MEDICAL REHABILITATION

IN NATURAL DISASTERS

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Declaration

I, Bhasker Amatya, hereby declare that:

The thesis comprises a series of published original work with my significant contribution as a joint author. I have included as part of the thesis a signed statement from each co-author of the included studies. None of the other authors of these published studies have any competing or conflicts of interest. This thesis contains no material which has been accepted for award of any degree or diploma in any other academic institution, and to the best of my knowledge all previously published works and materials used were acknowledged and referenced accordingly.

I, Bhasker Amatya, hereby certify that the work embodied in this thesis was exclusively initiated and completed within the Department of Rehabilitation, Royal Melbourne Hospital and has been done in collaboration with other researchers from other institutions. I was supported by the Department of Rehabilitation Medicine, Royal Melbourne Hospital and no external funding was available for the included studies.

The thesis is less than 100,000 words in lengths excluding tables, figures, bibliographies and appendices.

Bhasker Amatya

March 2017

['Declaration for a thesis with publication' forms are listed in *Appendix 1*]

"***I find hope in the darkest of days, and focus in the brightest. I do not judge the universe.*" - Dalai Lama**

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Preface

I certify that the thesis is my original work and all included studies in this review have over 70% of my contributions. I acknowledge the contribution to the thesis by:

- Prof Fary Khan (supervisor) – advice and guidance for all chapters.
- Professor Mary Galea (supervisor) - advice and critical review of the thesis.

I also like to acknowledge the contribution to the published journal articles by:

- Khan F, Amatya B, Gosney J, Rathore FA, Burkle Jr, FM. Medical rehabilitation in natural disasters: a systematic review. Archives of Physical Medicine and Rehabilitation 2015; 96(9):1709-1727.
    - Fary Khan: Assisted in selection of the studies and critical appraisal of the studies for the review and review of all drafts of the review including final draft.
    - Jim Gosney: review of the manuscript
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    - Frederick M. Burkle Jr: critical review of the final draft.
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- Khan F, Amatya B, Dhakal R, Abbott G, Graf M, Ramirez S, Lowenthal K, Galea MP. Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes. International Journal of Physical Medicine & Rehabilitation 2015; 3: 316.
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- Khan F, Amatya B. Rehabilitation medicine critical to disaster relief. Medical Journal of Australia InSight. Published online 29 August 2016.
    - Fary Khan: assistance in formulating concept and structure of the manuscript, review of the manuscript
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    - Jinan Li: critical review of manuscript
    - Mary P Galea: advice and critical review of manuscript

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- Professor Fary Khan

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- Professor Mary P Galea

_____ Date: 10/03/2017

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I would also like to thank the co-authors of all included manuscripts in this thesis, which could not have been undertaken without their support. It is my privilege and honour to be working with such a supportive group of people. I would also like to express my thanks and gratitude to the team members of our Royal Melbourne Hospital Emergency Medical Team led by Prof Fary Khan: Prof Mary Galea, Dr Geoff Abbott, Dr Alaeldin Elmalik, Mr Mark Graf, Mr Santos Ramirez, Ms Kathryn Lowenthal and Ms Bronwyn Miller. I would also like to acknowledge my colleagues at the Department of Rehabilitation, Royal Melbourne Hospital for their ongoing support.

I am grateful to my wife Laju and daughters Slesha and Tessa, for giving me space and time while working on this thesis. They are my greatest cheerleaders, inspiring me to continue learning and pursuing my doctorate degree.

Thank you all for so much love, encouragement and support. This body of work is certainly a joint accomplishment!

I would like to dedicate this work to all victims of natural disasters. Their pain and suffering has motivated me to act and commit my time in helping ease their sufferings and improve their condition and quality of life. Finally, I

would also like to dedicate this work to all emergency responders, who work in challenging and difficult circumstances, but are committed to helping people in need in emergencies/disasters.

"*The world breaks everyone and afterward many are strong at the broken places*" - Ernest Hemingway

List of Publications

This thesis is based on the following studies, which in the text will be referred to by their Roman numerals.

I. Khan F, **Amatya B**, Gosney J, Rathore FA, Burkle Jr, FM. Medical rehabilitation in natural disasters: a systematic review. Archives of Physical Medicine and Rehabilitation 2015; 96(9):1709-1727.

II. **Amatya B**, Khan F. Overview of Medical Rehabilitation in Natural Disasters in the Pacific Island Countries. Physical Medicine and Rehabilitation – International 2016:3 (4):1090.

III. Khan F, **Amatya B**, Rathore FA, Galea MP. Medical Rehabilitation in Natural Disasters in the Asia-Pacific Region: The Way Forward. International Journal of Natural Disaster and Health Security, 2015; 2(2), 6-12.

IV. Khan F, **Amatya B**, Dhakal R, Abbott G, Graf M, Ramirez S, Lowenthal K, Galea MP. Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes. International Journal of Physical Medicine & Rehabilitation 2015; 3: 316.

V. Khan F, **Amatya B**. Rehabilitation medicine critical to disaster relief. Medical Journal of Australia InSight. Published online 29 August 2016.

VI. **Amatya B**, Galea MP, Li J, Khan F. Medical rehabilitation in disaster relief: towards a new perspective. Journal of Rehabilitation Medicine 2017; 49: Epub ahead of print (doi: 10.2340/16501977-2250) (*Appendix 2*)

Other publications and presentations arising from this thesis

Peer reviewed publications arising from collaborations associated with this thesis

The Royal Melbourne Hospital (RMH) Rehabilitation Team recognizes the importance of rehabilitation needs for disaster victims, and strengthening the capacity of local service providers to sustain long-term care and social support of disaster survivors. We think this is pivotal to halt the perpetual cycle of disability and poverty particularly evident in low- and middle-income countries. It is great privileged to be a member of the RMH Team. As a member of the RMH team, I have been, and am currently enthusiastically involved in different activities in building local rehabilitation capacity in low- and middle-income countries.

Below are listed some of the peer reviewed publications arising from collaborations associated with this work, which are relevant to this thesis:

1. Khan F, **Amatya B**, Avirmed B, Yi YK, Shirmen B, Tsegmid N, Abbott G, Galea MP. WHO Global Disability Action Plan: the Mongolian Perspective. Journal of Rehabilitation 2017;49: (e-pub ahead of print) (*Appendix 3*)
2. Khan F, **Amatya B**, Sayed TM, Butt AW, Jamil K, Iqbal W, Elmalik A, Rathore FA, Abbott G. The World Health Organization - Disability Action Plan 2014–2021: Challenges and Perspectives for Physical Medicine and Rehabilitation in Pakistan. Journal of Rehabilitation Medicine 2017; 49: 10–21. (*Appendix 4*)
3. Khan F, **Amatya B**, Mannan H, Burkle Jr FM, Galea MP. Rehabilitation in Madagascar: Challenges in implementing the WHO Disability Action Plan. Journal of Rehabilitation Medicine 2015;47(8):688-96. (*Appendix 5*)

4. Khan F, **Amatya B**, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward (invited review and policy analysis). Physical Medicine and Rehabilitation - International 2015; 2(9): 1070. (*Appendix 6*)
5. Khan F, **Amatya B.** Refugee health and rehabilitation: challenges and response. Journal of Rehabilitation Medicine 2017;49:378-84. (*Appendix 7*)

Part of the included work in this thesis have been published and/or presented in the various national and international forums, including:

Conference proceedings and presentations

(Copies of presented posters are provided in *Appendix 8*)

Amatya B. Disaster management in Pacific- the way forward (Invited Speaker) 10th International Society Physical Rehabilitation Medicine, 30thApril–4th May, Buenos Aires, Argentina (Oral presentation)

Amatya B, Khan F, Dhakal R, Abbott G, Galea MP. Rehabilitation Screening Tool in Disaster Settings: Nepal Earthquakes 2015. WHO Emergency Medical Team Global Meeting, 28th-30th November 2016, Hong Kong (Poster Presentation).

Amatya B, Khan F, Gosney J, Rathore FA. Burkle Jr, FM. Medical rehabilitation in natural disasters. WHO Emergency Medical Team Global Meeting, 28th-30th November 2016, Hong Kong (Poster Presentation).

Amatya B. Medical Rehabilitation in Natural Disasters in the Pacific Island Countries. First Annual Scientific Meeting, Rehabilitation Medicine Society of Australia and New Zealand, 16-19 October 2016, Melbourne (Plenary lecture).

Amatya B, Khan F, Rathore FA, Galea M. Medical rehabilitation in natural disasters in the Asia-Pacific region: the way forward. First Annual Scientific Meeting, Rehabilitation Medicine Society of Australia and New Zealand, 16-19 October 2016, Melbourne (Poster presentation).

Amatya B, Khan F, Gosney J, Rathore FA. Burkle Jr, FM. Medical rehabilitation in natural disasters: a systematic review. 10th International Society Physical Rehabilitation Medicine, May 29th–2nd June, 2016 Kuala Lumpur (Oral presentation).

Khan F, **Amatya B**. Natural Disasters: the way forward for Rehabilitation. 10th International Society Physical Rehabilitation Medicine, May 29th–2nd June, 2016 Kuala Lumpur (Oral Presentation).

Khan F, **Amatya B**. Embedded Medical Rehabilitation Teams in Disaster Management- the Hindukush Earthquake. 10th International Society Physical Rehabilitation Medicine, May 29th–2nd June, Kuala Lumpur (Oral Presentation).

Amatya B, Khan F , Dhakal R, Abbott G, Graf M, Ramirez S, Lowenthal K, Galea MP. Rehabilitation of spinal cord injury: lessons learnt in disaster settings. Melbourne Health Research Week, 16th-23th June 2016, Melbourne (Poster presentation)

Khan F, **Amatya B**. Medical rehabilitation in natural disasters Combined meeting of Australian Faculty of Rehabilitation Medicine and New Zealand

Rehabilitation Association, 13th-17th October 2015, Wellington, New Zealand (Oral Presentation)

Khan F, **Amatya B**, Gosney J, Rathore FA, Burkle Jr, FM. Medical rehabilitation in natural disasters. Ninth World Congress of International Society of Physical Medicine and Rehabilitation (ISPRM), 19th-23rd June 2015, Berlin, Germany (Oral Presentation)

Awards

Recipient of the 'Community award for Commendable Service to the Nepalese Community 2016' for the effort in the care of victims of the Nepal earthquakes 2015. Nepalese Association of Victoria and Non-Resident Nepali Association, Australia.

Summary

The number of severe natural disasters (such as earthquakes, storms, draught, floods etc.) has escalated in recent years. Natural disasters often occur unexpectedly, precipitously and with great magnitude of destruction, resulting in significant loss of life and long-term disability from severe injuries including spinal cord injury, traumatic brain injury, limb amputation, fracture, peripheral nerve injury, crush injury and psychological impairment. In the last two decades, advances in disaster response/rescue and field management, have improved the survival rates of disaster victims significantly worldwide. Current data shows a significant increase in the number of injuries sustained relative to mortality, indicating medical rehabilitation is integral to comprehensive disaster management. Empirical evidence on medical rehabilitation following natural disasters is increasing and various studies have reported effectiveness of rehabilitation in survivors. Evidence suggests early provision of rehabilitation programs reduce disability, leading to better clinical outcomes, and improves participation and quality of life of disaster victims.

The World Health Organization (WHO) rehabilitation guidelines recommend implementation and access to rehabilitation during all phases of the disaster response. In line with this, 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.

Many countries now recognize the importance of disaster planning, preparedness and management initiatives, and their disaster management capacity and collaboration has improved. Unfortunately, major disparities and gaps amongst countries exist, and those with a high disaster risk tend to have a low coping capacity, with inadequate disaster response/management plans.

Many countries have limited or lack of access to appropriate services such as rehabilitation, where fragmented healthcare systems are compromised by lack of financial and political support. Rehabilitation-inclusive disaster management strategies/plans are yet to be developed in many countries, particularly in the Asia-Pacific region (where the majority of natural disasters occur). There is a concern in regards to the inadequacy of global organizational capacities and capabilities and matching of resources across the disaster cycle.

In past large-scale disasters, it was beyond the capacity of many countries to have optimal disaster management and many were dependent on global humanitarian and medical assistance. This is reflected by the growing number of emergency medical teams (EMTs) responding to disasters worldwide. However, the influx of EMTs during past disasters presented immense challenges regarding response coordination and management. There was lack of standardized protocols/guidelines, coordination and evaluation mechanisms in place. This resulted in inadequate care delivery, particularly rehabilitation, with often devastating consequences for the affected individuals, families and communities.

Although there have been improvements in the organization of emergency responses, care and services, this has often not extended to include rehabilitation services. Currently, there is increased scrutiny of the humanitarian response sector driven towards professionalism and accountability, to provide effective and appropriate interventions in different disaster settings. Further, there have been significant developments in international, regional and national collaboration and management capacities in disaster management, including implementation of disaster-risk reduction frameworks, quality and coordination mechanism of EMTs. One of the noteworthy developments is the establishment of the WHO-EMT Initiative and launch of EMT guidelines, including the '*Minimum technical standards and*

recommendations for rehabilitation in sudden onset disasters'. These guidelines not only classify medical response teams per their capability, but also set out the core standards for medical care of disaster victims. The WHO rehabilitation guideline provides standardized protocols for rehabilitation in future emergencies, acknowledging variations in type and patterns of injury, disease and subsequent long-term disability. It provides much needed direction for preparedness for rapid, professional, coordinated medical responses by both national and international response teams. It also provides guidance on building or strengthening the capacity of local and international EMTs within defined coordination mechanisms. A WHO registration system for all EMTs was initiated in July 2015, which enables establishment of a global registry of emergency medical response teams for deployment in future calamities.

There are still immense challenges in putting these standards into practice in disaster settings. The successful implementation of these frameworks will require increased resilience of the rehabilitation community with multi-stakeholder partnerships. There is still much progress to be made on tackling the underlying drivers of disaster risk, such as poverty, climate change, rapid urbanization, and factors such as environmental degradation, poor local governance, population growth, economic development patterns, to establish a rehabilitation-inclusive disaster management model for future catastrophes. 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 area.

This thesis explores the medical rehabilitation management of disaster survivors, following natural disasters. The aim was to provide evidence and systematic analyses of various rehabilitation interventions trialled in disaster survivors, in terms of their effectiveness, safety and cost-efficiency.

Rehabilitation professionals' role and gaps in evidence for medical rehabilitation in disaster management and Australian perspective were explored, specifically in the Asia-Pacific region. Further, a brief overview of current developments, challenges, and gaps in the rehabilitation-inclusive disaster management plan, including implementation of WHO guidelines, is discussed to improve care for victims of future calamities.

The thesis consists of ten chapters.

- ***Chapter 1*** provides an overview and epidemiology of natural disasters and medical rehabilitation in disaster settings. It highlights the potential role of medical rehabilitation during disasters.
- ***Chapter 2*** presents a detailed methodology of the thesis including rationale, key aims of the included studies, methods and structure.
- ***Chapter 3*** presents a systematic literature review to provide an evidence base for the outcomes and effectiveness of medical rehabilitation interventions in natural disaster survivors (**Study I**).
- ***Chapter 4*** provides an overview of the status of medical rehabilitation in natural disasters in the Asia-Pacific region (**Study II**).
- ***Chapter 5*** provides an overview of the status of medical rehabilitation in natural disasters in the Pacific Island countries (**Study III**).
- ***Chapter 6*** presents the experience of the Emergency Medical Rehabilitation Team (the Royal Melbourne Hospital Team) during the Nepal earthquakes in 2015 and validation of a field rehabilitation triage tool in disaster survivors with spinal cord injuries (**Study IV**).
- ***Chapter 7*** presents a commentary highlighting the role of medical rehabilitation in disasters from an Australian perspective **(Study V)**.
- ***Chapter 8*** provides a general discussion of current developments, gaps/barriers, and potential enablers/actions which need to

be considered (*The Way Forward*) in future natural calamities **(Study VI).**

- ***Chapter 9*** provides a summary of the overall findings.
- ***Chapter 10*** consists the bibliography list.

In conclusion, this thesis highlights the importance of medical rehabilitation during natural disasters and the need for early inclusion of medical rehabilitation professional/team during response planning and long-term comprehensive management of disaster victims, as rehabilitation needs of many disaster victims with complex or permanent disability often persist over the longer-term. Therefore, this thesis emphasizes the importance of strengthening and building the capacity of local service providers to sustain long-term care and social support of disaster survivors.

This thesis also highlights the need for investment in sustainable infrastructure and education in medical rehabilitation and for more methodologically robust studies to build evidence for rehabilitation programs, cost-effectiveness and outcome measurement in such settings. Rehabilitation response in future emergency situations will benefit from embedding specialized rehabilitation teams into disaster management plans within new and existing systems, and application of rigorously tested and context-appropriate research for improved quality of care. The challenge ahead is to provide well-timed and effective rehabilitation interventions in a coordinated and culturally appropriate way, to reach the intended population who needs most assistance.

A rehabilitation-inclusive disaster management plan is requisite and should be considered by all countries for the management of disaster survivors. Future successful and effective disaster management will depend on proficient leadership by the governing bodies, and willingness and commitments of countries to build a comprehensive/integrated approach to disaster planning

and management (including rehabilitation), targeting vulnerable communities to ensure effective services are available when needed.

Keywords: Natural disaster, rehabilitation, disability, disaster response, outcome

Glossary of terms

Biological disasters

A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mould) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying disease-causing agents such as parasites, bacteria, or viruses (e.g. malaria).

Climatological disasters

A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability.

Community-based rehabilitation

A strategy within general community development for rehabilitation, equalization of opportunities, poverty reduction and social inclusion of people with disabilities. Community-based rehabilitation is implemented through the combined efforts of people with disabilities themselves, their families, organizations, and communities, and the relevant governmental and nongovernmental health, education, vocational, social and other services.

Emergency medical team (EMT)

EMTs are groups of health professionals and supporting staff outside their area of origin (nationally or internationally), who provide health care specifically to populations affected by emergencies. They include governmental (both civilian and military) and non-governmental teams. EMTs respond to sudden-onset disasters to treat trauma and surgical cases. Their value in other types of emergencies, such as communicable disease outbreaks, has been demonstrated more recently.

Disability

An umbrella term for impairments, activity limitations and participation restrictions resulting from the interaction between people with health conditions and the environmental barriers they encounter (based on the International Classification of Functioning, Disability and Health).

Disaster

A serious disruption of functioning of a community or a society causing widespread human, material, economic or environmental losses which exceeds the ability of the affected community or society to cope using its own resources.

Extra-terrestrial disasters

A hazard caused by asteroids, meteoroids, and comets as they pass near-earth, enter the Earth's atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that affect the Earth's magnetosphere, ionosphere, and thermosphere.

Geophysical disasters

A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.

Hazard

A possible threat of source of exposure to injury, harm or loss, e.g. conflict, natural phenomena.

Hydrological disasters

A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.

Metrological disasters

A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.

Medical rehabilitation

A set of interventions designed to optimize functioning and reduce disability in individuals with health conditions [disease (acute or chronic), disorder, injury or trauma] in interaction with their environment.

Natural Disaster

A serious disruption of functioning of a community or a society causing widespread human, material, economic or environmental losses which exceeds the ability of the affected community or society to cope using its own resources.

Sudden Onset Disaster (SOD)

Disasters that occur with little or no warning, meaning there is insufficient time for the complete evacuation of the at-risk populations.

Contents

Declaration 2

Supervisors 3

Preface 4

Acknowledgements 7

List of Publications 9

Other publications and presentations arising from this thesis 10

Peer reviewed publications arising from collaborations associated with this thesis 10

Conference proceedings and presentations 11

Awards 13

Summary 14

Glossary of terms 20

List of abbreviations 27

List of figures 29

List of tables 29

List of appendices 30

CHAPTER 1 Introduction 32

1.1 Natural Disasters 33

1.1.1 Epidemiology of natural disasters 36

1.1.2 Consequences of Natural disasters 41

1.1.2.i Human impact of natural disasters 42

1.1.2.ii Economic damages from natural disasters 43

1.2 Medical rehabilitation during disasters 45

1.2.1 Role of rehabilitation physicians in disaster settings 49

CHAPTER 2 Overview and Methods 52

CHAPTER 3 A Systematic Review of Medical Rehabilitation in Natural Disasters 57

CHAPTER 4 Overview of Medical rehabilitation in natural disasters in the Asia-Pacific Region 75

CHAPTER 5 Overview of Medical rehabilitation in natural disasters in the Pacific Island Countries 83

CHAPTER 6 Rehabilitation Needs in Persons Following Spinal Cord Injury in Disaster Settings 91

CHAPTER 7 Medical Rehabilitation in Natural Disasters: Australian perspective 98

CHAPTER 8 General Discussion and The Way Forward 102

8.1 Overview of the thesis 103

8.2 Key issues addressed in this thesis 104

8.3 Summary of findings of individual studies 105

8.4 Challenges in disaster management 114

8.5 Current developments in disaster management 116

8.6 Challenges in putting EMT standards into practice 131

8.7 The way forward 133

8.8 Implication for clinical practice 138

8.9 Implications for research 139

CHAPTER 9 Conclusions 143

CHAPTER 10 References 148

Appendices 158
Appendix 1 159
Declarations of a thesis with publication 159
Appendix 2 164
Appendix 3 173
Appendix 4 182
Appendix 5 195
Appendix 6 205
Appendix 7 219
Appendix 8 227
Conference proceedings 227
Poster 1: Rehabilitation screening toolin disaster settings: Nepal earthquakes 2015 227
Poster 2. Medical rehabilitation in natural disasters 228
Poster 3. Medical rehabilitation in natural disasters in the Asia-Pacific region 229
Poster 4. Rehabilitation of spinal cord injury: lesson learnt in natural disaster settings 230
Poster 5. Medical rehabilitation in Madagascar: challenges in implementing the WHO Disability Action Plan 231
Appendix 9 Co-authors statements Study I 232
Appendix 10 Co-authors statements Study II 236
Appendix 11 Co-author statement Study III 239
Appendix 12 Co-authors statements Study IV 240

Appendix 13 Co-author statement Study V 247

Appendix 14 Assessment and triage tool for Spinal cord injury patients (Study IV) 248

List of abbreviations

AusMAT	Australian Medical Assistance Team
CRED	Centre for Research on the Epidemiology of Disasters
CRPD	Convention on the Rights of Persons with Disabilities
CRDR	Committee on Rehabilitation Disaster Relief
DRC	Disaster Rehabilitation Committee
EM-DAT	Emergency Events Database
EMT	Emergency medical team
ESCAP	Economic and Social Commission for Asia and the Pacific
FMT-WG	Foreign Medical Teams Working Group
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
ICF	International Classification of Function and Health
ICRC	International Committee of the Red Cross
ISO	International Organization of Standardization
GDP	Gross Domestic Product
ISPRM	International Society of Physical and Rehabilitation Medicine
NGO	Non-government organization
OCHA	Office for the Coordination of Humanitarian Affairs
ODA	Official Development Assistance
PAHO	Pan American Health Organization
PICs	Pacific Island Countries
PHT	Pacific Humanitarian Team
SIDS	small island developing states
RMH	Royal Melbourne Hospital
ROM	Range of motion

ROP	Regional Office for the Pacific
SCI	Spinal cord injury
SFDRR	Sendai Framework for Disaster Risk Reduction 2015-2030
SOPs	Standard Operating Procedures
SOPAC	Pacific Islands Applied Geoscience Commission
SNAP	Strategic National Action Plans
TBI	Traumatic brain injury
UNISDR	United Nation Office for Disaster Risk Reduction
UN	United Nations
US	United States
WHO	World Health Organization

List of figures

Figure 1. Number of natural disasters between 2000-2015 by countries
Figure 2. Number of reported natural disasters between 2000-2016
Figure 3. Impact of natural disasters on general health and health systems
Figure 4. Human impact by disaster types (2015 vs. 2005-2014)
Figure 5. Annual reported economic damages and time trend from disasters: 1980-2015
Figure 6. Number of deaths caused by natural disasters between 1994-2013 per country income group
Figure 7. Trends in the rehabilitation burden in sudden-onset disasters
Figure 8. Global Emergency Medical Team (EMT) Classification Process

List of tables

Table 1. Classification of natural disasters
Table 2. Deadliest earthquakes worldwide (2000- April 2016)
Table 3. Sendai Framework for Disaster Risk Reduction 2015-2030
Table 4. WHO classification of Emergency Medical Teams (EMTs)
Table 5. Overview of rehabilitation input by Emergency Medical Team (EMT) type

List of appendices

1. Declarations for a thesis with publication
2. Study VI. Amatya B, Galea MP, Li J, Khan F. Medical rehabilitation in disaster relief: towards a new perspective. Journal of Rehabilitation Medicine 2017; 49: Epub ahead of print (doi: 10.2340/16501977-2250) (Appendix 2)
3. Other research publication 1: Khan F, Amatya B, Avirmed B, Yi YK, Shirmen B, Tsegmid N, Abbott G, Galea MP. WHO Global Disability Action Plan: the Mongolian Perspective. Journal of Rehabilitation 2017 49:E-Pub ahead of print.
4. Other research publication 2: Khan F, Amatya B, Sayed TM, Butt AW, Jamil K, Iqbal W, Elmalik A, Rathore FA, Abbott G. The World Health Organisation - Disability Action Plan 2014–2021: Challenges and Perspectives for Physical Medicine and Rehabilitation in Pakistan. Journal of Rehabilitation Medicine 2017; 49: 10–21.
5. Other research publication 3: Khan F, Amatya B, Mannan H, Burkle Jr FM, Galea MP. Rehabilitation in Madagascar: Challenges in implementing the WHO Disability Action Plan. Journal of Rehabilitation Medicine 2015;47(8):688-96.
6. Other research publication 4: Khan F, Amatya B, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward (invited review and policy analysis). Physical Medicine and Rehabilitation - International 2015; 2(9): 1070.
7. Other research publication 5: Khan F, Amatya B. refugee health and rehabilitation: challenges and response. Journal of Rehabilitation Medicine 2017 49:387-84.
8. Conference proceedings:
    - Poster 1. Rehabilitation screening tool in disaster settings: Nepal earthquakes 2015
    - Poster 2. Medical rehabilitation in natural disasters

- Poster 3. Medical rehabilitation in natural disasters in the Asia-Pacific region: the way forward
- Poster 4. Rehabilitation of spinal cord injury: lessons learnt in disaster settings
- Poster 5. Medical rehabilitation in Madagascar: challenges in implementing the WHO Disability Action Plan

9. Co-Authors' Statements Study I
10. Co-Authors' Statements Study II
11. Co-Authors' Statements Study III
12. Co-Authors' Statements Study IV
13. Co-Authors' Statements Study V
14. Assessment and triage tool for spinal cord injury patients (Study IV)

CHAPTER 1

Introduction

This chapter provides an overview of natural disasters, including epidemiological data, and introduces the concept of medical rehabilitation and its role in disaster settings.

1.1 Natural Disasters

Various terms and definitions are used in the disaster management literature. For clarity and consistency purposes the terms used in this thesis are defined below:

The United Nations Office for Disaster Risk Reduction (UNISDR) defines disaster as '*a serious disruption of functioning of a community or a society causing widespread human, material, economic or environmental losses which exceeds the ability of the affected community or society to cope using its own resources*' (1). Disaster can be classified into:

- *Natural* (e.g., earthquakes, storms)
- *Technological* or *man-made* - events caused deliberately by humans (e.g., armed conflicts, terror attacks and other situations of violence) or by human negligence (e.g., industrial or transport accidents)
- *Complex humanitarian emergencies* - events caused as a result of several different hazards or a complex combination of both natural and man-made disasters with different causes (e.g., food insecurity, epidemics, displaced populations).

A natural disaster is defined as '*a situation or event caused by nature, which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering*' (2). Based on the etiology, natural disasters can be sub-classified into: Geophysical, Meteorological, Hydrological, Climatological and Biological. The classification

of natural disasters based on etiology is listed in *Table 1*. Natural hazards are labeled as natural disasters when human lives are lost and livelihoods damaged or destroyed (3). According to the Centre for Research on the Epidemiology of Disasters (CRED), the term hazard refers to '*a severe or extreme event such as a flood, storm, earthquake, volcanic eruption etc. which occurs naturally in any part of the world*' (page 12) (3).

Sudden onset disaster (SOD), a term developed by the WHO Health Cluster (4), is defined as '*disaster that occur with little or no warning, meaning that there is insufficient time for the complete evacuation of the at risk populations*'.

Table 1. Classification of Natural Disasters[1]

Subgroup	Definition	Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass movement (dry) (rockfall, landslide, avalanche, subsidence)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (spectrum from minutes to days)	Storm (tropical cyclone, extra-tropical cyclone, local storm)
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass movement (wet) (rockfall, landslide, avalanche, subsidence)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme temperature (heat wave, cold wave, extreme weather condition), Drought, Wildfire (forest fire, land fire)
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic (viral/bacterial/parasite/ fungal/prion infectious disease), insect infestation, animal stampede

[Adapted from Below et al 2009, CRED & Munich RE (5)]

[1] This classification is based on the global disaster data set "Emergency Events Database (EM-DAT)", Centre for Research on the Epidemiology of Disasters (CRED). At least one of the following criteria must be fulfilled for a disaster to be entered into the EM-DAT database: ≥10 people reported killed; ≥100 reported affected; declaration of a state of emergency; call for international assistance.

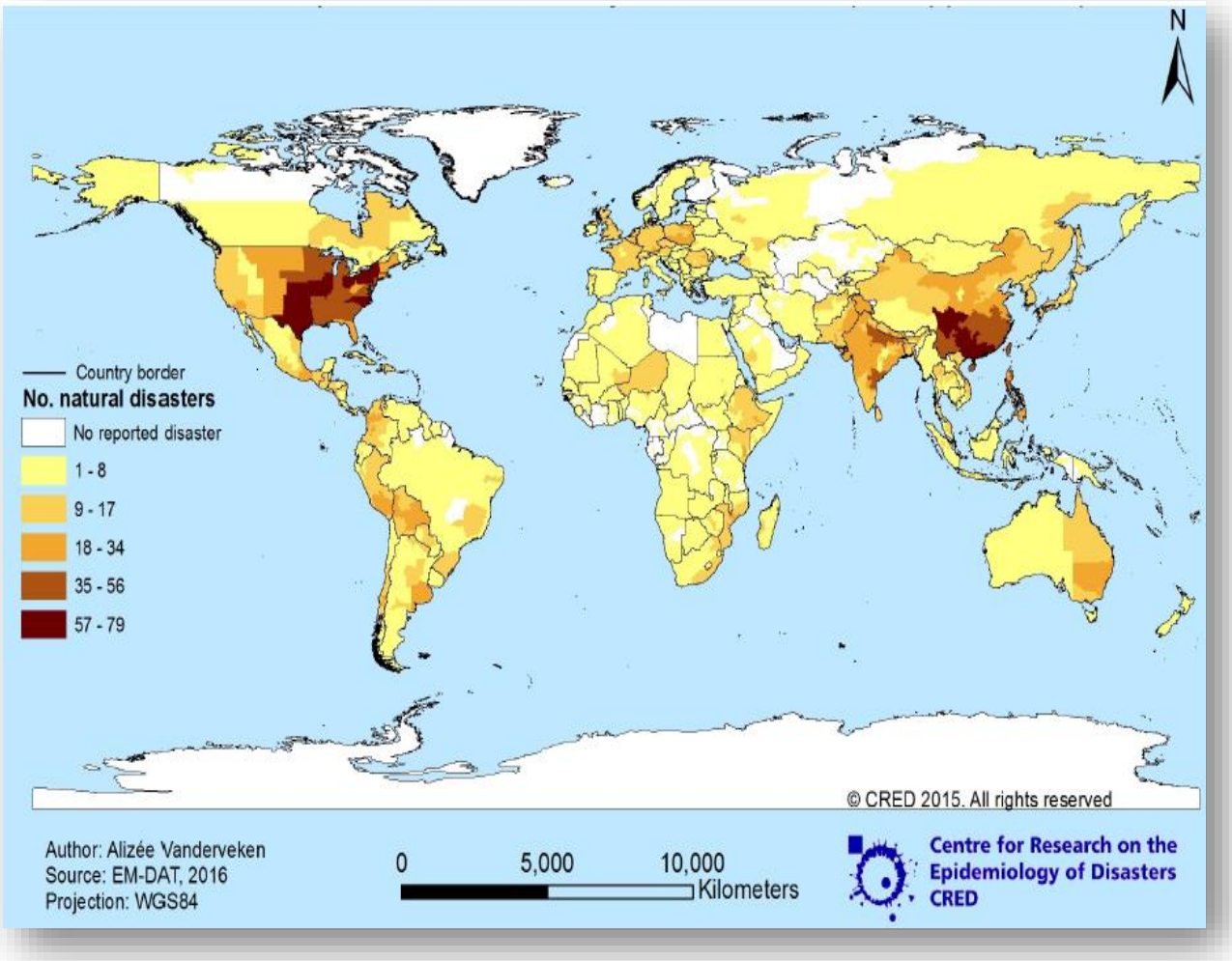
1.1.1 Epidemiology of natural disasters[2]

The number of severe natural disasters has escalated in recent years worldwide, mainly due to earthquake, drought, floods, and dry and wet mass movement. Natural disasters occur disproportionately, mainly in developing countries. Between 1991 and 2015, more than 90% of natural disaster deaths and 98% of people affected by natural disasters were from developing countries (*Figure 1*). In the 15-year period 2000-2015, there were over 5,900 disasters recorded worldwide (6), in which, an estimated 3.2 billion people were affected and over 1.2 million people lost their lives, with economic losses amounting over US$2 trillion (6). In the past two decades, although frequency of geophysical disasters (primarily earthquakes, including tsunamis, and volcanic eruptions) remained broadly constant, there was a sustained rise in climate- and weather-related events (floods, storms and heatwaves in particular) accounting for the majority of disasters (over two-thirds) in most years (7). Preliminary data show that in 2016 alone, 302 natural disasters occurred in 102 countries worldwide, which accounted for over 7,600 deaths, over 411 million affected persons, and over US$ 97 billion in economic losses (8).

Number of reported natural disasters between 2000-2016 in different continents is provided in *Figure 2*.

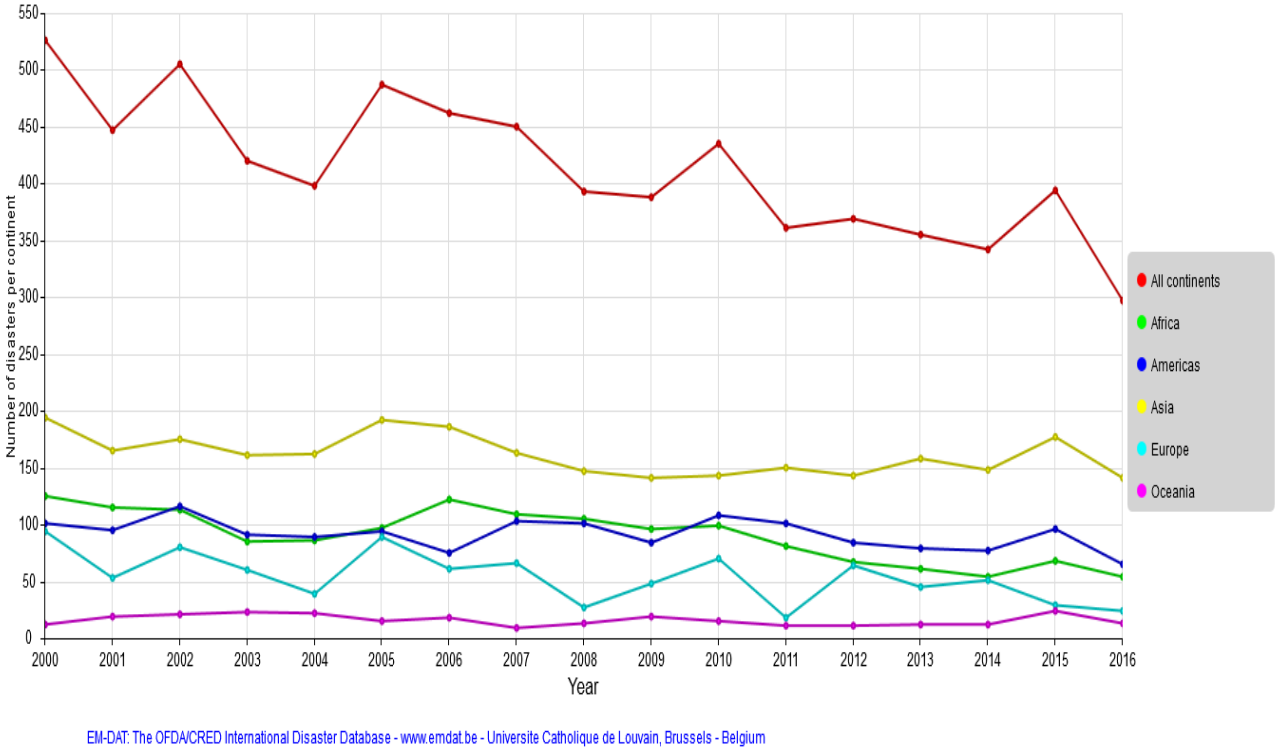
[2] Data presented (with permission) in this chapter are mainly based on EM-DAT, which contains comprehensive data on technological and natural disasters from 1900 to the present day. This database was created in1999, with collaboration between the United States Agency for International Development's Office Foreign Disaster Assistance and CRED, with the support of the WHO and the Belgian government. The main objective of EM-DAT is to inform humanitarian action at the national and international levels in order to improve decision-making in disaster preparedness, provide objective data for assessing communities' vulnerability to disasters and to help policy-makers set priorities.

Figure 1. Number of natural disasters between 2000-2015 by countries



[Published with permission, Source: EM-DAT 2016 (9)]

Figure 2. Number of reported natural disasters between 2000-2016



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The Asia-Pacific is the most disaster-prone region in the world, with over 40% of the world's disasters occurring in this region in the past decade (10). According to United Nations (UN) Economic and Social Commission for Asia and the Pacific (ESCAP) report, almost two-thirds of the total disasters that occurred globally between 2005 and 2014 occurred in the Asia-Pacific region, resulting in half a million fatalities (almost 60% of the total global deaths related to disasters) and an estimated over 1.4 billion people affected (80% of those affected globally) (11). In 2015 alone, over half (51%) of the world's natural disasters occurred in the Asia-Pacific region, which accounted for almost 65% of disaster victims with over 52% reported costs worldwide (more detail in **Study II**) (2). Further, Pacific Island Countries (PICs) are the most

natural disaster-prone regions in the world, classified among the world's top 30 most vulnerable nations to natural disasters, with approximately 41 tropical cyclones occurring each year (more detail in **Study III**). The PICs suffer, on average, combined disaster damages of more than $280 million every year and which cost some countries an average of up to 6.6% of their Gross Domestic Product (GDP) (12). Hydro-metrological disasters (floods, storms) were the most frequent and most expensive type of disaster during the past two decades and create a large socioeconomic burden with significant impact on healthcare costs, social infrastructure, and the environment (3).

A list of major earthquakes worldwide between 2000-2016 (the majority of which occurred in the Asia-Pacific region) are listed in *Table 2*.

Table 2. Deadliest earthquakes worldwide (2000- 2016)

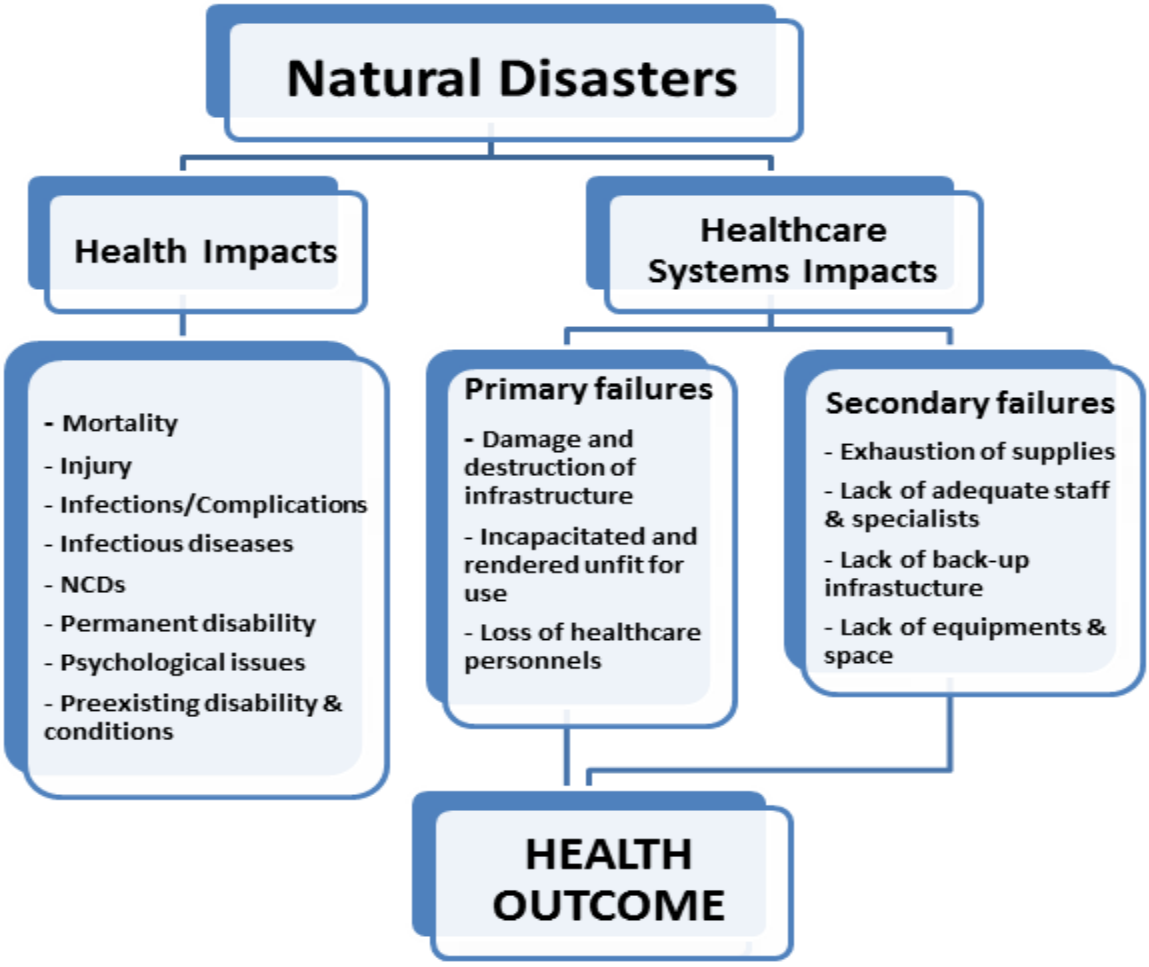
Date	Magnitude	Fatalities	Region/Country
30/10/2016	6.5	0	Norcia, Italy
26/10/2016	6.1	1	Marche province, Italy
24/08/2016	6.2	296	Rieti & Ascoli province, Italy
16/04/2016	7.8	661	Esmeraldas province, Ecuador
02/03/2016	7.8	0	Mentawai Islands, Indonesia
16/09/2015	8.3	14	West of Illapel, Chile
26/10/2015	7.5	399	Hindu-Kush, Pakistan/Afghanistan
12/05/2015	7.3	218	Kodari, Nepal
25/04/2015	7.8	8,964	Barpak, Lamjung district, Nepal
08/03/2014	6.2	729	near Wenping, China
24/09/2013	7.7	825	near Awaran, Pakistan
06/02/2012	6.7	113	Negros-Cebu region, Philippines
11/03/2011	9.0	20,896	near east coast of Honshu, Japan
12/01/2010	7.0	316,000	Haiti
06/04/2009	6.3	300	L'Aquila, Italy
30/09/2009	7.5	1,117	Southern Sumatra, Indonesia
12/05/2008	7.9	87,587	Eastern Sichuan, China
15/08/2007	8.0	514	near coast of Central Peru
26/05/2006	6.3	5,749	Java, Indonesia
08/10/2005	7.6	80,361	Kashmir region, Pakistan
28/03/2005	8.6	1,300	Norther Sumatra, Indonesia
26/12/2004	9.1	227,898	Northern Sumatra, Indonesia
26/12/2003	6.6	31,000	South-eastern Iran
25/03/2002	6.1	1,000	Hindu-Kush region, Afghanistan
26/01/2001	7.7	20,023	Gujrat, India
04/06/2000	7.9	103	Southern Sumatra, Indonesia

[Source EM-DAT 2017 (9)]

1.1.2 Consequences of Natural disasters

The impacts of natural disasters on population and health infrastructure, although they might differ in intensity and change depending on the nature and scale of disasters, the outcomes to a large extent could be similar (13). *Figure 3* summarizes the general health and health system impacts of natural disasters.

Figure 3. Impact of natural disasters on general health and health systems

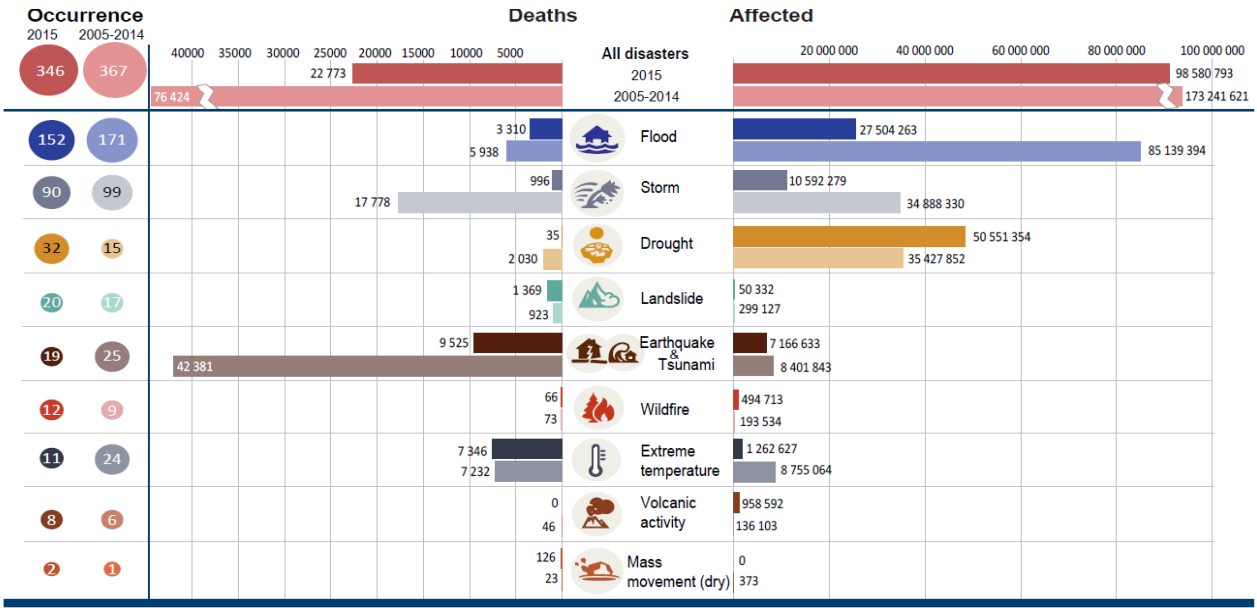


[Adapted from MICRODIS 2008 (13)]

1.1.2.i Human impact of natural disasters

Natural disasters result in significant loss of life and long-term disability from severe injuries including spinal cord injury (SCI), traumatic brain injury (TBI), limb amputation, fracture, peripheral nerve injury, crush injury, and psychological impairment (14-16). Between 1994 and 2013 natural disasters claimed an estimated 1.35 million lives, with almost 68,000 lives lost annually (3). During this 20-year period, almost 218 million people were affected on average per annum (3). The incidence of morbidity and mortality due to natural disasters varies based on the nature and amplitude of disasters, and various human and environmental factors. Geophysical disasters (earthquakes including tsunamis) are associated with the highest mortality amongst all other types of disaster put together, claiming an estimated 750,000 lives between 1994 and 2013 (3). *Figure 4* shows the human impact of disasters by type and comparing 2015 with decade ahead (2005-2014).

Figure 4. Human impact by disaster types (2015 vs. 2005-2014)



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1.1.2.ii Economic damages from natural disasters

Natural disaster-related economic losses have increased tenfold in the past four decades, and the estimated cost for these exceeds $100 billion annually (17). Over the period 1994-2013 the recorded total economic losses due to natural disasters were estimated to be US$ 2,600 billion, which may be underestimated by as much as 50% (3). In the last two decades, storms were the most expensive type of disaster in terms of recorded lost assets (US$ 936 billion), followed by earthquakes (US$ 787 billion) and floods (US$ 636 billion) (3). There is significant disparity of disaster impact amongst countries in terms of income level. This depends not only on the magnitude and intensity of a disaster, but also on national preparedness and the efficiency of responses to disasters (3).

Although low- and lower-middle-income countries experienced fewer disasters compared to high- and upper-middle-income countries (44% vs. 56%) between 1994 and 2013, they suffered a disproportionately high 68% of global mortality (3). On average, the mortality rate due to disasters in 1994-2013 was three times higher in low-income countries than in high-income countries (332 deaths vs. 105 deaths on average) (3). This was accompanied by a significant proportionate economic loss and long-term negative consequences on human development in these countries. For example, the total value of economic damage and losses caused by the 2010 Haiti earthquake was estimated at US$ 7.8 billion, surpassing the country's GDP in 2009, which delayed the country's economic development by 10 years (18). Further, there was significant immediate impact on the capacity of the health services, both in terms of infrastructure and health workers, with 30 out of 49 hospitals damaged or destroyed (18). *Figure 5* illustrates the annual reported economic losses and trends from disasters between 1980 to 2015 and *Figure 6* shows the number deaths due to disasters per country income group between 1994 to 2013.

Figure 5. Annual reported economic damages and time trend from disasters: 1980 - 2015

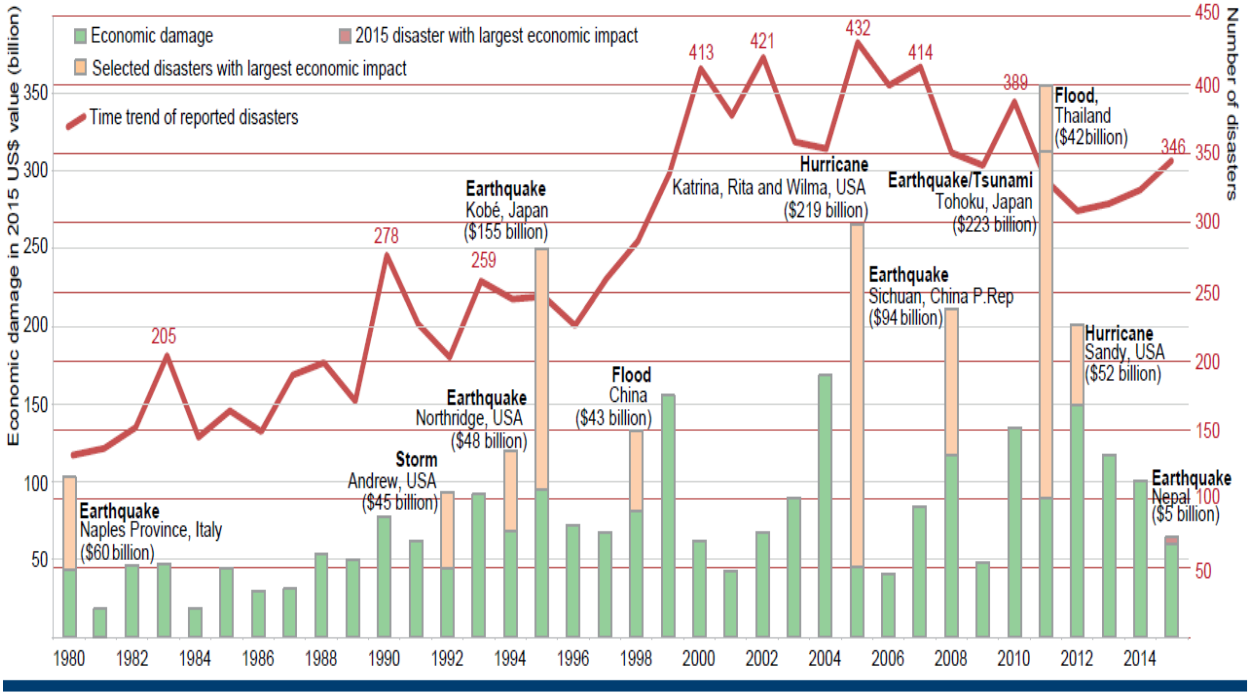

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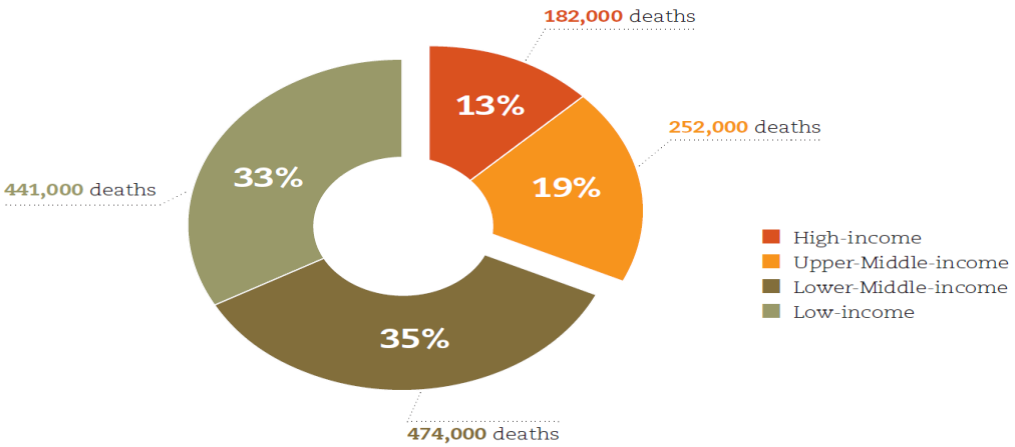
Figure 6. Number of deaths caused by natural disaster between 1994 - 2013 per country income group



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1.2 Medical rehabilitation during disasters

The WHO in the World Disability Report defines rehabilitation as '*a set of measures that assists 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' (19)*. The recently published WHO guideline - 'Rehabilitation in health systems' (20) elaborate this definition in broader terms, beyond the concept that rehabilitation is not only for persons with disabilities, but is for everyone with needs (21). The guideline defines rehabilitation as '*a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions (disease (acute or chronic), disorder, injury or trauma) in interaction with their environment' (20)*.

Primary goals of medical rehabilitation are to address impairments, improve activity and participation within contextual factors (personal and environmental) (22), which aligns with the International Classification of Function and Health (ICF) (23) conceptual framework for disability, whereby disability is understood as the result of the interaction of health conditions and environmental factors (19). Effective rehabilitation includes management of injury/trauma, optimization of functional capabilities (including cognitive, neuropsychological function), and social re-integration of patients in view of geographical and cultural contextual factors that impact their functional performance (19, 22, 24). It helps to minimize the health, social and economic impact of health conditions, and maximizes people's ability to live, work and learn to their best potential (20).

Saving lives immediately following a natural disaster has been and is an urgent priority. It is one of the target of the new 15-year global framework for disaster risk reduction - the 'Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR)' (25). Current data show that though the fatalities are low in most disasters, the number affected and/or injured by these disasters

is staggering (*Figure 4*) (3). In most disasters, there is a significant increase in the number of injuries sustained relative to mortality (26, 27). This includes a significant upsurge in victims with complex and long-term disabling injuries (such as spinal cord injury, brain injury, musculoskeletal and nerve injuries) (24, 28). There can be a significant increase in the number of people with exacerbation of chronic medical conditions and psychological impairment (24, 29). Further, those with pre-existing disabilities are at risk of higher mortality rates and additional co-morbidities, especially those with mobility impairments. These signify the important role of medical rehabilitation in disaster settings and indicate a need for inclusion of medical rehabilitation as integral component of comprehensive disaster management.

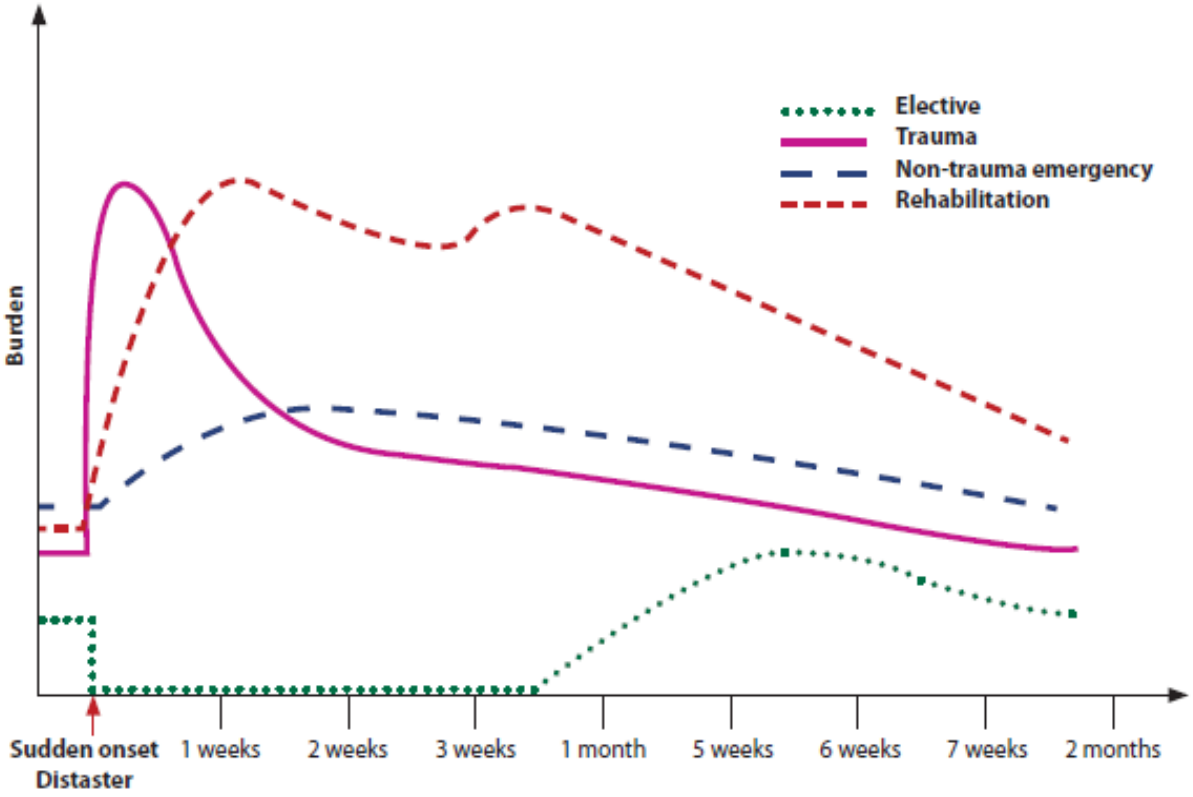
There is strong consensus amongst global health authorities, that medical rehabilitation should be initiated acutely during the emergency disaster response and should be continued in the community over a longer-term until treatment goals are achieved and survivors are successfully integrated into the society (24, 27, 30). The critical importance of rehabilitation during and after a natural disaster for the survivors is well-documented and evidence from the literature suggests that early involvement of rehabilitation programs can reduce disability with better clinical outcomes, and improve participation and quality of life of disaster victims (31-33). Evidence suggest that patients in centers with rehabilitation physician supervision had a reduced length of hospital stay, fewer complications and better clinical outcomes compared with patients without such provision (33, 34). The recently published, WHO Emergency Medical Team (EMT) initiative's guideline '*Classification and minimum standards for foreign medical teams in sudden onset disaster*' 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" (4, 29).

The rehabilitation need and demand can have different patterns in different emergencies, and may also differ over time (29). The rehabilitation need, however, is required at all stages of the response: in the initial acute stage when there is influx of trauma and non-trauma emergencies; in the post-acute period as complications arise and patients are prepared for discharge; and in the long-term in the community for those with complex, and permanent disabilities (24, 29, 35). *Figure 1* in **Study I** (Chapter 3) presents a rehabilitation continuum 'model'. This model suggested a plan of rehabilitation interventions after a natural disaster, which includes response-phase based on individual clinical needs for acute and core rehabilitation stages (including community-based rehabilitation); and comprises response, recovery, mitigation, and preparation phases (24, 27).

Demand for rehabilitation can increase over time, as triaging and discharge of patients (even those medically stable) can be problematic, due to destruction or damage of their home and livelihood. Further, demand for outpatient and community rehabilitation can spike post disaster, creating additional service needs (29). *Figure 7* indicates trends in the rehabilitation burden in sudden-onset disasters (35).

Regrettably, in previous responses to disasters, acute response plans and care protocols which focus on saving lives and treating acute injuries received most attention and rehabilitative needs were often neglected (24, 26). There was lack of sufficient rehabilitation capacity in response planning, with often devastating consequences for the affected individuals, families and communities (26, 29, 34). This is compounded by lack or inadequacy of disaster response plans and rehabilitation services in many developing countries where most disasters occur (28).

Figure 7. Trends in the rehabilitation burden in sudden-onset disasters



[Source: WHO 2016 (29, 35)]

In many disaster-prone countries, the majority of persons do not have access to appropriate services, nor do they have capacity to provide rehabilitation. They thus fail to meet existing needs, where fragmented healthcare systems are compromised by lack of financial and political support (20, 36, 37). The situation is further compounded in many disasters, mainly in a large-scale disaster, when local health infrastructure including rehabilitation resources can be destroyed or be quickly overwhelmed by influx of new victims. On many occasions, the need varies considerably depending on the magnitude and type of disaster, and there is requirement for international humanitarian assistance (3).

Rehabilitation remains an essential element of the humanitarian assistance, particularly as disability may follow a wave of traumatic injury or widespread disease (38). Rehabilitation is a holistic approach to patient care

delivered by an interdisciplinary team encompassing a range of professions, including: medical, physiotherapy, occupational therapy, orthotics and prosthetics, psychology, nutritionist and social work. Rehabilitation management in disaster includes (but is not limited to):

- medical care and general health maintenance
- post-surgical care including prevention and management of complications
- assessment of evolving and long-term injury patterns
- assess rehabilitation needs and resource requirements (including provision of assistive devices)
- patient education and self-care training (including carer and/or family)
- establishment and planning of patient triage, discharge, referral, and tracking systems
- collaboration with other rehabilitation and healthcare service providers, and coordination with emergency systems and host health system and government authorities
- education, training and capacity-building with local rehabilitation providers
- evaluation of the level of disaster victims' social and occupational participation and modification of barriers to successful and efficient community reintegration
- long-term care planning
- data collection, management and analysis

1.2.1 Role of rehabilitation physicians in disaster settings

The WHO World Report on Disability (19) indicates that "*rehabilitation services are essential services to be provided by foreign aid for humanitarian crises*" (p.108). The 'Sphere Project' - a voluntary initiative which sets common principles and universal minimum standards for the

delivery of quality humanitarian response, in its handbook '*Humanitarian Charter and Minimum Standards in Humanitarian Response'*, further reinforces the importance of rehabilitation and states that surgery provided during a humanitarian crisis without any immediate rehabilitation can result in a complete failure in restoring functional capacities of the patient (39).

The WHO's rehabilitation technical standards for EMTs the '*Classification and Minimum Standards for Foreign Medical Teams in Sudden Onset Disaster*' specifies rehabilitation as a minimum standard for all types of EMTs and postulates the requirement for inclusion of rehabilitation professionals in their staffing configuration from initial deployment in a ratio of one rehabilitation professional to 20 beds (4). Under the WHO-EMT initiative, the first guidelines for rehabilitation teams in disasters: '*Emergency medical teams: minimum technical standards and recommendations for rehabilitation*' was recently launched at the EMT Global Meeting 2016, in Hong Kong (more details are provided Chapter 8) (29). These guidelines set out the core standards for rehabilitation and provide guidance on building or strengthening the capacity of EMTs for rehabilitation within defined coordination mechanisms. The standards and recommendations for national and international EMTs are designed to ensure better patient care and a continuum of care beyond their departure from the affected area. It provides the minimum standards for all EMTs in regard to workforce, field hospital environment, rehabilitation equipment and consumables, and information management (29).

All rehabilitation personnel are required to use these minimum standards when responding to future disasters. These guidelines recognize that the role of rehabilitation is multidimensional and reflects evolving clinical requirements, transitioning from emergency surgical support in established facilities to less acute rehabilitative input for injuries and

complications in the community (14, 29). The role of a rehabilitation medicine physician in any disaster event is crucial and should be integrated into the interdisciplinary field medical and/or surgical teams (14, 15, 17, 18). Rehabilitation physicians perform critical roles following disasters, as they are not only trained in diagnosis and treatment of general health conditions, but are also expert in disability and 'functioning' (14). They also coordinate member roles, depending on the context of the disaster victims' clinical and rehabilitation needs and the post-disaster environment, and perform a role in integrating rehabilitation efforts with other health strategies and providers (26, 28). Their key role in disaster settings also is to work with (and train/educate) local healthcare providers, patients, families, and community volunteers in support of community-based rehabilitation programing efforts (such as prescription and use of assistive devices, mobility aids and adaptive technologies). The potential roles of a rehabilitation physician following disaster are provided in **Study I** in Chapter 3.

CHAPTER 2

Overview and Methods

This chapter presents an outline of the thesis, including key objectives, specific aims of included studies, and the thesis structure.

As aforementioned in Chapter 1, the important role of medical rehabilitation in disaster settings is well recognized and there is consensus amongst the disaster management authorities that medical rehabilitation is an integral component of disaster management. The role of rehabilitation personnel during disasters is evolving, and there is increasing recognition that these professionals should be involved in all aspects of disaster management. Favorable outcomes from involvement of rehabilitation personnel in major disasters are well documented. However, there is still poor recognition and inadequate early involvement of rehabilitation personnel in disaster response. The literature on effectiveness of rehabilitation interventions around the world in disaster settings is scarce.

2.1 Objectives

The overarching objective of this thesis is to systematically examine the role of medical rehabilitation and rehabilitation interventions currently used during natural disasters. It also aims to highlight the challenges faced by the high-risk countries and current developments in this area. This thesis uses a multi-pronged approach and includes six studies of diverse methodology.

The specific aim for each study was:

- **Study I** – To systematically assess the effectiveness, safety, and cost-efficiency of medical rehabilitation intervention in survivors of natural disasters, focusing on approaches that are effective (type of rehabilitation intervention) and outcomes that are affected (functional activity, participation). This study explored gaps in evidence for medical rehabilitation in disaster settings.

- **Study II** – To provide an overview and status of medical rehabilitation in natural disasters in the Asia-Pacific region. It highlights the role of medical rehabilitation in disaster response and management, potential challenges faced by the countries in the region and key initial perspectives which need consideration for future disaster planning.
- **Study III** – To present a regional overview of medical rehabilitation status in the Pacific Island Countries, and strengths and challenges for medical rehabilitation in natural disaster settings in this most natural disaster-prone region in the world.
- **Study IV** - To describe the use of a rehabilitation triage tool developed by the Australian Foreign Medical Rehabilitation team for patients following the Nepal earthquake, and to highlight personal experiences and lessons learn to improve outcomes for spinal cord injuries in future disaster settings.
- **Study V** – To elaborate the role of rehabilitation in natural disasters and current developments and challenges from an Australian perspective.
- **Study VI** – To provide an overview of current developments in rehabilitation in disasters. It highlights the challenges and key steps in implementation of recently published WHO minimum standards for rehabilitation in emergencies guidelines.

2.2 Methods

All studies are published in academic journals. **Study VI** which is recently published online (*Appendix 2*).

- **Study I** – A comprehensive literature search was conducted using medical and health science electronic databases (PubMed, MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature, Cochrane Library, PsycINFO) up to September 2014 for studies

evaluating rehabilitation interventions in disaster settings. Two independent reviewers selected studies reporting outcomes for natural disaster survivors after medical rehabilitation that addressed functional restoration and participation. Two reviewers independently extracted data and assessed the methodologic quality of the studies using the Critical Appraisal Skills Program's appraisal tools. A meta-analysis was not possible because of heterogeneity among included trials; therefore, a narrative analysis was performed for best evidence synthesis.

- **Study II** – A literature search of the academic and grey literature was conducted to identify the manuscripts that provided status of medical rehabilitation in natural disasters in the Asia-Pacific region. A narrative analysis of the findings was presented under different sub-headings.
- **Study III** – A literature search of the academic and grey literature was conducted to identify the manuscripts that provided rehabilitation status in the Pacific Island Countries, one of the most natural disaster-prone regions in the world. Narrative syntheses of findings were presented including strengths and challenges for medical rehabilitation in natural disaster settings in these countries.
- **Study IV** – A prospective case series of spinal cord injury survivors during 2015 Nepal earthquakes conducted by the seven-member Australian Rehabilitation EMT from the Royal Melbourne Hospital (RMH) during their deployment to a 40-bed Nepalese sub-acute medical facility. Over an 8-day period, data were collected during daily ward rounds with Nepalese rehabilitation staff. The EMT assumed a facilitator role in conducting daily triage and teaching clinical rounds and consensus case conference meetings with local staff. A field tool was designed and approved by local staff to triage, plan patient clinical management and further care.

- **Study V** – A rapid desk-top literature search of the academic and grey literature was conducted to identify the manuscripts that described the role of rehabilitation in natural disasters and current developments and challenges from the Australian perspective.
- **Study VI** – A literature review was conducted to provide an overview on current developments in rehabilitation sector in disasters. The challenges and key steps forward in implementation of recently published WHO minimum standards for rehabilitation in emergencies guidelines were scrutinized and presented as future recommendations.

CHAPTER 3

A Systematic Review of Medical Rehabilitation in Natural Disasters

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Study I

Khan F, Amatya B, Gosney J, Rathore FA, Burkle Jr, FM. Medical rehabilitation in natural disasters: a systematic review. *Archives of Physical Medicine and Rehabilitation* 2015; 96(9):1709-1727.

Co-Authors' Statements are provided in Appendix 9.

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REVIEW ARTICLE

Medical Rehabilitation in Natural Disasters: A Review

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Abstract

Objective: To present an evidence-based overview of the effectiveness of medical rehabilitation intervention in natural disaster survivors and outcomes that are affected.

Data Sources: A literature search was conducted using medical and health science electronic databases (PubMed, MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature, Cochrane Library, PsycINFO) up to September 2014.

Study Selection: Two independent reviewers selected studies reporting outcomes for natural disaster survivors after medical rehabilitation that addressed functional restoration and participation.

Data Extraction: Two reviewers independently extracted data and assessed the methodologic quality of the studies using the Critical Appraisal Skills Program's appraisal tools.

Data Synthesis: A meta-analysis was not possible because of heterogeneity among included trials; therefore, a narrative analysis was performed for best evidence synthesis. Ten studies (2 randomized controlled trials, 8 observational studies) investigated a variety of medical rehabilitation interventions for natural disaster survivors to evaluate best evidence to date. The interventions ranged from comprehensive multidisciplinary rehabilitation to community educational programs. Studies scored low on quality assessment because of methodologic limitations. The findings suggest some evidence for the effectiveness of inpatient rehabilitation in reducing disability and improving participation and quality of life and for community-based rehabilitation for participation. There were no data available for associated costs.

Conclusions: The findings highlight the need to incorporate medical rehabilitation into response planning and disaster management for future natural catastrophes. Access to rehabilitation and investment in sustainable infrastructure and education are crucial. More methodologically robust studies are needed to build evidence for rehabilitation programs, cost-effectiveness, and outcome measurement in such settings.

Archives of Physical Medicine and Rehabilitation 2015;96:1709-27

Disaster is defined by the World Health Organization (WHO) as "a serious disruption of functioning of a community or a society causing widespread human, material, economic or environmental losses which exceeds the ability of the affected community or society to cope using its own resources."[1(p6)] In general, disaster can be classified into the following: natural, technologic (eg, nuclear accidents), and complex humanitarian emergencies (eg, wars). A natural disaster is defined as "a situation or event caused by nature, which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering."[2(p5)] Natural disasters can be classified by etiology (table 1).

Natural disasters may result in significant loss of life and long-term disability from severe injuries, including spinal cord injury

An audio podcast accompanies this article. Listen at www.archives-pmr.org.

Supported by internal resources of the Rehabilitation Department, Royal Melbourne Hospital, Royal Park Campus, Melbourne, Australia.

Disclosures: none.

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http://dx.doi.org/10.1016/j.apmr.2015.02.007

Table 1 Classification of natural disasters

Subgroup	Definition	Main Type
Geophysical	Events originating from solid earth	Earthquake, volcano, mass movement (dry)
Meteorologic	Events caused by short-lived/small- to mesoscale atmospheric processes (spectrum from minutes to days)	Storm
Hydrologic	Events caused by deviations in the normative water cycle and/or overflow of bodies of water caused by wind setup	Flood, mass movement (wet)
Climatologic	Events caused by long-lived/meso- to macroscale processes (in the spectrum from intraseasonal to multidecadal climate variability)	Extreme temperature, drought, wildfire
Biologic	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, insect infestation, animal stampede

NOTE. Adapted from the Centre for Research on the Epidemiology of Disasters.[2]

(SCI), traumatic brain injury, limb amputation, fracture, peripheral nerve injury, crush injury, and psychological impairment.[3,4] It is estimated that >100,000 lives are lost annually as a result of natural disasters.[5] The incidence of morbidity and mortality because of natural disasters varies based on nature and the amplitude of disasters and various human and environmental factors.[6] Natural disasters create a large socioeconomic burden with significant impact on health care costs, social infrastructure, and the environment.[3,4] The number of severe natural disasters has escalated in recent years, threatening WHO sustainable development and poverty reduction initiatives.[7] Natural disaster−related economic losses have increased 10-fold in the last 4 decades, with estimated costs of >$100 billion annually.[8] Moreover, most natural disasters and disaster-related deaths occur in low-resourced regions (estimated 97%) with significant proportionate economic loss and long-term negative consequences on human development.[4,5]

Saving lives immediately after a natural disaster is an urgent priority. Current data show a significant increase in the numbers of injuries sustained relative to mortality,[6] indicating that medical and nonmedical rehabilitation (ie, restoration of rehabilitation services, infrastructure) are integral to comprehensive disaster management.[9,10] Medical rehabilitation is "a set of measures that assists 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."[11(p96)] Primary goals of medical rehabilitation are to improve activity and participation within contextual factors (personal, environmental).[12] This includes management of acute injury, optimization of functional capabilities (including cognitive and neuropsychological function), and social reintegration.[3,4] Further, those with preexisting disabilities are at higher risk of mortality and additional comorbidities during natural disasters.[6] With an increasing frequency of natural disasters, there is greater focus on the role of rehabilitation in disaster management. The disaster rehabilitation continuum model (fig 1) includes a response phase based on individual clinical needs for acute and core rehabilitation stages (including community-based rehabilitation [CBR]) and comprises response, recovery, mitigation, and preparation phases.[3] The aim is to enhance community health through an organized system of injury, acute care, and longer-term rehabilitation, fully integrated into the public health system of a local community.[3,6,9]

The role of a rehabilitation medicine physician in any disaster event should be integrated into the multidisciplinary field medical team,[6] which should include nursing and allied health disciplines (box 1).[6,12] The critical role of this team after a disaster is directed toward conservation of body function, activity, and participation domains defined by the WHO's *International Classification of Functioning, Disability and Health* (ICF) framework.[6,13] Rehabilitation technical standards (including foreign medical teams), core standards, and guiding principles should be followed for appropriate care.[14] This process is multidimensional and reflects evolving clinical requirements, transitioning from emergency surgical support in established facilities to less acute rehabilitative input for injuries and complications in the community.[4] There is evidence that patients treated in services with rehabilitation facilities after natural disasters have reduced length of hospital stay, fewer complications, and better clinical outcomes compared with patients in centers with no rehabilitation physician supervision.[6]

Disaster health research encompasses the traditional disaster cycle comprising preparedness, response, recovery, and mitigation phases.[15] Most disaster literature addresses recovery, including rehabilitation service infrastructure.[9] Empirical evidence on medical rehabilitation after natural disasters is increasing, and various studies evaluate effectiveness of rehabilitation in survivors; however, most reports are narratives.[3,6,16] Nevertheless, there is a lack of studies systematically analyzing various rehabilitation interventions in a natural disaster settings. The benefit and harms associated with these interventions need to be established comprehensively to guide disaster management teams and policymakers. This review, therefore, systematically assessed the effectiveness, safety, and cost-efficiency of medical rehabilitation intervention in survivors of natural disasters, focusing on approaches that are effective (type of rehabilitation intervention) and outcomes that are affected (functional activity, participation). This study also explored gaps in evidence for medical rehabilitation in this area.

List of abbreviations:

ADL activities of daily living
CASP Critical Appraisal Skills Program
CBR community-based rehabilitation
CI confidence interval
ICF *International Classification of Functioning, Disability and Health*
MBI Modified Barthel Index
NGO nongovernmental organization
PTSD posttraumatic stress disorder
QOL quality of life
SCI spinal cord injury
WHO World Health Organization

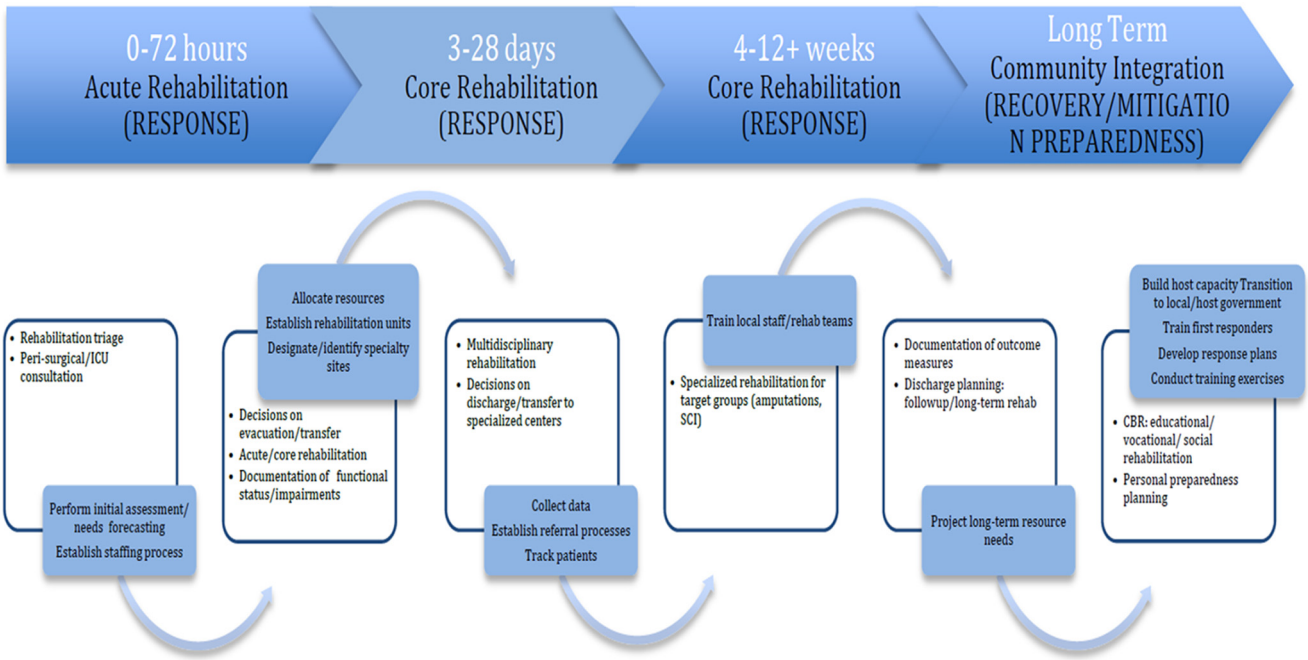

Fig 1 Disaster rehabilitation continuum by time postdisaster and stage (phase). Unshaded regions indicate key clinical activities; shaded regions, nonclinical activities. Abbreviation: ICU, intensive care unit. Adapted from Elsevier.[3]

Methods

A comprehensive, integrated approach was used to review the literature (peer review, gray literature) for medical rehabilitation interventions in natural disasters. A search of the peer-review literature was conducted using medical and health science electronic databases (MEDLINE, PubMed, Embase, Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Cochrane Library) from 2000 to September 2014. The terms natural disaster, disaster management, and rehabilitation interventions, with related phrases, were used. Medical Subject Headings search terms was used for all databases, and a keyword search was used if Medical Subject Headings terms were not available (see appendix 1 for full search details). Publication bias was minimized by sourcing unpublished data where possible.[17] Bibliographies of identified articles were searched, and a manual search was done of relevant journals for additional references. A search of the gray literature was conducted using relevant Internet search engines and websites, including the Center for International Rehabilitation Information and Exchange Database of International Rehabilitation Research, System for Information on Grey Literature in Europe, New York Academy of Medicine Grey Literature Database, WHO Libraries, National Quality Measures Clearinghouse, and Google Scholar. Various health care institutions and governmental and nongovernmental organizations (NGOs) associated with disaster management were also consulted for relevant studies. Authors and known experts in the field were also contacted.

Inclusion and exclusion criteria

All studies that reported medical rehabilitation interventions and associated data in which victims of natural disasters participated were eligible for inclusion, irrespective of study design. Qualifying data included health outcomes (ie, functional restoration, improved symptoms/impairments, participation), health care processes, safety, and economic outcomes (associated costs and resource utilization). Studies involving other disaster

Box 1 Potential roles of a rehabilitation medicine physician after disaster[4,6]

- Coordinate member roles depending on context of the victims' rehabilitation needs and postdisaster environment.
- Participate in victim triage, perioperative, and postoperative consultation.
- Participate in mobile community services, (eg, postoperative follow-up, triage, treating persons with disabling injuries not presenting to hospital facilities).
- Coordination and work with local health care providers, patients, families, and community volunteers in support of community-based rehabilitation programing efforts (eg, prescription and use of assistive devices, mobility aids, adaptive technologies).
- Training team members and local providers in various settings across the care continuum.
- Develop host rehabilitation service provision capacity by supporting establishment of structured training programs.
- Coordinate with host rehabilitation service providers, disaster managers, and health officials to develop additional rehabilitation infrastructure programs for long-term care of disaster victims.
- Planning for rehabilitation infrastructure and response for future disasters.

types in which data for natural disasters were reported were also included.

Studies were excluded if they did not report on medical rehabilitation interventions and evaluated outcomes related to disaster response only or reported medical rehabilitation physical infrastructure or technical developments. Studies reporting epidemiology of injury and disability or the impact of natural disasters on health systems were excluded because these have been reported elsewhere.[6] Non-English language studies, theses, systematic/narrative reviews, editorials, case reports, conference proceedings, and studies conducted before year 2000 were excluded.

Study selection and data extraction

Two reviewers (B.A., F.K.) independently screened all identified study titles and abstracts for inclusion based on the selection criteria. Any disagreements were resolved by consensus discussion. A standard proforma created a priori was used to extract data from studies that met the eligibility criteria, which included study characteristics (publication date and country, study type, sample characteristics, outcome measures) and intervention characteristics (type, intensity, domains, settings, delivery mode and duration). Additional description of rehabilitation interventions was obtained from the study corresponding author where necessary.

Two authors (F.K., B.A.) independently assessed the methodologic quality and grade of evidence of included studies with the Critical Appraisal Skills Program (CASP) tool.[18] The CASP tool uses a systematic approach to appraise different study designs from the following domains: study validity, methodologic quality, presentation of results, and external validity.[18] One item from all CASP checklists (Can the results be applied to the local population?) and another form, cohort/case control studies checklist (Do the results of this study fit with other available evidence?), were not included because the focus of this review was not tied to a specific local population and the purpose was to compare results across studies.[19] The articles were graded independently, and any disagreements were resolved through consensus. Each of the items from the checklists were judged with yes (low risk of bias, score 1), no (high risk of bias), or cannot tell (unclear or unknown risk of bias, score 0). Total scores were used to grade the methodologic quality of each study assessed (maximum score of 10 for cohort studies and randomized controlled trials, maximum score of 9 for case-control studies).[18,19] All outcomes were categorized according to the WHO's ICF framework,[13] and reporting guidelines for systematic reviews were followed.

Results

The combined searches retrieved 2766 published titles and abstracts, of which 2751 were screened after removal of duplicates. Thirty-four abstracts met preliminary inclusion criteria, and full texts of these articles were assessed; 19 of these were excluded because of inappropriate study design (systematic reviews, narrative reviews, commentaries) or because they were not related to natural disasters. Four additional relevant articles were identified from bibliographies. Ten studies (2 randomized controlled trials, 8 observational studies), which reported medical rehabilitation interventions after natural disasters, met the inclusion criteria for this review. The study selection process is summarized in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (fig 2).

Study characteristics

The characteristics of the 10 included studies are summarized in table 2. Most studies (n=8) were conducted in China and evaluated different cohorts of survivors from the 2008 Sichuan earthquake. Further, 2 studies evaluated survivors of the 2004 tsunami in India and Sri Lanka. Overall, these studies included 2013 participants (range, 22−510; median, 166). Participants' ages ranged from 9 to 76 years, and most were women (1 study included only survivors who were women[20]). Three studies evaluated rehabilitation interventions in cohorts of limb fracture victims,[21-23] 2 included SCI survivors,[24,25] 1 evaluated newly diagnosed posttraumatic stress disorder (PTSD) victims,[26] and 1 included school children.[27]

Rehabilitation interventions and outcome measures description

Table 3 summarizes the rehabilitation interventions in included studies. Institution-based rehabilitation programs were evaluated in 6 studies,[21-26] 3 studies evaluated CBR,[20,27] and 1 study evaluated both institution-based rehabilitation and CBR.[28] The intervention types varied and ranged from comprehensive multidisciplinary rehabilitation programs to structured mental health community programs. Two studies conducted a comparative analysis of early and late rehabilitation interventions with control groups with usual care only.[22,28] Most rehabilitation programs used physical and/or psychological components. Duration and intensity of the interventions varied and ranged from 2 to 12 weeks (4 studies[22-24,28] did not report rehabilitation duration). Follow-up period and outcome measures used also varied between trials. Details of assessment time points and outcome measures in each trial categorized based on ICF framework are tabulated in table 4.

Study quality assessment

Table 5 provides a quality assessment of the included studies using the CASP tool.[18] The methodologic quality of included studies varied, and CASP grade scores ranged from 2 to 8 out of 10. The overall quality of most included studies was low or moderate, with only 1 study[26] categorized as good quality (score, 8/10). There was consensus agreement amongst reviewers regarding methodology used in the studies. All trials had substantial flaws in methodologic design with a high risk of bias related to group allocation procedures, heterogeneous patient characteristics, reporting of interventions, and outcome analysis. Two randomized controlled trials[26,27] did not indicate allocation or blinding procedures sufficiently and were underpowered. The remaining studies were observational studies. Most studies did not provide duration or intensity of therapy. Four studies[24-26,29] had small convenience samples, and 3 studies[24,25,29] lacked a control group. Outcome measurement tools varied among studies, and some tools used were not validated (eg, General and Medical Questionnaire, Assessment of Physical Dysfunction). Three studies[20,27,29] did not provide any ethical statement related to trial process, whereas 3 studies discussed their findings imprecisely.[20,22,29]

Effectiveness of rehabilitation interventions

Data from included studies could not be pooled because of heterogeneity among the trials in terms of study design, type of interventions, outcome measures used, and study population.

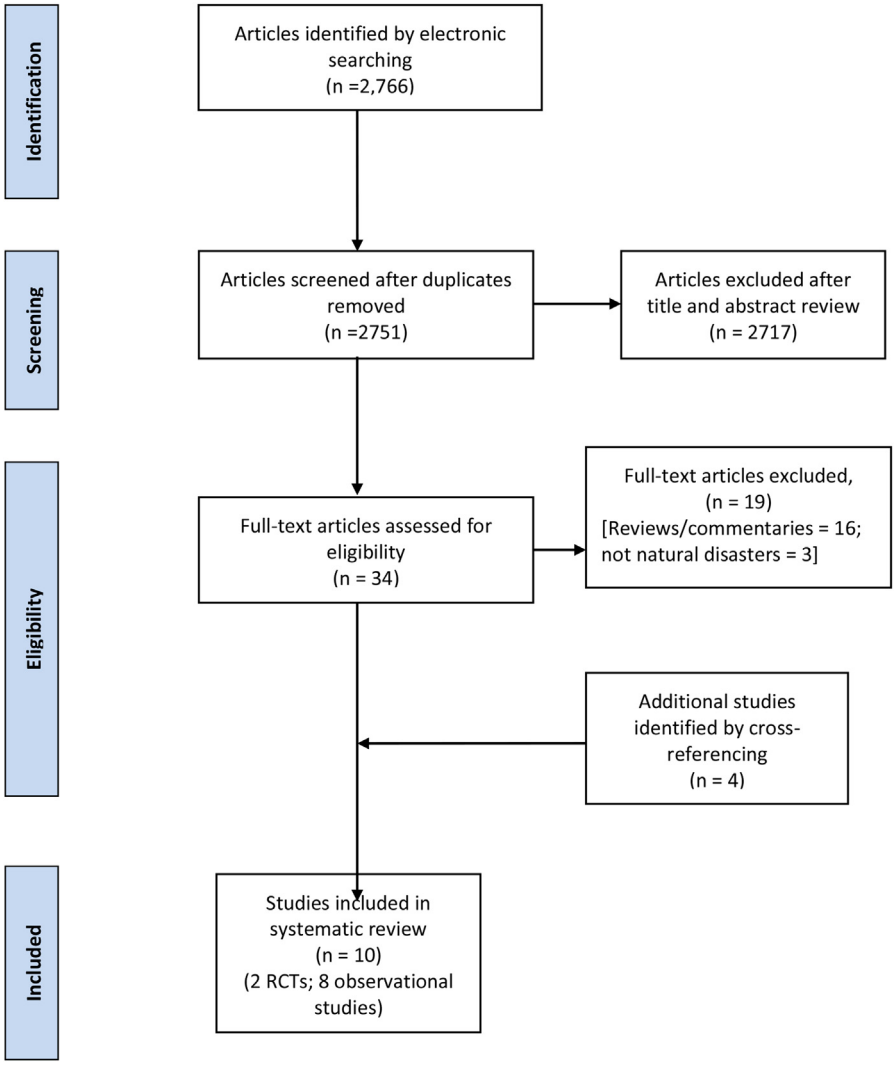

Fig 2 Flow diagram showing selection of articles reviewed. Abbreviation: RCT, randomized controlled trial.

Therefore, a narrative analysis was used for evidence synthesis rather than attempting a meta-analysis (see table 2). A summary of the findings of the included trials is subsequently summarized based on outcomes categorized according to the WHO's ICF framework (see table 4).[13]

Improvement in functional activity

Six studies[22-25,27,28] assessed and reported changes at the level of activity (n=1593). These studies evaluated participants at different time points after the rehabilitation intervention, using different outcome measures (see table 4). Four studies used the Barthel Index to measure functional activity in survivors of the Sichuan earthquake[22,24,25,28] and showed significant improvement in functional activity in those who received medical rehabilitation. Li et al[25] evaluated functional outcomes in SCI earthquake victims and found that 35% of study participants achieved moderate independence in activities of daily living (ADL) and 90% regained some self-care ability prior to discharge. The rehabilitation intervention was found to be the strongest predictor of increased functional gain (using Modified Barthel Index [MBI] scores) by 34 points (95% confidence interval [CI], 28–41).[25] Another study in a similar SCI cohort found substantial functional gain sustained up to 1-year follow-up.[24] The authors reported that compared with discharge data from primary rehabilitation, the MBI and Walking Index for Spinal Cord Injury II scores increased significantly ($P<.05$), indicating improvement in ADL and walking ability.[24]

One study[22] evaluating functional outcomes, health-related quality of life (QOL), and life satisfaction in fracture victims 27 months after the Sichuan earthquake found that ADL and life satisfaction in the intervention groups (both early and late medical rehabilitation) significantly improved compared with the control group ($P<.05$ for both the MBI and Life Satisfaction Questionnaire). Another study[28] demonstrated that a long-term structured rehabilitation services program (comprising NGOs, local health departments, and professional rehabilitation volunteers) in survivors of the Sichuan earthquake significantly improved physical functioning (Barthel Index scores) in both early (baseline: 73.8; 95% CI, 72.5–75.2; follow-up: 90.5; 95% CI, 88.9–92.0; $P<.05$) and late (baseline: 82.2; 95% CI, 76.5–87.8; follow-up: 96.9; 95% CI, 92.4–101.4; $P<.05$) rehabilitation groups at 1-year follow-up, but not in the control group (baseline: 86.8; 95% CI, 83.6–90.1; follow-up: 92.8; 95% CI, 89.7–96.0, $P>.05$). Ni et al[23] in another

Table 2 Summary of included studies (according to hierarchy of study design)

Study Author, Year, Country	Objectives	Study Type	Participants and Demographic Characteristics	Results/Outcomes	Author's Conclusions
Zang et al,[26] 2013, China	Evaluate efficacy of NET as a short-term treatment for PTSD in Chinese earthquake survivors (2008 Sichuan)	Randomized waitlist control trial	N=22 11 participants each in the intervention and waitlist control groups Mean age, 55.7±11.7y; range, 37−75y; 77% women; 86% married; 77 had primary or less education; 81% had no fixed income; 36% were injured in the earthquake; 55% experienced >2 times traumatic events	Compared with waitlist control group at posttreatment, the NET group showed significant reductions in PTSD symptoms: IES-R avoidance, intrusion, and hyperarousal subscales ($P<.001$ for all); anxiety and depression: HADS subscales ($P<.001$); general mental stress: GHQ-28 ($P<.0001$); and increased posttraumatic growth: CiOQ ($P<.001$). These changes remained stable for up to a 2-month follow-up. Measures of social support (MSPSS) and coping (SCSQ) did not sustain improvements.	NET is effective in treating postearthquake traumatic symptoms in Chinese earthquake survivors. There was significant positive effect of NET for anxiety, depression, and general mental health. The findings inform future management of PTSD after natural disasters.
Berger and Gelkopf,[27] 2009, Sri Lanka	Evaluate efficacy of a school-based intervention in reducing stress-related symptoms in Sri Lankan children exposed to tsunami	Quasi-randomized controlled trial with waitlist controls	N=166 (elementary school students) Intervention group: n=84; Control group: n=82 Age: 6−18y, 58% women	Tsunami exposure 82.1% of the intervention group and 85.4% of the control group were physically hurt during the tsunami. 66.7% of the intervention group and 53.7% of the control group knew someone close who had died in the tsunami. Other outcomes Significant improvement in the intervention group compared with the control group (interaction time × group): PTSD severity ($F=53.52$, $P<.001$), functional problems ($F=40.73$, $P<.001$), somatic complaints ($F=44.8$, $P<.001$), depression ($F=23.55$, $P<.001$), and hope ($F=54.46$, $P\leq.001$) scores. Covariance analysis with baseline measures (as covariance) on each outcome measure showed a distinct time × group × baseline interaction: PTSD severity ($F=65.24$, $P<.001$), depression ($F=58.08$, $P<.001$), somatic symptoms ($F=51.62$; $P<.001$), functional problems ($F=132.00$, $P<.001$), and hope ($F=35.67$, $P<.001$). 82% of probable PTSD cases in the intervention group improved compared with 23% in the control group ($P=.0011$).	A universal school-based intervention may be helpful in mitigating posttsunami trauma-related symptoms in children. Those with more severe symptoms benefited most.

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Table 2 (*continued*)

Study Author, Year, Country	Objectives	Study Type	Participants and Demographic Characteristics	Results/Outcomes	Author's Conclusions
				Pearson correlation within the intervention group showed higher scores at baseline were related with the differential scores (postassessment −baseline assessment) on the PTSD severity scale (r=.70), depression scale (r=.72), somatic scale (r=.71), functional problem scale (r=.67), and hope scale (r=.56).	
Becker,[20] 2009, India	Effectiveness of a psychosocial program, a community-based mental health initiative for survivors of 2004 tsunami in India	Prospective cohort study	N=200 Intervention group: n=100 (women from an affected village) Control group: n=100 (volunteer women from nearby affected village) Aged 26−45y; 90% married; most had <5y of education	Both the intervention and control groups had experienced some form of loss. At baseline, 32% reported symptoms of severe mental distress, and 22% reported moderate symptoms in the intervention group compared with 34% and 24% respectively, in the control group (SRQ). Significant decrease in total IES scores (P<.001) and subscale IES scores of avoidance (P<.001), intrusion (P<.001), and hypervigilance (P<.001), indicating an improvement in symptoms for the psychosocial intervention group.	Psychosocial intervention is an effective strategy for reducing emotional distress for women tsunami survivors and should be included in disaster response in resource-poor countries.
Zhang et al,[28] 2013, China	Evaluate effectiveness of rehabilitation services program comprised of NGOs, local health departments, and professional rehabilitation volunteers in survivors of 2008 Sichuan earthquake	Longitudinal quasi-experimental study	N=510 (divided into 2 intervention groups: NHV-E: n=298; NHV-L: n=101 and control group: n=111) Mean age, 53.7±16.2y; 65% women; 82.8% had fractures; 5.1% had SCI; mean rehabilitation duration in NHV-E group, 52.6±19.1d and in NHV-L group, 51.5±19d	Physical functioning significantly increased in the NHV-E and NHV-L groups at follow-up but not in the control group after adjustment for sex, age, type of injury, and time to measurement. NHV-E improved BI scores by about 11.3 points at follow-up (95% CI, 9.0−13.7); NHV-L improved by 10.7 points (95% CI, 7.9−13.6). Significant effects were found of both the rehabilitation program (11.14; 95% CI, 9.0−13.3) and spontaneous recovery (5.03; 95% CI, 1.73 −8.34). The effect of NHV-E (11.3; 95% CI, 9.0 −13.7) was marginally greater than that of NHV-L (10.7; 95% CI, 7.9−13.6).	The rehabilitation service program improved physical functioning of earthquake survivors. The rehabilitation program benefited rehabilitation disaster relief planning. Both institution- and community-based programs should be considered for future rehabilitation disaster relief efforts.

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Table 2 (*continued*)

Study Author, Year, Country	Objectives	Study Type	Participants and Demographic Characteristics	Results/Outcomes	Author's Conclusions
				Significant differences in baseline and follow-up BI scores in NHV-E (baseline: 73.8, 95% CI, 72.5—75.2; follow-up: 90.5, 95% CI, 88.9—92.0) and NHV-L (baseline: 82.2, 95% CI, 76.5—87.8; follow-up: 96.9, 95% CI, 92.4—101.4), whereas the difference is no longer significant in the control group (baseline: 86.8, 95% CI, 83.6—90.1; follow-up: 92.8, 95% CI, 89.7—96.0). Effectiveness of specific program components could not be determined.	
Hu et al,[24] 2012, China	Compare functional status, QOL, and community integration of earthquake survivors (2008 Sichuan earthquake) with SCI at 12mo postdischarge from institution-based rehabilitation into the community	Prospective cohort study	N=26 Mean age, 52.6±15.8y; range, 20—79y; 57% women; 69% married; 53% had formal education; 46.2% were illiterate; 15% were in paid employment; mean value of annual family income for all survivors, $849±$503	At 1-y follow-up in the community Medical complications All patients reported spasmodic pain; 46% reported a new pressure sore, 53.8% reported neurogenic bladder, and 57.7% reported had urinary tract infection. Functional status Compared with data at discharge from primary rehabilitation, the MBI and WISCI II scores increased significantly ($P<.05$), improved ADL, and improved walking on returning to the community. Pain and depressive symptoms decreased insignificantly ($P=.836$); however, 26.9% required antidepressant treatment and 53.8% required psychological counseling. QOL Improved significantly in the community, total score ($P=.011$), self-ratings of QOL ($P<.001$), general health ($P<.001$), and satisfaction with social relations ($P=.017$). Physical health and psychological health domains improved, whereas satisfaction with the environmental decreased (not statistically significant.)	Functional status, QOL, general health, satisfaction with social relations and some areas of community integration (physical independence, mobility) improved significantly after a year after rehabilitation of SCI earthquake survivors. Rehabilitation should address emotional and cognitive function and re-employment in SCI.

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Table 2 (*continued*)

Study Author, Year, Country	Objectives	Study Type	Participants and Demographic Characteristics	Results/Outcomes	Author's Conclusions
				Social participation/community integration Physical independence and mobility improved ($P<.05$), and CHART-SF was higher than at discharge (not significant). No statistically meaningful differences were identified in occupation and actual social integration.	
Li et al,[25] 2012, China	Evaluate functional outcomes of rehabilitation intervention in survivors of the 2008 Sichuan earthquake and assess determinants of rehabilitation effectiveness, medical complications, and outcomes	Prospective cohort study	N=51 Mean age, 38.5±9.6y; range, 11–77y; 58% women; 43.1% had complete SCI at the beginning of rehabilitation. Most patients had lesions at the thoracolumbar level (43%), 29% had thoracic lesions, and 9% had cervical lesions.	Most victims rescued from the debris within 30min of the earthquake (70.6%), and all surviving victims rescued within 9h. 86.3% patients received surgical spinal stabilization; only 7 of these underwent surgery within 5 days after the earthquake. 94.1% of patients began rehabilitation therapy within 4mo. 90% resumed walking using orthoses; 90.2% used a wheelchair. Patient unadjusted/raw MBI scores improved significantly (mean difference, 29±16.9 points) during the rehabilitation program. At the end of therapy, 35% patients achieved moderate ADL independence, and 90.2% regained some self-care ability. Rehabilitation program was the strongest predictor of significantly increased MBI scores (increase of 34 points; 95% CI, 28–41). Complications included: bowel and bladder dysfunction (60.8% and 58.8%, respectively); 63% (pressure ulcers) to 85% (deep vein thrombosis). Earlier rescue and rehabilitation were significant positive predictors of rehabilitation effectiveness.	Earthquake victims with SCI may achieve significantly improved functional rehabilitation outcomes with organized programs.

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Table 2 (*continued*)

Study Author, Year, Country	Objectives	Study Type	Participants and Demographic Characteristics	Results/Outcomes	Author's Conclusions
Zhang et al,[22] 2012, China	Evaluate functional outcomes, QOL, and life satisfaction in fracture victims 27mo after the 2008 Sichuan earthquake	Cross-sectional quasi-experimental study	N = 390 (survivors with fractures divided into 2 intervention groups; early intervention group: n = 226; late intervention group: n = 80; and a control group n = 84) Mean age, 53.6±17.1y; most were women; 35% had primary education or were illiterate; 83% were married; 10% had an average level of annual family income; 31% had remunerative employment	ADL and life satisfaction in the intervention groups significantly improved compared with the control group ($P<.05$ for all). HRQOL was higher in early intervention subjects compared with controls ($P=.008$). Group differences in pain level were not significant. Early and late intervention groups found no differences in any measures. Good performance of ADL ($P<.001$) and widowed marital status ($P=.032$) predicted high HRQOL, whereas pain was associated with worse outcomes ($P<.001$). Rehabilitation therapy, remunerative employment, and being a woman were predictors of improved life satisfaction. Participants who received rehabilitation, or were in paid employment or female subjects showed higher life satisfaction.	The findings demonstrate effectiveness of rehabilitation (early and late) on functional outcomes, HRQOL, and life satisfaction in earthquake fracture victims.
Ni et al,[23] 2013, China	Evaluate effectiveness of rehabilitation on physical dysfunction and PTSD in fracture victims at 50mo after the Sichuan earthquake of 2008 and identify PTSD risk factors	Retrospective cohort study	N = 450 Intervention group: n = 245 control group: n = 214 Mean age, 54±17.8y; >63% women; >77% married; most had no or only elementary education; most had above-average household income, but were not providing the main household income	Physical dysfunction Data showed statistically significant differences in favor of the rehabilitation group in physical dysfunction (rehabilitation group: 32.24%, control: 67.76%; $\chi^2=57.65$, $P<.001$); and $P<.01$, respectively. PTSD Unadjusted data showed statistically significant differences in favor of the rehabilitation group (rehabilitation group: mean ± SE, 32.15±0.7; control group: mean ± SE, 34.04±0.7; $t=1.9$; $P<.05$) and for the adjusted group differences ($P<.05$). Being a woman, having average or above-average family income, having witnessed death, and fearfulness were risk factors for PTSD symptoms, 50mo after the earthquake.	Physical dysfunction and PTSD were significantly reduced by the rehabilitation intervention. Future medical rehabilitation strategies should assist survivors in dealing with both physical and psychological effects of natural disasters.

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Table 2 (*continued*)

Study Author, Year, Country	Objectives	Study Type	Participants and Demographic Characteristics	Results/Outcomes	Author's Conclusions
Huang and Wong,[29] 2013, China	Investigate effects of social group work with survivors of the Wenchuan earthquake	Before and after qualitative study	N = 24 Age range, 33–76y; 91% women and married; 9% widowed; 45% had no formal education; and 55% only had primary education	Most participants indicated they did not indulge in thinking about the earthquake, and life became meaningful after joining the group. Participants' social networks were broadened and strengthened after joining the group, and they recognized the importance of mutual understanding and developed a sense of cooperation. After participating in group activities, most women felt happy or that life was more meaningful and their health improved.	Social group work in recreational activities is effective in alleviating disaster survivors' feelings of distress and depression, improves their psychosocial well-being and recovery.
Xiao et al,[21] 2011, China	Analyze factors affecting functional recovery of earthquake survivors with fractures in Sichuan	Case series	N = 174 (survivors with tibial shaft fractures) Mean age, 48.8±14.8y; 57% women; 33% illiterate; 16% positive depressive symptoms; 51.1% received rehabilitation training	51.1% characterized as either excellent or good in functional recovery based on Johner-Wruhs' criteria Functional recovery was positively associated with rehabilitation intervention (OR = 5.3; 95% CI, 2.38–11.67), but it was negatively correlated with the immobilization duration (OR per 10-d increase = .87; 95% CI, .80–.95), age (OR per 10-y increase = .54; 95% CI, .42–.71), and depressive symptomatology (OR = .21; 95% CI, .06–.72).	Functional recovery of postearthquake survivors with fractures is related to availability of rehabilitation treatment, duration of immobilization, depressive symptoms, and age.

Abbreviations: BI, Barthel Index; CHART-SF, Craig Handicap Assessment and Reporting Technique-Short Form; CiOQ, Changes in Outlook Questionnaire; GHQ-28, General Health Questionnaire-28; HADS, Hospital Anxiety and Depression Scale; HRQOL, health-related quality of life; IES-R, Impact of Event Scale-Revised; MSPSS, Multidimensional Scale of Perceived Social Support; NET, narrative exposure therapy; NHV-E, early intervention group; NHV-L, late intervention group; OR, odds ratio; SCSQ, Simplified Coping Style Questionnaire; SRQ, Self-Reporting Questionnaire; WISCI II, Walking Index for Spinal Cord Injury II.

Table 3 Summary of rehabilitation interventions by program content, setting, and duration/intensity (alphabetical by authors)

	Rehabilitation Intervention		
Study	Content	Settings	Duration/Intensity
Becker[20]	Psychological care program: 10 trained community-level workers provided group sessions consisting of 10 participants, based on a train-a-trainer model: a 3-day experimental training program in psychological care (understanding and diagnosis, therapy techniques, stages of reactions and spectrum of care, needs assessments and referral, special needs of vulnerable groups of women, children, and disabled survivors) provided by the National Institute of Mental Health and Neurosciences professional team (psychiatrists, psychiatric social workers, nurses).	Affected community	3 times per week for 2h per session for 3mo
Berger and Gelkopf[27]	Mental health program: a structured program ERASE Stress Sri Lanka: a classroom-based program providing psychoeducational material, cognitive-behavioral skills, meditative practices, and bioenergetic exercises.	Schools in affected community	12 sessions (90-min sessions per week)
Huang and Wong[29]	Social activity program: 2 recreational activity groups were organized by 2 social workers, including various group activities, promotion of harmony among members and fostered group leaders, and communication with other groups outside the community.	Community centers	Once a week (60—90min); 9 total session
Hu et al[24]	Institution-based rehabilitation therapy (details not provided).	Hospital rehabilitation facilities	Details not provided
Li et al[25]	Individualized rehabilitation program provided by multidisciplinary rehabilitation team, comprised of physiatrists, therapists (physical, occupational, traditional modalities), rehabilitation nurses, volunteers, and other consulting medical specialists. Rehabilitation modalities included exercises, muscle strengthening, transfers, training ADL, and mobility training; ultrasound, functional electrical stimulation, electrotherapy, infrared, and lymphatic flow modalities; traditional Chinese therapies (acupuncture, massage); education in management of bladder and bowel continence, skin care, and self-exercise; and assistive devices (prostheses, orthoses) prescribed and provided if indicated.	3 hospitals	Average 3-mo duration
Ni et al[23]	Institution-based comprehensive rehabilitation program, including therapeutic interventions, training and education, and vocational and social rehabilitation (details not provided).	Hospital rehabilitation facilities	Details not provided
Xiao et al[21]	Institution-based rehabilitation interventions delivered by physiotherapists, which included muscle strengthening exercises, joint mobilization and muscle stretching to improve ROM, standing and walking exercises, pain/scar treatment, and other electromagnetic and heat treatments as necessary.	Hospital rehabilitation facilities	Two 40-min sessions per day for >1mo

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Table 3 (*continued*)

Study	Rehabilitation Intervention		
	Content	Settings	Duration/Intensity
Zang et al[26]	Narrative exposure therapy in which the patient, assisted by the therapist, constructed a detailed chronologic report of his/her own biography with a special focus on the traumatic experiences; the narrative was recorded by the counselor and corrected with each subsequent reading. The participants were encouraged to relive emotions while reporting the events.	Hospital rehabilitation facilities	4 therapy sessions (60—90min) for 2wk with 2—4d between each session
Zhang et al[22]	Institutional-based rehabilitation (details not provided).	Hospital rehabilitation facilities	Details not provided
Zhang et al[28]	Rehabilitation program comprised: institutional-based rehabilitation, including muscle strengthening and ROM exercises; training in self-care and mobility activities; education in bladder, bowel, and skin care management; provision of assistive devices; and traditional Chinese therapies (acupuncture, massage). This was followed by CBR, including medical care, rehabilitation, assistive devices, health prevention, and health promotion. Other CBR sectors comprising livelihood, social support, and empowerment were addressed via employment services, personal assistants, and patient self-help peer groups, respectively, among other interventions.	Hospital and community rehabilitation facilities	Details not provided

Abbreviation: ROM, range of motion.

Table 4 Summary of outcome measures and assessment time points in included studies (alphabetical by authors)

Study	Assessment Time Points	Outcome Assessed*			
		Activity	Impairment	Participation	Others
Becker[20]	Baseline, postintervention (3mo)			IES, SRQ	
Berger and Gelkopf[27]	Baseline, 2mo postintervention	CDIS	UCLA PTSD, DPS	Hope questionnaire, BDI	Objective and subjective exposure
Huang and Wong[29]	Postintervention (9wk)				Qualitative transcripts from in-depth interviews
Hu et al[24]	Baseline (discharge from rehabilitation facility) and 1-y follow-up	MBI, WICSI II	AIS, complications, VAS pain	PHQ-9, CHART-SF, WHOQOL-BREF	
Li et al[25]	Discharge from rehabilitation facility (3mo on average)	MBI, ambulation status	AIS		
Ni et al[23]	Retrospective 50mo postearthquake	Subjective assessment of physical dysfunction		PCL-C	Earthquake exposure impact
Xiao et al[21]	15mo postearthquake		VAS pain, fracture healing (Johner-Wruhs' criteria)	CES-D	General and medical questionnaire, anthropometric measurements, leg radiograph
Zang et al[26]	Baseline, post 2-wk treatment, 4wk, and after 2mo		GHQ-28	CiOQ-S, HADS, SCSQ, MSPSS	
Zhang et al[22]	27mo postearthquake	MBI	VAS pain	SF-36	LiSat-9
Zhang et al[28]	27.5—34mo postearthquake	BI			

Abbreviations: AIS, ASIA Impairment Scale; BDI, Beck Depression Inventory; BI, Barthel Index; CDIS, Child Diagnostic Interview Schedule; CES-D, Center for Epidemiologic Studies Depression Scale; CHART-SF, Craig Handicap Assessment and Reporting Technique-Short Form; CiOQ-S, Short Form of the Changes in Outlook Questionnaire; DPS, Diagnostic Predictive Scales; GHQ-28, General Health Questionnaire-28; HADS, Hospital Anxiety and Depression Scale; IES, Impact of Event Scale; LiSat-9, Life Satisfaction Questionnaire; MSPSS, Multidimensional Scale of Perceived Social Support; PCL-C, PTSD Checklist-Civilian Version; PHQ-9, Patient Health Questionnaire depression module; SCSQ, Simplified Coping Style Questionnaire; SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey; SRQ, Self-Reporting Questionnaire; UCLA PTSD, University of California Los Angeles Post Traumatic Stress Disorder; VAS, visual analog scale; WHOQOL-BREF, World Health Organization Quality of Life-BREF; WISCI II, Walking Index for Spinal Cord Injury II.

* Categorized according to the ICF.[13]

Table 5 Levels of quality of individual studies (CASP approach*)

Randomized Controlled Trials											
Study	Clear Focused Issue	Adequate Randomization Procedure	Participants Properly Accounted	Blinding of Participants/ Assessors	Groups Similar at Start	Groups Treated Equally	Large Treatment Effect	Precise Treatment Effect	Clinically Important Outcomes Considered	Benefits Worth Harms and Costs	CASP Grade†
Zang et al[26]	+	+	+	−	+	+	+	+	+	?	8/10
Berger and Gelkopf[27]	+	−	+	−	?	−	+	+	+	?	5/10

Observational studies											
Study	Clear Focused Issue	Appropriate Method	Appropriate Cohort Recruitment	Exposure Accurately Measured	Outcome Accurately Measured	Important Confounding Factors Accounted	Adequate Follow-Up	Strong Exposure and Outcome Relation	Precise Results	Believe the Results	CASP Grade†
Becker[20]	+	+	?	−	−	−	−	−	?	?	2/10
Zhang et al[28]	+	+	+	+	−	?	+	?	?	?	5/10
Hu et al[24]	+	−	?	?	+	−	+	+	−	?	4/10
Li et al[25]	+	−	+	−	−	−	+	+	−	?	4/10
Zhang et al[22]	+	+	+	?	+	−	+	?	+	?	6/10
Ni et al[23]	+	+	+	−	?	−	+	+	−	?	5/10
Huang and Wong[29]	+	−	−	−	−	?	−	−	−	?	1/10
Xiao et al[21]	+	−	+	−	−	−	+	−	−	?	3/10

Abbreviations: +, yes; −, no; ?, cannot tell.

* CASP critical appraisal tool for qualitative research.[18]

† The judgement of value given for each study is specifically based on the data related to this review.

study retrospectively investigated the effectiveness of the rehabilitation intervention on physical dysfunction and PTSD in fracture victims 50 months after the Sichuan earthquake. The authors reported that physical dysfunction was less prominent in the rehabilitation group than the control group ($P<.01$) postintervention.[23] Another study[27] evaluated a school-based intervention in reducing stress-related symptomatology among Sri Lankan children exposed to the tsunami and found significant reduction in functional problems in the intervention group compared with the waitlist control group ($P<.001$).

Improvement in impairments

Overall, 6 studies[21,22,24-27] assessed symptoms/impairments as an outcome, using different measures (n=829). One study showed significant decrease in somatic symptoms ($P<.001$) after a school-based intervention in reducing stress-related symptoms in children exposed to the tsunami.[27] Zang et al[26] evaluated the efficacy of narrative exposure therapy for PTSD in earthquake survivors and showed significant reductions in mental symptoms (Impact of Event Scale scores, $P<.001$) and general mental stress (General Health Questionnaire scores, $P<.0001$) at 2-months follow-up compared with the waitlist control group. Three studies assessing pain reported some reduction in the visual analog scale pain score; however, these were not statistically significant (see table 2).[22,24,25]

Improvement in participation: psychological outcomes

Overall, 6 studies[20,21,23,24,26,27] assessed psychological outcomes, with 3 studies[20,26,27] evaluating it as a primary outcome (n=1038). Becker[20] showed that a psychological rehabilitation intervention (structured in-community psychological care) delivered by trained community health workers for women survivors of tsunami significantly improved psychosocial symptoms, as measured by the Impact of Event Scale scores (total, $P<.001$; subscale scores: avoidance, $P<.001$; intrusion, $P<.001$; hypervigilance, $P<.001$). The author reported that 82% of probable PTSD cases in the intervention group improved and could no longer be classified as PTSD compared with only 23% in the control group ($P=.001$).[20] Another study[27] evaluating the efficacy of school-based intervention in reducing stress-related symptoms among Sri Lankan children exposed to tsunami found significant improvement in PTSD severity ($P<.001$), depression ($P<.001$), and hope ($P\leq.001$) scores in the intervention group. Zang[26] evaluated the efficacy of narrative exposure treatment for PTSD and showed that compared with the waitlist control group at posttreatment, the intervention group showed significant reductions in PTSD symptoms (Impact of Event Scale-Revised subscales of avoidance, intrusion, and hyperarousal: $P<.001$ for all; Hospital Anxiety and Depression Scale subscales of anxiety and depression: $P<.001$). Hu et al[24] in another study found a small nonsignificant improvement in depression measured by the Patient Health Questionnaire Depression model in the intervention group at 1 year posttreatment ($P=.836$). The authors reported that psychological symptoms were still prevalent, with 26.9% of participants still requiring antidepressant treatment and 53.8% psychological counseling.[24] One study[23] showed a clinically meaningful improvement in PTSD in the intervention group measured by the PTSD Checklist-Civilian Version ($P<.05$) (see table 2).

Improvement in participation: QOL

Overall, 2 studies evaluated QOL as a secondary outcome, using different outcome measures (n=416).[22,24] Hu[24] reported significant improvement in QOL at 1-year follow-up after inpatient rehabilitation intervention using the World Health Organization Quality of Life Scale. Total World Health Organization Quality of Life Scale score ($P=.011$), self-ratings of QOL ($P<.001$) and general health ($P<.001$), and satisfaction with social relations ($P=.017$) improved significantly, whereas the physical health and psychological health domain scores increased but were not statistically significant.[24] Another study[22] showed significant improvement in QOL measured using the Medical Outcomes Study 36-Item Short-Form Health Survey in the early intervention group ($P=.008$) compared with the participants in the control group, but not in the late intervention (after 1y) group ($P=.067$). The authors also found that good performance of ADL and, surprisingly, a widowed marital status predicted higher QOL (see table 2).[22]

Improvement in participation: community integration

Two studies[22,24] evaluated community integration using different outcome measures (n=416). Hu[24] used the Craig Handicap Assessment and Reporting Technique-Short Form scale to compare community integration of earthquake survivors with SCI at the time of discharge from institution-based rehabilitation with scores at 1 year after returning to the community. The authors found a small nonsignificant improvement in Craig Handicap Assessment and Reporting Technique-Short Form scores at 1-year follow-up compared with scores at discharge ($P=.127$). The authors reported that physical independence and mobility increased and cognitive independence decreased significantly ($P<.05$ for both). There was no statistically meaningful difference in occupation and social integration.[24] Zhang et al[22] in another study found no stable effect of the rehabilitation intervention for adequacy of social support from 3 different sources: family, friends, and significant others members (measured by the Multidimensional Scale of Perceived Social Support). There was also no effect of the intervention in improving active and passive coping (measured by the Simplified Coping Style Questionnaire) (see table 2).[22]

Safety

None of the included studies evaluated or reported adverse effects.

Cost-effectiveness

No studies reported any data on cost-effectiveness, investment costs, or resource utilization.

Caregiver-related issues

Caregiver burden was not evaluated in any of the studies.

Discussion

This systematic review provides an evidence-based overview of the effectiveness of various medical rehabilitation interventions used for survivors of natural disasters. A multipronged approach assimilated published literature for currently available evidence by including both qualitative and quantitative studies. The study highlights scarce research and a lack of robust, methodologically strong studies in this area. Most included studies were of poor quality as a result of multiple methodologic flaws (eg, unclear/lack of participant recruitment, group allocation, bias-minimizing procedures). The included studies showed marked heterogeneity in terms of intervention types, measurement tools used (even for

identical outcomes), treatment protocols (for both intervention and control groups), and length of follow-up. Therefore, best evidence synthesis was performed using a narrative approach.

This review includes a total of 10 trials (2 randomized controlled trials, 8 observational studies). Most interventions evaluated in these studies were complex and included >1 active rehabilitation component. The interventions evaluated differed in many aspects, including characteristics, type and intervention goals, number and extent of the intervention components, duration and intensity, and mode of delivery. Most interventions included physical activity and psychosocial care as intervention components. Comparative control interventions varied between studies ranging from no intervention to waitlist groups. The findings from this review suggest that there is some evidence for medical rehabilitation for survivors of natural disasters in producing short- and long-term gains for functional activities (ADL, physical activity, etc), impairments (eg, psychological symptoms), and participation (QOL, social reintegration). There is no evidence for cost-effectiveness of these programs and for the best type/mode/intensity (frequency, duration) of intervention or superiority of one intervention over another.

Natural disasters have become more frequent recently, causing mass casualties and severe physical injuries and psychological disorders impacting QOL of survivors. The critical importance and role of providing rehabilitation services during and after a natural disaster is well-discussed in the literature.[3,4,10,16,30-32] There is also strong opinion among the disaster management experts that medical rehabilitation in any humanitarian disaster should be initiated in the immediate emergency response phase, and as disaster transitions away, it should be continued in the community over the longer term to restore function and enhance participation of survivors.[4,30,31] Improving or restoring physical and psychosocial abilities is a key issue in rehabilitation of disaster victims, and a rehabilitation approach for these people can be helpful.[4,32] Rehabilitation planning includes the following: assessment of evolving and long-term injury patterns, rehabilitation needs, and resource requirements; data collection, management, and analysis; establishment of patient triage, discharge, referral, and tracking systems; collaboration with other rehabilitation and health care service providers; and coordination with emergency systems and host health system and government managers.[3] Long-term rehabilitation planning is critical for community recovery where services should be accessible and includes general health maintenance. Regrettably, however, acute response plans and acute care protocols, which focus on saving lives and treating acute injuries, get much of the attention in any disaster, and rehabilitative needs are often neglected.[3]

The included studies highlight many challenges in implementing and evaluating rehabilitation interventions in natural disaster survivors. First, natural disaster often occurs unexpectedly and precipitously with great magnitude of destruction, resulting in mass casualties and complex disabling injuries requiring multidisciplinary management. Second, the survivors can present with one or a combination of diverse clinical presentations (including medical complications) and with varying levels of disability, requiring an individualized approach. Third, the disaster itself results in severe disruption of local health service infrastructure, including supporting communication and supply/transportation networks, compromising medical response and optimal management of the victims.[3] Moreover, natural disasters mostly occur in developing countries and in remote, resource-scarce regions where rehabilitation services either do not exist or are underdeveloped.[3,16] In most cases, burden of sudden onset and magnitude of traumatic disabling conditions can overwhelm and deplete already overstretched available rehabilitation services and health care infrastructure/resources.[3,16] A lack of understanding of the geographic location, availability of the local health services, and shortage of trained rehabilitation professionals and medical workforce in close proximity can further hinder the comprehensive management.[33] Special needs and management (including evacuation) plans for persons with preexisting disabilities and/or comorbidities generally are often disregarded because the rescuers and planners are mostly unaware of their presence in the community or fail to identify them, placing this vulnerable population at an increased risk of developing additional disabilities, worsening of preexisting disability, and mortality.[3,16]

This review included studies with different research designs in the synthesis of evidence for natural disaster rehabilitation, rather than including only experimental designs. The evidence synthesis highlights the need for systematic data collection in the course of real-life practice and long-term follow-up of outcomes. Selection of feasible and responsive outcome measures and listing of specific interventions (modalities, duration, etc) used in disaster settings is important.

Study limitations

The limitations of methodology used and completeness of this review cannot be ruled out. Despite the extended range of terms used to capture the relevant literature, the search strategy principally encompassed cited literature. Further, the search strategy included searching of reference lists only within the relevant articles for other possible articles missed in electronic searches, which may have introduced a reference bias and may have missed some relevant articles, including negative and unpublished trials. Finally, though the CASP approach used to appraise studies is a robust system for evaluating various trial-based evidences, its sensitivity is still debatable.[34] In this instance, however, its use was appropriate given that studies identified in this review were of mixed methods.

The way forward

Although significant improvements in the coordination and organization of acute care and services in humanitarian catastrophes, including natural disasters, has reduced mortality, this has often not extended to include rehabilitation services. Rehabilitation is an expensive resource, and the evidence to support specific rehabilitation interventions in natural disaster survivors has long been neglected. This review highlights many gaps in the evidence base for medical rehabilitation in natural disaster survivors in terms of the types of rehabilitation interventions, settings, components, modalities, and duration of therapy; lack of effective care pathways; and longer-term outcomes for these survivors, including functional restoration and societal reintegration (participation). Most literature in rehabilitation care in nature disaster survivors exists in silos for isolated conditions (eg, SCI, fractures, psychological conditions). The WHO recently endorsed the *WHO Global Disability Action Plan 2014–2021: Better Health for All People with Disability*,[35] which aims to improve access to health services; strengthen and extend rehabilitation, assistive technology, and support services; and improve data collection and research. The WHO rehabilitation guidelines recommend implementation and access to rehabilitation early during the response phase and

longer-term in the community.[36] The system issues for medical rehabilitation in disaster settings may include the following: expense of setting up these programs, staff expertise, insufficient support for patients along the recovery trajectory with loss of livelihood and productivity, difficulty in access and/or lack of rehabilitation services because of geographic barriers, and lack of social support systems in the longer term.

Implications for practice and research in medical rehabilitation for natural disaster survivors include the need for the following: more methodologically robust studies (ie, well-designed research methods); regular, systematic standardized data collection during disasters; capacity building for disaster management for outcomes in real-life settings; research priority for rehabilitation needs assessment for service delivery planning and delivery[3]; incorporation of perspectives of patients (and/or caregivers) in treatment; outcome measures to reflect the complex constructs using domains of the WHO's ICF; consensus on a battery of measures to capture changes in physical ability and psychosocial adjustment; research on the cost-effectiveness of medical rehabilitation intervention; innovations and models of rehabilitation (eg, telerehabilitation) that offer paradigm shifts in delivery of timely and transparent services and that are cost-effective and patient centered; research on disaster survivors' participatory limitations because of work, family, and social reintegration; more rehabilitation professionals and educating other health care professionals in rehabilitation principles and practice; effective coordination and collaborative research initiatives between international organizations, national and international NGOs in partnership with the local government and health professionals providing rehabilitation services after a disaster[4]; efficient allocation of human and material resources to provide optimal, comprehensive rehabilitative care for the affected population; inclusion of rehabilitation doctors as members of foreign medical teams for rehabilitation input to mitigate disability[33]; development of guidelines and reporting tools for rehabilitation intervention in crisis settings and inclusion in the Consensus Guidelines on Reports of Field Interventions in Disasters and Emergencies[37]; and future studies on professionalizing rehabilitation in resource-poor settings.

Conclusions

This review highlights sparse literature and the lack of high-quality studies in rehabilitation after natural disasters. Assimilation of data from existing studies was difficult because of the diverse content, delivery of rehabilitation, and range of outcome measures used. Although evidence for effectiveness of rehabilitation in natural disaster victims is limited, the gap in current research should not be interpreted as ineffectiveness of rehabilitation in this population. The challenge is to conduct rigorous trials in complex disaster settings to assess outcomes for rehabilitation interventions.

In the current emerging global context of reduced mortality and increased morbidity after natural disasters, the need for rehabilitation will only increase. This review highlights the increasing awareness of medical rehabilitation for effective short- and longer-term management of natural disaster survivors. Medical rehabilitation needs to be incorporated into future response planning and disaster management for improved access to rehabilitation services and investment in sustainable infrastructure, education, and workforce development.

Keywords

Community integration; Disaster survivors, earthquake; Physical functioning; Quality of life; Rehabilitation

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Appendix 1 Search Strategy Applied to Search Medical and Health Databases

1. 'rehabilitation care'
2. 'rehabilitation'
3. "multidisciplinary rehabilitation". ti,ab
4. 'physical activity'
5. 'physiotherapist'
6. 'physiotherapy'
7. 'home care'
8. 'occupational therapy'
9. 'dietitian'
10. nutritional AND services
11. 'counseling'
12. 'educational activities'
13. 'social work'
14. 'cognitive therapy'
15. 'behaviour therapy'
16. 'speech therapy'
17. OR/(1-14)
18. disaster AND management
19. disaster AND response
20. disaster AND mitigation
21. 'international agencies'
22. humanitarian
23. disaster AND information AND system
24. 'international cooperation'
25. OR/(18-24)
26. 'natural disaster'/exp OR 'natural disaster'
27. 'geographic and geological phenomena
28. complex AND emergency
29. "complex emergency".ti,ab
30. 'earthquake'
31. 'volcano'
32. 'fire'
33. 'flooding
34. 'drought'
35. 'tsunami'
36. 'freeze'42,944
37. 'heatwave'
38. tropical AND cyclone
39. 'storm'
40. OR/(26-39)
41. 17 AND 25
42. 41 AND 40

References

1. ReliefWeb Project. Glossary of humanitarian terms. Geneva: ReliefWeb; 2008.
2. 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.
3. 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;93:1875-81.
4. Gosney J, Reinhardt JD, Haig AJ, Li J. Developing post-disaster physical rehabilitation: role of the World Health Organization Liaison Sub-Committee on Rehabilitation Disaster Relief of the International Society of Physical and Rehabilitation Medicine. J Rehabil Med 2011;43:965-8.
5. United Nations International Strategy for Disaster Reduction. Natural disasters and sustainable development: understanding the links between development, environment and natural disasters. Background Paper No. 5. Geneva: United Nations Department of Economic and Social Affairs; 2001.
6. Reinhardt JD, Li J, Gosney J, et al. Disability and health-related rehabilitation in international disaster relief. Glob Health Action 2011;4:7191.
7. Smith E, Wasiak J, Sen A, Archer F, Burkle FM Jr. Three decades of disasters: a review of disaster-specific literature from 1977-2009. Prehosp Disaster Med 2009;24:306-11.
8. International Strategy for Disaster Reduction (ISDR). Global assessment report on disaster risk reduction (GAR). Geneva: United Nations; 2013.
9. Dhameja A. Disaster rehabilitation: towards a new perspective. In: Pinkowski J, editor. Disaster management handbook. Boca Raton: CRC Pr; 2008.
10. Landry MD, McGlynn M, Ng E, et al. Humanitarian response following the earthquake in Haiti: reflections on unprecedented need for rehabilitation. World Health Popul 2010;12:18-22.
11. World Health Organization. World report on disability. Geneva: World Health Organization; 2011.
12. Khan F, Amatya B, Hoffman K. Systematic review of multidisciplinary rehabilitation in patients with multiple trauma. Br J Surg 2012;99(Suppl 1):88-96.
13. World Health Organization. International classification of functioning, disability and health (ICF). Geneva: World Health Organization; 2001.
14. 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.
15. Burns AS, O'Connell C, Rathore F. Meeting the challenges of spinal cord injury care following sudden onset disaster: lessons learned. J Rehabil Med 2012;44:414-20.
16. Gosney JE, Reinhardt JD, von Groote PM, Rathore FA, Melvin JL. Medical rehabilitation of spinal cord injury following earthquakes in rehabilitation resource-scarce settings: implications for disaster research. Spinal Cord 2013;51:603-9.
17. Egger M, Smith GD. Bias in location and selection of studies. BMJ 1998;316:61-6.
18. Critical Appraisal Skills Programme. CASP checklists. Available at: http://www.casp-uk.net/#!casp-tools-checklists/c18f8. Accessed September 20, 2014.
19. Patelarou E, Kelly FK. Indoor exposure and adverse birth outcomes related to fetal growth, miscarriage and prematurity: a systematic review. Int J Environ Res Public Health 2014;11:5904-33.
20. Becker SM. Psychosocial care for women survivors of the tsunami disaster in India. Am J Pub Health 2009;99:654-8.
21. Xiao M, Li J, Zhang X, Zhao Z. Factors affecting functional outcome of Sichuan-earthquake survivors with tibial shaft fractures: a follow-up study. J Rehabil Med 2011;43:515-20.
22. Zhang X, Hu XR, Reinhardt JD, et al. Functional outcomes and health-related quality of life in fracture victims 27 months after the Sichuan earthquake. J Rehabil Med 2012;44:206-9.
23. Ni J, Reinhardt JD, Zhang X, et al. Dysfunction and post-traumatic stress disorder in fracture victims 50 months after the Sichuan earthquake. PLoS One 2013;8:e77535.
24. Hu X, Zhang X, Gosney JE, et al. Analysis of functional status, quality of life and community integration in earthquake survivors with spinal cord injury at hospital discharge and one-year follow-up in the community. J Rehabil Med 2012;44:200-5.
25. Li Y, Reinhardt JD, Gosney JE, et al. Evaluation of functional outcomes of physical rehabilitation and medical complications in spinal cord injury victims of the Sichuan earthquake. J Rehabil Med 2012;44:534-40.
26. Zang Y, Hunt N, Cox T. A randomised controlled pilot study: the effectiveness of narrative exposure therapy with adult survivors of the Sichuan earthquake. BMC Psychiatry 2013;13:41.
27. Berger R, Gelkopf M. School-based intervention for the treatment of tsunami-related distress in children: a quasi-randomized controlled trial. Psychother Psychosom 2009;78:364-71.
28. Zhang X, Reinhardt JD, Gosney JE, Li J. The NHV Rehabilitation Services Program improves long-term physical functioning in survivors of the 2008 Sichuan earthquake: a longitudinal quasi experiment. PLoS One 2013;8:e53995.
29. Huang Y, Wong H. Effects of social group work with survivors of the Wenchuan earthquake in a transitional community. Health Soc Care Community 2013;21:327-37.
30. Gosney JE Jr. Physical medicine and rehabilitation: critical role in disaster response. Disaster Med Public Health Prep 2010;4:110-2.
31. Landry MD, O'Connell C, Tardif G, Burns A. Post-earthquake Haiti: the critical role for rehabilitation services following a humanitarian crisis. Disabil Rehabil 2010;32:1616-8.
32. Landry MD, Quigley A, Nakhle A, Nixon SA. Implications of a gap between demand and supply for rehabilitation in post-earthquake Haiti. Physiother Res Int 2010;15:123-5.
33. Nickerson JW, Chackungal S, Knowlton L, McQueen K, Burkle FM. Surgical care during humanitarian crises: a systematic review of published surgical caseload data from foreign medical teams. Prehosp Disaster Med 2012;27:184-9.
34. Kane GA, Wood VA, Barlow J. Parenting programmes: a systematic review and synthesis of qualitative research. Child Care Health Dev 2007;33:784-93.
35. World Health Organization. WHO global disability action plan 2014–2021: better health for all people with disability. Geneva: World Health Organization; 2014.
36. World Health Organization. Community-based rehabilitation guidelines. Geneva: World Health Organization; 2010.
37. Bradt DA, Aitken P. Disaster medicine reporting: the need for new guidelines and the CONFIDE statement. Emerg Med Australas 2010;22:483-7.

CHAPTER 4

Overview of Medical rehabilitation in natural disasters in the Asia-Pacific Region

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Study II

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Co-Authors Statements are provided in *Appendix 9*.

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International Journal of Natural Disasters & Health Security (IJNHS)

Medical Rehabilitation in Natural Disasters in the Asia-Pacific Region: The Way Forward

Review Article

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Abstract

The Asia-Pacific is the most disaster-prone region in the world, with over 40% of the world's disasters occurring here in the past decade. This region has geo-political and socio-economic diversity which increases vulnerability to natural and other disasters. With increasing frequency of natural disasters, there is greater focus on the role of rehabilitation in disaster response and management. Early rehabilitation and preventative care in disaster survivors has the potential to minimize complications, optimize early recovery and reduce the economic burden. This article presents an overview of medical rehabilitation status in natural disaster settings in the Asia-Pacific region. It highlights the role of medical rehabilitation in disaster response and management, potential challenges faced by the countries in the region and key initial perspectives which need consideration for future disaster planning. Rehabilitation and long-term management of disaster survivors requires diverse forms of multi-sectorial partnerships, strategic collaboration, provision of service development, research and knowledge transfer.

Keywords: Natural Disaster; Rehabilitation; Disability; Disaster Response; Outcome.

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Introduction

A disaster is '*a serious disruption of functioning of society, which poses a significant, widespread threat to human life, health, property or the environment, whether arising from accident, nature or human activity, whether developing suddenly or as a result of long-term processes, but excluding armed conflict*' [1]. Based on the aetiology, disasters can be classified into: a 'man-made'(war, conflict etc.) or 'natural' [2]. A 'natural disaster' is '*a situation or event caused by nature, which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering*' [3]. Natural disasters can be: *Geophysical* (earthquake, volcano, dry mass movement); *Meteorological* (storms); *Hydrological* (flood, wet mass movement); *Climatological* (extreme Temperature, drought, wildfire/bushfire); and *Biological* (epidemic, insect infestation, animal stampede) [3].

The Asia-Pacific is the most disaster-prone region in the world, with over 40% of the world's disasters occurring in this region in the past decade. These include earthquakes, cyclones, landslides/floods, drought and bush-fires [4]. According to United Nation (UN) Economic and Social Commission for Asia and Pacific (ESCAP) report, of the 3,979 disasters that occurred globally between 2005 and 2014, over 1,625 occurred in this region, resulting in half a million fatalities (almost 60% of the total global deaths related to disasters) [5]. These disasters affected over 1.4 billion people and constitute 80% of those affected globally [5]. The economic losses resulting from these is estimated at US $523 billion [5]. In 2014 alone, more than half of the world's 226 natural disasters occurred in the Asia-Pacific region, with over $60 billion worth of economic damage [6]. It is projected that by the year 2030, the region could average $160 billion per year of annual economic losses [5]. Hydrological disasters (floods/ storms) are common in the region, and result in higher economic damage relative to human toll. A list of major disasters that occurred in the Asia-Pacific region between 2000 to 2015 are listed in Table 1[7].

The Centre for Research on the Epidemiology of Disasters (CRED), predicts that natural disasters will escalate every year worldwide, and the Asia-Pacific region remains the most susceptible to these in the future [8]. The region has the highest disaster risk potential as the world's two most seismically active fault lines cross many countries in this region [5, 9]; it has three major ocean basins and many areas lie along major typhoon tracks [5]. Further, the region is more prone to hydrological disasters due

Table 1. Major natural disaster in Asia-Pacific region (2000-2015).

Date	Casualties, and effects (estimate)	Economic loss US$ (estimate)	Event type	Location
January 26 2001	20,000 deaths, 167,000 injured	$5.5 billion	Gujarat earthquake	India
26-Dec-03	28,000 dead and 30,000 injured	Over $30 million in property damage	Bam earthquake	Iran
26-Dec-04	230,000 deaths, 1.7 million displaced	$10 billion in property damage	2004 Indian Ocean earthquake & tsunami	Indian Ocean
8-Oct-05	79,000 deaths, 106,000 injured, 4 million displaced	$5.5 billion, over 32,000 properties destroyed	2005 Kashmir earthquake	Pakistan
November12, 2007	200 deaths, 152 9,500 displaced.	$71.4 million	Cyclone Guba and flood	Papua New Guinea
15-Nov-07	5,000-10,000 deaths, 5,000 injured, 1 million displaced	$1.5 billion	Cyclone Sidr	Bangladesh
3-May-08	133,500 deaths, 55,000 missing	$10 billion	Cyclone Nargis	Myanmar
12-May-08	75,000 deaths, 365,000 injured, 5 million displaced	$30 billion	2008 Sichuan earthquake	China
August 18, 2008	2,400 deaths, 3,500 missing, 3 million displaced	$135 million, over 236,000 properties damaged	Bihar flood	India
20-Sep-09	1,200 deaths, 2,900 injured	$745 million, 150,000 buildings damaged	Sumatra earthquake	Indonesia (Padang)
February 7-March 14, 2009	73 deaths, 414 injured, 7,562 displaced	$4.6 billion, 5,530 properties damaged	Black Saturday bushfires	Australia
26-Jul-10	1,781 deaths, 2,966 injured	$43 billion	Floods	Pakistan (Indus river)
22-Feb-11	185 deaths, 1,500 injured	$11.2 billion, 100,000 properties damaged	Christchurch earthquake	New Zealand
11-Mar-11	15,881 deaths, 2,668 missing, 6,142 injured	$235 billion, 130,000 properties destroyed	Tohoku earthquake and tsunami (including Fukushima nuclear power plant meltdown)	Japan
20-Apr-13	160 deaths, 5,700 injured	Over 10,000 properties destroyed	Sichuan earthquake	China
April 24 and May 12, 2015	8,633 deaths, deaths, 103,686 injured, 2.8 million displaced	Over 1 million homes destroyed	Nepal earthquake	Nepal
May-June 2015	5,000 deaths	unknown	Heatwave	India, Pakistan

Source: Butt et al 2014 [7], Vos et al 2010 [3]

to climate change-related events (such as rising seas, increasing drought, rainfall etc.). The region, therefore, experiences some of the world's worst natural hazards such as earthquakes, volcanic eruptions, cyclones and monsoons [9].

The Asia-Pacific region is amongst the most diverse in the world-geographically, economically and politically [10]. The remarkable geographical diversity ranges from tiny island nations in the Pacific (such as Kiribati, Vanuatu), to populous countries like China and India [11]. Many countries in the region are also affected by man-made disasters (such as war, conflict etc.). Economically, the region has vast diversity, ranging from economic superpowers (such as Japan, China, Australia) to the world's poorest countries (such as Bangladesh, Nepal etc.). The region accounts for more than 60% of the world's poverty-stricken people with over 770 million people living on less than $1.25 a day [5, 12]. These people are most vulnerable to the catastrophes as they live in more exposed areas, have weak livelihoods and fewer resources. Further, the region has many of the world's megacities with over 8 million people (such as Mumbai, Beijing, Manila), with exposure of a large population to hazard risks [7]. Natural disasters potentially can have serious economic implications and can derail both national and individual household economies, which are already over strained and weak in most low-economic countries [4].

Table 2. Summary of rehabilitation interventions evaluated in Asia-Pacific region.

Interventions	Findings	References (host country)
Psychological programs		
Community-based psychological Program (group sessions)	Effective in reducing emotional distress for women tsunami survivors	Becker SM 2009 [31] India
School-based mental health program	Helpful in mitigating post-disaster-related symptoms in children, and those with more severe symptoms benefited most	Berger & Gelkopf [32] Sri Lanka
Narrative Exposure Therapy (NET)	Significant positive effect on anxiety, depression and general mental health	Zang et al 2013 [33] China
Social activity program		
Recreational activity groups	Effective in alleviating disaster survivors' feelings of distress and depression, improves their psychosocial well-being and recovery	Huang and Wong 2013 [34] China
Hospital-based rehabilitation program		
Comprehensive rehabilitation program (therapeutic interventions: exercise, symptom management; training and education; vocational and social rehabilitation; assistive devices	Significant improvement in: functional status, QoL, general health, satisfaction with social relationships and some areas of community integration (physical independence and mobility)	Hu et al 2012 [35], Li et al 2012 [36], Ni et al 2013 [37], Xiao et al 2011 [38], Zhang et al 2012 [39] China
Mixed (hospital-and community –based) rehabilitation model		
NHV rehabilitation program comprised NGOs (N), local health departments (H), and professional rehabilitation volunteers (V): Institutional-based rehabilitation followed by CBR	Significantly improved physical functioning of earthquake survivors	Zhang et al 2013 [40] China

[Source Khan et al 2015 [2]]

CBR= community-based rehabilitation, NET = Narrative Exposure Therapy, NGOs = non-governmental organisations, QoL = quality of life

Further, weak governance can impede any disaster risk reduction and effective management. According to the Asian Development Bank, the region's economic progress will be undermined by the rising number of disasters [12].

Despite progress in surveillance and early warning systems and evacuations, the Asia-Pacific region is still largely unprepared for its response to mega-disasters [4]. This requires improved regional information exchange, strengthened regional cooperation for effective post-disaster management and joint coordination to address cross-border disasters [4, 6, 8]. The Asia-Pacific region's poor population remain vulnerable and exposed to disasters, and have borne the brunt of these cataclysms.

Key Regional Initiatives in Disaster Management

In recent years, there have been improvements in international and regional collaboration; and management capacities in disaster management. There is increased attention on disaster prevention and preparedness, especially early warning systems, early evacuation (for hydrological disasters) and awareness. In 1947, the UN established the Economic and Social Commission for Asia and the Pacific (ESCAP) as an intergovernmental forum for all countries in the region (53 members, 9 associates), covering over 60% of the world's population (4.1 billion people). In 2004, the 'Hyogo Framework for Action' (Kobe), was adopted after the Indian Ocean tsunami, aimed at reducing disaster-related losses, both of human, and social, economic and environmental assets. The UN General Assembly (September 2005), implemented this framework through the International Strategy for Disaster Reduction in Asia to enhance regional co-operation.Although, the 'Hyogo Framework' provides a strong foundation for governments to take on a greater role at all levels, it is based on voluntary commitment and is limited in its capacity to move certain actions forward [4]. Currently, leaders and decision-makers across the region are preparing to finalize a new global framework for disaster risk reduction to replace the Hyogo Framework [4].

In the wake of Cyclone Nargis (Myanmar 2008), the Association of Southeast Asian Nations (ASEAN) Humanitarian Task Force was established, which effectively led the coordination and dis-

tribution of aid to victims. The ASEAN Agreement on Disaster Management and Emergency Response 2010–2015 (AADMER) was ratified by ten member states, and in 2009, issued a statement on disaster management to enhance regional preparedness for natural disasters. The Pacific Platform for Disaster Risk Management (PPDRM) Framework for Action 2010–2015 was adopted in August 2010, to enhance disaster risk management in Pacific countries. In 2011, the Indian Ocean Tsunami Warning and Mitigation System was established. Currently, most countries in the region have some form of legal and regulatory framework as well as institutional structures for managing disaster risk [4]. However, there are still major disparities and gaps amongst the member countries and those with high disaster risks tend to have low coping capacity [5]. Many countries have already introduced disaster resistance building codes, however, due to poverty and lack of regulatory and meaningful enforcement, much of the infrastructure is yet to meet optimal standards.

Medical Rehabilitation in Disaster Settings

Due to advances in response, rescue and field management, emergency/surgical and medical care (including infection control) in many disasters, there has been authoritative transition worldwide from high mortality to a significant increase in morbidity rates [13]. The disaster victims are surviving at relatively higher rates, however, many have a range of long-term severe physical and psychological injuries which impact their quality of life. Further, those with pre-existing disabilities and additional co-morbidities are at risk of higher mortality and further morbidities as a result of a natural disaster [14]. These people require integrated interdisciplinary care from the acute phase of disaster management to sub-acute care (in hospital and/or community) to enable their previous level of function and reintegration into the community [15]. This highlights medical and non-medical rehabilitation (rehabilitation services, infrastructure, buildings etc.) as integral to comprehensive disaster management [2, 15, 16, 17].

Medical rehabilitation is '*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*' [17]. Primary goals of medical rehabilitation include management of acute injury, optimization of functional capabilities (including physical, cognitive, neuropsychological function) and social re-integration [14]. Rehabilitation in disaster setting includes: assessment of injury patterns, 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; and data collection, management and analysis [13, 14]. Long-term rehabilitation planning is critical for community recovery where services should be accessible, and include general health maintenance [2, 14]. The treating team includes physical and rehabilitation medicine (PRM) physicians, nurses and allied health professionals.

As aforementioned, natural disasters can cause complex disabilities, which are costly to treat and have socioeconomic implications due to increased demand for long-term health care, social and vocational services, and caregiver burden [2, 14]. There is strong consensus that medical rehabilitation in any humanitarian disaster should be initiated in the immediate emergency response phase, and as disaster transitions away, it should continue in the community over a longer-term to restore function and enhance participation of survivors, affected directly or indirectly in the disaster [15, 18]. There is evidence suggesting early involvement of rehabilitation in disaster setting, reduces disability, post-operative complications and improves participation (quality of life) [2, 13, 14]. The WHO advocates that "*rehabilitation is one of the core functions of trauma care systems in regular healthcare and as such, Foreign Medical Teams (FMT) should have specific plans for the provision of rehabilitation services to their patients post sudden-onset disasters*" [19]. This aligns with the vision and objectives of the WHO Global Disability Action Plan 2014-2021 and the implementation of United Nations Convention on the Rights of Persons with Disability (CRPD) [20, 21].

Despite significant improvements in the coordination and organization of acute care services in emergency responses worldwide, this has not extended to include rehabilitation services [13]. Acute medical response in disaster settings focuses on saving lives and acute injuries get much of the attention, while rehabilitative needs are often neglected [2, 14, 22]. In many Asia-Pacific countries, disaster response plans and rehabilitation services are generally inadequate or absent [6]. There is a lack of access to appropriate services in many countries, where fragmented healthcare systems are compromised by lack of financial and political support [4, 5]. During disasters, often the existing local rehabilitation resources can be damaged and/or disrupted and can be quickly overwhelmed with an influx of injury/disease and require international humanitarian assistance [23] To date, there is no documentation of inclusion of the rehabilitation professionals in the emergency-response staffing configuration in any disasters in the Asia-Pacific region. The need for overall rehabilitation services in these countries during disasters is not well defined in terms of type, intensity and settings. On many occasions, rehabilitation services are integrated with other health services in public hospital systems, where there are no services for specific and complex disaster-related disabilities, such as spinal cord injury (SCI) [24]. Further, there is lack of disability-disaggregated data within general statistics for disaster zones [23].

Improving or restoring physical and psychosocial abilities is a key issue in rehabilitation of disaster victims, and rehabilitation approaches should include a spectrum of treatments and interventions [13, 14]. The role of the PRM physician is critical in disaster settings to coordinate the post-disaster rehabilitation needs and management of victims [13]. Earlier experiences in disaster zones have raised awareness and need for inclusion of rehabilitation in response and planning for humanitarian catastrophes [18, 25]. Studies evaluating the effectiveness of rehabilitation intervention following a natural disaster are scarce [2, 13]. A few studies have investigated a variety of medical rehabilitation interventions for natural disaster survivors, which range from comprehensive multidisciplinary rehabilitation to community educational programs [2]. The overall, findings from these studies suggest that post-disaster rehabilitation was effective in reducing disability, improving participation and quality of life [2] (Table 2). Further, other studies have demonstrated that involvement of PMR physicians in the disaster zone resulted in positive and better clinical outcomes, reduced length of hospital stay and fewer complications [24, 26].

Physical Medicine and Rehabilitation professionals challenges in disaster settings

The many challenges for rehabilitation professionals during dis-

aster settings in the Asia-Pacific region include [2, 13, 14, 22, 27]:

- Rehabilitation infrastructure/services are not fully developed, or existing host healthcare infrastructure disrupted or destroyed due to unprecedented volume of are disaster victims
- Rehabilitation services are mainly hospital-based and overwhelmed requiring make-shift centres
- Discharge from the healthcare facilities into community is difficult due to lack of appropriate, accessible housing, adding pressure to an overstretched healthcare infrastructure
- Lack of coordination with and amongst disaster management organisations (including FMTs), which are predominantly deployed in the acute phase; and with national and international non-governmental organisations (NGOs)
- Many FMTs do not include rehabilitation physicians or their inclusion is restricted to the intermediate and longer-term settings only
- Lack of skilled human resources locally (e.g., PRM physicians), which limits access to skilled multidisciplinary care
- Hospital-orientated units are unable to serve longer-term needs of disabled people with residual functional and psychological disabilities
- Inadequate community rehabilitation resources and facilities
- Limited psychological support and cognitive rehabilitation for those with post-traumatic stress disorders (PTSD)
- Lack of relevant and purposeful reporting and tools to review services provided to those affected by disaster and improve humanitarian coordination for long-term care planning
- Deployment to affected areas is complicated by damaged and/or disrupted infrastructure (as roads, transport, communications etc.)
- Cultural beliefs of people affected about disability and the disaster itself may limit potential impact of rehabilitative services.

Identified Gaps for Action

With increasing frequency of natural disasters in the Asia-Pacific region, there is greater focus on the role of rehabilitation in disaster management. Many disaster survivors, such as those with traumatic brain injuries (TBI), SCI etc. are vulnerable populations requiring long-term planning for service delivery and rehabilitation [24]. Early aggressive rehabilitation and preventative care in these survivors has the potential to minimize complications, facilitate early recovery and reduce the economic burden [13, 14]. Specifically, there are some key initial perspectives which need consideration for future disaster planning, listed below:

Collaboration and governance

The establishment of a national disaster response healthcare organisation is recommended for a leadership role to coordinate and provide cooperative effort, and to enhance capacity of national and international health care organisations (and FMTs), for effective management and preparedness in disaster settings. These should include inter-disciplinary and inter-sectoral partnerships for disaster management, preparedness, emergency response and longer-term planning. All national and international representative organisations (including NGOs) should be stakeholders and participate, contribute to planning, monitoring and evaluation of disaster management agenda and processes, including rehabilitation. The governing body (and stakeholders) should build up the system by enhancing capacities of healthcare institutions, individuals and communities in the care process. For example, in Australia, the federal Department of Health established the Australian Medical Assistance Teams (AusMAT), which is a comprehensive management system capable of responding to disaster both nationally and internationally [28]. The AusMAT comprises multi-disciplinary teams of doctors, nurses, paramedics, pharmacists, fire-fighters (logisticians), allied health and environmental health staff [28].

Building capacity in rehabilitation (including regional capacity)

Several countries in the Asia-Pacific region do not have adequate rehabilitation capacity in terms of human resources, services and funding. The regional member countries need to develop self-sustaining rehabilitation capacity (at various levels) and collaborate in capacity building to manage the after math and impact of disasters in the longer-term. The ASEAN collaboration can be much more effective. The International Society of Physical and Medical Rehabilitation established it's Committee for Disaster Relief to enhance capacity building in medical rehabilitation with focus on the Asia- Pacific. Further, the WHO published the 'Classification and Minimum Standards for Foreign Medical Teams in Sudden Onset Disasters' in 2013 [19] which provides guiding principles and core standards for all FMTs, and recommends rehabilitation as a minimum standard. The 'Emergency Medical Teams: Minimum Standards for Rehabilitation' document (in draft) provides guidance and standards on rehabilitation requirements such as elements of rehabilitation service provision, workforce, quality assurance for patient management, equipment and consumables, accessibility, information management; research and development (personal communication with the publication team).

Person-centred multidisciplinary care

All survivors should be assessed with individualised care plans including rehabilitation [2, 13, 14]. The post-disaster MD team may include: PMR physicians, treating medical/surgical and allied health personnel. Treatment goals should be non-discriminatory and aligned with UN Convention of the Rights of Persons with Disabilities [19].

Improve communication (information gathering, sharing and disseminating)

Improvement in accessibility and overcoming information barriers are a priority in any disaster effort. Data should be collected by relevant services, with a 'lead' governing agency facilitating and coordinating this information for dissemination to relevant authorities for longer-term management in the community [14, 23]. Fostering understanding and learning from past experiences in disaster management through knowledge exchange and greater access to information/data is crucial for future capacity building and planning.

Increase public awareness and active participation/inclusion of disaster survivors/family/community partners

Personal preparedness and active participation of the survivors (and families) should be included in decision making and goal setting, which contribute to effective longer-term management. Disaster survivors should be empowered and educated to actively

participate in, and contribute to, the development and monitoring of treatment plans, programs and actions.

Strengthen evidence-based information, education and access to information

Access to information and knowledge in post-disaster management can be fragmented and inequitable [29]. Timely dissemination of information enables active participation and contribution from treating teams. All stakeholders (and related organisations) with expertise should be considered for knowledge transfer and education. Multi-stakeholder partnerships should build and implement evidence-based disaster-management approaches for informed decisions and effective action. Regular data collection during disaster management enhances reporting and accountability for disaster survivors. These data can highlight clinical gaps in care so lessons may be learnt for future disaster management. Governments should collaborate with treating teams and community organisations to implement and define existing and new commitments.

Strengthen community-based rehabilitation

Various initiatives should be in place to empower and strengthen community-based organisations for longer-term rehabilitation of disaster survivors (especially women, children, older and disabled persons) in the community. Inclusive risk reduction strategies prior to and after a disaster should reduce vulnerability, and mitigate the impact of disaster and further loss of life. Further, the government should assure the socio-economic security of individuals and communities, where possible.

Summary

The Asia-Pacific region remains highly vulnerable to frequent natural disasters. Disaster risk and disaster-related human suffering are escalating due to the emerging effects of climate change, population growth, rapid urbanization, development patterns and growing poverty. The lessons from past disasters show that building longer-term management approaches (including rehabilitation) remain a key priority in any disaster-management plan. The longer-term health consequences and disability can be overwhelming for the survivors (their families), society and the health system. The year 2015 marks the end of the 'Hyogo Framework for Action', and the beginning of a new 15-year plan – the 'Sendai Framework for Disaster Risk Reduction 2015-2030', which sets up an agenda for all sectors of society for collaborative effort for successful future disaster planning and management [30].

Disaster management in a broader sense is consequently a burgeoning field in the developing world. At a national level, the capacity building approach needs to include the development of an integrated disaster risk management plan; emergency response management; inter-sectoral and interdisciplinary partnership amongst governmental, private, national and international sectors; increasing public awareness and involving the victims and their families in the management plan; longer-term care and rehabilitation of victims; and strengthening community-based rehabilitation. Longer-term management of disaster survivors requires diverse forms of multi-stakeholder partnerships (including governmental bodies, local health-care institutions, NGOs and civil society organizations) related to persons with disabilities, FMTs, community organisations and the private sector.

Effective future disaster management will depend on the capacity and willingness of countries and communities across the region to embrace and disseminate effective methods of disaster risk governance and preparedness, and develop appropriate policies for a collaborative and coordinated management system. The challenge ahead is develop a comprehensive, targeted and integrated approach to disaster risk management and post-disaster management (including rehabilitation), stretching across sectors and jurisdictions and reaching vulnerable communities at risk.

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References

[1]. ReliefWeb Project (2008) Glossary of humanitarian terms. Available from: www.reliefweb.int/glossaries
[2]. Khan F, Amatya B, Gosney J, Rathore FA, Burkle FM Jr. (2015) Medical Rehabilitation in Natural Disasters: A Review. Arch Phys Med Rehabil 96(9): 1709-1727.
[3]. Vos F, Rodriguez J, Below R, Guha-Sapir D (2010) Annual Disaster Statistical Review 2009: The Numbers and Trends. Centre for Research on the Epidemiology of Disasters (CRED), Brussels. 1-37.
[4]. Brassard C, Giles DW, Howitt AM (2015) Natural Disaster Management in the Asia-Pacific: Policy and Governance, In: Disaster Risk Reduction: Methods, Approaches and Practices. Springer , Kyoto, Japan.
[5]. Economic and Social Commission for Asia and the Pacific (ESCAP) (2015) Disasters Without Boarders: Regional Resilience for Sustainable Development. Asia-Pacific Disaster Report United Nations, Bangkok.
[6]. Economic and Social Commission for Asia and the Pacific (ESCAP) (2015) Disasters in Asia Pacific: 2014 year in review. United Nations, Bangkok.
[7]. Butt S, Hitoshi N, Nottage L (2014) Asia-Pacific Disaster Management. Comparative and Socio-legal Perspectives. Springer, Heidelberg.
[8]. Economic and Social Commission for Asia and the Pacific (ESCAP) (2015) Economic and Social Survey of Asia and the Pacific. United Nations, Bangkok.
[9]. International Council for Science (2008) Science plan on hazards and disasters: earthquakes, floods and landslides. ICSU Regional Office for Asia and Pacific, Kuala Lumpur, Malaysia.
[10]. Simpson A, Cummins P, Dhu T, Griffin J, Schneider J (2008) Assessing natural disaster risk in the Asia-Pacific region. AusGeo News 90.
[11]. Economic and Social Commission for Asia and the Pacific (ESCAP) (2014) ESCAP Annual Report. United Nations, Bangkok.
[12]. Independent Evaluation Department (2012) ADB's Response to Natural Disasters and Disaster Risks. Asian Development Bank (ADB).
[13]. Reinhardt JD, Li J, Gosney J, Rathore FA, Haig AJ, et al. (2011) Disability and health-related rehabilitation in international disaster relief. Glob Health Action 4: 7191.
[14]. Rathore FA, Gosney JE, Reinhardt JD, Haig AJ, Li J, et al. (2012) Medical rehabilitation after natural disasters: why, when, and how? Arch Phys Med Rehabil 93(10): 1875-1881.
[15]. Gosney J, Reinhardt JD, Haig AJ, Li J (2011) Developing post-disaster physical rehabilitation: role of the World Health Organization Liaison Sub-Committee on Rehabilitation Disaster Relief of the International Society of Physical and Rehabilitation Medicine. J Rehabil Med 43(11): 965-968.
[16]. Dhameja A (2008) Disaster rehabilitation: towards a new perspective. In: Disaster management handbook. CRC Press, FL, USA.
[17]. World Health Organization (2011) World Report on Disability. WHO, Geneva, Switzerland.
[18]. Landry MD, McGlynn M, Ng E, Andreoli A, Devji T, et al. (2010) Humanitarian response following the earthquake in Haiti: reflections on unprecedented need for rehabilitation. World Health Popul 12(1): 18-22.
[19]. Norton I, von Schreeb J, Aitken P, Herard P, Lajolo C (2013) Classification

and Minimum Standards for Foreign Medical Teams in Sudden Onset Disaster. WHO, Geneva.
[20]. United Nations (2006) Convention on the Rights of Persons with Disabilities. http://www2.ohchr.org/english/law/disabilities-convention.htm.
[21]. World Health Organization (2014) WHO global disability action plan 2014–2021: Better health for all people with disability. WHO, Geneva.
[22]. Khan F, Amatya B, Mannan H, Burkle FM Jr, Galea MP (2015) Rehabilitation in Madagascar: Challenges in implementing the World Health Organization Disability Action Plan. J Rehabil Med 47(8): 688-696.
[23]. Nickerson JW, Chackungal S, Knowlton L, McQueen K, Burkle FM (2012) Surgical care during humanitarian crises: a systematic review of published surgical caseload data from foreign medical teams. Prehosp Disaster Med 27(2): 184-189.
[24]. Rathore MF, Rashid P, Butt AW, Malik AA, Gill ZA, et al. (2007) Epidemiology of spinal cord injuries in the 2005 Pakistan earthquake. Spinal Cord 45(10): 658-663.
[25]. Landry MD, O'Connell C, Tardif G, Burns A (2010) Post-earthquake Haiti: the critical role for rehabilitation services following a humanitarian crisis. Disabil Rehabil 32(19): 1616-1618.
[26]. Gosney JE Jr. (2010) Physical medicine and rehabilitation: critical role in disaster response. Disaster Med Public Health Prep 4(2): 110-112.
[27]. Smith E, Wasiak J, Sen A, Archer F, Burkle FM Jr. (2009) Three decades of disasters: a review of disaster-specific literature from 1977-2009. Prehosp Disaster Med 24(4): 306-311.
[28]. National Critical Care and Trauma Response Centre (2015) Australian Medical Assistance Teams (AUSMAT) http://www.nationaltraumacentre.nt.gov.au/what-we-do/disaster-management/ausmat.
[29]. Olness K, Sinha M, Herran M, Cheren M, Srivieng P (2005) Training of Health Care Professionals on the Special Needs of Children in the Management of Disasters: Experience in Asia, Africa, and Latin America. Ambul Pediatr 5(4): 244-248.
[30]. United Nations Office for Disaster Risk Reduction (2015) Sendai Framework for Disaster Risk Reduction 2015-2030. UNISDR, Geneva.
[31]. Becker SM (2009) Psychosocial Care for Women Survivors of the Tsunami Disaster in India. Am J Public Health 99(4): 654-658.
[32]. Berger R, Gelkopf M (2009) School-Based Intervention for the Treatment of Tsunami-Related Distress in Children: A Quasi-Randomized Controlled Trial. Psychother Psychosom 78(6): 364-371.
[33]. Zang Y, Hunt N, Cox T (2013) A randomised controlled pilot study: the effectiveness of narrative exposure therapy with adult survivors of the Sichuan earthquake. BMC Psychiatry 13: 41.
[34]. Huang Y,Wong H (2013) Effects of social group work with survivors of the Wenchuan earthquake in a transitional community. Health Soc Care Community 21(3): 327-337.
[35]. Hu X, Zhang X, Gosney JE, Reinhardt JD, Chen S, et al. (2012) Analysis of functional status, quality of life and community integration in earthquake survivors with spinal cord injury at hospital discharge and one-year follow-up in the community. J Rehabil Med 44(3): 200-205.
[36]. Li Y, Reinhardt JD, Gosney JE, Zhang X, Hu X, et al. (2012) Evaluation of functional outcomes of physical rehabilitation and medical complications in spinal cord injury victims of the Sichuan earthquake. J Rehabil Med 44(7): 534-540.
[37]. Ni J, Reinhardt JD, Zhang X, Xiao M, Li L, et al. (2013) Dysfunction and post-traumatic stress disorder in fracture victims 50 months after the Sichuan earthquake. PLoS One 8(10): e77535.
[38]. Xiao M, Li J, Zhang X, Zhao Z (2011) Factors affecting functional outcome of Sichuan-earthquake survivors with tibial shaft fractures: a follow-up study. J Rehabil Med 43(6): 515-520.
[39]. Zhang X, Hu XR, Reinhardt JD, Zhu HJ, Gosney JE, et al. (2012) Functional outcomes and health-related quality of life in fracture victims 27 months after the Sichuan earthquake. J Rehabil Med 44(3): 206-209.
[40]. Zhang X, Reinhardt JD, Gosney JE, Li J (2013) The NHV Rehabilitation Services Program Improves Long-Term Physical Functioning in Survivors of the 2008 Sichuan Earthquake: a longitudinal quasi Experiment. PLoS One 8: e53995.

CHAPTER 5

Overview of Medical rehabilitation in natural disasters in the Pacific Island Countries

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Study III

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Co-Author Statement is provided in *Appendix 11*.

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Special Article – Disability and Rehabilitation

Overview of Medical Rehabilitation in Natural Disasters in the Pacific Island Countries

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Abstract

Pacific Island Countries (PICs) are one of the most natural disaster-prone regions in the world. Natural disasters in Pacific region are mainly due to meteorological (storm, typhoons), hydrological (flood, wet mass movement); and/or climatological (extreme temperature, drought, wildfire/bushfire) causes. This article presents a regional overview of medical rehabilitation status, and strengths and challenges for medical rehabilitation in natural disaster settings. In most PICs, rehabilitation medicine is still in infancy stage. In disaster settings, acute response and care protocols focusing on saving lives and treating acute injuries get most attention, whilst, rehabilitative needs are not prioritized in many cases. Operational/managerial factors seem to most impact rehabilitative care of disaster victims in PICs, these include: lack of systems and care protocols; limited provision of effective rehabilitation inclusive education, training and awareness-raising programs, funding issues, poor leadership, planning and communication, infrastructure, human resources, and poor institutional arrangement. Rehabilitation-inclusive disaster management plan is needed for longer-term management of disaster victims.

Keywords: Natural disaster; Rehabilitation; Pacific Island Countries; Disability; Disaster response

Abbreviations

CRDR: Committee on Rehabilitation Disaster Relief; ESCAP: Economic and Social Commission for Asia and the Pacific; GDP: Gross Domestic Product; ISPRM: International Society of Physical and Rehabilitation Medicine; OCHA: Office for the Coordination of Humanitarian Affairs; ODA: Official Development Assistance; PICs: Pacific Island Countries; PHT: Pacific Humanitarian Team; SIDS: Small Island Developing States; ROP: Regional Office for the Pacific; SOPAC: Pacific Islands Applied Geoscience Commission; SNAP: Strategic National Action Plans; UN: United Nations; WHO: World Health Organisation.

Introduction

The Pacific Island Countries (PICs) consist of 14 countries, divided into three zones: Micronesia, Melanesia and Polynesia [1]. The region has a population of about 9 million people, majority (about 80%) living in rural areas [2]. Of these, it is estimated 800,000 people have some form of disability [2]. The PICs are among the most isolated countries geographically with about 1000 islands scattered over an area across 180 million square kilometres of ocean (Figure 1) [3,4]. Further, small land areas and economies with low diversification, limited natural resources, poor infrastructure and limited capacity, paucity of human and financial resources, and significant distances to major markets have affected development and often led to a high degree of economic volatility [3,4]. The region is unique and diverse biologically, socio-economically and culturally. Papua New Guinea (PNG) is the largest among the group (population of > 6.7 million), while Niue, with an estimated population of 1000 being a smallest member. Amongst the PICs, Kiribati is one of the most remote and geographically-dispersed countries in the world, with 33 coral atolls spread over 3.5 million km^2 of ocean (area larger than India), while Solomon Islands is scattered with almost 1,000 small islands and atolls [5]. Depending on their specific social, economic and environmental vulnerabilities, the United Nations (UN) have categorised all PICs as small island developing states (SIDS). In most PICs, agriculture and fisheries are the primary source of income. Many countries are heavily dependent on overseas support, with half receiving Official Development Assistance (ODA) exceeding 30% of their Gross Domestic Product (GDP) [5]. Five PICs (Kiribati, Samoa, Solomon Islands, Tuvalu and Vanuatu) are categorised amongst the UN's least developed countries, reflecting low incomes, weak human assets (nutrition, health, education) and economic vulnerability (Table 1) [5].

Natural Disaster in the PICs

Natural disasters are escalating worldwide, including in the PICs [6]. The PICs are classified amongst the world's top 30 most vulnerable nations to natural disasters [5,6]. High disaster-risk in the region is mainly due to seismically active fault lines, major ocean basins, major typhoon tracks and susceptibility to hydrological disasters due to climate change-related events (such as rising seas, increasing drought and rainfall etc.) [7,8]. The geographical conditions of small low lying island states in the region isolated by vast expanses of ocean, increase their vulnerability to climate-related hazards and different types of natural disasters, predominantly: meteorological (cyclones, tropical storm, typhoons); hydrological (flood, wet mass movement); climatological (increasing sea level rise, extreme temperature, drought, wildfire/bushfire). Of the total of 3,979 disasters that occurred globally between 2005 and 2014, almost half (over 1,625) occurred in the Asia-Pacific region [8]. This resulted in half a million

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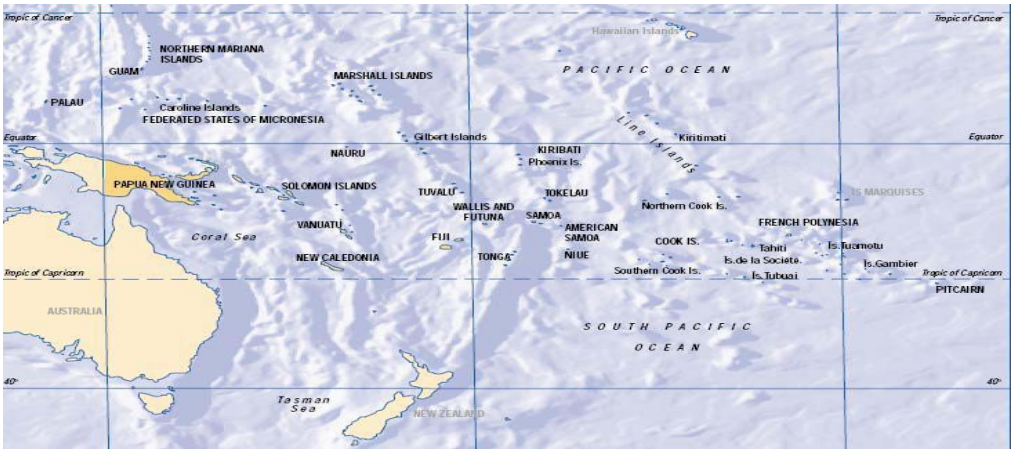

Figure 1: Pacific Island Nations and Territories. Source UNEP 2009, Russell 2009 [3,4].

Table 1: Pacific Island Countries (alphabetical) - geographical and socio-economic features.

Country	Sub-Region	Population ('000s)	Area (km^2)	GDP per capita (US$)	GDP growth	HCP* (per 1000 population)
Cook Islands	Polynesia	20	237 (15 islands)	10,875	-1.2%	11
Federated States of Micronesia	Micronesia	111	701 (59 islands)	2,183	-2.9%	3
Fiji	Melanesia	864	18,273 (322 islands)	3,499	0.2%	3
Kiribati	Micronesia	100	811 (36 islands)	1,490	3.8%	4
Marshall Islands	Micronesia	64	181 (34 islands)	2,851	1.2%	4
Nauru	Micronesia	10	21 (1 island)	2,071	-0.1%	11
Niue	Polynesia	1	259 (1 island)	9,618	5.6%	13
Palau	Micronesia	21	444 (31 islands)	8,423	2.0%	7
Papua New Guinea	Melanesia	6,745	462840 (151 islands)	897	7.0%	0.6
Samoa	Polynesia	179	2,785 (7 islands)	2,672	4.5%	2
Solomon Islands	Melanesia	550	30,407 (138 islands)	1,014	7.3%	2
Tonga	Polynesia	104	650 (67 islands)	2,629	1.2%	4
Tuvalu	Polynesia	10	26 (10 islands)	1,831	2.5%	6
Vanuatu	Melanesia	245	12,281 (81 islands)	2,218	6.6%	2

Adapted from Duncan D 2011 (5) and Gero et al 2013 [35].
*HCP: Health Care Professional (doctors, nurses, midwives); GDP: Gross Domestic Product.

fatalities (equates to 60% of total global disaster –related deaths) and estimated over 1.4 billion people affected (constituting 80% of total affected globally due to disasters) [8]. The economic losses owing to these disasters were estimated > US $523 billion [8]. Hydrological disasters (such as floods and storms) are most common in the region, which cause higher economic damage relative to human toll. On average approx. 41 tropical cyclones occur each year in the Pacific region alone, making it the most destructive in terms of economic loss. According to the World Bank, the PICs suffer on average, combined disaster damages of more than US$280 million every year and cost some countries an average of up to 6.6% of GDP every year (global averages typically of 1.2%) [9]. Eight PICs (Vanuatu, Niue, Tonga, the Federated States of Micronesia, Solomon Islands, Fiji, Marshall Islands and Cook Islands) are amongst the 20 countries in the world with the highest average annual disaster losses scaled by GDP [9]. The economic impact in the region associated with natural disasters, are a significant barrier to growth of many countries [10]. A list of various kinds of natural disasters in the PICs between 1950–2004 is detailed in Table 2 and list of major disasters that occurred in the Pacific region between 2014 to 2015 are tabulated in Table 3.

Key Regional Initiatives in Disaster Management

Although PICs have achieved progress in terms of life expectancy, infant mortality rates, and infectious disease control etc., the economic growth, however, has been well below global average. Overall, the regional disaster management capacities and collaboration have improved in recent years and the PICs recognise the importance for

Table 2: Natural disasters in the Pacific Islands (1950–2004)*.

Natural disaster type	Number	Reported Fatalities	Population Affected**	Reported Losses (US$ Million)
Windstorms (Cyclones, tidal surges and storms)	157	1,380	2,496,808	$5,903.90
Droughts	10	0	629,580	$137.00
Floods	8	40	246,644	$94.80
Earthquakes	17	53	22,254	$330.60
Others (landslides, tsunamis, volcano eruptions, wild fires and epidemics)	15	274	21,520+	$60.00
Melanesia	110	1,130	2,115,332	$1,654.90
Polynesia	71	494	1,041,012	$1,797.40
Micronesia	26	123	260,662	$3,074.04
Total Pacific	207	1,747	3,417,006	$6,526.30

Adapted from Pacific Islands Applied Geoscience Commission (SOPAC) 2009 [11] [Source: World Bank 2006]
*All data excludes Papua New Guinea.
** Figures include both fatalities and total population affected.

Table 3: Major natural disaster in Pacific region (2014 - 2015).

Country	Year	Event	Number affected	Number displaced	Number killed
Kiribati	March, 2015	Cyclone Pam passed over as a category 2 story	2,000	-	-
Tuvalu	March, 2015	Cyclone Pam passed over as a category 2 story	4,600	350	-
Vanuatu	March 10-13, 2015	Cyclone Pam passed over as a Category 5 system	189,000	4,000	11
Vanuatu	March 10-13, 2014	Cyclone Lusi passed over as a Category 2 system	20,000	149	10
Federated States of Micronesia	March 29 and April 1, 2015	Typhoon Maysak made landfall at Chuuk on Ulithi and Yap	29,700	1,500	4
Palau	November 7, 2013	Super Typhoon Haiyan passed directly over the island of Kayangel	2,300	900	
Solomon Islands	April, 2014	Three days of heavy rain caused flash floods	52,000	10,000	22
Marshall Islands	March 3, 2014	King tides inundated Majuro Atoll and some outer islands	1,730	940	
Tonga	January 11, 2014	Cyclone Ian passed directly over the Ha'apai Group as a Category 5 system	5,000	2,335	1

Source: Office for the Coordination of Humanitarian Affairs (OCHA).

disaster planning and management initiatives [11]. In line with other countries in the Asia-Pacific, there is growing attention in the PICs on disaster prevention and preparedness, especially early warning systems, early evacuation and awareness. The United Nations (UN) regional arm the Economic and Social Commission for Asia and the Pacific (ESCAP) (1947) was established as an inter-governmental forum for all countries and territories of Asia and Pacific region, and currently has 53 members and 9 associate members covering more than 60% of the world's population (4.1 billion people). Early in 1994, all PIC governments agreed on a common strategy for disaster reduction at the World Conference on Natural Disaster Reduction held in Yokohama, Japan [12]. In 1999, UN Office for the Coordination of Humanitarian Affairs (OCHA) established a Regional Office for the Pacific (ROP), with aim to mobilize and coordinate effective and principled humanitarian action in the region in partnership with national and international actors. In 2008, the OCHA ROP established the Pacific Humanitarian Team (PHT) to improve the timeliness, effectiveness and predictability of humanitarian response and coordination of humanitarian action using a regional cluster approach in the region, by bringing together humanitarian actors in the region to support governments. Currently, the OCHA ROP supports all 14 Pacific Island countries. Australia is the key funder of disability initiatives in the PICs under its "Development for All" strategy [2].

At the regional level, Pacific Forum Islands Leaders in 2005 approved the Pacific Disaster Risk Reduction and Disaster Management Framework for Action 2005 – 2015 (Madang Framework) [11]. The key activities under this framework to date include: Pacific Catastrophe Risk Financing Mechanism (under development); Regional Tsunami Exercise and Pacific Disaster Net (online virtual Center of Excellence) [13]. In 2006, to support capacity-building in disaster-risk management in the PICs, Pacific Disaster Risk Management (DRM) Partnership Network was established comprising more than 30 regional and international organizations [11,13]. This Partnership Network is assisting and supporting the PICs to develop and implement Strategic National Action Plans (SNAP) for disaster risk management with funding from major donors such as European Islands and Australian Aid (AusAID) [11]. Other key objective of this network is to sustain a regional network of development partners that work in the different areas of disaster management to improve regional cooperation, coordination and collaboration; strengthen thematic areas identified in the 2005-15 Pacific Framework for Action; monitor and evaluate national progress; reduce duplication of efforts and ensure assistance is built on the efforts and experiences of each other [13]. Many PICs currently have the SNAP, while in some countries processes are underway to develop this action plan.

In August 2010, the Pacific Platform for Disaster Risk Management (PPDRM) Framework for Action 2010–2015 was adopted, to enhance disaster risk management in the PICs. Currently, most counties in the region have some form of legal and regulatory frameworks for managing disaster risk [14]. Regional cooperation mechanisms developed include a range of activities, such as Pacific Risk Exposure Database, Regional Specialized Meteorological Center for Tropical Cyclone in Nadi, Pacific Tsunami Warning Center, Melanesian Volcanological Network and others [13]. Unfortunately, major disparities and gaps amongst the PICs exist, and those with high disaster risk tend to have low coping capacity [8,15]. People in these region are vulnerable to the future natural calamities as they live in more exposed areas and have weak livelihoods and few resources [8,15]. In recent international forum, at the third UN World Conference in Sendai, Japan (March 18, 2015), leaders and decision-makers across the region adopted a new global framework for disaster risk reduction - the 'Sendai Framework for Disaster Risk Reduction 2015-2030' [16]. The Sendai Framework is successor instrument to the 'UN Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters' and was developed on elements which ensure continuity with the work done by States and other stakeholders under the 'Hyogo Framework' [16]. This new framework introduces innovations and emphasises on disaster risk management as opposed to disaster-management. Further, the Sendai Framework broadened disaster risk reduction significantly to focus on both natural and man-made hazards and related environmental, technological and biological hazards and risks; and provides a strong foundation for governments to take on a greater role at all levels [16]. Similar to the 'Hyogo Framework', the 'Sendai Framework' is also based on voluntary commitment of the member states. As many argue that the 'Hyogo Framework' was limited in its capacity to move certain actions forward [14], it is still unclear whether the 'Sendai Framework' will have similar difficulty.

Medical Rehabilitation in Disaster Settings

With advances in rescue and field management in disasters, survival rates have improved significantly worldwide [17]. However, rates of long-term physical disabilities, and mental and psychological disorders related to disasters are on the rise, requiring integrated interdisciplinary longer-term collaborative care from the acute phase of disaster to community reintegration [18,19]. There is a strong consensus amongst the disaster management authorities, that long-term rehabilitation planning is critical [19-21] and integral part of the comprehensive disaster management of victims [22]. The main aims of medical rehabilitation in disaster settings include: collaboration in the management of acute injury, optimization of functional capabilities (including cognitive, neuropsychological function) post-acute care, and social re-integration [18,23]. The role of rehabilitation physician/team in disaster settings is extensive and has an array of activities such as: coordination and assessment of injury patterns and post-disaster rehabilitation needs; valuation of resource requirements (including long-term); establishment of patient triage, discharge, referral, and tracking systems; collaboration with other healthcare service providers (local and international); coordination with emergency response systems, host health system and government managers; data collection, management and analysis and others [17,18].

The medical rehabilitation process should be initiated immediately (early) during the emergency response phase, and should continue in the community over a longer-term [19,24]. There is strong evidence that early involvement of rehabilitation programs can reduce disability, improve participation and quality of life of disaster victims [17,18,21]. Further, studies conducted in previous disasters have demonstrated that involvement of rehabilitation physician in the disaster management, results in positive and improved disaster victims' clinical outcomes, reduced length of hospital stay and fewer complications [25,26]. Despite the evidence, regrettably, often emergency responses and disaster management do not extend to include rehabilitation services [17]. In many disasters, the acute response and care protocols focusing on saving lives and treating acute injuries get utmost attention, and rehabilitative needs are often ignored [18,21,27].

Rehabilitation approach for disaster victims should include a wide spectrum of treatments and interventions [17,18]. The importance of rehabilitation services and need for inclusion of rehabilitation in response and planning for humanitarian catastrophes are well documented [24,28]. This review did not find any evidence of inclusion of rehabilitation professionals in emergency-response staffing configuration in any of disasters in the Pacific region. Similar to previous disasters worldwide, there are immense challenges for rehabilitation personnel, particularly, during the disaster settings in the PICs. These may include (but not limited to) [18,21,25,29]:

- Rehabilitation services do not exist and/or are in infancy stage in many PICs, and in many PICs these services are usually integrated within other health services in public hospitals (mainly in urban areas)
- Limited number of services specific for complex disaster-related disabilities
- During disasters, existing host-healthcare infrastructure (including rehabilitation services) may be damaged and/or disrupted or overwhelmed by the influx of disaster victims
- Discharge from healthcare facilities/community re-integration can be challenging due to lack of appropriate, accessible housing
- Poor coordination amongst disaster management organisations (national and international)
- Limited number of skilled human resources locally-few or no rehabilitation professionals
- Inadequate community rehabilitation resources and facilities
- Limited provision of psychological support and cognitive rehabilitation
- Lack of reporting, assessment, measurement and data collection tools
- Deployment to the affected areas can be complicated by damaged and/or disrupted infrastructure, such as roads, transport, communications etc.
- Cultural beliefs and practice of the people affected about

disability and the disaster itself

- Challenges posed by distance, diverse languages, cultural differences and geographic barriers

- Cost of access to rehabilitation services can be a barrier for victims due to lack or limited provision of disability support and government health plans

Identified Gaps for Action

Natural disasters potentially have significant consequences and serious economic implication for the PICs [11,14]. The challenges in disaster management are common for most developing countries, including PICs. Despite progress in surveillance and early warning systems and evacuations, overall Asia and Pacific region is still largely unprepared in disaster management [14]. Most importantly, some of the Pacific countries at greatest risk for natural disasters are those that are the least developed to manage these disaster-related risks [4,11]. The PICs recognise the immense challenges ahead for effective disaster risk management [11]. There is urgent need for investments in disaster risk reduction and disaster management in the Pacific region. This will not only improve physical and psychosocial disabilities of the disaster victims, but also result in significant economic benefit to the governments and community. For example, it is estimated that investment in reduction of coastal erosion in Kiribati can achieve net economic returns of a minimum of A$1.1 million [11,30]. The PICs seems to be heading in the right direction and are considering improving prospects for national development, through supporting investment in disaster risk reduction, climate change adaptation and disaster management [11]. Improved regional information exchange, strengthened regional cooperation for effective post-disaster management and joint coordination to address cross-border disasters are critical for disaster management [6,14,31].

With escalation of natural disasters, there is greater focus on the role of medical rehabilitation in disaster management worldwide. Many disaster survivors, mainly with severe injuries such as those with traumatic brain injuries (TBI), spinal cord injuries (SCI), and musculoskeletal injuries necessitate long-term planning for service delivery and rehabilitation [26]. Therefore, rehabilitation services and community care need to be prioritised in regional disaster management programs. Some issues and perspectives for consideration by the PICs for future disaster planning, include [29,32,33]:

- Leadership role of the central national healthcare ministry/ organisation to coordinate and provide cooperative effort in disaster management to enhance capacity (national and international health care organisations, NGOs and Emergency Medical Teams)

- Robust inter-disciplinary and inter-sectoral partnerships need to be stimulated for disaster management, preparedness, emergency response and long-term planning

- All national and international representative organisations (including NGOs, disability-related society) should be recognised as important stakeholder group and included in disaster management agenda and processes, especially rehabilitation

- Develop comprehensive disaster management system

- Building capacity in rehabilitation (including regional capacity) and improving collaboration between all health care services

- Person-centred interdisciplinary care which includes rehabilitation of all survivors

- Service provision (including funding) of assistive devices such as crutches, prostheses, wheelchairs etc., when appropriate

- Treatment goals must be non-discriminatory and require alignment with key international Human Rights and principles of the UN Convention of the Rights of Persons with Disabilities

- Improve communication (information gathering, sharing and disseminating), cost-effectiveness and proactive technologies

- Information needs to disseminate to relevant authorities for longer-term management

- Fostering knowledge exchange and greater access to information/data for future capacity building

- Increase public awareness and active participation/ inclusion of disaster survivors/family/community

- Leadership guidance from the governmental and other relevant authorities for training and empowerment and educational programs for healthcare professionals in regards to disasters and disability

- Rehabilitation capacity building at national health level and other relevant institutions for development of skilled workforces

- Access to information to enable active participation and contribution from treating teams

- Bilateral assistance for disaster victims: health security, financial, job creation, resources tailored to country characteristics

- Strengthen evidence-based information, data and knowledge

- Build grass root capacity for disasters preparedness

- Strengthen community-based rehabilitation

Discussion

Natural disasters (and related human-suffering) are escalating worldwide due to many factors, including: emerging effects of climate change, population growth, rapid urbanization, development patterns and poverty. Pacific region remains one of the most susceptible and exposed to natural disasters. The region is diverse geographically, economically, culturally and politically, which impede disaster risk reduction and effective management. Sustained disaster management progress in the region will require long-term cooperation by international partners and donors to provide lifesaving response and recovery assistance to victims when disasters strike. More broadly, greater economic integration, public awareness and education, more equitable resource, more innovative methods and adaptation to climate change will be needed for long-term management of future disasters in the PICs.

Long-term health consequences and disability affect many disasters victims, their family/carers, society and the overall health system. The National Action Plan for disaster management for PICs should include comprehensive long-term rehabilitation inclusive

management approach. The 'Sendai Framework for Disaster Risk Reduction 2015-2030', sets up an agenda for all government and sectors of society for collaborative effort for successful future disaster planning and management. The PICs are formulating their National Action Plans and other initiatives for disaster management and risk reduction. At national level, the capacity building approach needs to include the development of integrated disaster risk management and emergency response management plan, with inter-sectoral and interdisciplinary partnership amongst governmental, private, national and international sectors. The disaster management plan should consist long-term care and rehabilitation of the victims, which will require strengthening of community based organizations and more involvement of disaster victims and their families in planning.

Natural disaster management is acquiring a global attention. A futuristic perspective would have to look into the outlines of previous disaster experiences and come up with a systematic disaster rehabilitation strategy. The UN and WHO are key global actors with relevance to shaping disaster vulnerability and management in the PICs. Explicitly, the WHO Disability and Rehabilitation (DAR) Team works to support Member States to develop appropriate, effective and sustainable rehabilitation programs for persons with disabilities arising from all causes and has a number of collaborating partners and networks of rehabilitation experts [34]. The role of the WHO Liaison Sub-Committee on Rehabilitation Disaster Relief (CRDR) of the International Society of Physical and Rehabilitation Medicine (ISPRM) is vital in future disasters to facilitate coordination among major rehabilitation providers responding to the many needs in disasters, to minimize delay and duplication in the deployment and to deliver timely and effective rehabilitative care to the victims [19]. Many recent developments and initiatives could be regarded as the much needed steps, this includes the drafting of the 'Emergency Medical Teams: Minimum Standards for Rehabilitation' (in Print-personal communication), which define standards for rehabilitation in emergencies acknowledging that variations in type and patterns of injury, disease and subsequent long-term disability that arise in different scenarios. In consonance with the new perspective, coordination and collaboration with other organisations (both national and international) in the field of disaster relief, rehabilitation and recovery, is crucial for future. Further, in post-natural disaster recovery phase, is important that the government ensures that investments in healthcare and health infrastructure are designed for long-term sustainability and is innovative. The government planning should also emphasise successful community reintegration of disaster victims, revitalizing the culture of community resiliency.

Conclusion

Natural disasters result in significant numbers of severely injured who require comprehensive and protracted rehabilitation. Management of survivors in future disasters will require diverse forms of multi-stakeholder partnerships, including partnership with governmental bodies, local health care institutions, NGOs and INGOs, civil society organizations related to persons with disabilities, EMTs, community organisations and private sector. The successful and effective future disaster management will depend on the capacity and willingness of the PICs to embrace and disseminate effective methods of disaster risk governance and preparedness, and develop appropriate policies, regulations and legislations. The challenges ahead are developing a comprehensive, targeted and integrated approach to disaster risk management. Furthermore, there is a need for long-term rehabilitation inclusive post-disaster management strategies, stretching across all government and non-governmental sectors and jurisdictions, and vulnerable communities.

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References

1. WHO/SOPAC. Sanitation, hygiene and drinking water in the Pacific island countries: converting commitment into action (ISN 978-92-9061-401-2). Geneva: World Health Organization; 2008.
2. Pacific Islands Forum Secretariat. Pacific Disability Rights Framework 2016-2025 (Draft). Box Hill, Australia: Australian Disability and Development Consortium (ADDC); 2016.
3. United Nations Environment Programme (UNEP). Pacific Islands environment outlook. SPREP 2000. 2000.
4. Russell L. Poverty, climate change and health in Pacific Island Countries. Sydney: University of Sydney; April 2009.
5. Duncan D. Freshwater under threat: Pacific Islands. Bangkok: Regional Office for Asia and the Pacific, United Nations Environment Programme (UNEP); November 2011.
6. Economic and Social Commission for Asia and the Pacific (ESCAP). Economic and Social Survey of Asia and the Pacific. Bangkok: United Nations; 2015.
7. International Council for Science. Science plan on hazards and disasters: earthquakes, floods and landslides. Kuala Lumpur, Malaysia: ICSU Regional Office for Asia and Pacific; June 2008.
8. Economic and Social Commission for Asia and the Pacific (ESCAP). Disasters Without Boarders: Regional Resilience for Sustainable Development. Asia-Pacific Disaster Report Bangkok: United Nations; 2015.
9. Okuyama Y, Sahin S. Impact estimation of disasters: a global aggregate for 1960 to 2007. Washington, D.C.: World Bank; 2009.
10. Bettencourt S, Croad R, Freeman P, Hay J, Jones R, King P, et al. Not if but When, Adapting to natural hazards in the Pacific Islands Region. A policy note. Pacific Islands Country Management Unit: World Bank; 2006).
11. Pacific Islands Applied Geoscience Commission (SOPAC). Economic costs of natural disasters in the Pacific Islands region and measures to address them. Rarotonga, Cook Islands: Forum Economic Ministers' Meeting October 2009.
12. Hamnett MP. Natural disaster mitigation in Pacific Island Countries: a policy guide for planners and decision-makers: South Pacific Disaster Reduction Programme; 1995.
13. United nations office for Disaster Risk Reduction. Progress and Challenges in Disaster Risk Reduction: A contribution towards the development of policy indicators for the Post-2015 Framework on Disaster Risk Reduction Geneva, Switzerland: UNISDR; 2014.
14. 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.
15. Simpson A, Cummins P, Dhu T, Griffin J, Schneider J. Assessing natural disaster risk in the Asia-Pacific region. Aus Geo News 90. 2008.
16. United Nations Office for Disaster Risk Reduction. Sendai Framework for Disaster Risk Reduction 2015-2030. Geneva: UNISDR; 2015.
17. Reinhardt JD, Li J, Gosney J, Rathore FA, Haig AJ, Marx M, International

Society of Physical and Rehabilitation Medicine's Sub-Committee on Rehabilitation Disaster Relief. Disability and health-related rehabilitation in international disaster relief. Glob Health Action. 2011; 4: 7191.

18. 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.

19. Gosney J, Reinhardt JD, Haig AJ, Li J. Developing post-disaster physical rehabilitation: role of the World Health Organization Liaison Sub-Committee on Rehabilitation Disaster Relief of the International Society of Physical and Rehabilitation Medicine. J Rehabil Med. 2011; 43: 965-968.

20. Dhameja A. Disaster rehabilitation: towards a new perspective. In: Pinkowski J, editor. Disaster management handbook. FL, USA: CRC Press, 2008.

21. 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.

22. Thomas-Crusells J, McElhaney JE, Aguado MT. Report of the ad-hoc consultation on aging and immunization for a future WHO research agenda on life-course immunization. Vaccine. 2012; 30: 6007-6012.

23. Khan F, Amatya B, Hoffman K. Systematic review of multidisciplinary rehabilitation in patients with multiple trauma. Br J Surg. 2012; 99 Suppl 1: 88-96.

24. 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.

25. Gosney JE Jr. Physical medicine and rehabilitation: critical role in disaster response. Disaster Med Public Health Prep. 2010; 4: 110-112.

26. Rathore MF, 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.

27. Khan F, Amatya B, Mannan H, Burkle FM Jr, Galea MP. Rehabilitation in Madagascar: Challenges in implementing the World Health Organization Disability Action Plan. J Rehabil Med. 2015; 47: 688-696.

28. Landry MD, O'Connell C, Tardif G, Burns A. Post-earthquake Haiti: the critical role for rehabilitation services following a humanitarian crisis. Disabil Rehabil. 2010; 32: 1616-1618.

29. 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.

30. Greer Consulting Services. Kiribati Technical Report, Economic Analysis of Aggregate Mining on Tarawa (EU EDF 8 – SOPAC Project Report). Suva, Fiji: Pacific Islands Applied Geoscience Commission (SOPAC) March 2007.

31. Economic and Social Commission for Asia and the Pacific (ESCAP). Disasters in Asia Pacific: 2104 year in review. Bangkok: United Nations; 2015.

32. Khan F, Amatya B, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward. Phys Med Rehabil Int. 2015; 2: 1070.

33. Butt S, Hitoshi N, Nottage L. Asia-Pacific Disaster Management. Comparative and Socio-legal Perspectives. Heidelberg: Springer, 2014.

34. World Health Organization. Disasters, disability and rehabilitation. Geneva, Switzerland: WHO, Department of Injuries and Violence Prevention; 2005.

35. Gero A, Fletcher SM, Rumsey M, Thiessen J, Kuruppu N, Buchan J, et al. Disaster response and climate change in the Pacific. Gold Coast, Australia: National Climate Change Adaptation Research Facility; 2013.

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CHAPTER 6

Rehabilitation Needs in Persons Following Spinal Cord Injury in Disaster Settings

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Study IV

Khan F, Amatya B, Dhakal R, Abbott G, Graf M, Ramirez S, Lowenthal K, Galea MP. Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes. International Journal of Physical Medicine & Rehabilitation 2015; 3: 316.

Co-authors Statements are provided in *Appendix 12*.

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Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes

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Abstract

Objective: To report on the use of a 'triage' clinical tool for rehabilitation decision-making process and outcomes in an acute disaster setting- the Nepal earthquake (EQ); and the lessons learnt.

Participants and Setting: Consecutive EQ victims with a spinal cord injury (SCI) (n=101) admitted to a Nepalese sub-acute medical facility.

Intervention: An accredited WHO Foreign Medical Team (FMT) from the Royal Melbourne Hospital was deployed to assist with priorities identified by the host institution: develop triage processes for clinical outcomes, identify barriers and train local healthcare professionals.

Results: The triage tool was clinically useful in identifying patients requiring immediate and urgent rehabilitation intervention for a range of disabilities. Mean age was 34.4 ± 15.1 years and female (53.5%) admitted 2-10 days following injury. Over two-thirds had SCI (78%) with common clinical issues: pain (74%), bladder (73%) and bowel dysfunction (58%), and pressure ulcers (33.3%). Participants reported symptoms consistent with post-traumatic stress. The 'triaging' and disability management plans were well received by staff, as patients were stream-lined for step-down facilities; during this process barriers were identified for future action.

Conclusion: A collaborative interdisciplinary approach using the triage tool improved clinical outcomes in the disaster-setting. Long-term planning should include early rehabilitation, community-based programs, accreditation, partnerships, and inclusion of persons with disability.

Keywords: Spinal cord injury; Rehabilitation; Earthquake; Disability, Disaster response; Foreign Medical Teams; Health outcome

Introduction

Nepal, a Himalayan nation (area of 147,181km2) in South Asia has over 27.8 million inhabitants [1]. It ranks in the 'low' income group with gross national income per capita (2013) of US$2260, placing it 145th on the World Bank Human Development Index [2]. Only 18% of Nepalese people live in urban areas, and an estimated 24% of the total population live below the poverty line of less than $1 per day [1]. The median age of the population is 20.1 years with a life expectancy of only 66.2 years [1]. The literacy rate among adults aged 15 years and above is 65.9% (2011) [3].

A 7.8-magnitude earthquake erupted in Nepal on 25th of April 2015 (11:56 am local time), with the epicentre approximately 80km northwest of the capital, Kathmandu. This was followed by continuous aftershocks with two earthquakes over 6.1 magnitudes. Three weeks later, on 12 May the country was struck again by a 7.3 magnitude tremor with epicentre near Mount Everest (76km northeast of Kathmandu), causing further deaths, injuries and destruction in the affected area. As of 22nd May 2015, the Ministry of Health and Population (MoHP) confirmed: greater than 5.6 million people affected by the earthquake, 2.8 million displaced, 8,633 deaths, 103,686 injured and more than one million homes destroyed nationwide [4]. Subsequent tremors and aftershocks (>1200 recorded) triggered fresh landslides and avalanches, making the combined disaster the deadliest in the country's history. The mounds of rubble and debris created by the disaster impeded life-saving operations and access to affected areas, mainly the remote mountainous regions. The natural disaster affected 35 districts, of which 14 were severely damaged (80% of houses severely damaged) [4]. An estimated 1100 health facilities were damaged in the earthquake (456 completely, 690 partially destroyed), predominantly village health-posts which supply basic medicines and other routine services in remote communities, outside the Kathmandu valley [4]. The forthcoming monsoon further threatened the country's fragile transportation network, and the ongoing aid effort and rebuilding, while access to medical care remained a big challenge.

A total of 128 Foreign Medical Teams (FMTs) from 38 different countries were officially deployed in Nepal along with 47 National Medical Teams, based on expertise and capabilities [5]. This deployment was jointly coordinated by the Nepalese MoHP, the Health Emergency Operation Centre (HEOC) and the WHO Disaster-Management Committee. The MoHP reported 4.2 million people needed urgent health services and basic humanitarian assistance. As of 29 May, there were an estimated 200-300 patients with spinal cord injuries (SCI), and 40-60 amputees [6]. The need for rehabilitation care of injured persons was highlighted and as of current update there has been request for rehabilitation of over 250 severely injured persons from Kathmandu valley alone [5]. Currently, few facilities specialize in SCI rehabilitation in the Kathmandu valley, while others are transitional care centres.

In general, the Nepalese MoHP and general medical community (with the FMTs) coped well with the challenges presented by the earthquake. However, consistent with previous reports from earlier earthquakes (Haiti, Pakistan, China) [7-12], various gaps in disaster management processes and patient care were identified at both ground and management level. The aim of this report is to describe the use of a rehabilitation triage tool by the Australian FMT for patients following the Nepal earthquake, and to highlight lessons learnt to improve SCI care in future disaster settings. This effort was part of a much larger initiative of the WHO, to support the MoHP and set-up systems of care to stream-line clinical care for the EQ survivors and disaster management, and improve collaboration with various NGO's and community partners.

Methods

Setting

An Australian rehabilitation FMT from the Royal Melbourne Hospital (RMH) was deployed to a 40-bed Nepalese sub-acute medical facility on the 8th of May 2015, after the major earthquake on 25th April 2015. This clinical deployment was approved by the MoHP, the ISPRM, the RMH as well as the local facility. The local facility, a not-for-profit centre, is located in the outskirts of Kathmandu, and offers a range of rehabilitation services to patients (disproportionately from the poorer sections of Nepalese society), including vocational retraining. At the time of the EQ disaster, there were no Nepalese rehabilitation physicians working in Nepal. The only Nepali rehabilitation trainee (RD-author) (currently training in Bangladesh) was recalled to assist the disaster victims. The FMT worked with him, rehabilitation consultant from Bangladesh and the local nursing and allied health staff at the facility.

Procedure

The FMT underwent a full accreditation process by the WHO and the MoHP Nepal prior to deployment. The mission was to conduct a disability 'needs' assessment, assist in patient triage, care and outcomes for earthquake victims, and provide education and training to local staff for additional capacity. The FMT submitted daily surveillance reports and an exit report to both the MoHP and WHO rehabilitation sub-cluster as mandated; in addition, they attended the FMT Coordination meetings at MoHP, where possible.

Over an 8-day period, the 7 member-FMT (3 rehabilitation physicians, 2 nurses, 1 physiotherapist, 1 orthotist) conducted daily ward rounds with Nepalese rehabilitation staff. The FMT assumed a facilitator role in conducting daily triage and teaching clinical rounds and consensus case conference meetings with local staff. With interdisciplinary clinical input, a needs analysis was performed on day 1, which identified the need to triage all patients at the facility to streamline care and discharge planning processes. A field tool was designed and approved by local staff to plan patient clinical management and further care.

Data collection

All patients admitted to the centre after the earthquakes were assessed. All data was collected by the RMH team and the Chief Nepali Physician (RD), prospectively during the ward rounds by the treating FMT. All clinical and process-related information was shared with the local clinicians on the ward rounds for treatment plans, and feedback was incorporated. SCI was diagnosed on clinical presentation and available imaging, and documented by the neurosurgeon, spinal surgeon, or rehabilitation medicine specialist. The American Spinal Injury Association Impairment Scale (AIS) [13] was used to classify the severity of SCI.

On the third day of the RMH FMT deployment, the second 7.3 magnitude earthquake was experienced while clinical ward rounds were being conducted. The FMT was then involved in a 'new' disaster management plan, and assisted in the evacuation and care of the SCI patients, moving them into makeshift tents outside, until the hospital building was inspected and considered safe by MoHP.

Results

The RMH mission was a small part of the overall WHO effort. Unexpectedly, the RMH FMT witnessed a crisis situation, a 'disaster within a disaster' with the second earthquake creating additional challenges given the limited resources and staff at the centre. The facility was initially resourced for only 40 patients but had over 85 new patients admitted after the first earthquake, while another 20 awaited transport the day of the second earthquake. There was, however, strong leadership of coordinating and government bodies, such as MoHP, Nepal Health and Research Council (NHRC) and the WHO. The FMT team attended the briefings given by the FMT Coordination Committee, led by the Secretary of NHRC, a WHO representative, and representatives from the Nepalese Army and Police. Based on the 'needs' assessment and interactive feedback from the management staff, physicians and other health professionals, various activities at the medical facility were prioritised, and are described below.

Development of a triage tool

A user-friendly one-page structured clinical rehabilitation triage tool was developed on the first day of deployment (available from the Authors) with input from the local medical and therapy staff. The triage tool was used to identify patients who needed urgent and/or specific rehabilitation intervention, for ease of patient processing, for planning treatment and possible discharge from the facility. The triage tool included: patient demographics, a list of relevant disabilities (physical status, pain, continence), usual interventions, and psychosocial elements, e.g. discharge destination (step-down, home, community- based rehabilitation [CBR]). The tool was used in 101 consecutive patients admitted to the centre after the two earthquakes. The tool was well received by the staff, who found it helpful for their routine clinical practice. A decision was made to use it in the longer term, with minor adjustments to suit local needs. Unfortunately, many

patients identified as not having SCI (who could have been discharged into the community) had no homes to return to after the earthquake, and were to be housed in temporary step-down facilities set up by the MoHP.

Clinical triage tool audit

The demographics and clinical characteristics of consecutive inpatients are provided in Table 1. The mean age of participants (n=101) was 34.4 years (±15.1 years), range 11 to 86 years. Over half were female (53.5%), and many were blue collar workers (and students). Over two-thirds had SCI, while 19 patients (18.8%) had spinal fractures without SCI. More than two-thirds (n=74, 73.3%) had bladder problems and over half (58%) had bowel issues. Pressure ulcers were identified in one-third of all patients (33.3%). All participants reported some form of psychological trauma, which included severe anxiety, fear, or sleep disturbance, all symptoms consistent with post-traumatic stress disorder (PTSD). Three-quarters of the sample reported some degree of pain (n=75), one-quarter (25.7%) had neuropathic pain. The mean pain score on Visual Analogue Scale (VAS, 0=no pain to 10=extreme pain) was 3.8 ± 2.7 (ranging from 0 - 10) (Table 1).

Variables	n (%) [unless stated other wise]
Age years (Mean ± SD, range)	34.4 ± 15.1 (11 - 86)
Female	54 (53.5)
SCI	79 (78.2)
Spinal fracture without SCI	19 (18.8)
Other fractures/injuries	3 (3.0)
Comorbidities	23 (22.8)
Psychological trauma[#]	101 (100)
Physical disability (Paralysis)	59 (58.4)
Bladder issues	74 (73.3)
IDC	72 (71.3)
Intermittent catheter	3 (3.0)
UTI (lab evidence)	2 (2.0)
Fluid balance chart documentation	3 (3.0)
Bowel issues	
Constipation	57 (56.4)
Overflow with retention	2 (2.0)
Pressure ulcers (Grade I – IV)[*]	34 (33.7)
Positioning and alignment	81 (80.2)
Turning protocol	74 (73.3)
Pressure mattress	1 (1.0)
Daily skin inspection	78 (77.2)
Pressure area dressings	30 (29.7)
Pain VAS score (0-10) [Mean ± SD, range]	3.8 ± 2.7 (0 - 10)
Neuropathic	26 (25.7)
Musculoskeletal	24 (23.8)
Mixed	25 (24.8)
Discharge plan	
Rehabilitation	83 (82.2)
Step-down[**]	9 (8.9)
Home destroyed	92 (91.1)

Table 1: Socio-demographic and clinical characteristics of the participants (n=101). IDC=Indwelling catheter; n=Total Number; SCI=Spinal Cord Injury; SD=Standard Deviation; UTI=Urinary Tract Infection. [#]Psychological trauma includes severe anxiety, fear, sleep disturbance. [*]Recommended strategies for skin care. [**]Step-down=care facility funded by the MoHP in the community.

The triage tool findings were assessed every day after the ward round and discussed with the local clinical staff. All patients were grouped according to the major categories of triage: immediate mobilisation and/or rehabilitation, step-down, CBR, discharge home or unsuitable for rehabilitation. Of the 101 patients evaluated, only 9 were categorised as ready to be transferred to a step-down facility funded by the MoHP in the community; 83 required immediate rehabilitation (including mobilisation), with the remainder categorised as able to be discharged home upon recovery from their wounds and/or depending on their post-discharge living circumstances. The team also applied the reverse triage process [14] where possible by providing more attention to the most seriously injured patients, in order to utilise staff and scarce resources more appropriately.

Characteristics of SCI

Of the 79 participants with SCI, the majority (n=38.48%) had lumbar injuries, followed by thoracic level injuries (48%). Six participants had injuries at two different spinal levels. Almost one-third of the participants (n=26.33%) were classified as AIS A, while 23% were AIS B and 18% AIS C. One participant sustained a central cord syndrome, and one had a cauda equina injury (Table 2).

AIS*	SCI location					
	C1-C8	T1-T12	L1-L5	Below S1	Mixed	Total n (%)
A	4	7	11		4	26 (32.9)
B	2	7	8		1	18 (22.8)
C	2	3	9			14 (17.7)
D		7	5			12 (15.2)
E		1	5		1	7 (8.9)
CCS	1					1 (1.3)
CES				1		1 (1.3)
Total n (%)	9 (11.54)	25 (31.6)	38 (48.1)	1 (1.3)	6 (7.6)	79 (100)

[*]American Spinal Injury Association Impairment Scale (AIS) [13]:

A: Complete. No sensory or motor function is preserved in the sacral segments S4-S5.

B: Sensory incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5 (light touch, pin prick at S4-S5 or deep anal pressure), AND no motor function is preserved more than three levels below the motor level on either side of the body.

C: Motor incomplete. Motor function is preserved below the neurological level and more than half of key muscle functions below the single neurological level of injury (NLI) have a muscle grade less than 3.

D: Motor incomplete. Motor function is preserved below the neurological level and at least half of key muscle functions below the NLI have a muscle grade of 3 or greater.

E: normal.

Table 2: SCI level and AIS classification* of the participants (n=79). CCS: Central Cord sSyndrome; CES: Cauda Equina Syndrome; n: Total number; SCI: Spinal Cord Injury.

Clinical need and staff education

The RMH FMT integrated with 3 local staff teams (each had two physicians, one PT, one OT and two nurses). All teams conducted daily ward rounds and patient assessment, followed by 1-2 hours case-conference discussion to plan treatment. Further, the RMH FMT team conducted education and training on different issues, such as: fracture management/bracing; fracture classification; preventative care and SCI disability management; pain management; spasticity care; mobilisation program/precautions; management of contractures and complications of immobility; patient-centred care concepts; concurrent closed head injury (if relevant); diet, falls, pressure care and wound and psychological management.

Access to pain medications (especially agents for neuropathic pain), urinary catheters, intravenous lines, special pressure care dressings and antibiotics was challenging. Electricity cuts further limited usable sterilization equipment for wound management, suture removal etc. Materials and tools to fashion orthoses and spinal braces was particularly challenging in the setting. The FMT and local orthotists used available tools to adjust bracing. Pathology and imaging results for many SCI were limited or unavailable, as the facility was in a sub-acute setting and did not have these facilities on site. Many patients had no or limited post-surgical notes or precautions. There was limited ability to request neurosurgical or orthopaedic surgical advice, as acute hospitals at the time were overflowing with patients arriving with acute injuries from the earthquakes.

Despite these barriers, the RMH FMT recognised the local centre as a well-designed, spacious facility with dedicated clinical staff. The centre has partnerships with community organisations and strong fund-raising and advocacy programs. The RMH FMT conducted a leadership workshop for clinical staff on issues such as: team building; capacity building; rehabilitation processes and organisation; triage and prognosis; general ward set-up; models of care; systems of management of referrals; medical documentation and record keeping; patient-centred care and the need for evidence-based practice in SCI.

Identified gaps for action

Nepal faces various challenges in the long-term management of earthquake survivors. The healthcare focus for disaster management was primarily on acute care; rehabilitation services and community care were less prioritised. The SCI survivors are a vulnerable population requiring long-term planning for service delivery and rehabilitation. Early aggressive rehabilitation and preventative care in SCI has the potential to minimize complications such as pressure ulcers, constipation etc. Based on FMT experiences and feedback from participants in different workshops, the gaps and challenges identified were presented to the WHO Rehabilitation Sub-cluster (in the Daily Surveillance and Exit Reports), the MoHP and presented to the Director (and a board member) of the Nepalese facility on the 14th of May 2015. These included:

- Lack of access to timely neurosurgical advice regarding mobilisation following spinal surgery.
- Lack of beds (patients accommodated in corridors, even prior to 13th May earthquake).
- Lack of continuous electrical supply (e.g., for autoclaving).
- Lack of procedural training for volunteers and carers.
- Lack of emergency packs in case of evacuation.
- Lack of medical equipment such as glucometers, urine dipsticks, dressings etc.
- Limited imaging (MRI, CT, X Rays) and laboratory tests.
- **Orthotics/prosthetics** - tools needed for adjustments; no prefabricated devices.
- Limited materials (adequate supplies of gloves, dressings, tweezers, staple removers, torches etc.).
- Limited number of appropriate wheelchairs and cushions for seating, pillows and cushions for positioning patients in bed.
- Lack of pressure mattresses for patients with pressure ulcers.
- Very limited access to medical records or information on procedures performed on the spine following surgery.
- Limited information on surgical post-operative precautions or on wound management.
- Limited painkillers (especially for neuropathic pain), anticoagulants etc.
- Limited awareness of evidence-based practice.
- Limited psychological support.

Discussion

This is the first narrative report presenting a 'snapshot' of the on-ground experience of an FMT assessing and managing SCI patients during and after the major earthquakes in Nepal. Overall, the RMH FMT deployment was productive in providing assistance and management of SCI survivors. The FMT was able to improve clinical disability planning and patient management, educate/train staff and strengthen rehabilitation services. The team developed a one-page structured triage tool and used it for 101 SCI earthquake victims admitted to the facility during their deployment. The triage tool was well received by the clinical staff and assisted in patient flow and management.

Major earthquakes are devastating and associated with high death rates and mass casualties with many traumatic injuries. The earthquakes in Nepal resulted in significant loss of life and long-term disability from severe injuries, including SCI. They created a large socioeconomic burden with major economic loss and long-term negative consequences on human development, infrastructure and the environment. Despite focus on acute care in such settings, the importance of early rehabilitation focusing on prevention of complications in SCI patients cannot be over-emphasized. The importance and role of rehabilitation services during and after a natural disaster are discussed elsewhere [9,15-20]. There is consensus

amongst disaster management experts that medical rehabilitation should be initiated in the emergency response phase, and continued in the community over the longer-term to restore function and enhance participation of survivors [15,16,18].

Reports from previous humanitarian catastrophes suggest that, despite high quality care provided by FMTs in such situations, deployment of FMTs is not based on situational needs, with significant variation in capacities, clinical competencies and professional ethics [21]. Lack of coordination, systems for monitoring, and common terminologies, definitions and frameworks hindered evidence to guide future deployments and improvement of this system [22,23].

There was a strong consensus in the post-Haiti earthquake PAHO/WHO meeting in Cuba (December 2011), for the need for international standards, greater accountability, more stringent oversight, better coordination, and improved reporting [22]. A resolution recommending "a flexible mechanism for registration and accreditation of rapid-response FMTs with the goal of improving quality of medical response in coordination with WHO" was passed in 2012 [21]. Following this, recommendations from a technical expert group from the cuba meeting a FMT working group (FMT-WG) was created to oversee mechanisms for "complementarity" of FMTs, enhance their role and to coordinate their different services before deployment and on arrival [21,22]. A classification system for FMTs based on capabilities, professional standards and outline for the various processes for FMTs, such as on-site coordination/registration with national authorities and mechanisms for authorising arriving teams, has since been developed [21].

Many of these requirements and standards were applied and implemented in the current Nepalese disaster situation. Rehabilitative care had focal attention. However, as in previous disaster responses, more emphasis was on the acute response, saving lives and treating acute injuries. The role of acute rehabilitation and preventative care, especially in SCI, needs to be highlighted. The MoHP and WHO formed a Rehabilitation Sub-cluster for the FMTs, which included the RMH team and others. A requirement was the submission of daily surveillance reports and an exit report with needs assessments, gaps and recommendations to the MoHP.

The rehabilitation sub-cluster identified SCI care as a critical gap, and flagged funding with WHO and MoHP [24]. Recently, on 29th May 2015, the MoHP outlined a 2-year strategic plan for the emergency response and the recovery phase. This feeds directly into the health sector reconstruction, scaling-up of rehabilitation activities following emergencies, and longer-term strengthening of rehabilitation services and links with tertiary, district and grassroots levels. The government has established step-down rehabilitation centres offering nursing and rehabilitation, in and around Kathmandu, with capacity to accommodate over 700 patients [24]. This initiative ensured 100 free step-down beds in various facilities. Further, plans are nearing completion to establish fixed-point centres or step-down facilities in the worst affected districts and meeting with the main trauma centres to refine referral procedures [6]. However, this plan is yet to include comprehensive rehabilitation, preventative care (to minimize complications) and CBR programs for societal integration of SCI survivors. The role of early rehabilitation intervention, preventative strategies to prevent complications in SCI, subacute and community-based rehabilitation programs is critical. This may likely duplicate some assessment processes and compromise care provision to patients over time. The MoHP will need to develop minimum standards for rehabilitation facilities, integrate community-based rehabilitation, establish referral systems for care providers, invest in infrastructure, IT support, documentation and record keeping, and basic data collection to inform further action [17,25].

The Rehabilitation FMT team made various suggestions which need to be considered in future planning and responses to SCI management in disaster settings (Box 1).

Box 1: Lessons learned and the way forward

- More qualified personnel in rehabilitation medicine, nursing and allied health.
- Improved clinical reasoning.
- Improved processes relating to clinical documentation.
- Development of procedures for all process measures from admission to community discharge and longer-term follow-up.
- Development of a referral form and reporting systems for rehabilitation.
- Use of systems and processes for organised delivery of rehabilitation.
- Improved links with acute referrers.
- Expanded community-based rehabilitation through capacity-building.
- Access to capacity building initiatives such as courses, conferences, telemedicine, library, to upskill staff.
- Care-giver training (including PTSD education and support).
- Better communication and improved links with acute hospital referrers and post-discharge follow-up in the community.
- Increased use of information-technology to enhance Continuing Medical Education and promote available services for consumers.
- Increased clinical capacity through organised educational activities e.g. journal club.
- Delivery of evidence-based practice and encourage research.
- Development of Peer Support groups.
- Link with regional organisations, e.g. South Asian Association for Regional Cooperation (SAARC).
- Encouragement of overseas training and mentorship for staff.
- Registration of the Nepalese Rehabilitation Society with the International Society of Physical Rehabilitation Medicine (ISPRM).
- Provision of Key Performance Indicators, Standards of Care & accreditation criteria for Rehabilitation facilities by the MoHP.

Throughout the recent earthquakes, the Nepalese people maintained a positive attitude and a resilient spirit during this difficult time. This report supports the disaster initiatives, coordination and collaborative effort made by the Nepal MoHP and the FMTs. Significant improvements in FMT accreditation during these earthquakes were noted compared with previous Haiti and Pakistan earthquake reports [12,19]. However, much more work is needed to strengthen the disaster relief efforts. In our experience there were specific challenges working with some of the international non-governmental organisations. Efforts should be made for better accountability, use of existing resources, reliable data-sets for analyses in trends in morbidity and disability, and for community re-integration of injured persons. The latter however, was beyond the scope of our mission. The ISPRM can assist the WHO rehabilitation sub-cluster with formal policy on disaster management, advocacy and training, standards for rehabilitation in disaster settings, technical standards, rehabilitation leadership roles in FMTs, requirements for deployment, FMT staffing and configuration, referral and information management, assistive

devices and equipment, data collection, research and surveillance to inform future action. The psychological impact of earthquakes on survivors needs further study.

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References

1. World Health Organisation (2015) Nepal: WHO statistical profile.
2. http://www.who.int/countries/npl/en/
3. World Health Organisation (2013) WHO Country Cooperation Strategy: Nepal, 2013–2017. WHO Regional Office for South-East Asia, New Delhi, India.
4. Ministry of Health and Population: Government of Nepal (2015) Health Sector Response: Daily Situation Update Report: Nepal Earthquake 2015. Health Emergency Operation Centre: Kathmandu, Nepal.
5. Ministry of Health and Population: Government of Nepal (2015) Health Sector Response: Situation Update Report: Nepal Earthquake 2015. Health Emergency Operation Centre: Kathmandu, Nepal.
6. Ministry of Health and Population: Government of Nepal (2015) Injury Rehab Summary for Health Cluster MoHP, Kathmandu.
7. Burns AS, O'Connell C, Landry MD (2010) Spinal cord injury in postearthquake Haiti: lessons learned and future needs. PM&R 2: 695-697.
8. Chu K, Stokes C, Trelles M, Ford N (2011) Improving effective surgical delivery in humanitarian disasters: lessons from Haiti. PLoS Med 8: e1001025.
9. Landry MD, McGlynn M, Ng E, Andreoli A, Devji T, et al. (2010) Humanitarian response following the earthquake in Haiti: reflections on unprecedented need for rehabilitation. World Health Popul 12: 18-22.
10. Rauch A, Baumberger M, Moise FG, von Elm E, Reinhardt JD (2011) Rehabilitation needs assessment in persons with spinal cord injury following the 2010 earthquake in Haiti: a pilot study using an ICF-based tool. J Rehabil Med 43: 969-975.
11. Chen R, Song Y, Kong Q, Zhou C, Liu L (2009) Analysis of 78 patients with spinal injuries in the 2008 Sichuan, China, earthquake. Orthopedics 32: 322.
12. Rathore FA, Farooq F, Muzammil S, New PW, Ahmad N, et al. (2008) Spinal cord injury management and rehabilitation: highlights and shortcomings from the 2005 earthquake in Pakistan. Arch Phys Med Rehabil 89: 579-585.
13. Kirshblum SC, Burns SP, Biering-Sorensen F, Donovan W, Graves DE, et al (2011) International standards for neurological classification of spinal cord injury (revised 2011). J Spinal Cord Med 34: 535-546.
14. Awais S, Saeed A (2013) Study of the severity of musculoskeletal injuries and triage during the 2005 Pakistan earthquake. Int Orthop 37: 1443-1447.
15. Gosney J, Reinhardt JD, Haig AJ, Li J (2011) Developing post-disaster physical rehabilitation: role of the World Health Organization Liaison Sub-Committee on Rehabilitation Disaster Relief of the International Society of Physical and Rehabilitation Medicine. J Rehabil Med 43: 965-968.
16. Gosney JE (2010) Physical medicine and rehabilitation: critical role in disaster response. Disaster Med Public Health Prep 4: 110-112.
17. Gosney JE, Reinhardt JD, von Groote PM, Rathore FA, Melvin JL (2013) Medical rehabilitation of spinal cord injury following earthquakes in rehabilitation resource-scarce settings: implications for disaster research. Spinal Cord 51: 603-609.
18. Landry MD, O'Connell C, Tardif G, Burns A (2010) Post-earthquake Haiti: the critical role for rehabilitation services following a humanitarian crisis. Disabil Rehabil 32: 1616-1618.
19. Landry MD, Quigley A, Nakhle A, Nixon SA (2010) Implications of a gap between demand and supply for rehabilitation in post-earthquake Haiti. Physiother Res Int 15: 123-125.
20. Rathore FA, Gosney JE, Reinhardt JD, Haig AJ, Li J, et al. (2012) Medical rehabilitation after natural disasters: why, when, and how? Arch Phys Med Rehabil 93: 1875-1881.
21. Foreign Medical Team Working Group (5 May 2013) Registration and coordination of Foreign Medical Teams responding to sudden onset disasters: the way forward.
22. Burkle FM, Nickerson JW, von Schreeb J, Redmond AD, McQueen KA, et al. (2012) Emergency surgery data and documentation reporting forms for sudden-onset humanitarian crises, natural disasters and the existing burden of surgical disease. Prehosp Disaster Med 27: 577-582.
23. Lind K, Gerdin M, Wladis A, Westman L, von Schreeb J (2012) Time for order in chaos! A health system framework for foreign medical teams in earthquakes. Prehosp Disaster Med 27: 90-93.
24. Himalayan News Services (2015) Step-down centres for those injured in earthquake. The Himalayan Times.
25. Khan F, Amatya B, Gosney J, Rathore FA, Burkle FM (2015) Medical Rehabilitation in Natural Disasters: A Systematic Review. Arch Phys Med Rehabil 96: 1709-1727.

CHAPTER 7

Medical Rehabilitation in Natural Disasters: an Australian perspective

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Study V

Khan F, **Amatya B**. Rehabilitation medicine critical to disaster relief. Medical Journal of Australia InSight. Published online 29 August 2016.
Link: http://www.doctorportal.com.au/mjainsight/2016/33/rehabilitation-medicine-critical-to-disaster-relief/

Co-author Statement is provided in *Appendix 13*.

29 August 2016

Rehabilitation medicine critical to disaster relief

Authored by
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WITH the increasing frequency of natural disasters, there is a greater need for rehabilitation medicine in disaster management. Unfortunately, most disaster response plans, particularly rehabilitation services, are generally inadequate or absent in many disaster-prone countries in our region (here and here).

Natural disasters are escalating worldwide, including earthquakes, drought, floods, volcanic eruptions, and dry and wet mass movement. The economic and human exposure to disaster risk has increased due to combined effects of climate change, population growth, urbanisation and poorly planned development. The human toll is an estimated 100 000 deaths annually. Most of them (97%) occur in low-resourced regions with significant economic loss and long term negative consequences on development. Over 40% of the world's disasters in the past decade have occurred in the Asia-Pacific region. The survival of a family in a developing country is dependent on the main breadwinner. Economic losses from natural disasters have increased 10-fold in the past 4 decades to more than $100 billion annually.

The response to the most recent natural disasters has led to improvements in international and regional collaboration and management capacities in disaster management. In 2005, the Australian Government Disaster Recovery Committee was established to provide guidance and coordinate the implementation of tailored disaster recovery assistance measures following natural disasters.

Australia is recognised globally for disaster-risk management, expertise in governance, preparedness, hazard identification and technological innovation. It has played a significant role in the region with an investment of over $100 million per annum in the past 4 years. The National Critical Care and Response Centre in Darwin (funded by the Australian Government) runs a training course for the Australian Medical Assistance Team – health professionals who are experts in their fields – and provides them with skills to practise in disaster settings. These trained staff have been involved in various deployments.

Natural disasters are unexpected but can cause great destruction, mass casualties, and complex and long term disabling injuries (eg, spinal cord injury, acquired brain injury, multiple trauma and psychological impairment) that require interdisciplinary management, especially medical rehabilitation (here and here). The mortality and morbidity vary depending on the location, type and amplitude of disasters, demographic and environmental factors. Advances in emergency field response have improved survival rates; however, the morbidity due to injuries and the social consequences has increased.

There is evidence that if medical rehabilitation is initiated in the immediate emergency response phase and continued in the community until treatment goals are achieved (here, here and here), there is a reduction in disability, improvement in clinical outcomes and increased participation of disaster victims. The focus of rehabilitation is on management of acute injury and related complications, optimisation of functional capabilities (including physical, cognitive, neuropsychological etc), longer term care and social reintegration (here and here). The processes for implementing rehabilitation programs include: assessment of evolving and long term injury patterns and rehabilitation needs and resource requirements; patient triage, discharge, referral and tracking systems; collaboration with other health care service providers; and coordination with emergency and health care systems and other relevant stakeholders (here and here).

Barriers to rehabilitation services include limited access, fragmented health care systems — compromised by lack of financial and political support — and lack of a skilled workforce (here and here). In large-scale disasters, local existing health services can be overwhelmed (here and here). Limited capacity, in particular the availability of rehabilitation professionals, can compromise management (here and here).

The role of a rehabilitation medicine physician is crucial in any disaster event and needs to be integrated within the multidisciplinary field-medical teams (here, here and here). Unfortunately, rehabilitation services are considered a low priority in disaster settings not only in many developing countries, where rehabilitation services are underdeveloped (here and here), but also in Australia, where we have a strong medical rehabilitation workforce. There are major disparities between countries; those with high disaster risk have low-coping capacity, scarce resources and populations living in more exposed areas (here and here). Also, global organisational capacities and capabilities are limited, with mismatched resources across the entire disaster cycle such that prevention, preparedness and rehabilitation have been consistently neglected.

For example, following the 2010 Haiti earthquake, there was an influx of humanitarian organisations, but many were not experienced and posed challenges for the overall coordination of aid effort, including the rehabilitation sector. An estimated 40% of amputations performed could have been avoided (here and here). A third of the total number

of deaths that occurred days or weeks after the impact could have been prevented by improved trauma care.

This led to implementation, by the World Health Organization Emergency Medical Teams Initiative, of standards and accreditation for accountability and improved reporting systems for humanitarian agencies, including the rehabilitation sector (here and here). The WHO standards currently recommend the implementation and early access to rehabilitation during both the response and longer term phase in the community.

The newly drafted ([in print], personal communication, 2016), but yet to be implemented, *WHO emergency medical teams: minimum standards for rehabilitation* defines standards for rehabilitation in emergencies, acknowledging variations in type and patterns of injury, disease and subsequent long term disability.

Australia has a strategic location in the Asia-Pacific region and plays a major role in assisting regional partners for capacity building and planned response to disasters, for example, following the recent cyclones. However, it is an omission that medical rehabilitation is not included in our disaster response and planning.

The engagement of our local rehabilitation medicine workforce and strong partnerships are needed with key stakeholders, such as the WHO Disability and Rehabilitation Team, which develops effective and sustainable rehabilitation programs for persons with disabilities. Collaboration with international rehabilitation medicine organisations, such as the WHO Liaison Sub-Committee on Rehabilitation Disaster Relief of the International Society of Physical and Rehabilitation Medicine, in future disasters will facilitate a coordinated rehabilitation response to disasters.

The Royal Melbourne Hospital (RMH) is a leader in recognising this and supported the deployment of a rehabilitation multidisciplinary team to the recent earthquakes zones in Nepal, in May 2015, and in the Hindu Kush region, in November 2015. The RMH rehabilitation team effort was endorsed by the Australasian Faculty of Rehabilitation Medicine of the Royal Australasian College of Physicians.

Despite the fact that there has been significant investment in acute medical care and disaster-risk reduction and in view of the increase in morbidity from injuries which require medical rehabilitation, there is an urgent need to incorporate medical rehabilitation into disaster-response teams. The input of rehabilitation is crucial to minimise disability and facilitate social reintegration of disaster victims.

The challenge is for the key players in the region (government, non-government and professional bodies) to develop a comprehensive, targeted and integrated approach to disaster planning and management, which must include medical rehabilitation.

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CHAPTER 8

General Discussions and the Way Forward

Study VI

Part of this section is published online (Appendix 2):

Amatya B, Galea MP, Li J, Khan F. Medical rehabilitation in disaster relief: towards a new perspective. Journal of Rehabilitation 2017;49: Epub ahead of print. doi: 10.2340/16501977-2250

This chapter provides a general discussion of the thesis and outlines overall findings from the preceding chapters 3 to 7. A comprehensive description of challenges in disaster management, current developments and the way forward in this area are discussed. Finally, implications for clinicians and researchers in this area are outlined.

8.1 Overview of the thesis

This thesis reviewed medical rehabilitation in natural disasters with a particular focus on the role, current developments, and issues and gaps relating to rehabilitation during disasters. It outlines the current status of rehabilitation and challenges in disaster-prone regions. The five studies listed in the Chapters 3 to 7 used mainly qualitative approaches.

Study I systematically evaluated the effectiveness and safety of medical rehabilitation intervention for survivors of natural disasters and lists the gaps in evidence for medical rehabilitation in this area. This review was the first to evaluate and accumulate evidence for the effectiveness of medical rehabilitation for effective short and longer-term management of natural disaster survivors. In **Studies II and III**, the status of medical rehabilitation in natural disasters in the Asia-Pacific region and Pacific Island Countries (where the majority of natural disasters occur) were scrutinized and potential challenges faced by the countries in the region in disaster response and management, including rehabilitation, was discussed. Both studies are the first in the region to comprehensively describe the significance of rehabilitation and its need in disaster management, and provide insight into important steps for shaping disaster vulnerability and management for medical rehabilitation in the region. In **Study IV** the personal experience of the Royal Melbourne Hospital Rehabilitation EMT during the 2015 Nepal earthquakes and lessons learnt to improve the outcomes of persons with spinal cord injuries during this

disaster were highlighted. To our knowledge this study is first to use and validate a rehabilitation triage tool in disaster settings for spinal cord injury survivors to improve triage and planning of patients across the care continuum. **Study V** provides commentary on the role of rehabilitation in natural disasters and current developments and challenges from the Australian perspective. Finally, **Study VI** highlights the challenges in disaster management and current developments in rehabilitation during disasters, including potential challenges and key steps forward in implementation of the recently published WHO guideline for minimum standards for rehabilitation in emergencies. (Based on Discussion section)

8.2 Key issues addressed in this thesis

The series of studies compiled in this thesis address various issues and limitations of the existing literature in disaster rehabilitation, and complexity in providing rehabilitation in disaster settings. The key issues identified included:

- Sparse literature
- Heterogeneity and the spectrum of problems in survivors of natural disasters
- Lack of systematic evidence supporting rehabilitation intervention for victims of natural disasters
- Limited information regarding the effectiveness of specific 'components': duration, timing and intensity of rehabilitation interventions
- Lack of standardized, user-friendly and sensitive assessment and outcome measurement tools
- Challenges in conducting methodologically rigorous studies (e.g. RCTs) in disaster settings

- Lack of comprehensive rehabilitation models, guidelines/protocols
- Difficulties and challenges associated with care delivery
- Lack of structured system that facilitates communication and agreement on findings between treating clinicians/clinical teams
- Lack of incorporation of patient perspectives in rehabilitation programs and involvement of victims and/or carers/family in the decision-making process
- Lack of incorporation of goal-setting, especially in Community-Based Rehabilitation (CBR), with respect to functions that are most important to the patients and families

8.3 Summary of findings of individual studies

Study I provides the best available evidence to support the effectiveness of medical rehabilitation intervention in natural disaster survivors. Overall, ten studies (2 randomized controlled trials, 8 observational studies) investigated a variety of medical rehabilitation interventions for natural disaster survivors, ranging from comprehensive multidisciplinary rehabilitation to community educational programs. The interventions evaluated were heterogeneous and differed in many aspects, including characteristics, type and intervention goals, number and extent of the intervention components, duration and intensity, and mode of delivery. The majority of the interventions included physical activity and psychosocial care as rehabilitation intervention component. The findings suggested that there is some evidence for medical rehabilitation for survivors of natural disasters in producing short and long-term gains for functional activities (activities of daily living, physical activity, etc.), impairments (e.g., psychological symptoms), and participation (quality of life, social reintegration). There was no evidence for cost-effectiveness of these programs and for the best type/mode/intensity (frequency, duration) of

intervention or superiority of one intervention over another. The study also highlighted scarce research and a lack of robust, methodologically strong studies in this area.

Summary of key findings:

- A variety of medical rehabilitation interventions were trialled in survivors of natural disasters; these ranged from comprehensive multidisciplinary rehabilitation to community educational programs, the majority including physical and/or psychological components.
- The rehabilitation intervention was found to be the strongest predictor of increased and sustained functional gain, improved health-related quality of life.
- A long-term structured and coordinated rehabilitation services program (comprising NGOs, local health departments, and professional rehabilitation volunteers) for earthquake survivors, significantly improved physical functioning.
- Psychological rehabilitation intervention (structured in-community psychological care) significantly improved psychosocial symptoms (PTSD, depression, stress etc.).
- The majority of studies had methodologic limitations and no data were available for associated costs and safety of these interventions.
- More methodologically robust studies are needed to build evidence for rehabilitation programs, cost-effectiveness, and outcome measurement in such settings.
- The findings highlight the need to incorporate medical rehabilitation into response planning and disaster management for future natural catastrophes.

- Access to rehabilitation and investment in sustainable infrastructure and education are crucial.

Study II provides information on medical rehabilitation status in natural disaster settings in the Asia-Pacific region, the most disaster-prone region in the world, with over 40% of the world's disasters occurring here in the past decade. The region is prone to all types of disasters, including earthquakes, cyclones, landslides/floods, drought and bush-fires. Between 2005 and 2014, there were half a million disaster-related fatalities (almost 60% of the total global deaths related to disasters), and over 1.4 billion people affected. There were significant economic losses resulting from these disasters and it is projected that by the year 2030, the region could average $160 billion per year of annual disaster-related economic losses. Currently, there is increased attention on disaster prevention and preparedness in the region, especially early warning systems, early evacuation (for hydrological disasters) and awareness. However, many countries are still largely unprepared for response to mega-disasters. In many countries, disaster response plans and rehabilitation services are generally inadequate or absent. Their fragmented healthcare systems are compromised by lack of financial and political support. Some of the key initial perspectives which need consideration for future rehabilitation-inclusive disaster planning in this region, include: collaboration and governance; building capacity in rehabilitation (including regional capacity); provision of person-centered multidisciplinary care; improvement in communication (information gathering, sharing and disseminating); increase in public awareness and active participation/inclusion of disaster survivors/family/community partners; strengthening of evidence-based information, education and access to information and strengthening community-based rehabilitation.

Summary of key findings:

- The Asia-Pacific region is the most disaster-prone region in the world, with over 40% of the world's disasters occurring here in the past decade.
- The Asia-Pacific region remains the most susceptible to natural disasters and has the highest disaster risk potential as the world's two most seismically active fault lines cross many countries in this region.
- Currently, there is greater focus on the role of rehabilitation in disaster response and management in the region and there have been improvements in international and regional collaboration, and management capacities in disaster management.
- Despite progress in surveillance and early warning systems and evacuations, the Asia-Pacific region is still largely unprepared for its response to mega-disasters. In many past disasters, the main focus of disaster management has been in acute care services in emergency responses and has not extended to include rehabilitation services.
- There is strong evidence from the studies conducted in the region demonstrating that early rehabilitation and preventative care in disaster survivors has the potential to minimize complications, optimize early recovery and reduce the economic burden.
- There are many challenges for rehabilitation professionals during disasters due to significant geo-political, socio-economic and cultural diversity in the region.
- At a national level, strong leadership and governance from the healthcare authorities is needed for healthcare capacity building (including rehabilitation), which include development of an integrated

disaster risk management plan; rehabilitation-inclusive emergency response and disaster management strategy; inter-sectoral and interdisciplinary partnership amongst governmental, private, national and international sectors; increasing public awareness and involving the victims and their families in the management plan; longer-term care and rehabilitation of victims; strengthening community-based rehabilitation and fostering research and knowledge transfer.

Study III provided a regional overview of medical rehabilitation status, and strengths and challenges for medical rehabilitation in natural disaster settings in Pacific Island Countries (PICs), one of the most natural disaster-prone regions in the world. Meteorological (storm, typhoons) and hydrological (flood, wet mass movement); and/or climatological (extreme temperature, drought, wildfire/bushfire) are the most frequent disaster in the region. The region is diverse geographically, economically, culturally and politically, which impedes disaster risk reduction and effective management. As in other countries in the Asia-Pacific region, in most PICs, rehabilitation medicine is still in the infancy stage. Experience from past disasters has demonstrated that acute response and care protocols focusing on saving lives and treating acute injuries receive most attention, whilst rehabilitative needs are not prioritized in many cases. Operational/managerial factors seem to impact most rehabilitative care of disaster victims. Sustained disaster management progress in the region will require long-term cooperation by international partners and donors to provide lifesaving response and recovery assistance to victims. The study highlighted the need for rehabilitation-inclusive disaster management plans for longer-term management of future disaster victims, stretching across all government and non-governmental sectors and jurisdictions, targeting vulnerable communities.

Summary of key findings:

- Pacific Island Countries (PICs) are one of the most natural disaster-prone regions in the world, mainly due to meteorological (storm, typhoons), hydrological (flood, wet mass movement); and/or climatological (extreme temperature, drought, wildfire/bushfire) causes.
- The PICs recognize the importance for disaster planning, and management initiatives and regional disaster management capacities and collaboration have improved in recent years.
- In past disasters, acute response and care protocols focusing on saving lives and treating acute injuries have received most attention, whilst in many cases, rehabilitative needs are not prioritized.
- In most PICs, rehabilitation services do not exist or are still in the infancy stage.
- Operational/managerial factors seem to most impact rehabilitative care of disaster victims in PICs, these include: lack of systems and care protocols; limited provision of effective rehabilitation inclusive education, training and awareness-raising programs, funding issues, poor leadership, planning and communication, infrastructure, human resources, and poor institutional arrangement.
- Rehabilitation-inclusive disaster management plans are needed for longer-term management of disaster victims.
- Successful and effective future disaster management will depend on the capacity and willingness of the PICs to embrace and disseminate effective methods of disaster risk governance and preparedness, and develop appropriate policies, regulations and legislations; and long-

term rehabilitation inclusive post-disaster management strategies, stretching across all government and non-governmental sectors and jurisdictions, and communities.

- There is a need for strengthening and developing regional collaboration and coordination regarding a rehabilitation-inclusive disaster management mechanism.

Study IV highlighted the personal experience of the 7-member RMH Rehabilitation EMT deployed to a SCI rehabilitation center following the 2015 Nepal earthquake, and described how development and use of rehabilitation triage tool by the team impacted patient care. The study highlighted lessons learnt in disaster setting to stream-line clinical care for the earthquake survivors and management, and improve collaboration with various NGOs and community partners, to improve care of patients with SCI. A field tool (*Appendix 14*), designed with input from local staff to plan patient clinical management, triage and further care, was found to be useful in identifying patients requiring immediate and urgent rehabilitation intervention for a range of spinal injury-related disabilities. The study also highlighted some gaps and challenges identified during the deployment, which were presented to the WHO Rehabilitation Sub-cluster, the Nepalese Ministry of Health and the local healthcare service. The study demonstrated that a collaborative interdisciplinary approach with local healthcare service in disaster settings was productive and feasible, and using simple user-friendly triage tool improved clinical outcomes of the disaster survivors.

Summary of key findings:

- In general, the Nepalese Government and local medical community (with the EMTs) coped well with the challenges presented by the earthquakes.
- The creation of a coordination cell with the help of the WHO-EMT initiative was valuable in helping local health authorities to address gaps and coordinate the deployment of the EMTs (both local and international) and maintain the minimum standards and professionalism required by these responding teams.
- The WHO and Ministry of Health and Population of Nepal formed a rehabilitation sub-cluster for the EMTs, which identified SCI as a critical group requiring early rehabilitation intervention and preventative strategies to prevent complications and restore functional capabilities.
- Various gaps in disaster management processes and patient care were identified at both ground and management level, which included a lack of proper documentation and assessment tools.
- An one-page structured clinical rehabilitation triage tool, which was developed based on needs assessment, with input from the local medical and therapy staff, was clinically useful in identifying patients requiring immediate and urgent rehabilitation intervention for a range of disabilities.
- The triage tool was used to identify patients who needed urgent and/or specific rehabilitation intervention, for ease of patient processing, for planning treatment and possible triage/discharge from the facility.
- Incorporation of the EMTs within the local teams was found to be effective and feasible not only in care delivery, but also in local capacity building, knowledge sharing/transfer, and identifying gaps for action.

- The key challenges for rehabilitation personnel in disaster settings are quick adaptation and cooperation with the local treating teams and operating/working independently with limited available resources (both equipment and human resources).

Study V provided a brief commentary, accentuating the role of rehabilitation in natural disasters and current developments and challenges from an Australian perspective. Australia is recognized globally for disaster-risk management, expertise in governance, preparedness, hazard identification and technological innovation. It has played a significant role in the pacific region in disaster responses and management.

Summary of key findings:

- Australia has a strategic location in the Asia-Pacific and plays a major role in assisting regional partners for capacity building and planned response to disasters.
- The Australian Government Disaster Recovery Committee (GDRC) was established in 2005, to provide guidance and coordinate implementation of tailored disaster recovery assistance measures following natural disasters.
- The GDRC has played a significant role in the region with investment of over $100 million per annum in the last 4 years.
- There is robust collaboration with regional partners with government and NGOs, including the World Bank (e.g. GFDR), UN agencies (e.g. UNISDR).
- The Australian Government funds the National Critical Care & Response Centre in Darwin, which runs the Australian Medical

Assistance Team (AusMAT) training course for health professionals to provide them with skills to prepare them for disaster settings.

8.4 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 calamities living in more exposed areas (11, 40). Disaster response plans and services are generally inadequate or absent in many disaster-prone countries (28, 41), and few have access to appropriate services such as rehabilitation, where healthcare systems are still fragmented (31, 42).

Lack of access to timely treatment and rehabilitation, particularly by poor and rural disaster survivors, will further contribute to deteriorating preexisting inequality in health for these cohorts. In large-scale disasters, local existing 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 (24, 28). Further, a shortage or lack of skilled healthcare (including rehabilitation) professionals and medical workforce can further hinder comprehensive management (37, 42). 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 (29). However, the influx of EMTs during past disasters presented immense challenges in regards to response coordination, management and

evaluation. Further, in many past disasters, deployment of medical teams was decided by the individual countries or organizations, and on many occasions these teams worked on their own, without any 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 (43). This resulted in significant challenges and inadequate care delivery, particularly in rehabilitation, with often devastating consequences for the affected individuals, families and communities (24, 26, 29). Furthermore, there is concern in regards to 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 of which were unregistered, and without standardized protocol, or coordination mechanisms in place (18, 43, 44). 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 (4, 44, 45). One study (17) showed that a significant proportion of deaths occurred days or weeks after the Haiti earthquake could have been prevented by improved patient care. Of the many EMTs deployed in Haiti, 44 were identified as having deployed in the first month alone. Of this, only 25% adhered to essential deployment requirements and none followed the full requirements of the WHO and/or Pan American Health Organization (PAHO) (46, 47). Due to the lack of data and transparency, it was impossible to determine the effectiveness of the care delivered by the first wave of EMTs (46). Likewise, during the 2004 Indian Ocean tsunami the number of EMTs deployed exceeded what was needed, given the rapid mobilization of local trauma teams from the affected countries

(43). Another review of the humanitarian response to the earthquake reported that despite the high quality of care provided by the EMTs, they were not coordinated and lacked common terminologies, definitions and frameworks, and many were not adapted to the medical needs of victims (47, 48).

8.5 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. The deficiency of the response to the 2010 Haitian earthquake in terms of poor coordination and management, insufficient/inappropriate patient care, in adequate documentation etc., catalyzed the international medical community to address these shortcomings, and requirements for greater accountability, stringent quality performance oversight, documentation and reporting, and a recognized process leading to professionalization of the emergency response teams (47, 49).

Some key developments in disaster management, including rehabilitation in last decade are summarized below:

1. The United Nations (UN) Office for Disaster Risk Reduction (UNISDR) leads the global response for international humanitarian crises. It initiates different programs 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 adopted by representatives of 168 member states at the World Conference on Disaster Risk Reduction in Kobe, Japan, in 2005 (3). Over the last ten years, although voluntary

and non-binding, the Hyogo ramework has been embraced by central and local governments, the private sector and civil society groups (3). Under this initiative, significant global progress has occurred in disaster risk management, including raising awareness, promoting prevention, preparedness and mitigation (50). 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 one 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 (3).

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 3) (25). The SFDRR is built on elements which 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 (25). 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 (25). The SFDRR specified 'rehabilitation' as a component of one of the key priorities (Priority 4, *Table 3*) (25). The term 'rehabilitation', however, is more inclined towards the infrastructure rehabilitation processes, rather than medical rehabilitative care of patients. Unfortunately, in this document, the medical rehabilitation of victims and the establishment of emergency

relief and healthcare 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 (51). Similar to the 'Hyogo Framework', the 'Sendai Framework' is also voluntary commitment of member states and depends on the capacity and willingness of countries to take concrete action (10, 41).

Table 3. Sendai Framework for Disaster Risk Reduction 2015-2030

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	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	By 2030: • 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

[Adapted from: UNISDR 2015 (25)] GDP = gross domestic product

3. The World Bank's '*Global Facility for Disaster Reduction and Recovery (GFDRR)*' is another key initiative committed to assisting developing countries, reduce their vulnerability to natural hazards, with a global partnership of over 45 countries and international organizations (54).

This initiative conducts post-disaster need assessments worldwide and supports national governments in recovery and reconstruction, to reduce costs of future disasters. It implements programs 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 (54). The GFDRR program, 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 programs focused on building capacity in rehabilitation medicine in its work plan for 2017 (55).

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 Emergency Medical Teams, EMT) *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 PAHO in 2012 (43). This is the precursor of current WHO-EMT unit and initiative.

The EMT program 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 (44). The first guideline, the '*Classification and Minimum Standards for Foreign Medical Teams in sudden onset*

disasters', was published in September 2013 (4). The EMT Initiative comprises 11 working groups, including a rehabilitation group. This document provided the benchmark requirements for medical teams seeking to respond to emergencies and coordinating their deployment by classifying teams according to their capability (4). *Table 4* lists the type of EMTs.

Table 4. WHO classification of Emergency Medical Teams (EMTs)

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

[Adapted from WHO 2016 (29)]

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

5. The *International Society of Physical and Rehabilitation Medicine (ISPRM)*, the leading international society in the field of rehabilitation, has prioritized the role of medical rehabilitation in disaster management in its agenda (52). In accordance with WHO-ISPRM Liaison initiative the

ISPRM Disaster Rehabilitation Committee (DRC) (Committee on Rehabilitation Disaster Relief) was officially formed at 5th ISPRM World Congress (Istanbul, Turkey, 2009), to advocate the physical and rehabilitation medicine perspective in minimizing disability and optimizing functioning and health-related quality of life in persons who sustain traumatic injury and those with pre-existing disability in a natural or man-made disaster (24, 53). The strategic objectives of the ISPRM DRC include: support ISPRM member National Society response to disasters; provide education and training resources on rehabilitation disaster management; host disaster rehabilitation programs/sessions at ISPRM congresses and other professional meetings; provide expert physical and rehabilitation medicine consultation to the WHO and other rehabilitation disaster management stakeholders; partner with the WHO, other international rehabilitation professional societies, and other organizations to advance global disaster rehabilitation policy and practice and perform and facilitate disaster rehabilitation research (53).

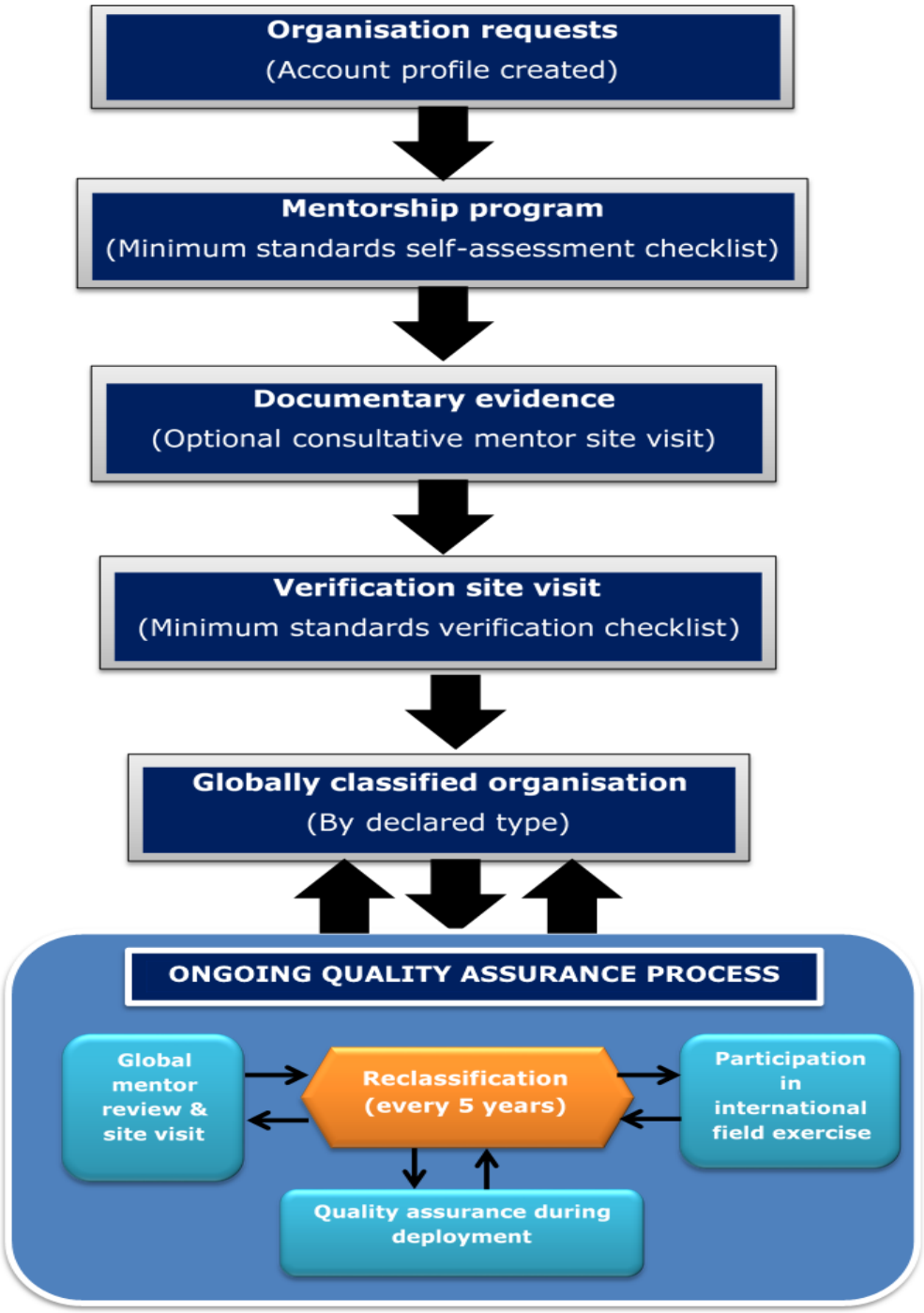
The committee's proposed work plan also includes: coordination with national rehabilitation societies via ISRPM WHO regional representatives to establish national society disaster committees; partner with local and national disaster authorities to develop a rehabilitation disaster response infrastructure that would strengthen local response capability and facilitate the international response depending on the scale of the disaster; building a rehabilitation disaster response capability in low-resource regions; establish a subject matter expert database (ISPRM members) and training in the policy and practice of disaster rehabilitation (24, 53). The ISPRM DRC was actively involved in the WHO-EMT initiatives, particularly in developing the rehabilitation minimum standard guidelines. Further, the ISPRM database can serve multiple purposes as a repository of disaster

rehabilitation expertise, which will facilitate deployment of rehabilitation physicians and other rehabilitation professionals in support of international rehabilitation disaster relief efforts.

6. *WHO Global registration process of EMTs*

   A new WHO registration system for all EMTs was initiated in July 2015 (*Figure 8*), which enables establishment of a global register of emergency medical response teams for deployment in emergencies (44). This EMT Register will assist organizations in identifying suitable teams when planning their responses in future disasters. As of 2016, six 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 (44). 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 program (44). However, currently no rehabilitation specialized cells are included in this list.

Figure 8. Global EMT Classification Process



[Adapted form WHO-EMT initiative (44)]

7. Rehabilitation guidelines for disasters

As aforementioned, the WHO-EMT initiative acknowledges rehabilitation as an integral aspect of medical response and patient-centered care in disaster settings in the guidelines: '*Classification and minimum standards for foreign medical teams in sudden onset disasters' (4)*. It recognizes that 'rehabilitation is one of the core component 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 SODs' (4, 29). The guidelines emphasize the 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 (29). Reports from past emergency responses demonstrated a lack of integration of rehabilitation professionals into EMTs and lack of coordination with other EMT members (surgical and medical), which detract from patient-centered care (29). This prompted the Rehabilitation Working Group under the EMT initiative, in developing the first guideline for rehabilitation teams in SODs: the '*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) (29). 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 this guideline are listed in *Box 1*.

Box 1. Key minimum standards for EMTs

- At least one 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 m^2 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

[Source: WHO 2016 (29)]

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 (29). *Table 5* provides an overview of rehabilitation input by EMT type, and specific discharge considerations.

Table 5. Overview of rehabilitation input by EMT type

Injury type	EMT Type 1	EMT Type 2 & 3	Referral and discharge consideration
Basic fracture (conservative management)	• Provide clear guidance on weight-bearing status • Provide assistive devices • Advise on ROM & functional use	As Type 1	• Rehabilitation follow-up
Complex fracture	• Stabilize and refer	• Provide assistive devices • Advise on ROM & precautions • Functional retraining • External-fixator care • Pain management • Patient and care provider education	• Clarify time for removal of external fixator • Progression of weight-bearing status • Education about possible complications • Rehabilitation follow-up
Spinal cord injury	• Neurological assessment • Advice regarding pressure area prevention and care • Refer according to national protocol or specialized care team	• Neurological assessment • Pain management • Functional retraining • Provide temporary wheelchair • Refer according to national protocol or specialized care team • Patient and care provider education	• 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	• Advise on appropriate dressing • Refer to specialized care team if indicated	• Advise on appropriate dressing • Positioning, including splinting if indicated • ROM, strength & functional retraining	• Identify step-down facility if required • Identify providers of local burns/ plastics care &/or specialized burns care team for scar management, including compression garments

		• Refer to burns/plastics specialized care team if indicated • Patient & care provider education	• Long-term rehabilitation follow up required for scar maturation & risk for contracture
Peripheral nerve injury	• Positioning, including splinting if indicated • Patient & care provider education • Refer as indicated	• Positioning, including splinting if indicated • Patient & care provider education • ROM, strength & functional retraining • Pain management • Refer to microsurgery specialized care team if indicated	• 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	• Basic neurological & cognitive assessment • Refer as indicated	• Neurological & cognitive assessments • Positioning, including splinting if indicated • ROM, strength & functional retraining • Patient & care provider education • Refer to neurological specialized care team if indicated	• 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	• Advise on appropriate dressing • Refer as indicated	• Advise on appropriate dressing • Provide assistive devices • ROM, strength & functional retraining • Patient & care provider education • Refer to plastics specialized care team if indicated	• Identify plastics specialized care team early • Progression of weight-bearing status • Education about possible complications, such as infection • Rehabilitation follow-up if indicated

Amputation	• Basic wound management • Refer to type 2 or 3 or national facility	• Preoperative advice according to prosthetic availability & functional outcomes • Stump management • Provide temporary assistive devices • Pain management • ROM, strength & functional retraining • Patient & care provider education	• Referral to local provider for long-term assistive devices, such as prosthetic &/or wheelchair if indicated • Rehabilitation follow-up

EMT: Emergency Medical Team, ROM: range of motion. [Adapted from WHO 2016 (29)]

8.6 Challenges in putting EMT standards into practice

The minimum standards for rehabilitation clearly set out the principles for rehabilitation and provide guidance on strengthening the EMT capacity. However, it is yet to be implemented and to our knowledge, many specialized team (such as rehabilitation) are yet to receive any mentorship, or 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 Meeting, Hong Kong).
- Many specialized rehabilitation teams and/or Non-Governmental Organizations teams may have a limited number of team members. It is still unclear if these teams will embed within larger verified EMTs or require individual team certification as rehabilitation specialized cells.
- Most disaster-prone countries are largely unprepared and have poor planning for disaster management (24, 41) and lag in investment in rehabilitation disaster-risk reduction, infrastructure and management. Responding promptly to the needs of people affected will be challenging.
- Disasters damage local infrastructure and disrupt health systems, often in remote, under-served areas, compounding challenges for all response teams, including rehabilitation. It is uncertain how and what processes are needed for rehabilitation teams to function within local health systems, where rehabilitation services do not exist and/or are in their infancy.

- Lack of, or limited availability of, systematic rehabilitation processes and/or interventions in many low- and middle-income countries may hinder effective and timely delivery of appropriate interventions. Assessing or screening of the victims will be only useful when resources and interventions are available. Further, there is greater chance to miss the people most at risk if there is delay in delivering resources and suitable interventions (56). For example psychiatric support mechanisms were not available in the immediate aftermath of the Asian tsunami in many places to provide to those in need (56).
- EMT programs 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 programs for EMTs and/or local professionals, including rehabilitation in disaster settings. Current programs focus on individual professional development, and on multidisciplinary EMT operational performance (57). For example, the Australian Medical Assistance Team (AusMAT), a certified EMT, conducts a 'Team Member Course' for a multi-disciplinary team of doctors, nurses, paramedics, pharmacists, fire-fighters (logisticians), allied health and environmental health staff (58). 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 disaster context (58).
- Although many organizations have developed "core competencies" considered to be essential knowledge and skills for disaster healthcare

personnel, many are, however, imprecise and use inconsistent terminology and structure. There is lack of standards for best practice and none are validated. (59, 60).

- Lack of or insufficient population data in many disasters make it difficult for EMTs to identify target populations and/or deliver targeted interventions. Further, the absence of a platform for sharing and collection of data, research impedes quality of care delivered.
- Limited evidence (including feasibility) for many rehabilitation interventions in disaster settings hinders evidence-based practice in these settings.
- There is a need to develop Standard Operating Procedures (SOPs) on each subject based on clinical evidence-based standards, which will assist in improving awareness, clarification and application principles appropriate to a disaster response. This will facilitate and progress uniformity of the performance, coordination, quality of care and accountability of the international disaster response.
- Standardized assessment and monitoring tools are yet to be developed, which can be challenging in terms of patient assessment/management and/or program monitoring and evaluation.

8.7 The way forward

The WHO World report on disability strongly advocates that all Member States '*develop, implement, and monitor polices, regulatory mechanisms, and standards for rehabilitation services, as well as promoting access to those services*' ((19), p. 122). This is further elaborated in the WHO global disability action plan 2014–2021 (objective 2): '*to strengthen and extend rehabilitation, rehabilitation, assistive technology, assistance and support services, and community-based rehabilitation*" ((61), p. 3). However, rehabilitation has

been a low priority for many governments, especially in low- and middle-income countries with limited health investment, which has resulted in under-developed, poorly coordinated services to respond to the growing population demand for services (20).

Ensuring effective rehabilitation care of disaster victims is not an easy task, with many issues. As natural disasters escalate, it is more likely that there will be more calls for international medical assistance and humanitarian aid. There is a clear mandate for all EMTs (including rehabilitation) to act quickly, efficiently and effectively during disasters (4). There is also strong consensus amongst the 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 (24, 27, 28). 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 (26). 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-centered, coordinated and transparent services in future disasters (4).

The successful implementation of the minimum standard framework will require increased resilience of the rehabilitation community with multi-stakeholder partnerships. Lessons learnt from previous disasters and incorporation of these information into long-term planning may serve to preclude repetition of mistakes made in past and reduce future vulnerability. Successful strategic implementation will require exhaustive context and situation analysis, as resource requirements may vary for each disaster. 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 environmental degradation, poor local governance, population growth,

economic development patterns, to establish a rehabilitation-inclusive disaster management model for future catastrophes. A strategic and successful implementation of the guidelines recommendations will require partnership and support from numerous stakeholders, within and beyond the rehabilitation sector. Some perspectives that need to be considered include:

- 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 (61).
- Governments, especially of low- and middle-income countries, needs to prioritize rehabilitation as a key health agenda and improve integration of rehabilitation into healthcare systems to effectively and efficiently meet population needs.
- Mapping/evaluation of current rehabilitation facilities and pre-existing rehabilitation 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. Training and education of local health personnel, development of local emergency preparedness and evacuation plan, strengthening of community-based

and vocational rehabilitation programs for sustainable long-term care are priorities.

- Embedding specialized teams, (including rehabilitation cells), with the larger teams might be a solution to foster better and speedy 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) will unquestionably exceed those currently verified/certified by the WHO.
- Need for EMTs/rehabilitation specialized cells 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 low-resource disaster settings based on evidence-based best practice guidelines.
- Development of a standardized/universal and user-friendly assessment tool and data reporting form that could be easily reproduced and completed under austere conditions 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 (*Appendix 14*) (62). Existing validated functional assessment tools (such as the Functional Independence Measure) are impractical in such contexts, due to a requirement for trained staff, lack of inter-cultural validity, and inadequacy for largely illiterate populations (26, 63). Burkle et al proposed two utilitarian standardized emergency surgery data and documentation reporting forms for SODs, natural disasters and the existing burden of surgical disease (47). It is yet unknown if these forms have been validated.

- A standardized education and training module for EMTs (especially rehabilitation) is required, more centered 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 health care professionals is needed.
- Development of innovative models of rehabilitation (e.g. telerehabilitation, mobile apps, etc.) that offer delivery of timely, cost-efficient and patient-centered services is needed.
- Improve communication and networks (information gathering, sharing and disseminating), using cost-effective and innovative technologies.
- Fostering of research for robust evidence for rehabilitation, knowledge exchange and greater access to information/data.
- Building of local volunteer/carer programs (including family members, community etc.), which are a more proactive and cost-effective model for long-term management of disaster victims.
- Increased public awareness and education about disability and rehabilitation.
- Establishment of 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.

8.8 Implication for clinical practice

The aim of rehabilitation in disaster settings is to enhance patient care through an organized system of injury, acute care and longer-term care continuum, fully integrated into the public health system of a local community. The body of work included in this thesis provides understanding of the healthcare and rehabilitation needs and issues faced by the disaster victims. The recommendation for rehabilitation personnel working independently in a specialized rehabilitation cell or embedded within other EMTs, includes proactive assessment and screening of disaster victims for common disaster-related problems and/or preexisting disability and medical conditions, regular specialist evaluation and follow-up to assess need for appropriate intervention. The aim is to provide appropriate and adequate care to the disaster survivors to achieve and maintain optimal functioning and independence, and successful reintegration into the community.

Due to the complexity and nature of injuries, rehabilitation programs should be individualized to meet the needs of patients, with specialist input from the multidisciplinary team and active participation of patients and/or family members. Rehabilitation clinicians have a significant role in disaster settings and can be key experts in transition of patient care from acute to the community. Depending upon the scale and nature of disasters, needs and challenges for rehabilitation might vary considerably. Specialized rehabilitation skills become increasingly necessary at times due to the broad range of injuries and conditions of the victims. Their roles are indisputably

multi-faceted (from clinicians to the administrators) and are well placed to address various challenges that arise during the complex disaster situations.

All health professionals including rehabilitation clinicians should be aware of the potential difficulties and clinical needs that victims, particularly older adults, persons with preexisting disabilities and medical conditions, pregnant women and children, may experience as a result of a natural disaster, especially when evacuations and relocations occur.

8.9 Implications for research

Disaster health research encompasses the traditional disaster cycle comprising preparedness, response, recovery, and mitigation phases (64). There is strong consensus that health-related research must form an integral part of disaster response, in order to identify effective ways of mitigating the health impact of disasters and strengthen evidence-base for interventions and/or care provided (65). Conducting research in an emergency response situation is more complex and challenging, as it poses ethical, methodological and logistical challenges for researchers (66). Time for planning, ethical review process and resources may be in short supply in disaster settings (66, 67). Further distinctive features of ethical challenges of disaster research might include: populations affected by disaster may be traumatized and highly vulnerable to participate; research activities may hinder relief efforts; risks associated with research participation may shift rapidly as post-disaster situations evolve; research protocols may be time-sensitive and need to be implemented quickly after a disaster event; potential participants may confuse research activities with relief operations; the potential population may not be able to provide consent or participate due to language barrier/education or lack of family members/carers (66).

Currently, there is a range of resources available that can support disaster researchers, such as, the WHO's "Ethics in epidemics, emergencies and disasters: research, surveillance and patient care: training manual 2015' (68), an ethics framework developed for the Research for Health in Humanitarian Crises initiative (69), and others. While it is essential to uphold ethical principles and scientific validity while conducting research in disaster settings, it is also vital to generate knowledge in a timely manner and maintain public trust, and not unduly compromise the care of disaster victims (65). Ideally, research needs to planned ahead and research ethics committees must develop procedures to ensure appropriate, timely and flexible mechanisms and procedures (such as pre-screening of study protocols, advance and/or accelerated review) for ethical review and oversight (65, 66).

Research in disaster settings, particularly from the rehabilitation perspective is scarce and specific evidence gaps exist around many rehabilitation interventions in the disaster settings. The findings from the systematic review (Chapter 2, *Study I*) outlined the need for more robust, methodologically strong studies in this area. It also highlighted the need to assess the effectiveness and/or feasibility of specific rehabilitation interventions (and components) and to determine appropriate settings, target population and intensity of rehabilitation therapy. Further, there is need for research to determine the cost and/or safety of these interventions. There is a need for system-level research, including the types and impact of different service delivery models, governance structures and financial allocation and distribution (20). Mental health problems including post-traumatic stress disorder (PTSD), depression and anxiety are highly prevalent in all type of disasters; these are not well studied, particularly from the rehabilitation perspective. More evidence is required for effectiveness and feasibility of psychosocial interventions, and to better understand mechanisms of transition

of care from the acute crisis to the community integration phase and a continuum of care models in the longer-term.

There is growing evidence that chronic disease and long-term disability create a great burden during and aftermath of disaster. However, currently, reporting of these issues is mostly anecdotal, with limited information and knowledge, particularly the burden of natural disasters on chronic health problems. These are not well documented. Furthermore, there is a need for more research (prospective longitudinal studies) about the long-term health prospects of newly disabled victims and those with pre-existing disability from a range of different country settings. The perspective of patients and their family/carers should be incorporated in treatment goal-setting and decision-making, however, this information is yet to be reported and needs further evaluation. More research is needed for cultural and contextual considerations of disaster settings for rehabilitation service delivery.

Research should be conducted to develop a reliable, valid and user-friendly standardized assessment and/or evaluation tools in crisis settings which reflects domains of the ICF framework. More epidemiological/sociological research is needed for future disaster planning and capacity building, including impacts on health care systems and their recovery after disaster in terms of structure, service provision, personal etc. Further work needs to be done to develop specific indicators to measure the impact of implementation of the minimum standards and guidelines.

Some key considerations required while conducting research in disaster settings are listed below in *Box 2* (65, 66, 68).

Box 2. Key considerations required for research in disaster settings

- Research in disaster situations must be planned in advance, where possible
- Ensure adequate resources including human resources

- Obtain approval from researchers and local ethics committees
- Research should be responsive to the health needs or priorities of the disaster victims
- Assess potential benefits and risks of experimental interventions and communicate these clearly to potential participants
- Fair selection of participants is essential to ensure that the burden and benefits in the selection of groups of subjects are equitably distributed
- Study designs need to be chosen so that studies will yield meaningful data in a rapidly evolving situation for scientific validity
- Study designs must be feasible and appropriate in a disaster situation and ethical merits of trial designs must be carefully assessed
- Ensure local community engagement in research and research planning
- Research should be conducted in a culturally sensitive manner
- Develop appropriate, timely and flexible study protocols to facilitate ethical review
- Obtain informed consent for study participation even in a situation of duress
- Conduct of research must not unduly compromise the care of the disaster victim

CHAPTER 9

Conclusions

Natural disasters 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, urbanisation and poorly planned infrastructure and development. Any major disaster can derail a small, weak economy for decades and has considerable implications for international aid programs. Natural disasters can significantly compromise country's development progress, reduce the effectiveness of aid investments, and halt or slow progress towards the achievement of UN Millennium Development Goals. Natural hazard risks also influence the type and scale of disaster relief and humanitarian response required of aid agencies.

Recent advances in disaster response/rescue and field management, have improved the survival rates of disaster victims significantly, worldwide. Current disaster data demonstrates a staggering number of persons with injuries relative to mortality. 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, etc. An increase in the number of victims with exacerbation of pre-existing chronic medical conditions and psychological impairment is possible. These problems necessitate comprehensive long-term interdisciplinary management, including rehabilitation. Further, as the disaster situation transits away from the emergency response, the provision of rehabilitation services increasingly will be fundamental to restore function and independence, and maximise quality of life of the survivors.

Overall, the primary goals of medical rehabilitation include management of acute injury, prevention and management of related complications, optimization of functional capabilities (including physical, cognitive, neuropsychological function) and social re-integration. This is not different in

disaster settings, however, it can be more complex and challenging, mainly due to requirements for a multi-pronged approach, including: timely and speedy assessment of injury patterns and management, needs and resource requirements (including in the long-term); establishment of patient triage, discharge, referral, and tracking systems; collaboration with other healthcare service providers (both local and international); coordination with emergency response systems, host health system and government managers; education of local healthcare providers and data collection/management. The rehabilitation team in disaster settings should comprise interdisciplinary members, including physical and rehabilitation medicine physicians, nurses and allied health professionals.

The critical importance of rehabilitation services for survivors during and after a natural disaster is well-documented. Evidence suggests early provision of rehabilitation programs reduces disability leading to better clinical outcomes, and improved participation and quality of life of disaster victims. 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. 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. The WHO rehabilitation guidelines recommend implementation and access to rehabilitation during all phases of disaster response and pinpoints rehabilitation as longest and costly phase of disaster management.

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, the inclusion of rehabilitation in the global disaster response initiative is a

significant development and improvement in this area. The WHO-EMT initiative and guidelines (including rehabilitation) provide structure and standardization, aligned with a set of overarching principles to prepare, plan and provide clinical care during disasters for future deployments. These developments could be regarded as the much-needed steps in the right direction. However, there are many challenges implementing these standards. Rehabilitation is complex and one of the most expensive phases of any patient care, particularly for those with severe and multiple impairments requiring long-term care (70, 71). Sustained efforts from the WHO-EMT Secretariat is 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. A sudden infusion of aid, including EMTs, during disasters and abrupt disruption in aid and/or departures of response teams post disasters can put enormous pressure on already overstretched local healthcare systems (72). More advancement is needed in the process of bridging the transition from an emergency medical response to local health systems, especially in low resourced regions afflicted by recurrent natural disasters. Australia has a strategic location in the Asia-Pacific (where the majority of disasters occur) and has a major role in assisting regional partners for capacity building and planned response to disasters. The ISPRM DRC can play significant role in this transition process and its role should be recognised in future disasters to facilitate coordination among major rehabilitation providers worldwide, 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, integrated rehabilitation-inclusive approach to disaster planning and management, targeting vulnerable communities at risk in future calamities. This approach should make way for

the right mix of evidence-based practice, local available practice and modern innovation and/or low-cost technologies. Future successful and effective disaster management will depend on the proficient leadership of the governing bodies (international and national), and the willingness and commitment of countries to build a systematic advance planning and preparedness to ensure that effective services, including rehabilitation are available.

Current developments in disaster management highlight the need to incorporate rehabilitation in future catastrophes to ensure quality of care is provided to those in need. In accord with the new perspective, disasters can be viewed as developmental opportunities for many countries where medical rehabilitation is still in the infancy stage. However, paradoxical as it may sound, future disaster events will open new possibilities for development of a rehabilitation-inclusive disaster management plan. Working with the local health workforce, fostering local resources and building local rehabilitation capacity are needed for future calamities. The road ahead is complex, but full of possibilities.

CHAPTER 10

References

1. United Nations International Strategy for Disaster Reduction. UNISDR Terminology on Disaster Risk Reduction Geneva: UNISDR; 2009.
2. Guha-Sapir D, Hoyois Ph, Below R. Annual Disaster Statistical Review 2015: The Numbers and Trends. Brussels: Centre for Research on the Epidemiology of Disasters (CRED); 2016.
3. Centre for Research on the Epidemiology of Disasters (CRED). The human cost of natural disasters: a global perspective. Brussels: CRED; 2015.
4. 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.
5. Below R, Wirtz A, Guha-Sapir D. Disaster Category Classification and Peril Terminology for Operational Purposes Brussels, Munich Common accord of Centre for Research on the Epidemiology of Disasters (CRED) and Munich Reinsurance Company (Munich RE); 2009.
6. Guha-Sapir D, Vanderveken A. CRED CRUNCH: The EM-DAT higher resolution disaster data (Issue No. 43) Brussels: Centre for Research on the Epidemiology of Disasters (CRED); July 2016.
7. United Nation Office for Disaster Risk Reduction (UNISDR) and Centre for Research on the Epidemiology of Disasters (CRED). Poverty & Death: Disaster Mortality 1996-2015. Brussels: CRED and UNISDR; 2016.
8. Guha-Sapir D, Vanderveken A. CRED CRUNCH: 2016 preliminary data: Human impact of natural disasters (Issue No. 45) Brussels: Centre for Research on the Epidemiology of Disasters (CRED); December 2016.
9. Guha-Sapir D, Below R, Hoyois Ph. EM-DAT: The CRED/OFDA International Disaster Database. [cited 2016 12 December]; Available from: www.emdat.be

10. 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.
11. Economic and Social Commission for Asia and the Pacific (ESCAP). Disasters Without Boarders: Regional Resilience for Sustainable Development. Asia-Pacific Disaster Report Bangkok: United Nations; 2015.
12. Okuyama Y, Sahin S. Impact estimation of disasters: a global aggregate for 1960 to 2007. Washington, D.C.: World Bank; 2009.
13. MICRODIS Health Working Group. PART I: Literature Review: Health Impact of Natural Disasters (Earthquakes, windstorms and floods). Brussels, Belgium: MICRODIS; 2008.
14. Gosney J, Reinhardt JD, Haig AJ, Li J. Developing post-disaster physical rehabilitation: role of the World Health Organization Liaison Sub-Committee on Rehabilitation Disaster Relief of the International Society of Physical and Rehabilitation Medicine. J Rehabil Med 2011; 43: 965-968.
15. Landry MD, Singh CS, Carnie L, Stephenson F, Hill A, Hill C. Spinal cord injury rehabilitation in post-earthquake Haiti: the critical role for non-governmental organisations. Physiotherapy 2010; 96: 267-268.
16. 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.
17. International Strategy for Disaster Reduction (ISDR). Global Assessment Report on Disaster Risk Reduction (GAR) Geneva, Switzerland: United Nations; 2013

18. de Goyet CdV, Sarmiento J, Grünewald F. Health response to the earthquake in Haiti January 2010: Lessons to be learned for the next massive sudden-onset disaster. Washington, D.C.: Pan American Health Organization (PAHO); 2011.
19. World Health Organization. World Report on Disability. Geneva, Switzerland: WHO; 2011.
20. World Health Organization. Rehabilitation in health systems. Licence: CC BY-NC-SA 3.0 IGO. Geneva: 2017; 2017.
21. World Health Organization. Rehabilitation: key for health in the 21st century (WHO/NMH/NVI/17.3). Geneva: WHO; 2017.
22. Khan F, Amatya B, Hoffman K. Systematic review of multidisciplinary rehabilitation in patients with multiple trauma. Br J Surg 2012; 99 Suppl 1: 88-96.
23. World Health Organization (WHO). International classification of functioning, disability and health (ICF). Geneva: WHO, 2001.
24. 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.
25. United Nations Office for Disaster Risk Reduction. Sendai Framework for Disaster Risk Reduction 2015-2030. Geneva: UNISDR; 2015.
26. Reinhardt JD, Li J, Gosney J, Rathore FA, Haig AJ, Marx M, et al. Disability and health-related rehabilitation in international disaster relief. Glob Health Action 2011; 4: 7191.
27. 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.
28. Gosney JE, Jr. Physical medicine and rehabilitation: critical role in disaster response. Disaster Med Public Health Prep 2010; 4: 110-112.

29. World Health Organization. Emergency medical teams: minimum technical standards and recommendations for rehabilitation. Licence: CC BY-NC-SA 3.0 IGO. Geneva: WHO; 2016.
30. 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 Popul 2010; 12: 18-22.
31. 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.
32. Li Y, Reinhardt JD, Gosney JE, Zhang X, Hu X, Chen S, et al. Evaluation of functional outcomes of physical rehabilitation and medical complications in spinal cord injury victims of the Sichuan earthquake. J Rehabil Med 2012; 44: 534-540.
33. Rathore FA, Farooq F, Muzammil S, New PW, Ahmad N, Haig AJ. Spinal cord injury management and rehabilitation: highlights and shortcomings from the 2005 earthquake in Pakistan. Arch Phys Med Rehabil 2008; 89: 579-585.
34. Mallick M, Aurakzai JK, Bile KM, Ahmed N. Large-scale physical disabilities and their management in the aftermath of the 2005 earthquake in Pakistan. East Mediterr Health J 2010; 16 Suppl: S98-105.
35. 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 152-143.
36. Rathore FA, Gosney J. Rehabilitation lessons from the 2005 Pakistan earthquake and others since - looking back and ahead? J Pak Med Assoc 2015; 65: 1036-1038.

37. 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.
38. Iezzoni LI, Ronan LJ. Disability legacy of the Haitian earthquake. Ann Intern Med 2010; 152: 812-814.
39. The Sphere Project. Humanitarian Charter and Minimum Standards in Humanitarian Reponse In: Greaney P PS, Wilson D, editor.; 2011; Rugby, UK: Practical Action Publishing; 2011.
40. Butt S, Hitoshi N, Nottage L. Asia-Pacific Disaster Management. Comparative and Socio-legal Perspectives. Heidelberg: Springer, 2014.
41. Amatya B, Khan F. Overview of medical rehabilitation in natural disasters in the Pacific Island Countries. Phys Med Rehabil Int 2016; 3: 1090.
42. 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.
43. 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.
44. World Health Organization. Emergency Medical Teams: World Health Organization EMT Initiative. Geneva: WHO; November 2016.
45. 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); January 2012.

46. Gerdin M, Wladis A, von Schreeb J. Foreign field hospitals after the 2010 Haiti earthquake: how good were we? Emerg Med J 2013; 30: e8.
47. Burkle FM, Jr., Nickerson JW, von Schreeb J, Redmond AD, McQueen KA, Norton I, et al. Emergency surgery data and documentation reporting forms for sudden-onset humanitarian crises, natural disasters and the existing burden of surgical disease. Prehosp Disaster Med 2012; 27: 577-582.
48. Lind K, Gerdin M, Wladis A, Westman L, von Schreeb J. Time for order in chaos! A health system framework for foreign medical teams in earthquakes. Prehosp Disaster Med 2012; 27: 90-93.
49. 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 Prep 2012; 6: 10-12.
50. United nations office for Disaster Risk Reduction. Progress and Challenges in Disaster Risk Reduction: A contribution towards the development of policy indicators for the Post-2015 Framework on Disaster Risk Reduction Geneva, Switzerland: UNISDR; 2014.
51. Khan F, Amatya B. Rehabilitation medicine critical to disaster relief. Med J Aust InSight [serial on the internet]. 29 August 2016 Available from: http://www.doctorportal.com.au/mjainsight/2016/33/rehabilitation-medicine-critical-to-disaster-relief/.
52. Stucki G, von Groote PM, DeLisa JA, Imamura M, Melvin JL, Haig AJ, et al. Chapter 6: The policy agenda of ISPRM. J Rehabil Med 2009; 41: 843-852.

53. International Society of Physical and Rehabilitation Medicine (ISPRM). Policy Statement: Response to a sudden-onset natural disaster. 11 August 2016 [cited 2017 12 Jan]. Available from: file:///F:/CRDR%20ISPRM/ISPRM-Policy-statement-Response-to-a-sudden-onset-natural-disaster-Aug-2016.pdf.
54. Global Facility for Disaster Reduction and Recovery (GFDRR). Bringing Resilience to Scale. Annual report. Washington D.C.: GFDRR; 2016.
55. 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 D.C.: GFDRR; 2016.
56. Bryant RA. Recovery after the tsunami: timeline for rehabilitation. J Clin Psychiatry 2006; 67 Suppl 2: 50-55.
57. 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 Curr 2016; 8.
58. National Critical Care and Trauma Response Centre. Australian Medical Assistance Teams (AUSMAT) 2015 [cited 2016 27 Nov]; Available from: http://www.nationaltraumacentre.nt.gov.au/what-we-do/disaster-management/ausmat.
59. 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.
60. 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 Prep 2015; 9: 430-439.
61. World Health Organization. WHO Global Disability Action Plan 2014–2021: Better health for all people with disability. Geneva: WHO; 2014.

62. 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.
63. 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.
64. Burns AS, O'Connell C, Rathore F. Meeting the challenges of spinal cord injury care following sudden onset disaster: lessons learned. J Rehabil Med 2012; 44: 414-420.
65. Council for International Organizations of Medical Sciences (CIOMS). Guideline 20: Research in disaster situations. 2013 02 Feb 2017; Geneva: CIOMS; 2013.
66. Hunt M, Tansey CM, Anderson J, Boulanger RF, Eckenwiler L, Pringle J, et al. The Challenge of Timely, Responsive and Rigorous Ethics Review of Disaster Research: Views of Research Ethics Committee Members. PLoS One 2016; 11: e0157142.
67. Lee AC, Booth A, Challen K, Gardois P, Goodacre S. Disaster management in low- and middle-income countries: scoping review of the evidence base. Emerg Med J 2014; 31: e78-83.
68. World Health Organization. Ethics in epidemics, emergencies and disasters: research, surveillance and patient care: training manual 2015. Geneva: WHO; 2015.
69. Curry DRW, J; R, Caplan A. An ethical framework for the development and review of health research proposals involving humanitarian contexts: . California: Enhancing Learning and Research for Humanitarian Assistance (ELRHA): R2HC Programme; Jan 2014.

70. Turner-Stokes L. The evidence for the cost-effectiveness of rehabilitation following acquired brain injury. Clin Med (Lond) 2004; 4: 10-12.
71. Khan F, Amatya B, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward. Phys Med Rehabil Int 2015; 2: 1070.
72. Leaning J, Guha-Sapir D. Natural disasters, armed conflict, and public health. N Engl J Med 2013; 369: 1836-1842.

Appendices

Appendix 1

Declarations of a thesis with publication

Declaration for a thesis with publication

THE UNIVERSITY OF MELBOURNE

PhD and MPhil students may include a primary research publication in their thesis in lieu of a chapter if:

- The student contributed greater than 50% of the content in the publication and is the "primary author", ie. the student was responsible primarily for the planning, execution and preparation of the work for publication
- It has been peer-reviewed and accepted for publication
- The student has approval to include the publication in their thesis from their Advisory Committee
- It is a primary publication that reports on original research conducted by the student during their enrolment
- The initial draft of the work was written by the student and any subsequent editing in response to co-authors and editors reviews was performed by the student
- The publication is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in the thesis

Students must submit this form, along with *Co-author authorisation forms* completed by each co-author, when the thesis is submitted to the Thesis Examination System: *https://tes.app.unimelb.edu.au/*. If you are including multiple publications in your thesis you will need to complete a separate form for each publication. Further information on this policy is available at: *gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication*

A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Medical rehabilitation in natural disasters: a systematic review	
Authors	Khan F, Amatya B, Gosney J, Rathore FA, Burkle Jr, FM	
Student's contribution (%)	70	
Journal or book name	Archives of Physical Medicine and Rehabilitation	
Volume/page numbers	96(9):1709-1727	
Status	☐ Accepted and In press ☒ Published	Date accepted/ published

B. STUDENT'S DECLARATION

I declare that the publication above meets the requirements to be included in the thesis

Student's name	Student's signature	Date *(dd/mm/yy)*
Bhasker Amatya		26/2/2017

C. PRINCIPAL SUPERVISOR'S DECLARATION

I declare that:

- the information above is accurate
- The advisory committee has met and agreed to the inclusion of this publication in the student's thesis
- All of the co-authors of the publication have reviewed the above information and have agreed to its veracity
- 'Co-Author Authorisation' forms for each co-author are attached.

Supervisor's name	Supervisor's signature	Date *(dd/mm/yy)*
Fary Khan		28/2/17

The University of Melbourne
CRICOS Provider Number: 00116K

Last Updated 17 August 2015

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Medical Rehabilitation in Natural Disasters in the Asia-Pacific Region: The Way Forward	
Authors	Khan F, Amatya B, Rathore FA, Galea MP	
Student's contribution (%)	70	
Journal or book name	International Journal of Natural Disaster and Health Security	
Volume/page numbers	2 (2):6-12	
Status	☐ Accepted and In press ☒ Published	Date accepted/ published

B. STUDENT'S DECLARATION

I declare that the publication above meets the requirements to be included in the thesis

Student's name	Student's signature	Date *(dd/mm/yy)*
Bhasker Amatya	Bhasker	26/2/2017

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Overview of Medical Rehabilitation in Natural Disasters in the Pacific Island Countries	
Authors	Amatya B, Khan F	
Student's contribution (%)	70	
Journal or book name	Physical Medicine and Rehabilitation – International	
Volume/page numbers	3 (4):1090	
Status	☐ Accepted and In press ☒ Published	Date accepted/ published

B. STUDENT'S DECLARATION

I declare that the publication above meets the requirements to be included in the thesis

Student's name	Student's signature	Date *(dd/mm/yy)*
Bhasker Amatya	Bhasker Amatya	26/2/2017

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Supervisor's name	Supervisor's signature	Date *(dd/mm/yy)*
Fary Khan	Fary Khan	28/2/17

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes	
Authors	Khan F, Amatya B, Dhakal R, Abbott G, Graf M, Ramirez S, Lowenthal K, Galea MP	
Student's contribution (%)	70	
Journal or book name	International Journal of Physical Medicine & Rehabilitation	
Volume/page numbers	3: 316	
Status	☐ Accepted and In press ☒ Published	Date accepted/ published

B. STUDENT'S DECLARATION

I declare that the publication above meets the requirements to be included in the thesis

Student's name	Student's signature	Date *(dd/mm/yy)*
Bhasker Amatya	Bhasker Amatya	26/2/2017

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Rehabilitation medicine critical to disaster relief	
Authors	Khan F, Amatya B	
Student's contribution (%)	70	
Journal or book name	Medical Journal of Australia InSight	
Volume/page numbers	Published online 29 August 2016	
Status	☐ Accepted and In press ☒ Published	Date accepted/ published

B. STUDENT'S DECLARATION

I declare that the publication above meets the requirements to be included in the thesis

Student's name	Student's signature	Date *(dd/mm/yy)*
Bhasker Amatya		

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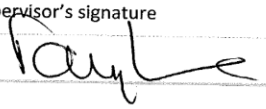
Supervisor's name	Supervisor's signature	Date *(dd/mm/yy)*
Fary Khan		2/3/2017

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Last Updated 17 August 2015

Appendix 2

Study VI:

Amatya B, Galea MP, Li J, Khan F. Medical rehabilitation in disaster relief: towards a new perspective. Journal of Rehabilitation 2017;49: Epub ahead of print. doi: 10.2340/16501977-2250

J Rehabil Med 2017; 49: Epub ahead of print

SPECIAL REPORT

MEDICAL REHABILIATION IN DISASTER RELIEF: TOWARDS A NEW PERSPECTIVE

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From the [1]Department of Rehabilitation Medicine, Royal Melbourne Hospital, Parkville, Victoria, Australia, [2]Department of Medicine (Royal Melbourne Hospital) The University of Melbourne, Parkville, [3]Australian Rehabilitation Research Centre, Royal Melbourne Hospital, Parkville, [4]School of Public Health and Preventive Medicine, Monash University, Victoria, Australia and [5]Department 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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J Rehabil Med 2017; 49: 00–00

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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

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

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 vaction	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	By 2030 • 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.

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.

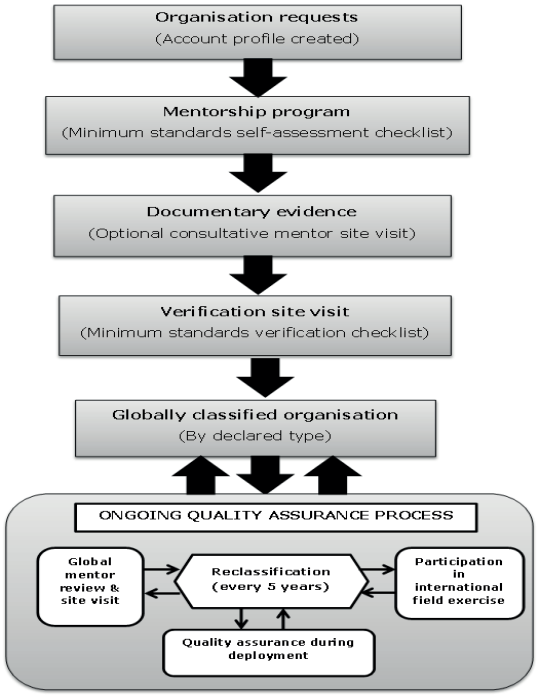

Fig. 1. Global Emergency Medical Team (EMT) classification process. Adapted from World Health Organization (WHO) EMT initiative (22).

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 m^2 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)	• Provide clear guidance on weight-bearing status • Provide assistive devices • Advise on ROM & functional use	As Type 1	• Rehabilitation follow-up
Complex fracture	• Stabilize and refer	• Provide assistive devices • Advise on ROM & precautions • Functional retraining • External-fixator care • Pain management • Patient and care provider education	• Clarify time for removal of external fixator • Progression of weight-bearing status • Education about possible complications • Rehabilitation follow-up
Spinal cord injury	• Neurological assessment • Advice regarding pressure area prevention and care • Refer according to national protocol or specialized care team	• Neurological assessment • Pain management • Functional re-training • Provide temporary wheelchair • Refer according to national protocol or specialized care team • Patient and care provider education	• 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	• Advise on appropriate dressing • Refer to specialized care team if indicated	• 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	• 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	• Positioning, including splinting if indicated • Patient & care provider education • Refer as indicated	• Positioning, including splinting if indicated • Patient & care provider education • ROM, strength & functional retraining • Pain management • Refer to microsurgery specialized care team if indicated	• 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	• Basic neurological & cognitive assessment • Refer as indicated	• Neurological & cognitive assessments • Positioning, including splinting if indicated • ROM, strength & functional retraining • Patient & care provider education • Refer to neurological specialized care team if indicated	• 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	• Advise on appropriate dressing • Refer as indicated	• Advise on appropriate dressing • Provide assistive devices • ROM, strength & functional retraining • Patient & care provider education • Refer to plastics specialized care team if indicated	• Identify plastics specialized care team early • Progression of weight-bearing status • Education about possible complications, such as infection • Rehabilitation follow-up, if indicated
Amputation	• Basic wound management • Refer to type 2 or 3 or national facility	• Preoperative advice according to prosthetic availability & functional outcomes • Stump management • Provide temporary assistive devices • Pain management • ROM, strength & functional retraining • Patient & care provider education	• 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 exit 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] 29 Aug 2016. 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.

Appendix 3

Other research publication 1

Khan F, Amatya B, Avirmed B, Yi YK, Shirmen B, Tsegmid N, Abbott G, Galea MP. WHO Global Disability Action Plan: the Mongolian Perspective. Journal of Rehabilitation 2017;49:Epub ahead of print. doi: 10.2340/16501977-2207

J Rehabil Med 2017; 49: Epub ahead of print

ORIGINAL REPORT

WORLD HEALTH ORGANIZATION GLOBAL DISABILITY ACTION PLAN: THE MONGOLIAN PERSPECTIVE

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Objective: **To provide an update on disability and rehabilitation in Mongolia, and to identify potential barriers and facilitators for implementation of the World Health Organization (WHO) Global Disability Action Plan (GDAP).**

Methods: **A 4-member rehabilitation team from the Royal Melbourne Hospital conducted an intensive 6-day workshop at the Mongolian National University of Medical Sciences, for local healthcare professionals ($n = 77$) from medical rehabilitation facilities (urban/rural, public/private) and non-governmental organizations. A modified Delphi method (interactive sessions, consensus agreement) identified challenges for rehabilitation service provision and disability education and attitudes, using GDAP objectives.**

Results: **The GDAP summary actions were considered useful for clinicians, policy-makers, government and persons with disabilities. The main challenges identified were: limited knowledge of disability services and rehabilitation within healthcare sectors; lack of coordination between sectors; geo-topographical issues; limited skilled workforces; lack of disability data, guidelines and accreditation standards; poor legislation and political commitment. The facilitators were: strong leadership; advocacy of disability-inclusive development; investment in local infrastructure/human resources; opportunities for coordination and partnerships between the healthcare sector and other stakeholders; research opportunities; and dissemination of information.**

Conclusion: **Disability and rehabilitation is an emerging priority in Mongolia to address the rights and needs of persons with disabilities. The GDAP provides guidance to facilitate access and strengthen rehabilitation services.**

Key words: disability; rehabilitation; Mongolia; World Health Organization.

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An estimated 1 billion people worldwide have a disability, with approximately 80% living in low-income developing countries (1). In 2006, The United Nations (UN) General Assembly adopted the Convention on Rights of Persons with Disabilities (CRPD) to highlight disability as a human experience that occurs as an interaction of a person with a health condition or impairment with his or her environment (2). The CRPD encourages all member states to adopt appropriate measures to eliminate discrimination and poverty, and to improve health and education of persons with disabilities (PwD) (1, 2), and has identified rehabilitation as a care process to support physical independence, mental, social and vocational ability (Article 26) (1). In 2011, the World Health Organization (WHO) World Report on Disability (WRD) supported implementation of the CRPD and provided comprehensive information on disability with special emphasis on rehabilitation (1). It highlighted inadequacy in resources and inequalities in access to care for PwD, especially in low-income countries (3–5). Other reports conducted in different countries (3, 5–7) outline a lack of disability-inclusive policies and standards, negative attitudes/discrimination, limited provision of services and/or service delivery, inadequate funding, and limited research data.

The WHO Global Disability Action Plan 2014–2021 (GDAP): Better Health for All People with Disability (6) provides a list of specific actions and metrics of success to achieve the 3 main objectives listed in Box 1. These include: a human rights-based approach (empowerment of PwD); life-course approach (continuum of care); universal health coverage; a culturally-appropriate person-centred approach; multi-sectoral, community-based rehabilitation (CBR); and universal design (6).

The main objectives of the GDAP are shown in Box 1.

Box 1. Objectives of the WHO Global Disability Action Plan (GDAP) 2014–2021: Better Health for All People With Disabilities (6)

1. Remove barriers and improve access to health services and programmes
2. Strengthen and extend rehabilitation, habilitation, assistive technology, assistance and support services, and community-based rehabilitation
3. Strengthen collection of relevant and internationally comparable data on disability and support research on disability and related services

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MONGOLIA

Mongolia is a large central-Asian country, bordering with the People's Republic of China on the south-east, Russia in the north and Kazakhstan on the west. It occupies a total area of 1.56 million km2 (world's 19th-largest country) divided into 21 provinces (aimags), which are further divided into 329 districts (soums) (7). Mongolia is sparsely populated, with only 3 million people (2015), (population density 1.8 persons/km2) (7). The majority (>71%) live in urban areas, with almost half residing in Ulaanbaatar (8). There are significant disparities amongst the aimags/soums in terms of healthcare capacity, infrastructure and level of governance. The population median age is 27 years (approximately 27% are aged ≤15 years) and life expectancy at birth is 68.9 years (9). In 2015, Mongolia had one of the highest literacy rates (>98%) in the world (for adults aged >15 years).

Mongolia has experienced positive economic growth since its political transition to democracy (in the early 1990s), and since 2004 there has been significant growth in gross domestic product (GDP), with GDP per capita (PPP) of US$2,107 in 2007 (10). The World Bank income classification categorizes Mongolia as a low-middle income country, rated 114 out of 182 on the Human Development Index (HDI), according to the UNDP Human Development Report (2007) (11). Mongolia's Human Development Index (HDI) increased by 1.02% annually from 0.676 to 0.727 between 2000 and 2007 (11). Mining and agriculture (mainly livestock husbandry) remain the major economic resources. Despite positive trends in economic growth, there is disparity between rural and urban areas (7); many rural people reside in traditional Mongolian tents (gers), and 27.4% of the population lives below the poverty line (WHO 2012) (12). The Mongolian government spends 6.3% of GDP on healthcare (total expenditure on health per capita of US$345 in 2012) (10). Similar to other developing countries, considerable effort has gone into improving the acute-care sector, while post-acute care (including rehabilitation) is a lesser priority at many levels. Overall, key determinants of poor health include: illiteracy, unemployment, gender inequality, and rapid urbanization (8, 13).

Despite the introduction of various disability-inclusive policies in many developing countries, PwD continue to have difficulty exercising their civil and political rights, and accessing education and employment (14). Mongolia is not an exception in this context. Although the GDAP is a step forward in provision of rehabilitation services to PwD, providing the opportunity to strengthen and extend rehabilitation, it can be challenging for the Physical Medicine and Rehabilitation (PM&R) community, as it sets high standards and requires evidence-based rehabilitative care (15). Previous studies (14, 16) report challenges in successful implementation of the GDAP and in setting priorities based on the action plan in countries such as Madagascar (14) and Pakistan (16).

This cross-sectional study provides an overview of the current PM&R effort in Mongolia (based on literature review and interactive feedback from various service providers) compiled during an organized workshop programme to document the challenges and strengths within the existing healthcare system, corresponding with the established objectives listed in the GDAP.

METHODS

The visiting team (FK, BA, GA, MG) were invited by the Mongolian National University of Medical Sciences (MNUMS) and local PM&R society as independent experts (June 2016) to run an 6-day intensive teaching programme in association with the University General Hospital, Ulaanbaatar, Mongolia. Within the programme, a 1-day workshop concentrated solely on utilizing the GDAP framework to identify barriers and facilitators, and the remaining sessions focused on educating participants, building workforce capacity, and developing rehabilitation standards and operational set-up for PM&R services within Mongolia. This exercise was approved by the MNUMS and the Royal Melbourne Hospital.

Participants and procedure

The training programme at the MNUMS was attended by 77 healthcare professionals from various medical rehabilitation centres across Mongolia (including rural areas and private sector). These included: 55 rehabilitation physicians, 6 neurologists, 6 physiotherapists, 5 nurses and 5 resident medical doctors. Input was also obtained from 2 social workers and one clinical psychologist. All participants were invited by MNUMS and comprised approximately 80% of the existing Mongolian workforce (of the 200 original PM&R members listed, many are general physicians, retired and/or were unavailable). In addition, the visiting team met with independent professionals from non-governmental organizations (NGOs) working in Mongolia (mainly South Korea and Japan).

Over a 6-day period, the visiting team (FK, BA, GA, MG) assumed a facilitator role in conducting an intensive teaching programme, including a 1-day consensus workshop based on the objectives listed in the GDAP. During the programme, the visiting team summarized the GDAP, and evidence in the field of rehabilitation in various plenary and interactive panel sessions. These included: basic principles of rehabilitation, evidence-based practice and research methods, disability care planning, capacity building, leadership skills development, rehabilitation nursing, symptomatic management (spasticity, pain, wound care, etc.) and others. The "host" hospital lead medical team provided information about the health service and system in Mongolia, including specific challenges faced by PM&R professionals. All information was supplemented with more specific and recorded data during the workshop. During the workshop, participants were divided into 3 panels to ensure that various

health professionals were as evenly distributed as possible. Each panel focused specifically on 1 of 3 GDAP objectives. All participants completed a form outlining an overview of the GDAP, with blank corresponding columns for responses. Based on their experiences and issues faced in service delivery, participants in each panel discussed their views and perspectives of various challenges and recorded specific barriers/problems relating to: service provision, attitudes/approaches to PwD, service delivery, education, etc., in line with the GDAP. Participants also listed potential facilitators for the GDAP objectives. At all times the GDAP was used as a blueprint for discussion and allowed the visiting team to educate the audience (mainly junior doctors, nurses and some allied health professionals), many of whom were not familiar with the GDAP document.

In order to gather collective participant opinion, a modified Delphi-consensus method was used. This involved a presentation by 2 speakers from each group, on behalf of their designated panel, followed by a face-to-face large-group discussion in order to brainstorm additional and emerging issues, and to avoid the dominance of some participants that can occur in nominal group consensus methods. At the end, a formal iterative decision-making and consensus process (with $\geq$80% of participants agreeing) was conducted, tabulating potential challenges and facilitators in implementation of the GDAP.

Data collection and analysis

Throughout the workshop, participants submitted their responses in writing for each GDAP objective. They were encouraged to document any emerging issues and present these in the large-group interactive session. The facilitators recorded additional information, comments and recommendations provided by the participants, where possible. All data were collated using the content analytical technique (17). Two authors (FA, BA) scrutinized each response and coded the information using a line-by-line process, which was further clustered into a common suggested "term". When there was no consensus about the possible "term", a final consensus was made through discussion amongst all authors. All authors discussed the final content analysis and reviewed the preliminary version of terms for refinement.

In addition, a desktop literature search (academic and grey literature using available medical and health science electronic databases (PubMed, EMBASE, CINAHL, AMED, LILACS and the Cochrane Library), internet search engines (such as System for Information on Grey Literature in Europe; New York Academy of Medicine Grey Literature Collection, National Quality Measures Clearinghouse, and Google Scholar)) and various governmental and non-governmental organizations websites) was conducted for relevant publications (including academic articles, reports, related website contents, etc.) for current status on disability and rehabilitation in Mongolia. All relevant information was discussed with participants in this context. Known experts in this field were contacted for further information on disability-related policies and legislation in Mongolia.

RESULTS

Based on the aforementioned multi-pronged approach to obtaining data, the results are summarized in 2 sections below: (*i*) an overview of current disability and PM&R status in Mongolia; and (*ii*) findings from the interactive and consensus session with regards to GDAP implementation.

Disability status in Mongolia

Disability burden. Despite growing awareness of disability in Mongolia, accurate epidemiological data on disability and disability-related burden is lacking. According to the Mongolian *Law on the Social Protection of Persons with Disabilities*, PwD are defined as "those persons with limited physical or mental abilities, either genetically inherited or acquired during life, persons born with deformations or disability caused by illness or accident which limits full ability to work, mute persons or person officially diagnosed with sight, hearing, or body or mental disabilities" (7, 18). Based on the Economic and Social Commission for Asia and the Pacific (ESCAP) Disability Survey 2015, the disability-prevalence rate in Mongolia is 3.9% (108,071 persons) (18). Of these, majority have a physical disability (29%), 19% mental/intellectual, 15% visual, 12% hearing, and 6% speech-related disability (18). The majority of PwD (52%) are aged >40 years (18). However, based on the *World Report on Disability* disability prevalence rate estimation of 15% (or 1 in 7 people) (1), there are an estimated 450,000 PwD in Mongolia. There are no current employment data for PwD. However, according to the Ministry of Social Welfare and Labour (2001), of the 39,700 PwD categorized as persons able to work, only 13% (5,200) were employed and an estimated 88% were living below the poverty line (7). More recent data show that 80% of PwD aged >15 years are unemployed (19). Furthermore, PwD are 4 times as likely to be employed in the informal sector (7, 18). The level of education of the PwD population is lower than that of the total population, with almost 22% of PwD aged over 10 years being uneducated (19).

Similar to other developing countries, Mongolia is experiencing a transition in disease burden, from communicable diseases to chronic and non-communicable diseases (NCDs) (8). The prevalence of disability in Mongolia is escalating due to an ageing population, and an increase in chronic conditions, and injuries (8, 9, 20). In 2010, the top 3 causes of overall disability-adjusted life years (DALYs) in Mongolia were: ischaemic heart disease (IHD), lower respiratory infections, and cerebrovascular disease (9, 21). The leading 5 causes of "years lived with disability" (YLDs) were: major depressive disorder, low back pain, alcohol use disorders, neck pain, and other musculoskeletal disorders (22). Diseases of the circulatory system, neoplasm and injury, poisoning and others accounted for 73.3% of all deaths in Mongolia (8). Leading causes of death included: IHD (>4,000 deaths in 2012), and cerebrovascular diseases (stroke) with over 3,000 deaths (9). These conditions contribute to significant economic and social costs for PwD, their families, and the community (13, 20, 22).

Disability policies and legislation. In the last 2 decades, Mongolia has made steady progress in improving the health of its population, through support from several international and national partners. The Ministry of Health is responsible for formulating and monitoring health policies and programmes (8), while the Ministry of Social Welfare and Labour implements state policy for vulnerable groups including PwD (7). Other national government agencies (such as the National Centre for Health Development, National Public Health Institute, National Maternal and Child Health Center) and health institutions play a significant role in implementing health policy and programmes (7, 8, 23). Other government organizations (Mongolian National Coordination Committee on Disabilities, Poverty Alleviation Fund Council, the Local Development Fund and the Employment Promotion Fund) support disabled job-seekers and employees (7). Furthermore, many local and international NGOs contribute to implementation of health service delivery at various levels.

The Mongolian government embraced the issue of disability as a priority and in the first democratic Mongolian Constitution (1992), acknowledged equal rights for all citizens (7). The *Health Law* (1998, 2006, 2011) signifies the right to primary and maternal healthcare, and public health services to all citizens regardless of socio-economic status and health insurance coverage (7, 20). The first *Mongolian Social Security Law for People with Disabilities* (1995, 1998) adopted the *Law on Social Protection of People with Disabilities* (2005) (7) for social assistance and benefits for PwD in Mongolia. The *Social Security Law* includes: provision of identification cards, clearly defined government agencies and type of support for individuals, rehabilitation and after-care, employment, recreation and social services for PwD (7).

Mongolia became a signatory to the *Proclamation on the Full Participation and Equality of People with Disabilities in the Asian and Pacific Region* in 2001 (7), and in 2009 ratified the UN CRPD (18). The government established the Health Insurance Fund in 1994, funded by compulsory contribution of 4% of income in the formally employed sector and a flat contribution rate for herdsmen, students and the self-employed. This scheme, however, does not include rehabilitation and has challenges in the informal sector.

Healthcare service delivery. In the 1990s, the Mongolian health system transitioned from the centralized Semashko model (inherited from the former Soviet Union) to a more decentralized model. Unfortunately, the move towards decentralization has seen more administrative than financial success (19). Currently, the Mongolian health system is a single statutory system divided in principle according to 2 main administrative divisions: aimags and the capital city. Aimags are divided into soums, and soums into baghs. The health system delivery is based on a 3-tier model that provides health services at primary, secondary and tertiary levels, with varying complexity and advancement (13, 20). Mongolia has more than twice the mean number of hospitals than that of other similar transition countries in Europe. It has a higher number of beds, at 68.1 per 10,000 population (2011) (10). Although the majority of health services are delivered by the public sector, the number of private healthcare providers (hospitals and clinics) has increased significantly in last decade (almost doubled from 683 in 2005 to 1184 in 2011) (20). The majority of these, however, are small hospitals with 10–20 beds and outpatient clinics (20).

The National Rehabilitation Center (established in 1999), consists of 4 different departments, and has been the main organization in the field of vocational and medical rehabilitation for PwD (24). The community-based rehabilitation (CBR) programmes are generally funded by an Italian NGO, the Associazione Italiana Amici di Raoul Follereau (AIFO) and implemented by the Community Development Department (24, 25). The CBR programme covers 18 aimags and 8 soums, and is planned to extend to all aimags throughout the country by 2018 (24). Many inclusive education training support programmes for PwD (their families) have been organized (24).

Healthcare human resources. In general, Mongolia has well-developed healthcare infrastructure and human resources (13, 20). Although Mongolia has a large number of health workers, most are concentrated in urban areas. In 2010, the number of doctors working in Ulaanbaatar was 3.94 per 1,000 population while, in aimags, almost half of this number (1.85 per 1,000 population) (13). In 2011, there were an estimated 3.4 primary healthcare doctors per 10,000 population working in soums and family health centres, and 1,677 doctors working in 1,184 private health facilities. In rural areas and villages, care for nomadic herdsmen, families and communities is provided by bagh feldshers, trained mid-level health personnel paid by the soum health centres (20). In 2011, there were 1,058 bagh feldshers working at soum health centres and soum hospitals (20).

Rehabilitation medicine is an emerging field in Mongolia. There are no definite official data on the PM&R specialist workforce. However, there are over 200 rehabilitation physicians and over 100 physiotherapists (PTs) registered in the Mongolian Society of PM&R (established in 2005). Since 2000, MNUMS commenced a postgraduate residency-training pro-

gramme in the Department of PM&R, and each year approximately 8–12 medical doctors graduate as rehabilitation physicians (26). There are PM&R departments in every major hospital, but almost all provide consultancy and ambulatory care (not inpatient care), and work conjointly with traditional medicine. The number of traditional medicine doctors has increased dramatically since 1990 following recognition by the Mongolian government and currently make up 10–15% of all medical graduates (20).

Interactive workshop on the Global Disability Action Plan

All participants ($n=77$) contributed actively to the group discussion and consensus method. Most were newly trained rehabilitation specialists and many (especially PTs) were not familiar with the GDAP, and had limited knowledge of disability programmes in Mongolia. The participants agreed that the GDAP provides comprehensive summary actions for the government, policymakers, clinicians and PwD. The participants provided multiple responses (in writing) across each GDAP objective. Overall, for GDAP objective 1, participants indicated 42 potential challenges/barriers and 31 potential facilitators/enablers; for objective 2: 51 challenges/barriers and 44 facilitators/enablers; and for objective 3: 20 challenges/barriers and 18 facilitators/enablers. A number of common suggested "terms" were coded, based on participants' feedback and consensus agreement. There was significant overlap with regards to the terms amongst the 3 GDAP objectives. Hence, the final set of "terms" was formulated collating all "terms", which included 38 potential challenges/barriers and 36 potential facilitators/enablers. The final set of potential facilitators and challenges in implementation of the proposed standard actions in the GDAP for rehabilitation are summarized in Table I.

DISCUSSION

This paper presents narrative findings on disability and PM&R status, and outlines potential barriers and facilitators for implementation of the GDAP from the Mongolian perspective. Mongolia has a multi-tiered and mixed-healthcare delivery system. Consistent with the worldwide pattern of population health transition, Mongolia is already in a stage of epidemiological transition from communicable diseases to the NCDs, due to the escalating prevalence of NCDs, which account for a predominant share of morbidity and mortality (9, 21, 27). The Mongolian government has prioritized disability and rehabilitation as one of its key agendas. The level of funding, human resources and health infrastructure specifically are well developed in urban areas, but are not optimal in rural areas (23). Since 1990, healthcare facilities and programmes have grown exponentially in most areas of Mongolia (11). However, the system still emphasizes provision of healthcare through hospitals, resulting in a fragmented and inefficient hospital sector providing generally low-quality care (23). This is further compounded by poorly developed primary healthcare sector, financing systems, human resources and planning, and regulatory processes (23). In line with this, many medical specialties, including PM&R are yet to develop at the optimum level. Although there is a PM&R department in many major hospitals, many health professionals work in silos, and most programmes are conjoint with and/or subjugated by traditional medicine. The rehabilitation service provision at the national level is fairly disjointed within capital and aimags health departments, NGOs and the private sector, providing services mostly through vertically-managed disease-specific mechanisms (13, 20, 23). Many physicians, particularly PM&R specialists, international NGOs (INGOs) and NGOs working in the field of disability management have little coordination. Furthermore, discernible urban-rural disparities in healthcare delivery and an imbalance in the health workforce compound the overall healthcare system (20). Similar to many developing countries, Mongolia has limited research and data on disability, impeding formulation of country-specific policies and programmes.

Since the establishment of the National Rehabilitation Center (1999), and the postgraduate resident training programme for PM&R at MNUMS (in 2000), the profile of rehabilitation medicine has improved, but remains under-developed (especially in rural settings) and poorly integrated with the acute healthcare systems. There are limited inpatient rehabilitation facilities (most offer ambulatory programmes), and limited specialized rehabilitation facilities (e.g. spinal or acquired brain injury rehabilitation units). The funding for comprehensive disability management and rehabilitation is not optimal and is not always covered by the Mongolian Health Insurance systems. There is lack of other allied healthcare professionals, such as occupational therapists, speech therapists, prosthetics, etc. There is minimal awareness regarding rehabilitation medicine amongst the public as well as general healthcare professionals, and it is often confused with traditional medicine. Other barriers include: lack of modern equipment (therapeutic and diagnostic), limited training and professional development prospects, and limited health services infrastructure and human resources in rehabilitation. The healthcare system itself at the national, provincial and district levels

Table I. Potential challenges and facilitators in implementation of the World Health Organization (WHO) Global Disability Action Plan 2014–2021 in Mongolia (n=77)

Potential challenges/barriers	Potential facilitators/enablers in the next 5–6 years
• Lack of strong leadership, need for a central body for developing governance • Health priority more driven towards acute sector and communicable disease • Limited commitment from the government, limited funding or under-funded programmes • Inadequate investment for health sector and financial support for HCPs • Poor coordination/collaboration among different government sectors and ministries • Limited coordination/collaboration among different healthcare sectors [hospitals (private and public), primary, community, INGOs and NGOs] • Lag in implementation of health policies • Inclusion of traditional medicine with rehabilitation (traditional medicine prioritized) • Poor education/knowledge about disability/rehabilitation amongst policy-makers, government authorities, etc. • Legislation policy for employment/education/health for PwD not enforced • Scarcity of disability-related data (inaccurate data; under-estimation and under-representation of disability prevalence, cost data, etc.) • Lack of specific regulation (job description) for specific healthcare professionals (such as allied health professionals) • Lack of processes to involve all stakeholders (including PM&R professionals) in policy development • Few specific disability-rehabilitation standards or key performance indicators (not up to date) • Limited leadership development programmes and professional development programmes for HCPs • Poor provision of infrastructure, accessibility in public places and transport for PwD • Limited specialized PM&R centres, such as for stroke, spinal cord injuries, etc. • Lack of multidisciplinary team approach and systems/models of care • Rehabilitation services not well integrated with acute services and lack of inpatient rehabilitation facilities • Limited numbers of community healthcare facilities and disability services, particularly in rural areas for PwD • Lack of structured standard referral systems from acute to sub-acute care and to community • Maldistribution of human resources (HCPs more centralized in capital and urban areas) and demoralized workforce • Poor awareness, misconception and cultural belief about disability • Belief in traditional medicine amongst general public and health practitioners • Limited number of adequate primary care services • Lack of continuum of care • Lack of emergency assistance programmes for PwD • Lack of evidence-base guidelines/protocols and disability centred measures and tools • Lack of undergraduate courses in rehabilitation in medical institutions and limited professional courses/training programmes in academic institution • No staff development or appraisal systems in hospitals or community settings • Limited access to education or web-based learning, professional development, training in new innovations and therapy • Poor awareness amongst healthcare professionals about disability and PM&R • Minimal integration of community-based programmes with acute services • Lack of family/carer education and limited provision of inclusion of caregivers of PwD and/or PwD in care programmes, decision-making • Minimal information available to public about access to rehabilitation services • Rehabilitation workforce minimally trained in research methodology including data collection; research not identified as a priority • Limited funding for research and lack of awards or recognition for research work • Limited staff capacity, training support, guidance and/or mentorship and facilities available for research	• Establishment of legislative and central capacity building body • Education/awareness programmes about disability and PM&R for policy-makers, government authorities, hospital administrators • Inclusion of HCPs including rehabilitation physicians in policy development • Strengthening management capacity, public-private partnerships • Establishment of healthcare standards/policies and implementation and evaluation • Development of Key Performance Indicators, Standards of Care and accreditation criteria for rehabilitation facilities and staff by the Ministry of Health • Coordination and communication between governmental bodies, healthcare sectors, various INGOs/NGOs and community organizations • More active role of PM&R departments in facilitating leadership skills and governance • International cooperation and support for PM&R development and training • Development of evidence-based guidelines/protocols and outcome measures for disability and rehabilitation • Development of Continuous Medical Education (CME) programmes for HCPs, skill training and educational programmes (national/international) • Increased health budget expenditure for disability and PM&R • Development of standard data collection systems (training ICF) • Training and educational programme for PwD, families and carers of PwD • Improvement of social welfare, livelihood and benefits for PwD • Development of new rehabilitation infrastructure and re-evaluation of existing services • Development of standard referral systems • Promotion of CBR • Development of inpatient rehabilitation units, and specialized rehabilitation facilities (including in remote areas) • Development of telerehabilitation • Public awareness and educational programmes • New medical equipment and technology supportive to the local needs (including in rural areas) • Development of consumer organizations (including PwD at national and local level) • Initiatives/programmes and funding for development of allied health professionals • Development of vocational rehabilitation programme (jobs, education etc.) for PwD • More active role of national society of PM&R • Development of innovative teaching models, using interactive problem-based learning and clinical capacity through organized educational activities • Collaboration with international partners for staff education/training • More CBR services linked with main hospital networks and through inclusion of carers, PwD in decision-making processes • Adequate financial support and advocacy for assistive devices and technology and expansion to rural areas • Development of Mobile Rehabilitation Units to deliver care in remote areas • Build research capacity in rehabilitation by training and educating medical staff in research methodologies • Development of research, data collection methods/measurement tools in disability and rehabilitation • Involvement of government and academic institutions to establish national research centre/foundation • Collaboration with international partners in research and development • International aid/assistance in research capacity building

CBR: community-based rehabilitation; HCP: healthcare professionals; ICF: International Classification of Functioning, Disability and Health; INGO: international non-governmental organization; IT: information technology; NGO: non-governmental organization; PM&R: physical medicine and rehabilitation; PwD: persons with disabilities; WHO: World Health Organization.

is still patchy. At the community level, care of PwD (including CBR) is predominantly funded by NGOs and charitable organizations (25).

The GDAP provides comprehensive summary actions for disability and offers the Mongolian government, policymakers and other relevant stakeholders a blueprint for implementing the recommendations of the World Disability Report. The Mongolian health sector now has the opportunity to improve and build on existing programmes, and develop more comprehensive and

innovative programmes for long-term care of PwD. A modified Delphi method in this study allowed all participants to contribute their opinion on potential barriers/challenges for successful implementation of the GDAP. Participant feedback was positive, and most were satisfied with the overall consensus process. Multidisciplinary input within the group was beneficial, and the group was fairly diverse in their areas of expertise and range of views. The group heterogeneity was reflected in the widespread range of terms and potential issues that emerged. Group discussion and a consensus round served to remove duplicate or similar terms/issues and formulate the final set of barriers and facilitators.

There is a strong impetus to improve the disability and rehabilitation sector in Mongolia. The key issues from participants' feedback reflected the need for a centralized leadership for provision of standards for rehabilitative care and key performance indicators for rehabilitation, up-skilling the workforce, developing infrastructure and support systems, access to new equipment for therapy and integration of all relevant sectors (including NGOs and consumer groups). There is opportunity for PM&R professionals, consumer organizations and NGOs to come together not only for improving clinical practice and service delivery, training, education and research; but also for coordinated and pro-active lobbying to prioritize challenges that need to be addressed for successful implementation of the GDAP.

Some limitations in this study cannot be ruled out. This is a cross-sectional study and did not intend to test specific hypotheses through systematic analysis. Content analytical technique summarized data derived from the interactive feedback from participants attending an organized workshop programme. This study was intended as a preliminary descriptive study, with the aim of summarizing disability and rehabilitation efforts in Mongolia based on the GDAP, and to identify barriers/challenges and facilitators from the perspective of participants for the implementation of this action plan. The study cohort of health professionals were invited by MNUMS and did not include other stakeholders (such as governmental, social work organizations, organizations of PwD), which may limit the generalizability and validity of these findings. However, the study cohort included PM&R professionals from a wide geographical population in Mongolia, and was representative of the wider sample currently operational in the community both in urban and rural areas. The visiting team was not involved in participant selection, as this was beyond their authority. The team contacted some NGOs and a few family members of PwD to include their viewpoint. The authors believe the findings reflect the current issues/problems faced by the PM&R workforce in Mongolia at large. They are unaware of any similar study in Mongolia addressing such issues.

Mongolia has made good progress in building its national health capacity for the acute healthcare sector, public health emergency preparedness, and infection prevention and control (11). However, there is a critical need to build the system, integrating and linking other emerging capacities, like PM&R. Effective delivery of healthcare services, including rehabilitation, especially in rural areas, is challenging due to the sparse and scattered distribution of the population, long distances and nomadic lifestyles (mainly in rural areas) (13, 20). Other potential problems for implementation of the GDAP include repeated restructuring of the health system, poor financial support for education and health sectors, rising unemployment and rapid urbanization. The needs of PwD can easily be overlooked in the current environment.

In summary, like many developing countries, the rights and healthcare needs of PwD in Mongolia have many barriers to their inclusion in key aspects of society. There were many similarities in the barriers identified in consensus exercises in both Madagascar and Pakistan PM&R (14, 16) to those of their Mongolian counterparts. Many PwD remain marginalized and their capabilities underestimated. Despite strong commitment from government for disability-inclusive and sustainable development programmes, there remains a gap between policy and practice. The key issues raised by the participants are listed below.

- Leadership from the Ministry of Health (and other governmental authorities) for development of PM&R standards, accreditation and key performance indicators.
- Evidence-based models of care.
- Organized integrated healthcare systems (patient referrals, continuum of care after discharge, CBR, etc.).
- Integration of PM&R with acute health services and development of inpatient PM&R facilities.
- Tailoring the GDAP recommendations to suit the local environment for accessibility to mainstream services.
- Development of systematic data collection methods for disability (such as a national disability registry).
- Improving infrastructure for disabled access for transport and buildings and social support systems.
- Upskilling, educating and developing the PM&R workforce using innovation, technology/web-based systems.
- Promoting awareness of disability and rehabilitation needs.
- Investment in research and (national and international) collaboration.

In conclusion, the role of PM&R in the Mongolian healthcare system is expanding to address the rights and needs of the growing numbers of PwD. All PM&R participants stressed the need to empower PwD for active participation in society and development. The interactive consensus method using the GDAP as a tool was useful to gather information, improve access and to strengthen PM&R services in Mongolia.

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REFERENCES

1. World Health Organization. World report on disability. Geneva: WHO; 2011.
2. United Nations. Convention on the Rights of Persons with Disabilities. 2006 [cited 2016 Jul 1]. Available from: http://www2.ohchr.org/english/law/disabilities-convention.htm.
3. 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.
4. Shrivastava SR, Shrivastava PS, Ramasamy JD. Reduction in global burden of stroke in underserved areas. J Neurosci Rural Pract 2013; 4: 475–476.
5. Khan F, Amatya B, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward. Phys Med Rehabil Int 2015; 2: 1070.
6. World Health Organization. WHO global disability action plan 2014–2021: better health for all people with disability. Geneva: WHO; 2014.
7. International Labour Office (IOL). Mongolia country profile. Employment of people with disabilities: the impact of legislation (Asia and the Pacific). Geneva: IOL and Development Cooperation Ireland (DCI); March 2003.
8. World Health Organization (WHO). Country cooperation strategy for Mongolia 2010–2015. Geneva: WHO; 2010.
9. World Health Organization. Mongolia: WHO statistical profile. Geneva: WHO; 2012.
10. Federal Statistical Office of Germany (Destatis). Mongolia: Statistical country profiles. Wiesbaden: Statistisches Bundesamt; 2015.
11. World Health Organization. Country cooperation strategy: Mongolia. Geneva: WHO; May 2014.
12. United Nations Economic and Social Commission for Asia and the Pacific. Statistical Yearbook for Asia and the Pacific 2014. Bangkok: United Nations; 2014.
13. World Health Organization (WHO). Mongolia health system review (Health Systems in Transition, Vol. 3 No. 2). Geneva: Asia Pacific Observatory on Health Systems and Policies, WHO; 2013.
14. Khan F, Amatya B, Mannan H, Burkle FM, Jr, Galea MP. Rehabilitation in Madagascar: challenges in implementing the World Health Organization Disability Action Plan. J Rehabil Med 2015; 47: 688–696.
15. Gutenbrunner C, Negrini S, Kiekens C, Zampolini M, Nugraha B. The Global Disability Action Plan 2014–2021 of the World Health Organisation (WHO): a major step towards better health for all people with disabilities. Chance and challenge for Physical and Rehabilitation Medicine (PRM). Eur J Phys Rehabil Med 2015; 51: 1–4.
16. Khan F, Amatya B, Sayed TM, Butt AW, Jamil K, Iqbal W, et al. The World Health Organisation – Global Disability Action Plan 2014–2021: challenges and perspectives for physical medicine and rehabilitation in Pakistan. J Rehabil Med 2017; 49: 10–21.
17. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res 2005; 15: 1277–1288.
18. United Nations Economic and Social Commission for Asia and the Pacific. Disability at a Glance 2015: strengthening employment prospects for persons with disabilities in Asia and the Pacific. Bangkok: ESCAP; 2015.
19. Ministry of Population Development and Social Protection of Mongolia; Ministry of Health of Mongolia. Make the right real workshop in Mongolia. Ulaanbaatar: Government of Mongolia; 26 March 2014.
20. World health Organisation (WHO); Mongolian Ministry of Health. Health service delivery profile: Mongolia. Geneva: WHO; 2012.
21. World Health Organization. Non-communicable diseases country profiles: Mongolia. Geneva: WHO; 2011.
22. Institute for Health Metrics and Evaluation. Global burden of disease (GBD) – Mongolia Seattle: IHME: 2010 [cited 2016 Sep 10]. Available from: http://www.healthdata.org/mongolia.
23. Asian Development Bank (ADB). Mongolia: health and social protection. Manila: Operations Evaluation Department, ADB; Oct 2008.
24. Asia-Pacific Development Center on Disability (APDCD). Disability movement in the Asia-Pacific Region. Bangkok: APDCD; 2016 [cited 2016 Sep 12]. Available from: http://www.apcdfoundation.org/?q=content/disability-movement-asia-pacific-region.
25. Sharma M, Deepak S. A case study of the community based rehabilitation programme in Mongolia. Bologna: Associazione Italiana Amici di Raoul Follereau (AIFO); 2001 [cited 2016 Sep 12]. Available from: http://english.aifo.it/disability/apdrj/apdrj102/mongolia.pdf.
26. Avirmed B, Sh B, Batgerel O. Present status and future prospects of PMR in Mongolia. International Symposium Japan; 2005.
27. Enkh-Oyun T, Kotani K, Davaalkham D, Aoyama Y, Tsuboi S, Oguma T, et al. Ischemic heart disease and its related factors in Mongolia: a nationwide survey. J Community Health 2013; 38: 919–925.

Appendix 4

Other research publication 2

Khan F, Amatya B, Sayed TM, Butt AW, Jamil K, Iqbal W, Elmalik A, Rathore FA, Abbott G. The World Health Organisation - Disability Action Plan 2014–2021: Challenges and Perspectives for Physical Medicine and Rehabilitation in Pakistan. Journal of Rehabilitation Medicine 2017; 49: 10–21.

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SPECIAL REPORT

WORLD HEALTH ORGANIZATION GLOBAL DISABILITY ACTION PLAN 2014–2021: CHALLENGES AND PERSPECTIVES FOR PHYSICAL MEDICINE AND REHABILITATION IN PAKISTAN

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***Objective*: To provide an update on disability and outline potential barriers and facilitators for implementation of the World Health Organization Global Disability Action Plan (GDAP) in Pakistan.**

***Methods*: A 6-day workshop at the Armed Forces Institute of Rehabilitation Medicine, Islamabad facilitated by rehabilitation staff from Royal Melbourne Hospital, Australia. Local healthcare professionals ($n = 33$) from medical rehabilitation facilities identified challenges in service provision, education and attitudes/approaches to people with disabilities, using consensus agreement for objectives listed in the GDAP.**

***Results*: Respondents agreed on the following challenges in implementing the GDAP: shortage of skilled work-force, fragmented healthcare system, poor coordination between acute and subacute healthcare sectors, limited health services infrastructure and funding, lack of disability data, poor legislation, lack of guidelines and accreditation standards, limited awareness/knowledge of disability, socio-cultural perceptions and geo-topographical issues. The main facilitators included: need for governing/leadership bodies, engagement of healthcare professionals and institutions using a multi-sectoral approach, new partnerships and strategic collaboration, provision of financial and technical assistance, future policy direction, research and development.**

***Conclusion*: The barriers to implementing the GDAP identified here highlight the emerging priorities and challenges in the development of rehabilitation medicine and GDAP implementation in a developing country. The GDAP summary actions were useful planning tools to improve access and strengthen rehabilitation services.**

Key words: disability; rehabilitation; Pakistan; World Health Organization.

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There are an estimated 650 million people with disabilities (PwD) in the Asia-Pacific region (65% of the total global disability population), equating to 1 in every 6 persons (1–3). The United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD) recognizes that "disability is an evolving concept that results from the interaction between persons with impairments and attitudinal and environmental barriers that hinder their full active participation in society on an equal basis with others" (4). This "paradigm shift" in attitudes to PwD, views PwD as active members of society with equal rights (4) and delivered a normative framework for disability, ratified by 147 member states including Pakistan (3). Despite this commitment from UN Member states, there remains a significant gap in service provision for this cohort in the community in terms of healthcare and access to services. The implementation of rehabilitation policies and legislation are not optimal in many countries (1). In the South-Asia region (similar to other developing countries) (5), non-communicable diseases (NCDs), environmental factors, road trauma, disasters and man-made conflict are key factors contributing to disability prevalence (3).

Pakistan is the sixth most populous country in the world (population >180 million, area approximately 800,000 km^2) (6), bordered by India, Afghanistan, Iran and China. Pakistan comprises 5 main provinces: Punjab, Khyber-Pakhtunkhwa, Sindh, Balochistan and, relatively smaller, Gilgit-Baltistan; and 3 territories: Federally Administered Tribal Areas, Islamabad Capital Territory and Kashmir (6). Punjab and Sindh are the most densely populated regions (7); however, approximately 64% of the Pakistani population live in remote and rural areas (7). There are significant disparities amongst the provinces in terms of capacity, infrastructure and level of governance, due to topography, security issues and/or natural disasters (3).

The median age of the population of Pakistan is 23 years (with over 35% of the population being younger than 14 years). Life expectancy at birth is 65 years

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(8). The literacy rate among adults aged 15 years and over is just above 56% (6, 8). According to World Bank income classification, Pakistan is categorized as a "low-middle" income country, and is ranked 146th (out of 186 countries) in the Human Development Index, with gross national income *per capita* (in 2013) of US $2,880 (6, 8). Pakistan remains impoverished and underdeveloped, with 60.2% of the population living below US$2 dollars a day (9). Gender inequities, particularly in marginalized populations, are prominent, with 58% of females over the age of 15 years being illiterate compared to 33% of males (6, 9). Universal education is yet to be achieved in Pakistan. Compared with other member countries of the South Asian Association for Regional Cooperation (SAARC) (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka), Pakistan has low net primary (72.5% in 2012) and tertiary education enrolment rates of only 9.5% (9).

Overall spending on healthcare by the government of Pakistan is low, with total expenditure on health per capita of US $126 (in 2013), or 2.8% of total expenditure of gross development product (GDP) (6, 8). The majority of PwD in Pakistan, as in many developing countries (5, 10, 11), are economically deprived and experience difficulties in accessing basic health services, including rehabilitation services (7, 12). Similar to other SAARC countries, much effort has gone into improving the acute care sector, while post-acute care (including rehabilitation), is still undeveloped at many levels (7, 12). Overall, key determinants of poor health include: literacy, unemployment, gender inequality, social exclusion, rapid urbanization, and environmental degradation (3, 6). Furthermore, war/conflict, terrorism, chronic insecurity, frequent disasters (both natural and man-made), intertwined with political instability, poor governance and dependency on foreign assistance compound the lack of an effective healthcare system in Pakistan. Despite attempts to introduce various policies for PwD, they continue to have difficulty exercising their civil and political rights, and gaining access to education and employment (13). An estimated economic loss of approximately US $11.9–15.4 billion or 4.9–6.3% of Pakistan's GDP is attributed to exclusion of PwD as productive members of society (13, 14).

An overview of disability and current rehabilitation status in Pakistan is set out below.

Burden of disability

There is limited epidemiological data on disability and disability-related burden in Pakistan. Based on the 1998 population census, there are an estimated 3 million PwD in Pakistan, and a disability prevalence rate of 2.5%. This is significantly lower than the "worldwide" disability prevalence rate estimation of 15% (or 1 in 7 people) based on the World Report on Disability (1). Based on this reported prevalence of disability and a population of 185.1 million (2014) (7), the number of PwD in Pakistan may exceed 27 million people. NCDs remain a significant cause of overall burden of disease in Pakistan, contributing an estimated 40.3% of overall disability-adjusted life years (DALYs) in 2012, followed by injuries, which account for 11% of DALYs (15). Amongst NCDs, DALYs attributed to cardiovascular disease (CVD) is the highest (7.3%), followed by behavioural conditions (5.1%), cancer (4.5%), and neurological conditions (3.6%) (15). NCDs contribute to 50% of overall mortality, with 19% due to CVD alone; while communicable diseases contribute 39% and injuries 11% (8). Consistent with other SAARC countries, the prevalence of disability in Pakistan is increasing due to natural disasters and conflict, cultural factors, political instability, increase in chronic conditions, an ageing population and economic down-turn (3, 13). Despite the lack of conclusive data, the economic and social costs of disability are significant for PwD (their families), the community and the nation (1).

Disability policies and legislation

National development policies in many South-Asian countries have not adequately addressed the concerns of PwD. In response to the UN's International Year of Disability 1981, the government of Pakistan initiated their first law dealing specifically with disability: the "Disabled Persons (Employment and Rehabilitation) Ordinance 1981", to promote equal working rights, focusing on employment and segregated education for PwD (13). The Ordinance specified that all government agencies and companies with more than 100 employees were required to ensure that at least 1% of their workforce consisted of PwD or pay a levy; this law, however, is poorly implemented. After a hiatus of 20 years, in consultation with the health, education, labour, housing and science and technology ministries, as well as relevant non-governmental organizations (NGOs) and local organizations, the first "National Policy for Persons with Disabilities" was approved in 2002 (13). The policy advocates rights of PwD for access to medical and rehabilitation services, education, employment and social participation and systematically specifies guiding principles and strategies, with the focus on empowering PwD. In 2006, the "National Plan of Action" was introduced to provide a roadmap for implementing the national policy, with short- and long-term measures. However, due to the amended Constitution and division of legislative powers (from

federal to provincial government), including social welfare, mental illness, workers' welfare, employer liability and education, the policy was not endorsed (13, 16). In 1990, the Pakistan "Convention on the Rights of the Child" was ratified for rights of children with disabilities (Article 2, Article 23). The "National Plan of Action for Children (2006 to 2015)" was further ratified, for rights of children with disabilities and PwD (17). The "Convention on the Elimination of all Forms of Discrimination against Women", ratified in 1996, however, did not directly address the rights of women with disabilities. Similarly, the "National Education Policy" (2009) did not contain any direct objective to address the needs of children and women with disabilities (17). Pakistan signed the UNCRPD in 2008 and ratified the convention in 2011 (3). Furthermore, the UNCRPD Secretariat for the Implementation of the Convention was established in 2012 and a formulation of a Core Committee followed to monitor/coordinate with all stakeholders for implementation of the Convention (17).

Policy approaches to disability have largely improved in the last few years in Pakistan, and there is better collaboration between acute and rehabilitation facilities and various NGOs, who provide social care for PwD. More work, however, is needed for the government to implement better laws and policies, for services to be efficient and effective, and for organizations working with PwD to adopt a co-ordinated approach to communicate their needs. There is much to be done with regard to disabled access to buildings, parking, transportation, and access to advocacy, provision of assistive devices, aids, counselling, social welfare and assistance to PwD. In general, there is lack of public awareness of economic and social implications for PwD. The CRPD offers a blueprint for a rights-based approach to mainstreaming PwD, underlining the government's commitment to protecting the civil, political, social and economic rights of PwD. However, many agree that little has changed in accordance with the framework, set up in the CRPD framework (7, 13), and millions of PwD remain excluded from healthcare, rehabilitation, and social participation.

Human resources

There are an estimated 8 physicians per 10,000 population in Pakistan, which is significantly higher than other SAARC member countries, except India (with 16 physicians per 10,000 population) (3). (Table I). Overall, it is estimated that there are more than 200,000 doctors, 33,793 specialist doctors (more than 170 trained neurologists) registered with the Pakistan Medical and Dental Council (as of October 2015) (18). There are an estimated 46,000 nurses and 4,500 lady health visitors currently registered in Pakistan (3, 6). To date, 48 physicians have qualified as physical medicine and rehabilitation (PM&R) fellows, the majority ($n=32$) of whom work in military facilities; while the remainder work in the private and public sectors, which service the majority of PwD in Pakistan (18). Currently, there are an estimated 1,700 physiotherapists in Pakistan, with 1,300 expected to graduate annually. There are approximately 200 trained occupational therapists, 250 speech and language therapists, and no formally trained nurses in rehabilitation. There is a significant shortage of trained and available healthcare professionals with inequitable staff distribution across rural areas (particularly in the rehabilitation sector) (7). Importantly, there is still no formal professional organization representing PM&R specialists. PM&R staff from various rehabilitation settings are focusing on building interdisciplinary teams, communication and decision-making processes in order to operate as cohesive teams.

Service delivery

Since the adoption of the CRPD in 2011, there has been an increased awareness of the disability-inclusive national development strategies, goals and programmes in Pakistan. However, the health system in Pakistan has faced enormous challenges in recent decades, due to sectoral conflicts, natural disasters, poverty, political uncertainty and a decrease in international aid. In 2010, there were 989 public hospitals and 800 private hospitals, 596 rural health centres and 4,910 basic health units at the primary healthcare level (19, 20). According to the World Health Organization (WHO), there are a mean of 6 hospital beds per 10,000 population (3). Rehabilitation services are increasing significantly in Pakistan, compared with its counterparts in the region. There are 3 established rehabilitation centres, 15 departments of rehabilitation medicine, 32 physiotherapy departments (mainly in the army) currently operational in Pakistan (7). In addition, there are 4 smaller regional facilities that provide supportive rehabilitation, including community-based rehabilitation programmes. There are however, only 2 institutes of PM&R in the country: the Armed Forces Institute of Rehabilitation Medicine (AFIRM) primarily catering for the military, and another in private sector (21). It is estimated that PM&R is being practiced at 23 locations in the country; however, most of these centres do not follow a multidisciplinary approach (7). There are also some centres for spinal cord injuries run by NGOs and physiotherapists (7, 21). In 1997 the College of Physicians and Surgeons of Pakistan recognized PM&R as a specialty and provided the fellowship training programme in PM&R. Currently, along with the AFIRM,

Table I. Summary of current health systems/resources for disability in South Asian Association for Regional Cooperation member countries

Country	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Population[a]	30.6 million	156.6 million	0.75 million	1.2 billion	0.35 million	27.8 million	185.1 million (2014)[b]	21.3 million
Economic statistics	GNI per capita (2013): $2,000 Total expenditure health: 8.1% of GPD HDI rank: 175 Annual disability spending: **US**$34.8 million	GNI per capita: $2,030; Total expenditure on health: 3.7% of GPD 43% living below poverty line (US$ 1.25/day) HDI rank: 146; Annual disability spending: no information	GNI per capita (2013): $7,210 Total expenditure on health: 3.6% of GPD HDI rank: 140 Annual disability spending: no information	GNI per capita: $5,350; Total expenditure on health: 4.2% of GPD HDI rank: 136 Annual disability spending: Indian rupee 4.8 billion	GNI per capita: $8,110; Total expenditure on health: 10.8% of GPD HDI rank: 104 Annual disability spending: no information	GNI per capita: $2,260; Total expenditure on health: 6.0% of GPD HDI rank: 157 Annual disability spending: no information	GNI per capita[b]: $4,920; Total expenditure on health: 2.8% of GPD HDI rank: 146 Annual disability spending: Pakistani rupee 366 million	GNI per capita: $9,470; Total expenditure on health: 3.4% of GPD HDI rank: 92 Annual disability spending: Lankan rupee 25 million
Human resources (healthcare)	Physicians: 2.3/10,000 people; No specific specialization in PM&R No data on other healthcare and allied health personnel	Physicians: 3.6/10,000 people; Currently active: PM&R physicians: 200. PT: 1300; PT assistants: 600; SLTs: 33; P&O technicians: very few; over 900 persons completed CBR training courses	Physicians: 0.074/10,000 people; nurses/midwives: 0.3/10,000 people No information on rehabilitation professionals	Physicians: 7/10,000 people; several national institutions and 250 private institutions conduct training courses for rehabilitation specialists	Physicians: 16/10,000 people; nurses: 44.4/10,000 people; PT: 22 (2005) No information on rehabilitation professionals	Physicians: 0.21/10,000 people (2004) No information on rehabilitation professionals	Physicians: 8/10,000 people (113,700 doctors, 21,800 specialist doctors); Nurses 6/10,000 people (46,000 nurses and 4500 lady health visitors); PM&R specialists: 38 (25 in armed forces)	Physicians: 6.8/10,000 people; currently employed in government hospitals: 363 PTs; 107 OTs and 35 S&LTs; 8,000 of the 14,000 CBR volunteers; No trained PM&R physician
Health services/ infrastructures	Access to health centres: 51% and hospital: 32.4%; Many rehabilitation services funded by NGOs and charities PT services: 44/364 districts; CBR and outreach programmes implemented: 80/364 districts; orthopaedic centres: 13/34 provinces	Approximately 4 beds/10,000 people; piloting 68 Integrated Disability Service Centres in 64 districts, with 323 PTs, 83 OTs, 37 P&O and 19 speech therapists. Many rehabilitation services funded by NGOs and charities	32 hospitals, 192 basic health units, 48 indigenous hospitals and over 550 outreach clinics, free healthcare services to cover 90% population (2012). No information on rehabilitation centres	5 composite, 4 regional and 120 district rehabilitation centres, institutions at intermediary and district level exist for PwD	1 main referral general public hospital, 6 regional public general hospitals, 13 hospitals, 132 healthcare centres, 108 health posts. Many rehabilitation services funded by NGOs and charities	19 medical colleges, >100 paramedical institutions, no rehabilitation professionals. Many rehabilitation services funded by NGOs and charities	989 public, 800 private hospitals, 596 rural health centres and 4910 basic health units at the primary healthcare level (2010). 15 departments of rehabilitation medicine, 32 PT departments (mainly in army) Approximately 6 beds/10,000 people	5 rehabilitation hospitals; 50 base and district hospitals with PT units, 8 physical rehabilitation centres in 6 districts produce P&O devices.
Disability data	PwD: 0.9 million; Disability prevalence: 2.7 (2005); 4.8% of total population	PwD: 13.3 million; Disability prevalence: 9.0 (2008); (approximately 750,000 persons) of the population in need of P&O services	PwD: 0.02 million; Disability prevalence: 3.4 (2005)	PwD: 22 million, Disability prevalence: 2.1 (2001) Proportion of PwD to total population 1.8–2.1%;	PwD: 9,216; Disability prevalence: 3.4 (2002)	PwD: 0.1 million, Disability prevalence: 0.5 (2001)	PwD: 3.3 million, Disability prevalence: 2.5% (1998)	PwD; 0.3 million, Disability prevalence: 1.6 (2001); Approximately 105,000 persons require P&O services
Disability type	Physical: 36.5%, visual and hearing: 25.5%, intellectual: 18.8%, mental: 9.7%, multiple: 9.4%	Physical: 22.5%, visual: 13.7%, hearing: 16.8%, intellectual (memory loss): 10.1%, mental: 12.8%, others 24.2%	Physical (mobility): 17.4%, visual: 23.5%, hearing: 35.7%, speech: 17.8%, mental: 5.5%	Movement: 27.9%, visual:48.5%, hearing: 5.8%, speech: 7.5%, mental: 10.3%	Visual: 33.2%, speech: 28.6%, Mental: 27.8%, others 10.4%	Physical: 39.3%, blind: 15.9%, deaf: 24.6%, mental (retarded): 12.7%, multiple: 7.5%	Physical: 18.9%, visual: 8.1%, hearing: 7.4%, intellectual: 7.6%, mental: 6.4%, multiple: 8.2%, others 43.4%	Physical: 55.3%, visual: 25.2%, hearing/ speech: 26.7%, mental: 25.1%%
Disability legislation for PwD	CRPD ratified: 2012; Comprehensive national disability policy 2003; National Disability Action Plan (2008–2011); National Priority Programme "Health for All Afghans" from 2012; Physical Rehabilitation Strategy	CRPD signed and ratified: 2007; Disability Welfare Act (2001); National Policy on Disability (2004); National Action Plan on Disability (2006); Disability Rights and Protection Act (2013); signatory to the Asian and Pacific Decade of PwD (2002–2012) and (2013–2022)	CRPD signed 2007; no information in regards to laws and policies for PwD	CRPD signed and ratified: 2007; PwD Equal Opportunities, Protection of Rights and Full Participation Act (1995); Mental Health Act (1987); National Policy for Persons with Disabilities (2006); Rehabilitation Council of India Act (1995)	CRPD signed 2007 and ratified 2010; Law on Protecting the Rights of People with Special Needs and Financial Assistance (2009); National Disability Policy; Strategic Action Plan 2009–2013; Action Plan for Children with Disabilities 2008–2013	CRPD signed 2008 and ratified:2010; Person with Disability Welfare Act 2039; Person with Disability Welfare Regulation 2051, National Disability Policy 2006; National Disability Action Plan 2006–2016	CRPD signature 2008, ratification 2011; National Policy for PwD: 2002; National Plan of Action 2006–2025; the Disabled Persons (Employment and Rehabilitation) Ordinance1981; Convention on the Rights of the Child 1990; Convention on Elimination of all Discrimination against Women 1996	CRPD signed 2007; Protection of the Rights of Persons with Disabilities Act (1996); RanaViru Seva Act (1999); Visually Handicapped Trust Fund Act (1992); Disabled Persons' Accessibility Regulation (2003); National Policy on Disability (2003); Action Plan for PwD (2011)

Table I cont

Country	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Support scheme for PwD	Financial support only to persons with war-related disabilities; services available for all PwD	Allowances programme: 300 Taka per person/ month	No information	Disability pension for persons living below the poverty line, aged 18–59 years, with severe (>80%) or multiple disability	Home for people with special needs (psychiatric and geriatric patients); monthly financial allowance for persons with visual disability (totally blind)	No information	Benazir Income Support Programme; Financial assistance through Pakistan Bait ul Mal; Free medical treatment to PwD and their dependent family members in Federal/Provincial Government hospitals/ dispensaries; 50% concession in air/train fare for PwD; 2% employment quota reserved in public and private sector; 10-year age relaxation in upper age limit for Government service	No information
Research and evaluation	Limited research in rehabilitation field	Research in rehabilitation field limited to acute care outcomes. Member of ISPRM	No research in rehabilitation field	Currently an upward trend in research in the medical rehabilitation. Member of ISPRM	No research in rehabilitation field	No research in rehabilitation field	Currently an upward trend in research in the medical rehabilitation	Research in rehabilitation limited mostly to acute care outcomes.

Main sources: WHO Country Profile; WHO Health Statistics 2011; WHO Disability and rehabilitation status 2004 (14); ESCAP 2012.
[a]Population in millions in 2013 unless stated otherwise; [b]Statistical Yearbook for Asia and the Pacific 2014.
CRPD: Convention on the Rights of Persons with Disabilities; HDI: Human Development Index; GDP: gross domestic product; GNI: gross national income; ISPRM: International Society of Physical and Rehabilitation Medicine; OT: occupational therapists; NCDs: non-communicable diseases; P&O: prosthetics and orthotics; PM&R: physical medicine and rehabilitation; PT: physiotherapists; PwD: persons with disability; SLTs: speech and language therapists; WHO: World Health Organization; CBR: community-based rehabilitation.

there are 5 other departments/institutions for fellowship training in PM&R: 2 in Lahore, and 1 each in Karachi, Peshawar and Muzaffarabad. However, there is currently no undergraduate teaching programme of rehabilitation medicine in medical institutes.

Table I compares data on disabilities, disability legislation, healthcare infrastructures and resources and support services in Pakistan with those for other SAARC countries.

Study objective

The objective of this cross-sectional study was to provide an update on the current rehabilitation efforts in Pakistan based on implementation of the WHO's Global Disability Action Plan (GDAP) (2014–2021) (Table II). Interactive feedback from Pakistani rehabilitation professionals was utilized during an organized workshop programme to document the challenges and strengths expressed by attendees corresponding to the established objectives listed in the GDAP.

METHODS

The authors (FK, BA, GA, AE) were invited as independent experts (November 2015) by the Medical Directorate, Military General Headquarters and the Armed Forces Institute of Rehabilitation Medicine (AFIRM), based in Islamabad, Pakistan, to assist with the assessment and planning rehabilitation needs of disaster victims, including those affected by the recent Hindu Kush earthquake (7.5 magnitude on 26 October 2015); and to assist in education and training of rehabilitation staff at AFIRM. One focus was to utilize the GDAP framework to build workforce capacity, develop standards and key performance indicators, operational set-up for rehabilitation services, infrastructure for a sustainable horizontal health system, development of a rehabilitation care-model from acute setting through to community, referral management, consumer involvement, and research methodology (data collection, rehabilitation registry) based on the Australian experience. This exercise was approved by the AFIRM and the Royal Melbourne Hospital.

Participants and procedure

A 6-day training workshop programme was held at the AFIRM. A total of 33 healthcare professionals from various medical rehabilitation centres (including rural areas) attended the workshops, including: 14 rehabilitation physicians, 3 neurologists, 2 general practitioners, 5 nurses, 2 prosthetists, 2 occupational therapists, 4 physiotherapists and 1 speech pathologist. Input was also obtained from 2 social workers and 1 clinical psychologist. These participants were invited by the Military General Headquarters (GHQ), Pakistan Army, the Army Medical College and Armed Forces Postgraduate Medical Institute, Rawalpindi. In addition, authors also met with a number of independent NGOs working in Peshawar, including the Pakistan Institute of Prosthetics and Orthotic Sciences, and the Pakistan Paraplegic Centre.

Over a 6-day period, the authors (FK, BA, GA, AE) assumed a facilitator role in conducting an extensive teaching programme, including workshops and consensus meetings

Table II. World Health Organization Global Disability Action Plan 2014–2021: Better health for all people with disability (22)

The action plan provides a comprehensive list of specific actions and metrics of success to achieve the plan's following 3 objectives:

1. Remove barriers and improve access to health services and programmes;
2. Strengthen and extend rehabilitation, assistive technology, assistance and support services, and community-based rehabilitation;
3. Strengthen collection of relevant and internationally comparable data on disability and support research on disability and related services.

based on the objectives listed in the GDAP. Prior to the detailed workshops, the authors summarized the state of evidence in the field of rehabilitation in the form of multiple plenary and interactive panel sessions. The teaching sessions included basic principles of rehabilitation, evidence-based practices, disability care planning, linking information technology, data and health record systems with acute hospital referrers and those in the community; capacity building; leadership skills development and nursing and symptomatic management (spasticity, pain, wound care, etc.). The "host" hospital lead medical and allied health team also provided presentations on their health services, including specific challenges faced by their rehabilitation staff. All information volunteered was supplemented with more specific recorded data during the workshop settings. During the workshops the participants were divided into 3 panels to ensure that the various specialist and skill base were evenly distributed. Each panel focused on 1 of the 3 GDAP objectives and were provided with a printed overview of the GDAP with blank corresponding columns to complete their responses. Based on their experiences and the issues they faced in service delivery, the participants in each panel were then asked to work out and discuss their views and perspectives of various problems that were highlighted relating to service provision, attitudes/approaches to PwD, gaps in service provision, education, related challenges and potential barriers and solutions designed for these issues. At all times the GDAP was used as a blueprint for discussion and allowed the authors to educate the audience, many of whom were not familiar with the GDAP document (mainly nurses and some allied health). Each panel included 2 speakers who presented on behalf of their designated panel, followed by a large group discussion for opportunity to brainstorm additional and emerging issues. Finally, a formal iterative decision-making and consensus process (with ≥80% of the participants agreeing) was conducted, tabulating potential challenges and facilitators in implementation of the GDAP.

Data collection and analysis

Throughout the workshops, participants submitted their responses in writing for each GDAP objective. They were encouraged to document any emerging issues and present these in the large group interactive session. The author-facilitators recorded additional information, comments and recommendations provided by the participants, where possible. All data were collated using content analytical technique (23). Two authors (FA, BA) scrutinized each response and coded the information using a line-by-line process, which were further clustered into a common suggestive "term". When no consensus was met about the possible "term", a final consensus was made by discussion amongst all the authors. Four authors (FA, BA, GA, AE) discussed the final content analysis and reviewed the preliminary version of terms for refinement.

In addition, a literature search of academic and grey literature using available internet search engines and websites was conducted for relevant publications (including academic articles, reports, related website contents, etc.), and relevant information discussed with participants. Known experts in this field were also contacted for further information on disability-related policies and legislation in Pakistan.

RESULTS

All participants ($n=33$) contributed actively to group discussions and the consensus method. Most were not familiar with the GDAP, and reported a lack of available information about the current developments and programmes with regards to disability. The participants provided multiple responses (in writing) across each GDAP objective. The participants agreed that the GDAP provides comprehensive summary actions for PwD and offers the government, policymakers, and other relevant stakeholders a blueprint for implementing the recommendations of the World Disability Report. Overall, for GDAP objective 1: participants indicated 62 potential challenges/barriers and 51 potential facilitators/enablers; for GDAP objective 2: 68 challenges/barriers and 55 facilitators/enablers; for GDAP objective 3: 29 challenges/barriers and 28 facilitators/enablers. Based on participants' feedback, consensus agreement and collation of data, a number of common suggest "terms" were coded. The final set of "terms" were formulated, which included for GDAP objective 1: 50 potential challenges/barriers and 49 potential facilitators/enablers; objective 2: 54 challenges/barriers and 55 facilitators/enablers and objective 3: 19 challenges/barriers and 20 facilitators/enablers. The final set of the potential facilitators and challenges in implementation of the proposed standard actions in the GDAP for rehabilitation are summarized in Table III.

DISCUSSION

Pakistan has a multi-tiered, mixed healthcare delivery system, which includes both state and provincial, and profit and not-for-profit service provisions. Similar to other SAARC member countries, although communicable diseases still account for a predominant share of morbidity and mortality, Pakistan is in a stage of an epidemiological transition due to the increasing prevalence of NCDs (3). The Pakistani Health Department has prioritized NCDs and rehabilitation as 1 of the key agendas (6). Levels of funding, human resources and health infrastructure are largely poor, particularly in rural areas of Pakistan (7). In past decades, healthcare facilities and programmes have grown exponentially in most areas of Pakistan. However, many are fragmented and/or work in isolation, and many programmes run only on a time-limited basis (6). There is duplication and wastage of resources, as many healthcare initiatives/facilities are supported or funded by different levels of government and/or development partners

Table III. Potential challenges and facilitators in implementation of the World Health Organization Global Disability Action Plan 2014–2021 in Pakistan ($n = 33$)

Actions	Potential challenges/barriers	Potential facilitators/enablers in the next 5–6 years
Objective 1: Remove barriers and improve access to health services and programmes		
1.1 Develop and/or reform health and disability laws, policies, strategies and plans	• Lack of definition for disability • Low priority of health in legislative process • Health priority more driven towards acute sector and NCDs • Unstable political and economic situation • Poor political commitment • Existing policies underfunded • Lack of coordination/collaboration amongst different government sectors and ministries • Lag in implementation of existing policies • Lack of consensus on who is responsible for enforcing and/or funding new legislations/policies • Lack of education/knowledge about disability amongst policymakers, government authorities, etc. • Lack of disability-related data	• Knowledge management capacity-building initiatives for policymakers, government authorities through media, awareness programme, lobbying • Adequate resource allocation • Review existing policy documentation and surveillance systems • Governing body to develop health policies from coordination to implementation; sectoral approach for alignment in disability care • Input from rehabilitation physicians in policy, • Strengthen management capacity, public-private partnerships through legislation and regulation • Establish a secondary level body of advocacy/oversight for implementation and evaluation of policies • Coordination and communication between central and provincial bodies • Strengthen National Health Information systems • Involve rehabilitation physicians, PwD and community organization in policy, legislation, programme development • Linkage with SAARC regional organizations • International cooperation and WHO support
1.2 Develop leadership and governance for disability-inclusive health	• Lack of central body for developing governance • Lack of coordination/collaboration among different government sectors, hospitals (private and public), DPOs, NGOs • Lack of process to involve all stakeholders (including rehabilitation medical professionals) in policy development • No disability-rehabilitation standards or key performance indicators • No specific accreditation standards or criteria for rehabilitation facilities and for staff • Limited workforce leadership development programmes	• Establishment of legislative and central capacity building body which included governmental authorities, health professionals, PwD and families, representative form regional health departments, quality of services, NGOs and DPOs • Capacity-building for educators for health work-force • Implement plan for quality control and health inputs • Coordinate and link various NGOs and DPOs with hospitals • More active role of rehabilitation medicine departments in facilitating leadership skills and governance • Improve web-based access to evidence-based guidelines/protocols and outcome measures for disability • Development key performance indicators and Standards of Care and accreditation criteria for rehabilitation facilities and staff
1.3 Remove barriers to financing and affordability for PwD	• Budget deficit and inadequate financial support • Lack of accurate data; underestimation and underrepresentation of disability prevalence, cost data, etc. • Decreased international aid • Lack of rehabilitation facilities in public sectors • Out-of-pocket payment for services and assistive devices/aids • Lack of government/private insurance • Lack of enforcement and evaluation of legislation policy for employment/education/health for PwD	• Increased health budget expenditure • Develop health insurance policies and coverage for PwD • Proper utilization of exiting social security systems such as "Zakat" • Use indigenous resources • More international financial assistance • Training and educational programme for PwD – build workforce • Improvement of social welfare, livelihood and benefits for PwD
1.4 Remove barriers to service delivery	• Lack of infrastructure • Non-disability friendly public places and transport • Corruption • Conflicts/war and terrorism • Topography of Pakistan distinct rural hard to access setups • Lack of rehabilitation for specific conditions such as stroke, spinal cord injuries etc. • Lack of multidisciplinary team approach and systems/models of care • Lack of integration with acute hospitals	• Accountability of resource allocation • Development of infrastructure and awareness of existing services • Development of comprehensive counter-terrorism and conflict policies • Structured standard referral systems: acute to sub-acute • Promotion of community-based rehabilitation • Development of Mobile Units to deliver care in remote areas • Train healthcare workers for home-based/community-based care • Telerehabilitation and local technology • Improve provision of disability friendly public facilities and transportation • Public awareness and educational programmes • Public-private sector partnership for service provision

Table III cont.

Actions	Potential challenges/barriers	Potential facilitators/enablers in the next 5–6 years
1.5 Overcome specific challenges to the quality of healthcare experienced by PwD	• Limited access to disability services, particularly in rural areas • Lack of adequate referral system • Lack of human resources • High illiteracy, poverty • Discrimination and stigma • Poor awareness of health services • Misconception and cultural belief about disability • Belief in traditional or native healers • Lack of adequate primary care services • Lack of follow-ups	• Central body to implement national health policy • Enhance interdisciplinary interaction • Decentralization of healthcare facilities including rehabilitation • Minimization of cultural stigma through public campaigns/awareness programmes • Skill training and educational programmes for healthcare staff • Development of consumer organizations for advocacy (including PwD at national and local level) • Development of strategies for engagement of staff and PwD (and families)
1.6 Meet the specific needs of PwD in health emergency risk management	• Lack of infrastructure and human resources • Lack of emergency assistance programmes for PwD • Lack of access to healthcare services, public transports etc. • Minimal collaboration and/or referrals between emergency staff and rehabilitation personnel in tertiary facilities • Lack of disability-centred measures paramedical services/disaster management plans • Lack of adequate primary care services • Lack of follow-up	• Assessment and evaluation to identify need to mobilize resources • Coordination of intervention • Build healthcare infrastructure and human resource capacity • Inclusion of emergency responses in resettlement plans for PwD • Improve communication systems and collaboration between acute and rehabilitation staff • International cooperation in humanitarian crises
Objective 2: Strengthen and extend rehabilitation, habilitation, assistive technology, assistance and support services, and community-based rehabilitation		
2.1 Provide leadership for developing policies, strategies and plans	• Same as 1.1 above • Inadequate financial support and budgetary constrain • Lack of accurate data; underestimation and underrepresentation of disability prevalence, cost data, etc. • Lack of awareness of extent of problems/issues facing disability	• Same as 1.1 above • More active role of Department of Rehabilitation Medicine • Establishment of the formal National society of PM&R • Public awareness through national forum
2.2 Provide adequate financial resources	• Same as 1.2 above • Acute care driven healthcare system	• Same as 1.2 above • Improvement of social welfare and livelihood
2.3 Develop and maintain a sustainable workforce	• limited skill base interdisciplinary workforce • Lack of undergraduate courses in rehabilitation in medical schools • Limited infrastructures and professional courses/training programmes in academic institution • No educational standards or key performance indicators for rehabilitation or continuous medical education evaluation • No staff development or appraisal systems in hospitals or community settings • Lack of guidelines/protocols • Limited access to education or IT-based learning • Limited opportunity for training in new innovations and therapy • Inadequate distribution of healthcare professionals – mostly urban setting • Poor awareness amongst healthcare professionals about workforce development • Demoralised workforce	• Develop a strategic workforce development plan by the government and establishment of national observatory for human resources • More funding and opportunity to develop a skilled workforce • More courses on rehabilitation in academic institutions and hospitals • Development of strategies for upskilling, empowerment and staff engagement • Develop teaching models, using interactive problem-based learning • Increase clinical capacity through organized educational activities, e.g. journal clubs, grand rounds. etc. • Motivation of clinical staff • Promotion of interdisciplinary teaching and interaction • Establish workforce management and retention programmes • Collaboration with international partners for staff training overseas

Table III cont.

Actions	Potential challenges/barriers	Potential facilitators/enablers in the next 5–6 years
2.4 Expand and strengthen rehabilitation services ensuring integration, across the continuum of care	• No accreditation standards or key performance indicators for rehabilitation • Rehabilitation services included with other general hospital services not well integrated nor identified for attention • Lack of structured standard referral systems from acute to sub-acute care to community • Lack of healthcare delivery models for Rehabilitation services • Minimal integration of community based programmes with acute services • Poor follow-up after discharge from acute facility and rehabilitation hospitals • Lack of family/carer education	• Development of accreditation standards for rehabilitation facilities and key performance indicators • Develop rehabilitation services within the existing health infrastructure • Improved profile of rehabilitation services in acute hospitals and integration of these services with other acute care sectors • More community-based rehabilitation services linked with main hospital networks • Incentives and mechanisms for retaining healthcare personnel especially in rural and remote areas • Use of IT systems, telemedicine and web-based services for improving awareness and access • Provision of equipment and technology for therapy in rehabilitation
2.5 Make available appropriate assistive technologies	• Lack of government services and health insurance • Private insurance does not include cover for rehabilitation mobility aids (wheelchairs, cane, and walker), or those for activities of daily living, orthotics, or prosthetic devices • Lack of awareness • Lack of human resources and infrastructure	• Adequate financial support • Advocacy for assistive technology funding • Inclusion of PwD and consumer organizations to raise awareness about technology • Expansion of assistive technologies to rural areas • Development and/or establishment of allied health rehabilitation services within the existing health infrastructure • Development of Mobile Units
2.6 Promote access to a range of assistance and support services	• Minimal information available to public about access to rehabilitation services • Lack of coordination with NGOs, DPOs and other charitable consumer/organization • Lack of insurance/government support for accessing rehabilitation services	• Campaign/awareness programme involving DPOS, NGOs and other charitable/consumer organizations • Develop Mobile Units to deliver care in remote areas • Expansion of community-based rehabilitation • International aid including WHO • Develop research programmes
2.7 Engage, support and build capacity of PwD and caregivers	• Exclusion of caregivers of PwD in care services • Poverty • High illiteracy • Misconception and cultural belief about disability • Belief in traditional or native healers • Pursuit of social support by PwD • Lack of social security • Lack of family support	• Involvement and education of caregivers in rehabilitation settings • Improve awareness of existing services/benefits for PwD/carers • Development of consumer support organizations for PwD at national and local level • Skill training for carers • Expansion of community-based rehabilitation through inclusion of carers in decision-making processes.
Objective 3: Strengthen collection of relevant and internationally comparable data on disability and support research on disability and related services		
3.1 Improve disability data collection (survey)	• Lack of universal coding system • Lack of trained human resource • Lack of reporting and information-gathering systems • Unreliable timely access to patient medical records • Rehabilitation workforce minimally trained in research methodology including data collection • Cultural barrier/misconception – unwilling to disclose • Logistical/ethical issues	• Promotion of operational research in disability and health systems • Set a minimal data set for rehabilitation • Set a universal coding system • Improve processes relating to clinical documentation/measurement tools • Commence medical staff training in research methodologies • Establish hospital-based IT systems for data entry • Disability specific registries in the future
3.2 Reform national data collection systems based on the ICF	• Lack of standard data collection systems • Minimal awareness and no incentive for hospitals or staff to participate • Limited staff training and support for ICF usage • Lack of national registries • Lack of financial support	• Implementation and training in ICF model • Develop standard data collection systems • Mandatory data collection across all sectors • Linkage of performance indicators to health outcomes • Involvement and active participation of National Federations, NGOs, DPOs

Table III cont.

Actions	• Potential challenges/barriers	• Potential facilitators/enablers in the next 5–6 years
3.3 Strengthen research on priority issues in disability	• Research not identified as a priority for rehabilitation • Lack of awards or recognition for research works • Limited support and IT available for research • Limited staff capacity and training for research • Lack of available research professionals • Limited guidance and/or mentorship • Lack of funding for research	• Involve government and academic institutions to conduct research • Train research professionals • Improve access to IT and web-based programmes • Build research capacity in rehabilitation • Cooperation with international partners in research and development • Involvement and active participation of National Federations • International aid/assistance in research capacity building • Establish national research centre/foundation

Sources:
WHO Country Cooperation Strategy at a Glance: Pakistan May 2014;
WHO Country Profile: Pakistan;
IOM Country Fact Sheet: Pakistan 2014;
WHO Health Statistics 2011;
ESCAP Statistical Year Book for Asia and the Pacific 2014; WHO Global Infobase;
WHO Bulletin; UN Human Development Report 2014.
CRPD: Convention on the Rights of Persons with Disabilities; DPOs: Disabled People's Organizations; GDP: Gross Domestic Product; ICF: International Classification of Functioning, Disability and Health; IT: information technology; NCDs: non-communicable diseases; NGO: non-governmental organization; PM&R: Physical Medicine and Rehabilitation; PwD: persons with disability; SAARC: South Asian Association for Regional Cooperation; WHO: World Health Organization.

within overlapping topographical areas (24). Service provision at the federal level is fragmented, with provincial and district health departments, military and social security institutions, NGOs and private sector providing services mostly through vertically-managed disease-specific mechanisms (7, 12). Many physicians, particularly PM&R specialists, International NGOs and NGOs working in the field of disability management are working in isolation with little coordination. Furthermore, discernible urban-rural disparities in healthcare delivery and an imbalance in the health workforce compound the overall the problem in healthcare system. Similar to other developing countries, Pakistan has limited research and data on disability, impeding formulation of policies and programmes (7).

Although the profile of rehabilitation medicine has improved in Pakistan, compared with other SAARC member countries, it remains underdeveloped (especially in rural settings) and poorly integrated with the acute healthcare systems. There is limited funding for comprehensive disability management and minimal awareness regarding rehabilitation amongst the public and healthcare professionals (25). Rehabilitation is still confused with "physiotherapy and exercise" by the general public and by many healthcare professionals, who are unaware of existing comprehensive rehabilitation settings (21). Other barriers include a lack of a central coordination body, limited health services infrastructure and human resources. The healthcare system itself at the federal, provincial and district level is fragmented. At the community level, care of PwD (including community-based rehabilitation) is predominantly funded by NGOs and charitable organizations, such as the National Collective of Organizations Working for Disabled Persons, Handicap International, Christian Blind Mission, International Red Crescent, etc. (19). Cultural stigma and the perception of disability as an end-of-life situation, is common in Pakistan and results in poor management of PwD. Furthermore, Pakistan suffers from periodic major natural disasters (earthquakes, unprecedented floods, heat-waves) which further escalate disability prevalence within the already overstretched healthcare system. Likewise, growing militancy, leading to armed conflict and internal population displacements/migration, has created security-compromised areas, making access to healthcare problematic.

Disability is a human rights issue and all PwD are active participants in society (1). The GDAP provides comprehensive summary actions for disability and offers the Pakistani government, policymakers and other relevant stakeholders a blueprint for implementing the recommendations of the World Disability Report. The Pakistani people now have an opportunity and imperative to improve and build on existing care

programmes for comprehensive care for PwD. Based on feedback and consensus from participants in this report, there is a strong will and impetus to improve the disability and rehabilitation sector in Pakistan. Importantly, there is a need for centralized leadership for provision of standards for rehabilitative care and key performance indicators for rehabilitation facilities, staff engagement, up-skilling the workforce, development of infrastructure and support systems, access to equipment for therapy, and integration of all relevant sectors (including NGOs and consumer groups). These need to be supplemented by local community-based rehabilitation centres (especially in rural settings), with establishment of regional hubs for improved access and broader-based services. Given the fragmented nature of existing rehabilitation services, there is the opportunity for professionals to work together to achieve improved clinical practice and service delivery, training, education and research. A collaborative, coordinated and pro-active lobbying effort by rehabilitation medicine professionals, consumer organizations and NGOs will prioritize challenges that need to be addressed for implementation of the GDAP. Most recently, the WHO approved the new collaboration plan with the International Society of Physical and Rehabilitation Medicine (ISPRM), which is a milestone for ISPRM as an NGO in special relations with the WHO (26). This collaboration plan reacts to the WHO GDAP and defines concrete projects that respond to the objectives and recommended actions of the GDAP.

Study limitations

There are several limitations in this study. First, this study is cross-sectional and is not intended to test specific hypotheses through systematic analysis, it uses content analytical technique (16) to summarize data derived from interactive feedback from healthcare professionals attending an organized workshop programme. This is intended as a preliminary descriptive study, with the aim of updating rehabilitation efforts and plans in Pakistan based on the GDAP, and identifying challenges and strengths from the perspective of participants. Secondly, the study cohort is comprised of health professionals selected by the AFIRM and, although there was feedback from families of affected persons, it did not include other stakeholders (such as social work organizations, organizations of PwD, and PwD), which may limit the generalizability and validity of these findings. However, the study cohort includes rehabilitation professionals from a wide geographical population in Pakistan, and represents the wider sample currently operational in the community. The authors were not involved in participant selection as this was beyond their authority. The authors believe that the findings reflect the current issues/problems faced in the country at large. They are unaware of any similar study conducted in Pakistan or any SAARC country that address such issues.

Conclusion

As in many developing countries (5), the rights and healthcare needs of PwD in Pakistan remain limited to policies and legislation, with many barriers to their inclusion in key aspects of society. Many PwD remain marginalized, and their capabilities underestimated. Despite strong commitment from government, the gap between policy and practice continues to exist. A participatory framework to build disability-inclusive and sustainable development is in progress. There was consensus amongst all workshop participants that the following steps are necessary in order to further develop rehabilitation medical services in Pakistan:

- Develop and tailor GDAP recommendations to suit the local environment for accessibility to mainstream services, policymakers and administrators
- Establish leadership from the Ministry of Health for rehabilitation standards, accreditation and key performance indicators
- Develop evidence-based healthcare models or systems (e.g. patient referrals from acute to rehabilitation services, follow-up after discharge from acute care, timely access to medical records, etc.)
- Integrate rehabilitation services with acute health services and incorporation of rehabilitation medicine department within the health system in medical schools and hospitals (especially public hospitals)
- Develop and implement systematic data collection for disability to develop national registry
- Establish a central body for oversight and coordination of rehabilitation for efficiency and efficacy
- Improve infrastructure for disabled access for transport and buildings; and social support systems
- Upskill, educate and develop the rehabilitation workforce using innovation, technology/web-based systems
- Engage the workforce, consumers (caregivers) and NGOs for lobbying government, improving awareness of disability services, and determining the social and economic impact of disability
- Strengthen investment in research at every level to improve understanding, awareness and centrality of disability issues.

The role of rehabilitation in global health is expanding to address the rights and needs of the growing number of PwD. The GDAP summary actions are useful planning tools for improving access to, and strengthening, rehabilitation services, and data col-

lation for outcome research and benchmarking. All workshop participants in this study appreciated the process and emphasized the urgent need to empower PwD and include them in mainstream society and development. In order to achieve the objectives of the GDAP, strong leadership from governmental bodies, political commitment, investment in local infrastructure/human resources, dissemination of information and advocacy of disability inclusive development are urgently needed.

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REFERENCES

1. World Health Organization (WHO). World report on disability. Geneva: WHO; 2011.
2. World Health Organization. Promoting access to healthcare services for persons with disabilities. Geneva: WHO; 2006.
3. United Nations Economic and Social Commission for Asia and the Pacific. Disability at a Glance 2012: strengthening the evidence base in Asia and the Pacific. Bangkok: ESCAP; Sep 2012.
4. United Nations. Convention on the rights of persons with disabilities. 2006 [cited 2014 Oct 10]; Available from: http://www2.ohchr.org/english/law/disabilities-convention.htm.
5. 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.
6. World Health Organization. Country Cooperation Strategy for WHO and Pakistan 2011–2017. Cairo: WHO Regional Office for the Eastern Mediterranean; 2013.
7. 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.
8. World Health Organization. Country Health Profile: Pakistan. Geneva: WHO; Latest updated: Jan 2015.
9. United Nations Economic and Social Commission for Asia and the Pacific. Statistical Yearbook for Asia and the Pacific 2014. Bangkok: United Nations; 2014.
10. Soopramanien A. Mauritius calling: medical care and neurorehabilitation needs in an oceanic idyll. Arch Phys Med Rehabil 2012; 93: 2377–2381.
11. World Health Organization. Disability and rehabilitation status review of disability issues and rehabilitation services in 29 African Countries. Geneva: WHO; 2004.
12. Mansoor SN, Rathore FA. Rehabilitation medicine: awareness and survival in Pakistan. Khyber Med Univ J 2014; 6: 139–140.
13. The Economist Intelligence Unit Limited. Moving from the margins: Mainstreaming persons with disabilities in Pakistan. London: British Council; Aug 2014.
14. Metts RL. Disability issues, trends and recommendations for the World Bank. Washington, DC: The World Bank; 2000.
15. World Health Organization. Global Health Estimates for the years 2000–2012. 2012 [cited 2015 Dec 1]. Available from: http://www.who.int/healthinfo/global_burden_disease/estimates/en/.
16. Network of Organizations Working for Persons with Disabilities. A report on the status of persons with disabilities and the way forward Pakistan. Karachi: NOWPDP; 2008.
17. The Institute for Social Justice. Situation of persons with disability in Pakistan: with focus on women and girls with disabilities. Islamabad: ISJ. [cited 2016 Jan 5] Available from: www.isj.org.pk.
18. Pakistan Medical and Dental Council. Statistics: toatal number of doctors/dental surgeons. 10th Nov 2014 [cited 2015 Nov 25]; Available from: http://www.pmdc.org.pk/Statistics/tabid/103/Default.aspx.
19. International Organization for Migration. Country fact sheet: Pakistan. Geneva: IOM; August 2014.
20. World Health Organization. World health statistics 2011. Geneva: WHO; 2011.
21. Khan F, Amatya B, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward Phys Med Rehabil Int 2015; 2: 1070.
22. World Health Organization. WHO global disability action plan 2014–2021: better health for all people with disability. Geneva: WHO; 2014.
23. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res 2005; 15: 1277–1288.
24. Rathore FA, Gosney J. Rehabilitation lessons from the 2005 Pakistan earthquake and others since – looking back and ahead? J Pak Med Assoc 2015; 65: 1036–1038.
25. Rathore FA, Muzammil S. The decrepit state of trauma care in under-developed healthcare settings and the need to integrate trauma rehabilitation as a continuum of care. J Pak Med Assoc 2015; 65: 108–109.
26. The ISPRM-WHO-Liaison Committee (ISPRM-WHO-LC). WHO and ISPRM. [cited 2016 Apr 12]; Available from: http://www.isprm.org/collaborate/who-isprm/.

Appendix 5

Other research publication 3

Khan F, Amatya B, Mannan H, Burkle Jr FM, Galea MP. Rehabilitation in Madagascar: Challenges in implementing the WHO Disability Action Plan. Journal of Rehabilitation Medicine 2015;47(8):688-96.

SPECIAL REPORT

REHABILITATION IN MADAGASCAR: CHALLENGES IN IMPLEMENTING THE WORLD HEALTH ORGANIZATION DISABILITY ACTION PLAN

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Objective: **To provide an update on rehabilitation in Madagascar by using local knowledge to outline the potential barriers and facilitators for implementation of the World Health Organization (WHO) Disability Action Plan (DAP).**

Methods: **A 14-day extensive workshop programme (September–October 2014) was held at the University Hospital Antananarivo and Antsirabe, with the Department of Health Madagascar, by rehabilitation staff from Royal Melbourne Hospital, Australia. Attendees were rehabilitation professionals (*n*=29) from 3 main rehabilitation facilities in Madagascar, who identified various challenges faced in service provision, education and attitudes/approaches to people with disabilities. Their responses and suggested barriers/facilitators were recorded following consensus agreement, using objectives listed in the DAP.**

Results: **The barriers and facilitators outlined by participants in implementing the DAP objectives include: engagement of health professionals and institutions using a multisectoral approach, new partnerships, strategic collaboration, provision of technical assistance, future policy directions, and research and development. Other challenges for many basic policies included: access to rehabilitation services, geographical coverage, shortage of skilled work-force, limited info-technology systems; lack of care-models and facility/staff accreditation standards; limited health services infrastructure and "disconnect" between acute and community-based rehabilitation.**

Conclusion: **The DAP summary actions were useful planning tools to improve access, strengthen rehabilitation services and community-based rehabilitation, and collate data for outcome research.**

Key words: disability; rehabilitation; Madagascar; World Health Organization.

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INTRODUCTION

There are an estimated 1 billion people with disabilities (PwD) worldwide, of whom 110–190 million have significant difficulties and 80% reside in low-income countries (1, 2). The United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD), through international standards and a normative framework for disability, provides for a paradigm shift in attitudes and approaches to PwD, viewing them as active contributing members of society with equal rights (3). Although a number of UN member countries signed the convention, there remain significant gaps in service provision for PwD in terms of implementation of rehabilitation policies and legislation, funding and access to services (4), especially in the developing world. The World Health Organization (WHO) estimates that in 2011 only 3% of individuals worldwide received adequate rehabilitation requirements (1) and, in developing countries alone, 0.5% of the population was unable to obtain the prostheses or orthotics they needed (5, 6).

Madagascar, the fourth largest island in the world (area 587,041 km^2), situated in the Indian Ocean has more than 22.2 million inhabitants (4, 5). The WHO ranks it in the low-income group, with gross national income per capita (2012) of US$930 (6), placing it 155th on the World Bank Human Development Index (7). Only 33% of Malagasy people live in urban areas, and an estimated 92% of the total population live on less than $2 per day. The median age of the population is 18.3 years, with a life expectancy of only 52 years (6). The literacy rate among adults aged 15 years and above is 64% (1). Overall spending on healthcare by the Malagasy Government is significantly lower than that of the average African region. In 2012, total expenditure on health per capita was US$40, which equates to 4.1% of total expenditure (6). The majority of PwD in Madagascar, as in many developing countries (8, 9), are economically deprived and experience difficulties in accessing basic health services, including rehabilitation services. Furthermore, similar to other sub-Saharan African countries, much effort has gone into improving the acute care sector. The post-acute care system, including rehabilitation, is undeveloped at many levels (10–14).

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Table I compares the data on common disabilities, disability legislation, non-governmental agencies (NGOs), community-based rehabilitation programmes (CBR) and support services of Madagascar with that of 4 sub-Saharan African countries (14).

The objective of this paper is to provide an update on rehabilitation efforts and plans in Madagascar based on implementation of the WHO's Disability Action Plan (DAP) of 2014–2021 and endorsed by the world's health ministers to improve health for all people with disability. The authors utilized interactive feedback from rehabilitation professionals from Madagascar attending an organized workshop programme and recorded both the realistic challenges and strengths the attendees found in meeting the established objectives listed in the DAP.

METHODS

The authors (FK, MG) were invited as independent experts (September–October 2014) by the Madagascar Department of Health (Antananarivo) in association with the UK-based charity Overseas Partnering and Training Initiative (OPT IN) and the University of Leeds, to assist in improving education and training of rehabilitation staff in the newly formed Malagasy Rehabilitation Society. The focus was on taking the DAP guidelines and building capacity in the workforce, developing standards and key performance indicators; and up-skilling in specific areas, such as rehabilitation services operational set-up, infrastructure for horizontal health systems, development from acute through to community, referral management, consumer involvement, research methodology, including data collection, and setting up a rehabilitation registry based on the Australian experience. This exercise was approved by the Malagasy Health Department and the Royal Melbourne Hospital.

Non-communicable diseases (NCDs) and rehabilitation have recently been prioritized by the Malagasy Health Department. There are 6 regions in Madagascar with 3 established rehabilitation centres in Antananarivo, Antsirabe, and the Mahajanga region. In addition, there are 4 smaller regional facilities that provide supportive rehabilitation including CBR programmes. As yet, there are no operational National CBR Programs in Madagascar and existing programmes are run mainly by NGOs (14). Over a 14-day period, the authors also assumed a facilitator role in conducting extensive teaching programmes, including workshops and consensus meetings based on the DAP in the Department of Rehabilitation, University Hospital Antananarivo and in the Antsirabe Hospital. In addition, participants from the more remote Mahajanga Rehabilitation Hospital also attended additional workshops held at the University Hospital Antananarivo. A total of 29 healthcare professionals attended these workshops and meetings, which included approximately 9 rehabilitation physicians (including a representative from the Department of Health), 2 surgeons, 4 nurses, 3 prosthetists, 3 occupational therapists, 7 physiotherapists and 1 speech pathologist from various rehabilitation centres. The authors also met with a number

Table I. *Summary of current health systems/resources for disability in some Sub-Saharan African countries*

Country	Madagascar	Mozambique	Senegal	Ethiopia	Congo-Brazzaville
Demographics Population	22.9 mil*; PwD:7–8% (2000)	25.8 mil*; PwD: 5.9% (2000)	14.1 mil*; PwD: 10% (1998)	91.7 mil*; PwD: 1.8% (1998)	4.4 mil*; PwD: no data
Cause of disabilities (mobility, self-care, vision)	Stroke; cerebral palsy; infectious diseases (polio, leprosy); drug and alcohol use	Infectious diseases (polio, malaria, meningitis); war; landmines	Diabetes; infectious diseases (polio, onchocerciasis); road accidents and landmines	Infectious diseases (polio, leprosy); road accidents; malnutrition	Infectious diseases (polio, leprosy, malaria)
Legislation of disability for PwD	1998: Law for equal rights, 2007: CRPD ratified; 2003: National Decade of Disabled persons; Action Plan: 2007–2012	1990: Constitution to support PwDs; 1999: Disability-specific policy	National policy, but no explicit laws, for disability; 1984: education for disabled children	1994: Employment rights of the disabled 1996: Social welfare policy	1992: Law on protection and education of PWDs National Health Plan not implemented for disability
Human resources (healthcare)	Physicians: 0.16/1000 people; (in 2007); 3,150 doctors, 5,661 nurses, 385 community health workers	Physicians: 0.03/1000 people (2008); no data on rehabilitation personnel	Physicians: 0.06/1000 people (2008); no data on rehabilitation personnel	Physicians: 0.03/1,000 people (2008); no data on rehabilitation personnel	Physicians: 0.2/1,000 people (2006); no data on rehabilitation personnel
NGOs and DPOs	Many (religious, cultural, sporting associations); Handicap International; Union des Associations d'Handicapés de Madagascar	11 organizations provide government with technical support, none independent	8 NGOs, all in advisory roles in policy and technical support	11 NGOs; most focus their services in urban areas with limited coverage	No information available
National CBR programmes	None, most funded by NGOs	1993: CBR by Ministry of Social Welfare for 2000 PwDs	None, 1 CBR in 1988 by the Red Cross – now suspended due to financial constraints	1983: CBR initiated in 2 provinces by NGOs with the government but only in urban areas	National programme in 1999–2001 covering 11 regions of the country
Research and evaluation	Some research on clubfoot; member of ISPRM	None; no inter-country collaboration	None; member African Rehabilitation Institute	None; member African Rehabilitation Institute and affiliate Rehabilitation International	None

(Main sources: WHO Country Profile; Regional Office for Africa WHO; WHO Health Statistics 2011; WHO Disability and rehabilitation status 2004 (14)).
*Population in millions in 2013.
CBR: community-based rehabilitation; DPO: disabled people's organizations, ISPRM: International Society of Physical and Rehabilitation Medicine; NGO: non-governmental organization; PwD: persons with disability.

of independent NGOs working in Anatanarivo, including OTs involved in CBR programmes and those involved in assisting the University of Antananarivo in developing training courses in Occupational and Physical Therapy programmes. However, because there are various levels of trained allied health staff, visiting NGOs, medical and other volunteers in Madagascar the exact number of fully accredited rehabilitation professionals is unclear. Participants in these workshops were invited by the Department of Health along with the University of Antananarivo and comprised approximately 60% of the academic and rehabilitation leadership teams across the country.

Prior to the detailed workshops, the host hospital's lead medical and allied health team provided presentations on their health services, including specific challenges faced by their rehabilitation staff under the DAP. All this volunteered information was supplemented with more specific and recorded data during the workshop settings. The teaching programme and workshops included basic principles of rehabilitation, disability care planning, linking information technology (IT), data and health record systems with acute hospital referrers and those in the community; CBR and capacity building; and leadership skills development, etc. Based on earlier presentations by lead local rehabilitation staff about issues they faced in service delivery, the participants were then asked to work out and discuss their views and perspectives of the various problems that were highlighted relating to service provision, attitudes/approaches to PwD, gaps in service provision, education, related challenges and potential barriers and solutions designed to tackle these issues. At all times the 2014–2021 DAP was used as a blueprint for discussion and allowed the authors to educate the audience, many of whom were not familiar with the document's specifics. In addition, a simplified overview of the DAP worded for the French-speaking audience was used, using an interpreter provided by the Malagasy Department of Health. This was followed by a formal iterative decision-making and consensus process tabulating potential challenges and facilitators in the implementation of the DAP. Throughout the workshops, the author-facilitators recorded all information provided by the participants in writing, as there was limited access to computers or internet. In addition, they conducted a desktop literature search of academic and grey literature using available internet search engines and websites for relevant publications (including academic articles, reports, related website contents, etc.) and discussed relevant information with the participants. Known experts in this field were also contacted for further information on disability-related policies and legislations. A formal presentation of all results from this exercise was made by the authors to both the Malagasy Department of Health and all workshop attendees on 7 October 2014.

RESULTS

Based on the above-stated multi-pronged avenues to obtain data, an overview of current rehabilitation status and associated challenges in implementation of the WHO's DAP was summarized in 3 major sections: (*i*) burden of disability, (*ii*) current developments, and (*iii*) WHO Global Disability Action Plan, as follows.

Burden of disability

In Madagascar there is no epidemiological data on disability, and limited data on disability-related burden. Based on the worldwide disability prevalence rate-estimation of 15% (or 1 in 7 people) from the World Report on Disability (1), there are an estimated 2.8 million PwD in Madagascar. NCDs are a noteworthy cause of overall burden of disease in Madagascar, contributing an estimated 29% of overall disability-adjusted life years (DALYs) in 2004, followed by injuries (8% DALYs) (1). Amongst NCDs, DALYs attributed to cancer are estimated at 12.1, for neuropsychiatric conditions 2.3, and for cardiovascular diseases (CVDs) 2% (15). Communicable diseases are still the main cause of mortality; however, NCDs contribute to 39% of overall mortality, with 18% due to CVDs alone. The age-standardized death rate due to cerebrovascular diseases (such as stroke) is 134.9 per 100,000 (4). Consistent with other countries in Africa (13), the prevalence of disability in Madagascar is escalating due to an ageing population, a rise in chronic conditions, political instability and economic down-turn. Despite the lack of conclusive data on the economic and social costs of disability for Madagascar, these costs are significant for PwD (their families), the community and the nation (1).

Disability policies and legislation. In 1997, the Malagasy Government initiated the Law on Disability (Act No. 97-044), to promote equal social rights and freedoms for PwD, as for other citizens (16). The law advocates rights of PwD for access to medical and rehabilitation services, education, employment and social participation (4). In 2002, Madagascar ratified the National Decade of Disabled Persons 2003–2013 in accordance with the Continental Plan of Action of the African Decade of Disabled Persons, and with the UN CRPD in 2007 (15). Madagascar has an operational multi-sectoral national policy, strategy or action plan that integrates several NCDs and shared-risk factors, and has some evidence-based national guidelines/protocols for the management of major NCDs, using a primary care approach. The collaboration between acute and rehabilitation facilities and various NGOs, who provide social care for PwD, has improved in the last few years. More work, however, is needed to implement these policies; and surveillance and/or monitoring systems to enable reporting of healthcare data are yet to be established. Compliance with the UN standards, such as disabled access to buildings, parking, transportation, etc., can be improved. The PwD have limited access to advocacy, provision of assistive devices, aids, counselling and community integration assistance. In general, the public are unaware of the economic and social implications for PwD. However, there is some progress, as Madagascar subscribed to the International Health Partnership and related initiatives (IHP+) in 2008, which aligns development partners with a single national strategy, a monitoring and evaluation framework and a joint review process to improve harmonization and accountability for achieving the health-related Millennium Development Goals (17). In the same year the Ministry of Health also signed up to the guiding principles of a sector-wide approach along with the 22 development partners to address the challenges facing the health sector; however, it is unknown if this contains rehabilitation medicine (17).

Human resources. Overall, there are an estimated 3,150 doctors, 5,661 nurses and 385 community health workers currently registered in Madagascar (15). However, there is a shortage of trained and available healthcare professionals, and inequitable distribution of staff across rural areas (particularly in the rehabilitation sector). There are an estimated 1.6 physicians per 10,000 population in Madagascar, which is significantly lower than the regional average of 2.6 (14, 15). The Department of

Health, in conjunction with a UK-based charity (OPT IN), commenced a mid-level diploma programme at the University of Antananarivo approximately 4 years ago. This capacity-building initiative is now being supported by the Royal Melbourne Hospital, Australia. There are 10 rehabilitation specialists in the country, including 8 new graduates. There is less than one physiotherapist and nurse per 10,000 people (18), and no accurate data are available regarding other rehabilitation personnel, such as occupational therapists or speech pathologists, social workers or psychologists. Importantly, the Malagasy Society of Rehabilitation Medicine and allied health staff in rehabilitation settings are focussing on building multidisciplinary teamwork, communication and decision-making processes to operate as a cohesive team. However, the lack of IT systems limits participation in web-based international teaching initiatives.

Service delivery. The Malagasy health system has been struggling for some years, due to poverty, political uncertainty and a decrease in international aid. Rehabilitation services are still minimal for the general population, especially for PwD and those living in rural areas. The few existing rehabilitation services are not integrated with acute health services, and are based in urban areas, mainly in the capital. There are, on average, 3 hospital beds per 10,000 population and 6 improved rehabilitation services (4). The hospital infrastructure lacks computers/fax and other administrative equipment. There are no healthcare models or systems in place (e.g. patient referrals from acute to rehabilitation services, follow-up after discharge from acute care, timely access to medical records, etc.), which results in fragmented care. There are no hydrotherapy facilities or well-equipped gymnasiums for patients in hospitals or in the community. Existing equipment is often in disrepair. The most common physical therapy treatment provided in rehabilitation facilities is massage, in line with the cultural expectation of receiving treatment. There are limited occupational therapy and no speech pathology or psychology services at tertiary rehabilitation facilities. Although the focus is on developing CBR; access to qualified staff, lack of infrastructure and funding are the main barriers for provision of customized programmes, patient education and provision of appropriate equipment. At the community level, care of PwD (including CBR) is predominantly funded by NGOs and charitable organizations, such as the National Collective of Organizations Working for Disabled Persons, Handicap International, Christian Blind Mission, International Red Crescent, etc. There are, however, operational NCD Departments within the Ministry of Health and Population.

Current developments

Like most sub-Saharan countries, current disability management and supports in Madagascar are inequitable, underfunded, fragmented, inefficient and often inaccessible (11). Despite these barriers, overall health services show a trend towards improvement over the past 2 decades (19), mainly in the control and prevention of communicable diseases. In the last 5 years, there has been some development in the rehabilitation field. For example, Madagascar is one of few sub-Saharan African countries with an established rehabilitation network. The Society of Physical and Rehabilitation Medicine was established in 2013, and since 2014 has been a member of the International Society of Physical and Rehabilitation Medicine (20). It has an active website to communicate with its members and recently hosted its first National Congress on Cerebral Palsy (in March 2014). The Malagasy Rehabilitation Society is currently outlining its standards and key performance indicators and setting up data collection procedures to form a national rehabilitation data-set.

More recently, there has been much interest amongst physicians in postgraduate training in rehabilitation at the University of Antananarivo. Rehabilitation for specific conditions requiring multidisciplinary input, such as spinal cord injury, will commence in one tertiary facility in the capital in 2015. There are measures to improve communication between health professionals in rehabilitation services and the acute care sector for improved patient referral procedures. While there is some coordination between the government and NGOs (and charitable organizations) for funded conferences/ workshops, education and training opportunities must be expanded and sustained.

WHO Global Disability Action Plan

The DAP provides encouragement for all national and international partners to enhance the quality of life of people around the world (21). The WHO specifies all Member States to promote this development and adapt it as a key national priority. The main goals of the DAP are:

- to remove barriers and improve access to health services and programmes,
- to strengthen and extend rehabilitation, assistive technology and support services, and community-based rehabilitation,
- to strengthen disability data collection for international comparability, and to support research.

As stated above, similar to other developing countries, Madagascar faces various challenges and barriers for implementation of the core objectives of the DAP. Healthcare priority is still primarily focused on acute care (19); sub-acute care and rehabilitation services get less attention. The PwD are amongst the most marginalized in Madagascar and are unaware of their rights and benefit entitlements. There are limited data on the needs and unmet needs of PwD, impeding planning for service delivery in rehabilitation. In general, there is lack of awareness amongst citizens with regard to disability, which is perceived as a curse and/or a contagious disease in many parts of the country. This results in stigma and discrimination against PwD, limiting their societal participation. Furthermore, medical rehabilitation, including PwD, is not recognized by citizens and their families and many prefer traditional or native healers, especially in rural areas.

Based on participant feedback, consensus agreement and using a bottom-up approach in developing recommendations for the future, some of the potential facilitators and challenges in implementation of the proposed standard actions in the DAP for rehabilitation are summarized in Table II.

Table II. *Potential challenges and facilitators in implementation of the World Health Organization (WHO) Disability Action Plan 2014–21 in Madagascar* (n=29)

Actions	Current state	Potential challenges/barriers	Potential facilitators/enablers in the next 5–6 years
Objective 1: Remove barriers and improve access to health services and programmes			
1.1 Develop and/or reform health and disability laws, policies, strategies and plans	Law on Disability (Act No. 97-044) 1997; CRPD ratified: 2007; National Decade of Disabled Persons (2003), The Madagascar Action Plan 2007–12; International Health Partnership and related initiatives 2008	• Health priority more driven towards acute sector and communicable disease • Unstable political and economic situation • Poor past political commitment • Existing policies underfunded • Lack of coordination/collaboration among different government sectors and ministries • Lag in implementation of existing policies • Lack of consensus on who is responsible for enforcing and/or funding new legislations/policies	• Health Ministry to develop health policies from coordination to implementation; sectoral approach for alignment in disability care • Strengthen management capacity through legislation and regulation • Implement health financing strategies for equity and social protection • International cooperation and WHO support • Knowledge management capacity-building initiatives • Strengthen National Health Information systems • Guidelines for public-private partnerships in healthcare • Review pharmaceutical policy documentation and surveillance systems • Establish a secondary level body for implementation and evaluation at the community level • Involve PwD and community organization in policy development • Linkage with regional organizations, e.g. South Africa, Mauritius
1.2 Develop leadership and governance for disability-inclusive health	National coordination/funding: Ministry of Health and Population	• No central body for developing governance • Lack of coordination/ collaboration among different government sectors, hospitals and CBRs • No disability-rehabilitation standards or key performance indicators • No specific accreditation standards or criteria for rehabilitation facilities and for staff • Limited workforce leadership development programmes	• Ministry of Health – central capacity building body for health professionals and management for operational effectiveness of regional health departments and quality of services • Capacity-building for educators for health work-force • Implement plan for quality control and health inputs • Coordinate and link various government and NGOs with hospitals • More active role of National Association of Rehabilitation Medicine in facilitating leadership skills and governance • Improve web-based access to evidence-based guidelines/protocols and outcome measures for disability • Provide Key Performance Indicators and Standards of Care • Development of accreditation criteria for staff and rehabilitation facilities
1.3 Remove barriers to financing and affordability for PwD	Per capita health expenditure $40 (2012); Health expenditure as % of GDP 4.1 (2012); Government health spending 15.3% (2012); 70% of total spending on health- 30% contributed international donors and private sources	• Budget deficit • Decreased international aid • Out-of-pocket payment for services • Lack of government/private insurance • Lack of legislation or national policy for employment/ education/health	• Increased health budget expenditure in line with the African neighbours • More international financial assistance • Training and educational programme for PwD – build workforce • Improvement of social welfare, livelihood and benefits • Development of national social/governmental insurance coverage for PwD
1.4 Remove barriers to service delivery	Approximately 3 hospital beds per 10,000 people	• Lack of infrastructure • Non-disability friendly public places and transport • Geographical location – isolation • Lack of rehabilitation for specific conditions such as stroke, spinal cord injuries, etc. • Lack of adequate referral system • Lack of multidisciplinary team approach and systems/ models of care • Lack of integration with acute hospitals	• Development of infrastructure and awareness of existing services • Structured standard referral systems: acute to sub-acute • Promotion of community-based rehabilitation • Development of Mobile Units to deliver care in remote areas • Telerehabilitation and local technology • Provision of disability friendly public facilities and transportation • Public awareness and educational programmes • Public-private sector partnership for service provision
1.5 Overcome specific challenges to the quality of healthcare experienced by PwD	Total death: NCDs: 39%; cerebrovascular diseases: female 6.4% (age standardized death rate: 134.9/100,000 population)	• Poverty • High illiteracy • Discrimination and stigma • Poor awareness of health services • Misconception and cultural belief about disability • Belief in traditional or native healers • Limited access to disability services	• Ministry of Health-central body to implement national health promotion policy • Minimization of cultural stigma through public campaigns • Skill training and educational programmes for healthcare staff • Development of consumer organizations for advocacy (including PwD at national and local level) • Identify needs to develop initiatives for unmet needs of PwD • Development of strategies for engagement of staff and patients

Table II. *Contd.*

1.6 Meet the specific needs of PwD in health emergency risk management	No information	• Lack of emergency assistance programmes for PwD • Lack of ambulance availability and transportation • Minimal collaboration and/or referrals between emergency staff and rehabilitation personnel in tertiary facilities	• Rapid assessment and evaluation to identify needs to mobilize resources • Coordination of interventions • Build local capacity • Improve communication systems and collaboration between acute and rehabilitation staff; International cooperation in humanitarian crises
Objective 2: To strengthen and extend rehabilitation, habilitation, assistive technology, assistance and support services, and community-based rehabilitation			
2.1 Provide leadership for developing policies, strategies and plans	Same as 1.1 above	Same as 1.1 above	• Same as 1.1 • More active role of Malagasy National Association of Rehabilitation Medicine
2.2 Provide adequate financial resources	No data available for welfare or support for PwD and their families	Same as 1.2	• Same as 1.2 • Improvement of social welfare and livelihood
2.3 Develop and maintain a sustainable workforce	PRM: 10 Physicians or 1.6/10,000 people; (in 2010); total of 3150 doctors, 5661 nurses, 385 community health workers PT:<1/10,0000 people Department of Health commenced mid-level Diploma course at University of Antananarivo	• Interdisciplinary workforce – limited skill base • No educational standards or key performance indicators (KPIs) for rehabilitation or continuous medical education evaluation • No staff development or appraisal systems in hospitals or community settings • Limited access to education or IT-based learning • Limited opportunity to train in new equipment for therapy delivery or hydrotherapy • Inadequate distribution of healthcare professionals – mostly urban setting • Limited infrastructures and professional courses/training programmes in academic institution • Poor awareness amongst healthcare professionals about workforce development • Demoralized workforce	• Ministry of Health – develop a strategic workforce development plan • Establishment of national observatory for human resources • More funding and opportunity to develop a skilled workforce • More courses on disability in academic institutions and hospitals • Development of strategies for empowerment and staff engagement • Develop teaching models, using interactive problem-based learning • Increase clinical capacity through organized educational activities, e.g. journal clubs, grand rounds, etc. • Motivation of clinical staff • Promotion of interdisciplinary teaching and interaction • Commence OT training using international links within region • Establish workforce management and retention programmes • Collaboration with international partners for staff training overseas
2.4 Expand and strengthen rehabilitation services ensuring integration, across the continuum of care	Improve rehabilitation services	• No accreditation standards or key performance indicators for rehabilitation • Rehabilitation services included with other general hospital services not well integrated nor identified for attention • Lack of structured standard referral systems from acute to sub-acute care to community • Lack of healthcare delivery models for Rehabilitation services • Minimal integration of community based programmes with acute services • Poor follow-up after discharge from acute facility and rehabilitation hospitals	• Ministry of Health to establish clear accreditation standards for rehabilitation facilities and key performance indicators • Develop rehabilitation services within the existing health infrastructure • Improved profile of rehabilitation services in acute hospitals • More community-based rehabilitation services linked with main hospital networks • Incentives and mechanisms for retaining healthcare personnel especially in rural and remote areas • Use of IT systems, telemedicine and web-based services for improving awareness and access • Provision of equipment and technology for therapy in rehabilitation
2.5 Make available appropriate assistive technologies	No information	• Lack of government services and health insurance • Private insurance does not include cover for rehabilitation mobility aids (wheelchairs, cane, and walker), or those for activities of daily living, orthotics, or prosthetic devices.	• Advocacy for assistive technology funding – Government and NGOs • Inclusion of PwD and consumer organizations to raise awareness about technology • Expansion of assistive technologies to rural areas • Development of Mobile Units
2.6 Promote access to a range of assistance and support services	No information	• Minimal information available to public about access to rehabilitation services • Lack of insurance/ government support for accessing rehabilitation services	• Health Department to develop web-based campaign for support involving consumer organizations and NGOs – promote awareness • Develop Mobile Units to deliver care in remote areas • Expansion of community-based rehabilitation through capacity-building

Table II. *Contd.*

2.7 Engage, support and build capacity of PwD and caregivers	No information	• No inclusion of caregivers of PwD in rehabilitation • Poverty • High illiteracy • Misconception and cultural belief about disability • Belief in traditional or native healers • Pursuit of social support by PwD – rather than being independent and productive	• Involvement and education of caregivers in rehabilitation settings • Improve awareness of existing services/benefits for PwD/carers • Development of consumer support organizations for PwD at national and local level • Skill training for carers • Expansion of community-based rehabilitation through inclusion of carers in decision-making processes.
Objective 3: To strengthen collection of relevant and internationally comparable data on disability and support research on disability and related services			
3.1 Improve disability data collection (survey)	Limited national data; Based on WHO Report on Disability, estimated PwD 2.8 mil (15% of total population)	• Lack of reporting and information-gathering systems • Unreliable timely access to patient medical records • Rehabilitation workforce minimally trained in research methodology including data collection	• Promotion of operational research in disability and health systems • Set a minimal data-set for rehabilitation • Improve processes relating to clinical documentation • Commence medical staff training in research methodologies using audit tools • Establish hospital-based IT systems for data entry • Disability-specific registries in the future
3.2 Reform national data collection systems based on the ICF	No national data collection system; concept of ICF not well understood	• Lack of standard data collection systems • Minimal awareness and no incentive for hospitals or staff to participate • Limited staff training and support for ICF usage	• Implementation and training in ICF model • Develop standard data collection systems • Mandatory data collection across all sectors – acute and community • Linkage of performance indicators to health outcomes
3.3 Strengthen research on priority issues in disability	Limited research in disability/rehabilitation	• Research not identified as a priority for rehabilitation • Limited support and IT available for research • Limited staff capacity and training for research • Lack of available research professionals • Little funding for research	• Involve government and academic institutions to conduct research on disability issues • Train research professionals • Improve access to IT and web-based programmes • Build research capacity in rehabilitation • Cooperation with international partners in research and development

(Sources: WHO Country Cooperation Strategy at a Glance: Madagascar May 2014; WHO Country Profile; Regional Office for Africa WHO; WHO Health Statistics 2011; WHO Global Infobase; WHO Bulletin; UN Human Development Report 2014). CRPD: Convention on the Rights of Persons with Disabilities; GDP: Gross Domestic Product; ICF: International Classification of Functioning, Disability and Health; IT: information technology; NGO: non-governmental organization; PwD: persons with disability; WHO: World Health Organization.

DISCUSSION

Similar to other low-resource countries (13, 22, 23), Madagascar faces many challenges in improving its healthcare systems. The Malagasy people have concentrated on improving the acute-care sector given the high prevalence of communicable diseases. The focus on disability and provision of rehabilitative services, however, is well below that of its African neighbours. The concept of longer-term rehabilitation service delivery or lifetime care is not well established. Data for disability are not disaggregated from general health data, so the need for developing rehabilitation services, outcome assessments and minimal key performance indicators for the sector is unknown. Despite political commitment to improving care and support for PwD, the implementation of many basic policies remains limited in terms of access to rehabilitation services, geographical coverage, skilled work-force shortages, limited IT systems and infrastructure; and lack of care-models, and facility and staff accreditation standards for rehabilitation. Although the profile of rehabilitation medicine in the Madagascar health system has improved in recent years, it remains poorly integrated with acute healthcare systems. Rehabilitation participants report low morale and a poor sense of achievement. The patient referral mechanisms are unclear between acute health services, rehabilitation and longer-term community services. The lack of a central coordination body and limited health services infrastructure compounds the problem of comprehensive management of PwD, as most healthcare services are based in urban areas. Undesirable cultural stigma and poor awareness about disability and rehabilitation amongst general citizens, impedes access and service delivery.

The DAP provides comprehensive summary actions for disability and offers the Malagasy Government, policymakers, and other relevant stakeholders a blueprint for implementing the recommendations of the World Disability Report and CRPD. The Malagasy people now have an opportunity and imperative to improve and build on existing care programmes for comprehensive care for PwD. Based on feedback and consensus from participants in this report, there is need for strong leadership for providing standards for rehabilitative care and key performance indicators for rehabilitation facilities and staff involved. It is important to engage and up-skill staff, provide infrastructure and IT support, and assist in the integration of all relevant sectors including NGOs and consumer groups (24). The existing rehabilitation facilities require a skilled work-force and access to equipment for therapy provision. They need to be supplemented by local CBR centres, especially in rural areas, with establishment of regional hubs for improved access and broader-based services. Given that the existing CBR staff (funded mainly by NGOs), often have well-developed programmes, there

is opportunity for professionals in physical and rehabilitation medicine and CBR to come together for improved clinical practice and service delivery; as well as training and education. A collaborative, coordinated and pro-active lobbying effort by the Malagasy Society of Rehabilitation Medicine, consumer organizations and NGOs will prioritize challenges that need to be addressed for implementation of the DAP. The responses and suggestions about specific items in the DAP framework for action are listed in Table II.

This study has some potential limitations. Firstly, this is a cross-sectional study and bulk of data were derived from the interactive feedback from the healthcare professionals attending an organized workshop programme, rather than from a detailed examination of certain hypotheses or through systematic analysis. This study was intended as a preliminary descriptive study, with the aim of updating knowledge about rehabilitation efforts and plans in Madagascar based on implementation of the DAP and identifying realistic challenges and strengths from the participants' perspective. Secondly, the study cohort is made up of health professionals selected by the Malagasy Health Department, which may limit the generalizability and validity of these findings. The authors were not involved in any participant selection process, and this was also beyond their remit. The study cohort, however, covers rehabilitation professionals from a wide geographical population in Madagascar, and represents the wider sample currently operational in the community. The authors believe the findings reflect the current issues/problems faced in the country at large. They are unaware of any similar study conducted in Madagascar or any sub-Saharan country that addresses this issue.

In summary, there was consensus amongst all Malagasy participants in the workshops that further steps required to develop rehabilitation medical services in Madagascar should include the following:

- develop and tailor DAP recommendations to suit the local environment, for accessibility to mainstream services, policymakers and administrators
- improve infrastructure for disabled access to transport and buildings; as well as benefits and social support systems
- establish and sustain leadership from the Ministry of Health for setting rehabilitation standards for accreditation and key performance indicators
- establish collaborative integrated models of care and service delivery supported by infrastructure, IT and evidence-based rehabilitative care
- up-skill, educate and develop the rehabilitation workforce using technology and web-based systems
- engage the workforce, consumers (their caregivers) and NGOs for lobbying and improved awareness of disability services and the social and economic impact of disability
- develop systematic data-collection methods to inform rehabilitation outcomes and research capacity in rehabilitation.

In conclusion, the DAP summary actions were useful planning tools to improve access and strengthen rehabilitation services and CBR, and collate data for outcome research and benchmarking. The process was culturally sensitive and appreciated by all participants including the Ministry of Health. This is the first narrative report of participants contributing local knowledge to the actions recommended by the DAP to achieve various objectives in the real world using a bottom-up approach in the Malagasy setting. A similar follow-up conference designed around education and training, in which the DAP is constantly reviewed under improved data acquisition and analysis, is recommended.

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REFERENCES

1. World Health Organization. World report on disability. Geneva: WHO; 2011.
2. World Health Organization. Promoting access to healthcare services for persons with disabilities. Geneva: WHO; 2006.
3. United Nations. Convention on the rights of persons with disabilities. Geneva: UN; 2006 [cited 2014 10 Oct]. Available from: http://www2.ohchr.org/english/law/disabilities-convention.htm
4. World Health Organization. Country health system fact sheet 2006: Madagascar. Geneva: WHO, 2006.
5. Wikipedia. Madagascar. 2014 [cited 2014 2 Nov]. Available from: http://en.wikipedia.org/wiki/Madagascar.
6. World Health Organization. Madagascar. Geneva: WHO; 2014 [cited 2014 2 Nov]. Available from: http://www.who.int/countries/mdg/en/
7. Human Development Report Team. Human Development Report. New York: United Nations Development Programme; 2014.
8. 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.
9. Bhatia M, Joseph B. Rehabilitation of cerebral palsy in a developing country: the need for comprehensive assessment. Ped Rehabil 2001; 4: 83–86.
10. Soopramanien A. Mauritius calling: medical care and neurorehabilitation needs in an oceanic idyll. Arch Phys Med Rehabil 2012; 93: 2377–2381.
11. Lemogoum D, Degaute JP, Bovet P. Stroke prevention, treatment, and rehabilitation in Sub-Saharan Africa. Am J Prev Med 2005; 29: 95–101.
12. Ogungbo B, Ogun A, Ushewokunze S, Mendelow A, Walker R, Rodgers H. How can we improve the management of stroke in Nigeria, Africa? African J Neurol Sci 2005; 24: 9–19.
13. Tuakli-Wosornu YA, Haig AJ. Implementing the World Report on Disability in West Africa: challenges and opportunities for Ghana. Am J Phys Med Rehabil 2014; 93: S50–S57.

14. World Health Organization. Disability and rehabilitation status review of disability issues and rehabilitation services in 29 African Countries. Geneva: WHO, 2004.
15. Regional Office for Africa World Health Organization. Madagascar: factsheets of health statistics. Geneva: WHO, 2010.
16. Handiplanet Echanges. Act No. 97-044 on Disability, Madagascar 1997 [cited 2014 10 Nov]. Available from: http://www.handiplanet-echanges.info/Members/acbhm_espoir_244/act-no-97-044-on-disability-1997-madagascar-en#sthash.aGpAv3aX.dpuf.
17. World Health Organization. Country Cooperation Strategy at a glance: Madagascar. Geneva: WHO; 2014.
18. World Health Organization. Global atlas of the health workforce 2008 [cited 2014 10 Nov]. Available from: http://www.who.int/globalatlas/autologin/hrh_login.asp.
19. World Health Organization. Bulletin of the WHO: Primary health care: back to basics in Madagascar. Geneva: WHO; 2008.
20. International Society of Physical Medicine and Rehabilitation. ISPRM welcomes a new member: AMPR Mada from Madagascar. ISPRM; May 2014 [cited 2014 2 Nov]. Available from: http://www.isprm.org/news/isprm-welcomes-a-new-member-ampr-mada-from-madagascar/#.VHHeccIcQ5s.
21. World Health Organization. WHO global disability action plan 2014–2021: better health for all people with disability. Geneva: WHO; 2014.
22. Guzman JM, Salazar EG. Disability and rehabilitation in Mexico. Am J Phys Med Rehabil 2014; 93: S36–S38.
23. Kusumastuti P, Pradanasari R, Ratnawati A. The problems of people with disability in Indonesia and what is being learned from the World Report on Disability. Am J Phys Med Rehabil 2014; 93: S63–S67.
24. Mannan H, Boostrom C, Maclachlan M, McAuliffe E, Khasnabis C, Gupta N. A systematic review of the effectiveness of alternative cadres in community based rehabilitation. Hum Resour Health 2012; 10: 20.

Appendix 6

Other research publication 4

Khan F, Amatya B, Mannan H, Rathore FA. Neurorehabilitation in developing countries: a way forward (invited review and policy analysis). Physical Medicine and Rehabilitation - International 2015; 2(9): 1070.

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Research Article

Neurorehabilitation in Developing Countries: Challenges and the Way Forward

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Abstract

Neurological disorders affect one billion people worldwide and have significant disability-burden with longer-term functional and psychosocial issues that need comprehensive management, including rehabilitation. The prevalence of disability due to neurological conditions is escalating worldwide. These add to the economic burden for healthcare systems (particularly in low-resourced countries), where despite improved acute health care systems, health policies have not extended to include rehabilitation. Neurorehabilitation is interdisciplinary and cross-sectorial, requiring collaborative coordinated effort of diverse sectors, professions, patients and community. This article provides a narrative overview of literature on neurorehabilitation in developing countries and highlights some of the challenges in implementation of the World Health Organization's Global Disability Action Plan (DAP), focusing on rehabilitation (Objective 2) within the context of neurological conditions. Several issues related to neurorehabilitation are discussed for a systematic approach to build horizontal health care systems that are sustainable and responsive; involvement of bilateral agencies using multi-sectorial approach, new partnerships, strategic collaboration; provision of technical assistance, research and development; and capacity-building for a strong interdisciplinary workforce. Other factors that need to be addressed include governance for strengthening health care systems through logistics, surveillance and service delivery; and adequate scaling. The DAP provides comprehensive summary actions to tackle global disability, including neurological disorder-related disability, and offers governments, policy-makers and other relevant stakeholders a blueprint for implementing recommendations of the World Disability Report and the Convention on the Rights of Persons with Disabilities, and facilitate social inclusion of persons with neurological conditions, in countries at all stages of development.

Keywords: Disability, rehabilitation; Neurological disorder; Developing country; World Health Organisation

Abbreviations

CBR: Community-Based Rehabilitation; COAG: Council of Australian Governments; CP: Cerebral palsy; CRPD: Convention on the Rights of Persons with Disabilities; CT: Computer Tomography; CVD: Cardio-Vascular Disease; DALY: Disability Adjusted Life Years; DAP: Disability Action Plan; HDI: Human Development Index; GDP: Gross Domestic Product; GNI: Gross National Income; ICF: International Classification of Functioning, Disability and Health; LTNCs: Long-Term Neurological Conditions; MRI: Medical Resonance Imaging; NCDs: Non-Communicable Diseases; NDA: National Disability Agreement; NGO: Non-Governmental Organisation; OECD: Organisation for Economic Co-operation and Development; OT: Occupational Therapists; PM&R: Physical Medicine and Rehabilitation; P&O: Prosthetics and Orthotics; PT: Physiotherapists; PwD: Person with Disability; RCI: Rehabilitation Council of India; SCI: Spinal Cord Injury; SLTs: Speech and Language Therapists; TBI: Traumatic Brian Injury; UN: United Nations; WHO: World Health Organization; US: United States; WFN: World Federation of Neurology.

Background

The World Report on Disability estimates over one billion people with disabilities globally, which equates to15% of world population or 1 in 7 people (based on 2010 global population estimates) [1]. Of these 110-190 million have significant difficulties, such as inability to walk, perform self-care, or communicate, or to participate in education or employment [1]. The prevalence of disability is significantly higher in low-income than in high-income countries, with an estimated 80% persons with disability (PwD) living in low-income countries [2]. Disability prevalence rates are also associated with poverty and personal wealth, with 20.7% of PwD in the lowest-wealth compared with 11.0% in the highest-wealth quintile [1,3].

The world-wide prevalence of disability is escalating, potentially due to global trends in population ageing, rise in chronic conditions (including Non-Communicable Diseases, NCDs such as cardio vascular diseases, diabetes etc.) and upsurge in natural/man-made disasters [1,2]. Persons aged 60 years and above are projected to increase from 675 million in 2005 to 1.9 billion by 2050 globally [4]. Over next 30 years, the estimated increase in number of older people

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with profound disability by 70% [5]. The estimation-based data is sparse, particularly for developing countries, making it difficult to gauge trends and causes over time. Further, national estimates vary considerably amongst countries and are generally difficult to compare [1]. Economic and social costs of disability are difficult to quantify and to date; there is no inclusive estimate data for overall cost [1]. The reasons for this includes: variation in definitions of disability, different data collection and reporting methods, variation in type/content of disability services/programs; limited data on the cost components of disability; lack of standardized methods for cost-estimation; lack of routine data collection and national registries for disability and others. However, available data suggests that economic and social costs of disability to individuals, families, communities and nations (direct and indirect costs) are significant [1]. The estimated cost of disability is around 10% of public social expenditure across Organisation for Economic Co-operation and Development (OECD) (up to 25% in some countries) [1,6].

The majority of PwD is economically deprived and experience difficulties in accessing basic health services (including rehabilitation) [2]. Only 3% of individuals who need rehabilitation globally receive the service [7], and this is significantly higher for PwD in low-income compared with high-income countries [1]. It is estimated that people needing prostheses or orthotic-related services represent 0.5% of the population in developing countries, and 30 million people alone in Africa, Asia, and Latin America require over 180,000 rehabilitation professionals [8,9]. A global survey of government action (n = 114 countries) in 2006, on the implementation of the United Nations (UN) Standard Rules on the Equalization of Opportunities for PwD reported significant gap in service provision [10]. Rehabilitation policies were not adopted in 48 UN member states (42%); legislation on rehabilitation for PwD not passed in half (50%); and rehabilitation programs not established in 46 countries (40%) [10]. Further, in 2005, one-third of countries globally did not allocate any specific budget for rehabilitation services [1].

Though musculoskeletal conditions (such as arthritis trauma) are prevalent and major cause of disability, neurological insults are more complex, and have a greater disability burden (due to concurrent physical, speech, cognitive and behavioral issues) over longer period of time [11]. Neurological disorders affect up to 1 billion people worldwide and constitute 6.3% of the global burden of disease [12]. Nervous system disorders have significant disease-burden worldwide with an estimated 92 million disability-adjusted life-years (DALYs) in 2005, which is projected to increase by 12% to 103 million in 2030 [12]. The estimated DALYs for neurological disorders were highest for lower-middle and low-income countries [12]. Of these, cerebrovascular diseases (CVD) such as stroke, infarcts/hemorrhages, contribute more than half of the burden in DALYs, followed by Alzheimer and dementia (12% each) [12]. Further, neurological disorders constitute 12% of total deaths globally, with CVD contributing almost 85% of deaths [12], which is significantly higher in lower-middle income countries compared with high-income countries (16.8% vs. 13.2%) [11]. DALYs per 100,000 population and deaths attributable to 10 most common neurological disorders in 2005 in low-income and low-middle income countries according to the World Bank is tabulated in Table 1.

Figure 1: Integrated neurorehabilitation model of care.

Neurological Rehabilitation

Neurorehabilitation is the delivery of a coordinated interdisciplinary care program comprising '*a set of measures that assist individuals who experience (or are likely to experience) disability to achieve and maintain optimal function in interaction with their environment*' [1], for maximum independence and social reintegration [13,14]. The treating team includes neurologists, rehabilitation physicians, nurses and allied health professionals. These programs are individualized and goal-oriented to meet the specific needs of the PwD [15] and encompass the International Classification of Functioning, Disability and Health (ICF) framework, where activity limitation (e.g. mobility, continence, self-care) and participation restriction (e.g. work, driving, community activities) interact with contextual factors (environmental and personal) that influence performance and participatory outcomes [1,4,16].

Long-term neurological conditions (LTNCs) [17] (Box 1) can cause complex disabilities, are costly to treat and have socioeconomic implications due to increased demand for health care, social and vocational services, and caregiver burden [18]. Despite improved medical care and survivorship, people with LTNCs have significant medium to longer-term functional and psychosocial issues that limit daily activity and participation [18]. These require integrated interdisciplinary collaborative care in hospital and community to enable these people to live independently in the community (Figure 1).

Box 1: Classification of LTNCs [17]:

- Sudden onset conditions, e.g. acquired brain injury or spinal cord injury.
- Intermittent and unpredictable conditions, e.g. epilepsy, certain types of headache or early multiple sclerosis (MS), where relapses and remissions lead to marked variation in the care needed.
- Progressive conditions, e.g. motor neurone disease, Parkinson's disease or later stages of MS where progressive deterioration in neurological function leads to increasing dependence on help and care from others.
- Stable neurological conditions, but with changing needs due to development or ageing, e.g. Post- polio syndrome or cerebral palsy (CP) in adults.

Key Global Initiatives

The UN Millennium Development Goals focus on reducing extreme poverty, improving health, education and environmental sustainability to improve lives of the world's poorest populations by

Table 1: Disability-adjusted life year (DALYs) per 100,000 population and deaths attributable to neurological disorders globally and for 'Low' and 'Low middle' income countries (World Bank category)* in 2005.

Neurological conditions	DALYs			Death		
	World	Low income	Low middle income	World	Low income	Low middle income
Cerebrovascular disease	788.4	662.5	1061.2	9.9	6.41	15.81
Alzheimer's and other Dementias	172	90.7	150.7	0.73	0.41	0.34
Migraine	118.9	114	106.8	0.00	0.00	0.00
Epilepsy	113.4	158.3	80	0.22	0.28	0.17
Tetanus	99.7	228.6	10.8	0.33	0.64	0.04
Meningitis	82.9	143.2	51.2	0.26	0.39	0.18
Parkinson's disease	25.1	15.1	19.7	0.18	0.06	0.18
Multiple sclerosis	23.4	20.1	23.3	0.03	0.01	0.02
Japanese encephalitis	8.7	13.0	9.0	0.02	0.03	0.01
Poliomyelitis	1.8	2.6	1.6	0.00	0.00	0.00
Total	**1434.3**	**1448.1**	**1514.3**	**11.67**	**8.23**	**16.77**

(Adapted from WHO Neurological disorders: public health challenges 2006 [12])

**Income categories are based on World Bank estimates of gross national income (GNI) per capita in 2001: low income ≤ GNI US$ 745; lower middle income = GNI US$ 746–2975.*

the year 2015 [4]. All eight goals aim for advancement of rights of PwD, their economic and social empowerment, and active participation [4]. It advocates tailored interventions for local (socioeconomic) conditions, improved levels of human development and health in the developing nations. In 2006, the UN General Assembly adopted Convention on the Rights of Persons with Disabilities (CRPD), together with the World Program of Action and the Standard Rules on Equalization of Opportunities for Persons with Disabilities, which provide strengthened international standards and normative framework for disability [1,19]. The CRPD and ICF highlight various factors and/or barriers, that restrict participation for PwD such as [1]: policies and standards; negative attitudes; lack of provision of services, service delivery (poor coordination among services, inadequate staffing, staff competencies, and training); inadequate funding; and lack of accessibility, consultation and involvement of PwD (in decision-making), data and evidence generation. The CRPD (Article 26) emphasizes access to rehabilitation as vital for PwD to be independent through supporting their physical, mental, social and vocational ability, and for inclusion and participation [1]. Further, the WHO 'World Disability Report' (2011) supports implementation of the CRPD and provides comprehensive information on disability with special emphasis on rehabilitation [1].

The WHO launched a number of global public health projects, including Global Initiatives on Neurology and Public Health [12] in response to the 'Global Burden of Disease' study, which highlighted neurological disorders as one of the greatest threats to world public health. The WHO in collaboration with the World Federation of Neurology (WFN) conducted an international Survey of Country Resources for Neurological Disorders (109 countries, covering over 90% of world population) and in 2004 published the first comprehensive report on country resources for neurological disorders, to increase professional and public awareness of the global burden and to emphasize the need for provision of neurological care in first-level and referral health facilities [20]. This report highlighted the inadequacy in resources and inequalities in access to care for patients with neurological disorders, especially in those living in the developing world [21]. In 2006, the WHO published: 'Neurological disorders: public health challenges' [12], to inform and help governments, public health institutions, NGOs and others to formulate public health policies directed at specific neurological disorders; and technical guidelines and policy papers for improved access for PwD (e.g., community-based rehabilitation; manual wheelchairs, training packages etc.).

In April 2014, the WHO global 'Disability Action Plan' (DAP) 2014–2021, provided a comprehensive list of specific actions to achieve the objectives: human- rights based approach (empowerment of PwD); life-course approach (continuum of care); universal health coverage; culturally-appropriate person-centered approach; multi-sectoral, community-based rehabilitation; and universal design [22]. The main goals of the DAP are to:

- Remove barriers and improve access to health services and programs,
- Strengthen and extend rehabilitation, assistive technology and support services,
- Community-based rehabilitation, and
- Strengthen disability data collection for international comparability, and to support research.

Methods

This article presents an overview of neurorehabilitation status in developing countries and highlights some of the challenges in implementation of the DAP. A comprehensive approach was employed to review the existing literature for neurorehabilitation-related material. A search of peer-review literature was conducted for the previous 15 years using medical and health science electronic databases: Medline, PubMed, EMBASE, CINHAL, PsycINFO, and Cochrane Library; manual search of relevant journals and bibliographies of identified articles (for additional references). A

Table 2: Summary of current health status, systems and resources for disability in some developing countries.

Country	Geographical data	Epidemiology: overall disability	Epidemiology: neurological conditions	Policies & Legislation	Funding mechanisms	Human resources	Service delivery	Other issues
			Asia					
Afghanistan	Area: 652,000 km^2 Population: 29,825,000 HDI rank: 169 GNI per capita*: $1,560	4.8% of total population, 2.7% with severe disability; Proportion of PwD to total population: 2.7%; Unemployment: >70%; No access to education: 73%	Total death: NCDs= 37%; cerebrovascular diseases: male 2.6%, (age standard Death Rate: 121.5/100,000 population)	CRPD ratified: 2012; Comprehensive national disability policy 2003; National Disability Action Plan (2008–2011); National Priority Program 'Health for All Afghans' from 2012	Total expenditure on health per capita (2012): $47; Total expenditure on health as % of GDP (2012): 8.7%; National coordination/ funding: Ministry of Labour, Social Affairs, Martyrs; Majority of rehab services funded by NGOs & external donors	Physicians: 2.3/10,000 people; No specific specialisation in PM&R No data on other health care & allied health personnel	Availability of health centres: 51% Hospital access: 32.4% Majority of rehabilitation services funded by NGOs & charities PT services: 44/364 districts; CBR and out-reach programs implemented: 80/364 districts; orthopaedic centres (tertiary level only): 13/34 provinces	No action plan for management of neurological disorders or rehabilitation. Research in the medical rehabilitation minimal, limited (descriptive epidemiological data only). War & terrorism, lack of education & training main barriers.
Bangladesh	Area: 147,570 km^2 Population: 155 mil HDI rank: 142 GNI per capita*: $2,030; 43%living below national poverty line of US$1.25/day	10.8% of total population; Proportion of PwD to total population 5.6% Unemployment: no data; access to education for children: <4%; 0.5% (approx.. 750,000 persons) of the population in needof P&O services	Total death: NCDs= 59%; Cerebrovascular diseases: male 5.9%, female 6.3% (2004) SCI: 93–174 Persons/million populations, with 14- 22,000 persons needing continuous rehabilitation services; CP: estimated prevalence is between 2.12–2.45/1000 live births	CRPD ratified: 2007-8; Disability Welfare Act (2001); National Policy on Disability (2004); Five-year National Action Plan on Disability (2006); Disability Rights and Protection Act (2013); signatory to the Asian and Pacific Decade of Persons with Disabilities (2002–2012) and (2013–2022)	Total health expenditure per capita (2012): $68; Total expenditure on health as % of GDP (2012): 3.6; National coordination/ funding: Ministry of Health and Family Welfare and Ministry of Social Welfare	Physicians: 3.6/10,000 people; Currently active: PM&R physicians: 200. PT: 1300; PT assistants: 600; SLTs: 33; P&O technicians: very few as no accredited training; over 900 persons completed CBR training courses.	Approx. 4 beds/10,000 population; World Bank funded project currently piloting 68 Integrated Disability Service Centres in 64 districts, in which there are 323 PTs, 83 OTs, 37 P&O &19 speech therapists IDSCs plan to start 32 mobile clinics using adapted buses, equipped with therapeutic equipment. Majority of rehabilitation services funded and run by NGOs & charities	No official definition, policy or strategy of PM&R in National Health Policy2011 and in the Health, Population and NutritionSector Development Program 2011–2016. Research in rehabilitation field limited to acute care outcomes.

India [53, 54, 55]	Area: 3,287,590km^2 Population: 1.2 billion HDI rank: 135 GNI per capita*: $3,910	Proportion of PwD to total population 1.8-2.1% Unemployment: 26-34%; access to education for children: 47.5% (rural area)-44.4% (urban area) 75% live in rural areas; illiterate: 49%	Total death: NCDs = 60%; cerebrovascular diseases: male 6.7%, female 7.5% (age standard Death Rate: 108.05/100,000 population) Stroke: crude prevalence rates 90-222/100,000 persons; mortality rate 73/100,000 persons	CRPD ratified: 2007; PwD Equal Opportunities, Protection of Rights & Full Participation Act (1995); Mental Health Act (1987); National Policy for Persons with Disabilities (2006)	National Handicapped and Finance Development Cooperation provides loans on concessional terms for self-employment; 3% reservation in employment for PwD in governmental jobs; provision of tax relief for families & PwD National coordination/ funding: Central Coordination Committee and Central Executive disability Committee, under the Ministry of Social Justice & Empowerment	Physicians: 7/10,000 people; several national institutions and 250 private institutions conduct training courses for rehabilitation specialists	5 composite, 4 regional and 120 district rehabilitation centres, institutions at village, intermediary and district level exits throughout for welfare of PwD	Large rural population, poverty, limited access, financial issues for PwD & cultural taboos about disability. Currently an upward trend in research in the medical rehabilitation. .
Sri Lanka	Area: 65,610 km^2 Population: 21.1 mil HDI rank: 73 GNI per capita* : $6,030	1.6% of total population 2001 census (underestimated), according to WHO estimated 3 mil PwD; 14.4% of households have a member with a disability or with chronic illness (2009/10); Approx. 105,000 persons require P&O services	Total death: NCDs= 75%; cerebrovascular diseases: 6.3%, (stroke 3rd most cause of total death) SCI: 3000-4000 persons needing continuous rehabilitation services, annual incidence: 250-300 persons; CP: estimated prevalence is between 2–2.5/1000 live births	CRPD ratified: 2007; Protection of the Rights of Persons with Disabilities Act (1996); RanaviruSeva Act (1999a); Visually Handicapped Trust Fund Act (1992); Sri Lanka Federation of the Visually Handicapped (Incorporation) Act (2007); National Policy on Disability for Sri Lanka (2003)	Total expenditure on health per capita (2012): $189; Total expenditure on health as % of GDP (2012): 3.2; National coordination/ funding: Ministry of Social Services, and National Council for Persons with Disabilities Ministry of Social Services provides various welfare support for PwD and their families including financial support, assistive devices	Physicians: 6.8/10,000 people; currently employed in government hospitals: 363 PTs; 107 OTs and 35 S&LTs;8,000 of the 14,000 CBR volunteers; No trained rehabilitation medicine physicians	Ministry of Health runs 5 rehabilitation hospitals in 5 provinces and has short-term plans to have at least one rehabilitation hospital per province 50 Base Hospitals and District Hospitals also have smaller PT units and 8 physical rehabilitation centres in 6 districts produce P&O devices.	Political stability and social taboos barriers to accessing rehabilitation. Research in rehabilitation limited mostly to acute care outcomes.
Pacific region								
Papua New Guinea [56, 57]	Area: 462,840 km^2 Population: 7.2 mil HDI rank: 157 GNI per capita*: $2,740	PwD: 975,000 people 2% or about 19,500 people receive services; Disability prevalence range:0.9% to11.1%	Total death: NCDs= 42%; cerebrovascular diseases: 4.1%, (age standard Death Rate: 103.3/100,000 population)	CRPD ratified: 2007-8; Disability Welfare Act (2001); National Policy on Disability (2004); Five-year NationalAction Plan on Disability (2006); National Health Plan 2011-2020 (2011)	Total expenditure on health per capita (2012): $151; Total expenditure on health as % of GDP (2012): 5.2; 20% of health sector expenditure in PNG from donors, with Australia contributing the single largest share. National coordination/ funding: National Department of Health	Physicians: 0.5/10,000 people; 326 medical officers; 2032 allied health workers, 1622 nurses/midwives; 1093 community health workers (2012)	1 national referral hospital, 1 specialist, 4 regional and 16 provincial public Hospitals; Free of charge public health and primary health care services; lack of data on rehabilitation	Service delivery fragmented between National Department of Health and provincial governments. Social taboos about disability and other cultural issues. Limited rehabilitation research.
Africa								

Madagascar	Area: 587,041 km^2 Population: 22.2 mil HDI rank: 155 GNI per capita*: $930	Based on WHO Report on Disability, estimated person with disability 2.8 mil	Total death: NCDs= 39%; cerebrovascular diseases: female 6.4% (age standard Death Rate: 134.9/100,000 population)	CRPD ratified: 2007; National Decade of Disabled Persons (2003), The Madagascar Action Plan 2007–2012	Total expenditure on health per capita (2012): $40; Total expenditure on health as % of GDP (2012): 4.1 Government health spending (2008): 14.6%; 70% of total spending on health; 30% contributed international donors and other private sources National coordination/ funding: Ministry of Health	Physicians: 1.6/10,000 people; (in 2010) and a total of 3,150 doctors, 5,661 nurses, 385 community health workers	Approx. 3 hospital beds per 10,000 people	No data on any welfare support for PwD & their families. Limited hospital capacity and education training opportunities. Research in the medical rehabilitation is limited.
Mauritius [29, 44]	Area: 2,040 km^2 Population: 1.2 mil HDI rank: 63 GNI per capita*: $15,060	Proportion of PwD to total population 5.6% Unemployment: no data; access to education for children: <4%	Total death: NCDs = 85%; cerebrovascular diseases: male 15.4%, female 18.2% (age standard Death Rate: 142.3/100,000 population); Incidence per million (2005-9): stroke- 428.3–910, TBI-141.6–299.1, SCI-12.5–23.3	CRPD ratified: 2011; Standard Rules on the Equalization of Opportunities for Persons with Disabilities (2011)	Total expenditure on health per capita (2012): $784; Total expenditure on health as % of GDP (2012): 4.8 National coordination/ funding: Ministry of Health and Quality of Life Ministry provides various welfare support for PwD and their families	Physicians: <0.5/10,000 people; (in 2010) P&RM specialists; 4, PT: 17; OT: 29; Dietician: 16; S&LT: 5; clinical psychologists: 4	Apprx.150 medical institutions providing tertiary, primary, district, and regional health care; 7 major hospitals (bed capacity 2500); 19 private Clinics (807 beds)	The welfare system has not given enough weight to specific disability needs. Research in the medical rehabilitation is limited.
Ghana	Area: 238,535 km^2 Population: 25.2 mil HDI rank: 138 GNI per capita*: $1,910	Prevalence of disability: 7-12% (women=10.6%; men=6.2%; 64% of adults with disabilities are women; 3 most common types of disability: visual, auditory & physical Impairments; total years of education=2.41 years; primary education percentage completion rate: 54%	Total death: NCDs= 42%; Cerebrovascular disease: female 6.1% (age standard Death Rate:81.3/100,000 population)	CRPD ratified: 2007-8; Persons with Disability Act (2006),	Total expenditure on health per capita (2012): $106; Total expenditure on health as % of GDP (2012): 5.2 National coordination/ funding: Ministry of Health	Physicians: 1/10,000 people;	Ghana Health Service, responsible for service delivery; Ghana Federation of the Disabled (1987), encompassing Ghana Society of the Physically Disabled (1980), Association of the Blind (1963), National Association of the Deaf (1968), Parents Association of Children with Intellectual Disability (2001), Association of Persons Living with Albinism (2003), andShare Care Ghana (2006)	Attitudinal challenges to full socioeconomic inclusion of PwD. Built physical environment lacks key accessibility tools that enable social inclusion. Institutional challenges for PwD cuts across medical, financial, publichealth, social science, and religious arenas.

(Main source: WHO Country Profile; WHO Health Statistics 2011, WHO Global Info base, UN Human Development Report 2014, Handicap International report 2014 [26]).

*Purchasing power parity (PPP) in US$.

CBR: Community based rehabilitation; CP: Cerebral palsy; CRPD: Convention on the Rights of Persons with Disabilities; HDI: Human development index; GDP: Gross Domestic Product; GNI: Gross National Income; OT: Occupational therapists; NCDs = non-communicable diseases; P&O: Prosthetics and orthotics; PM&R: Physical Medicine and Rehabilitation; PT: Physiotherapists; PwD: persons with disability; SCI: Spinal cord injury; SLTs: Speech and Language Therapists; TBI: Traumatic brain injury; WHO: World Health organisation.

search of grey literature was conducted using relevant internet search engines and websites including: the Centre for International Rehabilitation Information and Exchange Database of International Rehabilitation Research, the System for Information on Grey Literature in Europe, the New York Academy of Medicine Grey Literature Collection, WHO Libraries, and Google Scholar. Web-portals of various healthcare institutions and governmental and non-governmental organisations (NGOs) associated with neurorehabilitation were reviewed for relevant studies. Authors and known experts in the field were also contacted. A narrative overview of key concepts identified in these studies is presented below.

Challenges and potential barriers for implementation of the disability action plan

With progress of society and economy, and improvements in health care systems, health status of populations in developing countries has greatly improved in past half-century. Concomitantly, these countries are confronted with greater scale of disability with multiple and complex causes, including neurological conditions [1,12]. In most developing countries, the emphasis of health care is still directed primarily to curative and preventive aspects of disease, and rehabilitation gets less priority [23]. The DAP provides a major boost for rehabilitation services for the WHO member States, national and international partners and consumer organizations to enhance the quality of life of PwD, worldwide. This resolution calls for the implementation and adaptation of the proposed standardized actions as a national priority [22]. The objectives of the DAP area global standard for applicability across countries, professions, cultures, and sectors worldwide.

Global standards do not always fulfill expectation of enhanced communication at multiple levels in society [24]. There appear to be contrasts and imbalances within operational healthcare systems in many countries in terms of policies, funding structure/infrastructure, capacity, human and physical resources, technology etc. Usually, PwD, including those with neurological conditions, are more vulnerable in society and are affected by constraints in the provision of health-care systems [12]. In terms of neurorehabilitation services, the global picture is still vague. There is lack of routinely collected data for disability, limited information about the needs and unmet needs of PwD, variability in definitions used for disability and various types of disability (e.g., physical, mental, behavioral, intellectual) and variation in settings [1,22]. Further, there is diversity in models of care, interventions and modalities, outcome measurement, type and quality within neurorehabilitation services [1, 22]. Healthcare systems and practices vary amongst countries, however, many challenges in neurorehabilitation are similar to generic rehabilitation services in terms of implementation of the DAP. An additional challenge for neurorehabilitation and the DAP in the context of developing countries is these conditions are often complex, with significant disability-burden worldwide. These people have concurrent physical, speech, cognitive and behavioural issues which can cause cumulative deficits over longer-term requiring specialized services for comprehensive management. These add to the economic burden for the individual (their families) and healthcare systems. Many challenges across healthcare settings for neurorehabilitation occur at both macro (international, governmental, policy) and micro (community, social, individual) level, and are common to most low-resource countries, where despite improved acute health care systems, the health policies have not fully extended to include rehabilitation. Some potential challenges for implementation of the DAP, particularly for neurorehabilitation service provision (2nd DAP objective), are summarised below.

Macro level

Policy and planning: Healthcare organisations and neurorehabilitation services have immense task of developing correct policies, laws, and delivery systems with coordination strategy adapted to local needs. These services may be confronted with expectations stemming from their institutional environment (e.g., government agencies, administrations, patient organizations) concerning improvement of quality of care and clinical outcomes. Policies also need to specifically promote the human rights of PwD [25]. Despite the burden attributed to neurological disorders, many low-middle income countries in the developing world have health policies that do not cover neurological disorders at the same level as other medical conditions [12]. Importantly, these conditions are largely absent from the national health agendas [12]. Legislation or policies for overall management of PwD, have been adapted in many developing countries such as India, Afghanistan, Bangladesh, Sri Lanka [26], Ghana [27], Pakistan [28], Mauritius [29] and others, however, disability culture in many remains in a nascent stage [28]. The existing policies are underfunded and often there is a lack of coordination and collaboration amongst different sectors and ministries involved [30]. Despite availability of policies on rehabilitation in some countries, there is lag in implementation of these policies and/or overall delivery of the rehabilitation service [1]. Further, there is no consensus on who is responsible for enforcing and/or funding new legislations such as CRPD, the other WHO recommendations etc. [30].

Infrastructure: Many persons with neurological conditions require highly specialized skills for appropriate diagnosis and management. Most developing nations lack or have limited number of adequate and efficient health services, particularly in rural areas [31]. In these countries sub-specialized services (such as stroke units) are restricted to urban areas [20]. The availability of rehabilitation services across regions varies, and many developing countries still have limited or no organized rehabilitation services [1]. In many, these services exist through NGO initiatives and charitable organisations; these are often dependent on external funding, independent of national public health systems [26]. The persons with neurological disabilities usually depend on family members for help with daily activities, which perpetuates the cycle of poverty [32]. There is minimal data collection, reporting and information-gathering system, which impedes evaluation and monitoring of the situation over-time to alert the health system to emerging trends, and to facilitate planning [32].

Resources: Lack of funding and human resources can hinder proficient implementation and management of the DAP. Currently, available resources for disability in most countries are inadequate and inequitably distributed [1,20]. In majority of low-income countries there are limited budgets for services for neurological conditions. The WHO survey showed only 10.4% of the responding countries (mainly high-income countries) have a separate budget for neurological illnesses within their health budgets, and two-thirds of the low-

income countries have no disability benefits available [20]. Out-of-pocket payment by patients is the major source of financing in most low-income countries, which is likely to result in financial hardship and inequity in utilization of healthcare services [20].

Health information systems: In the developing world, healthcare systems are limited by resources, capability and lack of information technology (IT) systems. Data on neurorehabilitation is incomplete and fragmented, and often not disaggregated from other health-care services information [33]. Despite availability of the ICF for over a decade, there is no indicator or common framework for describing and measuring rehabilitation in many countries; and rehabilitation measures are often excluded from existing classification systems [1]. Inadequate health information systems and communication strategies across health care sectors and between providers (notably between primary and secondary care), is still prominent worldwide, even in developed countries like Australia [34]. Other barriers to provision of neurorehabilitation services, include, inconsistent and insufficient data collection processes, multiple clinical information systems and incompatible technologies [1,34].

Referral systems: Many developing countries have no systems of appropriate referral mechanism for neurological illnesses at provincial or national level. Therefore, many people miss appropriate services and/or care continuum in the community, after discharged from an acute facility. An effective referral system is required to ensure a close relationship/coordination between all levels of the health system to ensure those with neurological disorders, receive the best possible care and regular follow-up [12,35]. This will build capacity and enhance access to better quality care and provide cost-effective use of hospital, community and primary health care services.

Developing leadership, workforce and capacity: The lack of neurorehabilitation specialists and allied health personnel is a challenge in most developing countries [3]. For example, the median number of neurologists in low-income countries is 0.03 per 100,000 populations, which is considerably lower compared with high-income countries (2.96 per 100,000) [20]. This shortage is particularly evident in regions of Africa, South-East Asia, Eastern Mediterranean and the Western Pacific [20]. According to the WHO survey in sub-Saharan Africa, there are overall 6 rehabilitation physicians for more than 780 million people [1] and this number is much lower for neurorehabilitation specialists [29]. Paucity and inappropriate distribution of healthcare professionals between rural and urban regions contributes to limited rehabilitation service delivery [20]. In many developing countries, there is limited leadership guidance from governmental and other relevant authorities for training and empowerment programs for healthcare workers and PwD [36]. There is need for neurorehabilitation capacity building at national health authority level and other relevant institutions for development of a skilled workforce. Further, lack of training facilities and programs compound the problem of capacity building, specialist training and knowledge transfer for existing professionals.

Micro Level

At this level, the challenge is to assess how the DAP can be used to enhance the effectiveness of care delivery for persons requiring neurorehabilitation, and if so how this can be measured and evaluated using a standardised technique.

Poverty and cost of services: The cost of access to neurorehabilitation services is a barrier for PwD particularly in low-income countries, where most services are available only as an out-of-pocket payment [37]. Disability can be both a cause and consequence of poverty, which impedes PwD attaining required services [38]. Many PwD, including those with neurological disorders (and family) in low-income countries are either unemployed or have lower incomes, compromising adequate care [38].

Stigma and discrimination: Despite evidence of growing public acceptance of PwD, widespread stigma and discrimination still persists, often because of non-biologic concepts and cultural perception of disabilities [1]. These entrenched concepts and social stigma in public lead to active exclusion of these people from societal participation and opportunities to liaise with the able-bodied in public [27]. Further, there is evidence of wide gender inequalities in accessing rehabilitation services in many low-income countries [39]. This has resulted in unsuccessful implementation of the World Report on Disability's explicit recommendations for social inclusion such as community-based rehabilitation in African countries [27,40].

Awareness and education: Majority of PwD, are poorly educated and unaware of specialised specialities like rehabilitation; and information about benefits of rehabilitation are not easily available or understandable [1]. Lack of mistrust among PwD for medical practitioners in some cultures is still prevalent, particularly in rural areas, where first preference is to seek help from religious healers and traditional herbal medicine [1,41].

Access to services and assistive technologies: Disability and neurorehabilitation services are limited or often do not exist in rural areas, not only in developing countries but also in some parts of the developed world [1]. As most available services are usually based in urban areas, access to such facilities is often costly, time-consuming and difficult due to lack of transportation [42]. Assistive devices such as canes, crutches, prostheses, wheelchairs etc., are integral part of health care for persons with neurological conditions and widely prescribed to maintain, or improve functional capabilities and participation. In many high-income countries these are provided by national health care systems, through rehabilitation services, insurance companies, charities and NGOs. However, in many low-income countries there is still large gap in service provision of these essential disability services [1,39].

Professional, caregiver and consumer groups: Though there is an increasing trend in the number of professional, caregiver groups and NGOs, for PwD worldwide, there is limited number of such organisations for disabled population in low-income countries. According to WHO, there are no NGOs or other professional groups for neurological disorders in 35% of low-income countries [20].

Overview of neurorehabilitation in developing countries

Table 2 provides an overview of rehabilitation status in different developing countries, which potentially comprise barriers that challenge equitable access to rehabilitation services and quality of such services. In most developing countries, much effort has gone to improve the acute care sector, which has seen enormous progress. However, the post-acute care system, including long-term rehabilitation and social reintegration, is immature at many levels

[29]. The need for rehabilitation services in developing countries is not well defined in terms of type, settings, and intensity/duration due to lack of disability-disaggregated data within general statistics of the health and social sectors [26]. In most countries (Table 2), these services are still integrated with other health services in public hospitals where basic rehabilitation services are provided but not focused on specific disabilities (such as neurological). Although the WHO promotes the "bottom-up" approach through community-based rehabilitation for community decision-making, in most cases the process itself is often a "top-down" approach, with rehabilitation professionals still being the decision-makers for need assessment and management, while participation of PwD is limited [43].

Despite presence of comprehensive policies, their implementation remains limited in terms of geographical coverage, shortage of trained workers and unclear referral mechanisms between public health services and neurorehabilitation services. Huge challenges exist in many countries in terms of accessibility and lack or poorly developed healthcare infrastructure. Further, medical rehabilitation is yet to be recognised by PwD and their families [44]. In African countries, term 'rehabilitation' still has very misleading connotations of patient passivity and dependency [45], while in other countries like Pakistan the term rehabilitation is perceived as just physiotherapy or exercise alone [28,46] (Case study 1). As majority of rehabilitation services are being provided and funded by international donors and organisations, the security situation in some regions (such as Afghanistan, Pakistan) have restricted these organisations to expand their services to rural areas and sustainability of the few existing services is at risk [26]. In countries like Australia where, various major policies, projects and initiatives have been developed to address health issues, including health for PwD, there is still a wide gap between the health status of Indigenous people and that of other Australians (Case study 2). In Mauritius, there has been significant improvement in its health care system, especially in acute care sector (such as frontline services and procedures e.g. cardiac surgery) and controlling communicable diseases, however, post-acute care, including neurorehabilitation is still problematic at many levels (Case study 3) [29,44]. While in Madagascar, the concept of rehabilitation is still in early stages with many limitations (Case study 4).

Case study 1: Neuro-rehabilitation in Pakistan

Pakistan is a low-middle income country (area of 803,940 km2 and population of 180 million) with relatively under-developed and varied health care system between the rural and the urban areas. It is ranked 146th in Human development Index, with Gross National Income per capita of US $ 2,880. In recent years there is increased awareness about NCDs and physical disabilities. There are currently over 188,000 doctors (8.3 physicians/10,000 people) registered with the Pakistan Medical and Dental Council , and 170 trained neurologist -majority based in urban areas.

Rehabilitation is in infancy in Pakistan and confused with 'physiotherapy and exercises' alone by many health care professionals and general public. In 1997 College of Physicians and Surgeon of Pakistan (CPSP) recognized Physical Medicine and Rehabilitation (PM&R) as a specialty and started the 4-year Fellowship training program. To date 48 physicians have successfully qualified the PM&R Fellowship, and majority (30) are working in the military facilities; while only 15 PM&R physicians in the private and public health sector for majority of the PwD in Pakistan. Many medical schools and hospitals do not have specialised rehabilitation departments; and there is limited undergraduate teaching of rehabilitation medicine. Currently, there are estimated 1700 Physiotherapists in Pakistan and 1300 expected to graduate within one year. There are less than 200 trained occupational therapists, 250 speech and language therapists and no formally trained nurses in neuro-rehabilitation.

Data regarding disability and burden of neurological diseases is sparse and mostly comes from hospital- based studies conducted in tertiary care medical institutes/hospitals located in major cities. There is no national registry for stroke, neurological disorders or physical disabilities. The last national census was conducted in 1998 and disability was vaguely documented. There is a huge burden of neurological disorders, including stroke, with about 1,000 people diagnosed every day, out of which 400 die. The age standard total death rate from cerebrovascular disease is estimated to be 117.9/100,000 population. There are no comprehensive stroke units and only two centers in the country offer thrombolysis and six hospitals offer coordinated stroke services. Majority of stroke cases are managed in general medical wards, which often lack follow up, plan or referral for stroke rehabilitation. There are also some centers for spinal cord injuries run by NGOs such as International Red Crescent. The neurorehabilitation services for others e.g., multiple sclerosis, brain disorders (including traumatic brain injury (TBI), brain tumours), neuro-degenerative disorders are yet to be established.

There are only two institutes of PM&R in the country: Armed Forces Institute of Rehabilitation Medicine primarily catering for the military and another in private sector. There are no uniform protocols or guidelines for management of different neurological disabilities and rehabilitation is mostly neglected in official guidelines. For example, the clinical practice guidelines of the Pakistan Society of Neurology, reference the word "rehabilitation" only at 4 occasions, without any detail. There are many NGOs working in Pakistan in the field of disability but their focus is mainly on the social aspects and philanthropic support rather than comprehensive medical rehabilitation. There is no central body for the oversight and coordination, resulting in frequent duplication of effort. There is lack of funding not only for comprehensive management of neurological conditions, but for overall disability management and minimal awareness regarding neurorehabilitation amongst the public and health care professionals, who still practice traditional medical model rather than rehabilitation model for functional restoration and improvement in quality of life. Other barriers include lack of awareness and the perception of neurological disability as an end -of-life situation.

Source: Pakistan Medical and Dental Council, Rathore FA et al 2011, Rathore FA et al 2007 [28,46,47].

Case study 2: Indigenous health in Australia

The Australian Bureau of Statistics (2013) estimate suggests 700,000 indigenous Australians, these compared with their non-indigenous counterparts suffer ill-health, such as:

- Infant mortality rate 3 times higher than the national average.

- Age-standardised death rate 1.9 times higher and life expectancy around 10-11 years less.
- Age-standardised separation rate due to hospitalisation 2.5 times higher.
- Cardio-vascular disease (CVD) 1.2 times more common, with age-adjusted death rate from CVD 1.7 times higher.
- Diabetes 3.3 times more common.
- 2.7 times more likely to feel high or very high levels of psychological distress.
- Hospitalisation rate for injury 2.0 times higher.
- 42% of aged 15 years or older were employed and 17% were unemployed.
- Mean equalised gross household income 41% less.

Disability is a major issue in indigenous population, with 50% aged 15 years and over reporting some form of disability or a long-term health condition, in 2008. Further, 7.9% of all Indigenous people require assistance with core activities (i.e. had a profound/core activity restriction), which is 2.2 times higher compared to other Australians. One third (36%) of indigenous people with a disability or long-term health condition had problems accessing health care services and one in three (32%) adults experienced discrimination in the previous 12 months.

In response to the Social Justice Report 2005, highlighting the vast gap between the health of Indigenous and other Australians-the Australian government through the Council of Australian Governments (COAG) initiated 'Closing the Gap' commitment to achieve Indigenous health equality within 25 years. The National Disability Agreement (NDA) was further developed by the COAG to improve the outcomes for Indigenous people with disability. As a part of NDA, the National Indigenous Access Framework was initiated to ensure that the needs of Indigenous people with disability are addressed through accessible and appropriate service delivery, which includes accommodation, support, community support, community access, respite and employment services. The NDA support services were used by 41% population aged 0-64 years. In 2008, an advisory body for the government on the achievement of equitable and sustainable health outcomes in indigenous population, the National Indigenous Health Equality Council was established.

Despite various initiatives and policies, there remains a wide gap between the health status of Indigenous people and that of other Australians, particularly in disability. Rehabilitation services are limited in remote areas where majority of Indigenous Australians reside. Most services are either institutional-based and/or run by outreach services and many Aboriginal communities get limited access to institutional services, due to geographical distance, costs, culture and language. Other barriers in service provision are similar to those of developing countries, including: workforce shortages and staff-turnover, lack of awareness, inadequate communication across care sectors, geographical landscape, socioeconomic and other issues in rural and remote Australia.

Source: Australian Bureau of Statistics, Australian Indigenous Health Info Net [48,49].

Case study 3: Neurological rehabilitation in Mauritius

Mauritius has had an upsurge of NCDs, including neurological conditions. The period incidence-rate and period-prevalence rate for stroke (2005-09) ranged from 300.6 to 622.9 and 352.1 to 882.6 per 100,000 population, respectively. Stroke represented 26.5% of all deaths recorded from cerebrovascular diseases. The incidence rate and prevalence rate for TBI was slightly lower, ranging from 95.3 to 216.8 and 98.8 to 233.7 per 100,000 populations, respectively. While the incidence rate for spinal cord injury (SCI) ranged from 8.8-16.8 per 100,000 populations.

There are few trained rehabilitation specialists in the country. As of 2009, there were 1,500 doctors in the public and private sectors, 4 PM&R specialists (no neurorehabilitation specialists), only 17 physiotherapists and 33 assistants employed by the government, with one PT seeing almost 200 patients per day and thus delegating care to assistants. There are limited training programs for rehabilitation specialists in the academic institutions to date. Although, acute facilities for diagnostics (Computer Tomography Scan, Medical Resonance Imaging) and treatment (neurosurgery, cardiology, cardiac surgery and thrombolysis for stroke), have made significant progress in Mauritius; adequate long-term care for neurologically disabled, including rehabilitation is yet to be developed.

The Ministry of Health oversees the Community-Based Rehabilitation (CBR) programs, which do not focus exclusively on patients who need neurorehabilitation. However, regular home visit initiatives for the elderly under the CBR, provides some indirect benefit for neurologically disabled individuals. The government provides various welfare benefits for PwD (and their families) including financial support, assistive devices, advocacy, counseling, concessions for adults and refund transportation costs for disabled children (accompanying parents) attending schools, customs duty exemption on specially adapted cars. However, this system has not given enough weight to specific disability needs and PwD (and their relatives) are not aware and often fail to claim such benefits. Further, limited available resources could be utilized more appropriately.

The barriers in service provision for neurorehabilitation include: minimal access to healthcare services, weak coordination amongst the healthcare professionals and facilities, lack of adequate management in the community (such as home care; specialised equipment), inadequate human resources, lack of provision of infrastructure accessible for PwD and cultural stigma.

Source: MRC report 2012, Soopramanien A 2012 [29,44].

Case study 4: Rehabilitation services in Madagascar

Madagascar is the fourth largest island in the world situated in the Indian Ocean, with over 22.2 million inhabitants. There is no epidemiological data on disability in Madagascar. However, according to WHO's World Report on Disability prevalence figures equates to 2.8 million PwD in Madagascar. Madagascar ratified National Decade of Disabled Persons 2003-2013 in 2002 in accordance with the continental plan of action of the African Decade and the UN CRPD in 2007.

The health system is struggling, due to unstable political situation, poverty, high illiteracy, and decrease in international aid. Access to

medical care is limited for the general population, and especially for PwD and those living in rural areas accessibility and affordability are the main barriers. Further, disability is still perceived as a curse and/or contagious disease in many parts of the country and PwD are often isolated and marginalized.

There are estimated 1.6 physicians, less than 1 physiotherapist and an average of 3 hospital beds per 10,000 populations. Majority of hospitals and medical facilities are concentrated in urban areas (mainly the capital). Despite these barriers to access, health services have shown a trend toward improvement over the past 2 decades. In the last 5 years, some development has occurred in rehabilitation. It is one of few sub-Saharan African countries with established rehabilitation network. The Malagasy Department of Health in conjunction with a UK based Charity commenced post-graduation training in rehabilitation, (including neurorehabilitation) at the University of Antananarivo. To date there are 10 rehabilitation specialists in the country, including 8 recently completed the post-graduate course. Other progress includes the newly formed National Association of Rehabilitation Medicine, which hosted its first national congress in practice for cerebral palsy. Spinal cord rehabilitation is planned for commencement in tertiary hospitals in 2015. The communication and collaboration between rehabilitation and acute care sector health care professionals is minimal. There are some grassroots associations for PwD mainly funded and provided by the NGOs and charitable organisations, such as the National Collective of Organizations Working for Disabled Persons, Handicap International, and Christian Blind Mission etc.

Source: Disability World [50]; World Health Statistics 2011 [51] and Author's personal experience and communication with experts in Madagascar

On a positive note, there are countries that have made significant leaps in developing rehabilitation programs for PwD, such as India. India was one of the first countries to sign and ratify the UN Convention, and established the Rehabilitation Council of India (RCI) in 1986 [52]. In 1993, the Indian Parliament enacted the RCI Act and set it up as Statutory Body. The RCI currently regulates and monitors services given to PwD, develops education curriculum and maintains a Central Rehabilitation Register of all qualified professionals and personnel working in the field of Rehabilitation and Special Education. The trend of year-wise status of registration of rehabilitation professionals and personnel in the Central Rehabilitation Register has quadrupled from 2001-2 (20,118 registration) to 2012-13 (78,514 registrations) [52]. India has a long tradition of implementing CBR programs, involving the families and caregivers with good effect using local traditions. Use of technology such as mobile phone apps have also been developed to facilitate communication and education programs for PwD. Stroke and Spinal cord rehabilitation are well developed in urban areas, however, issues such as infrastructure, trained personnel etc. for rural populations are similar to those in other developing countries.

Discussion

Neurological conditions are complex and require specialized services for comprehensive management. The global increase in prevalence of neurological conditions has affected disability and added to the economic burden for national healthcare systems, particularly in low-resourced countries. Despite significant improvements in the acute health care systems in many developing countries, health policies have not extended to include rehabilitation services. For survivors of neurological insults (such as SCI, TBI, or stroke), structured long-term neurorehabilitation and NGOs for specific neurological disability are limited or do not exist. In many countries (including developed countries like Australia) most neurorehabilitation programs exists in 'silos'. Neurorehabilitation has evolved beyond conventional medical views to include consideration of needs of PwD, their function and social reintegration. It is an expensive resource; and the evidence to support specific neurorehabilitation interventions has long been neglected. The emerging advances in information and communication technology provide opportunities for alternative efficient and cost-effective method to deliver therapy using web-based devices (computer, mobile phones etc.) in a settings convenient for patients, such as telerehabilitation in-home, by minimising the barriers of distance, time, cost and healthcare system load [58]. The benefit and applicability of telerehabilitation/telehealth for persons with neurological conditions have been well documented in literature [58]. Further, there is a trend in progress towards 'Universal Health Coverage' in many countries worldwide, such as increasing enrolment in government health insurance, a movement towards expanded benefits packages, decreased out-of-pocket spending and increased government spending on health [59]. There is imperative for greater awareness of the gaps in resources for neuro rehabilitative care, to assist health planners and policy-makers to identify areas for urgent attention and planning.

The DAP provides comprehensive summary actions to tackle global disability and offers governments, policy makers, and other relevant stakeholders a blueprint for implementing the recommendations of the World Disability Report and CRPD, and facilitate social inclusion of persons with neurological conditions. Some recommendations to facilitate the process of implementation and change in practice include: the DAP actions should not be taken as a conceptual framework or academic information only, but used in practice at all levels of society; all involved partners and stakeholders should follow a rigorous process with effective and regular communication, in the implementation process. Further, although implementation is voluntary, the UN Member States, and partners should not interpret the DAP as lenient regulation, but adapt as legislation. Potential challenges/barriers ahead for global diffusion and implementation of the DAP, depends upon the country's health system to perform four vital functions: service provision, resource generation, funding and stewardship [12].

Summary

The significant longer-term health consequences of neurological conditions in low-resource countries can overwhelm the person (caregivers), society and the health system. The DAP sets up an agenda for all sectors of society for collaborative effort for successful implementation. Some of the recommendations to facilitate implementation of the DAP in neurorehabilitation in low-resource countries include:

- A systematic approach to building health care systems and processes for integrated neurorehabilitation services

from acute care through to community; and inclusion of primary health care.

- Set up a Global Health Fund using forums like the G20 to mobilize funding role in emerging countries, as these are especially relevant to neurological conditions with complex longer-term disability.
- Bilateral assistance for persons with neurological disability: health security/macroeconomics, financial - Universal health coverage (such as 'Medicare' in Australia), job creation, resources tailored to country characteristics (governance, policy, mindset etc.).
- To keep foreign multilateral and private agencies focusing on neurorehabilitation as instruments of aid, grants, concessions, aid-in-kind etc. under contractual laws.
- Time-based outcomes using the DAP with bilateral agencies working with other agencies, using multi-sectorial approach, new partnerships, strategic collaboration, provision of technical assistance, research and development.
- Investment in education and skill-development of neurorehabilitation professionals.
- Capacity building for a strong interdisciplinary workforce for neurorehabilitation.
- Post-2015 Millennium development goals should focus on sustainable neurorehabilitation programs, a governmental approach and resource scarcity.
- Infrastructure and IT support for sustainable health care for neurorehabilitation to drive economic growth and support health security.
- Governance support for strengthening neurorehabilitation health care systems through logistics, surveillance and service delivery.

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Authors' Contribution

FA and BA were involved in all aspects of the review. FA and BA coordination and prepared the final draft of the manuscript. HM provided valuable input into design and critically reviewed the manuscript. FR provided valuable assistance with the case studies and discussion. All authors read and approved the final manuscript.

References

1. World Health Organization. World Report on Disability. Geneva: WHO; 2011.
2. World Health Organization. Promoting access to healthcare services for persons with disabilities, in Disability and rehabilitation. Geneva: WHO; 2006.
3. Bethge M, von Groote P, Giustini A, Gutenbrunner C. The World Report on Disability: a challenge for rehabilitation medicine. Am J Phys Med Rehabil. 2014; 93: S4-11.
4. United Nations General Assembly. Keeping the promise: realizing the Millennium Development Goals for persons with disabilities towards 2015 and beyond: Report of the Secretary-General, New York: UN; 26 July 2010.
5. Giles LC, Cameron ID, Crotty M. Disability in older Australians: projections for 2006-2031. Med J Aust. 2003; 179: 130-133.
6. Organisation for Economic Co-Operation and Development. Sickness, disability and work: keeping on track in the economic downturn (Background paper). Paris: OECD; 2009.
7. South-North Centre for Dialogue and Development. Global survey of government actions on the implementation of the standard rules of the equalisation of opportunities for persons with disabilities. Amman: Office of the UN Special Rapporteur on Disabilities; 2006.
8. Lindstrom A. Appropriate technologies for assistive devices in low-income countries. In: Hsu JD, Michael JW, Fisk JR, editors. AAOS Atlas of orthoses and assistive devices. Philadelphia: Mosby/Eslevier; 2008.
9. Wooding S, Raphael B. Psychological impact of disasters and terrorism on children and adolescents: experiences from Australia. Prehosp Disaster Med. 2004; 19: 10-20.
10. South-North Centre for Dialogue and Development. Global survey of government actions on the implementation of the standard rules of the equalisation of opportunities for persons with disabilities. Amman: Office of the UN Special Rapporteur on Disabilities; 2006.
11. Khan F, Turner-Stokes L, Ng L, Kilpatrick T. Multidisciplinary rehabilitation for adults with multiple sclerosis. Cochrane Database Syst Rev. 2007; : CD006036.
12. World Health Organization. Neurological disorders: public health challenges. Geneva: WHO; 2006.
13. Department of Health. National Services Framework (NSF) for Long-term Conditions. Leeds: DH; March 2005.
14. Australian Rehabilitation Alliance. The need for a National Rehabilitation Strategy: working towards a clear and united rehabilitation strategy for Australia (Position Statement). Canberra: ARA; 10 August 2011.
15. Khan F, Amatya b, NgL, Drummond K, Olver J. Multidisciplinary rehabilitation after primary brain tumour treatment. Cochrane Database Syst Rev. 2013; 1: CD009509.
16. World Health Organisation. The International Classification of Functioning, Disability and Health. Geneva: WHO; 2001.
17. Royal College of Physicians, National Council for Palliative Care, and British Society of Rehabilitation Medicine. Long-term neurological conditions: management at the interface between neurology, rehabilitation and palliative care. Concise Guidance to Good Practice series, No 10. London: RCP; 2008.
18. Turner-Stokes L, Sykes N, Silber E, et al. From diagnosis to death: exploring the interface between neurology, rehabilitation and palliative care in managing people with long-term neurological conditions. Clin Med. 2007; 7: 129-136.
19. United Nations. Convention on the Rights of Persons with Disabilities. 2006.
20. World Health Organization and World Federation of Neurology. Atlas: country resources for neurological disorders. Geneva: WHO; 2004.
21. Janca A, Prilipko L, Costa e Silva JA. The World Health Organization's work on public health aspects of neurology. J Neurol Neurosurg Psychiatry. 1997; 63 Suppl 1: S6-7.
22. World Health Organization. WHO global disability action plan 2014–2021: Better health for all people with disability. In: Sixty-seventh world health assembly- A67/16. Provisional agenda item 13.3. Geneva: WHO; 2014.
23. Bhatia M, Joseph B. Rehabilitation of cerebral palsy in a developing country: the need for comprehensive assessment. Pediatr Rehabil. 2000; 4: 83-86.
24. Walgenbach P. The production of distrust by means of producing trust. Organisation Stud. 2001; 22: 693-714.
25. Mannan H, Eltayeb S, Maclachlan M, Amin M, McVeigh J, Munthali A, et al. Core concepts of human rights and inclusion of vulnerable groups in the mental health policies of Malawi, Namibia, and Sudan. Int J Ment Health Syst. 2013; 7: 7.

26. Axelsson C. Mapping report of physical rehabilitation services in Afghanistan, Bangladesh, Odisha (India) & Sri Lanka., Handicap International, 2014.

27. Tuakli-Wosornu YA, Haig AJ. Implementing the World Report on Disability in West Africa: challenges and opportunities for Ghana. Am J Phys Med Rehabil. 2014; 93: S50-57.

28. 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.

29. Soopramanien A. Mauritius calling: medical care and neurorehabilitation needs in an oceanic idyll. Arch Phys Med Rehabil. 2012; 93: 2377-2381.

30. World Health Organization. Disability and rehabilitation status review of disability issues and rehabilitation services in 29 African Countries. Geneva: WHO; 2004.

31. World Health Organization, Swedish Organizations of Disabled Persons International Aid Association. Part 1. Community-Based Rehabilitation as we experienced it - voices of persons with disabilities. Geneva: WHO; 2002.

32. Parnes P, Cameron D, Christie N, Cockburn L, Hashemi G, Yoshida K. Disability in low-income countries: issues and implications. Disabil Rehabil. 2009; 31: 1170-1180.

33. Worrall LE, Howe T, O'Callaghan A, Hill AJ, Rose M, Wallace SJ, et al. The World Report on Disability as a blueprint for international, national, and local aphasia services. Int J Speech Lang Pathol. 2013; 15: 106-112.

34. Digiacomo M, Davidson PM, Taylor KP, Smith JS, Dimer L, Ali M, et al. Health information system linkage and coordination are critical for increasing access to secondary prevention in Aboriginal health: a qualitative study. Qual Prim Care. 2010; 18: 17-26.

35. Turner-Stokes L, Sykes N, Silber E; Guideline Development Group. Long-term neurological conditions: management at the interface between neurology, rehabilitation and palliative care. Clin Med. 2008; 8: 186-191.

36. Kusumastuti P, Pradanasari R, Ratnawati A. The problems of people with disability in Indonesia and what is being learned from the World Report on Disability. Am J Phys Med Rehabil. 2014; 93: S63-67.

37. Mitra S, Findley PA, Sambamoorthi U. Health care expenditures of living with a disability: total expenditures, out-of-pocket expenses, and burden, 1996 to 2004. Arch Phys Med Rehabil. 2009; 90: 1532-1540.

38. Mitra S, Sambamoorthi U. Disability prevalence among adults: estimates for 54 countries and progress toward a global estimate. Disabil Rehabil. 2014; 36: 940-947.

39. Eide AH, Øderud T. Assistive technology in low income countries. In: Maclachlan M, Swartz L, editors. Disability and international development. Dordrecht, Netherlands: Springer; 2009.

40. Kuyini AB, Alhassan AR, Mahama FK. The Ghana community-based rehabilitation program for people with disabilities: what happened at the end of donor support? J Soc Work Disabil Rehabil. 2011; 10: 247-267.

41. McAllister L, Wylie K, Davidson B, Marshall J. The World Report on Disability: an impetus to reconceptualize services for people with communication disability. Int J Speech Lang Pathol. 2013; 15: 118-126.

42. Elrod CS, DeJong G. Determinants of utilization of physical rehabilitation services for persons with chronic and disabling conditions: an exploratory study. Arch Phys Med Rehabil. 2008; 89: 114-120.

43. Lang R. Empowerment and CBR? Issues raised by the South Indian experience (Chapter 9). In: Stone E, editor. Disability and Development: Learning from action and research on disability in the majority world. Leeds: The Disability Press; 1999; p. 130-148.

44. Mauritius Research Council. Needs assessment on neurological rehabilitation services in Mauritius. Mauritius: MRC; 2012.

45. Kurawa SS. The impact of disability on self and society: an agenda for research on rehabilitation of disabled in Nigeria. Procedia Soc Behav Sci. 2010; 5: 1804-1810.

46. Rathore MF, 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.

47. Pakistan Medical and Dental Council. Statistics.

48. Australian Bureau of Statistics. 4727.0.55.003 - Australian Aboriginal and Torres Strait Islander Health Survey: Biomedical Results. 2012-13.

49. Australian Indigenous Health Info Net. Overview of Australian Indigenous health status, 2013. 2014.

50. Razafinjato F. Madagascar: the official launch of the Decade of Disabled Persons.

51. World Health Organization. World health statistics 2011. Geneva: WHO; 2011.

52. Rehabilitation Council of India. 26th Annual Report 2012-13. New Delhi: RCI; 2013.

53. Bhaumik S. Study stokes debate over patterns of non-communicable disease in India. BMJ. 2013; 347: f4695.

54. Dalal PM, Bhattacharjee M. Stroke epidemic in India: hypertension-stroke control programme is urgently needed. J Assoc Physicians India. 2007; 55: 689-691.

55. Dalal P, Bhattacharjee M, Vairale J, Bhat P. UN millennium development goals: can we halt the stroke epidemic in India? Ann Indian Acad Neurol. 2007; 10: 130-136.

56. WHO and the National Department of Health. Health Service Delivery Profile: Papua New Guinea. Geneva: WHO; 2012.

57. Shaw A. Rehabilitation services in Papua New Guinea. P N G Med J. 2004; 47: 215-227.

58. Khan F, Amatya B, Kesselring J, Galea M. Telerehabilitation for persons with multiple sclerosis. Cochrane Database Syst Rev. 2015; 4: CD010508.

59. Lagomarsino G, Garabrant A, Adyas A, Muga R, Otoo N. Moving towards universal health coverage: health insurance reforms in nine developing countries in Africa and Asia. Lancet. 2012; 380: 933-943.

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Appendix 7

Other research publication 5

Khan F, Amatya B. Refugee health and rehabilitation: challenges and response. Journal of Rehabilitation Medicine 2017; 49: 378–384

J Rehabil Med 2017; 49: 378–384

SPECIAL REPORT

REFUGEE HEALTH AND REHABILITATION: CHALLENGES AND RESPONSE

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Background: **The current global refugee crisis poses major challenges in providing effective healthcare to refugees, particularly for non-communicable diseases management and disability. This article provides an overview of refugee health and potential challenges from the rehabilitation perspective.**

Methods: **A literature search (both academic and grey literature) was conducted using medical and health science electronic databases and internet search engines (2001–2016). Both authors independently selected studies. Due to heterogeneity amongst identified articles, a narrative analysis was performed for best-evidence synthesis to outline the current health and rehabilitation status of refugees and existing gaps in care.**

Results: **Data suggest that infectious diseases requiring treatment in refugees are a minority; whilst non-communicable diseases, musculoskeletal conditions are prevalent. Many refugees arrive with complex health needs. One in 6 refugees have a physical health problem severely affecting their lives and two-thirds experience mental health problems, signifying the important role of rehabilitation. Refugees face continued disadvantage, poverty and dependence due to lack of cohesive support in their new country, which are determinants of both poor physical and mental health. This is compounded by language barriers, impoverishment, and lack of familiarity with the local environment and healthcare system. In Australia, there are concerns about sexual and gender-based violence in off-shore detention camps. Targeted physical and cognitive rehabilitative strategies have much to offer these vulnerable people to allow for improved activity and participation.**

Conclusion: **Strong leadership and effective action from national and international bodies is urgently needed to develop comprehensive rehabilitation-inclusive medical care for refugees.**

Key words: refugee health; function; disability; rehabilitation.

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The United Nations High Commissioner for Refugees (UNHCR) defines a refugee as: "a person who is outside their country of nationality due to a well-founded fear of persecution for reasons of race, religion, nationality, particular social group membership or political opinion and is unable or unwilling to avail themselves of the protection of their country or return to it" (1). The current refugee crisis poses major challenges worldwide. According to the UNHCR, in 2016, there were more than 60 million refugees worldwide (2). It is estimated that more than 1 million refugees crossed the Mediterranean into Europe in 2015 alone, and more than 3,000 died in the attempt (2). These figures are a fraction of an estimated more than 4 million registered refugees displaced to countries neighbouring Syria, including 2.1 million in Turkey and 1.1 million in Lebanon (3, 4).

Australia as a developed country accepts refugees under the UNHCR resettlement program. Since 1945, Australia legitimately settled over 75,000 refugees, mainly from Africa, Asia-Pacific and Middle Eastern regions (5–7). In 2014–2015, a total of 13,756 visas were granted for the Humanitarian Program (11,009 visas for the offshore component and 2747 for the onshore component) (8). Furthermore, in September 2015, the Australian Government announced an additional 12,000 Humanitarian Program places for people displaced by conflicts in Syria and Iraq (9).

Refugees and people seeking asylum, particularly in Australia, are not a homogenous population, they arrive from different countries and cultures (10–12) with complex health needs, and many experience trauma before, and during their deleterious journey (11–13). Furthermore, they may face the effects of continued disadvantage, poverty and dependence in their new country, which are determinants of both poor physical and mental health. This is compounded by difficulty/lack of communication due to language barriers, unfamiliarity with the local environment and healthcare systems, and cultural differences (13). These have consequences for provision of various services, including access to healthcare and a requirement for comprehensive screening and cohesive medical support systems (5, 6, 14).

Many refugees miss out on routine healthcare and face difficulties in accessing health services (14–16). Although the majority of refugees adapt to a new life and successfully integrate into the community, many face long-term healthcare challenges due to ongoing and existing health conditions. Drastic and frequent

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reforms in government policies and practices, and/or variability in classification of refugees and their entitlements make access to healthcare problematic, and under certain circumstances some refugees are denied rights to both employment and welfare benefits (12, 16). The international community faces numerous challenges in this regard. Empirical evidence on medical rehabilitation in refugee settings is lacking. There are limited studies evaluating medical rehabilitation interventions in this area. This narrative review assesses the current status of refugee health from the rehabilitation perspective and explores gaps in existing evidence in order to identify challenges for medical rehabilitation in this population.

METHODS

A desktop literature search (academic and grey literature, 2001–2016) using available medical and health science electronic databases (PubMed, EMBASE, CINAHL, AMED, LILACS and the Cochrane Library); internet search engines (such as the System for Information on Grey Literature in Europe; New York Academy of Medicine Grey Literature Collection, National Quality Measures Clearinghouse and Google Scholar); and the websites of various governmental and non-governmental organizations, was conducted for relevant publications for current status on rehabilitation in refugees. Combinations of multiple search terms for 3 themes were used: rehabilitation, refugee and outcome/recovery. Known experts in this field were contacted for further information on refugee-related policies and legislation.

All studies, irrespective of study design, which reported rehabilitation interventions and associated data in refugees, were included. Both authors independently screened all identified study titles and abstracts for inclusion; and any disagreements were resolved by consensus discussion. A standard *pro forma* created *a priori* was used to extract data from studies, which included study characteristics (publication date and country, study type, objectives, key findings and themes).

RESULTS

Based on the aforementioned multi-pronged approach to obtaining data, a limited number of published articles that reported refugee health issues in rehabilitation context were identified. Of the 196 articles identified from an extensive literature search only 11 published articles were selected as appropriate. The included studies were conducted in different continents: 5 in Australia; 5 in Europe (2 in Denmark and 1 each in the UK, Germany and Switzerland); and 1 in the USA. Due to heterogeneity amongst identified articles (in terms of study design, objectives and population), it was not possible to pool data for analytical purposes, therefore a narrative analysis was used for evidence synthesis, based on the reported themes in the included articles. Table I sets out the characteristics of the studies on refugee health issues and challenges from the rehabilitation perspective.

Health problems

Many refugees are at risk of complex physical, mental and social problems, which contribute to poor health outcomes and impede successful social integration. In many developed countries, such as Australia, all refugees undergo health checks before migration; however, many have ongoing health issues and concerns (14). There is limited evidence on the prevalence of disability amongst refugees and asylum seekers, with reported estimated disability rate varying from 3% to 10% (17, 18). This is compounded by a lack of documentation (e.g. past medical history, treatment) to attend comprehensively to their needs (19, 20). In many parts of the world there is little or no commissioning of services for refugees and asylum seekers with disabilities (17, 18).

Physical health

There is a strong perception that refugees are vectors of communicable diseases; however, data suggests that refugees with infectious diseases needing care and treatment are a minority (10, 21). Studies report that 1 in 6 refugees have a physical health problem severely impacting their life (10). The common physical health problems reported include: various injuries, infectious diseases and under-managed non-communicable diseases (NCDs), such as diabetes, hypertension, coronary heart diseases and musculoskeletal problems (e.g. backache, non-specific body pain) (21, 22). A high prevalence of NCDs during routine medical screening of refugees (30–90 days post-arrival) is widely reported, with musculoskeletal disease and pain problems (consequence of trauma, muscular tension, or emotional distress), cardiovascular disease (CVD), diabetes and chronic respiratory disease being the most common (21, 23). NCDs now represent the primary burden of disease, and are recognized as a major challenge in refugee healthcare management (21, 24); this has significant implication for rehabilitation medicine.

Psychological disorders

Refugees and asylum seekers are vulnerable to psychological disorders, mainly due to various traumas experienced before, during and after migration (25). Many face continued disadvantage and/or are isolated in their new countries. It is estimated that almost two-thirds of refugees experience mental health problems (such as anxiety, depression, post-traumatic stress disorder (PTSD), panic attacks or agoraphobia) (10,

Table I. Characteristics of the studies addressing refugees' health issues and challenges

Study year/Country	Design	Objective	Key themes/findings
Alprem et al. (20) 2016 USA	Survey ($n=199$) medical residents in Internal Medicine & Pediatrics	Assess perceived knowledge, attitudes, & experience with immigrant & refugees	• Most (82%) enjoyed caring for immigrants/refugees • 65% planned to care for this population after residency • 54% were uncomfortable with their knowledge regarding immigrant/refugee health • Specific challenges included: language (98%), cultural barriers (92%), time constraints (72%), & limited knowledge of tropical medicine (69%) • 82% wanted more training in refugee/migrant health
Amara et al. (21) 2014 Germany	Narrative review	Determine prevalence & distribution of chronic NCDs amongst urban refugees living in developing countries; to report refugee access to healthcare for NCDs	• Prevalence varied by refugees' region or country of origin • Most common NCDs: hypertension, musculoskeletal disease, diabetes and chronic respiratory disease • Most urban refugees in developing countries have adequate access to primary healthcare services, however, access to secondary & tertiary healthcare remains problematic • Financial barrier identified as main reason not seeking healthcare
Burnett A (10) 2001 UK	Narrative review	Overview of health needs of asylum seekers and refugees	• Have different experiences & expectations of health & of healthcare • Symptoms of psychological distress are common, but do not necessarily signify psychiatric disorders • Many have difficulty expressing healthcare needs & problems accessing healthcare • Poverty & social exclusion have a negative impact • Trained interpreters or advocates, (rather than family members or friends), should be used wherever possible • Community organizations provide invaluable support & reduce the isolation experienced by refugees • Many issues, such as women's health and child health issues, often not acknowledged
Cheng et al. (32) 2015 Australia	Qualitative case study	Analyse factors influencing Afghan refugees' access to primary care	Persistent barriers included: • Language • Cultural differences • Difficulties with transport to health centres • Long wait times • Cost of care, limited government funding
Harris & Zwar (28) 2005 Australia	Narrative review	Outline range of problems in refugee patients in general practice & some approaches to dealing with them	Common symptoms reported: • Psychological symptoms relate to their experience of torture & trauma: intense anxiety, poor sleeping pattern, depression • Post-traumatic stress disorder: poor concentration, heightened arousal & loss of memory • Children often suffer prolonged psychological distress • These compounded by effects of detention, discrimination, lack of social support & unemployment • Physical sequelae of torture or trauma: mal-united fractures, osteomyelitis, epilepsy or deafness from head injuries, or non-specific musculoskeletal pain or weakness • Infectious & nutritional diseases • Chronic illnesses including hypertension, heart disease, diabetes peptic ulcer disease
Joshi et al. (30) 2013 Australia	Systematic review	Identify components of primary healthcare service delivery models for refugees effective in improving access, quality & coordination of care	• Access improved by multidisciplinary staff, use of interpreters & bilingual staff, no-cost or low-cost services, outreach services, free transport to & from appointments, longer clinic opening hours, patient advocacy, & use of gender-concordant providers • Provide services, which are affordable, appropriate & acceptable to target groups • Coordination between the different healthcare services & those responding to social needs of clients improved through case-management by specialist workers • Quality of care improved by training staff in cultural sensitivity & appropriate use of interpreters
Lamb & Smith (31) 2002 Australia	Narrative review	Describe problems that refugees face in accessing effective healthcare & health service response	Barriers to attendance: • Language • Lack of resource, interpreters • Financial constraints • Limited trust of health service • Lack of familiarity with available services • Gaps in health service provision • Inadequate reimbursement to healthcare professionals • Lack of specialized services, mainly in rural areas • Lack of model of care for special groups such as children, aged and second-generation refugees • Lack of standardization of eligibility for healthcare services due to different visa categories
Persson & Gunvor (40) 2013 Denmark	Explorative qualitative interview study	Explore tortured refugees' expectations of the multidisciplinary pain rehabilitation program offered at rehabilitation centre	• Refugees had different, mostly positive expectations of the pain rehabilitation program • Positive outcomes, such as improved health, improved coping ability and decreased pain, were expected • Positive general expectations of trust and hope in the rehabilitation professionals
Stade et al. 2015 (39) Denmark	Qualitative before-after study	Explore the compliance, acceptability and treatment satisfaction using group basic body awareness therapy (BBAT) in traumatized refugees	• High acceptability, compliance and satisfaction with BBAT • Reduction of somatic and psychiatric symptoms & improved QoL, level of functioning and quality of movement
Uribe Guajardo et al. (25) 2016 Australia	Retrospective observational study	Explore psychological distress in 2 samples of Iraqi refugees, those who recently arrived ($n=225$, average length of stay=0.55 months) & those with a longer period of resettlement ($n=225$, average length of stay=58.5 months)	• Both group have significantly higher psychological distress compared with the general Australian population • Significant difference between groups, indicating study participants with longer periods of resettlement experienced higher levels of psychological distress than recent arrivals • Provision of assistance programs beyond the initial arrival period are required

Table I *cont.*

Study year/Country	Design	Objective	Key themes/findings
Walsh NE & Walsh WS (33) 2003 Switzerland	Narrative review	Rehabilitation consequences of landmine injuries	Factor that impede adequate treatment: • Limited accessibility of medical centres & transport • Lack of protection for wounded people from travelling to disputed areas where hospitals are located • Lack of security • Politics & administration constraints result in hindrance of delivery of appropriate medical care • Poverty • Limited education & social structure • Financial constraints • Lack of interagency coordination

BBAT: basic body awareness therapy; *n*=total number; NCDs: non-communicable diseases; QoL: quality of life; UK: United Kingdom; USA: United States of America.

26). A systematic review reported PTSD rates varying from 8% to 37.2% and depression from 28.3% to 75% in refugees of Iraqi background resettled in western countries (27). Many develop other mental symptoms and behaviour issues to avoid stimuli that remind them of past experiences. Furthermore, social isolation and/or poverty, hostility, discrimination and racism might have compounding negative effects on their mental well-being (28). Insomnia, poor sleep pattern, memory and concentration problems are commonly reported, which hinder learning and capacity for adaptation in their new environment (25). Health issues, particularly mental health, may be exacerbated by financial instability, unemployment, lack of education; and concern for family members who remain in their native countries and in refugee camps.

Other issues

Difficulty accessing healthcare services by refugees is well documented. Many are either unaware of available services (such as primary healthcare) (29–31), and/or specific health services (such as rehabilitation). At many times, they lack continuity of care for pre-existing health conditions. Concerns have been raised about risk of sexual, domestic and gender-based violence, whilst many refugees are separated from families and have limited protection and community support (29). Other health needs include: nutritional deficiencies, infectious diseases, under-immunization, poor dental and optical health, delayed growth and developmental milestones in children (29, 32). Furthermore, lack of security and political/administration constraints result in hindrance of delivery of appropriate medical care (33).

Role of rehabilitation

Medical care of refugees frequently takes place in difficult social, political, and economic contexts. Due to changing international political and/or financial circumstances, many countries (including Australia), have changed their immigration policy accordingly, and this has impacted healthcare policies. Gaps between legal and practical policy implementation and the lack of coordination between different tiers of government (state, federal) have had an undesirable impact on comprehensive management and adequate access to health services for refugees (7, 31). As aforementioned, there are significant changes in demographic profile of refugees, and broader changes to mental and physical health, with NCDs comprising high levels of vulnerability. Furthermore, many refugees have pre-existing disability and chronic health conditions, which have long-term individual health implications. There is evidence that these health conditions are amenable to intervention, and that comprehensive health assessment following resettlement improves short- and long-term health outcomes (14, 34). Many experts in this area, advocate the need for improved models of service provision to address the health needs of refugees and asylum-seekers to close gaps between identified needs and available services (6, 35), including rehabilitation (24, 33, 36, 37).

The complexity and magnitude of problems confronting health systems have served to underline the urgent need for re-framing the refugee crisis with increased cooperation and coordination, both within and beyond the country of settlement (3, 29). The challenge is more apparent for rehabilitation. There is no universal model to meet the rehabilitation needs of refugees, and priorities can vary greatly between population groups and contexts. A comprehensive evaluation of individual needs and their prioritization for rehabilitation should be undertaken (in the field), by qualified healthcare professionals. One study used the World Health Organization International Classification of Functioning, Disability and Health (ICF) to develop an interdisciplinary instrument to describe the overall health condition of traumatized refugees in Denmark (38). The ICF framework offered a standardized language to describe health and associated conditions in terms of functioning rather than symptoms and diagnosis, which is more applicable in the rehabilitation context. In this study, Jorgensen et al found that ICF was useful for a gene-

ral description of the total health condition (physical and mental functional ability; and the environmental impact) of refugees and was suitable to document and monitor effectiveness of rehabilitation in this population (38). Although the ICF Core Sets (both comprehensive and brief) for refugees were developed, they are yet to be validated in a refugee population (38). Another pilot study on effectiveness of basic body awareness therapy (BBAT), form of physiotherapy, (weekly group sessions 13 weeks) for traumatized refugees found that the intervention showed high acceptability, compliance and satisfaction (39). Furthermore, participants reported reduction in somatic and psychiatric symptoms; and improvement in level of functioning and quality of life (39). Persson & Gard, in an explorative qualitative study, evaluated refugees' expectations of a multidisciplinary pain rehabilitation programme (40). The study outlined that refugees' had different, mostly positive expectations of the pain rehabilitation programme and rehabilitation professionals, and the majority expected positive outcomes, such as improved health, coping ability and decreased pain (40).

DISCUSSION

This article provides a narrative overview of refugee health and potential challenges from the rehabilitation perspective. A multi-pronged approach assimilated published literature for currently available evidence for rehabilitation in refugee settings. It highlights sparse research and lack of robust intervention studies in this area. The included studies showed marked heterogeneity in terms of study design and objectives. The findings suggest a high prevalence of NCDs, including mental health conditions in the refugee population, comprising high levels of vulnerability and long-term health implications. Many refugees also have pre-existing disability and chronic health conditions. These problems necessitate comprehensive long-term interdisciplinary management, including rehabilitation. Addressing these issues following resettlement of refugees can improve short- and long-term health outcomes.

With escalating global conflicts, the international community is struggling to respond to the sharp growth in forced-displacement of people and resulting humanitarian crisis. Many argue abject failure of political leadership, and for effective action from national and international bodies, both to stabilize the countries from which migrants are coming, and to make the positive case for migration (4, 7). In Australia, the Humanitarian Settlement Services Program provides support services to all refugees during the first 6–12 months after arrival, which includes education, orientation and assistance to attend local health services and transition to independence (8, 13). The Humanitarian Program includes both: onshore protection/asylum component (to those people with Status of refugee already in Australia) and offshore resettlement component (resettlement to people overseas) (8). These components nonetheless are complicated by rapidly changing immigration policy and different visa types, which impact the overall health policy for refugee and asylum seekers (7). Further, approaches and practices for care provision to refugees can vary widely across the public health care services (7).

With increasing refugee crisis, the available primary health care services are insufficient to address chronic disease and related-disability management, which requires interdisciplinary long-term care (24, 36). Where appropriate, rehabilitation medicine needs to be incorporated in the health care model to improve physical, cognitive and psychological health of refugees, within existing contextual factors (personal and environmental), to improve activity and societal integration. This includes assessment of evolving and longer-term health issues, needs and resource requirements; establishment of adequate service provision and support, education and counselling; and collaboration with other healthcare service providers and relevant stakeholders (governmental and/or non-governmental). In those with pre-existing disability, rehabilitation professionals can provide input to modify barriers in living, environment and adaptive equipment to restore some functional independence, along with other key issues such as respite, long-term care and community integration. These rehabilitation programs may have rapid, tangible benefits to refugees and economic benefit for local community (33, 37).

Refugee health management requires a holistic approach to health, including physical, psychological, social and cultural dimensions. Barriers, such as cultural differences, language difficulties, lack of information about available services, and limited healthcare provider understanding of complex health concerns of refugees, all contribute to limited access to healthcare and poor outcomes. This is further complicated by complexity in refugee status classification and different levels of health service entitlements (depending on different visa categories), such as in Australia (6). The refugee rehabilitation programs should be embraced early after arrival and continued for longer-term in the community. There is a need for development of culturally appropriate health-related data tracking system of refugees for better understanding of their health care needs, (including rehabilitation services) in their new countries. However, often healthcare needs, including rehabilitation needs of refugees are

undetected or partially addressed as many 'needs' fall between existing gaps in care.

Limitations of methodology used and completeness of this review cannot be ruled out. Despite the extended range of terms used to capture the relevant literature, the search strategy principally encompassed cited literature. Further, the search strategy included searching of reference lists only within relevant articles, other possible articles may have been missed in electronic searches, including unpublished studies. Due to heterogeneity of identified studies with mixed methods, a systematic analytical method could not be applied to pool results. This highlights limited number of studies and many gaps in evidence-base for medical rehabilitation for refugee population, including lack of effective care pathways for long-term functional restoration and successful community integration.

The way forward

Refugees have unique and complex healthcare needs, impacting their mental, physical and social functioning, emphasizing the crucial role of rehabilitation (38). Although rehabilitation aspects of care should be part of periodic health screening and management, it is frequently ignored and yet to be incorporated in routine management plans. There is need for a comprehensive integrated evidence-based rehabilitation-inclusive healthcare model to tackle refugee health-issues, from initial screening to long-term management in the community. Given the importance of medical and psychosocial rehabilitation and vulnerability of the refugees, the medical community needs to be aware of challenges and gaps in service provision to meet the needs of this population. Futuristic successful and effective rehabilitation-inclusive refugee management will depend on the capacity and willingness of countries to build systematic planning and preparedness system for effective services for this population. From the rehabilitation perspective, some initiatives need consideration, and include (but not limited to):

- development of a central or national refugee-management body for coordinated, cooperative effort
- appropriate policies (guidelines), regulations and legislations
- routine comprehensive health screening (including rehabilitation needs)
- develop affordable, culturally responsive healthcare services
- mapping/evaluation of existing rehabilitation facilities and strengthen/expansion potential of these services to meet needs of refugees
- build strong inter-sectoral (national and international stakeholders) partnerships, with active consumer participation
- capacity building in comprehensive health management system (including rehabilitation) for sustainability
- improve communication with provision of credentialed interpreters; consumer groups
- advocacy and provision of healthcare information in different languages
- foster research, knowledge exchange and access to data to inform evidence-based practices
- active participation/inclusion of refugees and community advocates into planning and public awareness
- development of support systems, community-based rehabilitation and vocational programs

In conclusion, quality and accessible healthcare services (including rehabilitation) are an important part of addressing the health-related needs of refugees. With huge changes in demographics of refugees, there is now increasing evidence that health problems impacting these populations are escalating, and changing with time and circumstances. Some priorities include: provision of trained healthcare professionals, including rehabilitation professionals and service providers for refugee healthcare and entitlements; a strategic coordinated approach to facilitate access, build rapport and ongoing engagement; and retention of services for refugees. Innovative, culturally competent strategies to organize rehabilitation-inclusive healthcare services is essential to meet needs of refugees.

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REFERENCES

1. United Nations High Commissioner for Refugees (UNHCR). Convention and Protocol Relating to the Status of Refugees. Geneva: UNHCR; 1996.
2. United Nations High Commissioner for Refugees (UNHCR). Global Appeal 2016–17. Geneva: UNHCR; 2016.
3. Murphy A, Woodman M, Roberts B, McKee M. The neglected refugee crisis. BMJ 2016; 352: i484.
4. Roberts B, Murphy A, Mackee M. Europe's collective failure to address the refugee crisis. Public Health Rev 2016; 37: 1.
5. Clark A, Gilbert A, Rao D, Kerr L. 'Excuse me, do any of you ladies speak English?' Perspectives of refugee women living in South Australia: barriers to accessing primary health care and achieving the Quality Use of Medicines. Aust J Prim Health 2014; 20: 92–97.
6. Davidson N, Skull S, Burgner D, Kelly P, Raman S, Silove D, et al. An issue of access: delivering equitable health care

for newly arrived refugee children in Australia. J Paediatr Child Health 2004; 40: 569–575.
7. Correa-Velez I, Barnett AG, Gifford SM, Sackey D. Health status and use of health services among recently arrived men with refugee backgrounds: a comparative analysis of urban and regional settlement in South-east Queensland. Aust J Prim Health 2011; 17: 66–71.
8. Department of Immigration and Border Protection. Fact sheet – Australia's Refugee and Humanitarian Program. Canberra: DIPD; 2016 [cited 2016 Oct 25]. Available from: http://www.border.gov.au/about/corporate/information/fact-sheets/60refugee.
9. Department of Immigration and Border Protection. 2015–2016 Humanitarian Programme Outcomes. Canberra: DIPD; 2016 [cited 2016 Oct 25]. Available from: http://www.border.gov.au/about/reports-publications/research-statistics/statistics/live-in-australia/humanitarian-programme.
10. Burnett A, Peel M. Health needs of asylum seekers and refugees. BMJ 2001; 322: 544–547.
11. Murray SB, Skull SA. Hurdles to health: immigrant and refugee health care in Australia. Aust Health Rev 2005; 29: 25–29.
12. Zwi K, Raman S, Burgner D, Faniran S, Voss L, Blick B, et al. Towards better health for refugee children and young people in Australia and New Zealand: the Royal Australasian College of Physicians perspective. J Paediatr Child Health 2007; 43: 522–526.
13. Cheng IH, Vasi S, Wahidi S, Russell G. Rites of passage: improving refugee access to general practice services. Aust Fam Physician 2015; 44: 503–507.
14. Davidson N, Skull S, Chaney G, Frydenberg A, Jones C, Isaacs D, et al. Comprehensive health assessment for newly arrived refugee children in Australia. J Paediatr Child Health 2004; 40: 562–568.
15. Smith MS. Refugees in Australia: changing faces, changing needs. Med J Aust 2006; 185: 587–588.
16. McLeod A, Reeve M. The health status of quota refugees screened by New Zealand's Auckland Public Health Service between 1995 and 2000. New Zealand Med J 2005; 118: U1702.
17. Haroon S. The health needs of asylum seekers: briefing statement. London: Faculty of Public Health; May 2008.
18. Patel B, Kelley N. The social care needs of refugees and asylum seekers. Stakeholder participation race equality discussion paper 2. London: Social Care Institute for Excellence; 2006.
19. Jensen NK, Norredam M, Draebel T, Bogic M, Priebe S, Krasnik A. Providing medical care for undocumented migrants in Denmark: what are the challenges for health professionals? BMC Health Serv Res 2011; 11: 154.
20. Almqvist K, Broberg AG. Mental health and social adjustment in young refugee children 3 1/2 years after their arrival in Sweden. J Am Acad Child Adolesc Psychiatry 1999; 38: 723–730.
21. Amara AH, Aljunid SM. Noncommunicable diseases among urban refugees and asylum-seekers in developing countries: a neglected health care need. Global Health 2014; 10: 24.
22. Ackerman LK. Health problems of refugees. J Am Board Fam Pract 1997; 10: 337–348.
23. Burgess A. Health challenges for refugees and immigrants. Refugee Reports. Washingto DC: Immigration and Refugee Services of America; 2014. Available from: http://reliefweb.int/sites/reliefweb.int/files/resources/ACB7A9B4B95ED39A8525723D006D6047-irsa-refugee-health-apr04.pdf.
24. World Health Organisation. Health of Migrants: The Way Forward – Report of a Global Consultation, 3–5 March 2010, Madrid, Spain. Geneva: WHO; 2010.
25. Uribe Guajardo MG, Slewa-Younan S, Smith M, Eagar S, Stone G. Psychological distress is influenced by length of stay in resettled Iraqi refugees in Australia. Int J Ment Health Syst 2016; 10: 4.
26. Jaranson JM, Quiroga J. Evaluating the services of torture rehabilitation programmes: history and recommendations. Torture 2011; 21: 98–140.
27. Slewa-Younan S, Uribe MG, Heriseanu A, Hasan T. A systematic review of post-traumatic stress disorder and depression amongst Iraqi refugees located in Western Countries. J Immigr Minor Health 2014; 17: 1231–1239.
28. Harris M, Zwar N. Refugee health. Aust Fam Physician 2005; 34: 825–829.
29. Milosevic D, Cheng IH, Smith MM. The NSW Refugee Health Service – improving refugee access to primary care. Aust Fam Physician 2012; 41: 147–149.
30. Joshi C, Russell G, Cheng IH, Kay M, Pottie K, Alston M, et al. A narrative synthesis of the impact of primary health care delivery models for refugees in resettlement countries on access, quality and coordination. Int J Equity Health 2013; 12: 88.
31. Lamb CF, Smith M. Problems refugees face when accessing health services. N S W Public Health Bull 2002; 13: 161–163.
32. Cheng IH, Drillich A, Schattner P. Refugee experiences of general practice in countries of resettlement: a literature review. Br J Gen Pract 2015; 65: e171–e176.
33. Walsh NE, Walsh WS. Rehabilitation of landmine victims – the ultimate challenge Bull WHO 2003; 81: 665–670.
34. Woodland L, Burgner D, Paxton G, Zwi K. Health service delivery for newly arrived refugee children: a framework for good practice. J Paediatr Child Health 2010; 46: 560–567.
35. Raman S, Wood N, Webber M, Taylor KA, Isaacs D. Matching health needs of refugee children with services: how big is the gap? Aust New Zealand J Public Health 2009; 33: 466–470.
36. Leaning J, Spiegel P, Crisp J. Public health equity in refugee situations. Confl Health 2011; 5: 6.
37. Montgomery E, Foldspang A. Seeking asylum in Denmark: refugee children's mental health and exposure to violence. Eur J Public Health 2005; 15: 233–237.
38. Jorgensen U, Melchiorsen H, Gottlieb AG, Hallas V, Nielsen CV. Using the International Classification of Functioning, Disability and Health (ICF) to describe the functioning of traumatised refugees. Torture 2010; 20: 57–75.
39. Stade K, Skammeritz S, Hjortkjaer C, Carlsson J. "After all the traumas my body has been through, I feel good that it is still working." – Basic Body Awareness Therapy for traumatised refugees. Torture 2015; 25: 33–50.
40. Persson AL, Gard G. Tortured refugees' expectations of a multidisciplinary pain rehabilitation programme: an explorative qualitative study. J Rehabil Med 2013; 45: 286–292.

Appendix 8

Conference proceedings

Poster 1: Rehabilitation screening tool in disaster settings: Nepal earthquakes 2015

Rehabilitation Screening Tool in Disaster Settings: Nepal Earthquakes 2015

The Royal Melbourne Hospital

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Introduction

The Asia-Pacific is the most disaster-prone region in the world, with over 40% of the world's disasters occurring here in the past decade.[1] On April 25th and May 12th 2015, two mega earthquakes struck Nepal, resulting in over 8,600 casualties, 100,000 and more injured.

Aims

To present a Rehabilitation Foreign Medical Team's (FMT) effort for spinal cord injury (SCI) patients following earthquakes; focusing on collaborative effort with local bodies, lessons learnt and shortcomings in disaster management.

Disaster rehabilitation continuum model (PHASE)[4]

Role of rehab physician following disasters[1,4]

- Coordinate member roles within post-disaster context
- Victim triage, peri- and post-operative consultation, mobile community services & CBR
- Work with local healthcare providers, patients, families, community volunteers
- Train team members & local providers for service provision capacity
- Coordinate host service providers & disaster managers -rehab infrastructure & response for future disasters
- Support data collection for clinical outcomes

Methods

An accredited FMT from the Royal Melbourne Hospital (RMH) was deployed to an established rehabilitation centre for SCI (approved by the WHO & Nepal Ministry of Health and Population).

Data were collected prospectively during the ward rounds by the FMT with local physicians; and a triage tool was developed and validated.

RMH deployment

101 victims were assessed. Common clinical issues included: pain, bladder, bowel problems, and pressure ulcers. Psychological trauma (severe anxiety, fear, sleep disturbance) and symptoms consistent with post-traumatic stress were prevalent. The tool successfully assessed suitability for further inpatient rehabilitation, CBR and to a step-down facility for care planning.[5]

RMH team activities

- Addressing locally identified priorities
- General daily ward round with local healthcare professionals
- Development of screening/triage tool and facilitator role in conducting daily patient management/triage
- Daily consensus case conference meetings
- Need analysis, stabilization, comorbidities & complications and discharge planning
- Pain management & Spasticity care
- Mobilisation program & precautions
- Management of contractures & complications of immobility
- Diet, falls, pressure care etc.
- Staff education and capacity building

Patient management/triage tool

Key challenges

- Limited rehabilitation medicine capacity
- Limited access to timely neurosurgical advice
- Inadequate infrastructure (beds), medical equipment, human resources
- Procedural training for volunteers & carers
- Lack of emergency evacuation protocols
- Limited imaging and laboratory tests
- Poor documentation and record keeping
- Limited psychological support

Recommendations

- Need for more qualified rehabilitation staff
- Improved clinical reasoning & documentation, reporting systems
- Longer-term organised care delivery
- IT Communication & links with acute referrers, Telerehabilitation
- Expand CBR capacity
- Carer training, post-discharge follow-up
- Links with regional organisations (SAARC)
- Overseas training & mentorship
- Register Nepalese Rehabilitation Society
- Develop Key Performance Indicators, Standards of Care & accreditation criteria

Conclusion

A collaborative multidisciplinary (FMT and local staff) rehabilitation management of earthquake victims with a SCI resulted in better coordination and effective care. The rehabilitation screening/triage tool for 'needs' assessment was clinically useful and well received by staff.

Long-term planning for disasters should include early aggressive medical rehabilitation.

References

1. Khan F et al. Medical rehabilitation in natural disaster: a systematic review. Arch Phys Med Rehabil 2015;96:1709-27.
2. Vos F, et al. Annual disaster statistical review 2009: the numbers and trends. Brussels: CRED; 2010.
3. Rathore FA et al. Medical rehabilitation after natural disasters: why, when, and how? Arch Phys Med Rehabil 2012;93(10):1875-81.
4. Gosney J et al. Developing post-disaster physical rehabilitation: role of the WHO Liaison Sub-Committee on Rehabilitation Disaster Relief of the ISPRM. J Rehabil Med 2011;43(11):965-8.
5. Khan et al. Rehabilitation needs assessment in persons following SCI in Disaster Settings: Lessons learnt in 2015 Nepal Earthquakes. Int J Phys Med Rehabil 2015; 3: 316.

Poster 2. Medical rehabilitation in natural disasters

MEDICAL REHABILITATION IN NATURAL DISASTERS

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Introduction

Natural disasters is escalating world wide which create significant impact on health care costs, social infrastructure, and the environment. Current data show a significant increase in the numbers of injuries sustained relative to mortality, indicating that medical rehabilitation as integral to comprehensive disaster management.[1] Empirical evidence on medical rehabilitation after natural disasters is increasing.

Aim

To present an evidence-based overview of the effectiveness of medical rehabilitation intervention in natural disaster survivors and outcomes that are affected.

Type of natural disasters[1]

Subgroup	Definition	Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (spectrum from minutes to days)	Storm
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spactrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect Infestation, Animal Stampede

Deadliest Earthquakes (2000- April 2016)

Date	Magnitude	Fatalities	Region
16/04/2016	7.8	661	Esmeraldas province, Ecuador
2/03/2016	7.8	0	Muara Siberut, Mentawai Islands, Indonesia
16/09/2015	8.3	14	west of Illapel, Chile
26/10/2015	7.5	399	Hindu-Kush, Pakistan Afghanistan border
12/05/2015	7.3	218	Kodari, Nepal
12/04 2015	7.8	8,964	Barpak, Lamjung Nepal
08/03/2014	6.2	729	near Wenping, China
24/09/2013	7.7	825	61km NNE of Awaran, Pakistan
06/01/2012	6.7	113	Negros-Cebu region, Philippines
11/032011	9.0	20,896	Near the East Coast of Honshu, Japan
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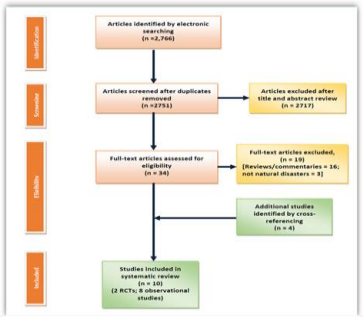
30/09/2009	7.5	1,117	Southern Sumatra, Indonesia
12/05/2008	7.9	87,587	Eastern Sichuan, China
15/08/2007	8.0	514	Near the Coast of Central Peru
26/05/2006	6.3	5,749	Java, Indonesia
08/10/2005	7.6	80,361	Pakistan
26/12/2004	9.1	227,898	Off West Coast of Northern Sumatra
26/12/2003	6.6	31,000	Southeastern Iran
25/03/2002	6.1	1,000	Hindu Kush Region, Afghanistan
26/01/2001	7.7	20,023	Gujarat, India
04/08/2000	7.9	103	Southern Sumatera, Indonesia

Methods

A comprehensive literature search was conducted using medical and health science electronic databases (PubMed, MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature, Cochrane Library, PsycINFO) up to September 2014. Two independent reviewers selected studies extracted data and assessed the methodologic quality of the studies using the Critical Appraisal Skills Program's appraisal tools.

Study selection flow chart



Results

Meta-analysis was not possible because of heterogeneity among included trials; therefore, a narrative analysis was performed. Ten studies (2 randomized controlled trials, 8 observational studies) investigated a variety of medical rehabilitation interventions Studies scored low on quality assessment because of methodologic limitations.

There were no data available for associated costs.

Summary of evaluated interventions

Study	Content	Settings	Duration & intensity
Becker SM 2009	Psychological care program	Affected community	3 times/week for 2 hour per session for 3 month
Berger & Gelkopf 2009	Mental health program ('TRAUE Stress Sri Lanka' (ESSL)	Schools in affected community	12 session (90 minutes session per week)
Huang & Wong 2013	Social activity program	Community centres	Once a week (60-90 minutes) 9 in total
Hu et al 2012	Institution based rehabilitation therapy	Hospital rehabilitation facilities	Details not provided
Li et al 2012	MD individualised rehabilitation program	3 hospitals	Average 3 months duration
Ni et al 2013	Institution-based comprehensive rehabilitation program	Hospital rehabilitation facilities	Details not provided
Xiao et al 2011	Institution-based rehabilitation interventions	Hospital rehabilitation facilities	Two 40 minutes session per day for > 1 month
Zang et al 2013	Narrative Exposure Therapy (NET)	Hospital rehabilitation facilities	4 therapy sessions (60-90 minutes) for 2 weeks
Zhang et al 2012	Institutional-based rehabilitation	Hospital rehabilitation facilities	Details not provided
Zhang et al. 2013	Institutional-based rehabilitation NHV program: NGOs (N), health departments (H), professional rehabilitation volunteers (V)	Hospital and community rehabilitation facilities	Details not provided

Summary of findings

Improvement in functional activity

N = 6 studies (1593 participants)

'Some' evidence for beneficial effect for:

- short & longer term gains in mobility and walking (up to 1 year)
- SCI victims: 35% achieved moderate independence in ADLs and 90% regained some self-care ability
- fracture victims: ADLs and life satisfaction improved
- organised rehabilitation services program (such as NHV model) significantly improved physical functioning

Improvement in impairment

N = 6 studies (829 participants)

'Some' evidence for beneficial effect for:

- improved psychological symptoms
- reduction in stress-related symptoms in children exposed to the tsunami
- reduction in mental symptoms in PTSD cohorts
- reduction in in pain

Improvement in participation

N = 6 studies (829 participants)

'Limited' evidence for:

- improved participation (QoL, social reintegration)
- psychosocial rehab improved psychological distress, stress
- reduction in PTSD symptoms
- improved satisfaction with social relationships

Summary of outcome measures used

Study	Assessment time-points	Outcome assessed (according to ICF)			
		Activity	Impairment	Participation	Others
Becker SM 2009	Baseline, post-intervention (3 months)			IES, SRQ	
Berger and Gelkopf 2009	Baseline, post-intervention (2 months)	CDIS	UCLA PTSD, DPS	Hope questionnaire, BDI	Objective/subjective exposure
Huang and Wong 2013	Post intervention (9 weeks)				Qualitative transcripts
Hu et al 2012	Baseline, discharge facility and 1 year follow up	MBI, WICSI II	AIS, Complications, VAS pain	PHQ-9, CHART-SF, WHOQOL-BREF	
Li et al 2012	Discharge from rehabilitation facility (3 months in average)	MBI, ambulation status	AIS		
Ni et al 2013	Retrospective 50 months post-earthquake	Subjective assessment		PCL-C	Earthquake exposure impact
Xiao et al 2011	15 months post-earthquake		VAS pain, fracture healing (Johner-Wruhs' criteria)	CES-D	General & anthropometric measurements, leg X-ray
Zang et al 2013	Baseline, post 2 weeks treatment, 4 weeks and after 3 months		GHQ-28	CIOQ-S, HADS, SCSQ, MSPSS	
Zhang et al 2012	27 months post-earthquake	MBI	VAS pain	SF-36	LiSat-9
Zhang et al 2013	27.5-34 months post-earthquake	BI			

Conclusion

The findings highlight the need to incorporate medical rehabilitation into response planning and disaster management for future natural catastrophes. Access to rehabilitation and investment in sustainable infrastructure and education are crucial. More methodologically robust studies are needed.

References

1. Vos F et al. Annual disaster statistical review 2009: the numbers and trends. Brussels: Centre for Research on the Epidemiology of Disasters (CRED); 2010.
2. Rathore FA et al. Medical rehabilitation after natural disasters: why, when, and how? Arch Phys Med Rehabil 2012;93(10):1875-81.
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Poster 3. Medical rehabilitation in natural disasters in the Asia-Pacific region

MEDICAL REHABILITATION IN NATURAL DISASTERS IN THE ASIA-PACIFIC REGION: THE WAY FORWARD

The Royal Melbourne Hospital

Amatya B[1,2,3], Khan F[1,2,3] , Rathore FA[4,5], Galea MP[1,2,3]

[1]Department of Rehabilitation Medicine, Royal Melbourne Hospital; [2]Department of Medicine, (Royal Melbourne Hospital), University of Melbourne; [3]Committee for Rehabilitation Disaster Relief, International Society of Physical and Rehabilitation Medicine , Geneva, Switzerland; [4]University of Health Sciences, Lahore, Pakistan

Introduction

Asia-Pacific is the most disaster-prone region in the world, with over 40% of the world's natural disasters occurring here in the past decade.[1] This region has geo-political & socio-economic diversity which increases vulnerability to natural & other disasters.

Aim

Overview of medical rehabilitation in natural disaster settings in the Asia-Pacific region; highlight role of medical rehabilitation in disaster response & management. identify potential challenges & key initial perspectives which need consideration for future disaster planning in the region.

Major natural disasters in Asia-Pacific (2000-15)[2,3]

Date	Casualties, and effects (estimate)	Economic loss US$ (estimate)	Event type	Location
Jan 26, 2001	20,000 deaths, 167,000 injured	$5.5 billion	Gujarat earthquake	India
Dec 26, 2003	26,000 dead and 30,000 injured	>$30 million damage	Bam earthquake	Iran
Dec 26, 2004	220,000 deaths; 1.7 million displaced	$10 billion damage	2004 Indian Ocean earthquake & tsunami	Indian Ocean
Oct 8, 2005	79,000 deaths, 106,000 injured, 4 million displaced	$5.5 billion, over 32,000 properties destroyed	2005 Kashmir earthquake	Pakistan
Nov 12, 2007	200 deaths;152 9,596 displaced.	$71.4 million	Cyclone Guba and flood	Papua New Guinea
Nov 15, 2007	5,000-10,000 deaths, 5,000 injured, 1 million displaced	$1.5 billion	Cyclone Sidr	Bangladesh
May 3, 2008	133,500 deaths, 55,000 missing	$10 billion	Cyclone Nargis	Myanmar
May 12, 2008	75,000 deaths, 365,000 injured, 5 million displaced	$30 billion	2008 Sichuan earthquake	China
Aug 18 2008	2,400 deaths, 3,500 missing, 3 million displaced	$135 million, over 236,000 properties damaged	Bihar flood	India
Sep 20, 2009	1,200 deaths, 2,900 injured	$745 million, 150,000 buildings damaged	Sumatra earthquake	Indonesia (Padang)
Feb 7 March 14, 2009	73 deaths, 414 injured, 7,562 displaced	$4.6 billion, 5,530 properties damaged	Black Saturday bushfires	Australia
July 29, 2010	1,781 deaths, 2,966 injured	$43 billion	Floods	Pakistan (Indus river)
Feb 22, 2011	185 deaths; 1,500 injured	$11.2 billion, 100,000 properties damaged	Christchurch earthquake	New Zealand
March 11, 2011	15,881 deaths, 2,668 missing, 6,142 injured	$235 billion, 130,000 properties destroyed	Tohoku earthquake and tsunami (including Fukushima nuclear power plant meltdown)	Japan
April 20, 2013	160 deaths; 5,700 injured	Over 10,000 properties destroyed	Sichuan earthquake	China
April 24 and May 12, 2015	8,633 deaths, deaths, 103,686 injured, 2.8 million displaced	Over 1 million homes destroyed	Nepal earthquake	Nepal
May-June 2015	5,000 deaths	unknown	Heatwave	India, Pakistan

Key regional initiatives

- 1947 - Economic & Social Commission for Asia &Pacific (ESCAP) (53 members, 60% of world's population ≈ 4.1 billion people)
- 2004 - Hyogo Framework for Action (Kobe) - Indian Ocean Tsunami
- 2008 - Association of Southeast Asian Nations (ASEAN) Humanitarian Task Force – after Cyclone Nargis, Myanmar
- 2009 - ASEAN Agreement on Disaster Management & Emergency Response 2010–2015 (AADMER) - ratified by 10 states
- 2010 - Pacific Platform for Disaster Risk Management (PPDRM) Framework for Action 2010–2015
- 2011 - Indian Ocean Tsunami Warning & Mitigation System
- 2015 - Sendai Framework for Disaster Risk Reduction 2015-2030'

Sendai Framework for Disaster Risk Reduction 2015-2030

Scope and purpose

The present framework will apply to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters, caused by natural or manmade hazards as well as related environmental, technological and biological hazards and risks. It aims to guide the multi-hazard management of disaster risk in development at all levels as well as within and across all sectors

Expected outcome

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries

Goal

Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience

Deadliest Earthquakes (2000- April 2016)[3]

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PM&R Challenges

- Medical rehab not integrated in disaster response planning & management
- Many EMTs do not include rehabilitation physicians
- Existing host healthcare infrastructure (disrupted/destroyed)
- Discharge issues – access, housing, transportation, community based rehabilitation (CBR) etc.
- Coordination between organisations: national & international
- Limited local skilled local health care professionals (e.g., PR&M physicians)
- Poor provision longer-term care planning, CBR resources & facilities
- Limited psychological & cognitive rehabilitation
- Lack of reporting & responsive measures
- Cultural beliefs/language
- Financial constraints expense of programs
- Geographical barriers, loss of livelihood
- Limited social support systems along the recovery trajectory
- Limited data of persons with pre-existing disabilities

The way forward

Collaboration & governance
- Develop comprehensive rehabilitation inclusive disaster management system
- Leadership role of central national healthcare ministry/organisation
- Enhance collaboration with national & international health care organisations, NGOs & EMTs

Building capacity in rehabilitation
- Rehabilitation capacity building & skilled workforce
- Develop robust inter-disciplinary & inter-sectoral partnerships
- Build preparedness/mitigation strategies

Person-centred interdisciplinary care
- Multidisciplinary team for treatment plan
- Develop standardised assessment tools & care plan
- Service provision (including funding) of assistive devices
- Non-discriminatory treatment goals

Improve communication
- Strengthen evidence-based information, data & research
- Foster understanding & learning from past experiences
- Timely dissemination of information

Increase public awareness
- Active participation of disaster survivors/family
- Empowerment & educational programs for healthcare professionals

Strengthen CBR
- Bilateral assistance for disaster victims: health security, financial, job creation, education
- Innovative models of rehabilitation (telerehabilitaion, mobile units etc.)

References

1. Khan F et al. Medical rehabilitation in natural disaster: a systematic review. Arch Phys Med Rehabil 2015;96:1709-27.
2. Vos F, et al. Annual disaster statistical review 2009: the numbers & trends. Brussels: CRED; 2010.
3. EM-DAT, USGS 2016.

Poster 4. Rehabilitation of spinal cord injury: lesson learnt in natural disaster settings

REHABILITATION OF SPINAL CORD INJURY

LESSONS LEARNT IN NATURAL DISASTER SETTINGS

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Type of natural disasters[2]

Subgroup	Definition	Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (spectrum from minutes to days)	Storm
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect infestation, Animal Stampede

Aim

To present a rehabilitation Foreign Medical Team's (FMT) effort for spinal cord injury (SCI) patients following earthquakes in Nepal; focusing on collaborative effort with local bodies, lessons learnt and shortcomings in disaster management.

Disaster rehabilitation continuum model (PHASE)[4]

Role of rehab physician following disater[1,3,4]

- Coordinate member roles within post-disaster context
- Victim triage, peri- and post-operative consultation, mobile community services & CBR
- Work with local healthcare providers, patients, families, community volunteers
- Train team members & local providers for service provision capacity
- Coordinate host service providers & disaster managers -rehab infrastructure & response for future disasters
- Support data collection

Methods

An accredited FMT from the Royal Melbourne Hospital (RMH) was deployed to an established rehabilitation centre for SCI in Nepal (approved - WHO & Nepal Ministry of Health and Population).

Data were collected prospectively during the ward rounds by the FMT with local physicians; and a triage tool was developed and validated.

RMH deployment

Of the 101 victims assessed, over two thirds (78%) had SCI (mean age = 34.4±15.1 years (range: 11-86 years; female 53.5%).
Common clinical issues were: pain (74%), bladder (73%), bowel problems (58%); and pressure ulcers (33.3%).

SCI level & AIS classification (n = 79)

AIS*	SCI location					
	C1-C8	T1-T12	L1-L5	Below S1	Mixed	Total n (%)
A	4	7	11		4	26 (32.9)
B	2	7	8		1	18 (22.8)
C	2	3	9			14 (17.7)
D		7	5			12 (15.2)
E		1	5		1	7 (8.9)
CCS	1					1 (1.3)
CES				1		1 (1.3)
Total n (%)	9 (11.54	25 (31.6)	38 (48.1)	1 (1.3)	6 (7.6)	79 (100)

Participants reported some form of psychological trauma (severe anxiety, fear, sleep disturbance) and symptoms consistent with post-traumatic stress. The rehabilitation triage tool for 'needs' assessment was clinically useful and well received by staff.

RMH team activities

- Addressing locally identified priorities
- General daily ward round with local healthcare professionals
- Development of triage tool and facilitator role in conducting daily triage
- Daily consensus case conference meetings
- Need analysis, stabilization, comorbidities & complications and discharge planning
- Pain management & Spasticity care
- Mobilisation program & precautions
- Management of contractures & complications of immobility
- Diet, falls, pressure care etc.
- Staff education and capacity building

Challenges

- Limited rehabilitation medicine capacity
- Access to timely neurosurgical advice
- Adequate infrastructure (beds, power supply), medical equipment, human resources
- Procedural training for volunteers & carers
- Emergency evacuation protocols
- Limited imaging and laboratory tests
- Poor documentation and record keeping
- Psychological support

Recommendations

- More qualified rehabilitation staff
- Improve clinical reasoning & documentation, reporting systems
- Longer-term organised care delivery
- IT Communication & links with acute referrers, expand CBR capacity
- Carer training, post-discharge follow-up
- Links with regional organisations (SAARC)
- Encourage overseas training & mentorship
- Register Nepalese Rehabilitation Society with ISPRM
- Develop Key Performance Indicators, Standards of Care & accreditation criteria

Conclusion

A collaborative multidisciplinary (FMT and local staff) rehabilitation management of earthquake victims with a SCI resulted in better coordination and effective care. Long-term planning for disasters should include early aggressive medical rehabilitation.

References

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Poster 5. Medical rehabilitation in Madagascar: challenges in implementing the WHO Disability Action Plan

Appendix 9

Co-authors statements Study I

Co-author authorisation form

THE UNIVERSITY OF MELBOURNE

All co-authors must complete this form. By signing below co-authors agree to the listed publication being included in the student's thesis and that the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

In cases where all members of a large consortium are listed as authors of a publication, only those that actively collaborated with the student on material contained within the thesis should complete this form. This form is to be used in conjunction with the *Declaration for a thesis with publication form*.

Students must submit this form, along with the *Declaration for thesis with publication form*, when the thesis is submitted to the Thesis Examination System: *https://tes.app.unimelb.edu.au/*

Further information on this policy and the requirements is available at:
gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication

A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Medical rehabilitation in natural disasters: a systematic review	
Authors	Khan F, Amatya B, Gosney J, Rathore FA, Burkle Jr, FM	
Student's contribution (%)	70	
Journal or book name	Archives of Physical Medicine and Rehabilitation	
Volume/page numbers	96(9):1709-1727	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

B. CO-AUTHOR'S DECLARATION *(to be completed by the collaborator)*

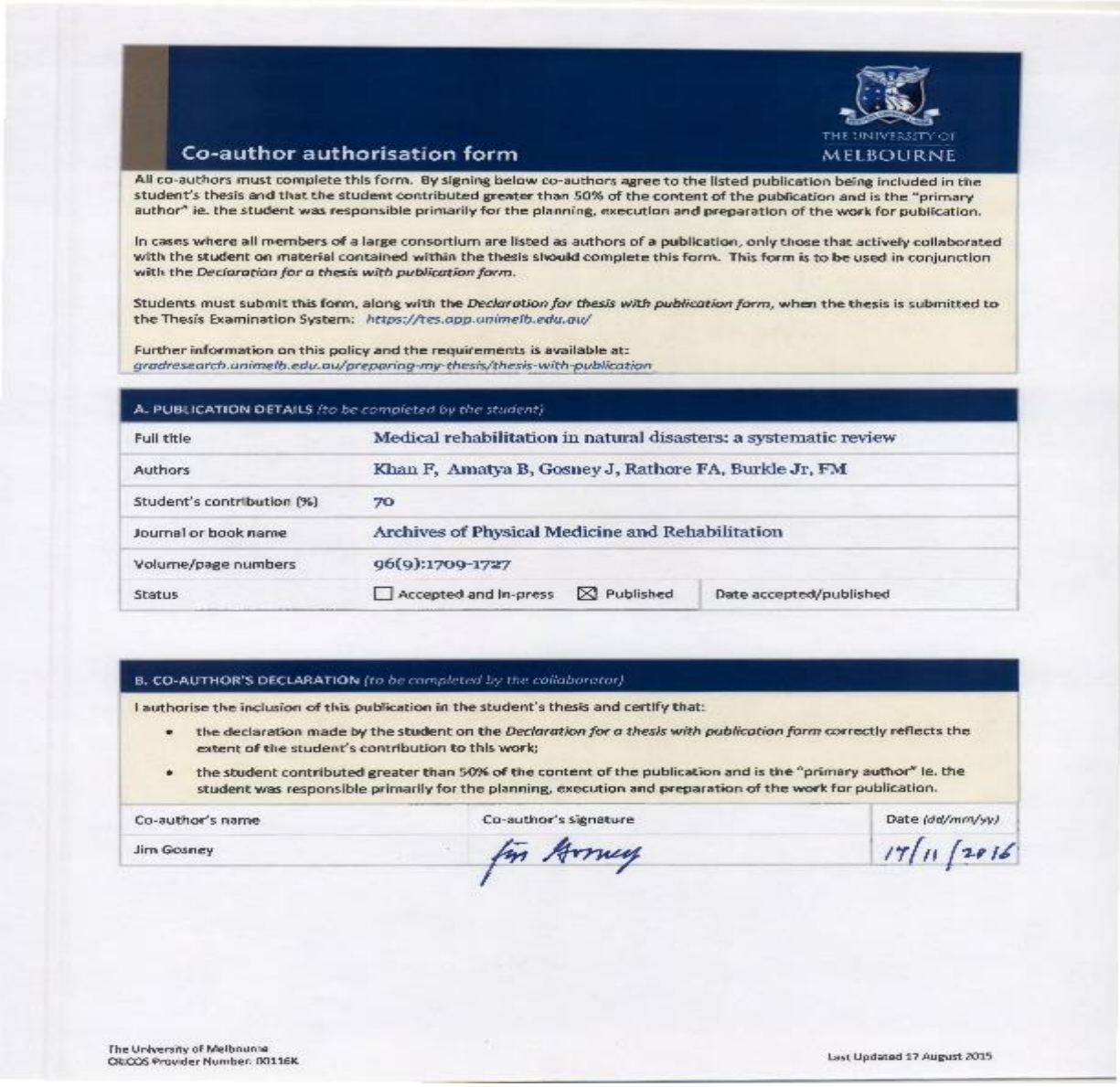
I authorise the inclusion of this publication in the student's thesis and certify that:

- the declaration made by the student on the *Declaration for a thesis with publication form* correctly reflects the extent of the student's contribution to this work;
- the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Fary Khan	Fary Khan	28/2/17

The University of Melbourne
CRICOS Provider Number: 00116K

Last Updated 17 August 2015



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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Medical rehabilitation in natural disasters: a systematic review	
Authors	Khan F, Amatya B, Gosney J, Rathore FA, Burkle Jr, FM	
Student's contribution (%)	70	
Journal or book name	Archives of Physical Medicine and Rehabilitation	
Volume/page numbers	96(9):1709-1727	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

B. CO-AUTHOR'S DECLARATION *(to be completed by the collaborator)*

I authorise the inclusion of this publication in the student's thesis and certify that:

- the declaration made by the student on the *Declaration for a thesis with publication form* correctly reflects the extent of the student's contribution to this work;
- the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Jim Gosney	Jim Gosney	17/11/2016

The University of Melbourne
CRICOS Provider Number: 00116K

Last Updated 17 August 2015

THE UNIVERSITY OF MELBOURNE

Co-author authorisation form

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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Farooq A Rathore		

THE UNIVERSITY OF MELBOURNE

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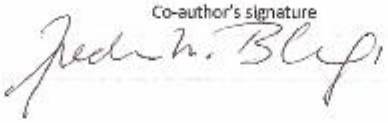
Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Frederick M. Burkle Jr		11/14/16

Appendix 10

Co-authors statements Study II

THE UNIVERSITY OF MELBOURNE

Co-author authorisation form

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gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication

A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Medical Rehabilitation in Natural Disasters in the Asia-Pacific Region: The Way Forward	
Authors	Khan F, Amatya B, Rathore FA, Galea MP	
Student's contribution (%)	70	
Journal or book name	International Journal of Natural Disaster and Health Security	
Volume/page numbers	2 (2):6-12	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

B. CO-AUTHOR'S DECLARATION *(to be completed by the collaborator)*

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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Fary Khan	Fary Khan	28/2/17

The University of Melbourne
CRICOS Provider Number: 00116K

Last Updated 17 August 2015

THE UNIVERSITY OF MELBOURNE

Co-author authorisation form

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Student's contribution (%)	70	
Journal or book name	International Journal of Natural Disaster and Health Security	
Volume/page numbers	2 (2):6-12	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

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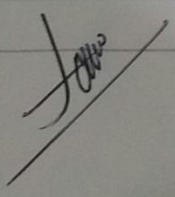
Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Farooq A Rathore		25/11/2016

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Medical Rehabilitation in Natural Disasters in the Asia-Pacific Region: The Way Forward	
Authors	Khan F, Amatya B, Rathore FA, Galea MP	
Student's contribution (%)	70	
Journal or book name	International Journal of Natural Disaster and Health Security	
Volume/page numbers	2 (2):6-12	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

B. CO-AUTHOR'S DECLARATION *(to be completed by the collaborator)*

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- the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Mary Galea	Mary P Galea	1/3/2017

The University of Melbourne
CRICOS Provider Number: 00116K

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Appendix 11

Co-author statement Study III

Co-author authorisation form

THE UNIVERSITY OF MELBOURNE

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gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication

A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Overview of Medical Rehabilitation in Natural Disasters in the Pacific Island Countries	
Authors	Amatya B, Khan F	
Student's contribution (%)	70	
Journal or book name	Physical Medicine and Rehabilitation – International	
Volume/page numbers	3 (4):1090	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

B. CO-AUTHOR'S DECLARATION *(to be completed by the collaborator)*

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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Fary Khan	Fary Le	28/2/17

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CRICOS Provider Number: 00116K

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Appendix 12

Co-authors statements Study IV

THE UNIVERSITY OF MELBOURNE

Co-author authorisation form

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A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes	
Authors	Khan F, Amatya B, Dhakal R, Abbott G, Graf M, Ramirez S, Lowenthal K, Galea MP	
Student's contribution (%)	70	
Journal or book name	International Journal of Physical Medicine & Rehabilitation	
Volume/page numbers	3: 316	
Status	☐ Accepted and In-press ☒ Published	Date accepted/published

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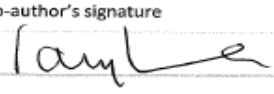
Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Fary Khan		28/2/17

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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Raju Dhakal	Rajudhakal	16/11/2016

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Geoff Abbott		27/1/2016

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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Mark Graf	Mark Graf	16/3/17

THE UNIVERSITY OF MELBOURNE

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Volume/page numbers	3: 316	
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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Santos Ramirezl		15/03/2017

THE UNIVERSITY OF MELBOURNE

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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Kathryn Lowenthal	Kowenthal	15/03/2017

THE UNIVERSITY OF MELBOURNE

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Full title	Rehabilitation Needs Assessment in Persons Following Spinal Cord Injury in Disaster Settings: Lessons Learnt in 2015 Nepal Earthquakes	
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Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
Mary Galea	Mary P Galea	1/3/2017

The University of Melbourne
CRICOS Provider Number: 00116K

Last Updated 17 August 2015

Appendix 13

Co-author statement Study V

Co-author authorisation form

THE UNIVERSITY OF MELBOURNE

All co-authors must complete this form. By signing below co-authors agree to the listed publication being included in the student's thesis and that the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

In cases where all members of a large consortium are listed as authors of a publication, only those that actively collaborated with the student on material contained within the thesis should complete this form. This form is to be used in conjunction with the *Declaration for a thesis with publication form.*

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gradresearch.unimelb.edu.au/preparing-my-thesis/thesis-with-publication

A. PUBLICATION DETAILS *(to be completed by the student)*

Full title	Rehabilitation medicine critical to disaster relief	
Authors	Khan F, Amatya B	
Student's contribution (%)	70	
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B. CO-AUTHOR'S DECLARATION *(to be completed by the collaborator)*

I authorise the inclusion of this publication in the student's thesis and certify that:

- the declaration made by the student on the *Declaration for a thesis with publication form* correctly reflects the extent of the student's contribution to this work;
- the student contributed greater than 50% of the content of the publication and is the "primary author" ie. the student was responsible primarily for the planning, execution and preparation of the work for publication.

Co-author's name	Co-author's signature	Date *(dd/mm/yy)*
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CRICOS Provider Number: 00116K

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Appendix 14

Assessment and triage tool for Spinal cord injury patients (Study IV)

RMH Team May 2015

Rehabilitation Management Form For Disaster Settings

Please circle where relevant, and initial last column

Patient identifier		**Date**						
Age		**Gender**	*Male*	*Female*				
Major diagnosis								
Comorbidities	DM	IHD	HT	COPD	Psych	fracture	Other (specify)	
Complications	Wound	Sepsis	Bladder/ incontinence	Constipation/ incontinence	Pressure ulcers	Falls	Other (specify)	
Disability								
1. Physical	Paralysis	Spasticity MAS (1-4)	Medications	Stretching	Mobilisation	Transfers	Ambulation	
	Gait aid	Single point stick	PUF	Other (specify)				
2. Continence	*Bowel*	Constipation	Overflow with retention	Laxatives Y/N				
	Bladder	Nocturia	Frequency	UTI	Catheterisation	Indwelling	Intermittent	
	Behaviour training	Double voiding	Fluid balance chart	Residual Volume < 100ml	Anticholinergics	Other (specify)		
3. Pressure ulcer prevention	Positioning and alignment	Turning protocol	Pressure mattress	Daily skin inspection	Pressure dressings	Tissue mobilisation		
4. Pain	Neuropathic	Musculoskeletal	Mixed	VAS (0-10)				
	Education	Review medication	Goal-setting					
5. Discharge plan	Rehabilitation	Step-down	CBR	Home	Unsuitable for rehabilitation			