



MEDICAL REHABILITATION IN DISASTER RELIEF: TOWARDS A NEW PERSPECTIVE

Bhasker AMATYA, MD, MPH^{1-3*}, Mary GALEA, PhD, BAppSci (Physio), BA, Grad Dip Physio, Grad Dip Neurosci¹⁻³, Jianan LI, MD⁵ and Fary KHAN, MBBS, MD, FAFRM (RACP)¹⁻⁴

From the ¹Department of Rehabilitation Medicine, Royal Melbourne Hospital, Parkville, Victoria, Australia, ²Department of Medicine (Royal Melbourne Hospital) The University of Melbourne, Parkville, ³Australian Rehabilitation Research Centre, Royal Melbourne Hospital, Parkville, ⁴School of Public Health and Preventive Medicine, Monash University, Victoria, Australia and ⁵Department of Rehabilitation Medicine, First Affiliated Hospital of Nanjing Medical University, Nanjing, China

With increasing frequency of natural disasters, there has been greater focus recently on the importance and role of rehabilitation services in disaster management. In past disasters, rehabilitative needs were often neglected, with emphasis on acute response plans focused on saving lives and treating acute injuries. There was a lack of, or inadequate, rehabilitation-inclusive disaster response plans and rehabilitation services in many disaster-prone developing countries. The World Health Organization (WHO) Emergency Medical Team (EMT) initiative recognizes rehabilitation as an integral part of medical response and patient-centred care in disaster settings. Current developments under this initiative include: the development of minimum standards for rehabilitation in emergencies to allow rapid, professional, coordinated medical response by both national and international EMTs. These guidelines ensure that EMTs deliver effective and coordinated patient care during disasters and continuum of care beyond their departure. The aim is to strengthen national capacity, foster an environment of self-empowerment of EMTs and local health services, and work in rehabilitation within defined coordination mechanisms in disaster-affected areas. A brief overview of rehabilitation in natural disasters, highlighting current developments, challenges; and gaps in the implementation of WHO guidelines for *Minimum Standards for Rehabilitation in Emergencies* is discussed in order to improve care for victims of future disasters.

Key words: natural disaster; rehabilitation; emergency medical team; disability; disaster response.

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Correspondence address: Bhasker Amatya, Department of Rehabilitation Medicine, Royal Melbourne Hospital, 34–54 Poplar Road Parkville, Melbourne VIC 3052, Australia. E-mail: bhasker.amatya@mh.org.au

Natural disasters (e.g. earthquakes, storms, drought, floods) often occur unexpectedly, precipitously and with great magnitude of destruction, resulting in mass casualties. As the frequency and amplitude of natural disasters has increased worldwide, human exposure to disaster risk is likewise escalating, mainly due to the combined effects of climate change, population growth, urbanization and poorly planned

infrastructure and development (1). Recent advances in disaster response/rescue and field management, have significantly improved the survival rates of disaster victims worldwide. Current disaster data demonstrates a staggering number of persons with injuries relative to mortality (2, 3). This includes an upsurge in survivors with complex and long-term disabling injuries, such as brain and spinal cord injury, peripheral nerve and musculoskeletal injuries. Furthermore, there may be an increase in the number of victims with exacerbation of chronic medical conditions and psychological impairment. These problems necessitate comprehensive long-term interdisciplinary management, including rehabilitation (3, 4).

Medical rehabilitation is defined as: “a set of measures that assist individuals who experience (or are likely to experience) disability to achieve and maintain optimal physical, sensory, intellectual, psychological and social functioning in interaction with their environment” (5). Overall primary goals of medical rehabilitation include management of acute injury, prevention and management of related complications, optimization of functional capabilities (including physical, cognitive, neuropsychological functioning) and social re-integration (6). These goals are not different in disaster settings; however, they can be more complex and challenging, and may include: assessment of injury patterns and management, needs and resource requirements (including long-term); establishment of patient triage, discharge, referral, and tracking systems; collaboration with other healthcare service providers; coordination with emergency response systems, host health system and government managers; education of local healthcare providers and data collection/management (2, 6). The team is interdisciplinary and includes physical and rehabilitation medicine physicians, nurses and allied health professionals.

EVIDENCE FOR MEDICAL REHABILITATION IN DISASTER SETTINGS

With increasing frequency of natural disasters and numbers of people injured, the critical importance of rehabilitation services for the survivors during and after a natural disaster is well-documented (3). There is still scarce research and a lack of robust, methodologically

strong innervational studies in this area, and current evidence is based mainly on observational studies, personal and anecdotal experiences (3, 6). Evidence suggests that early provision of rehabilitation programmes reduces disability, leading to better clinical outcomes, and improved participation and quality of life for disaster survivors (3, 6, 7). Disaster survivors treated in services with rehabilitation facilities have reduced length of hospital stay, fewer complications and better clinical outcomes compared with patients in centres with no rehabilitation physician supervision (2). The significant roles of allied health professionals, such as occupational therapy, physiotherapists in disaster preparedness, response, and recovery, are well documented (8–10). There is strong consensus amongst global health authorities that medical rehabilitation should be initiated in the immediate emergency response phase and should be continued in the community over a longer term until treatment goals are achieved and survivors are successfully reintegrated into society (3, 6, 11). The World Health Organization (WHO) rehabilitation guidelines recommend implementation and access to rehabilitation during all phases of disaster response, and pinpoint rehabilitation as the longest and most expensive phase of disaster management (12, 13).

CHALLENGES IN DISASTER MANAGEMENT

In recent years, many countries have recognized the importance of disaster planning, preparedness and management initiatives, and disaster management capacity (especially early warning systems, early evacuation and awareness) with improved collaboration (11). Unfortunately, major disparities and gaps amongst countries exist, and those with a high disaster-risk tend to have low coping capacity and a large population vulnerable to natural disasters living in more exposed areas (14, 15). Disaster response plans and services are generally inadequate or absent in many disaster-prone countries (16, 17), and few have access to appropriate services, such as rehabilitation, where fragmented healthcare systems are compromised by lack of financial and political support (7, 18). In large-scale disasters, existing local health service infrastructure and resources can be destroyed/severely disrupted and/or quickly overwhelmed by an influx of disaster victims, compromising the medical response and optimal management (6, 16). Furthermore, a shortage of, or lack of, trained healthcare (including rehabilitation) professionals and medical workforce can further hinder comprehensive management (18, 19). Hence, in disasters many countries are dependent on global humanitarian and medical assistance. This is reflected by the growing number

of Emergency Medical Teams (EMTs) responding to many disasters worldwide (20). However, influx of EMTs during past disasters has presented immense challenges with regards to response coordination, management and evaluation. Furthermore, in many past disasters, deployment of medical teams has been decided by the individual countries or organizations, and on many occasions these teams worked on their own, with no accreditation and/or coordination mechanism. Deployment of these teams was not always based on the needs of the situation; and there was significant variation in capacities, competencies and professional ethics (21). This resulted in significant challenges and inadequate care delivery, particularly rehabilitation, with often devastating consequences for the affected individuals, families and communities (2, 6, 20). Furthermore, there is concern regarding the inadequacy of global organizational capacities and capabilities and mismatching of resources across the entire disaster cycle, such that prevention and preparedness have been consistently short-changed (12). For example, during the earthquake in Haiti in January 2010, the international humanitarian response was catastrophic, with the influx of a large number of EMTs, many unregistered, without standardized protocols, or coordination mechanisms in place (21, 22). There was poor coordination and communication, particularly between service providers including EMTs, with suboptimal adherence to national and/or international standards, which resulted in unsatisfactory outcomes (22–24). One study (17) showed significant proportion of deaths occurred days or weeks after the Haiti earthquake could have been prevented by improved patient care. Likewise, during the 2004 Indian Ocean tsunami the number of EMTs that arrived exceeded what was needed given the rapid mobilization of trauma teams from within the countries (21).

CURRENT DEVELOPMENTS IN DISASTER MANAGEMENT

In the last decade, significant developments in international, regional and national collaboration and management capacities in disaster management have occurred, including quality and coordination mechanism of EMTs. Some key developments are discussed below:

1. The United Nations (UN) Office for Disaster Risk Reduction (UNISDR) leads the global response for international humanitarian crises. It initiates different programmes to improve community resilience and coordination of disaster-risk reduction activities worldwide. Following the 2004 Indian Ocean tsunami, under the leadership of UNISDR the *Hyogo*

Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters, the first comprehensive global blueprint for disaster risk reduction, was adapted by representatives of 168 member states at the World Conference on Disaster Risk Reduction in Kobe, Japan, in 2005 (25). Over the last 10 years, although voluntary and non-binding, the Hyogo framework has been embraced by central and local governments, the private sector and civil society groups (25). Under this initiative, significant global progress has occurred in disaster risk management, including raising awareness, promoting prevention, preparedness and mitigation (26). As of 2015, there were Hyogo framework focal points in 191 countries and 85 platforms for disaster-risk reduction, and 141 countries have carried out at least 1 review of their efforts to implement this framework for action through advances in risk governance, stronger institutions, education and science, and addressing underlying drivers of risk and strengthening preparedness and response mechanisms (25).

2. More recently, the third UNISDR World Conference in Sendai Japan (2015) adopted a new 15-year global framework for disaster risk reduction, the *Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR)* (Table I) (27). The SFDRR is built on elements that ensure continuity with the work done by states and other stakeholders under the Hyogo framework and introduces a number of innovations. It emphasizes disaster-risk management as opposed to disaster management. It broadens disaster-risk reduction significantly to focus on both natural and man-made hazards and related environmental, technological and biological hazards and risks (27). It provides a strong foundation for governments to take on a greater role at all levels and an agenda for all sectors of society for collaborative effort for successful future disaster planning and management (27). The SFDRR, specified “rehabilitation” as a component of 1 of the key priorities (Priority 4, Table I) (27). The term “rehabilitation”, however, is more inclined towards the rehabilitation infrastructure processes, rather than medical rehabilitative care of patients. Unfortunately, in this document, the medical rehabilitation of victims and the establishment of emergency relief and health-care stakeholders for disaster management (including EMTs) are rarely mentioned. This highlights the low priority attributed to medical rehabilitation services in disaster settings, not only by many developing countries, where rehabilitation services are underdeveloped, but also by developed countries with a strong medical rehabilitation workforce (28). Similar to the “Hyogo Framework”, the “Sendai Framework” is also voluntary commitment of member states and

Table I. Sendai Framework for Disaster Risk Reduction 2015–2030. Adapted from UNISDR 2015 (27)

Scope and purpose	The framework applies to risk of small- and large-scale disasters, caused by natural or man-made hazards, & related environmental, technological & biological hazards & risks – to guide multi-hazard management of disaster-risk in development at all levels, within & across all sectors
Expected outcome	Substantial reduction of disaster risk & loss of life, livelihood & health; and economic, physical, social, cultural & environmental assets of persons, businesses, communities
Goal	Prevent & reduce existing disaster-risk through implementation of integrated & inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political & institutional measures that prevent & reduce hazard exposure, increase preparedness for response & recovery, & strengthen resilience
Priorities for action	<ol style="list-style-type: none"> 1. Understanding disaster risk 2. Strengthen disaster risk governance to manage disaster risk 3. Investing in disaster risk reduction for resilience 4. Enhancing disaster preparedness for effective response, & to Build Back Better in recovery, rehabilitation & reconstruction
Targets	<p>By 2030</p> <ul style="list-style-type: none"> • reduce global disaster mortality, disaster-related economic loss in relation to global GDP • reduce disaster damage to critical infrastructure and disruption to services, in health & educational facilities, develop resilience • establish countries with national & local disaster-risk reduction strategies • enhance international cooperation through adequate & sustainable support to complement national actions for implementation, increase availability of & access to multi-hazard early warning systems & disaster risk information

GDP: gross domestic product.

depends on the capacity and willingness of countries to take concrete action (17, 29).

3. The World Bank’s *Global Facility for Disaster Reduction and Recovery (GFDRR)* is another key initiative committed to assisting developing countries to reduce their vulnerability to natural hazards, with a global partnership of over 45 countries and international organizations (30). This initiative conducts post-disaster needs assessments worldwide and supports national governments in recovery and reconstruction, to reduce the costs of future disasters. It implements programmes in partnership with national, regional and other international agencies, in accordance with the SFDRR, the Paris Agreement on Climate Change, and the UN Sustainable Development Goals (30). The GFDRR programme, including rehabilitation and reconstruction, aligns with the SFDRR priorities and disaster-risk management activities identified as priorities by communities; however, there are no details of programmes focused on building capacity in rehabilitation medicine in its work plan for 2017 (31).
4. *Emergency Medical Team (EMT) Initiative*. Lessons from past disasters highlight the need for better coordination and cooperation, and evaluation of professionalism and accountability of national and

international disaster responders. This prompted the global community of international medical responders to work towards the establishment of the *Foreign Medical Teams (now termed EMTs) Working Group (FMT-WG)* in a post-Haiti meeting in Cuba in 2010. This resolution recommended “a flexible mechanism for registration and accreditation of rapid-response foreign medical teams with the goal of improving the quality of medical response in coordination with WHO”, which was passed at the Pan American Health Organisation (PAHO) in 2012 (21). This is the precursor of the current WHO EMT unit and initiative. This EMT programme has demonstrated a more systematic approach to medical team deployment and organized deployment responses to recent natural disasters, such as typhoon Haiyan in the Philippines in 2013, tropical cyclone Pam in the Pacific region in 2015 and the Nepal earthquakes in 2015 (22). The first guideline, the *Classification and Minimum Standards for Foreign Medical Teams in sudden onset disasters*, was published in September 2013 (24). The EMT Initiative comprises 11 working groups, including a rehabilitation group. This guideline provided the benchmark requirements for medical teams seeking to respond to emergencies and coordinating their deployment by classifying teams according to their capability (24). Table II lists the types of EMTs.

5. WHO global registration process of EMTs. A new WHO registration system for all EMTs was initiated in July 2015 (Fig. 1), which enables establishment of a global register of emergency medical response teams for deployment in emergencies (22). As of 2016, 4 acute medical teams (from Australia, China, Israel, Japan and the Russian Federation) have progressed to full verification and 75 teams from different part of the world have commenced a mentorship process and seeking quality assurance (22). By the end of 2017, an expected 50 additional teams will have been verified for quality assurance, and over 100 will be in the mentorship programme (22). However, currently no Rehabilitation specialized cells are included in this list.

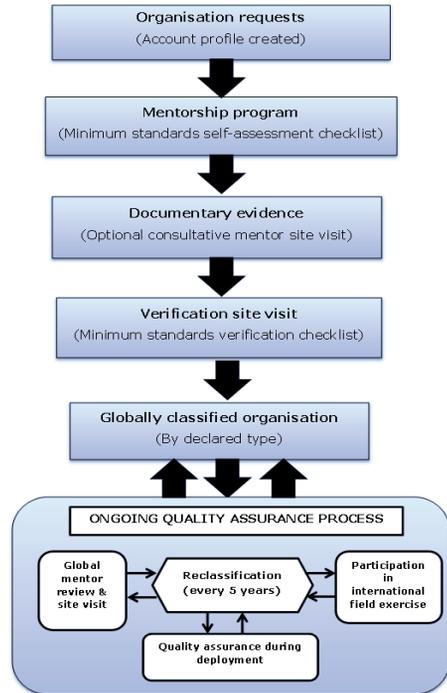


Fig. 1. Global Emergency Medical Team (EMT) classification process. Adapted from World Health Organization (WHO) EMT initiative (22).

6. *Rehabilitation guidelines for disasters.* As aforementioned, the WHO EMT initiative acknowledges rehabilitation as an integral aspect of medical response and patient-centred care in disaster settings in the guidelines: *Classification and Minimum Standards for Foreign Medical Teams in Sudden Onset Disasters* (24). It recognizes that “rehabilitation is one of the core functions of trauma care systems in regular health care and, as such, EMTs should have specific plans for the provision of rehabilitation services to their patients post sudden onset disaster” (20, 24). The guidelines emphasize importance of early rehabilitation for positive functional outcomes by ensuring a rapid, professional, coordinated medical response that includes rehabilitation professionals by both national and international teams (20). Reports from past emergency responses demonstrated a lack of integration of rehabilitation professionals

Table II. World Health Organization (WHO) classification of Emergency Medical Teams (EMTs). Adapted from WHO 2016 (20)

Type	Description	Capacity (per day)	Minimum length of stay, weeks
1 (Mobile)	Mobile outpatient teams: teams to access the smallest communities in remote areas	> 50 outpatients	2
1 (Fixed)	Outpatient facilities with or without tented structure	> 100 outpatients	2
2	Inpatient facilities with surgery	> 100 outpatients & 20 inpatients; 7 major or 15 minor operations	3
3	Referral leave care, inpatient facilities, surgery and high dependency	> 100 outpatients and 40 inpatients, including 4–6 intensive care beds; 15 major and 30 minor operations	4–6
Specialized care team*	Teams that can join local facilities or EMTs to provide supplementary specialist care	Variable	Variable

*Specialize in a specific medical area, such as rehabilitation. May be as small as 2–3 senior specialists, or a specialist facility.

into EMTs and lack of coordination with other EMT members (surgical and medical), which detract from patient-centred care (20). This prompted the Rehabilitation Working Group under the EMT initiative, to develop the first guideline for rehabilitation teams in sudden onset disasters: “*Emergency Medical Teams: Minimum Technical Standards and Recommendations for Rehabilitation*”. This guideline, launched at the EMT Global Meeting 2016 in Hong Kong, was developed with collaboration between WHO and global experts from the rehabilitation field including the International Society of Physical and Rehabilitation Medicine (ISPRM) (20). It sets out the core standards for rehabilitation and provides guidance on building or strengthening the capacity of EMTs for rehabilitation within defined coordination mechanisms in this area. The recommendations require that both national and international EMTs must ensure improved patient care and a continuum

of care beyond their departure from the affected area. The guidelines provide the minimum standards for all EMTs regarding workforce, field hospital environment, rehabilitation equipment/consumables and information management. The key standards for EMTs within these guidelines are listed in Box 1.

All teams on the WHO EMT Global Classification List will now be required to use these minimum technical standards for rehabilitation in the future, and demonstrate adherence to standards (20). Table III provides

Box 1. Key minimum standards for EMTs. Source: WHO 2016 (20).

- At least 1 rehabilitation professional per 20 beds at time of initial deployment, with further recruitment depending on case-load and local rehabilitation capacity
- Allocation of purpose-specific rehabilitation space of at least 12 m² for all type 3 EMTs (i.e. referral leave care, inpatient facilities, surgery and high dependency)
- Deployment of EMTs with at least the essential rehabilitation equipment and consumables according to team type

Table III. Overview of rehabilitation input by Emergency Medical Team (EMT) type. Adapted from WHO 2016 (20)

Injury type	EMT Type 1	EMT Type 2 & 3	Referral and discharge consideration
Basic fracture (conservative management)	<ul style="list-style-type: none"> • Provide clear guidance on weight-bearing status • Provide assistive devices • Advise on ROM & functional use 	As Type 1	<ul style="list-style-type: none"> • Rehabilitation follow-up
Complex fracture	<ul style="list-style-type: none"> • Stabilize and refer 	<ul style="list-style-type: none"> • Provide assistive devices • Advise on ROM & precautions • Functional retraining • External-fixator care • Pain management • Patient and care provider education 	<ul style="list-style-type: none"> • Clarify time for removal of external fixator • Progression of weight-bearing status • Education about possible complications • Rehabilitation follow-up
Spinal cord injury	<ul style="list-style-type: none"> • Neurological assessment • Advise regarding pressure area prevention and care • Refer according to national protocol or specialized care team 	<ul style="list-style-type: none"> • Neurological assessment • Pain management • Functional re-training • Provide temporary wheelchair • Refer according to national protocol or specialized care team • Patient and care provider education 	<ul style="list-style-type: none"> • Provide temporary assistive devices, including pressure-relieving equipment • Educated on self-care, including bladder/ bowel management, & precautions • Referral to local provider for long-term assistive devices • Rehabilitation follow-up
Burns	<ul style="list-style-type: none"> • Advise on appropriate dressing • Refer to specialized care team if indicated 	<ul style="list-style-type: none"> • Advise on appropriate dressing • Positioning, including splinting if indicated • ROM, strength & functional retraining • Refer to burns/plastics specialized care team if indicated • Patient & care provider education 	<ul style="list-style-type: none"> • Identify step-down facility if required • Identify providers of local burns/ plastics care &/or specialized burns care team for scar management, including compression garments • Long-term rehabilitation follow-up required for scar maturation & risk for contracture
Peripheral nerve injury	<ul style="list-style-type: none"> • Positioning, including splinting if indicated • Patient & care provider education • Refer as indicated 	<ul style="list-style-type: none"> • Positioning, including splinting if indicated • Patient & care provider education • ROM, strength & functional retraining • Pain management • Refer to microsurgery specialized care team if indicated 	<ul style="list-style-type: none"> • Identify microsurgery specialist care early if surgical intervention anticipated • Referral to local provider for long-term assistive devices (such as orthotics) • Education about possible complications, such as contracture • Rehabilitation follow-up
Traumatic brain injury	<ul style="list-style-type: none"> • Basic neurological & cognitive assessment • Refer as indicated 	<ul style="list-style-type: none"> • Neurological & cognitive assessments • Positioning, including splinting if indicated • ROM, strength & functional retraining • Patient & care provider education • Refer to neurological specialized care team if indicated 	<ul style="list-style-type: none"> • Identify step-down facility if required • Identify local providers of neurological rehabilitation Provide long-term follow-up throughout neurological recovery • Referral to local provider for long-term assistive devices, if indicated
Wounds	<ul style="list-style-type: none"> • Advise on appropriate dressing • Refer as indicated 	<ul style="list-style-type: none"> • Advise on appropriate dressing • Provide assistive devices • ROM, strength & functional retraining • Patient & care provider education • Refer to plastics specialized care team if indicated 	<ul style="list-style-type: none"> • Identify plastics specialized care team early • Progression of weight-bearing status • Education about possible complications, such as infection • Rehabilitation follow-up, if indicated
Amputation	<ul style="list-style-type: none"> • Basic wound management • Refer to type 2 or 3 or national facility 	<ul style="list-style-type: none"> • Preoperative advice according to prosthetic availability & functional outcomes • Stump management • Provide temporary assistive devices • Pain management • ROM, strength & functional retraining • Patient & care provider education 	<ul style="list-style-type: none"> • Referral to local provider for long-term assistive devices, such as prosthetic &/or wheelchair, if indicated • Rehabilitation follow-up

ROM: range of motion.

an overview of rehabilitation input by EMT type, and specific discharge considerations.

CHALLENGES IN PUTTING EMT STANDARDS INTO PRACTICE

The minimum standards for rehabilitation clearly set out the standards for rehabilitation and provide guidance on strengthening EMT capacity. However, they are yet to be implemented and, to our knowledge, many specialized teams (such as rehabilitation) are yet to receive any mentorship, or to be considered for full verification at this time. There are still immense challenges in putting these standards into practice in disaster settings, these include:

- Although the WHO EMT registration mechanism is progressing, it has been slow due to the rigorous and complex process (only 6 teams are fully certified to date) requiring considerable resources (personal communication with delegates during 2016 EMT Global Meet, Hong Kong).
- Many specialized rehabilitation teams and/or non-governmental organization (NGO) teams may have a limited number of team members. It remains unclear whether these teams will embed within larger verified EMTs and/or require individual team certification as rehabilitation specialized cells.
- Most disaster-prone countries are largely unprepared and have poor planning for disaster management (6, 17) and lag in investment in rehabilitation disaster-risk reduction, infrastructure and management. Responding promptly to the needs of the people affected will be challenging.
- Disasters damage local infrastructure and disrupt health systems, often in remote, underserved areas, compounding challenges for all response teams, including rehabilitation. It is uncertain how rehabilitation teams will function, and what processes are needed for them to function, within local health systems where rehabilitation services do not exist and/or are in their infancy.
- EMT programmes tend to be short term and reactionary, and many team members are volunteers, which may impact on prior planning or preparation and beyond.
- The safety and security of EMTs during deployment, logistical and operational issues for EMTs in remote areas are often overlooked. This includes legal and ethical challenges confronting EMTs during activation and at deployment.
- There is lack of standardized education, training and capacity-building programmes for EMTs and/or local professionals, including rehabilitation in disaster settings. Current programmes focus on individual

professional development, and on operational performance of multidisciplinary EMTs (32). For example, the Australian Medical Assistance Team (AusMAT), a certified EMT, conducts “Team Member Course” for a multi-disciplinary team of doctors, nurses, paramedics, pharmacists, fire-fighters (logisticians), allied health and environmental health staff (33). It focuses on individual and team capacity-building by providing trainees with theoretical knowledge, disaster response and preparation for mental and physical challenges encountered in the disaster context (33).

- Although many organizations have developed “core competencies” considered to be essential knowledge and skills for disaster healthcare personnel, many are imprecise and use inconsistent terminology and structure. There is a lack of standards for best practice and none are validated (34, 35).
- Lack of, or insufficient, population data in many disasters makes it difficult for EMTs to identify target populations and/or deliver targeted interventions. Furthermore, absence of a platform for sharing and collection of data research impedes the quality of care delivered.
- Limited evidence (including feasibility) for many rehabilitation interventions in disaster settings hinders evidence-based practice in these settings.
- Standardized assessment and monitoring tools are yet to be developed, which can be challenging in terms of patient assessment/management and/or programme monitoring and evaluation.

THE WAY FORWARD

There is a clear mandate for all EMTs (including rehabilitation) to act quickly, efficiently and effectively during disasters (24). There is also strong consensus amongst disaster relief professionals that rehabilitation is an integral component of disaster management and rehabilitation professionals can add considerable value to patient care during response, acute and post-disaster phases (3, 6, 16). Regrettably, although there have been significant improvements in the organization of emergency responses/care and services, this has often not extended to include rehabilitation services (2). The WHO EMT initiative, including publication of the rehabilitation guideline provides a paradigm shift in rehabilitation-inclusive disaster management, to deliver timely, cost-effective, patient-centred, coordinated and transparent services in future disasters (24). The successful implementation of a minimum standard framework will require increased resilience of the rehabilitation community with multi-stakeholder partnerships. There is still much progress to be made in tackling the underlying drivers of disaster risk, such as poverty, climate

change, rapid urbanization; and factors such as poor local governance, population growth, economic development patterns, to establish rehabilitation-inclusive disaster management model for future catastrophes. Some perspectives need to be considered, including:

- Appropriate, strong governance for planning and management of future disasters by relevant international and national bodies (UNISDR, WHO, ISPRM, local Health Ministries, etc.), with local governing bodies and multiple stakeholders (local and international).
- There is a need for investment in disaster-risk reduction and disaster planning and management, with adequate access to rehabilitation and assistive technology, sustainable infrastructure, support services and education/research (36).
- Mapping/evaluation of current rehabilitation facilities and pre-existing capacity by the local Ministries of Health (particularly in disaster-prone regions) and strengthening/expanding the potential of these services for future disasters is a priority.
- Development of a central national disaster management body (national and regional) to coordinate and provide cooperative effort, develop appropriate policies, regulations and legislation based on local needs.
- Strengthening capacity building and fostering an environment of empowerment of local service providers is required. Furthermore, strengthening community-based and vocational rehabilitation programmes for sustainable long-term care.
- Embedding specialized teams, (including rehabilitation cells), with the larger teams might be a solution to foster better and rapid management. This will allow more organizations to work together to form larger teams and supplement each other instead of working independently.
- Establishment of an *ad-hoc* EMT registration and deployment process could be optimal at this stage, until there is an adequate number of confirmed certified EMTs in the system. If a mega-disaster were to occur in the near future in a low-resource country, the need for EMTs (especially Rehabilitation) would unquestionably exceed those currently verified/certified.
- Need for EMT/rehabilitation specialized cell will vary depending on disaster type and setting, hence, deployment/response should be aligned with local needs and reflect epidemiological profile of the emergency, such as for spinal cord injury, burns, amputees.
- More rigorous and appropriate research to improve the quality of evidence for different rehabilitation interventions in different disaster contexts. Iterative research processes need to be firmly embedded within new and existing systems for monitoring and evaluation of deployments.
- Development of patient care protocols/guidelines specific for disaster settings (low-resourced) based on evidence-based best-practice guidelines.
- Development of a standardized and user-friendly assessment tool is required. For example, a short single-page screening and triage tool, developed and used during 2015 Nepal earthquakes, was found to be feasible and effective in improving clinical outcomes (37). Existing validated functional assessment tools (such as the Functional Independence Measure) are impractical in such contexts, due to requirement for trained staff, lack of inter-cultural validity, and inadequacy for largely illiterate populations (2, 38).
- Standardized education and training modules for EMTs (especially rehabilitation) is required, more centred on multidisciplinary EMTs operational performance. A system for enhancement of capacities of healthcare professionals in disaster rehabilitation and inclusion of disaster management modules in educational curricula of all healthcare professionals is needed.
- Development of innovative models of rehabilitation (e.g. telerehabilitation, mobile apps) that offer delivery of timely, cost-efficient and patient-centred services is needed.
- Improve communication (information gathering, sharing and disseminating), using cost-effectiveness and proactive technologies. This include, foster research, knowledge exchange and greater access to information/data.
- Build local volunteer/carer programmes (including family members, community, etc.), which are a more proactive and cost-effective model for long-term management of disaster victims.
- Increase public awareness and education about disability and rehabilitation.
- A legal international framework that regulates relief, and monitors accountability of the deployed teams/organizations.
- Recognition of social and cultural barriers within the disaster settings, which play a significant role in effective disaster management and planning.

CONCLUSION

Medical rehabilitation of disaster victims is essential, not only to improve their functional capabilities (including cognitive, neuropsychological function), but also their activity and participation within contextual factors (personal and environmental) for social reintegration. Learning from past catastrophes, inclusion of rehabilitation in the global disaster response initiative is a significant development and improvement in this area. The WHO EMT initiative Rehabilitation Guideli-

nes (20) provides structure and standardization, aligned with a set of overarching principles, to prepare, plan and provide clinical care during disasters for future deployments. However, there are many challenges in implementing these standards. Rehabilitation is the most expensive phase of any patient care, particularly for those with severe and multiple impairments requiring long-term care (13, 39). Sustained efforts from the WHO EMT Secretariat are needed to establish and maintain the EMT workforce (including rehabilitation) that possesses the knowledge, skill and ability to support all health-related aspects of disaster management (40). The role of the WHO Liaison Sub-Committee the Disaster Rehabilitation Committee (DRC) of the ISPRM, should be recognized in future disasters to facilitate coordination among major rehabilitation providers to minimize delay and duplication in deployment and deliver timely and effective rehabilitative care to victims. All countries prone to natural disasters should focus on planning and invest more in rehabilitation infrastructure and workforce. The challenge ahead is to develop a comprehensive, targeted and integrated rehabilitation-inclusive approach to disaster planning and management, targeting vulnerable communities at risk in future disasters. Future successful and effective disaster management will depend on the proficient leadership of the governing bodies (both international and national), and the willingness and commitment of countries to build systematic advance planning and preparedness to ensure that effective services (including rehabilitation) are available when needed.

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REFERENCES

1. Vos F, Rodriguez J, Below R, Guha-Sapir D. Annual Disaster Statistical Review 2009: the numbers and trends. Brussels: Centre for Research on the Epidemiology of Disasters (CRED); 2010.
2. Reinhardt JD, Li J, Gosney J, Rathore FA, Haig AJ, Marx M, et al. Disability and health-related rehabilitation in international disaster relief. *Global Health Action* 2011; 4: 7191.
3. Khan F, Amatya B, Gosney J, Rathore FA, Burkle FM, Jr. Medical rehabilitation in natural disasters: a review. *Arch Phys Med Rehabil* 2015; 96: 1709–1727.
4. Rathore MFA, Rashid P, Butt AW, Malik AA, Gill ZA, Haig AJ.

- Epidemiology of spinal cord injuries in the 2005 Pakistan earthquake. *Spinal Cord* 2007; 45: 658–663.
5. World Health Organization. World report on disability. Geneva: WHO; 2011.
6. Rathore FA, Gosney JE, Reinhardt JD, Haig AJ, Li J, DeLisa JA. Medical rehabilitation after natural disasters: why, when, and how? *Arch Phys Med Rehabil* 2012; 93: 1875–1881.
7. Khan F, Amatya B, Rathore FA, Galea MP. Medical rehabilitation in natural disasters in the Asia-Pacific region: the way forward. *Int J Natural Disaster Health Secur* 2015; 2: 6–12.
8. Lee HC. The role of occupational therapy in the recovery stage of disaster relief: a report from earthquake stricken areas in China. *Aust Occup Ther J* 2014; 61: 28–31.
9. Scaffa ME, Gerardi S, Herzberg G, McColl MA. The role of occupational therapy in disaster preparedness, response, and recovery. *Am J Occup Ther* 2006; 60: 642–649.
10. World Confederation for Physical Therapy (WCPT). WCPT report: the role of physical therapists in disaster management. London: WCPT; 2016.
11. Landry MD, McGlynn M, Ng E, Andreoli A, Devji T, Bower C, et al. Humanitarian response following the earthquake in Haiti: reflections on unprecedented need for rehabilitation. *World Health Population* 2010; 12: 18–22.
12. World Health Organization. Community-based rehabilitation guidelines. Geneva: WHO; 2010.
13. von Schreeb J, Riddez L, Samnegard H, Rosling H. Foreign field hospitals in the recent sudden-onset disasters in Iran, Haiti, Indonesia, and Pakistan. *Prehosp Disaster Med* 2008; 23: 144–151; discussion 152–153.
14. Economic and Social Commission for Asia and the Pacific (ESCAP). Disasters without borders: regional resilience for sustainable development. Asia-Pacific Disaster Report Bangkok: United Nations; 2015.
15. Butt S, Hitoshi N, Nottage L. Asia-Pacific Disaster Management. Comparative and socio-legal perspectives. Heidelberg: Springer; 2014.
16. Gosney JE, Jr. Physical medicine and rehabilitation: critical role in disaster response. *Disaster Med Pub Health Preparedness* 2010; 4: 110–112.
17. Amatya B, Khan F. Overview of medical rehabilitation in natural disasters in the Pacific Island Countries. *Phys Med Rehabil Int* 2016; 3: 1090.
18. Khan F, Amatya B, Mannan H, Burkle FM, Galea MP. Rehabilitation in Madagascar: challenges in implementing the World Health Organization Disability Action Plan. *J Rehabil Med* 2015; 47: 688–696.
19. Rathore FA, New PW, Iftikhar A. A report on disability and rehabilitation medicine in Pakistan: past, present, and future directions. *Arch Phys Med Rehabil* 2011; 92: 161–166.
20. World Health Organization. Emergency Medical Teams: minimum technical standards and recommendations for rehabilitation. Licence: CC BY-NC-SA 3.0 IGO. Geneva: WHO; 2016.
21. Global Health Cluster – Foreign Medical Team Working Group. Registration and coordination of Foreign Medical Teams responding to sudden onset disasters: the way forward. Geneva: World Health Organization; 5 May 2013.
22. World Health Organization. Emergency Medical Teams: World Health Organization EMT Initiative. Geneva: WHO; Nov 2016.
23. Tataryn M, Blanchet K. Evaluation of post-earthquake physical rehabilitation response in Haiti, 2010 – a systems analysis. London: International Centre for Evidence on Disability (ICED), London School of Hygiene & Tropical Medicine (LSHTM) (Funded by CBM); Jan 2012.
24. Global Health Cluster – Foreign Medical Team Working Group. Classification and minimum standards for foreign medical teams in sudden onset disasters. Geneva: World Health Organization; 2013.
25. Centre for Research on the Epidemiology of Disasters (CRED). The human cost of natural disasters: a global perspective. Brussels: CRED; 2015.
26. United nations office for Disaster Risk Reduction. Progress and Challenges in Disaster Risk Reduction: A contribu-

- tion towards the development of policy indicators for the Post-2015 Framework on Disaster Risk Reduction Geneva: UNISDR; 2014.
27. United Nations Office for Disaster Risk Reduction. Sendai Framework for Disaster Risk Reduction 2015–2030. Geneva: UNISDR; 2015.
 28. Khan F, Amatya B. Rehabilitation medicine critical to disaster relief. *Med J Aust InSight* [Internet] [accessed 2016 Aug 29]. Available from: <http://www.doctorportal.com.au/mjainsight/2016/33/rehabilitation-medicine-critical-to-disaster-relief/>.
 29. Brassard C, Giles DW, Howitt AM. Natural disaster management in the Asia-Pacific: policy and governance. In: Shaw R, editor. *Disaster risk reduction: methods, approaches and practices*. Kyoto: Springer Japan; 2015.
 30. Global Facility for Disaster Reduction and Recovery (GFDRR). *Bringing resilience to scale. Annual report*. Washington DC: GFDRR; 2016.
 31. Global Facility for Disaster Reduction and Recovery (GFDRR). *Bringing resilience to scale: a work plan for the global facility for disaster reduction and recovery 2017*. Washington DC: GFDRR; 2016.
 32. Amat Camacho N, Hughes A, Burkle FM, Jr, Ingrassia PL, Ragazzoni L, Redmond A, et al. Education and Training of Emergency Medical Teams: Recommendations for a Global Operational Learning Framework. *PLoS Currents* 2016; 8.
 33. National Critical Care and Trauma Response Centre. *Australian Medical Assistance Teams (AUSMAT) 2015*. Available from: <http://www.nationaltraumacentre.nt.gov.au/what-we-do/disaster-management/ausmat>.
 34. Daily E, Padjen P, Birnbaum M. A review of competencies developed for disaster healthcare providers: limitations of current processes and applicability. *Prehosp Disaster Med* 2010; 25: 387–395.
 35. Ripoll Gallardo A, Djalali A, Foletti M, Ragazzoni L, Della Corte F, Lupescu O, et al. Core competencies in disaster management and humanitarian assistance: a systematic review. *Disaster Med Public Health Preparedness* 2015; 9: 430–439.
 36. World Health Organization. *WHO Global Disability Action Plan 2014–2021: Better Health for All People with Disability*. Geneva: WHO; 2014.
 37. Khan F, Amatya B, Dhakal R, Abbott G, Graf M, Ramirez S, et al. Rehabilitation needs assessment in persons following spinal cord injury in disaster settings: lessons learnt in 2015 Nepal earthquakes. *Int J Phys Med Rehabil* 2015; 3: 316.
 38. Gohy B, Ali E, Van den Bergh R, Schillberg E, Nasim M, Naimi MM, et al. Early physical and functional rehabilitation of trauma patients in the Medecins Sans Frontieres trauma centre in Kunduz, Afghanistan: luxury or necessity? *Int Health* 2016; 8: 381–389.
 39. Turner-Stokes L. The evidence for the cost-effectiveness of rehabilitation following acquired brain injury. *Clin Med (Lond)* 2004; 4: 10–12.
 40. Burkle FM, Jr. The development of multidisciplinary core competencies: the first step in the professionalization of disaster medicine and public health preparedness on a global scale. *Disaster Med Public Health Preparedness* 2012; 6: 10–12.