

# The Current State of Ambulances and Emergency Medical Services in the Hilly Region of Nepal

Shresha SK,<sup>1</sup> Weiner Y,<sup>2</sup> Therriault C<sup>3</sup>

<sup>1</sup>Department of General Practice and Emergency Medicine,  
Dhulikhel Hospital, Kathmandu University Hospital,  
Kathmandu University School of Medical Sciences,  
Dhulikhel, Kavre, Nepal.

<sup>2</sup>Keck School of Medicine of the University of Southern California,  
Los Angeles, California, United States.

## Corresponding Author

Sanu Krishna Shrestha  
Department of General Practice and Emergency Medicine,  
Dhulikhel Hospital, Kathmandu University Hospital,  
Kathmandu University School of Medical Sciences,  
Dhulikhel, Kavre, Nepal.  
E-mail: drsan7@gmail.com

## Citation

Shresha SK, Weiner Y, Therriault C. The Current State of Ambulances and Emergency Medical Services in the Hilly Region of Nepal. *Kathmandu Univ Med J.* **Online First.**

## ABSTRACT

### Background

Pre-hospital care in Nepal has seen marked improvement in recent years. Emergency medical services means out of hospital acute medical care and/or transportation provided to a patient with an illness or an injury. It continues to lack centralization of resources and standardization across personnel and patient transport vehicles operating in the country.

### Objective

To describe the current state of ambulances including on-board equipment, emergency medical services and driver training among ambulances servicing a hilly region of Nepal.

### Method

A descriptive study was conducted among 117 ambulance drivers transporting patients to the Emergency Department at Dhulikhel Hospital in Kavre, Nepal. A convenience sampling was done to collect data using the self-structured questionnaire during a one-month period from 1<sup>st</sup> to 30<sup>th</sup> November 2021. The questionnaire contained 21 items to gather information about the status of ambulance services. Data was analyzed using descriptive statistics.

### Result

The majority of ambulances lack basic and advanced life support equipment. None of the ambulance drivers surveyed had completed formal ambulance driver training and only 35% had received some form of medical training. Most ambulances (70.1%) did not have a licensed paramedic onboard during transport. Majority of the ambulances (91%) were functioning as patient transport vehicle only and these were classified as C-grade ambulances.

### Conclusion

Ambulances remain poorly staffed and under-resourced and ambulance drivers largely lack formal training and credentialing. Targeted interventions and investment are required to bring emergency medical services into compliance with national standards.

## KEY WORDS

*Ambulance, Emergency medical services, Pre-hospital care*

## INTRODUCTION

Emergency medical services (EMS) is a fundamental component of the public health safety net in countries with mature emergency medicine enterprises and disaster response capabilities.<sup>1</sup> In recent years, Nepal has seen significant progress in its EMS. The introduction of the country's first ever toll-free emergency hotline, 102, has greatly improved access to emergency services and ambulance transport throughout the districts of Pokhara and Chitwan and the greater Kathmandu area.<sup>2</sup> Increased utilization of the hotline since its launch in 2011 indicates growing awareness and confidence in EMS in Nepal.<sup>3</sup> Nepal Ambulance Service (NAS) and Dhulikhel Hospital Emergency Medical Service (DEMS) have been crucial in training local emergency medical technicians (EMTs) and paramedics with equipping local ambulances.<sup>3,4</sup> Both organizations also operate emergency dispatch centers reachable by the 102 hotline, which has notably improved pre-hospital communication, including in-field patient management and coordination with receiving facilities.<sup>4</sup>

Despite these advancements, significant challenges remain in regards to the centralization and standardization of EMS in Nepal. The decentralized nature of the country's EMS system has been described in depth, particularly the continued reliance on non-ambulance transportation such as private vehicle, taxi, or local bus and ambulance drivers' personal mobile phone numbers rather than the 102 hotline during medical emergencies.<sup>2,5</sup>

Existing research references the lack of standardization across operating transport vehicles,<sup>6</sup> however, a more detailed picture of the variability in vehicle condition, onboard equipment, and ambulance driver characteristics has yet to be described. To address this gap, the study was conducted among the ambulance drivers with the aim of better illustrating the current state of EMS vehicles and personnel.

## METHODS

This was a descriptive cross-sectional study conducted among ambulance drivers in the Department of General Practice and Emergency Medicine at Dhulikhel Hospital (DH), Kathmandu University hospital from 1<sup>st</sup> – 30<sup>th</sup> November, 2021. Ethical approval from Institutional Review Committee (IRC), Kathmandu University School of Medical Sciences (KUSMS) was obtained to conduct the study.

A total of 117 ambulance drivers providing services in the hilly areas of Nepal such as Kavre, Sindhupalchowk, Sindhuli, Dolakha and Ramechhap districts and were willing to participate in the study were included in the study. A convenience sampling survey method was adopted to collect data from the respondents. Data collection instrument i.e. self-structured pre-designed questionnaire was used which contained demographic information of the respondents,

professional experience, training and credentialing, employer and salary information, vehicle characteristics, global positioning system (GPS) capabilities, usage, and an inventory of on-board equipment and medical supply. Ambulance drivers were first approached in the emergency department following patient handover. Those who were willing and available during data collection period were surveyed on the spot. A follow-up call to complete the survey over the phone was made to those who were willing but unavailable at the time of the encounter.

Data was sorted, coded and entered into Microsoft excel spreadsheet. Descriptive statistics including frequency, percentage, mean and standard deviation were used to analyze and summarize survey responses.

## RESULTS

A total of 117 ambulance drivers providing emergency transport services in the hilly region of Nepal were surveyed during the study period. All of the ambulance drivers who completed the survey were male.

### A. Driver Certifications, Trainings, and Employment

Of the 117 ambulance drivers surveyed, 41 (35.0%) had received some form of medical training. Of those 41 drivers, 23 received first aid training, 17 received basic life support (BLS) training, and 1 person received some other form of medical training. The majority of drivers (n = 24, 58.5%) most recent training session was one to two years ago. Eighty-one drivers (69.2%) had received training in correct personal protective equipment (PPE) use. None of the ambulance drivers received formal ambulance driving training. Drivers most commonly reported working as an ambulance driver for one to three years (n = 51, 43.6%). The majority of drivers (n = 111, 94.9%) were contracted employees of an institution such as NAS or a hospital in the region and received a structured salary from these employers as opposed to being paid directly by patients. Most drivers (n = 101, 86.3%) report working 24-hour shifts (Table 1).

### B. Ambulance Vehicle Characteristics and Usage

The most common vehicle providing ambulance services in the hilly region of Nepal is the Tata Sumo (n = 65, 57%), followed by the Mahindra Bolero (n = 39, 33%). The majority of ambulance vehicles (n = 80, 68.4%) were manufactured between the years of 2016 to 2021. Most ambulances (n = 78, 66.7%) were purchased with donation funds, 36 (30.8%) were purchased directly by the ambulance company, and 3 (2.6%) were donated cars from the community. Of the 117 ambulance drivers surveyed, only 80 vehicles (68.4%) were registered with the District Ambulance Management Committee. Nearly 80% (n = 93, 79.5%) of all vehicles have 4-wheel drive and only 37% (n = 43) of the ambulance vehicles had ever undergone a smoke pollution test. All the ambulances had updated full insurance (Table 2).

**Table 1. Ambulance driver certifications, training and employment (n=117)**

Characteristic	Value
<b>Years of experience as an ambulance, n (%)</b>	
< 1 year	17 (14.5)
1-3 years	51 (43.6)
3-5 years	14 (12.0)
5-10 years	29 (24.8)
> 10 years	6 (5.1)
<b>Ambulance driver training, n (%)</b>	
Yes	0 (0.0)
No	117 (100.0)
<b>PPE training received, n (%)</b>	
Yes	81 (69.2)
No	36 (30.8)
<b>Medical training received, n (%)</b>	
First aid	23 (56.1)
Basic life support	17 (41.5)
Other	1 (2.4)
None	76 (65.0)
<b>Date of medical training, n (%)</b>	
< 1 year ago	7 (17.1)
1-2 years ago	24 (58.5)
2-5 years ago	8 (19.5)
5-10 years ago	2 (4.9)
<b>Refresher medical training completed, n (%)</b>	
Yes	0 (0.0)
No	117 (100.0)
<b>Source of driver salary, n (%)</b>	
Contract with ambulance organization or hospital	111 (94.9)
District ambulance management committee	4 (3.4)
Individual patient	2 (1.7)
<b>Driver availability, n (%)</b>	
Daytime hours	3 (2.6)
24-hours	114 (97.4)
<b>Shift length, n (%)</b>	
8 hours	1 (0.9)
12 hours	15 (12.8)
24 hours	101 (86.3)

All respondents reported that their vehicles are used for patient transport purposes only. The majority of ambulances (36.7%) provided emergency transport for one to 10 patients in the past month. Notably, seven drivers (5.9%) reported transporting more than 50 patients in the past month (Table 2).

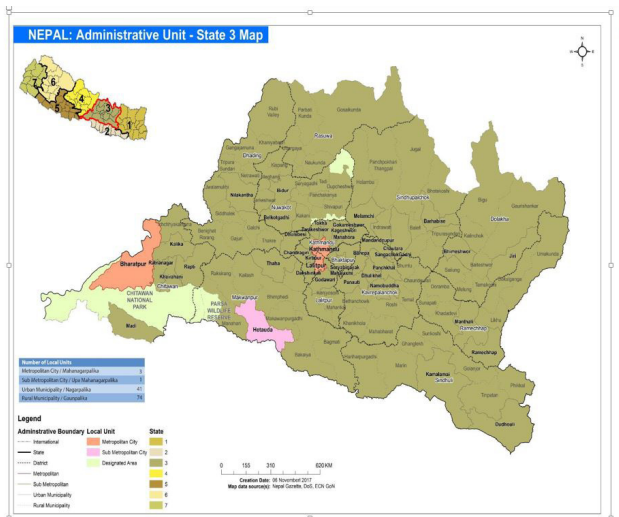
### C. Ambulance Vehicle Stationing and Tracking and Driver Communication

The 117 ambulances included in this study served several districts throughout the greater Kathmandu area. Most ambulances served either the region of Kavrepalanchowk

**Table 2. Ambulance vehicle characteristics and usage (n=117).**

Characteristic	Value
<b>Vehicle manufacturer, n (%)</b>	
Tata Sumo	65 (55.6)
Mahindra Bolero	39 (33.3)
Toyota Land cruiser	5 (4.3)
Other	8 (6.8)
<b>Vehicle year of production, n (%)</b>	
2001-2005	5 (4.3)
2006-2010	6 (5.1)
2011-2015	26 (22.2)
2016-2021	80 (68.4)
<b>Grade of the ambulance, n (%)</b>	
Ka (A-grade)	1 (0.9)
Kha (B-grade)	10 (8.5)
Patient transport vehicle (C-grade)	106 (90.6)
<b>Vehicle drive, n (%)</b>	
4-wheel drive	93 (79.5)
Front wheel drive	24 (63.2)
<b>Smoke pollution test completed, n (%)</b>	
Yes	43 (36.8)
No	74 (63.2)
<b>Registration with district ambulance management committee, n (%)</b>	
Yes	80 (67.5)
No	37 (32.5)
<b>Insurance coverage, n (%)</b>	
Yes	117 (100.0)
No	0 (0.0)
<b>Source of the ambulance</b>	
Donation	78 (66.7)
Community	3 (2.6)
Institutional	36 (30.8)
<b>Use of vehicle for non-patient transport purposes, n (%)</b>	
Yes	0 (0.0)
No	117 (100.0)
<b>Number of patients transports in the last month, n (%)</b>	
0	5 (4.3)
1-10	43 (36.8)
11-20	32 (27.4)
21-30	16 (13.7)
31-40	11 (9.4)
41-50	3 (2.6)
>50	7 (6.0)

(n = 34, 29.1%) or Sindhupalchowk (n = 31, 26.5%). Within their respective regions, the majority of ambulances are stationed at either a rural health post (n = 42, 35.9%) or the nearest hospital (n = 33, 28.2%) (Table 3). A regional map of the Bagmati Province, which includes the areas referenced in the survey results, is displayed in figure 1.



**Figure 1.** United Nations Nepal. Nepal: Administrative Unit - Bagmati Province map [Internet]. Available from: <https://un.org/np/map/nepal-administrative-unit-bagmati-province-map>.

Of the vehicles surveyed, 55 (47.0%) were equipped with a GPS tracking system that can determine the vehicle’s location at all times. The majority of ambulances being tracked via GPS are supervised by the Emergency Dispatch Center (n = 39, 71.0%) Dhulikhel Hospital. The other GPS-enabled vehicles were overseen by tracking centers in the municipalities of Charikot, Manthali and Ramechhap (Table 3).

All of the ambulance drivers used their mobile phones as the main method of communication between dispatch centers and receiving facilities. Twenty-eight (23.9%) of drivers reported that they always communicated with the receiving center after picking up a patient and 33 (28.2%) said they contacted the receiving facility at least half of the time. Drivers (47.9% of respondents) commonly reported, however, that they never communicated with the receiving facility and drive directly to the closest ED without giving prior notice. Similarly, most drivers (n = 69, 59.0%) did not contact the receiving hospital when providing inter-facility patient transfers (Table 3).

**D. Onboard Emergency Personnel, Equipment, and Medications**

Ambulances in Nepal are divided into three categories based on the availability of personnel and equipment on board. “Ka,” or A-grade, ambulances are considered fully-equipped medical transport vehicles. “Kha,” or B-grade, ambulances carry basic life support supplies but lack more advanced equipment. “Patient transport vehicles,” or C-grade ambulances, are outfitted with stretchers and occasionally supplemental oxygen.<sup>7</sup> At the time of this survey, only one of the 117 drivers reported driving an A-grade ambulance. Ten drivers (8.5%) reported driving B-grade ambulances. The vast majority of vehicles (n = 106, 90.6%), however, were classified as C-grade ambulances (Table 1).

**Table 3.** Ambulance vehicle station and tracking and driver communication (n=117)

Characteristic	Value
<b>Ambulance district, n (%)</b>	
Kavrepalanchowk	34 (29.1)
Sindhupalchowk	31 (26.5)
Sindhuli	24 (20.5)
Dolakha	15 (12.8)
Ramechhap	13 (11.1)
<b>Ambulance post, n (%)</b>	
Home	4 (3.4)
Hospital	33 (28.2)
Health Post	42 (35.9)
Police Station	7 (6.0)
Other	31 (26.5)
<b>GPS tracking system enabled, n (%)</b>	
Yes	55 (47.0)
No	62 (53.0)
<b>GPS tracking system affiliation, n (%)</b>	
Dhulikhel Hospital	39 (70.9)
Charikot	10 (18.2)
Manthali	4 (7.3)
Ramechhap	2 (3.6)
<b>Driver primary method of communication</b>	
Mobile phone	117 (100.0)
<b>Driver communicates with receiving facility during emergency transport</b>	
Always	28 (23.9)
Sometimes	33 (28.2)
Never	56 (47.9)
<b>Driver communicates with receiving facility during patient transfer</b>	
Always	48 (41.0)
Sometimes	0 (0.0)
Never	69 (59.0)
<b>Driver communicates with receiving facility during patient transfer</b>	
Always	68 (58.1)
Sometimes	24 (20.5)
Never	25 (21.4)

Eighty-two (70.1%) ambulances did not have a paramedic onboard to provide medical care for patients during transport. The remaining ambulances report either having a paramedic onboard at all times (n = 18, 15.4%) or “as needed” (n = 17, 14.5%), meaning that a paramedic would accompany a patient during transport only under critical circumstances (Table 4).

Most ambulances (n = 82, 70.1%) stocked personal protective equipment (PPE), but only 61 (52.1%) are

equipped with first aid supplies. Of note, the majority of ambulances did not carry a spinal board ( $n = 97$ , 83.0%), a cervical collar ( $n = 105$ , 89.7%), an automated external defibrillator (AED) ( $n = 106$ , 90.6%), or a ventilator ( $n = 116$ , 99.1%) onboard. When asked what medications were carried onboard the ambulance, 106 drivers (90.6%) reported that they did stock life-saving medications, including epinephrine, atropine and amiodarone. However, all 117 drivers reported that they did not administer medication to patients during transport. A complete list of ambulance inventory could be found in table 4.

**Table 4. Availability of personnel, equipment, and medications on ambulance vehicles (n=117)**

Item	Onboard, n (%)	Not onboard, n (%)	As needed, n (%)
<b>Licensed paramedic</b>	18 (15.4)	82 (70.1)	17 (14.5)
Oxygen supply	116 (99.1)	1 (0.9)	
Personal protective equipment	82 (70.1)	35 (29.9)	
Stretcher	63 (53.8)	54 (46.2)	
<b>First aid box</b>	61 (52.1)	56 (47.9)	
Pulse oximeter	40 (34.2)	77 (65.8)	
Spinal Board	20 (17.1)	97 (82.9)	
<b>Cervical collar</b>	12 (10.0)	105 (89.7)	
Splinting materials	12 (10.0)	105 (89.7)	
Patient monitor	12 (10.0)	105 (89.7)	
Nebulizer	11 (9.4)	106 (90.6)	
Wheel chair	11 (9.4)	106 (90.6)	
Automated external defibrillator (AED)	<b>11 (9.4)</b>	<b>106 (90.6)</b>	
Transport ventilator	1 (0.9)	116 (99.1)	
<b>Medications</b>			
Epinephrine	11 (9.4)	106 (90.6)	
Atropine	11 (9.4)	106 (90.6)	
Diclofenac	11 (9.4)	106 (90.6)	
Hydrocortisone	11 (9.4)	106 (90.6)	
Aminodarone	11 (9.4)	106 (90.6)	
Ibuprofen	11 (9.4)	106 (90.6)	
Metoclopramide	11 (9.4)	106 (90.6)	

## DISCUSSION

Although ambulance transport is more widely available and utilized than ever before in Nepal, pre-hospital care still faces significant challenges.<sup>5</sup> Previous studies investigating emergency transport services in Nepal emphasize a general lack of trained drivers, medical equipment, and onboard licensed paramedics as major limitations.<sup>5-9</sup> The results of this study demonstrated similar shortcomings among ambulance drivers and emergency transport vehicles arriving at the Emergency Department in DH, but go one step further in describing these specific deficits.

One of the most striking findings in this study was the lack of formal training completed by ambulance drivers. In September of 2021, the Nepal Ministry of Health and Population officially mandated that all drivers must complete an ambulance driver training program facilitated by the National Health Training Centre.<sup>10</sup> However, none of the drivers surveyed at DH reported having completed any form of ambulance driver training. Continued monitoring of ambulance driver adherence to the new government mandate is warranted to ensure that all drivers are held to a common standard of safety and performance.

The number of ambulances in circulation around the greater Kathmandu area has increased drastically in the last decade, making emergency transport more accessible to the majority of the population.<sup>11</sup> Despite improved access to EMS, patients may not necessarily be transported in an ambulance materially equipped to provide life-saving interventions. Only one A-grade ambulance equipped with advanced life support (ALS) equipment such as a ventilator and AED was reported. This singular ambulance was the only vehicle that meets the emergency transport vehicle standards of countries such as the United States and England, which require that all ambulances must stock ALS equipment such as AEDs, oxygen, and bag-valve masks, even those categorized as BLS vehicles.<sup>12-14</sup> Instead, the majority of ambulances in the region are considered C-grade patient transport vehicles, among which the inventory of onboard equipment varies greatly. Approximately half of ambulances surveyed reported having basic PPE and a first aid kit aboard, and even fewer carried a cervical collar, splinting materials, or a spinal board. The lack of ambulances fitted with basic medical equipment impedes the ability to provide stabilizing interventions during transport and thus warrants targeted investment.

Compounding the limited availability of medical equipment is the scarcity of trained medical providers available to staff the ambulances. Only 15.4% of drivers reported having a licensed paramedic aboard and most vehicles are staffed by only the driver. For the latter cases, this means that even though the majority of drivers report receiving some form of medical training such as first aid and BLS, they are unable to provide whatever patient care they are capable of during transit. These findings highlight the necessity of investing not only in equipment, but also in the hiring of additional personnel such that a trained driver and a skilled health care provider are simultaneously present on board in all ambulance vehicles during transport.

Another aspect of current EMS operations that demands attention is the inconsistent communication between ambulance drivers and receiving facilities. While the establishment of dispatch centers has helped to improve pre-hospital communications, there are still considerable lapses in correspondence between ambulance drivers and receiving facilities prior to patient arrival.<sup>4</sup> The vast majority of ambulance drivers arriving at DH report rarely if ever

communicating directly with destination hospitals. This is especially concerning for ambulances unequipped with GPS tracking or unaffiliated with a formal dispatch operation, as receiving facilities have no means by which to anticipate and prepare for incoming patients. Multiple previous studies have underscored the importance of efficient and standardized pre-hospital notification protocols in improving patient outcomes and reducing mortality.<sup>15-18</sup> Therefore, EMS in Nepal stands to benefit from increased efforts to train ambulance drivers in standardized and streamlined pre-hospital communication measures.

Despite the aforementioned deficits, the results of this study indicate that ambulances generally meet baseline standards for vehicle quality and condition. The current National Ambulance Guidelines mandate that ambulances must be less than ten years old in order to be registered as EMS transport vehicles.<sup>10</sup> The guidelines also require that all vehicles must be outfitted with 4-wheel drive to accommodate the many unpaved roads and rugged terrain of Nepal.<sup>10</sup> The majority of ambulances in this study met these standards. Finally, most ambulances have been registered with the District Ambulance Management Committee within the last three years. While equipment and personnel require significant future investment, notable effort is put towards maintaining the conditions of ambulance vehicles.

This study has potential limitations. Participants were recruited from only one site and included based on their accessibility and willingness to participate, and it is therefore possible that certain groups may be over-

under-represented in our sample. As a result, our findings may not be generalizable to the larger population of ambulance drivers and vehicles. Furthermore, while the exact number of ambulances or patient transport vehicles operating in Nepal is not known, it is unlikely that 117 ambulances servicing just one region of the country is sufficient to characterize the state of EMS nationwide. Further studies in other regions of Nepal, as well as larger scale surveys of the national EMS system are warranted.

## CONCLUSION

Ambulances serving the hilly region of Nepal remain poorly staffed and under-resourced and ambulance drivers largely lack formal training and credentialing. The results of this study provide a more comprehensive evaluation of the current state of EMS ambulance drivers and emergency transport vehicles than has previously been described in the literature. The specific trends identified suggest promising avenues for targeted intervention and investment to improve the current pre-hospital transport system in Nepal.

## CONCLUSION

We would like to express our gratitude to all the study participants for their participation in this study. We also would like to express our sincere thanks to the data collectors and staff of Dhulikhel hospital for their continuous support in conducting this study.

## REFERENCES

- 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 Sep 1;25(3):311-8.
- Bhandari D, Yadav NK. Developing an integrated emergency medical services in a low-income country like Nepal: a concept paper. *Int J Emerg Med*. 2020 Feb 7;13(1):1-5. doi: 10.1186/s12245-020-0268-1. PMID: 32028893; PMCID: PMC7006070.
- Waterstone AM, Prendergast NJ, Gongal R, Il'yasova D, Walker R. Ten Years of the Nepal Ambulance Service: Successful and Sustainable Efforts. *Wilderness Environ Med*. 2022 Dec 1;33(4):454-9.
- Jacobson CL, Basnet S, Bhatt A, Parajuli S, Shrestha SK. Emergency medical dispatcher training as a strategy to improve pre-hospital care in low- and middle-income countries: the case study of Nepal. *Int J Emerg Med*. 2021 May 6;14(1):28. doi: 10.1186/s12245-021-00355-8. PMID: 33957859; PMCID: PMC8100927.
- Gongal R, Dhungana B, Regmi S, Nakarmi M, Yadav B. Need of improvement in emergency medical service in urban cities. *JNMA J Nepal Med Assoc*. 2009 Apr-Jun;48(174):139-43. PMID: 20387355.
- Pandey NR. Emergency medicine in Nepal: present practice and direction for future. *Int J Emerg Med*. 2016 Dec;9(1):20. doi: 10.1186/s12245-016-0118-3. Epub 2016 Jul 15. PMID: 27416937; PMCID: PMC4947072.
- The Ministry of Health and Population. Guideline for Integrated Ambulance and Pre-hospital service operation 2077. [Internet]. Available from: Guideline for Integrated Ambulance and Pre-hospital service operation 2077 (publichealthupdate.com)
- Gurung R. Ambulance service "inadequate". The New Humanitarian [Internet]. 2012 Available from: <https://www.thenewhumanitarian.org/news/2012/09/10/ambulance-service-inadequate>.
- Meskin S, Huyler F, Gupta SK, Berger L. Delivery of emergency medical services in Kathmandu, Nepal. *Ann Emerg Med*. 1997 Mar;29(3):409-14. doi: 10.1016/s0196-0644(97)70355-x. PMID: 9055783.
- Nepal Ministry of Health and Population. National Ambulance Guideline, 2078. Health Emergency Operation Center of Nepal [Internet]. 2023. Available from: <https://heoc.mohp.gov.np/guidelines-publications/others/detail>.
- Regmi P, Paneru DP, Oli P, Baral U, Poudel D, Thapa DK. Ambulance service in Kathmandu, Nepal: service delivery constraints, challenges, and achievements during the COVID-19 pandemic. *Prehosp Disaster Med*. 2023 Feb;38(1):122-9.
- National Archives and Records Administration. § 410.41 Requirements for ambulance providers and suppliers. Code of Federal Regulations [Internet]. 2023. Available from: [https://www.ecfr.gov/current/title-42/chapter-IV/subchapter-B/part-410/subpart-B/section-410.41#p-410.41\(b\)\(1\)](https://www.ecfr.gov/current/title-42/chapter-IV/subchapter-B/part-410/subpart-B/section-410.41#p-410.41(b)(1)).

13. National Health Service England. Double-Crewed Ambulance Specification [Internet]. 2021. Available from: [https://www.england.nhs.uk/wp-content/uploads/2018/09/B0356\\_National-specification-base-vehicle-and-conversion\\_October-2021.pdf](https://www.england.nhs.uk/wp-content/uploads/2018/09/B0356_National-specification-base-vehicle-and-conversion_October-2021.pdf).
14. American Academy of Pediatrics; American College of Emergency Physicians; American College of Surgeons Committee on Trauma; Emergency Medical Services for Children; Emergency Nurses Association; National Association of EMS Physicians; National Association of State EMS Officials. Equipment for ground ambulances. *Prehosp Emerg Care*. 2014 Jan-Mar;18(1):92-7. doi: 10.3109/10903127.2013.851312. Epub 2013 Oct 29. PMID: 24168014.
15. Harmsen AM, Giannakopoulos G, Franschman G, Christiaans H, Bloemers F. Limitations in Prehospital Communication Between Trauma Helicopter, Ambulance Services, and Dispatch Centers. *J Emerg Med*. 2017 Apr;52(4):504-512. doi: 10.1016/j.jemermed.2016.11.010. Epub 2016 Dec 18. PMID: 27998633.
16. Liberman M, Mulder DS, Jurkovich GJ, Sampalis JS. The association between trauma system and trauma center components and outcome in a mature regionalized trauma system. *Surgery*. 2005 Jun;137(6):647-58. doi: 10.1016/j.surg.2005.03.011. PMID: 15933633.
17. Mitra B, Kumar V, O'Reilly G, Cameron P, Gupta A, Pandit AP, et al. Prehospital notification of injured patients presenting to a trauma centre in India: a prospective cohort study. *BMJ Open*. 2020 Jun 21;10(6):e033236. doi: 10.1136/bmjopen-2019-033236. PMID: 32565447; PMCID: PMC7311027.
18. Tayler-Smith K, Zachariah R, Manzi M, Van den Boogaard W, Nyandwi G, Reid T, et al. Achieving the millennium development goal of reducing maternal mortality in rural Africa: an experience from Burundi. *Trop Med Int Health*. 2013 Feb;18(2):166-74. doi: 10.1111/tmi.12022. Epub 2012 Nov 20. PMID: 23163431.