

Appendix B: Characteristics Comparator Care.

Author ID.	Study setting	Description of comparator care	Clinicians*	Education*	Scope(s) of Practice*
Garner et al., 2015 ¹⁰ .	Australia	Standard care by paramedics only was according to written protocols of the New South Wales Ambulance including: cannulation and up to 1-litre intravenous crystalloid infusion; ventilation via supraglottic airways and bag-valve-mask ventilation; intubation without neuromuscular blockade; needle chest decompression; midazolam for seizures or sedation; analgesia with methoxyflurane and morphine and splinting and spinal immobilisation. Monitoring consisted of pulse oximetry, ECG and manual BPs.	Paramedics	Paramedic = 3-4 yr Bachelor's degree	ALS
Hepple et al., 2019 ¹¹ .	England	Details not provided beyond the standard ambulance response in Northeast England by non-enhanced prehospital care teams.	EMTs, Paramedics	EMT = 12-18 months vocational training Paramedic = 2-4-year Bachelor's degree	ALS
Lyons et al., 2021 ⁷ .	Wales	Details the additional skills provided by the intervention rather than describing the comparator care in detail stating "EMRTS provides critical care interventions outside standard ambulance practice such as the administration of blood products and anaesthesia at the scene for both illness and injury (full details available in online Supporting Information Appendix S1)."	EMTs, Paramedics, SPs APPs	EMT = 12-18 months vocational training Paramedic = 2-4-year Bachelor's degree Specialist Paramedic = 6-12 month post-graduate diploma APP = 1-2 year Master's of Science degree	BLS ALS

Maddock et al., 2020 ¹² .	Scotland	“The vast majority of paramedics in Scotland do not have enhanced critical care skills.” “In more rural areas, the Scottish Ambulance Service’s response may be augmented by voluntary responder schemes such as those of BASICS (the British Association for Immediate Care) Scotland, meaning that some patients will be seen by a non-critical care doctor (often a local General Practitioner) or nurse in addition to standard (non-PHCCT) ambulance care.”	EMTs, Paramedics +/- RNs +/- GPs	EMT = 12-18 months vocational training Paramedic = 2-4-year Bachelor’s degree	BLS ALS +/- CC
Yeguiayan et al., 2011 ¹³ .	France	“The fire brigade will provide only basic life support and take the patient to the closest hospital.”	Fire Fighters	N/A	BLS
Fukuda et al., 2018 ¹⁴ .	Japan	“ Most ambulances include at least 1 emergency life-saving technician (ELST), certified to insert an intravenous catheter and a supra-glottic airway device (since 1991). In addition, a specially trained ELST, who has completed an extensive training program, can administer epinephrine and insert an endotracheal tube. Epinephrine administration and endotracheal intubation by specially trained ELST officially started in April 2006 and July 2004, respectively. As of 2014, almost all (97.4%) ambulances included at least 1 ELST, and most (82.9%) were specially trained ELSTs.”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training or 2-4 years Bachelor’s degree	BLS ALS

Goto et al., 2019 ¹⁵ .	Japan	“Most local governments use a one-tiered system, with a crew of three EMS personnel including at least one emergency lifesaving technician. Emergency lifesaving technicians are permitted to use several resuscitative methods, including automated external defibrillators, insertion of an airway adjunct or a peripheral intravenous line, and administration of Ringers lactate solution. However, only specifically emergency lifesaving technicians are permitted to insert a tracheal tube and administer intravenous adrenaline (epinephrine)”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS
Den Hartog et al., 2015 ¹⁶ .	Netherlands	“EMS units are staffed with paramedics, all of which are trained in prehospital trauma life support (PHTLS). EMS paramedics are not allowed to perform <u>all</u> Advanced Trauma Life Support (ATLS) procedures; for instance, they are not allowed to use general anaesthesia for intubation or to insert a chest tube.”	EMTs Paramedics	EMT = 12-18 months vocational training Paramedic = 4-year Bachelor’s degree + 9 month post-grad certificate.	ALS
Moors et al., 2019 ¹⁷ .	Netherlands	“ Prehospital medical care is primarily provided by an emergency medical service (EMS) system covering the entire country and staffed by paramedics. These paramedics are registered nurses, of whom the vast majority have a background of intensive care unit, emergency department, or anesthesia departments. They receive an additional training of 9 months.”	EMTs Paramedics	EMT = 12-18 months vocational training Paramedic = 4-year Bachelor’s degree + 9 m post-grad certificate.	ALS

Tsuboi et al., 2024 ¹⁸ .	Japan	“Through non-physician staffed ground emergency medical services (GEMS) in Japan, paramedics provide pre-hospital trauma care via oxygen administration, spinal immobilization, compression hemostasis, and cardiopulmonary resuscitation. Under a doctor's guidance, paramedics are now able to provide advanced first-aid measures for cardiopulmonary arrest, including semi-automatic defibrillation, tracheal intubation, pre-hospital lactated Ringer's solution treatment, and adrenaline administration”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor's degree	BLS ALS
De Jongh et al., 2012 ¹⁹ .	Netherlands	“In the Netherlands, all emergency medical services (EMS) are staffed by paramedics who have years of clinical experience and education (e.g., in intensive care or emergency medicine), supplemented with three additional years of specific ambulance training. All paramedics are Pre-Hospital Trauma Life Support (PHTLS) certified.”	EMTs Paramedics	EMT = 12-18 months vocational training Paramedic = 4-year Bachelor's degree + 9 month post-grad certificate.	ALS
Hesselfeldt et al., 2013 ²⁰ .	Denmark	“The existing regional EMS system consisted of ground units staffed with personnel on three competence levels. Level 1 is basic life support providers. Level 2 and 3 providers are all pre-hospital trauma life support certified with differentiated authority to administer intravenous fluid and medication. None has competence in tracheal intubation.	Ambulance Assistants Technicians (EMT) Paramedics	Ambulance Assistant = 12 months college education Technician (EMT) = minimum 1.5 year's experience experience as an ambulance assistant then completing 6-12 months college education	ALS

		Level 3 (paramedics) providers are allowed to insert laryngeal mask airway.”		Paramedics = minimum 5 years ambulance experience with a minimum of 3 years as an EMT, then completing 6 months college education	
Hagihara et al., 2014 ²¹ .	Japan	“An ambulance crew consisted of three emergency providers, including at least one emergency life-saving technician” “The certifying paramedic [BEMT <i>sic</i>] curriculum in Japan generally includes 180 h of lectures and practice in school and experience in 30 successful cases in the operating room under the instruction of an anesthesiologist.” “Emergency life-saving technicians are permitted to insert adjunct airways and to use semi-automated external defibrillators.” “Specially trained emergency life-saving technicians have been permitted to insert intravenous lines since July 2004, and certified emergency life-saving technicians have been permitted to administer intravenous epinephrine since April 2006”.	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <i>or</i> a 2–4-year Bachelor’s degree	BLS ALS
Bujak et al., 2022 ²² .	Poland	“In the case of OHCA, paramedics and EMS nurses in Po-land are credentialed to perform procedures recommend-	Paramedics RNs	Paramedic = 3-year Bachelor’s degree RN = 3-year (6 semester) Bachelor’s degree	BLS ALS

		ed by the European Resuscitation Council (ERC) guidelines on advanced life support (ALS), i.e., using a manual defibrillator, securing the airway with either a tracheal tube or supraglottic devices, and administering resuscitation drugs. Moreover, according to Polish law, paramedics and EMS nurses are allowed to withhold or terminate CPR. Furthermore, in Poland, the first-responder system has not been widely implemented, except for the firefighters of the State Fire Service, who are trained for CPR, including the use of an automated external defibrillator (AED), and may be dispatched by the dispatcher to initiate CPR when a long delay to EMS arrival is expected.”			
Endo et al., 2021 ²³ .	Japan	“ Japanese paramedics responding to trauma patients without cardiac arrest are limited to performing spinal motion restriction, external fixation of bone fractures, oxygen administration using a mask, and administration of Ringer’s solution (only to patients with shock).”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS
Hamilton et al., 2016 ²⁴ .	Denmark	“Emergency ambulances equipped with defibrillators and staffed with either emergency medical technicians (EMTs) who can perform basic life support or paramedics who can give advanced life support.”	Assistants Technicians (EMT) Paramedics	Ambulance Assistant = 12 months college education Technician (EMT) = minimum 1.5 year’s experience experience as an ambulance	BLS ALS

		“ Paramedics and other EMS personnel operate under standing orders and protocols.”		assistant then completing 6-12 months college education Paramedics = minimum 5 years ambulance experience with a minimum of 3 years as an EMT, then completing 6 months college education	
Hatakeyama et al., 2023 ²⁵ .	Japan	“Each ambulance has three personnel, at least one of whom is an emergency life-saving technician who has undertaken advanced training in the provision of pre-hospital emergency care. All emergency life-saving technicians are allowed to insert an intravenous line and an adjunct airway. The specially trained emergency life-saving technicians are permitted to insert tracheal tubes for patients with cardiac arrest. However, they are not able to insert tracheal tubes after the return of spontaneous circulation. They also are permitted to inject intravenous adrenaline.”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS
Kato et al., 2019 ²⁶ .	Japan	“Three EMS staff members are assigned to an ambulance, and all EMS personnel are able to provide cardiopulmonary resuscitation (CPR) for basic life support and have been trained to use semiautomatic external defibrillators and airway devices. At least one emergency life-saving technician is assigned to each	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS

		ambulance. Technicians are allowed to provide extensive resuscitation care, for example, they can give adrenaline through venous infusion lines and use advanced airway management, including intra-tracheal intubation”			
Sato et al., 2019 ²⁷ .	Japan	“A standard ambulance is staffed with three crewmembers, including at least one ELST. These crewmembers are trained in rescue, stabilisation, transportation and advanced care in traumatic and medical emergencies” “Two of the three crewmembers are qualified ELSTs who are permitted to use invasive alternative airways, such as a laryngeal mask airway and the Combitube, to treat patients with cardiac arrest. For those who have completed the Additional National Standard Training course, tracheal intubation is the treatment of choice in the management of patients with cardiac arrest. Authorised ELSTs are able to administer epinephrine.”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS
Obara et al., 2023 ²⁸ .	Japan	“Each emergency ambulance is staffed by three or four EMS crew members, at least one of whom is a highly trained staff member known as an ELST. ELSTs were authorized to provide advanced life support, including placement of supraglottic airway devices. Specially trained ELSTs were allowed to perform tracheal intubation and administer IV adrenaline.”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS

		“Intraosseous access by EMS personnel was not permitted.”			
Endo et al., 2020 ²⁹ .	Japan	“Medical interventions allowed to Japanese paramedics responding to trauma patients without cardiac arrest are limited to performing spinal motion restriction, external fixation of bone fractures, oxygen administration using a mask, and administration of Ringer’s solution (only to patients with shock).”	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2–4-year Bachelor’s degree	BLS ALS
Hatakeyama et al., 2021 ³⁰ .	Japan	Referenced previous publications included above.	BEMTs ELSTs	BEMT = 250h vocational training ELST = 2000h experience as BEMT + 6 months training <u>or</u> a 2-4-year Bachelor’s degree	BLS ALS
Pakkanen et al., 2019 ³¹ .	Finland	“Paramedic-staffed EMS units provided pre-hospital care in this region. During the study period, patients with a decreased level of consciousness were routinely administered oxygen according to national guidelines. Neuromuscular blocking agents were not available and pre-hospital advanced airway management was performed using sedatives and opioids only.”	Paramedics	Paramedic = 4-year Bachelor’s degree	ALS

* Clinical staffing, education and scope of practice reported as at the time of the study based upon published reports, websites, manuscripts and direct correspondence with EMS leaders within the countries.

Abbreviations

APP = Advanced Paramedic Practitioner

ALS = Advanced Life Support

BEMT = Basic Emergency Medical Technicians

BLS = Basic Life Support

CC = Critical Care

EMT = Emergency Medical Technician

ELST = Emergency Life-Saving Technician

GP = General Practitioner (Physician)

N/A = Not available

RN = Registered Nurse

SFAC = Standard First Aid Class

SP = Specialist Paramedic

Definitions

Basic Life Support (BLS) includes skills or procedures such as automated external defibrillation, oxygen administration, CPR, and supraglottic airways.

Advanced Life Support (ALS) includes skills or procedures such as administering parenteral (IV/IO) fluids and medications, defibrillation, and endotracheal intubation.

Critical Care (CC) includes skills or procedures such as prehospital emergency anaesthesia, surgical procedures, and blood product administration.