courses (n=4, 10.8%) respectively, with all-in-one courses evaluated in a single study (2.7%), and resuscitation in special populations in 2 (5.4%) studies . The trend of studies on the evaluation of alternative life support courses in LMIC is depicted in Fig 1.

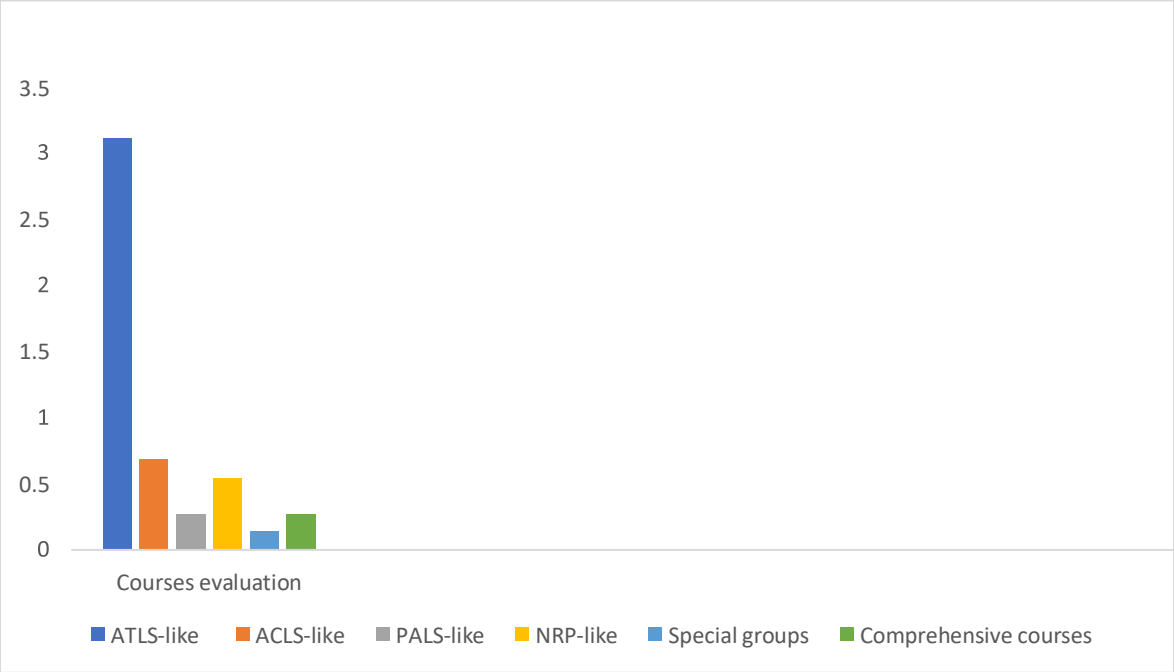

Figure 1 Trend of types of studies evaluating alternative courses in LMICs

SUMMARY OF EVIDENCE

Table 2 A and Table 2 B summarizes the results of this literature review. Studies evaluating alternativelife support courses in developing countries have involved virtually all the regions of concern , with a large bulk of the reports in Africa, from Central Africa (9) to Southern Africa (10), passing through Eastern Africa (11) and touching also North Africa (12), without leaving aside Asia (13) and the countries of Latin and Central America (14, 15). Some studies have even been multinational, involving more than one country (6).

Table 2 B Summary of the review

Study	Country	Study setting	Type of training
Hashmi etal. 2013	Pakistan	Hospital-based	Trauma resuscitation (adapted ATLS)
Elbaih et al.2022	Egypt	Hospital-based	Trauma resuscitation(STEP)
Sodhi et al.2011	India	Hospital-based	Adult resuscitation (ACLS-like course)
Petroze et al. 2015	Rwanda	Hospital-based	Trauma resuscitation (adapted-ATLS, adapted-TTT)
Nilsson et al. 2014	Kenya	Hospital-based	Obstetrical resuscitation(ASLO)
Sankar et al. 2019	India	Hospital-based	Pediatric resuscitation
Meaney et al. 2012	Botswana	Unspecified setting	CPR: instructor-led vs self-learning group
Kong et al 2015	South Africa	Hospital-based	Trauma resuscitation (ATLS)
Kong et al.2018	South Africa	Hospital-based	Trauma resuscitation(ATLS)
Lima et al.2009	Brazil	Hospital-based	CPR training
Ali et al.1994	Trinidad	Unspecified study setting	Trauma resuscitation (ATLS)
Alenyo et al. 2018	South Africa	Prehospital setting(on scene)	Major incidentsresuscitation (MIMMS)
Berndtson et al. 2019	Multinational	Hospital-based	Trauma resuscitation(TEAM)
Sun et al.201	South Africa	Prehospital setting	Trauma resuscitation (EFFAR)
Ben-Abramet al. 2000	Israel	Hospital-based	Trauma resuscitation(ATLS)
Ullrich etal. 2020	Uganda	Unspecified study setting	Trauma resuscitation (KATS)
Anderson et al. 2018	Uganda	Hospital-based	Trauma resuscitation
Ologunde et al. 2017	Multinational	Unspecified studysetting	Trauma resuscitation (PTC)
Wanjiku etal. 2017	Kenya	Unspecified study setting	Trauma resuscitation(ATLS)
Tenner et al. 2019	Multinational	All setting	All-in-one Resuscitation course (BEC)
Babu et al.2021	India	All setting	Trauma Resuscitation (ATAM)
Soomro et al. 2020	Pakistan	Hospital-based	Trauma Resuscitation (TEAM)
Hill et al.2018	Kenya	Hospital-based	Trauma Resuscitation (TEAM)

Saramma et al. 2016	India	Hospital-based	Adult resuscitation (BLS and ACLS)
Muzzammil et al. 2021	Pakistan	All settings	Trauma resuscitation (PTC)
Aboutanoset al. 2007	Ecuador	All settings	Trauma resuscitation
Tollpa et al.2020	DRCongo	Health centres and hospital settings	Trauma resuscitation (PTC)
Plessis etal. 2022	South Africa	Hospital-based	CPR (adult,pediatric, neonatal & obstetrical)
Mock et al.2005	Ghana	Hospital-based	Trauma resuscitation
Umuhoza et al. 2021	Rwanda	Hospital-based	Pediatric resuscitation
Delgado etal. 2016	Mexico	Hospital-based	Trauma resuscitation (TEAM)
Bhat et al.1993	India	Hospital-based	Neonatal resuscitation
WA Carlo et al. 2010	Multinational	Hospital-based	Neonatal resuscitation
M. Drake etal. 2019	Tanzania	Hospital-based	Neonatal resuscitation(HBB)
Hoban etal. 2013	Ethiopia	Hospital-based	Neonatal resuscitation(HBB)
Kurdin etal. 2017	Haiti	All settings	Trauma resuscitation (TEAM)

Note: *Studies assessing alternative life support courses in developing nations have been carried out worldwide, mainly within hospital settings, with a significant emphasis on trauma programs.*

The studies were mostly observational, such as the works of Kong et al (16), Lima et al (17), and looked mainly at the gain in knowledge or skill by the courses' participants, or their self-reported appraisal. There have been some control trials such as Sankar (18) and Meaney's studies (19). Few observational studies called before-and-after study looked at registries to see the outcomes of patients before and after providers' exposure to the courses under evaluation (20, 21).

The majority of studies were hospital-based. Few studies were interested in prehospital settings such as the evaluation of Saramma et al (22). Nevertheless, all professional strata have been h involved in these evaluations, and some studies have even looked at medical trainee performance after taking an alternative life support course such as the study of Hill et al (23). As mentioned above, evaluation of trauma studies has dominated the trend (see details below). In terms of their results, all these studies were positive either in terms of patient outcomes, or in terms of participants' gain in knowledge, skill or confidence/perception.

STUDIES EVALUATING ATLS-LIKE COURSES

Most studies evaluating the impact of ATLS-like courses training on patient outcomes in LMICs were designed as before-and-after intervention studies. In Pakistan, a study found that an Advanced Trauma Life Support Course training program resulted in a decrease in trauma-related deaths and complications (20).

Researchers in Egypt found that the Sequential Trauma Education Program (STEPS) helped decrease missed injuries from 12% to 9% in a study (12). STEPS is a useful alternative to ATLS for trauma patients in under-resourced settings. The course may improve physical exams, diagnostic workup, and imaging interpretation. However, missing data records may have biased the results.

A study in Rwanda, carried out by Petroze et al (4), evaluated the impact of the Trauma Team Training (TTT) course on patient outcomes using a collaborative injury registry. The study found a significant reduction in mortality rates after the training courses (8.77% vs. 6.26%, P-value: 0.009; OR 0.69 CI: 0.46-1.05), particularly in patients with higher Glasgow Coma Scale(GCS) scores. Confounding factors must be considered. The distribution of patients before and after the intervention was not fair in terms of severity, which could have affected the results. There was also a discrepancy in the use of diagnostic resources, which might have impacted mortality. It's unclear whether this was due to a more efficient use of resources after training or simply based on the cost of diagnostic resources like CT-Scan, as the mutual health insurance in Rwanda only covers a limited portion of services. Lastly, claiming that a single-session TTT course would significantly change the medical culture of practitioners in this institution may be presumptuous.

The largest body of evidence on the impact of ATLS-like courses, on participants (providers) in LMICs, derived from studies that used combined approaches to the evaluation. A study conducted by Berndtson et al. (24), compared the acquisition and retention of knowledge on Trauma Evaluation And Management (TEAM) between medical trainees from the United States of America and Ghana. Both groups had a pre and post-course test, with the same test at 6-month intervals. The American group demonstrated a decrease in knowledge retention, while the Ghanaian students had appreciable retention of the acquired knowledge. Both groups had a positive appraisal of the course's relevance, although they faced different barriers (24).

A study in Trinidad found that an ATLS-like course improved trauma care providers' knowledge and attitudes (25). The course resulted in faster interventions, increased confidence, and decreased mortality and morbidity. All respondents recommended it for emergency physicians (25) .

Researchers from Uganda developed a curriculum for trauma training in low to middle-income countries (26). The training program includes an emergency ward management section and a surgical section. The results showed a significant improvement in knowledge-based test scores and participants reported feeling more comfortable in operative skills after the course. This perception was maintained over one month, two months, and one year (26).

Wanjiku et al. (27) evaluated a modified version of ATLS for under-resourced settings in Kenya. The study found that the course significantly improved interns' knowledge, skills, and confidence, and the progress was sustained even after 9 months (27).

In a multicenter study, Abu et al. (28) evaluated the impact of the AII Trauma Assessment and Management(ATAM) course on managing injured patients. The study found a significant improvement in participants' knowledge post-training. The majority of participants reported positive feedback on the course's relevance, content, and presentation (28).

Trauma Evaluation and management (TEAM) is considered as a concise alternative to ATLS created to address the concern that the skills taught in ATLS are at a level too high for undergraduate students (29). An assessment was conducted on the impact of TEAM in the curriculum for 4th-year MBBS students in Pakistan, which showed that students who were tested after the TEAM workshops had significantly higher scores than those who were evaluated before the workshops (9 vs 7 $P<0.000$) (29). A post-course survey also indicated that most recipients had a positive appreciation of the course content, presentation, and relevance (29).

Hill et al. (23) conducted a study in Kenya evaluating the TEAM course's impact on 61 final-year medical students. Pre and post-course MCQ test showed a significant increase in knowledge ($P<0.001$). Feedback from both students and instructors was positive, with interactive teaching and small group demonstrations being the most approved aspects of the course (23).

Delgado et al. (15) conducted a study evaluating the impact of TEAM on medical students in Mexico who had not taken an ATLS-like course before. The study showed an improvement in the knowledge score in the post-course test compared to the pre-course test. The survey results showed that most students strongly agreed that the objectives of the course were achieved, their knowledge of trauma was improved, skills in trauma were improved, and they were satisfied with the TEAM course (15).

A study in Pakistan tested the effectiveness of the Primary Trauma Care (PTC) courses in trauma care (30). The study involved medical students, doctors, house officers, residents, and paramedics. The courses included lectures, workshops, and discussions on trauma scenarios. Results showed a significant increase in knowledge score and confidence matrix among participants from pre-course to post-course assessment (30).

In Ecuador, a 3-day basic trauma course was conducted for rural physicians (31). The course included lectures and practical sessions on topics like EMS, burns, and snakebites. The knowledge and skills gained were evaluated through a MCQ test, an OSCE, and a Likert scale-based course evaluation. The results showed a significant improvement in the MCQ test scores, particularly in head, abdominal, and pelvic injury topics. However, prehospital communication and the secondary survey were found to be inadequate(31).

In 2016, Global Health partnered with the Ministry of Health to introduce the PTC course in Kongo Central, DR Congo, to enhance the region's trauma care capacity (9). A study evaluated the effectiveness and retention of knowledge of healthcare providers who participated in the PTC courses (9). The mean MCQ score showed a significant improvement from pre to post-course. The majority of participants recommended PTC training for their setting (9).

A trauma training course was created at Kwame Nkrumah University to provide general practitioners in rural hospitals in Ghana with the necessary skills and knowledge for initial stabilization and definitive care (32). The course covered initial assessment, stabilization, diagnostic procedures, and surgical skills that could be performed safely by general practitioners (32). Pre and post-course tests were administered, and knowledge scores improved from 69% to 80% after the course (32). Follow-up interviews showed that participants had improved in all aspects of trauma care and had performed more procedures since completing the course. The study had some limitations, and the participants suggested having more practical sessions, fewer lectures, and a longer course duration with more emphasis on orthopedics (32).

Two studies conducted by Kong et al. (10, 16) in South Africa focused on the impact of ATLS training on the ability of junior doctors to identify safe anatomical sites for two major emergency procedures. Providers with ATLS training were significantly more competent in accurately identifying safe sites for intercostal chest drain and central venous catheter insertion compared to those without prior ATLS training.

Several studies were conducted with the sole objective of collecting self-reported opinions from participants. A study in Israel involved a survey of general pediatricians who had completed an ATLS-like course. According to the survey results, the recipients believed that their knowledge and practical performance of trauma care had significantly improved after completing the course(33).

A survey assessed the impact of Kampala Advanced Trauma Course (KATC) training on skill acquisition in Tanzania. (34). Some 106 trainees reported increased confidence in critical skills like airway and shock management. Inadequate equipment and staffing were reported as barriers to providing adequate trauma care. Limitations of the study include the subjective nature of the survey and potential bias due to the time elapsed between the course and the survey (the KATS course attendees from 2013-2016 received a survey one to three years later (34).

A study was conducted to evaluate the relevance of Primary Trauma Care (PTC) that has been implemented in Eastern, Central, and Southern Africa since 2012, through a collaboration between the University of Oxford and the College of Surgeons of Eastern, Central, and Southern Africa (COSESCA) (35). From 2012 to 2016, the investigators trained local instructors, coached new instructors, and evaluated the self-perceived impact of a PTC course on trauma patient management. Over 2000 providers participated in 10 courses across 10 countries.

The investigators administered post-course surveys online to 451 participants immediately after the course and to 351 participants 6 months later. Participants reported improved patient management and reduced mortality (35).

A survey, conducted in Haiti, tested the effectiveness of TEAM for practicing medical professionals rather than on trainees like previous studies (14). Most participants gave satisfactory scores to the course, with suggestions for improvements related to translation, presentations, videos, hands-on practice, and written handouts (14).

In overall, ATLS-like training courses in Low and Middle-Income Countries (LMICs) have been evaluated using different tiers of the Kirkpatrick model. A large portion of these evaluations falls in the category of combined evaluation, which provides a level 4 of evidence. Studies have shown a decrease in trauma-related deaths and complications. The participants have demonstrated improved knowledge retention, faster interventions, and increased confidence. The studies conducted encompassed diverse professionals, with a predominant focus on those working in hospitals.

STUDIES EVALUATING ACLS-LIKE COURSES

The evaluation of ACLS-like courses in LMICs tend to focus on how training in these courses affects the performance of CPR. A study in India found that implementing an ACLS-training program led to significant improvements in the rate of Return Of Spontaneous Circulation (ROSC) and the number of patients surviving to discharge (21).

A study in India evaluated the effects of a certified CPR training program on nurses (22). Results showed significant improvement in knowledge scores, but advanced life support skills decayed over time. Retraining was necessary, and yearly CPR training was recommended. There was no significant difference between certified and non-certified nurses in self-reported CPR performance, except for adherence to the 2010 AHA guideline (22).

A study at a South African hospital found that while most medical professionals had received CPR training, few had undergone recent retraining or had frequent exposure to CPR (36). Confidence in performing CPR varied, and only a small percentage achieved a high score on a CPR knowledge test (36).

A study in Botswana compared three groups of healthcare providers for CPR training using different training techniques(19). All groups showed good results immediately after the training, but skill remediation was necessary over time. There was no significant difference in CPR performance between the instruction methods used (19).

A study in Brazil analyzed how demographic, social, and educational backgrounds influence nursing professionals' CPR knowledge (17). Results showed that training significantly improved knowledge regardless of background, but those who completed their degree a long time ago or had a high social load performed poorly in pre-training tests. Regular practice and refresher courses are essential to improve performance (17).

To sum up, the assessment of ACLS-type courses in low- and middle-income countries primarily emphasized the development of skills in cardiopulmonary resuscitation (CPR). The studies included all types of healthcare professionals, although nurses were the majority, and were conducted in hospital settings. The findings indicate that training in these courses enhances the performance of CPR. Nevertheless, it is crucial to provide regular retraining to healthcare providers since advanced life support abilities tend to decay over time.

STUDIES EVALUATING PAEDIATRIC COURSES

Umuhoza and colleagues (37) evaluated the knowledge and skills of paediatric nurses in resuscitation . The nurses received a course in basic life support adapted to their setting. There was a significant improvement in knowledge and CPR skills immediately after the training. However, both knowledge and skills declined over time, suggesting the need for refresher trainings.(37).

A study conducted in India showed that a structured training program for healthcare providers significantly reduced medication errors during CPR among paediatric patients (18). The rate of medication errors decreased from 20% to 0%, with even better outcomes for providers certified in PALS-like course (18).

In conclusion, few studies have been published on paediatric courses. They were limited to the assessment of skill or knowledge. They indicate that training improves knowledge and skill, but that the level of providers should be maintained with refresher courses.

STUDIES EVALUATING NEONATAL COURSES

A multinational before-and-after study was carried out in six low and middle-income countries to evaluate the effect of training rural communities' birth attendants in Essential Newborn Care and modified Neonatal Resuscitation Program (NRP) on reducing newborn deaths (38). The study found that Essential Newborn Care training is effective by itself and that NRP training does not improve patient's outcomes further. Additionally, subgroup analysis showed that nurses, midwives, and traditional attendants demonstrated a reduction in stillbirths after the course intervention (38).

A study in India compared a one-day modified neonatal advanced life support course to a formal 3-day course (13). The results showed no significant difference in the post-test between the two groups, and participants of the shorter course reported it as adequate. The study supports the idea of alternate neonatal life support courses for under-resourced settings (13).

In 2010, a national HBB (Helping Babies Breathe) training was conducted in Ethiopia (39). Participants were a mix of physicians, nurses, and midwives from NGO and government sectors. The training significantly improved the knowledge and skills of participants in newborn resuscitation, with an increase in mean knowledge score from 7/10 to 9.4/10. Participants also expressed a high level of satisfaction with the course (39).

A Tanzanian study in 2019 introduced the HBB program in various facilities (11). Participants were trained and provided with equipment and learning materials. An On-Job-Training (OJT) tool was introduced at the workplace to improve skills retention. The study showed that different training approaches can enhance skills retention despite attrition(11).

In conclusion, the evaluations of neonatal training courses in the developing countries have focused on the test of knowledge and the assessment of the skill acquired by the participants but also on the outcomes of the patients. The results are encouraging and show that these alternative courses are effective in this setting.

STUDIES EVALUATING COMPREHENSIVE COURSES

As comprehensive courses, the review detected a publication on the Basics of Emergency Care (BEC) by Tenner et al. (6)The BEC course is an initiative of the World Health Organization and covers the essential of knowledge and practices required in emergency care for a frontline providers in under-resourced setting (40). The authors conducted a pilot implementation of the course in three Eastern African countries. The study involved surveying the facilitators and participants after the newly trained facilitators taught the course to local participants. The post-course survey indicated that the majority of recipients had increased confidence in emergency care. The knowledge test showed a significant improvement in the post-course test(6).

DISCUSSION

TYPES OF RESUSCITATION COURSES EVALUATED

The review showed that research on the evaluation of alternative life support courses in LMICs is disproportionally skewed toward the trauma resuscitation field. Injuries are counted among the leading cause of death in developing countries (41). Deaths and disabilities due to trauma injuries heavily affect LMICs where the availability of appropriate emergency services and specialized trauma units are disparately missing (4). In the sub-Saharan region, for example, with the growth of motorization, the current projection indicates that the burden of deaths and disability due to injury trauma will keep increasing in the region (35). If developing countries could reduce fatalities from traumatic injuries to the level of high-income countries, up to 1.9 million lives could be saved annually (34). One cost-effective manner to achieve this target is trauma education for frontline providers in LMICs.

The WHO recommends short and resource-adapted trauma courses as an efficient way to upskill providers from LMICs in managing injured patients (27). The present review suggests that short training trauma courses other than the standard ATLS are well-contextualized for LMICs and can improve trauma knowledge and skills of providers in LMICs, leading to more lives saved.

It must be noted however that emergency care training in LMICs should not solely focus on the rise of trauma illnesses, which are reaching epidemic levels. Neglecting maternal and child conditions, which still bear the largest burden of disease in these regions, is unacceptable. Unfortunately, life support courses developed for under-resourced areas have failed to adequately address these pressing issues. Our review revealed only one study on obstetric resuscitation, which covered a small aspect of the field (managing post-partum hemorrhage) (42).

Research has not given enough attention to the resuscitation of children and newborns in developing countries, despite these countries having the highest incidence of life-threatening paediatric diseases. Sadly, many children in these nations are dying due to severe infections and shock (43). Only two works in our review have addressed PALS-like courses.

Training in newborn resuscitation is a crucial emergency care aspect for LMICs. However, its evaluation has been insufficiently researched. A significant number of child deaths in LMICs occur in infants under one month old. Asphyxia is a common cause of death in newborns in these countries, yet it can be prevented with basic resuscitation techniques that do not require advanced resources. Therefore, it is essential to improve the capacity of neonatal resuscitation through training to reduce infant mortality rates in low-resource areas (11). Our review has found that neonatal courses have been evaluated in a limited number of studies..

Hopefully, newly emerging comprehensive courses will mitigate the limitation in coverage of disease burden by the proposed alternative life support courses for LMICs. Our review identified BEC as a comprehensive course.

We mentioned one pilot study evaluating the self-reported appraisal of participants to the BEC course, and our evaluation of the FEC courses administered during the last decade will be the second self-reported evaluation in this sub-group. Comprehensive courses bear the advantage of transferring to the recipients at a single training program the knowledge and skills required for resuscitation of different population groups (adult, trauma & child), thus sparing the cost and time of taking multiple courses (ACLS, PALS & ATLS). The non-inclusion of obstetrical and neonatal resuscitation in the material package of BEC and FEC constitutes one point of weakness for All-In-One curricula.

TYPES OF PROFESSIONALS TARGETED IN THE EVALUATION

In LMICs, the first providers in charge of initial resuscitation of critically ill patients are often none-specialist and under-qualified personnel, and it is fair-minded that the majority of studies that evaluated the effectiveness of alternative life support courses in LMICs targeted professionals of all qualification levels as participants.

A large proportion of studies in this review covered merely all professional strata in healthcare, from nurses to specialist doctors, thus reinforcing the idea of applicability of these courses to all categories of healthcare providers. Some studies, however, such as the papers of Hashmi (20) and Meaney (19), did not specify the occupational category. A few studies, particularly those evaluating the TEAM (23, 24, 29), have focused on junior physicians. Still others were interested in the professional category of nurses (22). Rarely were found studies that focused on paramedics (44). It is interesting to promote the evaluation of courses covering all healthcare professional categories in the LMICs because very often, a low-skilled personnel in these countries will find themselves at the forefront of emergency care and called upon to perform relatively complex tasks (45).

TYPES OF SETTINGS TAGETED IN THE EVALUATIONS

Most of the training evaluations recorded in this review are hospital-based rather them prehospital-based studies. Since prehospital services are limited or inexistent in many LMICs, hospital staff should be the major focus of the education intervention (4). However, few studies are reported on the pre-hospital sector (46)and a few others covering both settings (30). Perhaps with the expansion of pre-hospital intervention in developing countries, it is to be expected that there will be more evaluation studies in touching the prehospital sector.

METHODOLOGY OF EVALUATION USED BY DIFFERENT STUDIES

A limited number of studies identified in this review have provided evidence related to patient outcomes (12, 21). This type of evaluation was essentially oriented toward the analysis of registries to detect the change in the rate of the outcomes of interest (mortality, morbidity, missed injuries, complications, etc.) between the period before intervention and after intervention (12). The paucity of studies adopting this design in LMICs, although it can offer strong evidence, is explained by the fact that fewer LMICs possess standardized trauma-based registry systems allowing to track the outcome of patients (4).

In this review, most of the researched strategies to strengthen evidence of the effectiveness of courses in LMICs involved a combined evaluation (24, 26, 47). This type of evaluation involved assessing cognitive gain and/or retention, skill gain, and self-reported appraisal at various time points from the educational intervention. To make it easier to compute summative results in systematic reviews, it would be beneficial for authors to adopt the same method of combined evaluation. For instance, each study may include a pre and immediate post-course cognitive evaluation, followed by a follow-up for knowledge retention at 6 months. Additionally, a post-course survey and an immediate post-course skill assessment may be conducted, followed by an assessment of skills at 12 months. However, it must be acknowledged that conducting follow-up assessments may be challenging, as it requires contacting and gathering all participants who attended the initial evaluation.

It is important to note that the efficacy of studies on alternative life support courses in LMICs is primarily limited by their failure to account for the comprehensive impact of these courses on recipients, providers and patients simultaneously. Assessments focused on providers' satisfaction are inherently subjective when based solely on self-reported appraisals. Moreover, evaluations of candidates' knowledge or skills lack credibility if they are only conducted once, without considering long-term retention. Patient-centered studies are hampered by their observational nature, as the uneven distribution of patients before and after intervention may introduce bias into the results.

CONCLUSION:

LMIC countries face a significant challenge in providing adequate care for critically ill patients due to limited resources, resulting in a high mortality rate. To address this problem, resuscitation training can be provided to frontline emergency care staff through short, cost-effective training in advanced life support. The evidence drawn from this review suggests that LMICS can design effective and context-adapted life support courses to address their local needs. It is a fact that a single standard life support course for all settings can no longer stand. International advanced life support courses were developed for uptake by advanced providers, while in LMICs, the scarcity of such highly qualified professionals causes task shifting of complex management to frontline nurses and medical assistants. LMICs are thus invited to rethink the way they design curricula to strengthen the resuscitation performance of their healthcare workers.

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PART B. EVALUATION OF THE FUNDAMENTALS OF EMERGENCY CARE (FEC) COURSE FOR THE LAST DECADE: DEMOGRAPHIC PROFILE AND SELF-REPORTED APPRAISAL OF PARTICIPANTS.

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ORIGINAL ARTICLE

EVALUATION OF THE FUNDAMENTALS OF EMERGENCY CARE (FEC) COURSE FOR THE LAST DECADE: DEMOGRAPHIC PROFILE AND SELF-REPORTED APPRAISAL OF PARTICIPANTS

Ilunga Kamembela, Monique Venter, Peter Hodkinson

Department of Emergency Medicine, University of Cape Town

Key Words:

- **Fundamentals of Emergency Care (FEC)**
- **Evaluation**
- **Self-reported appraisal**

African Relevance:

- **The FEC program was developed within an African nation as an alternative to comparable international advanced life support courses.**
- **Its evaluation over the past ten years through surveys conducted on local professionals who have participated in the courses has met with broad approval from the latter.**

Corresponding author:

- **Email: Ilunga Kamembela <KMMILU001@myuct.ac.za>**

ABSTRACT:

Introduction: *The Fundamental of Emergency Care (FEC) is a short course designed to give key skills and approaches to emergency care for non-specialist healthcare providers. This course has been running since 2012 primarily from the Western Cape of South Africa, open to all medical professionals for a fee. The course is conducted through self-study of a manual, and then two days of intensive skills and simulation based training. We undertook to survey and evaluate past participants of the course to assess the impact and suitability of the course, in order to improve and guide further iterations and expansion of the training.*

Method: *We surveyed and analyzed all participants of FEC courses since inception using a series of email surveys. Descriptive statistics were performed using SPSS. The survey captured information about participants' profiles and opinions of the course.*

Results: *Out of approximately 500 participants in 24 courses over the last decade, 210 (42%) took part in the surveys. The study revealed that a majority of the participants (67.6%) were medical doctors, with only a small percentage (14.76%) working full-time in emergency centres. The participants hailed from diverse backgrounds, including both rural and urban settings, and all facility levels. The overall consensus among respondents was that the course was well-presented, of affordable cost, and contained relevant content that they found useful in their respective practices.*

Conclusion: *The FEC course has been established as a contextually relevant emergency short course for South Africa, providing an alternative to international courses which are often unaffordable, and may lack insights to local burden of disease and resource constraints. We believe that this is a model of training that can be expanded, locally adapted and remains feasible for local healthcare providers.*

INTRODUCTION:

Critical illness and injury account for millions of deaths worldwide , and the mortality due to these conditions is accentuated in low-middle-income countries owing to a lack of adequate resources and skills of frontline providers (1).

International Advanced Life Support short training courses, such as ACLS, PALS, and ATLS, have proven to be effective in improving patient care and reducing the mortality rate of critically ill patients in emergency settings (2). However, the widespread adoption of these courses is limited in low- to middle-income countries for a number of reasons - the mandatory accreditation required for local trainers, the expenses that this accreditation and individual participant accreditation entails, and the applicability of such international courses designed for settings of specific contexts (1).

To address the challenge of limited access to emergency care short courses in low resource settings, several alternative emergency care short courses have been launched (3). Many of them tend to focus on a single element of emergency care such as trauma (e.g. the Primary Trauma Care or PTC) (4), neonatal patients (e.g. Helping Baby Breathing or HBB) (5) etc. The Basics of Emergency Care (BEC) is a recent initiative of the WHO designed for under-resourced settings (6). The course has been implemented in Uganda, Tanzania and Zambia (6). It is unique in that it covers a wide range of emergency situations for adults, children, and trauma cases (all-in-one courses) (7).

Many of alternative life support courses have undergone extensive evaluation by various researchers, for example the Trauma Evaluation And Management (TEAM) has been reported in several papers (8, 9, 10). The results of these evaluations have been encouraging and demonstrate that these courses are a viable alternative to international programs in countries with limited resources.

The Fundamentals of Emergency Care (FEC) course was developed by the Department of Emergency Medicine at the University of Cape Town and has run since 2012 at various venues, largely in the Western Cape. The course is a comprehensive curriculum like BEC, encompassing adult, paediatric and trauma patients. It was designed to fill a perceived need for emergency care training that was locally relevant to the context and resource constraints of the South African healthcare setting, as well as being accessible to local emergency providers. The course is open to all medical professionals for a fee (The course initially cost R1500. Currently, it is worth R3500, which, after considering an annual inflation rate, is $184 per course session) The authors of this study have conducted an evaluation of the FEC course over a ten-year period, from 2012 to 2022.

FEC courses typically run with a maximum of twenty-five students, with 4-5 instructors, often from different disciplines but led by an experienced emergency physician. The course training methodology resembles established life support courses proposed for under-resourced settings like BEC (6, 11). It operates - using a flipped classroom approach where a manual is provided for self-study, which includes thirty-five chapters covering the basics of hospital based

emergency medical care. It provides an approach to critically ill or injured patients, as well as guidelines for the management of common and life-threatening conditions. The Candidates then spend two days of practical skills based that focuses on honing their skills through intensive and personalized teaching in small groups. They participate in team-based simulations that offer hands-on experience and valuable learning opportunities. These simulations are designed to help candidates apply the concepts they have learned in real-world scenarios, thereby enhancing their problem-solving abilities and decision-making skills. At the beginning of the two-days contact session, candidates complete a multiple-choice questionnaire as part of the pre-course assessment.

The aim of this descriptive study was to map the profile of healthcare professionals who attended the Fundamentals of Emergency Care (FEC) courses in the past decade, and to analyze their feedback on the benefits they gained from the course in their daily practice.

METHOD:

An online survey was conducted over several iterations, with an initial survey questionnaire piloted and developed in 2014. The survey has remained almost the same over the years, with a few additions and omissions and changes in some question formulations. The questionnaire consists of two main parts: the first part gathers information about the participants' biography, such as their professional category, position at work, work location, setting, and level of care, while the second part captures the candidates' self-appraisal of the course concerning its presentation and clinical relevance. The questions are either in the format of MCQ, requiring a single or multiple responses, or in the format of Likert Scale questions, or narrative comments (appendix A).

Over the past decade, three post-course surveys were undertaken . at intervals of 3-5 years. Firstly in 2014, then again in 2019 and finally in 2023. Each entailed an online invitation to participate, emailed out to past participants (emails are retained by the course administrators from each course). This invitation, with a link to the survey, and then weekly reminders were sent to all participants for up to three weeks to maximize the response rate.

The three distinct sets of surveys were merged into a unified dataset to facilitate comprehensive analysis. IBM SPSS Statistics 28.0.1.1 was used to perform simple descriptive statistics. For nominal data, we calculated the frequencies and percentages, whereas for numerical data, we examined the median, mode, standard deviation, and quartiles. Missing data was managed with IBM's guidelines (please visit www.ibm.com/support for more information). We were unable to analyze age and gender due to data systematically missing in the survey datasets prior to 2020. For other demographic data, we filled in missing information with mean values for each series, as less than 1% of the data was missing. We used a regression analysis in SPSS to estimate predictive values for missing data in variables related to candidates' self-appraisal of the course. For narrative response, we conducted a thematic analysis to identify recurring ideas. The study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences, UCT (HREC REF 741/2023).

RESULTS:

Over the course of ten years, from 2012 to 2022, 24 classes were held, with an estimate of 500 attendees. We were able to collect feedback from 210 participants for a complete evaluation of the program. This equates to an overall response rate of 42 %. Tables 1 & 2 provide details on surveys' responses and number of participants per venue, per year.

Tab 3 Series of survey

SURVEY PERIOD	SURVEY TOOL	PARTICIPANTS	RESPONDENTS
FEC course before 2014	Monkey survey		58
FEC course 2014-2019	Monkey survey	368	135
FEC course 2020-2022	Google survey	75	17
TOTAL			210

Tab 4 Number of participants per venue, per year

SURVEY/LOCATION	Cape Town		Worcester		George		Namibia		Others	
	Course	Survey	Course	Survey	Course	Survey	Course	Survey	Course	Survey
Before 2014		29	38	12		0	36	15		0
2014-2019	175	83	105	33	88	21	0	0	0	0
2020-2022	50	8	29	5	0	0	0	0	20	4

DEMOGRAPHIC PROFILE OF RESPONDENTS

The highest number of respondents were in 2017 (43) and 2018 (40). Most of the survey participants attended courses at Groote Schuur Hospital, 114 (54.3%), Worcester Hospital,45 (21.4%) and George,24 (11.4%). Some 112 (53.3%) of attendees funded the course themselves, 81 (38.6%) were sponsored by their institutions, 14 (6.7%) had combined sponsorship, and 3 (1.4%) did not state their mode of funding.

The survey was conducted among medical professionals, with the majority being doctors, 142 (67.6%), followed by paramedics and nurses, 47 and 21 (22.4% and 10%) respectively. The median number of years since the respondents' basic qualification was 6.5 (see Fig 1). Only 40 (19.1%) of the respondents worked full-time in an emergency unit.

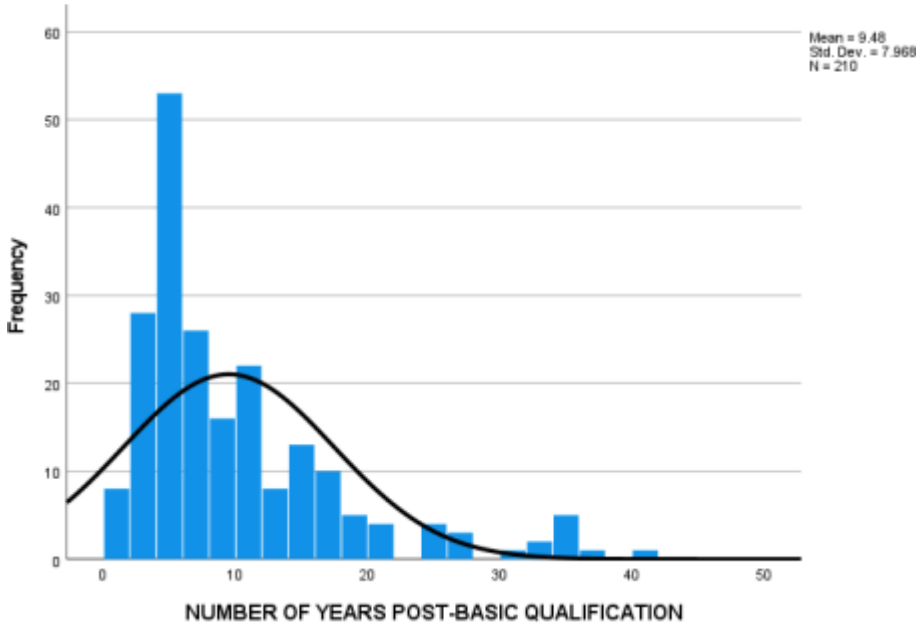

Figure 2 Number of year post-basic qualification

Most respondents during the FEC were practicing in the public sector - 162 (77.1%) and urban areas of South Africa, 128 (60.9%). However, by the time of evaluation, the percentage of respondents working in the public sector had decreased to 69.%, while the percentage of respondents working in urban South Africa had increased to 66.6%.

Respondents were employed in various settings during FEC, 58 (27.6%) in clinics or healthcare centres, while 43 (20.4%) were associated with district hospitals, and 42 (20%) were affiliated with regional or tertiary level hospitals. Additionally, 42 (20%) of respondents worked in the prehospital level, and 25 (10.9%) worked in GP offices. At the time of the survey, the distribution of work settings among participants remained the same.

SELF-REPORTED APPRAISAL

Participants were asked to rate different aspects of the course and to share their thoughts on the broadness of each course material offered. This included the syllabus, multiple choice testing, lectures, practical workshops, and simulation exercises.

Results indicated that 119 (95.2%) of respondents found the instructor-to-student ratio to be appropriate. However, the majority of students 144 (68.6%) believed that their instructors were too senior, not relatable to all students' level of understanding. Many students 162 (77.6%) found the overall duration of the course to be just right, and 187 (89%) felt that the cost was reasonable. The course material, including the manual (86.2%), MCQ testing (92.6%), lectures (83.2%), practical workshops (81.6%), and simulation exercises (78.7%), were all considered to be of appropriate length.

Students were asked to give their opinions on the clinical relevance of the course. When asked if they would recommend the course to others,180 (86.1%) of respondents replied positively. They rated twenty clinical topics (which comprised the main skills topics taught) based on a Likert scale from 1 to 5. These topics encompassed various areas such as adult and Pediatric resuscitation, difficult airway & intubation, IO & fluid resuscitation, ECG recognition, surgical airway, pacing & bradycardia, and IV access, among others. Most of the responders rated the clinical topics as good or very good.

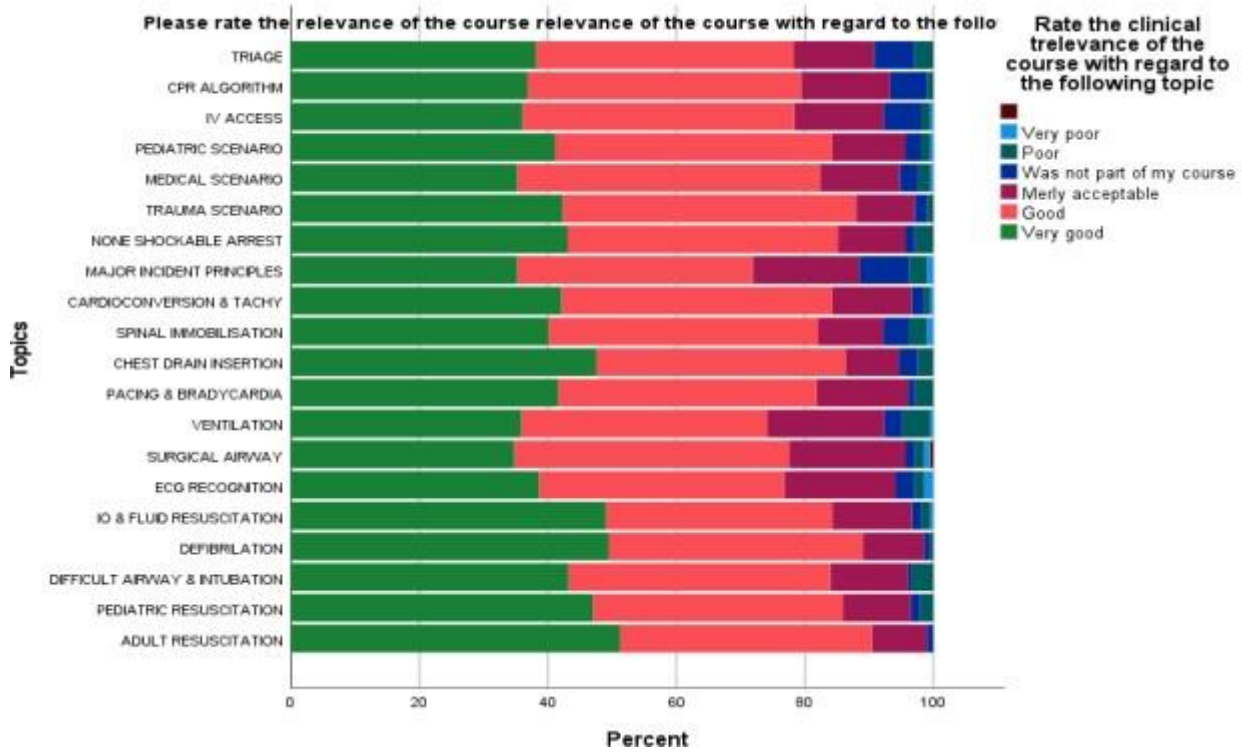

Figure 3 Relevance of different topics

Students rated a series of statements that aimed to assess the relevance of the FEC course as per figure 3. Most of the respondents either agreed or strongly agreed with each of these statements.

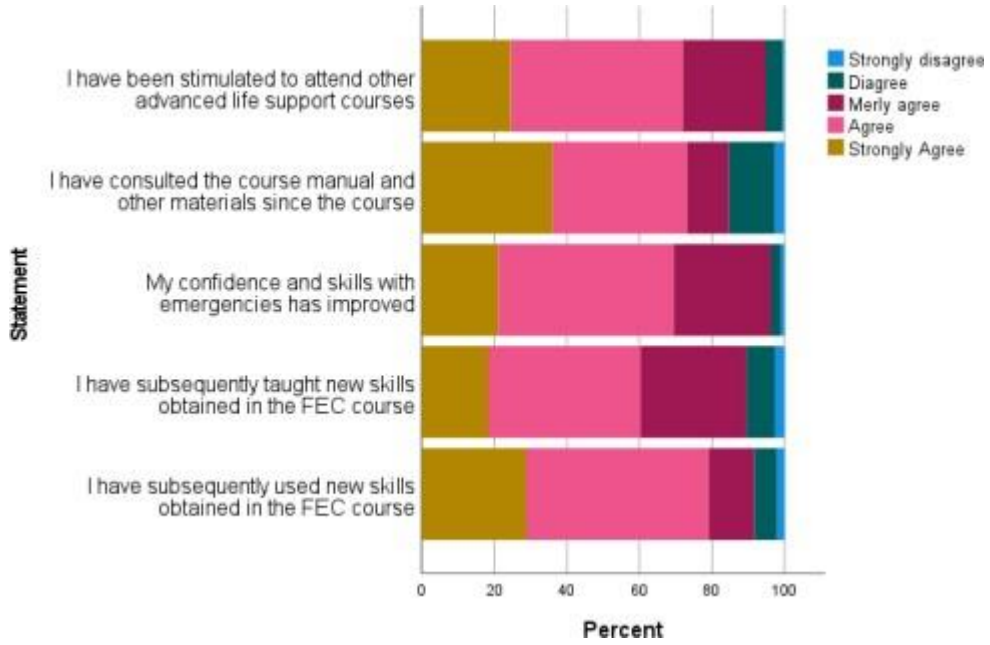

Figure 4 Statement around relevance of the FEC course

The survey also asked students to identify the most relevant settings (can be more than one) for the course. The rural hospital was the most valued setting with 185 (87.8%) of respondents selecting it, followed by the urban hospital, EMS setting, and rural primary healthcare with 145 (68.9%), 139 (66.32%), and 128 (61.0%) respectively.

When asked to compare FEC to other emergency short courses, a significant number of respondents provided narrative feedback indicating that they perceived FEC as an all-in-one course, in contrast to other courses that they considered to be individual. These responses suggest that FEC may be viewed as a more comprehensive training program in that it covers a wider range of topics than other courses, but in doing so not all topics are covered in depth, although the contents are more practical and locally relevant.

Several recommendations were made to enhance the quality of the course. The most frequently mentioned suggestions included extending the duration of the course, developing a refresher course, obtaining accreditation from the Health Professions Council of South Africa (HPCSA), and gaining recognition beyond the borders of South Africa. Additionally, there were requests to improve the course content by adding or enhancing topics such as ECG, trauma station, snakebite, and poisoning.

DISCUSSION:

ENROLMENT TO THE COURSE

Over the past ten years, the number of individuals who have participated in the FEC courses has reached approximately 500. This enrolment figure is considerably higher than the figures recorded for other emergency care courses offered in Low and Middle-Income Countries. For instance, Tenner's research on BEC (Basic Emergency Care) had only 76 participants enrolled in the course (6). On the other hand, the KATS (Kampala Trauma Course) study conducted by Ullrich in Tanzania recruited a total of 294 participants who attended courses between 2013 and 2016 (12), while other courses mentioned in the literature had barely 250 participants in the courses.

Despite the FEC course having a relatively high number of participants compared to other courses, the uptake rate remains low. It took several years to recruit five hundred participants. Howevera good ratio of instructor-to-trainee was maintained. The American Heart Association advises that the ratio of instructor-to-trainee should not exceed 1:7 for optimal training delivery. Therefore, it is crucial to reconsider the improvement strategies to increase the number of participants in the FEC course.

Before Ologunde et al. (4) evaluated the PTC (Primary Trauma care) course in Eastern and Central Africa, a cascade of training local instructors, followed by their mentoring during their initial teaching of the course to new candidates, was performed. This resulted in the enrolment of 2000 candidates in the course (4). Implementing such strategy can be an effective way to enhance the number of participants in the FEC course while maintaining a good ratio of instructor-to-trainee.

TARGETTED POPULATION

It's crucial to note that in low resourced settings, nurses are often the first responders in emergency situations before advanced care staff arrive (13). Therefore, they should be a priority for ALS training courses. However, only 10% of the respondents to the FEC study were nurses, compared to 67% being doctors, which is concerning. Furthermore, only 14.76% of respondents worked full-time in emergency units, indicating that the goal of disseminating FEC knowledge among staff most likely to provide emergency care to patients has not been achieved. Tenner and peers (6) in the assessment of BEC managed to recruit 61% of nurses versus 39% of doctors. Albeit our study showed a better distribution of FEC across facility levels: 27.62% for clinics and health centres, 20.48% for district hospitals, 20% in tertiary centres, and 20% in pre-hospital settings. The BEC evaluation showed a distribution of 28.8% for clinics and health centres, 45.8% for district hospitals, and 22.1% for tertiary institutions (6).

METHOD OF EVALUATION

Although the method of self-reported appraisals that was utilized in the present work to assess the effectiveness of FEC may be viewed as relatively weak evidence, it is still worth considering it positively. A significant number of previous evaluations of similar courses in low and middle-income countries have also used self-reported appraisals as a method of evaluation and have yielded positive results. One such study is the work of Ben-Abram et al. (14) which focused on trauma resuscitation and questioned the perception of providers on their knowledge and practice progress after receiving the course. Another study is the one by Ullrich et al. in Tanzania (12). It questioned the confidence gained in practice by professionals with varying qualifications and backgrounds after taking the Kampala Advanced Trauma Course (KATS) (12).

It is important to bear in mind that the most robust evidence is obtained when evaluations combine different options of Kirkpatrick or when evaluations examine outcomes of patients managed by providers who were exposed to the course being assessed. However, in the context of the FEC program, implementing such approaches is difficult since participants from different locations are brought together for a short period of time solely for the purpose of attending the course.

Nevertheless, in the face of challenges associated with periodic FEC evaluation using a combination of Kirkpatrick elements, it is feasible to administer a pre-and post-course MCQ test, alongside an immediate post-course survey and another one a few months later to assess retention. This approach has not been done in FEC evaluation so far but is anticipated to elevate the caliber of the acquired data and should strengthen the quality of evidence produced.

EVALUATION OUTCOME

The evaluation of the FEC course has revealed that the participants had a remarkably high level of enthusiasm for its value. While comparing the outcomes of participants' self-reported appraisal from studies conducted by other authors with the FEC evaluation can be challenging due to the use of different terminologies in the survey questionnaires, Tenner's evaluation of the Basic Emergency Care (BEC) comes closest to the present assessment. As the FEC program, the BEC program provides comprehensive emergency care training that covers child,adult and trauma resuscitation (7). The BEC evaluation encompasses the demographic profile of participants and self-reported data (6), aligning with the present study.

In the Tenner's study, participants were asked to rate their confidence in managing various emergencies after receiving the BEC course and provide feedback on the strengths and weaknesses of the course (6). On the other hand, in the FEC assessment, participants were required to rate the course format, content, and presentation, as well as the relevance of the topics covered. Both evaluations included a question on whether the participants would recommend the course to others.

The results of both the two studies have been positive and can be applied locally. However, it's essential to note that the FEC's evaluation was limited to providers in Southern Africa, while BEC's evaluation was limited to providers in East Africa (6). Therefore, the extent to which these results can be generalized to all developing countries is questionable. Nonetheless, the findings of these studies provide valuable insights into the effectiveness of advanced life support courses and can inform future training programs to better equip healthcare providers in under-equipped countries with the necessary skills and knowledge to save lives.

LIMITATIONS

It is imperative to acknowledge the issue of missing data encountered in this study. This is a common challenge in surveys, and we made every effort to address it. Our strategy involved replacing the missing data with the series averages or predictive data to maintain the sample size. This approach was intended to ensure that analysis and results are as robust and reliable as possible. While this approach is not without its limitations, it is a reasonable solution to a challenging problem that is often encountered in survey research.

The mode of survey administration can impact the response rate. The surveys were administered to participants via email after the course had ended, the response rate was of 42%. On the same path, the KATS study by Ulrich also employed an email survey a while after the course ended, and only achieved a response rate of 35.93% (12). In contrast, the BEC study by Tenner (6) and the TEAM study by Kurdin (15) administered the survey immediately after the course concluded, resulting in response rates of 100% and 86%, respectively. Similarly, the Anderson's EMWT/STARTLE study (11) and the Ologunde's PTC study (4) had high response rates of 100% and 71.10% respectively, achieved by administering the survey immediately after the course and following up via email. Emails are no longer the most popular means of communication (16). However, some officials find it challenging to adapt to new communication channels. Fortunately, it is now possible to create WhatsApp groups for stakeholders and send survey links anonymously through the platform. This could help overcome cultural barriers and improve response rates.

CONCLUSION:

Over the past ten years, around five hundred participants attended FEC courses, and 210 candidates among them responded to evaluation surveys, primarily doctors, from all facility levels. This study found that the course was well-received by participants, both in terms of presentationand clinical value.

The FEC course is a specialized short-term training program that has been specifically designed to cater to the urgent medical needs of South Africa. The course has been developed keeping in mind the local healthcare landscape and the unique challenges faced by healthcare providers in the region.

The decade evaluation of the FEC course through surveys administered to participants indicates that through the FEC course, healthcare providers in South Africa can be equipped with the necessary skills and knowledge to respond effectively and efficiently to emergencies in the local context. It provides a contextually relevant alternative to international emergency courses that are often expensive and may not be tailored to meet the specific needs of the South African healthcare system.

Future efforts to enhance the FEC course might include expanding the course, through active marketing across different professions to include doctors, nurses and prehospital providers, as well consideration to expand the delivery sites by training trainers at alternative venues. There is potential to leverage online learning platforms for pre-course learning, as well as pre and post course assessment to enhance evaluation.

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APPENDICES

Appendix A: ETHICS APPROVAL

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45 E-52-E-Floor- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-submissions@uct.ac.za
Website: www.health.uct.ac.za/home/human-research-ethics

06 October 2023

HREC REF: 741/2023

A/Prof P Hodkinson
Division of Emergency Medicine
F51, OMB
Email: peter.hodkinson@uct.ac.za
Student: kmmilu001@myuct.ac.za

Dear A/Prof Hodkinson

PROJECT TITLE: PARTICIPANTS' SELF-REPORTED APPRAISAL OF THE FUNDAMENTAL OF EMERGENCY CARE (FEC) COURSE: AN EVALUATION OF THE LAST DECADE (MPHIL EMERGENCY MEDICINE CANDIDATE DR ILUNGA KAMEMBELA) SUB STUDY OF 601/2014 AND 761/2018

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 October 2024.

Please submit a progress report, using the standardised Annual Progress Report Forms (FHS016) **or** (FHS 017) if the study continues beyond the approval period. Please submit a Standard Closure form (FHS 010) when the study has been completed, this includes after publication or thesis submission and final completion.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the Mphil Emergency Medicine Candidate Dr Ilunga Kamembela will also be involved in this study.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Please quote HREC REF 741/2023 in all your correspondence.

Yours sincerely

Signed by candidate

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007

RESEARCH PROPOSAL

1. BACKGROUND

The transition of disease burden observed in low/middle-income countries, characterized by an upsurge of injuries and non-communicable diseases, has exposed the need to improve the resuscitation skills of providers in LMICs (1). Contrarily to High-Income Countries where remarkable progress is noted, care of high acuity patients in developing countries remains inconsistent and often not aligned with recommended guidelines (1).

In the emergency setting, patients from low/middle-income countries are often attended by a provider with little knowledge and skills in advanced life support interventions (2). Education in the resuscitation of frontline providers in developing countries has been recognized as a necessity and a cost-effective strategy to improve the provision of emergency care and patient outcomes (1).

For this reason, international advanced life supports short-training courses like ACLS, PALS/APLS, and ATLS, traditionally taught in the developed world, are now gaining enthusiasm in low/middle-income countries (1). Several medical institutions in these countries currently require certification in these courses as recruitment criterium (1).

The recent International Liaison Committee on Resuscitation's systematic review advocates for the need to design contextualized advanced life support courses for developing countries with respect to disease burden and resource availability (2). Access to international life support courses in developing countries is hindered by the pricing and issue of proprietary since local instructors must purchase accreditation from international organizations who hold the ownership of these courses (1). Consequently, remote and rural areas in Africa, for example, will have a shortage of accredited instructors. Furthermore, international advanced life support courses use protocols and algorithms that do not relate to resource availability in low/middle- income countries (3).

Fundamentals of Emergency Care (FEC) is one of the responses to this adaptation challenge. The course was established in South Africa in 2008 and is offered by the division of emergency medicine of the universities of Cape Town (4). The course uses a flipped classroom approach, with a manual provided to candidates to study in advance, then two days of face to face workshops, skills teaching and simulation- scenario-based learning (4). The content of the course, adapted to frontline providers of all levels, covers key topics of provision of emergency care in South Africa and other African countries (4).

Since 2010, annual evaluation of FEC course has been conducted by the course's convenor through a post-course survey administered to attendees. The present project will be an update from the last four years. The investigator will survey candidates who attended the FEC course from 2018 to 2022. The result of this survey will be pooled with the previous data to constitute an evaluation spanning over a decade long. Of note, no course was dispensed from the second semester of 2020 throughout all the year 2021 due to COVID-19 pandemic.

To consider Kirkpatrick model of training evaluation, assessing the performance of an Advanced Life Support course can be achieved in four ways: 1) post-course survey

administered to recipients to assess their subjective perception of the extent to which the course is relevant and meet their needs 2) evaluation of knowledge acquisition and retention by administering pre-training, post-training and follow-up MCQ-test on the course content 3) evaluation of skill acquisition by administering an objective assessment like OSCE, simulation scenario test 4) evaluation of improvement of patient outcomes through controlled-RCTs or before and after training studies. In this perspective, our work sit in the first tier of Kirkpatrick model (5).

2. RESEARCH QUESTION AND OBJECTIVES

Our research study seeks to address the following question: How do the demographic profiles and viewpoints of individuals who took FEC courses compare to those who participated in other alternative courses in LMICs? To answer this question, we will analyze the self-reported data from FEC course participants spanning over the last ten years and compare their outcomes to those of participants in other courses.

1 PICO format of the research question

POPULATION	INTERVENTION(EXPOSURE)	CONTROL	OUTCOME
Participants to FEC course in SA during the last Decade	Course Evaluation	Participants to alternative life support courses other than FEC in LMICs	- Demographic profile - Self-reported opinions on the course taken

Our study aims to achieve the following objectives:

- To describe the demographic profile, professional background, and educational qualifications of the participants.
- To provide an overview of the FEC courses that were conducted between 2010 and 2022.
- To explore the practitioners' perceptions of the teaching methods used during the FEC course.
- To understand the participants' opinions on the value of FEC in their practice.

3. METHODOLOGY

3.1 STUDY DESIGN

The purpose of this cross-sectional survey is to assess individuals who have taken FEC courses between 2012 and 2022. The survey will consist of two phases and use the same questionnaire. In the first phase, data will be gathered retrospectively from post-course evaluations of participants who have attended any of the FEC courses between 2012 and 2020. This is considered a secondary data collection. In the second phase, the investigator will conduct primary data collection by surveying attendees of the last two years prospectively. Both groups will be exposed to the same survey questionnaire,and the outcomes will examine their profiles, opinions, and beliefs on the FEC course and its impact on their attitude towards clinical practice. The summative results of the two phases will be compared to the outcomes of other alternative courses conducted in LMICs, as per the literature review.

POPULATION

The study aims to survey healthcare workers who participated in FEC training courses at Cape Town's three main sites between 2012 and 2022. The courses were open to attendees of all categories, including doctors, nurses, and paramedics, from various settings. Attendees who took the courses from 2018 to 2020 will be surveyed, while those who participated from 2012 to 2017 were already assessed. The study will send an electronic survey via email to the targeted recipients using a Google survey form to minimize costs. Non-respondents will receive a participation request twice at a one-week interval. The study aims for a response rate of approximately 60%. All medical practitioner participants who give their consent to complete the survey will be included in the study.

3.2 SURVEY QUESTIONNAIRE.

The survey consists of questions that collect factual and judgmental data from participants to answer our research question. The questionnaire has two main themes: demographic and biographic characteristics, and the value of the FEC course. The survey was reviewed by an expert panel for relevance and clarity. It has been used previously and has shown to be effective with a smooth flow and no ambiguities or redundancies. It is important to use the same survey in the second phase to ensure consistency

FEC EVALUATION.
SURVEY QUESTIONN

The questionnaire is divided into 7 sections. Section 1 focuses on the participant's demographics and biographic information, with mostly close-ended questions. Section 2 deals with the FEC background of the participant, with close-ended questions that are either multichoice or checklist. Sections 3 & 4 allow the participant to rate the course in terms of its format, with Likert-scale style questions. Sections 5 & 6 explore the clinical relevance of the course and how it influences participants' attitudes in their practice. The last section looks at recommendations for the course by the participants

3.3 DATA ANALYSIS

The aim here is to organize information collected from the answers provided by respondents and apply appropriate statistic tools to identify patterns and get insight into recipients' opinions in line with the objectives of the study as asserted above.

The majority of the items in the questionnaire being close-ended questions will allow the generation of measurable data and to conduct quantitative analysis. Few items are formulated as open-ended questions, consenting narrative answers. In these later cases, a qualitative approach using thematic analysis will be applied, and consist of categorization of answers based on the similarity of themes expressed to draw out the pattern of ideas in the dataset.

The IBM SPSS statistic (version 28), downloadable free of charge from ICT UCT, will be utilized in the upcoming phase of the study to capture and analyze data. Data from the first phase were treated in Excel and can easily be exported into the SPSS dataset and merged with the new data for summative analysis.

SPPS software offers the essential package of tools for descriptive and analytic statistics on a convenient interface for the junior researcher, not requiring advanced knowledge of the informatic language or mastering of statistical formulas. The user just has to correctly define the feature of variables before entering data and selecting appropriate operations for analysis. Furthermore, SPSS allows the generation of handy graphs at each analysis.

Defining variables of FEC survey:

Each survey participant is a case, and every question is a variable. The answer given by a respondent to a question is the data attributed to that variable for the corresponding respondent

FEC SURVEY. DATA ANALYSIS. SAMPLE.s

The data in the dataset has three important attributes: an identifier, a label, and a type of data. The data in the dataset can be of different types such as numerical, categorical, dichotomous, or ordinal. There are two variables that are numerical: age and years after qualification. Categorical data is assigned a numerical code. For dichotomous questions, the data is assigned either 1 and 0 or 1 and 2. Multichoice

options are assigned codes in order of their position, such as 1, 2, 3, and so on. Checklist data is classified as either "yes" or "no" and assigned a code of 1 or 0, respectively. Likert scale questions are assigned codes of 1, 2, 3, and so on for each option. Variablescan be either input or output, and dependent variables can influence the outcomes of dependent data.

Descriptive statistic

The questionnaire has many variables, but only the important data will be reported in the dissertation paper. To describe the ordinal data, we will use mean, standard deviation, and minimum/maximum. You can find this information on SPSS by going to the menu Analysis/Descriptive statistics/Descriptive and selecting the "data view" option. For example, in our imaginary FEC class, the average age of participants is 35.28 years (with a standard deviation of +/- 6.57). The youngest participant was 27 years old, while the oldest was 53.

Table 2 Description of an ordinal data.

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	25	27	53	35.28	6.567
Valid N (listwise)	25				

Categorical data is presented as frequency and percentage. This can be computed in SPSS under Analysis/Descriptive Statistics/Frequency. Graphs can also be produced using the Graph Builder. Example: In our class, 44% of participants were female. Majority enrolled based on employer's recommendation (56%), followed by personal choice (32%). Only 12% attended to seek promotion

Table 3 Description of categorical data. Gender

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	14	56.0	56.0	56.0
	Female	11	44.0	44.0	100.0
	Total	25	100.0	100.0	

Table 4 Description of categorical data. Reason for enrolling

What was your main reason for enrolling in FEC course?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Personal choice to improve knowledge/skill	8	32.0	32.0	32.0
	Employer selection/recommendation	14	56.0	56.0	88.0
	Seeking promotion/Advancement	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

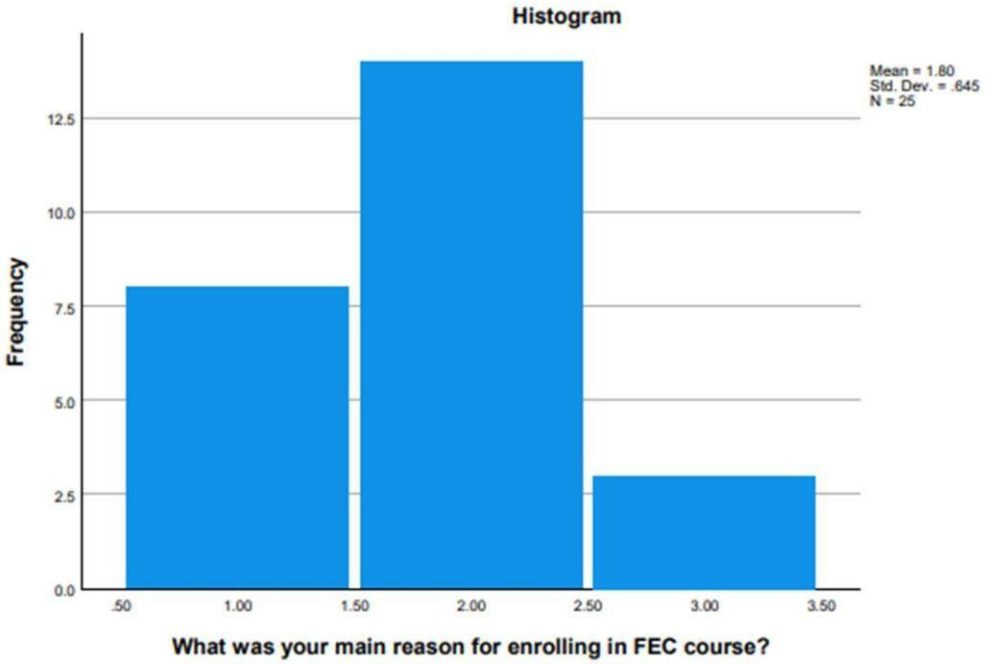

Figure 1 Description of categorical data. Histogram. Reason for enrolling

Likert scale questions being categorical data are described similarly to the above. In our fictitious class, 99% of respondents rated the usefulness of skill/knowledge gained from the topic “adult resuscitation” as very good or good (see table and figure below).

Table 5 Description. Likert scale. Adult resuscitation

Please rate the usefullness of the skill/knowledge gained from the Topic (ADULT RESUSCITATION)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Merly acceptable	1	4.0	4.0	4.0
	Good	11	44.0	44.0	48.0
	Very good	13	52.0	52.0	100.0
	Total	25	100.0	100.0	

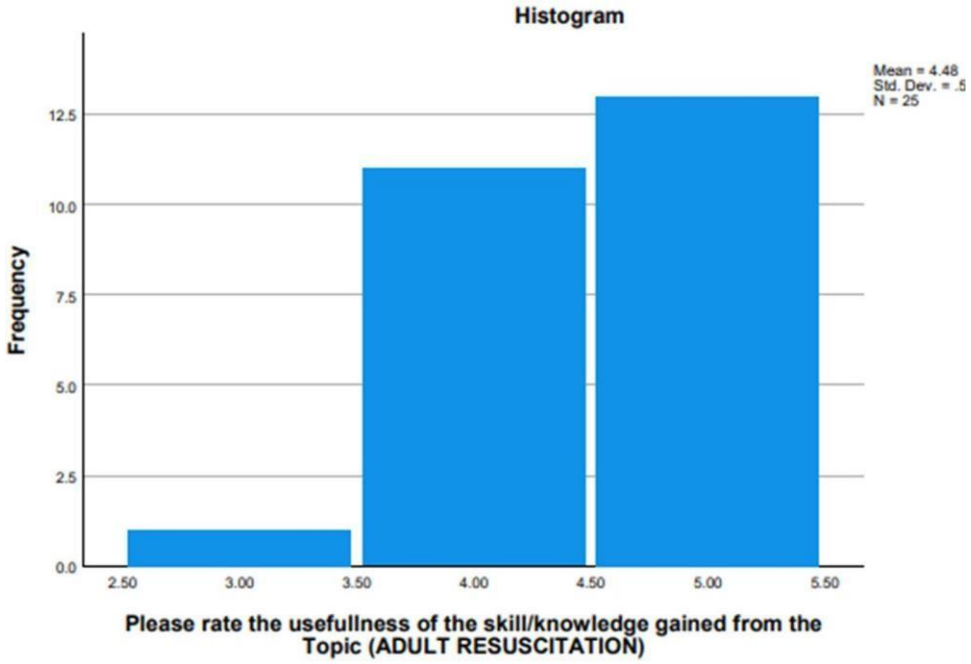

Figure 2 Description Likert scale. Adult resuscitation

For checklist-type questions, multiple options can be selected by each participant. To compute the frequency of "yes" answers, all dichotomous variables are gathered in one new variable. This can be done in the menu Analysis/Multiple responses/Define variable. The frequency of "yes" for each option can be computed in Analysis/Descriptive statistics/Frequency. In our sample, most participants believe that the FEC course is relevant to urban healthcare, while fewer believe it is relevant to rural primary care and other African countries' facilities.

Table 6 Description frequency. Multiple responses.

$FEC_Suitable_Settings Frequencies

		Responses		Percent of Cases
		N	Percent	
In which setting do you recommend FEC?[a]	Which setting you think is most relevant & usefull for? Rural Primary Health Care?	12	8.2%	48.0%
	Which setting you think is most relevant & usefull for? Rural Hospital?	23	15.8%	92.0%
	Which setting you think is most relevant & usefull for? Urban Primary Health Care?	25	17.1%	100.0%
	Which setting you think is most relevant & usefull for? Urban Hospital?	25	17.1%	100.0%
	Which setting you think is most relevant & usefull for? Urban Specialist Hospital?	25	17.1%	100.0%
	Which setting you think is most relevant & usefull for? EMS	25	17.1%	100.0%
	Which setting you think is most relevant & usefull for? Other African Countries?	11	7.5%	44.0%
Total		146	100.0%	584.0%

a. Dichotomy group tabulated at value 1.

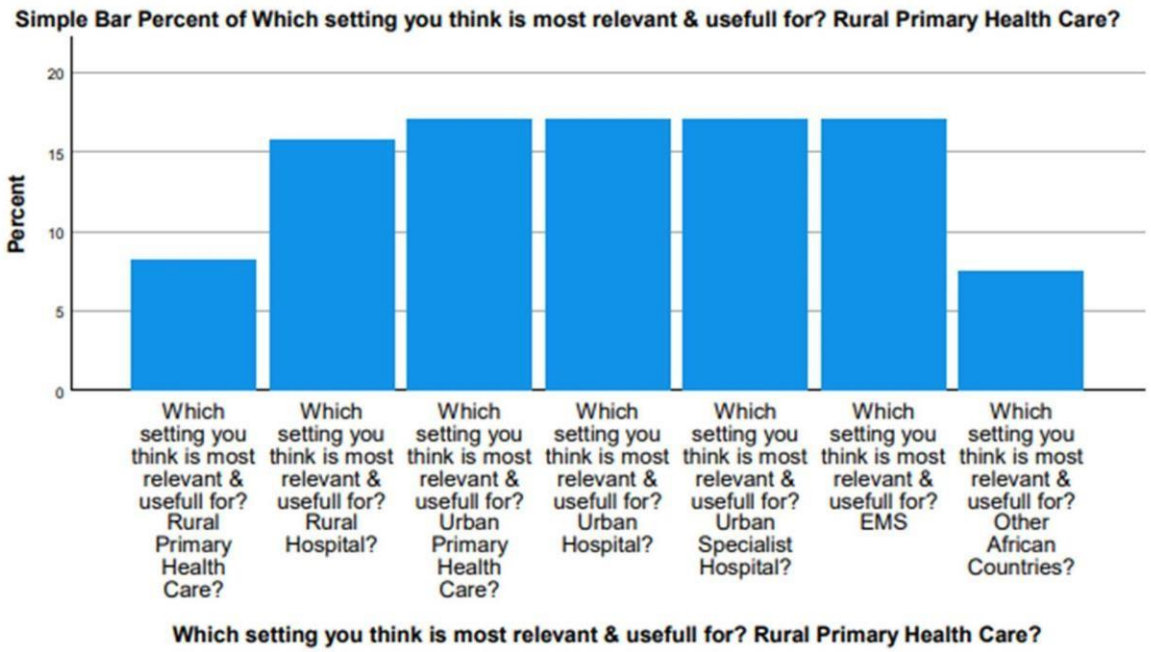

Figure 3 Description frequency. Multiple responses

Missing data

Missing data is a very common problem in surveys, and one that we will probably face and which can disturb the sample size and is likely to cause bias in the data analysis. The SPSS contains a build-in statistic system that allows you to analyze the pattern of missing data and replace the missing data with the mean value for each series or a predictive value.

3.4 DATA MANAGEMENT

Each participant's answered questionnaire form is recorded as a case in the dataset file and assigned an anonymous numeric identifier based on the order of form submission (1, 2, 3...). The data collected will be electronically stored under a secure password and shared only with key individuals involved in the research. The collected data will be deleted after 10 years from the date of publication of the research results.

4. ETHIC CONSIDERATIONS

The entrance to the survey will be sanctioned by an informed consent and confidentiality of participants is warranted. Results will be published in respect to the rule of anonymity. There is not conflict of interest in the development of this research project.

5. BUDGET

The total cost of the project is estimated to be of R36.811,80 and is fully funded by family contribution.

Table 7 Budget

RESEARCH PROJECT EXPENDITURES			
EXPENDITURES	Column1	Column2	AMOUNT(RANDS)
DISSERTATION FEE			R22.090
EDITOR FEE			R10.000
BIOSTATISTICS CONSULTATION			R4.000
UNMEASURABLES (2% OF TOT)			R721,80
TOTAL AMOUNT			R36.811,8

6. TIMELINE

Considering the date of resubmission of the proposal to the director as the starting date of the project, this project is a 24 weeks assignment comprising 8 tasks and is deemed to end by the 8th November 2023.

Table 8 Timeline

TIMELINE			
TASKS TO ACHIEVE	START	END	DURATION
TASK 1 approval of research proposal by the supervisors.	06.07.23	20.07.23	2 Weeks
TASK 2 Ethic boards' approval process	20.07.23	02.09.23	6 Weeks
TASK 3 Literature review (reading, drafting & review by supervisors)	22.05.23	07.08.23	9 Weeks
TASK 4 Survey (sending, recall & collection of responses)	02.09.23	30.09.23	4 Weeks
TASK 5 Data capture, analysis & discussion with supervisors/biostatic	01.10.23	19.11.23	7 Weeks
TASK 6 Drafting survey's findings	20.11.23	27.11.23	1 Week
TASK 7 Review of the dissertation by the editor	21.11.23	28.11.23	1 Week
TASK 8 Finalization with supervisor & submission of the work	29.11.23	13.12.23	2 Weeks

7. DISSEMINATION

It is a fact, thus disappointing, that only a tiny portion of medical research findings reach the end-users and are turned to be picked up and used in clinical practice and impact patient outcomes.

As researchers, we should not limit our responsibility in bringing out new knowledge but be actively involved in the plan and strategy of promoting dissemination and implementation of our findings in practice.

Positive input from FEC decade evaluation has definitively the potential to influence the practice of emergency care in South Africa and other African countries and reduce the cost of producing skilled frontline providers for LMICs. Solely counting on the role played by the university in the dissemination of dissertation papers via the campus library and online service won't guarantee access to all the stakeholders who can benefit from the results of this research. Few people get along with reading a full dissertation or thesis. We are intending to use four other channels to broaden the platform of the research consumers.

Publishing our research in the format of an original article in a dedicated medical journal is the first thing to do to reach a large scientific audience. The original article is by far the most referenced document type in medical publications. It offers the advantage of presenting completely but shortly (less than 15 pages) the result of research and saves time for readers.

Social media dissemination will be our second strategy. With social media like Facebook, and LinkedIn, we have today the chance to reach a gigantic size of stakeholders. Identifying groups with profiles of interest rather than individuals will be the best approach. And the matter here will not simply be to post the link to our work but to present briefly and in an attractive way (audio-visual?) our work.

Direct contact with other researchers working on similar topics and policymakers interested in our topic and sharing with them our study's abstract is a non-neglectable

way to gain references for our publication. Searching their emails, affiliations, and other contact details is the work to be done.

Cashing opportunities of conferences at the local or international level to present the abstract of our research is a good thing to do to get the connection with scientific researchers, policymakers, and providers out there.

The involvement of the investigator in the training and evaluation of FEC courses in other settings is a meaningful way to be directly in touch with frontline users of FEC as a clinical tool and participate in its implementation. We are figuring out for the future a project of implementation of FEC in healthcare zones of the Republic Democratic of Congo, a tropical country, to strengthen the capacity of frontline providers. A project thatcan cover assessment of needs (types of equipment available, burden of disease), the adaptation of the curriculum and review by an expert panel, course delivery, and courseevaluation (pre and post-course survey, pre and post-course MCQ test, before and after implementation mortality).

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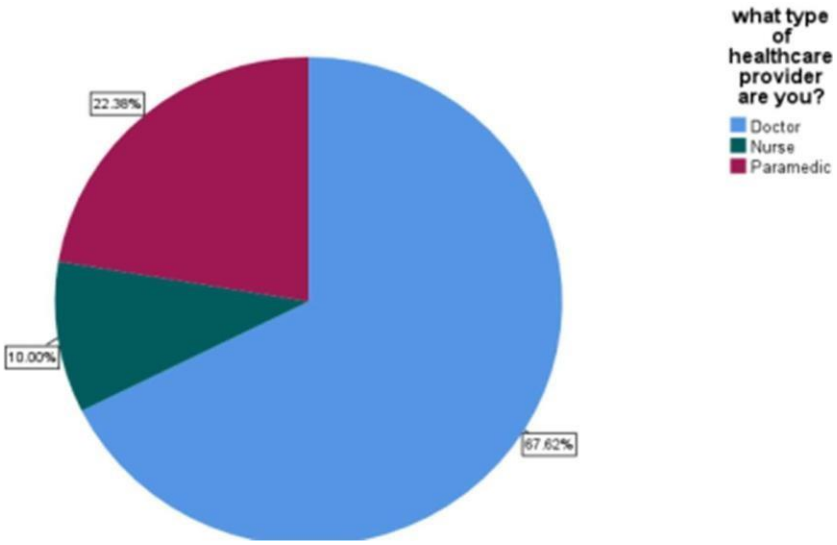
5. Abdulghani HM, Shaik, S. A., Khamis, N., Al-Drees, A. A., Irshad, M., Khalil, M. S., ... & , Isnani A. Research methodology workshops evaluation using the Kirkpatrick's model: translating theory into practice.2014 2023 March 23; 36(Suppl 1):[S24-S9 pp.].

Appendix C: SURVEY QUESTIONNAIRE

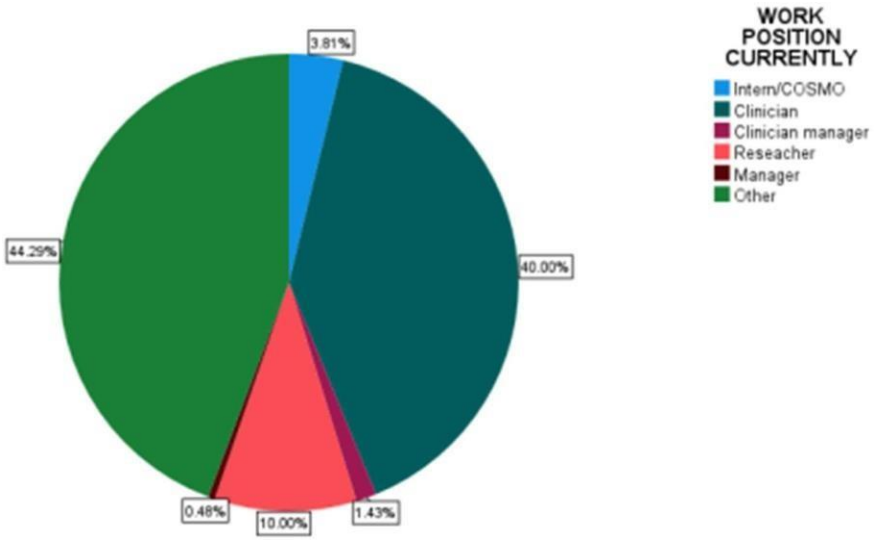
FEC EVALUATION QUESTIONNAIRE.pdf

1. DEMOGRAPHIC DATA

1.1 What type of healthcare provider are you?

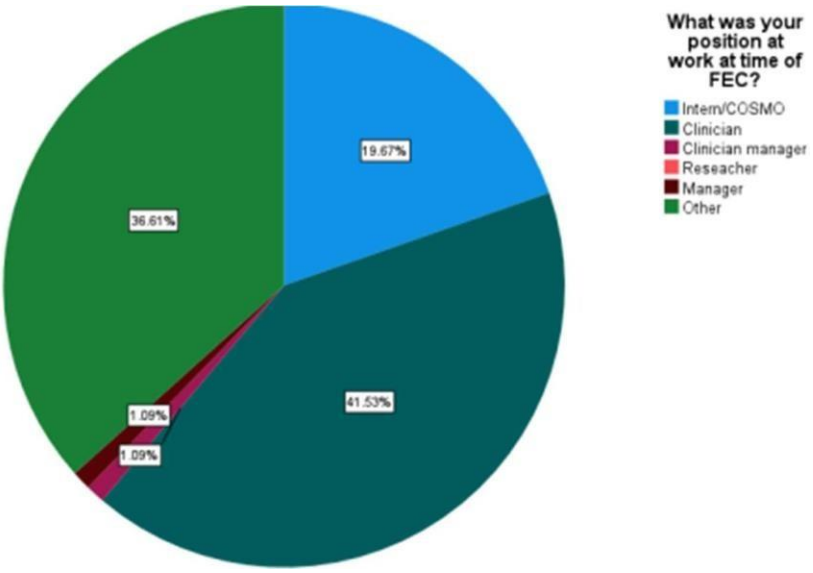


Q 1.2.1 What is your current position at work?

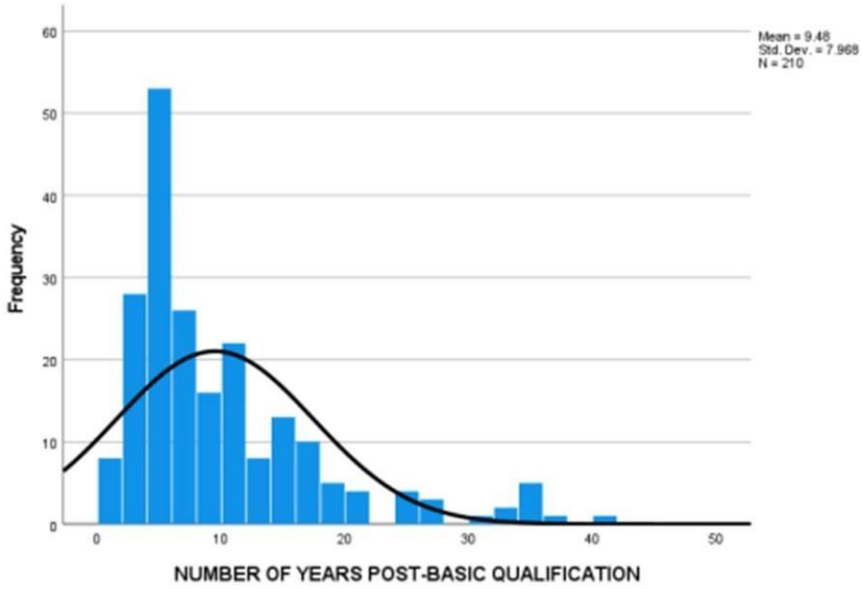


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.2.2 What was your position at work at time of FEC?

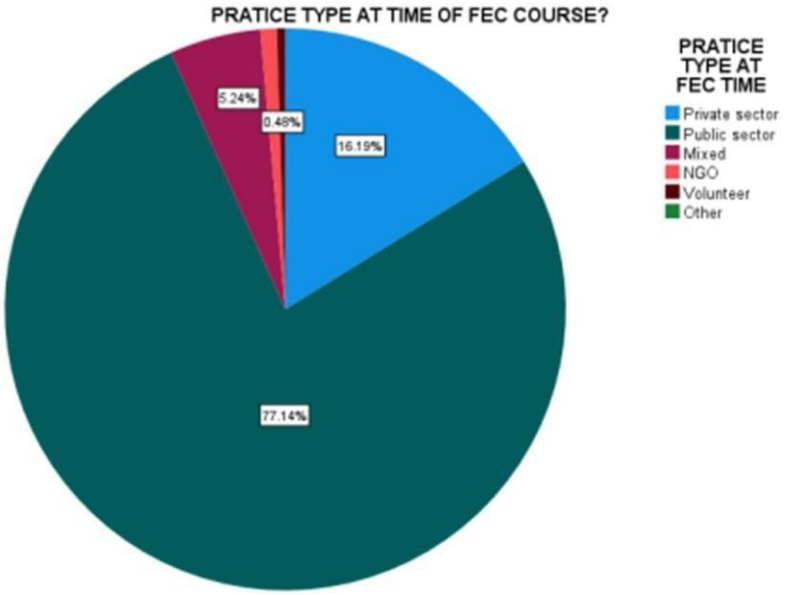


Q 1.3 Years post-basic qualification?

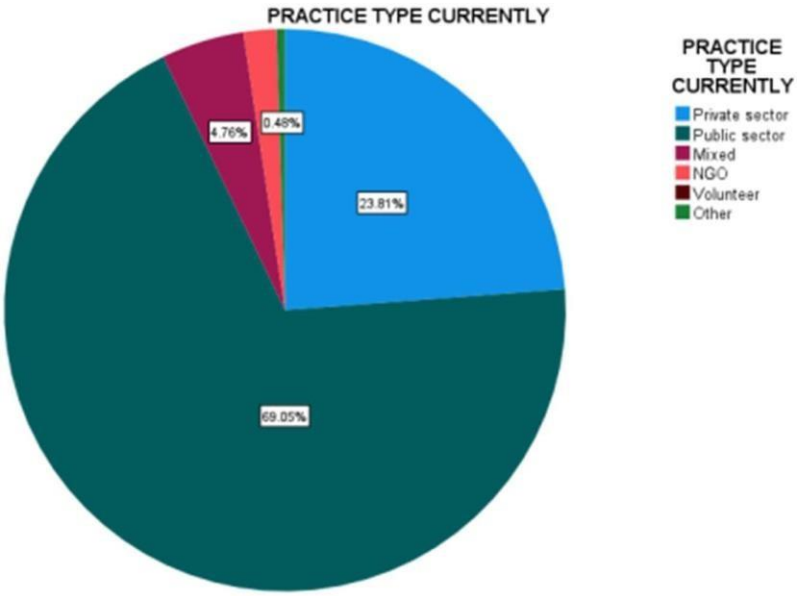


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.4.1 Type of practice at time of FEC course?

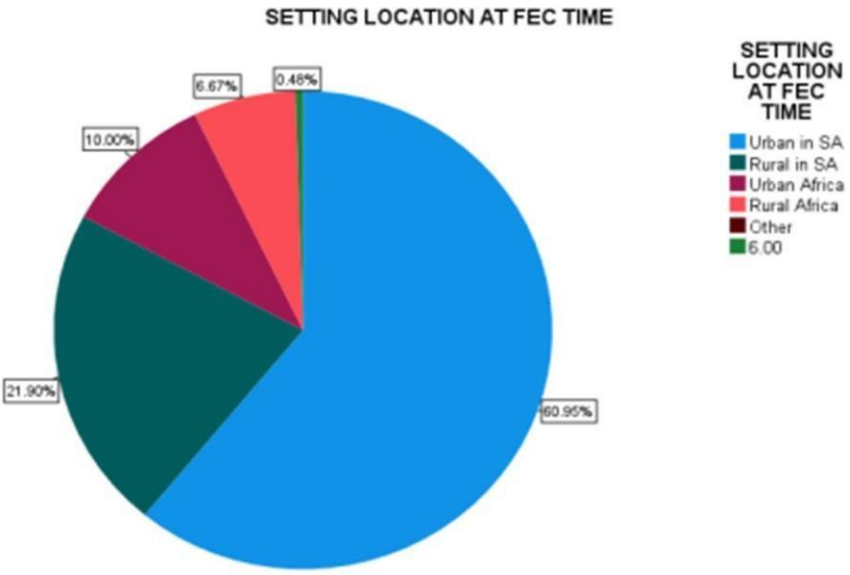


Q 1.4.2 Type of practice currently?

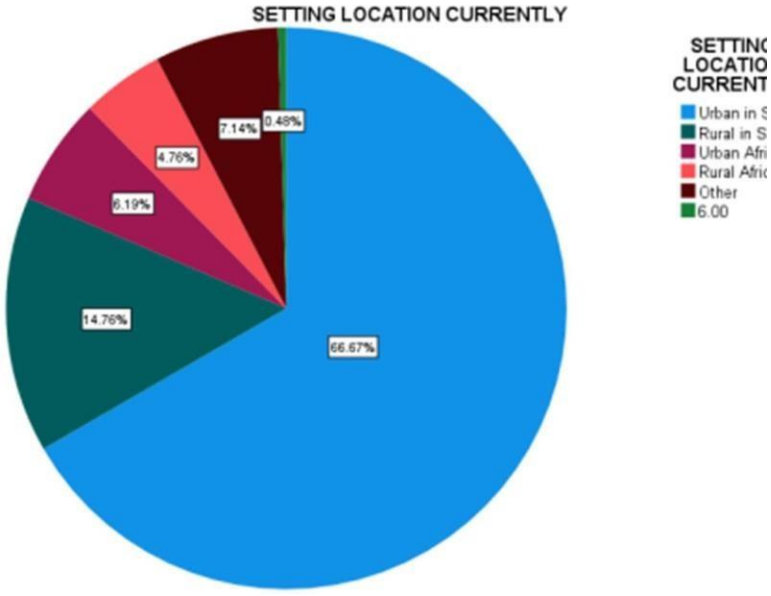


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.5.1 What type of setting were you working in at time of FEC?

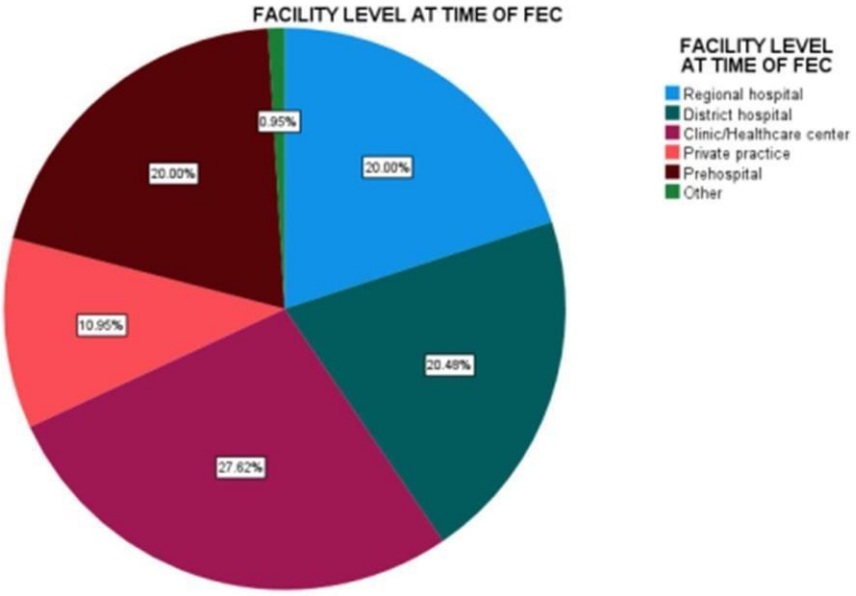


Q 1.5.2 What type of setting are you working in currently?

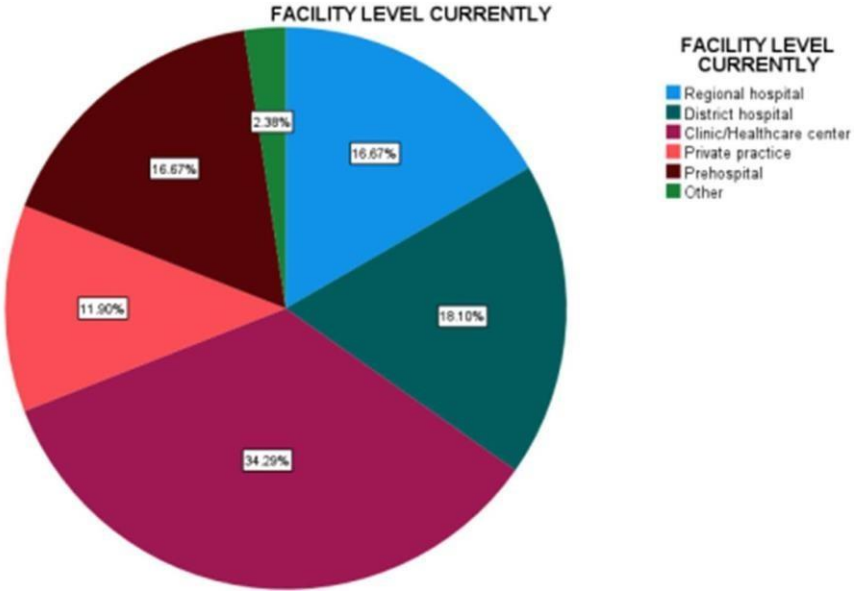


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.6.1 What type of medical facility did you work at time of FEC?

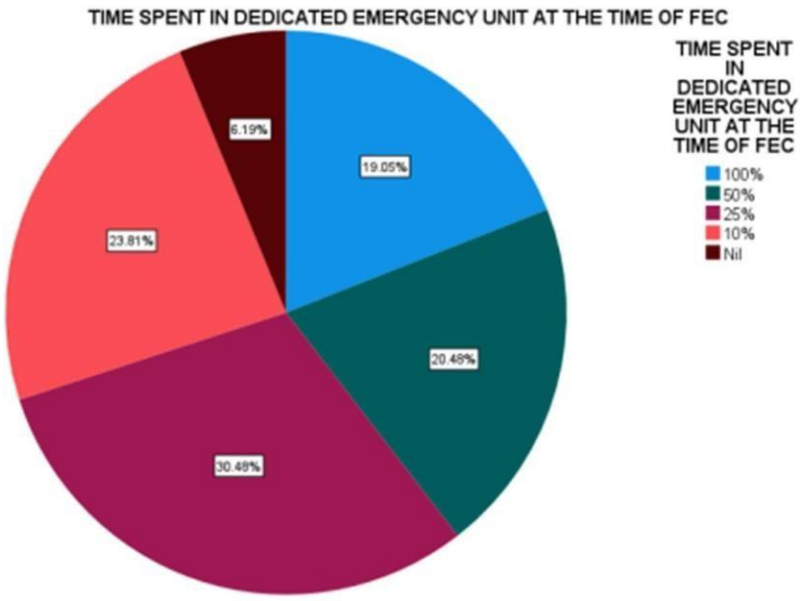


Q 1.6.2 What type of medical facility do work at currently?

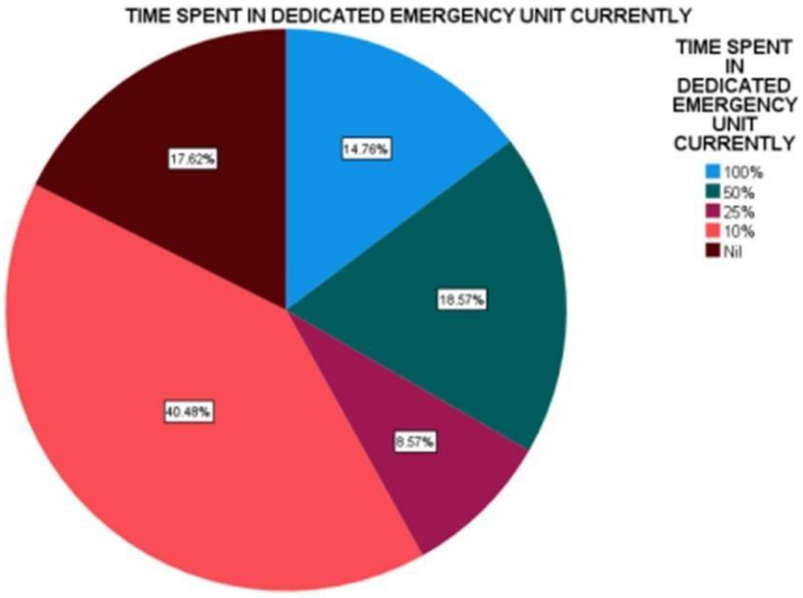


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.7.1 How much time were you spending in a dedicated emergency unit at time of FEC?

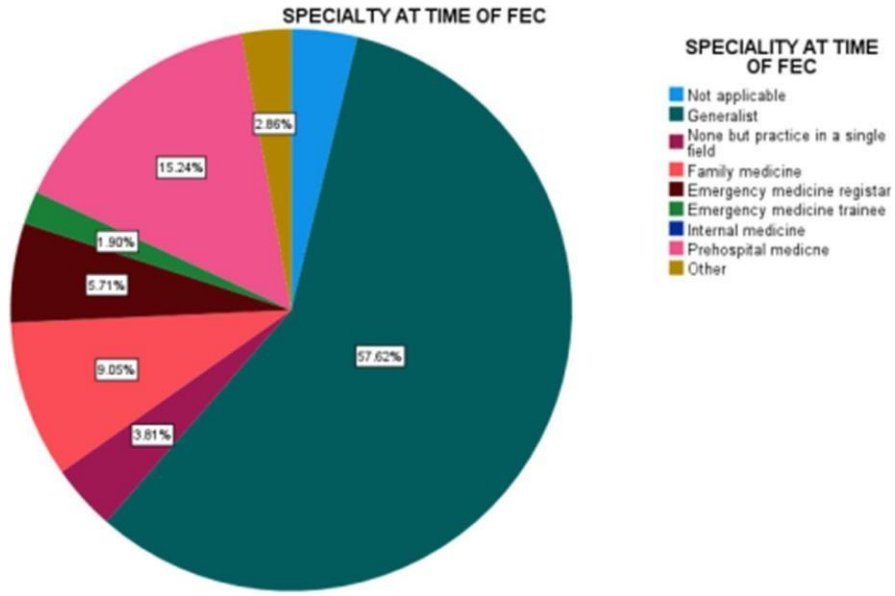


Q 1.7.2 How much time do you spend currently in a dedicated emergency unit?

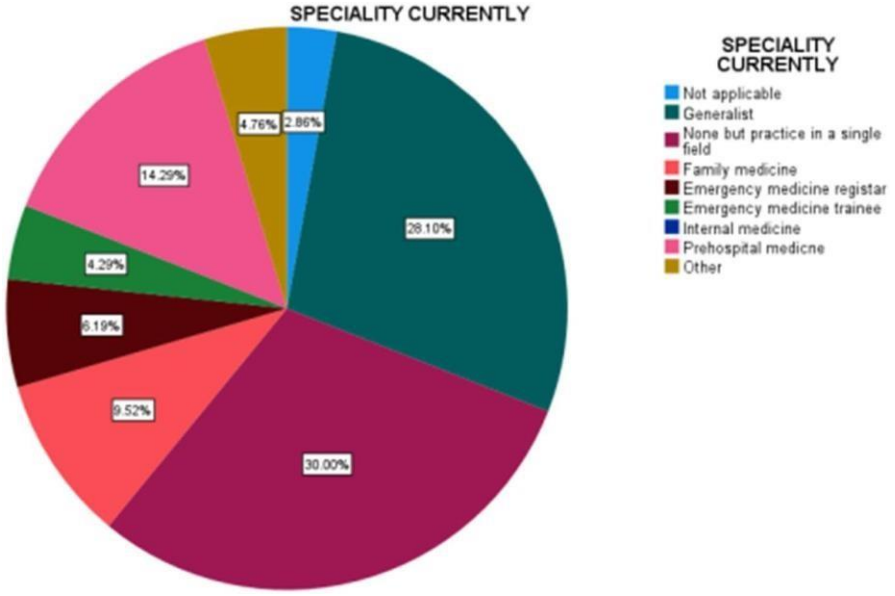


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.8.1 What is your specialty, if any, at time of FEC course?

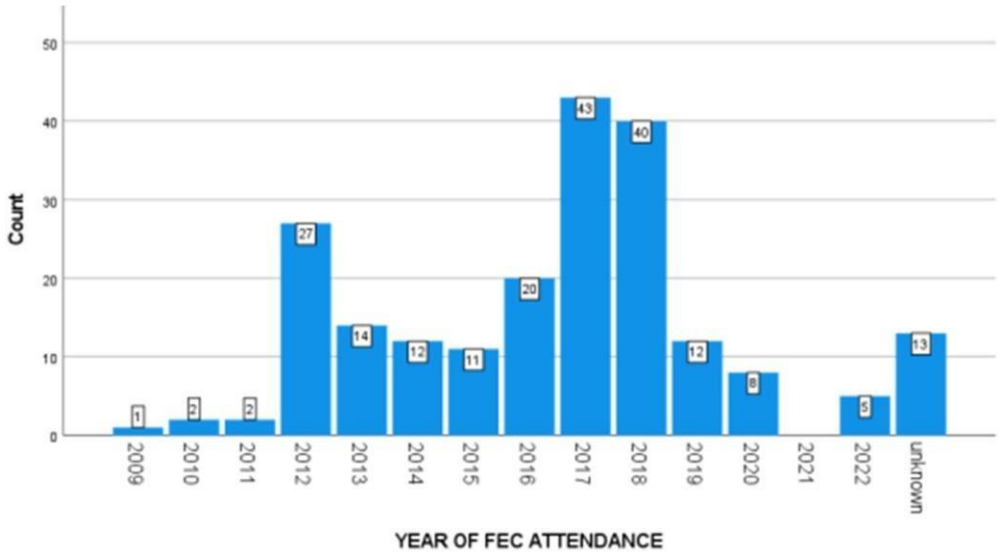


Q 1.8.2 What is your current specialty if any?

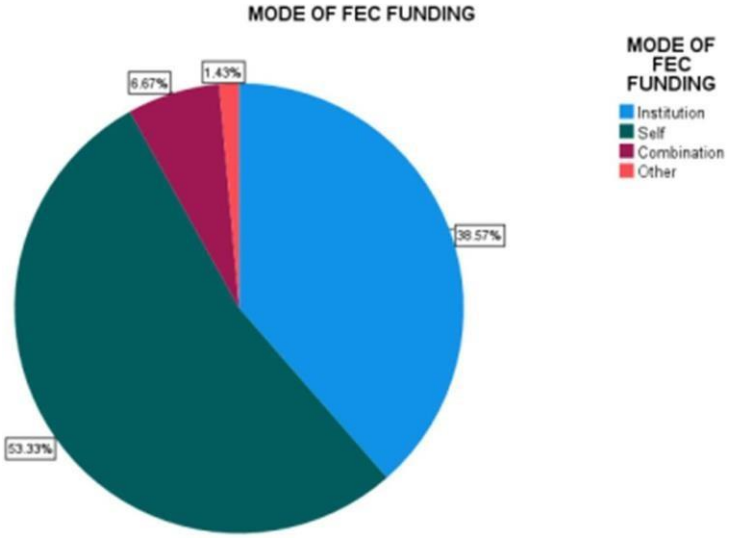


Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.9 In which year did you attend the FEC course?

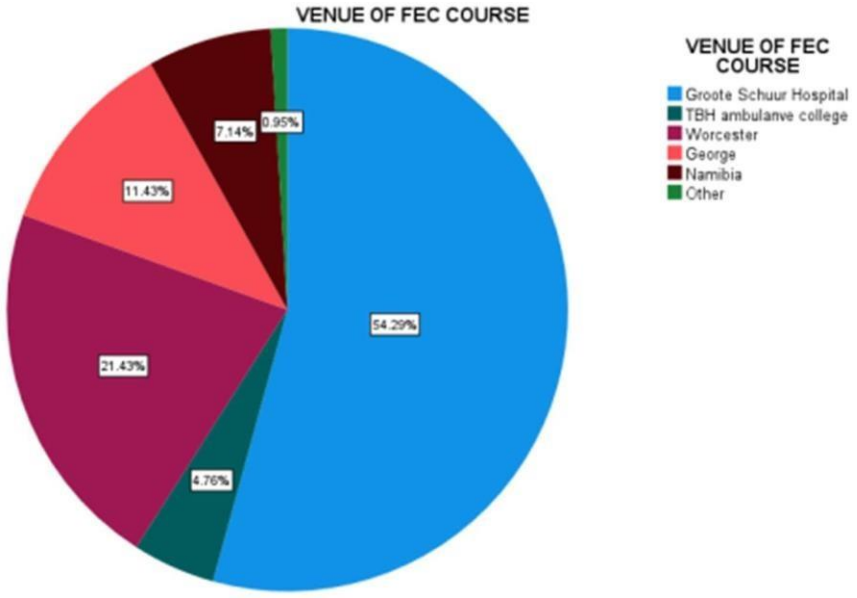


Q 1.10 How was your FEC course funded?



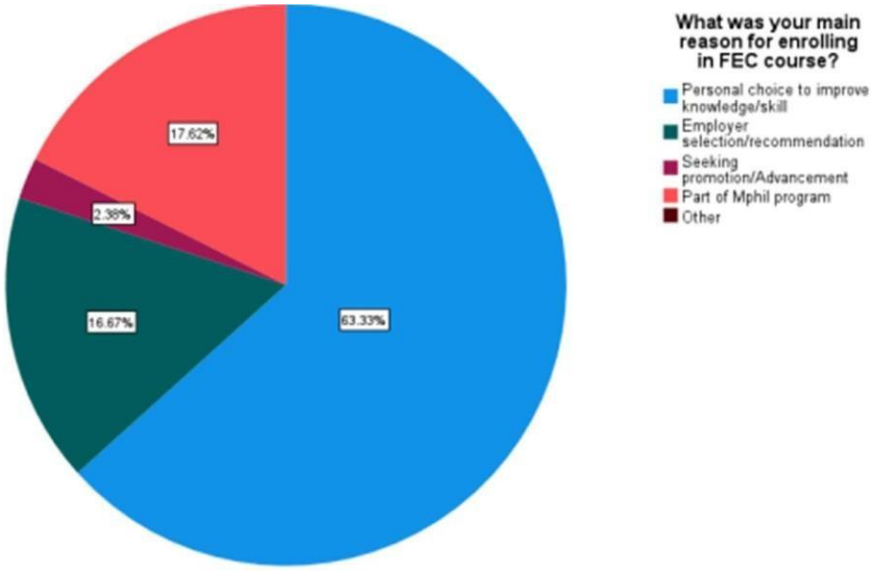
Appendix D: SUMMARY OF DATA ANALYSIS

Q 1.11 Location of the course?



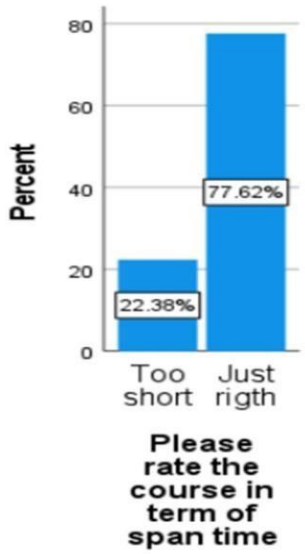
2. JUDGEMENTAL DATA

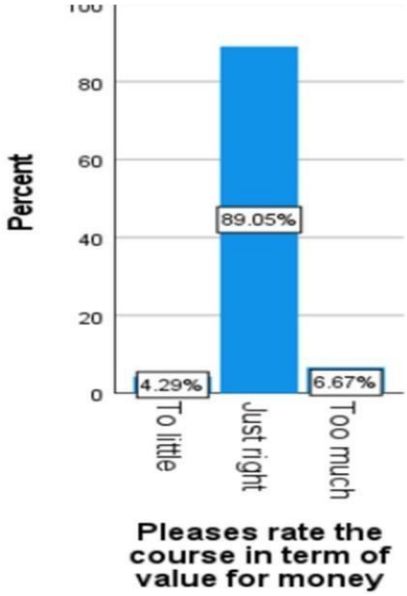
Q 2.1 What was your main reason for enrolling in the FEC course?

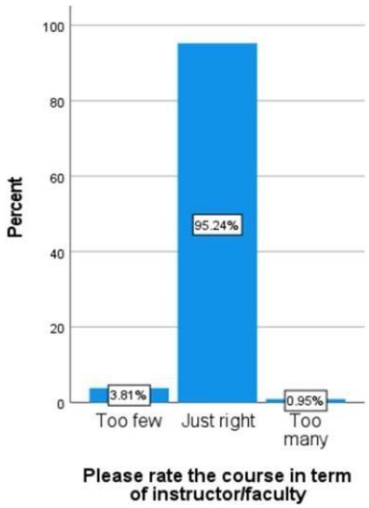


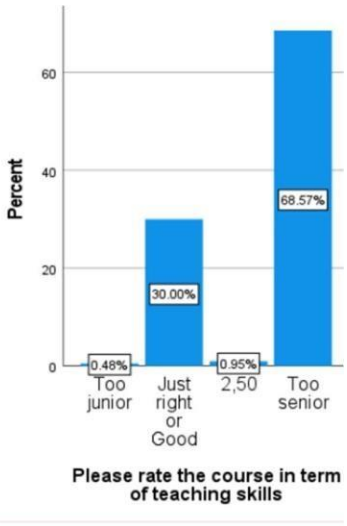
Appendix D: SUMMARY OF DATA ANALYSIS

Q 2.2.1 Please rate the course in terms of span time, value for money, instructor/faculty,faculty level and teaching skills.



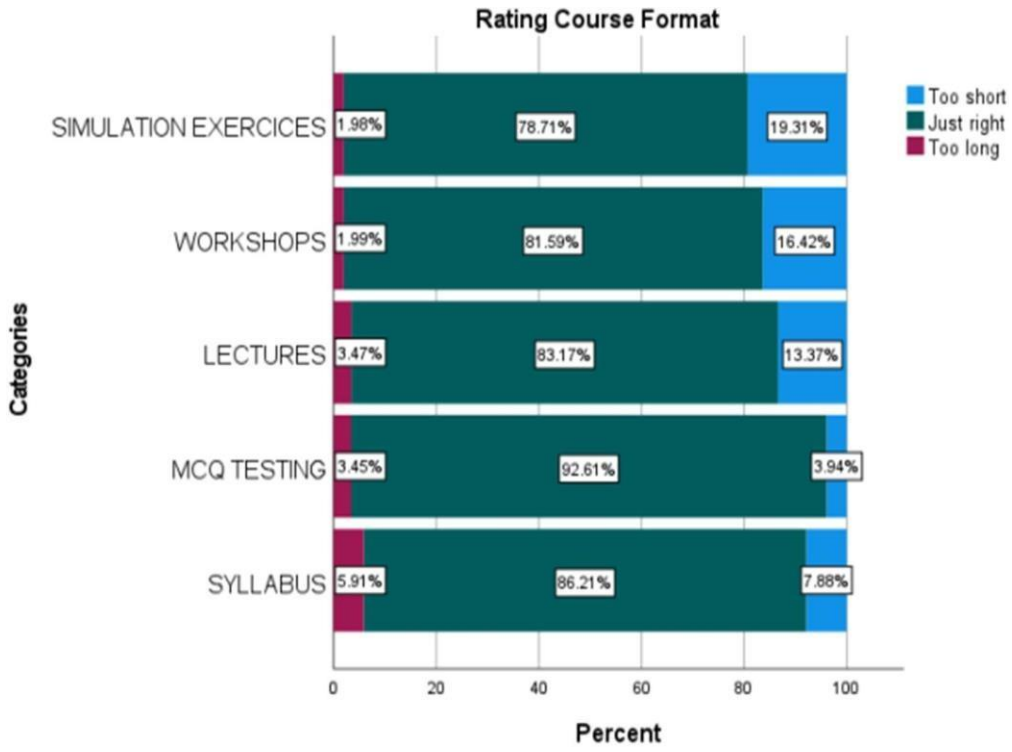






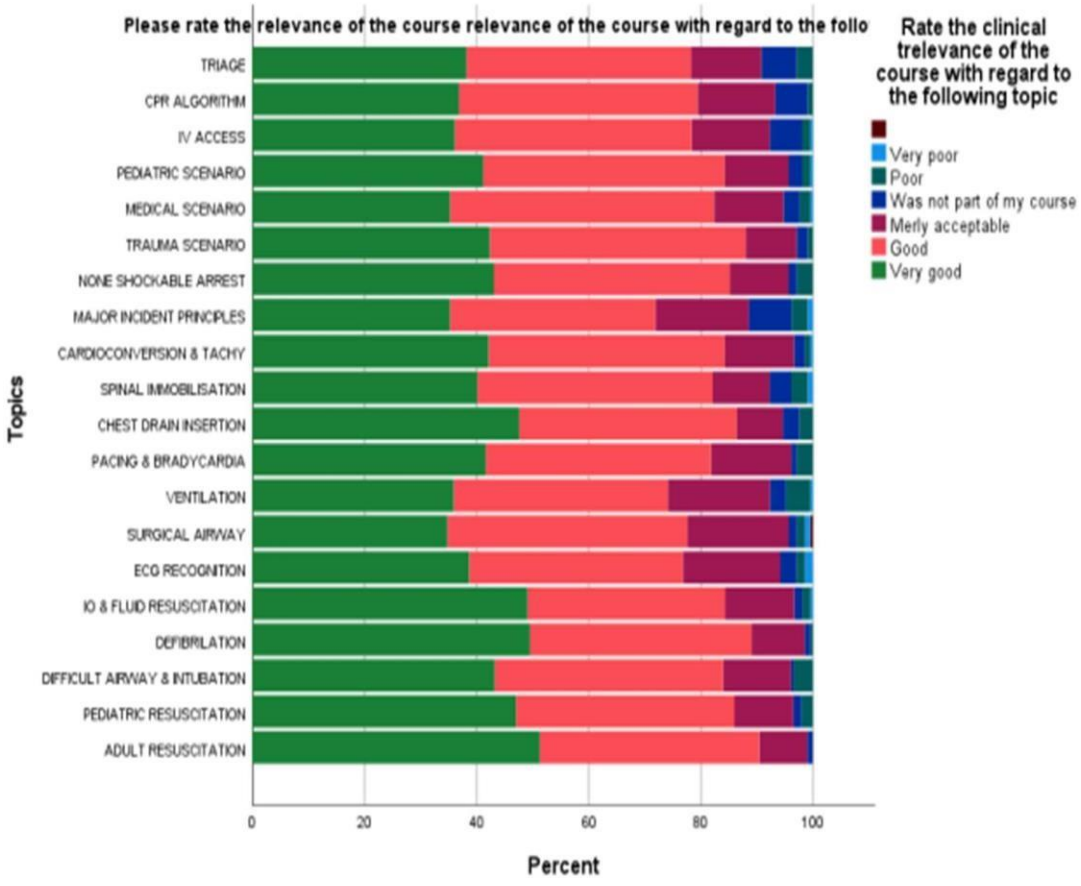
Appendix D: SUMMARY OF DATA ANALYSIS

Q 2.2.2 Please rate the overall format of the course (syllabus, MCQ testing, lectures,practical workshops & simulation exercises).



Appendix D: SUMMARY OF DATA ANALYSIS

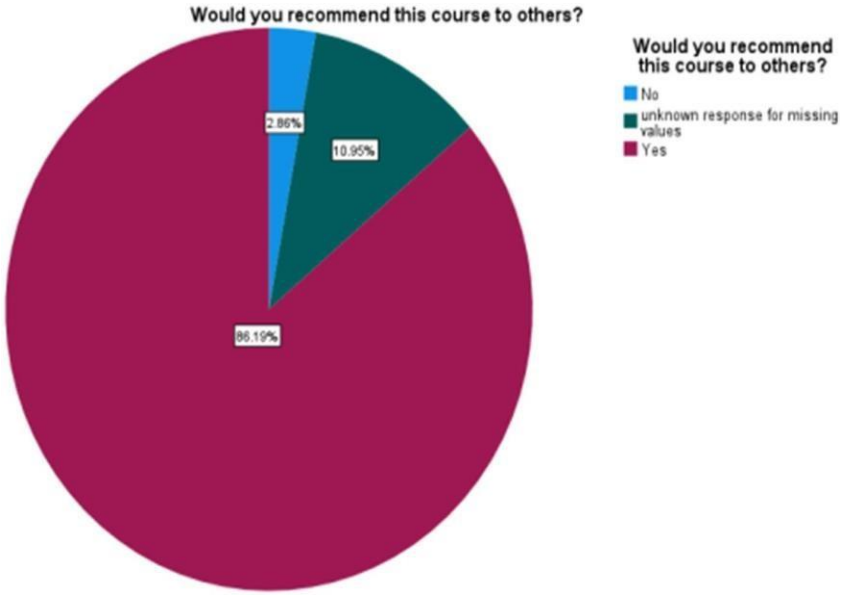
Q 2. 3 Please rate the following statement on a scale of 1 to 5 (1 being poor and 5 being very good) regarding relevance/usefulness of specific skill/ knowledge gained to your clinical practice.



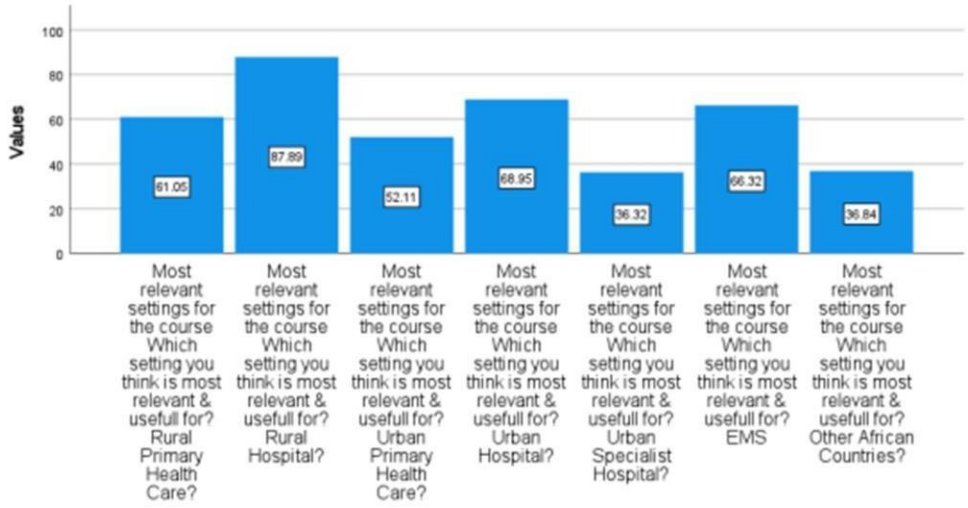
Appendix D: SUMMARY OF DATA ANALYSIS

Q 2.4.1 Will you recommend this course to others?

II



Q 2.4.2 Please specify which settings you think the course is the most relevant & useful for?



Appendix D: SUMMARY OF DATA ANALYSIS

Q 2.5 Please rate the following statement on a scale of 1-5 91-strongly disagree, 5-stronglyagree).