PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (**http://bmjopen.bmj.com/site/about/resources/checklist.pdf)** and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Retrospective observational study of characteristics of persons with amputations accessing International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and post-conflict countries
AUTHORS	Barth, Cornelia; Wladis, Andreas; Blake, Catherine; Bhandarkar, Prashant; Aebischer Perone, Sigirya; O'Sullivan, Cliona

VERSION 1 – REVIEW

REVIEWER	Skempes, Dimitrios Swiss Paraplegic Research
REVIEW RETURNED	30-Mar-2021

GENERAL COMMENTS	Reviewer Report – 30 March 2021 Early age at amputation and delayed admission to assistive technology and rehabilitation: a retrospective study from International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and post-conflict countries [ID: bmjopen-2021-049533] General Comments: This is a very interesting and highly relevant article to national efforts to strengthen health systems responses to disability, including especially through advanced access to rehabilitation and assistive technology for persons with limb amputation. The epidemiologic evidence presented in the paper sheds light into a longstanding issue affecting conflict and post-conflict countries – that of inexcusable delay of admission to rehabilitation after amputation – and has implications for both service delivery and policy at national and supranational level. Although the data are not representative of the population in the study countries and carry some limitations regarding accuracy, they provide insights on the potential magnitude of the problem and set the stage for further research and advocacy on the neglected issue of access to rehabilitation for persons with limb amputation (and obviously other physical disabilities) in conflict countries.

The introduction is succinct but contains the most important information describing the background and objectives of the study. Reference of the importance of rehabilitation as highlighted in the literature is however missing and needs to be added. What is also missing is a description of the study context. A section with key information on the five countries (key health and development indicators as well as brief description of the rehabilitation infrastructure) is needed. The methodology is well reported but readability could be improved with subheadings. Some further information on how potential biases were addressed or how this has affected the analyses (e.g. missing data) is also required. Some changes in the presentation of the Results section is also necessary to improve clarity of reporting of the findings. The authors are very familiar with the landscape of physical rehabilitation in fragile contexts and they discuss the results of their study in a very detailed manner, which I appreciate.

Specific comments:

Introduction:

Lines 13-19: Here the authors argue about the importance of rehabilitation but reference to influential documents and initiatives is missing. I would like to see the argument for the need for early rehabilitation in conflict affected settings strengthened. Some references that would help clarify the technical and global health aspects of early rehabilitation include

- The definition of the term early rehabilitation and what it encompasses (see the field handbook Early rehabilitation in Conflicts and disasters https://wfot.org/resources/early-rehabilitation-in-conflicts-and-disasters). How is this relevant (or not) in this particular study?

- The international obligation of countries that are signatories to the Convention on the Rights of Persons with Disabilities to provide rehabilitation as early as possible under Article 26 "Habilitation and Rehabilitation"

Skempes D, Stucki G, Bickenbach J. Health-related rehabilitation and human rights: analyzing states' obligations under the United Nations Convention on the Rights of Persons with Disabilities. Arch Phys Med Rehabil. 2015;96(1):163-73.

	Line 45: The authors could refer also to the WHO Resolution "Increasing access to assistive technology" which recommends the collection of population-based data on health and long-term care needs, including those that may be met by assistive technology in order to develop evidence-based strategies, policies and comprehensive programmes; https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R8-en.pdf?ua=1 to establish the rationale for their study in addition to the reasons/factors explained above Methods: Please include subheadings to improve readability. Some parts of the methods may need to be moved under the appropriate subheading. For example, Lines 28-31 refer to Data issues while Lines 35-36 Data management. Also Lines 39-42 refer to Data analysis. The way the methodology is currently reported creates confusion and I would suggest that you include the following subheadings - Study design and study context (with additional information on context) - Study participants (inclusion/exclusion criteria) - Data collection and data management - Data analysis - Data issues (you could also omit this section and include it - Ethical approval P6/Line 14: Additional information on the study context is needed to help readers better interpret the results and assess the implications of the findings. Some key indicators could be provided such as for example Human Development Index, Population, Population proportion under 15/over 60, Literacy rate, Health Expenditures, Causes of death, Morbidity statistics. This addition/revision is discretionary but I believe that would help identify potential causes of the delay of access to rehabilitation. For example, a low literacy rate may indicate lack of ability to see appropriate care and rehabilitation. A low proportion of people over 60 in combination with high proportion of children may explain the concertation of attention and healthcare resources to younger age groups.

	P6/Line 31: How these potential biases have affected the analysis/results and did the authors take any action to address this? P7/Lines 25 and Line 34: Is this the same text? It looks almost identical. Results: The results section is very detailed and the tables add important information. However I would prefer to see the results organized as they are organized in the tables. Please include subheadings in the results - Age at time of amputation, age at registration, delay between amputation and registration - Distribution by sex and age of persons presenting with traumatic and non-traumatic amputations - Distribution of Amputation Causes by Categories and in Detail, by Country - Amputation characteristics - Combinations and levels of amputation P16/Table 4. Please correct the typo in the title Discussion P17/Line 33: Insert reference evidencing the lack of essential health services in Cambodia The discussion is comprehensive and the shows how the goals of the study have been met offering also potential explanations in light of international evidence and local circumstances. The discussion highlights the lack of quality research on rehabilitation in conflict settings as well as the severe underfunding and underdevelopment of rehabilitation services. Given the long experience of the authors with humanitarian aid organizations and the increasing role of such organizations in local and regional efforts to address health system challenges, I would like to see some recommendations on what action might be most appropriate to enhance the impact of the work of such organizations in the provision of rehab/assistive technology, especially within the context of SGD 3.

VERSION 1 – AUTHOR RESPONSE

Point-by-point response for reviewers

Please note that changes to the manuscript are copied into this document where possible.

Responses to the reviewer are in red. Original text is in red, highlighted in grey, and **changes in red bold.**

Reviewer Report – 30 March 2021

Early age at amputation and delayed admission to assistive technology and rehabilitation: a retrospective study from International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and post-conflict countries [ID: bmjopen-2021-049533]

General Comments:

This is a very interesting and highly relevant article to national efforts to strengthen health systems responses to disability, including especially through advanced access to rehabilitation and assistive technology for persons with limb amputation. The epidemiologic evidence presented in the paper sheds light into a longstanding issue affecting conflict and post-conflict countries – that of inexcusable delay of admission to rehabilitation after amputation – and has implications for both service delivery and policy at national and supranational level.

Although the data are not representative of the population in the study countries and carry some limitations regarding accuracy, they provide insights on the potential magnitude of the problem and set the stage for further research and advocacy on the neglected issue of access to rehabilitation for persons with limb amputation (and obviously other physical disabilities) in conflict countries.

The introduction is succinct but contains the most important information describing the background and objectives of the study. Reference of the importance of rehabilitation as highlighted in the literature is however missing and needs to be added. What is also missing is a description of the study context. A section with key information on the five countries (key health and development indicators as well as brief description of the rehabilitation infrastructure) is needed. The methodology is well reported but readability could be improved with subheadings. Some further information on how potential biases were addressed or how this has affected the analyses (e.g. missing data) is also required. Some changes in the presentation of the Results section is also necessary to improve clarity of reporting of the findings. The authors are very familiar with the landscape of physical rehabilitation in fragile contexts and they discuss the results of their study in a very detailed manner, which I appreciate.

Response: Thank you for the appreciation and the valuable suggestions on how to strengthen the paper. Please see below how we addressed the points from the general comments.

Specific comments:

Introduction:

Lines 13-19: Here the authors argue about the importance of rehabilitation but reference to influential documents and initiatives is missing. I would like to see the argument for the need for early rehabilitation in conflict affected settings strengthened. Some references that would help clarify the technical and global health aspects of early rehabilitation include

- The definition of the term early rehabilitation and what it encompasses (see the field handbook Early rehabilitation in Conflicts and disasters https://wfot.org/resources/early-rehabilitation-in-conflicts-anddisasters). How is this relevant (or not) in this particular study?

- The international obligation of countries that are signatories to the Convention on the Rights of Persons with Disabilities to provide rehabilitation as early as possible under Article 26 "Habilitation and Rehabilitation"

Skempes D, Stucki G, Bickenbach J. Health-related rehabilitation and human rights: analyzing states' obligations under the United Nations Convention on the Rights of Persons with Disabilities. Arch Phys Med Rehabil. 2015;96(1):163-73.

Response: We appreciate the suggestion of further references, which we included in addition to other publications on rehabilitation as a human right and on guidelines

As copied below we stress that guidelines and position papers are important to raise awareness, but not enough. The same applies to early rehabilitation, which must be complemented with assistive technology provision and rehabilitation at all stages of the continuum of care. The populations in questions are not known well enough to justifiably advocate for, design and deliver context- and population-adapted rehabilitation, see p4/line14-30:

The World Health Assembly's 2018 resolution on improving access to AT and the 2021 resolution on the highest attainable standard of health for persons with disabilities indicate the many shortcomings and the need for increased recognition in this field.5,7
Access to appropriate rehabilitation and AT as a human right is integral to the Convention on the Rights of Persons with Disabilities, a fact that resulted in publications discussing implications, implementation and sobering reality-checks in numerous LMICs.8–13
Alarming needs and low supply are a well-known reality for global actors playing a key role in advocating for and providing rehabilitation in fragile settings including the International Committee of the Red Cross (ICRC), Humanity and Inclusion and the World Health Organisation (WHO). Guidelines, training resources and advocacy papers by such actors, often issued collectively, are specifically pointing out the importance and interdependence of early rehabilitation, AT and rehabilitation across the continuum of care.14–19
As such initiatives address knowledge gaps in this neglected field, their global implementation lags behind, even more so in countries of prolonged conflict or post-conflict with fragile health systems and a deprioritisation of rehabilitation services. As a consequence, there remains a lack of scientific papers on which to base further guideline development and research. This starts with affected populations in the countries themselves who remain largely unknown

Line 45: The authors could refer also to the WHO Resolution "Increasing access to assistive technology" which recommends the collection of population-based data on health and long-term care needs, including those that may be met by assistive technology in order to develop evidence-based strategies, policies and comprehensive programmes;
https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R8-en.pdf?ua=1 to establish the rationale for their study in addition to the reasons/factors explained above

Response: This WHA resolution as well as a most recent one on health standards for persons with disabilities are now referred to in p4/line7+16

Methods:

Please include subheadings to improve readability. Some parts of the methods may need to be moved under the appropriate subheading. For example, Lines 28-31 refer to Data issues while Lines 35-36 Data management. Also Lines 39-42 refer to Data analysis. The way the methodology is currently reported creates confusion and I would suggest that you include the following subheadings
- Study design and study context (with additional information on context)

- Study participants (inclusion/exclusion criteria)
- Data collection and data management
- Data analysis
- Data issues (you could also omit this section and include it - Ethical approval

Response: Subheadings are now added in line with BMJ Open abstract structure. The methods section is better structured, see p5-7

P6/Line 14: Additional information on the study context is needed to help readers better interpret the results and assess the implications of the findings. Some key indicators could be provided such as for example Human Development Index, Population, Population proportion under 15/over 60, Literacy rate, Health Expenditures, Causes of death, Morbidity statistics. This addition/revision is discretionary but I believe that would help identify potential causes of the delay of access to rehabilitation. For example, a low literacy rate may indicate lack of ability to see appropriate care and rehabilitation. A low proportion of people over 60 in combination with high proportion of children may explain the concertation of attention and healthcare resources to younger age groups.

Response: We have studied various indicators, see table below for your information, and found they align with the country classification by the World Bank. As the respective sources are easily accessible online, we refer to them on p5/line 23-25 as follows:

Besides post-conflict Cambodia, the countries represent contexts of protracted crises and are classified by the World Bank as low-income (Afghanistan, **Sudan**), LMIC (Cambodia, Myanmar), or upper middle-income (Iraq).31,32 **These differences are equally reflected in other indicators as available from open source sites by the United Nations Development Programme and the WHO.** [33,34]

	HDI	age median	adult literacy rate	health expenditure, % from GDP	3 main causes of death
afgh	0.511	18.4	43%	11.80%	Ischaemic heart disease (IHD), neonatal conditions, collective violence and legal intervention
cam	0.594	25.6	80.50%	5.90%	Stroke, IHD, lower respiratory infections
ira	0.674	21.0	85.60%	4.20%	IHD, stroke, neonatal conditinons
mya	n.a.	29.0	75.60%	4.70%	Stroke, IHD, COPD
sud	0.510	19.7	60.70%	6.30%	IHD, neonatal conditions, stroke

http://hdr.undp.org/en/data
https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death

P6/Line 31: How these potential biases have affected the analysis/results and did the authors take any action to address this?

Response: We deemed the dimension of T2D prevalence and its consequences too important to not be discussed despite potential bias due to lacking diagnosis (which in itself indicates the magnitude of the problem in such contexts). We further elaborated this bias on p6/line 36-42:

Potential bias
Data depended on the accuracy of self-report and recording of observations and assessments by PRC staff with varying professional training and subject to interpretation, hereby presenting potential biases. Variables such as sex and age are deemed robust. Challenges exist when recording the cause of non-traumatic amputation presentations as PRCs are rarely attached to a medical service to diagnose underlying conditions.

Unless a PwA checks in with externally confirmed T2D diagnosis, PRC staff rely on findings from their own assessment. They record non-traumatic causes as predefined in the database, which does not offer T2D as a stand-alone variable, but 'infectious', 'metabolic' or 'vascular' presentations. Chronic, often unknown health conditions in the studied countries lead to such presentations defined by PRC staff as amputation cause and are most likely related to NCD/T2D.36–38 Considering the dimension and consequences of T2D prevalence we merged causes under this heading despite absence of confirmed diagnosis.

This potential bias is also elaborated in the discussion including additional references, p16/line 35-36:

Many PRCs operate independently of other health structures and without medical personnel to confirm T2D diagnosis. Therefore, the numbers of amputation due to T2D may be underestimated, a conclusion also reported in amputation incidence studies.1 Metabolic and vascular causes as noted by rehabilitation personnel without diagnostic tools and competencies were most probably linked to T2D, vascular complication of T2D or another vascular NCD.37 Likewise, most infections causing non-traumatic amputations were assumed to result from undiagnosed or undocumented T2D with infected ulcer and gangrene.26,36

Common etiologies of diabetes foot ulcer include neuropathic (approximately 55%), arterial (10%) and neuroischemic causes (approximately 35%).38

P7/Lines 25 and Line 34: Is this the same text? It looks almost identical.

Response: corrected

Results:

The results section is very detailed and the tables add important information. However I would prefer to see the results organized as they are organized in the tables. Please include subheadings in the results

- Age at time of amputation, age at registration, delay between amputation and registration
- Distribution by sex and age of persons presenting with traumatic and non-traumatic amputations
- Distribution of Amputation Causes by Categories and in Detail, by Country
- Amputation characteristics - Combinations and levels of amputation

Response: The results section is now structured with subheadings and also shortened for better readability, see p5-17

P16/Table 4. Please correct the typo in the title

Response: done

Discussion

P17/Line 33: Insert reference evidencing the lack of essential health services in Cambodia

Response: done

The discussion is comprehensive and the shows how the goals of the study have been met offering also potential explanations in light of international evidence and local circumstances. The discussion highlights the lack of quality research on rehabilitation in conflict settings as well as the severe underfunding and underdevelopment of rehabilitation services. Given the long experience of the authors with humanitarian aid organizations and the increasing role of such organizations in local and regional efforts to address health system challenges, I would like to see some recommendations on what action might be most appropriate to enhance the impact of the work of such organizations in the provision of rehab/assistive technology, especially within the context of SGD 3.

Response: This is now adressed on p17/line 12-22:

The lack of T2D diagnostic data highlights the PRCs' unpreparedness for such scenarios, which will require changes of procedures, staffing ratio, occupancy rates and equipment and enhanced workforce skills regarding NCD/T2D management, diagnostics and data collections. International actors specialising in health and rehabilitation services and governments need to join forces and prioritise rehabilitation towards achieving sustainable development goal 3 which aims to "ensure healthy lives and promote well-being for all at all ages".53 Improved NCD management on primary healthcare level is the first step.54 Equally important will be adaptations of referral systems, interprofessional collaborations across the continuum of care and investments in systematic promotion of physical activity and preventive measures for persons at risk. To implement these recommendations, the health and rehabilitation expertise of international actors should get systematically informed by the contextualised know-how and commitment of local stakeholders including governmental and non-governmental institutions, health professionals and patients.

And on p18/p 23-26

We call out to rehabilitation service providers and healthcare professionals for a prioritisation of rehabilitation and a stronger and prompt involvement of rehabilitation professionals on all levels of the continuum of care. This includes international humanitarian interventions as well as local health system governance.

VERSION 2 – REVIEW

REVIEWER	Skempes, Dimitrios Swiss Paraplegic Research
REVIEW RETURNED	21-Jul-2021

GENERAL COMMENTS	Thank you for the opportunity to review the revised version. You will find my comments in the attached. I appreciate the efforts to address the issues raised during the first round of peer review and wish to congratulate you on the revisions made. The manuscript has improved substantially and I am certain that it will attract the attention of professional and human development actors alike. The reviewer provided a marked copy with additional comments. Please contact the publisher for full details.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

Dr. Dimitrios Skempes, Swiss Paraplegic Research

Comments to the Author:

Thank you for the opportunity to review the revised version. You will find my comments in the attached. I appreciate the efforts to address the issues raised during the first round of peer review and wish to congratulate you on the revisions made. The manuscript has improved substantially and I am certain that it will attract the attention of professional and human development actors alike.

The reviewer provided a marked copy with additional comments. Please contact the publisher for full details.

Appropriate rehabilitation and assistive technology (AT) have the potential to greatly diminish disability and allow the person to lead an independent, functional life[1,2].

insert citation to support this statement

Preventive measures on all levels of healthcare are essential to reduce the number of T2D- caused amputations[3,4]. Rather than solely managing amputations as the last consequence, rehabilitation professionals should get increasingly involved in provision of comprehensive care.

insert citation to support the claim that rehabilitation as a measure of disease prevention benefits individuals with amputations or other complex conditions of the musculoskeletal system.

Replace citation No10 with the following

Borg J, Lindström A, Larsson S. Assistive technology in developing countries: a review from the perspective of the Convention on the Rights of Persons with Disabilities. Prosthet Orthot Int. 2011 Mar;35(1):20-9. doi: 10.1177/0309364610389351.

1. von Kaeppler, E.P.; Hetherington, A.; Donnelley, C.A.; Ali, S.H.; Shirley, C.; Challa, S.T.; Lutyens, E.; Haonga, B.T.; Morshed, S.; Andrysek, J.; et al. Impact of prostheses on quality of life and functional status of transfemoral amputees in Tanzania. African J. Disabil. 2021, 10, doi:10.4102/ajod.v10i0.839.

2. MacLachlan, M.; Banes, D.; Bell, D.; Borg, J.; Donnelly, B.; Fembek, M.; Ghosh, R.; Gowran, R.J.; Hannay, E.; Hiscock, D.; et al. Assistive technology policy: a position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. Disabil. Rehabil. Assist. Technol. 2018, 13, doi:10.1080/17483107.2018.1468496.

3. Hap, K.; Biernat, K.; Konieczny, G. Patients with Diabetes Complicated by Peripheral Artery Disease: The Current State of Knowledge on Physiotherapy Interventions. J. Diabetes Res. 2021, 2021.

4. Freire, A.P.C.F.; Palma, M.R.; Lacombe, J.C.A.; Martins, R.M.L.; Lima, R.A. de O.; Pacagnelli, F.L. Implementation of physiotherapeutic shares in the prevention of diabetes complications in a Family Health Strategy. Fisioter. em Mov. 2015, 28, 69–76, doi:10.1590/0103-5150.028.001.AO07.