African Journal of Emergency Medicine 12 (2022) 129–134

Contents lists available at ScienceDirect

African Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/afjem

Training and certification in first responder care among mountaineering practitioners in east Africa

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ARTICLE INFO

Keywords:
First responder care training
Recertification
Refresher training
Mountaineering practitioners

ABSTRACT

Introduction: Mountaineering activities have potential risks for injuries and illnesses. Extreme weather conditions, high altitude, limited resources and accessibility to transport and definitive medical services calls for mountaineering practitioners to be well prepared through training and certification in first responder care. This is useful in cases when they have an injured climber and need to offer support in the tier-one emergency system care before accessing further care in a medical facility. The study sought to establish the first responder care training status of mountaineering practitioners and the associations of mountaineering practitioners' first responder care training levels and gender, age, years of work experience, and designation.

Methods: The study used cross-sectional analytical research design with a purposive sample of one hundred and thirty six (136) mountaineering practitioners in East Africa. Snowball sampling procedure was used to identify the respondents since there were no records indicating the population size or specific location of these mountaineering practitioners. A self-administrated questionnaire was used to collect data on whether they were trained or not; status of their up-to-date certification; institutions where they did their training and recertification; and their training levels in first responder care, which would cover the aim of the study.

Results: Majority of mountaineering practitioners (91.2%) had received some form of training. However, 47.1% had received training in basic first aid, which did not involve mountain related components. Outdoor practitioners' up-to-date training was dependent on their age ($p = 0.005$), and years of work experience ($p = 0.014$).

Discussion: There is need for mountaineering practitioners to have standardized minimum training in wilderness specific first responder care. The study recommends that the training and recertification should be undertaken on a regular basis by the mountaineering practitioners in East Africa.

Introduction

The remoteness, wilderness, beauty and a sense of achievement when climbers reach the top are reasons that draw our attention to the mountains. However, risk is an integral part of outdoor activities. It is therefore, key for mountaineering practitioners in managing the balance of risk and safety [1]. Mountaineering activities have potential risks for injuries and illnesses. In African rural settings, where mountaineering takes place, this is further complicated by the fact that one cannot access critical care immediately due to limited resources, poor network services and accessibility of means of transport to definitive medical services. This then warrants preparedness and training of practitioners to offer first responder care as they work towards evacuation and getting to hospitals.

It is important for mountaineering programmes to have a medical officer as part of the personnel. However, this is not always the case in the African setting, where medical personnel is a limited resource, even in the health facilities. In mountain settings, any climber whether a client, practitioner, or medical personnel, is liable to medical emergencies in the environment-related conditions like High Altitude Pulmonary Edema (HAPE), High Altitude Cerebral Edema (HACE), hypothermia and frostbite [2]. It is prudent for climbers to have a number of group members who are trained in first responder care [3]. This is also noted by Elbashir, et al in the case of local communities in Sudan [4].

The high altitude and wilderness aspects of first responder care are usually not covered in the basic urban (traditional) first aid programmes [5]. First responder care can be initiated by anyone in any sit-

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https://doi.org/10.1016/j.afjem.2022.02.006
Received 30 September 2021; Received in revised form 5 January 2022; Accepted 23 February 2022

uation, but it is noted that it should be influenced by circumstances, and training [6]. The most basic of the outdoor adventure and mountaineering practice first responder care training is Wilderness First Aid (WFA). For more advance training, one is required to undergo a Wilderness First Responder (WFR). Another level of first responder care training related to the wilderness settings is the Wilderness Emergency Medical Training (WEMT). Tour companies handling international clients especially from the USA, Europe, and other parts of the world and operating in East Africa require trip leaders to have minimum standard of training and certification. They either sponsor their local in country trip leaders for training and certification or send their groups with a foreign trip leader with similar training and certification.

Safety measures in the outdoor adventure should be employed within a broader risk management approach that represents best practice to health and safety [7]. Emergency care is a continuum, and there is need to improve prehospital care [8]. Within the spectrum of emergency care, first aid is regarded as the first level of care by out-of-hospital care providers relevant in African low resource areas [8]. According to the African context expert consensus by African Federation for Emergency Medicine (AFEM), the first aid offered by the bystanders is the tie-one system of emergency care [9]. The tier-two systems involve the out-of-hospital emergency care that is offered by professional medical responders [8]. For the mountaineering practitioners to provide tier-one system of first responder care, they need training in such care [10]. This first responder care training builds capacity to manage health emergencies in resource-limited settings [10]. For example, the wilderness first responder training for the mountaineering practitioners should have wilderness-specific components.

In Nepal, the Kathmandu, Nepal model was set up in order to improve emergency medical services systems and mountain medicine protocol [11]. Also, findings from a study on Nepal porters supported the need for training porters in wilderness first responder care [12]. There has been a challenge in the development of out-of-hospital emergency care in low- and middle-income countries, especially in Africa [13]. This has been the case in East Africa, where there has been no local national out-of-hospital emergency care policies or guidelines, especially concerning the wilderness and mountaineering practice [14–16]. The bigger challenge is that even within the hospital settings in developing countries, for example in Kenya [17], there is shortage of the healthcare workers. So it becomes more challenging to have the same personnel out in mountaineering programmes.

Mountaineering in East Africa has reported cases of mountain sicknesses, fatalities and injuries [2,18–20]. Wachira et al [2] showed reported evacuations on Mt. Kenya whereby 95 cases were due to mountain sickness and 10 cases were due to falls. On Mt. Kilimanjaro, a 2-year retrospective study had 56 cases of high altitude illnesses of referrals to a hospital in the region . The East African mountains are quite unique. East African Afro-Alpine Mountains lie very close to the equator but yet rises above 4,000 meters above sea level. All rise from the low plains typical of equatorial Savannah grasslands ecosystem but increase in altitude and subsequent climatic changes. A hike from the base of any East African mountain to the mountain top would be similar to experiencing a walk from the equator to the North or South Pole. The temperate zones on either Pole would experience summer and winter weather conditions over a 12-month period while for the East African mountaineers, they have to contend with summer temperatures during the day and subzero winter temperatures during the night at the topmost alpine zones. This poses mountain environmental-related concerns to visitors to the African mountains. Mt. Kilimanjaro is the highest free-standing mountain but it has its share of concern that may cause danger in the relative ease of ascent [20] in some routes like the Marangu route. This is the same case on Mt. Kenya on Sirimoni route. What is perceived as easy may end up contributing to mortality. It is also, noted that there are more people who die annually on Mt. Kilimanjaro, which is 5895 metres above sea level, than on Mt. Everest, which is 8848 metres above sea level [21].

Expeditions take from 3 days minimum on Mt. Kenya to 5 days or longer if it involves outdoor education expeditions. For Kilimanjaro, it is minimum 6 to 10 days depending on the route but it can also take longer if it is outdoor education expedition. For Rwenzori, it is also minimum 8 to 10 days depending on whether the visitors stay on central circuit or are attempting the main peaks. There are mountain rangers from the national parks authorities who offer rescue services. Generally, in the East African mountains, for every two kilometers, it takes an hour's effort to get back to a particular point, for casualty evacuation. Rescues may therefore take a couple of hours or days, depending on the point up the mountain the climber is, and the weather. In some cases, helicopter rescues are possible. In Mt. Kilimanjaro it is common practice for mountaineering groups to carry Automated External Defibrillator (AED). On Mt. Kenya and Rwenzori, this is not a standard practice. However, even when groups have carried the AED, there seems to be no lay person first responder care program that specifically trains on the correct use of the defibrillator. By and large, most porters and guides non-medical training is on the job with no laid out professional training pathway or requirement.

Just like the other low-resource settings in East Africa [22] the mountain regions need attention in strengthened emergency care systems and training [23]. This study was concerned with mountaineering practitioners who are part of the community in the mountaineering practice in East Africa. They have other roles to play in the program, like working as porters, guides, teachers and instructors. So when need arises, they would work within the tier-one system of out-of-hospital-emergency care, and if trained, within the tier-two system. The study found out how their status was, in this training. In addition, the practitioners at the mountains also differ in their demographics in terms of their age, gender and years of experience. The description of these demographics was also assessed. In addition, the mountaineering practitioners should take part in continued education through refresher courses and recertification in first responder care. This is because most of the knowledge and skills acquired during training tend to depreciate over time especially because emergencies do not take place every day and hence individuals are not in constant practice of the skills [24]. There is dearth of information on the status of the first responder care training and certification of the mountaineering practitioners in East Africa. This paper assesses the status of the East African mountaineering practitioners in terms of training, certification and up-to-date status in the provision of tier-one and tier-two systems in the out-of-hospital emergency care in East African mountains.

Methods

The study was part of was part of a larger cross-sectional survey titled, "Outdoor Adventure Practice in the Afro-Alpine Mountain Areas in East Africa: Training, Certification, Competence, and Standards in Injury Occurrence and Pre-Hospital Emergency Risk Management (PHERM)", which involved both qualitative and quantitative methods capturing data from various data sources. While the aim of the larger study was to establish the preparedness of the outdoor adventure practitioners in PHERM, the purpose of this paper is to specifically highlight the qualification of East African mountaineering practitioners in terms of training and certification in first responder care.

The study targeted; outdoor adventure facilitators, teachers, team-building instructors, park and forests authorities, guides, porters, and outdoor adventure institutions' management from East Africa. Snowball sampling [25] was used to identify the participants. This sampling procedure was suitable to select respondents from all groups and designations of respondents since there were no records indicating the population size or specific location of these mountaineering practitioners. The study visited existing programmes on the mountains, practitioners' associations and institutions where respondents are employed and kept recruiting on the spot until no other new potential respondent could be found. The study recruited a total of 136 participants

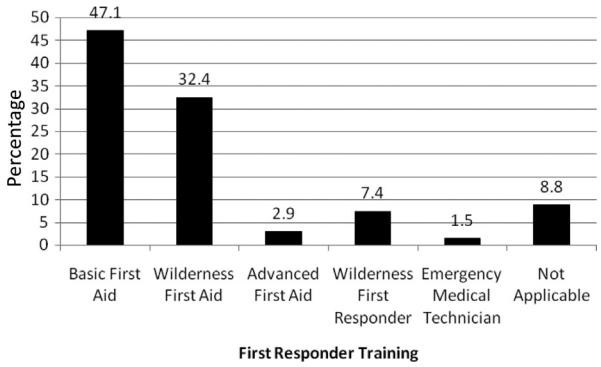

Fig. 1. Characteristics of respondents according to training and certification in first responder care.

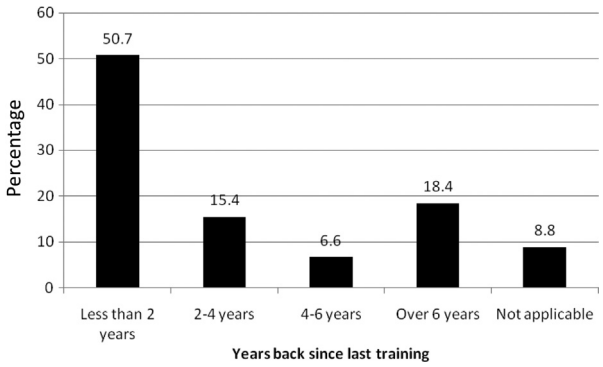

Fig. 2. Demographics of respondents according to years back since the last re-certification in first responder care training.

to respond to the study questionnaires. The study variables were the mountaineering practitioners' first responder training levels, and status of their up-to-date certification. The mountaineering practitioners are of various demographics, hence the study included their demographic characteristics of gender, age, designation, and work experience, .Ethical approval was obtained from Kenyatta University Ethics Review Committee (KUERC), Application No: PKU/590/I676, and a research permit obtained from National Commission for Science, Technology and Innovation (NACOSTI), Ref. No. NACOSTI/P/17/78169/19735. After explanation of the nature of the study, each respondent gave their consent to participate prior to providing any information.

A self-administrated questionnaire was used to collect data from the mountaineering practitioners. The questionnaire was divided into two sections; Section A sought respondents' bio data such as gender, age, years of experience and designation. Section B collected data on mountaineering practitioners' training and certification in first responder care. It collected data on whether they were trained or not; status of their up-to-date certification; institutions where they did their training and recertification; and their training levels in first responder care. The questionnaire found out whether the mountain practitioners were trained in Basic first aid (BFA), Wilderness first aid (WFA), Advanced first aid (AFA), Wilderness first responder (WFR), Emergency medical technician (EMT), Wilderness emergency medical technician (WEMT), and Paramedic.

The data entry and analysis was performed using Statistical Package for Social Sciences software package, version 22 [26]. Somers' delta (Somers' *d*, for short), a nonparametric measure of the strength and direction of association that exists between an ordinal dependent variable and an ordinal independent variable [27], was used to find out the association of socio demographic variables with the training status of the mountaineering practitioners in first responder care. $P < 0.05$ was taken as statistically significant association.

Results

The study sought to find out the status of the first responder care training by the mountaineering practitioners in East Africa (Fig. 1).

Out of the 136 (100%) of the respondents; 124 (91.2%) had training in first aid while 12 (8.8%) had no training in any form of first aid. More details of the distribution of the respondents' as per the demographic characteristics and training in first responder care are presented as support document 2. The association of respondents' demographic characteristics (gender, age, designation, and work experience) and the level of first responder care training and certification were not significant.

Certification in first responder care

Training in first responder care meant the respondents had attended and had certification in any of the following: Basic first aid (BFA); Wilderness first aid (WFA); Advanced first aid (AFA); Wilderness first responder (WFR); Emergency medical technician (EMT); Wilderness emergency medical technician (WEMT); and Paramedic. Those who had training in basic first aid were 64(47%), while only 2 (1%) had wilderness emergency medical technician qualification. Respondents with training in advanced first aid were 4(3%), while 44(32%) had wilderness first aid. It is noted that 12 (9%) had no training in first responder care, and 64(47%) had training in urban first aid. There was no trained paramedic. Only 60 (44%) had training in wilderness-related first aid.

Training institutes

The respondents reported to have obtained their training and certification from the following institutions: Sentinel Outdoor Institute, St. John's Ambulance, Kenya School of Adventure and Leadership (KESAL), China Red Cross, Kenya Red Cross, Uganda Red Cross, National Outdoor Leadership School (NOLS), Nairobi Aviation College, Kenyatta University, University of Nairobi, Kenya Wildlife Services (KWS), Nature Kenya, Uganda Wildlife Training Institute, and Salvage Wilderness. Most mountaineering practitioners had done basic first aid with time of exposure ranging from 8 h to 36 h, depending on the institution. Those who did their courses in the Universities like Kenyatta University and University of Nairobi took the longest time, covering 90 h of advanced first aid. Other institutions offering basic first aid, however, had it covered in either 8 h or 16 h.

Respondents' up-to-date certification in wilderness prehospital emergency care

The study investigated the up-to-date training status of the mountaineering practitioners (Fig. 2).

12 (8.8%) of the respondents had not trained and hence did not have any recertification. For the rest, 21 (15.4%, 9(6.6%), and 25 (18.4%) had lastly done recertification, the last 2–4 years, 4–6 years and over 6 years ago, respectively. Majority of the responds, 60 (50.7%) were actually up-to-date, but as noted in Fig. 2, majority of the respondents with up-to-date training, 31 (22.8%), were actually trained in urban first aid and not in wilderness first aid which is more necessary for mountaineering practitioners. More details of the distribution of the respondents' as per the demographic characteristics and up-to-date certification in first responder care are presented as support document 2.

Respondents who were less than 40 years old, 48 (35.3%) had more up-to-date certification compared to their older counterparts. Also, 35 (25.7%) of them who had been working in the outdoor adventure practice for less than seven years had more up-to-date first responder care training and certification compared to those who had worked for more than seven years.

Association of respondents' demographic characteristics and up-to-date training (years back since last recertification)

Somers' d was run to determine the association between up-to-date training and respondents' gender, age, designation, working experience, and the training level in first responder care. The association between gender, designation and the years back of training was weak, negative and not statistically significant. There was a positive correlation between up-to-date training and respondents age, which was statistically significant ($d = 0.185$, $p = 0.005$) Therefore, the association between the years back of training and age is positive and statistically significant. Therefore, as respondents aged, the years back since they did training went up. The older the participants, the lesser they had up-to-date certification. There was also a positive correlation between up-to-date training and respondents years of working experience, which was statistically significant ($d = 0.156$, $p = 0.014$). Respondents with less work experience had more recent recertification than the ones who had worked for longer years. The younger ones may also have been the ones who had trained in urban first aid. There was a weak, positive correlation between up-to-date training and respondents' level of first aid training, which was not statistically significant ($d = 0.150$, $p = 0.090$). This means that mountaineering practitioners did not have up-to-date recertification across board regardless of the category of the first responder care training.

Discussion

The study found that majority of the respondents had been trained in basic first aid. Perhaps this could be because the basic first aid is easily available to them, while the wilderness-based training and certification could be more costly and not easily accessible. This may be a factor that would hinder mountaineering practitioners from East Africa from the wilderness-specific training. Results also indicated that the mountaineering practitioners' training in first responder care was not determined by their age, gender, years of work experience, and designation. All the mountaineering practitioners, regardless of their demographics have the need to seek training in wilderness-based first aid. The mountain environment can be severe, extreme and isolated, whereby in case of emergency, there may be need for prolonged first responder patient care. The African Federation for Emergency Medicine's Out-of-Hospital Emergency Care (OHEC) committee recognized first aid as the first level of care that can be provided, especially in African resource-challenged areas [8]. It is recognized that first responder care cannot replace medical care, but it assists in preventing damage, or complications before health care is provided [21,28].

Training lay people is recognized as necessary in first responder care, especially in resource-poor settings [29–35]. Training and certification in wilderness first aid is important for mountaineering practitioners. This is because mountaineering related emergency care demands unique measures in dealing with limited resources and wilderness environmental concerns [36]. In outdoor adventure, individuals are likely to accept risks, of which seeking for thrill is usually one of the reasons for participation [37]. Therefore, it calls for the providers of mountaineering programmes to be prepared to reduce the risk levels while still accommodating the mountaineering thrills. Wilderness-based first responder care training should be a helpful tool for mountaineering practitioners in order to have self-efficacy in programmes [38,39]. Through training, they are also empowered to be mindful about their own safety [40].

The study did not find any practitioner who had trained as a paramedic. In addition to the lay people offering tier-one system in the mountains, there is need for support in the tier-two system, with more professional support and training in courses such as diploma in mountain medicine and many other related courses [21] pursued mainly by paramedics, nurses and medical doctors. Other studies within East Africa recommend the need to have standardized policies in the training and provision of various levels of out-of-hospital care [15,22]. Guidelines are necessary in the out-of-hospital care in the East African mountains. This is what practitioners in East Africa should recognize and refer the mountaineering participants to the accepted guidelines [20]. The case of the report by Sangeeta [41] is a good indication of developing a country's development and practice in mountain medicine. The emergency medicine sector can offer support in such training needs for the mountaineering and adventure practice in East Africa.

The study found diversity in the training institutions that the respondents had done their training from. They ranged from Sentinel Outdoor Institute, St. John's Ambulance, Kenya School of Adventure and Leadership (KESAL), China Red Cross, Kenya Red Cross, Uganda Red Cross, National Outdoor Leadership School (NOLS), Nairobi Aviation College, Kenyatta University, University of Nairobi, Kenya Wildlife Services (KWS), Nature Kenya, Uganda Wildlife Training Institute, and Salvage Wilderness. These institutions included Universities, Red Cross Society, and government departments like the wildlife services. It is important to note that the first responder training done by mountaineering practitioners in Africa should not be urban based. More so, the wilderness first responder qualifications may not relate to African setting, if the curriculum was not African specific and hence may not cover tropical African conditions and diseases.

The study results indicated that majority of the respondents did not have up-to-date training in first responder care. Respondents' up-to-date training was dependent on their age and years of work experience. The younger respondents, who also had lesser work experience, had more up-to-date training, compared to the older, more experienced respondents, though it was in basic first aid. This implied that the older practitioners were not taking their time to keep up-to-date through training and certification in first responder care. Best practice in emergency care training requires event organizers to check on whether first responder care certifications are current [42,43].

Refresher training can help the participants to retain skills after the initial training [44–46]. A number of studies across the world are in agreement that there is need for regular, frequent refresher courses and up-to date certification for first responder care training [47–49]. It is also known that the kind of incidences that need first aid responses do not occur every other day [50]. That is why there is need for continued training for refreshment and practice. Other studies have recommended recertification courses to review critical skills in first responder care [49]. Refresher courses in first responder care are encouraged in occupation specific settings [51]. First responder training and recertification can be part of the aspects in mountaineering safety management that should be sought after by the mountaineering practitioners in East Africa.

The study had the limitation of generalization of the findings, due to the dynamics of training in first response care in the rest of the world. The study also considered a relatively small sample size, hence most of the results were not statistically significant. The sample selected may not represent other mountaineering practitioners in other parts of the world. However, the interest of the study was to find out the status of the practitioners within East Africa. Another limitation involves the training protocols by various institutions. The study only found out the status of the training as reported by the mountaineering practitioners. It would be helpful, in the future, to follow up on the training and certification institutions to assess the content and the possibility of the mountaineering practitioners having some uniform level of training.

This study found out that majority of outdoor mountaineering practitioners in East Africa were trained only in basic (urban) first aid. This implies a need for further training focusing on wilderness first responder care among the mountaineering adventure practitioners in East Africa. Training in first responder care enhances the standard of care in the mountaineering industry. Mountaineering practitioners should follow the protocol learnt during first responder care training and offer support in the tier-one care in case of high altitude related emergency incidents. The study also found that the practitioners were not up-to-date in their first responder care training. It is important for the mountaineer-

ing practitioners in East Africa to consider being trained and up-to-date in terms of wilderness first responder care. This will ensure their self-efficacy in ensuring safety for clients in mountaineering programmes. In the year 2019, the World Health Assembly passed a resolution and urged member states to increase capacity through trainings for various occupational settings, on prehospital care [52]. This study suggests development of common training in the wilderness first responder programmes, with standards and policies on minimum requirements for mountaineering practitioners in East Africa. The ministry of health in the East African countries can offer support and guidelines in these efforts of regulating public training of the first responder care, to various community settings, including the mountaineering practitioners. There seems to be dearth of information on the training in mountain or wilderness medicine by medical physicians in East Africa. This is a needy scenario, whereby the programs rely on practitioners who, at the least may not also offer proper assistance guided by the appropriate training as lay persons in mountaineering. We recommend that mountaineering programmes should endeavour to include medical personnel as part of mountaineering practitioners. However, there is a challenge of availability of medical personnel who have training in wilderness medicine. The emergency medical societies in East Africa and Africa in general may consider ways to offer this support.

Dissemination of results

Results from this study have been presented in training workshops at the Kenya Wildlife Service (KWS) Mt. Kenya headquarters; Rwenzori Mountains National Headquarters, Uganda; and in Nairobi, for various mountaineering practitioners including porters, guides and wildlife wardens, outdoor adventure facilitators, and teachers drawn from East Africa.

Authors' contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: NM, LW and WS contributed in equal parts. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interest.

Acknowledgements

The authors acknowledge and thank Kenyatta University, Kenya, for funding this study through the Vice Chancellor's 2016 Research Grant. The funders had no role in the study design, data collection or reporting processes.

References

[1] Sports New Zealand. Outdoor Activities: Guidelines for leaders. https://sportnz.org.nz/media/3693/outdoor-activities-guidelines-for-leaders-complete.pdf; 2017 [accessed 28 September 2021].
[2] Wachira L, Muthomi N, Ooko S. Outdoor adventure practice in Kenya: injuries, illnesses, non-medical concerns, and evacuation profiles on Mt. Kenya. J Human Performance Extreme Environ. 2021;16(1). doi:10.7771/2327-2937.1137.
[3] Donelan S. Introduction to wilderness instructor: wilderness medicine within global health. Wilderness Environ Med 2012;23(1):83. doi:10.1016/j.wem.2011.11.009.
[4] Elbashir K, Gore R, Abuaaraki T, Roblin P, Botha M, Yousif M, Ostrovskiys G, Bloem C, James S. Prehospital emergency care and injury prevention in Sudan. Afr J Emerg Med 2014;4(4):170–3. doi:10.1016/j.afjem.2014.05.005.
[5] Johnson DE, Schimelpfenig T, Hubbell F, Frizzell L, Nicolazzo P, McEvoy D, Weil C, Cull A, Kimmel N. Minimum guidelines and scope of practice for wilderness first aid. Wilderness Environ Med 2013;24(4):456–62. doi:10.1016/j.wem.2013.05.003.
[6] Singletary EM, Charlton NP, Epstein JL, Ferguson JD, Jensen JL, MacPherson AI, Pellegrino JL, Smith WW, Swain JM, Lojero-Wheatley LF, Zideman DA. Part 15: First Aid: 2015 American Heart Association and American Red Cross guidelines update for first aid. Circulation 2015;32(18):S574–89. doi:10.1161/CIR.0000000000000269.
[7] Peden AE, Franklin RC, Larsen P. Survey of primary schools across Australia: an examination of key water safety issues. Int J Aquat Res Educ 2009;3(2). doi:10.25035/ijare.03.02.10.
[8] Mould-Millman NK, Stein C, Wallis LA. Time to standardise levels of care amongst Out-of-Hospital Emergency Care providers in Africa. Afr J Emerg Med 2016;6(1):54–5. doi:10.1016/j.afjem.2015.12.002.
[9] Mould-Millman NK, Naidoo R, De Vries S, Stein C, Wallis L. AFEM Consensus Conference, 2013. AFEM Out-of-Hospital Emergency Care Workgroup Consensus Paper: Advancing Out-of-Hospital Emergency Care in Africa: Advocacy and Development. Afr J Emerg Med. 2014; 2014;4(2):90–5. doi:10.1016/j.afjem.2014.02.001.
[10] Orkin AM, Venugopal J, Curran JD, Fortune MK, McArthur A, Mew E, Ritchie SD, Drennan IR, Exley A, Jamieson R, Johnson DE, MacPherson A, Martiniuk A, McDonald N, Osei-Ampofo M, Wegier P, Van de Velde S, VanderBurgh D. Emergency care with lay responders in underserved populations: a systematic review. Bull World Health Organ 2021;99(7):514–28. doi:10.2471/BLT.20.270249.
[11] Walker R, Auerbach PS, Kelley BV, Gongal R, Amsalem D, Mahadevan S. Implementing an emergency medical services system in Kathmandu, Nepal: a model for "white coat diplomacy. Wilderness Environ Med 2014;25(3):311–18. doi:10.1016/j.wem.2014.04.006.
[12] Koirala P, Wolpin SE, Peterson JT. High Altitude Illness: Knowledge, Practice, and Attitudes of Porters in Nepal. Wilderness Environ Med 2018;29(4):431–6. doi:10.1016/j.wem.2018.06.002.
[13] Suryanto Plummer V, Boyle M. EMS Systems in Lower-Middle Income Countries: A Literature Review. Prehosp Disaster Med 2017;32(1):64–70. doi:10.1017/S1049023X1600114X.
[14] Ningwa A, Muni K, Oporia F, Kalanzi J, Zziwa EB, Biribawa C, Kobusingye O. The state of emergency medical services and acute health facility care in Uganda: findings from a National Cross-Sectional Survey. BMC Health Serv Res 2020;20(1):634. doi:10.1186/s12913-020-05508-8.
[15] Nicholson B, McCollough C, Wachira B, Mould-Millman NK. Emergency medical services (EMS) training in Kenya: Findings and recommendations from an educational assessment. Afr J Emerg Med 2017;7(4):157–9. doi:10.1016/j.afjem.2017.06.002.
[16] Broccoli MC, Calvello EJ, Skog AP, Wachira B, Wallis LA. Perceptions of emergency care in Kenyan communities lacking access to formalised emergency medical systems: a qualitative study. BMJ Open 2015;19;5(11):e009208. doi:10.1136/bmjopen-2015-009208.
[17] Miseda MH, Were S, Murianki C, Mutuku M, Mutwiwa S. The implication of the shortage of health workforce specialist on universal health coverage in Kenya. Hum Resour Health 2017;15:80. doi:10.1186/s12960-017-0253-9.
[18] Lawrence JS, Reid SA. Risk Determinants of Acute Mountain Sickness and Summit Success on a 6-Day Ascent of Mount Kilimanjaro (5895 m). Wilderness Environ Med. 2016;27(1):78–84. doi:10.1016/j.wem.2015.11.011.
[19] Dekker MCJ, Mremi A, Kilonzo KG, Nyakunga G, Sakita F, Mvungi M, Urasa SJ, Masenga G, Howlett WP. Altitude-Related Disorders on Mount Kilimanjaro, Tanzania: Two-Year Survey in a Local Referral Center. Wilderness Environ Med 2021;32(1):36–40. doi:10.1016/j.wem.2020.10.003.
[20] Ross Hofmeyr, Meyer W, James M, De Decker R. Recognising and mitigating the risk of altitude-related illness. SAMJ, S. Afr. Med. J. 2016;106(9):834–5. doi:10.7196/SAMJ.2016.v106i9.11389.
[21] Hofmeyr R, Matthew J, De Decker R. Wilderness medicine in southern Africa. SAMJ, S. Afr. med. j. 2017;107(7):554–5. doi:10.7196/samj.2017.v107i7.12608.
[22] Kivlehan SM, Dixon J, Kalanzi J, Sawe HR, Chien E, Robert J, Wallis L, Reynolds TA. Strengthening emergency care knowledge and skills in Uganda and Tanzania with the WHO-ICRC Basic Emergency Care Course. Emerg Med J 2021;38(8):636–42. doi:10.1136/emermed-2020-209718.
[23] Faculty of Prehospital Care, Royal College of Surgeons of Edinburgh. Updated guidance on Medical provision for Wilderness Medicine, https://fphc.rcsed.ac.uk/myfphc/resources/academic-and-professional-resources/guidance-for-medical-provision-for-wilderness-medicine. pdf 2019 [accessed 15 September 2021]
[24] Joseph N, Kumar G, Babu Y, Nelliyanil M, Bhaskaran U. Knowledge of first aid skills among students of a medical college in mangalore city of South India. Ann Med Health Sci Res 2014;4(2):162–6 PMCID: PMC3991933.
[25] Naderifar M, Goli H, Ghaljaei F. Snowball Sampling: A Purposeful Method of Sampling in Qualitative Research. Strides in Development of Medical Education. In Press; 2017. doi:105812/sdme67670.
[26] Laerd Statistics. SPSS statistics tutorials, https://statistics.laerd.com/; 2016 [accessed 24 August 2021].
[27] Somers RH. A new asymmetric measure of association for ordinal variables. American Sociological Review 1962;27:799–811.
[28] Kaur N, Savitri Kaur M. A descriptive study to assess the level of knowledge regarding the first aid management among school teachers in selected schools of district Mohali, Punjab. J Health Med Informat. 2017;8:288. doi:10.4172/2157-7420.1000288.
[29] Callese TE, Richards CT, Shaw P, Schuetz SJ, Issa N, Paladino L, Swaroop M. Layperson trauma training in low- and middle-income countries: a review. J Surg Res. 2014;190(1):104–10. doi:10.1016/j.jss.2014.03.029.
[30] Marissa B, Tyler C, Sarah N, Schuetz S, Bazan C, laguna J, Shapiro M, Nabil I, Swaroop M, Mamta. The development and implementation of a layperson trauma first responder course in La paz, Bolivia: A pilot study. Injury J 2017;49(5):885–96. doi:10.1016/j.injury.2017.11.022.
[31] Kobusingye OC, Hyder AA, Bishai D, Hicks ER, Mock C, Joshipura M. Emergency

medical systems in low- and middle-income countries: recommendations for action. Bull World Health Organ 2005;83(8):626–31 PMCID:PMC2626309.
[32] Razzak JA, Kellermann AL. Emergency medical care in developing countries: is it worthwhile? Bull World Health Organ 2002;80(11):900–5 PMCID: PMC2567674.
[33] Bhalla K, Sriram V, Arora R, Ahuja R, Varghese M, Agrawal G, Tiwari G, Mohan D. The care and transport of trauma victims by layperson emergency medical systems: a qualitative study in Delhi, India. BMJ Glob Health 2019;19;4(6):e001963. doi:10.1136/bmjgh-2019-001963.
[34] Banstola A, Smart G, Raut R, Ghimire KP, Pant PR, Joshi P, Joshi SK, Mytton J. State of Post-injury First Response Systems in Nepal—A Nationwide Survey. Front. Public Health. 2021;9:407. doi:10.3389/fpubh.2021.607127.
[35] Anderson PD, Suter RE, Mulligan T, Bodiwala G, Razzak JA, Mock C. International Federation for Emergency Medicine (IFEM) Task Force on Access and Availability of Emergency Care. World Health Assembly Resolution 60.22 and its importance as a health care policy tool for improving emergency care access and availability globally. Ann Emerg Med 2012 Jul; 60(1):35–44 e3. doi:10.1016/j.annemergmed.2011.10.018.
[36] Boyd JJ, Agazzi G, Svajda D, Morgan AJ, Ferrandis S, Norris RL. Venomous snakebite in mountainous terrain: prevention and management. Wilderness Environ Med 2007;Fall;18(3):190–202. doi:10.1580/06-weme-ra-087r.1.
[37] Cater CI. Playing with risk? participant perceptions of risk and management implications in adventure tourism. J Tour Manage 2006;27(2):317–25. doi:10.1016/j.tourman.2004.10.005.
[38] Anderson AM, Leisey JM. Wilderness expo 2001: educating the general public on wilderness medicine and outdoor safety. Wilderness Environ Med 2002;13(3):221–4. doi:10.1580/1080-6032(2002)013[0221:WEETGP]2.0.CO;2.
[39] Sun JH, Wallis LA. The emergency first aid responder system model: using community members to assist life-threatening emergencies in violent, developing areas of need. Emerg Med J 2012;29:673–8. doi:10.1136/emermed-2011-200271.
[40] Broccoli MC, Calvello EJB, Skog AP, Wachira B, Wallis LA. Perceptions of emergency care in Kenyan communities lacking access to formalised emergency medical systems: a qualitative study. BMJ Open 2015;59(11):e009208. doi:10.1136/bmjopen-2015-009208.
[41] Poudel Sangeeta. Diploma in Mountain Medicine: A Perspective of a Female Doctor from Nepal. Alt Med Biol 2021;22:417–19. http://doi.org/10.1089/ham.2021.0021.
[42] Auckland Council. Guidelines: event safety risk assessment and management plan. https://www.aucklandcouncil.govt.nz/licences-regulations/manage-your-event/Documents/hs300-guidelines-event-safety-risk-assessment-plan.pdf 2018 [accessed 28 September 2021].
[43] Ministry of Education, New Zealand. New Zealand EOTC guidelines: Bringing the curriculum alive. https://eotc.tki.org.nz/content/download/2863/11562/file/EOTC%20Guidelines%20-%20Bringing%20the%20Curriculum%20Alive.pdf. 2016 [accessed 28 September 2021].
[44] Cummins RO, Schubach JA, Litwin PE, Hearne TR. Training lay persons to use automatic external defibrillators: success of initial training and one-year retention of skills. Am J Emerg Med 1989;7(2):143–9. doi:10.1016/0735-6757(89)90126-5.
[45] Nishiyama C, Iwami T, Murakami Y, Kitamura T, Okamoto Y, Marukawa S, Kawamura T. Effectiveness of simplified 15-min refresher BLS training program: a randomized controlled trial. Resuscit J 2015;90:56–60. doi:10.1016/j.resuscitation.2015.02.015.
[46] University of California. Field Operations safety manual. https://www.ucop.edu/safety-and-loss-prevention/_files/field-research-safety/uc-field-research-safety-manual.pdf 2019 [accessed 24 September 2021].
[47] Berden HJ, Bierens JJ, Willems FF, Hendrick JM, Pijls NH, Knape JT. Resuscitation skills of lay public after recent training. Ann Emerg Med 1994;23(5):1003–8. doi:10.1016/s0196-0644(94)70094-x.
[48] Thomas S, Raymond C. Risk and provider responsibility in outdoor adventure activities. Teach Dev J 1998;2(2):265–81. doi:10.1080/13664539800200054.
[49] Brandenburg WE, Davis CB. Medical knowledge and preparedness of climbers on colorado's 14,000-foot peaks. Wilderness Environ Med 2016(1):62–8. doi:10.1016/j.wem.2015.11.009.
[50] Muthomi N, Wachira L, Ooko S. Knowledge in pre-hospital emergency and risk management among outdoor adventure practitioners in East Africa afro-alpine mountains. Afr J Emerg Med 2021;11(1):87–92. doi:10.1016/j.afjem.2020.08.006.
[51] Alexis Descatha, Susanne Schunder-Tatzber, Jefferey Burgess, Pascal Cassan, Tatsuhiko Kubo, Sylvie Rotthier, Koji Wada, Michel Baer. EPROH Scientific Committee. Emergency preparedness and response in occupational setting: A position Statement. Front. Public Health. 2017;5:251. doi:10.3389/fpubh.2017.00251.
[52] World Health Assembly. Resolution 72.16. Emergency Care Systems for Universal Health Coverage: Ensuring Timely Care for the Acutely Ill and Injured. https://apps.who.int/gb/ebwha/pdf_files/WHA72/A72_R16-en.pdf?ua=1 2019 [accessed September 17, 2021].