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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

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TITLE

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

ABSTRACT

INTRODUCTION

Limb amputation incidence is particularly high in fragile contexts due to conflict, accidents and poorly managed diabetes. The study aim was to analyse demographic and amputation characteristics of persons with amputation (PwA) and time between amputation and rehabilitation in five countries.

METHODS

Countries with the highest numbers of PwA in the global International Committee of the Red Cross database were selected (Afghanistan, Cambodia, Iraq, Myanmar, Sudan). Data from 2009–2018 were cleaned, merged, and aggregated by sex, age at amputation and registration, environment, cause, combination, anatomical level. We analyzed differences in demographic factors and time to access rehabilitation between users with traumatic and non-traumatic amputation.

RESULTS

Data for 28446 individuals were included (4329 [15.2%] female). Most were traumatic amputations (73.4%, 20890) and 48.6% (13801) of these conflict related. The average age of men and women with traumatic amputation was 26.9 and 24.1 years respectively; for non-traumatic amputation it was 49.1 years and 45.9 years respectively. Delay between amputation and rehabilitation was on average 8.2 years for those with traumatic amputation and 3 years for those with non-traumatic amputation.

CONCLUSION

Young age for traumatic and non-traumatic amputations indicates the devastating impact of war and fragile health systems on a society. Long delays between amputation and rehabilitation reveal the mismatch of needs and resources. For rehabilitation service providers in fragile settings, it is an enormous task to manage the diversity of PwA of various causes, age, sex and additional conditions. Improved collaboration between primary healthcare, surgical and rehabilitation services are recommended to ensure comprehensive care for PwA.

FUNDING

None

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STRENGTHS AND LIMITATIONS OF THIS STUDY

- To our knowledge, this is the first large multicountry study on a highly vulnerable and • neglected group of persons with amputations seeking rehabilitation in contexts of conflict and post conflict
- Data originate from exceptionally challenging and diverse settings where providing • rehabilitation and collecting data is complex and constantly challenged by the volatility of the environment
- Limitations include that data are derived from ICRC supported structures only and cannot make statements on overall population or on persons not attending services

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INTRODUCTION

Limb amputation is a lifechanging event. Global incidence studies reveal a substantial lack of data from fragile contexts such as conflict affected or low and middle income countries (LMIC), but research has shown that amputation incidence is higher in populations with low economic and educational status resulting in limited access to healthcare, even in high income countries (HIC).^{1–3} People in fragile contexts are particularly at risk of amputation and many of them will have to cope without prosthetic care.⁴ Appropriate rehabilitation and assistive technology have the potential to greatly diminish disability and allow the person to lead an independent, functional life. This requires the availability of comprehensive, costly and lifelong services, which is particularly challenging in such environments. Rehabilitation services should span from early physiotherapy to prosthetic fitting, psychosocial support and social reintegration measures. A lower extremity amputation (LEA) requires prosthetic renewal every three years, for children every six months.⁵

Veterans from HIC who sustained conflict-related amputations abroad have been studied extensively whereas very little is known about the affected population in the countries themselves.^{6–8} Complex traumatic amputations and their sequalae in conflict- and mineaffected areas are known to be a huge challenge.^{4,9,10} Adding to this, and with profound consequences, is the increasing global burden of type two diabetes mellitus (T2D).¹¹ Overstretched health systems, particularly in LMIC, lacking access to basic diabetic care and high rates of undiagnosed T2D increase the risk and incidence of amputations.¹² Road traffic (RTA) and other accidents are an additional problem in countries with limited traffic and occupational safety standards.¹³

Persons with amputations (PwA) constitute the biggest cohort of users accessing rehabilitation services supported by the International Committee of the Red Cross (ICRC) in conflict and post-conflict states.¹⁴ Assisting conflict affected populations is at the centre of the ICRC's humanitarian mission and serving mine victims with limb loss is a core activity since the launch of its physical rehabilitation programme (PRP) in 1979.^{15,16}

Currently, the ICRC supports 152 rehabilitation structures in 35 countries offering multidisciplinary rehabilitation services for persons with physical disabilities and capacity building for rehabilitation workforce. With this support, 62172 persons worldwide were fitted with prostheses in 2019.¹⁵ There is very little information on the characteristics of PwA accessing rehabilitation in fragile contexts.

The overall aim of this study was to analyse characteristics of PwA accessing rehabilitation services in five ICRC contexts in 2009-2018 to better understand the needs and deduce implications for service provision. Specific aims were to explore differences in sex and age at amputation, at registration for rehabilitation, time between amputation and registration (delay), causes and characteristics of amputations.

METHODS
This study is a descriptive retrospective analysis of aggregated data. It reflects the records of
all PwA registered from 2009 to 2018 in ICRC-supported physical rehabilitation centres
(PRCs) in Afghanistan (n=7), Cambodia (n=2), Iraq (n=1), Myanmar (n= 5), and Sudan (n= 2).
Data were extracted from an ICRC-developed electronic database described in a previous
study. ¹⁴ The five countries representing the highest numbers of PwA attending PRCs were
selected for this study. Besides post-conflict Cambodia they represent contexts of protracted
crises and are classified by the World Bank as low-income (Afghanistan), LMIC (Cambodia,
Sudan, Myanmar), or upper middle-income (Iraq). ¹⁷
Data reflect representative user populations in the studied countries to varying degrees
depending on presence of other rehabilitation providers, or data management difficulties.
All PRCs were located in urban areas.
Participants include all persons with any type of acquired amputation newly attending for
prosthetic fitting. Excluded were persons attending with congenital limb loss. Upon
registration, demographic and clinical characteristics were captured as part of routine
documentation.
The variables retrieved from the database were: country, sex, age at registration and at
amputation, environment, cause, anatomic level and number of amputation(s). The origin of
the database were handwritten patient files transferred into an electronic system.
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.
The quantitative variables were cleaned, merged, disaggregated by sex and age and
organized into variables of interest. Environment referred to PwA's living environment and
was subject to local definitions of the terms urban or rural.
The delay between amputation and registration to rehabilitation was calculated by
subtracting the self-reported amputation date from the registration date as noted on the
user file.
Age at registration was grouped into young child: under 5; child: 5–17; young adult: 18–34;
adult: 35–59; older adult: over 60. Besides 'environment' all selected variables were
mandatory for data entry. Where software issues led to missing data, these were labelled
'no data' in the tables.
Figure 1 lists the causes as retrieved from the database and shows how causes were
categorised into traumatic or non-traumatic. Traumatic causes were further sub-categorised
as non-conflict- or conflict-related. We examined non-conflict-related traumatic causes by
accidental or non-accidental causes. Conflict-related causes were separated into caused by
weapons or by weapon-contamination, which encompasses the presence of mines, explosive
remnants of war (ERW) and other sources of contamination. ¹⁸
The database offered four labels for non-traumatic causes: cancer, infection, metabolic, or
vascular. For analysis, these were merged, except cancer (merged with 'other'), and
considered related to non-communicable diseases (NCD), potentially T2D. For amputation characteristics, PwA were counted by combinations of lower and upper extremity

amputations (UAE), by sex and non-traumatic versus traumatic causes. Levels were counted by number of amputations. We kept six levels of upper extremity amputations (UEA) as per database and aligned LEA to these, merging knee disarticulation with transcondylar amputation and hip disarticulation with hemipelvectomy for functional similarity.
Data analysis comprised of descriptive statistics, using Microsoft Office Excel 2016, R (version 3.6.1), R Studio for windows (version 1.2.5001) and SPSS (IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). Categorical data were summarised as counts and percentages across rows (sex) and columns (groups). Age at the time of amputation, registration and delay intervals were presented as means with 95% confidence intervals. Differences between groups were assessed using chi-square and independent sample t-tests. P values below 0.05 were considered statistically significant. The methods used and findings from the study are reported in line with the GATHER guidelines.¹⁹

Ethical exemption to conduct analysis on de-identified data was granted by the Swiss Ethics Committee Geneva [Reference number: REQ-2019-00027]. Data sharing agreements between the ICRC, Linköping University and University College Dublin were approved by each institution.

Patient and public involvement: for this retrospective study of routinely collected data patient involvement did not apply. The PRC managers and personnel and ICRC Expatriate staff onsite were regularly informed and involved, when the study was developed.
Interpretation of the data was based on their profound understanding of the respective contexts. Preliminary research results were presented by the main author in an ongoing process, online and in person during project visits where involved rehabilitation providers did and will continue to play an active role in research dissemination.

Patient and public involvement: for this retrospective study of routinely collected data, patient involvement in study design did not apply. However, consultation with key stakeholders (PRC managers and personnel and ICRC expatriate staff) was conducted regarding study design and feasibility and contextual analysis of findings. Interpretation of the data was based on these stakeholders' profound understanding of the respective contexts. The main author presented and discussed preliminary research results in an ongoing process, online and in person during project visits where involved rehabilitation providers did and will continue to play an active role in dissemination of the findings of this research.

RESULTS

 A total of 28446 individual user files were analysed with 4329 (15.2%) female PwA. Most data relate to Afghanistan (12364 [43.5%]), followed by Myanmar (5267 [18.5%]), Sudan (5012 [17.6%]), Iraq (3491 [12.3%]), and Cambodia (2312 [8.1%]).

Average age for traumatic amputation was 26.9 years in male, 24.1 years in female and for non-traumatic amputation it was 49.1 years in male, 45.9 years in female PwA. Average delay was significantly shorter in the non-traumatic group with 3 years compared to 8.2 years for those with traumatic amputation, (Table 1).

In all countries, delay was lowest in young children (0.0–2.5 years) and highest for males over 60 with traumatic amputations (16.6–22.5 years), except for Afghanistan (10.5 years for males aged 35–59 and 10.3 years for those over 60).

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Table 1. Age at time of amputation, age at registration, delay between amputation and registration

		Non-Traumat	ic Amputation	Traumatic	Amputation	Total – by	cause		
Country	Variables	Male	Female	Male	Female	Non-Trauma	Trauma	MD (95% CI)	P value
Total	•	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	, , ,	
	Age at amputation	49.1(48.6-49.6)	45.9(45.1-46.7)	26.9(26.7-27.1)	24.1(23.3-24.8)	48.2(47.8-48.6)	26.6(26.4-26.8)	21.7(21.3-22.1)	< 0.0
	Age at registration	52.2(51.8-52.7)	48.6(47.8-49.4)	35.2(35-35.4)	31.6(30.9-32.3)	51.2(50.8-51.6)	34.8(34.6-35)	16.4(16.0-16.9)	< 0.0
	Delay all users (years)	3.2(3.0-3.4)	2.7(2.4-3)	8.3(8.1-8.4)	7.5(7.1-8)	3.0(2.9-3.2)	8.2(8-8.3)	-5.1(-5.4-4.9)	< 0.0
	Delay by user age group (age at registration)	, í	, , ,	, í	`	, í			
	Young child (<5 years)	0.9(0.4-1.4)	1.3(0.8-1.8)	0.9(0.7-1.1)	1.0 (0.7-1.2)	1.1(0.7-1.4)	0.9(0.8-1.1)	0.1(-0.3-0.6)	0.5
	Child (5-17 years)	2.2(1.6-2.8)	2.2(1.5-2.8)	2.0 (1.9-2.2)	3.9(3.5-4.3)	2.2(1.8-2.6)	2.4(2.3-2.6)	-0.3(-0.7-0.2)	0.2
	Young Adult (18-34 years)	3.2(2.8-3.6)	3.1(2.5-3.7)	3.8(3.6-3.9)	7.2(6.6-7.8)	3.1(2.8-3.5)	4.1(3.9-4.2)	-0.9(-1.3-0.5)	< 0.0
	Adult (35-59 years)	2.9(2.7-3.2)	2.6(2.1-3)	13.7(13.4-14)	9.9(9-10.8)	2.8(2.6-3.1)	13.3(13.1-13.6)	-10.5(-10.9-10.1)	< 0.0
	Older Adult (>60 years)	3.5(3.1-3.9)	3(2.3-3.7)	16.9(16-17.7)	12.1(9.9-14.4)	3.4(3.1-3.7)	16.3(15.5-17.1)	-12.9(-13.7-12.2)	< 0.0
Afghanistar		, í	Ì Ì Ì Ì	, í	· · · · · · · · · · · · · · · · · · ·	, í		, , , , , , , , , , , , , , , , , , ,	
0	Age at amputation	48.8(46.2-51.4)	42.7(39.4-46)	24.8(24.3-25.3)	20.6(19.4-21.8)	46.8(44.8-48.9)	24.3(23.9-24.8)	22.5(21.7-23.2)	< 0.0
	Age at registration	50.3(49.2-51.3)	44.0 (42.5-45.4)	29.7(29.4-30)	26.6(25.6-27.6)	48.3(47.4-49.1)	29.4(29.1-29.7)	18.9(18.1-19.6)	< 0.0
	Delay all users (years)	1.6(1.3-1.9)	1.3(1.0-1.6)	4.9(4.8-5.1)	6.0 (5.5-6.6)	1.5(1.2-1.7)	5.0 (4.9-5.2)	-3.6(-4.0-3.2)	< 0.0
	Delay by user age group (age at registration)	, , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , ,						
	Young child (<5 years)	0.5(-0.2-1.2)	1.3(0.3-2.2)	0.9(0.6-1.1)	0.9(0.6-1.2)	0.8(0.2-1.3)	0.9(0.7-1.1)	-0.1(-0.8-0.5)	0.6
	Child (5-17 years)	1.1(0.6-1.7)	1.6(0.8-2.4)	1.8(1.6-2.0)	3.9(3.4-4.4)	1.3(0.9-1.8)	2.2(2.1-2.4)	-0.9(-1.5-0.3)	0.0
	Young Adult (18-34 years)	3.0(2.2-3.8)	2.1(1.2-2.9)	3.1(2.9-3.2)	7.8(6.9-8.7)	2.7(2.0-3.3)	3.4(3.2-3.5)	-0.7(-1.4-0.1)	0.0
	Adult (35-59 years)	1.4(0.9-1.9)	1(0.6-1.4)	10.5(10.0-11.0)	7.6(6.2-9.0)	1.2(0.9-1.6)	10.1(9.7-10.6)	-8.9(-9.8-8.0)	< 0.0
	Older Adult (>60 years)	1.3(0.7-1.8)	1.1(0.3-1.9)	10.3(9.1-11.6)	4.6(2.3-6.8)	1.2(0.8-1.7)	9.7(8.5-10.9)	-8.5(-9.6-7.4)	< 0.0
Cambodia		, í	, , , ,	, í	` / /	, í	· · · · · · · · · · · · · · · · · · ·	<u>````</u>	
	Age at amputation	46(38.5-53.6)	41.6(31.1-52.0)	28.6(27.2-29.9)	31.3(27.3-35.3)	44.7(38.6-50.8)	28.9(27.6-30.2)	15.8(13.7-17.9)	< 0.0
	Age at registration	48.9(45.9-51.9)	45.3(40.3-50.3)	42.7(42.0-43.3)	40.3(38-42.7)	47.8(45.2-50.4)	42.4(41.8-43.0)	5.4(3.2-7.6)	< 0.0
	Delay all users (years)	2.9(1.8-4.0)	3.8(1.5-6.1)	14.0 (13.4-14.6)	9.3(7.8-10.8)	3.2(2.2-4.2)	13.4(12.9-14.0)	-10.2(-12.0-8.5)	< 0.0
	Delay by user age group (age at registration)	, í	, í						
	Young child (<5 years)	2.5(1.5-3.5)##		1.0 (0.2-1.8)	0.0(0.0-0.0)##	2.5(1.5-3.5)	0.7(0.0-1.3)	1.8(0.2-3.4)	0.0
	Child (5-17 years)	9.5(-5.2-24.2)	4.6(0.4-8.7)	3.1(1.7-4.4)	3.7(1.3-6.2)	5.7(1.4-9.9)	3.2(2.1-4.4)	2.4(-1.2-6.0)	0.1
	Young Adult (18-34 years)	4.3(2.0-6.6)	3.9(-0.1-7.8)	4.7(4.1-5.3)	6.2(4.2-8.1)	4.2(2.2-6.1)	4.9(4.3-5.5)	-0.7(-2.9-1.5)	0.5
	Adult (35-59 years)	3.2(1.2-5.1)	3.1(0.4-5.8)	18.6(17.9-19.3)	10.9(8.7-13.2)	3.1(1.5-4.8)	17.9(17.2-18.5)	-14.7(-17.2-12.2)	< 0.0
	Older Adult (>60 years)	1.2(0.0.3-2)	4.3(-1.9-10.6)	19.7(17.7-21.7)	15.2(9.9-20.5)	2.1(0.1-4.1)	18.9(17-20.8)	-16.8(-20.5-13.1)	< 0.0
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	Age at amputation	54.4(50.7-58.2)	53.9(48-59.9)	26.8(25.7-28.0)	25.6(22.2-29.0)	54.3(51.2-57.5)	26.7(25.6-27.8)	27.6(26.6-28.6)	< 0.0
	Age at registration	56.6(55.7-57.6)	55.3(53.5-57.1)	39.1(38.5-39.8)	33.6(31.3-35.8)	56.3(55.4-57.1)	38.6(38-39.2)	17.7(16.6-18.7)	< 0.0
	Delay all users (years)	2.2(1.8-2.7)	1.7(1-2.3)	12.3(11.8-12.8)	8.1(6.7-9.6)	2.1(1.7-2.4)	11.9(11.5-12.4)	-9.9(-10.6-9.1)	< 0.0
	Delay by user age group (age at registration)	Ì Ì Ì Ì	Ì Ì Ì Ì	, í	· · · · · · · · · · · · · · · · · · ·	, í		, , , , , , , , , , , , , , , , , , ,	
	Young child (<5 years)	0.0(0.0-0.0)#	2.0(2.0-2.0)##	1.0 (0.4-1.6)	1.0(0.1-1.9)	1.0(-1.0-3.0)	1.0(0.5-1.5)	0(-1.7-1.7)	1.0
	Child (5-17 years)	4.1(1.2-7.1)	2.1(0-4.2)	2.9(2.2-3.5)	2.6(1.4-3.8)	3.1(1.3-5.0)	2.8(2.2-3.4)	0.3(-1.3-1.9)	0.6
	Young Adult (18-34 years)	3.8(1.8-5.7)	1.3(0.2-2.3)	5.7(5.2-6.2)	7.6(5.5-9.7)	3.0(1.6-4.4)	5.9(5.4-6.3)	-2.8(-4.7-1.0)	0.0
	Adult (35-59 years)	2.0(1.5-2.6)	1.4(0.7-2.1)	16.7(16-17.4)	11.0(8.1-13.9)	1.9(1.4-2.3)	16.3(15.6-17.0)	-14.4(-15.5-13.3)	< 0.0
	Older Adult (>60 years)	2.2(1.5-2.8)	1.9(0.8-3.0)	21.2(19.1-23.2)	10.9(5.2-16.5)	2.1(1.6-2.7)	20.4(18.4-22.4)	-18.3(-19.8-16.8)	< 0.0
Myanmar		((*)		((
J ··· ···	Age at amputation	46.7(43.7-49.8)	47.4(42.2-52.7)	29.6(28.6-30.5)	28.0 (25-31.1)	46.9(44.3-49.5)	29.4(28.5-30.3)	17.5(16.6-18.3)	<0.0
	Age at registration	52.0(51.0-52.9)	51.8(50-53.6)	40.7(40.3-41.2)	38.3(36.6-40)	51.9(51.1-52.8)	40.5(40.1-40.9)	11.4(10.5-12.3)	< 0.0

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		52(4.0.5.0)	4.2(2.4.5.2)	11.0(10.0.11.5)	10.2(0.0.11.()	50(1(55)	11 1(10 0 11 5)		-0.001
	Delay all users (years)	5.3(4.8-5.8)	4.3(3.4-5.3)	11.2(10.8-11.5)	10.3(9.0-11.6)	5.0 (4.6-5.5)	11.1(10.8-11.5)	-6.1(-6.7-5.4)	< 0.001
	Delay by user age group (age at registration)								
	Young child (<5 years)	1.0(1.0-1.0)#	2.0(2.0-2.0)#	2.0 (2.0-2.0)##	2.5(1.0.5-3.5)##	1.5(0.5-2.5)	2.3(1.8-2.7)	-0.8(-2.1-0.6)	0.196
	Child (5-17 years)	4.5(2.3-6.7)	5.6(3.0-8.2)	2.4(1.8-3.1)	3.9(2.5-5.3)	5.1(3.4-6.9)	2.8(2.2-3.4)	2.3(0.8-3.8)	0.003
	Young Adult (18-34 years)	2.6(2.0-3.2)	2.5(0.9-4.0)	4.5(4.2-4.8)	6.1(4.6-7.5)	2.6(2-3.2.0)	4.6(4.3-4.9)	-2(-3.0-1.1)	< 0.001
	Adult (35-59 years)	4.7(4.1-5.3)	4.3(2.9-5.6)	13.9(13.5-14.4)	13.1(11.0-15.1)	4.6(4.0-5.2)	13.9(13.4-14.3)	-9.3(-10.2-8.4)	< 0.001
	Older Adult (>60 years)	7.3(6.0-8.5)	4.8(2.8-6.8)	22.5(20.9-24.1)	19.3(13.2-25.3)	6.7(5.6-7.7)	22.2(20.7-23.8)	-15.6(-17.4-13.7)	< 0.001
Sudan									
	Age at amputation	48.5(46.5-50.5)	45(41.8-48.2)	30.5(29.1-32)	25.9(23.1-28.6)	47.6(45.9-49.3)	29.7(28.4-31.1)	17.9(16.9-18.9)	< 0.001
	Age at registration	52.1(51.4-52.7)	48.7(47.4-50)	39.7(38.9-40.5)	34(32.2-35.9)	51.2(50.6-51.8)	38.7(38.0-39.5)	12.5(11.5-13.4)	< 0.001
	Delay all users (years)	3.6(3.3-4.0)	3.7(3.1-4.3)	9.2(8.7-9.8)	8.2(7.1-9.3)	3.6(3.3-3.9)	9.1(8.6-9.6)	-5.4(-6.0-4.9)	< 0.001
	Delay by user age group (age at registration)								
	Young child (<5 years)	1.0(0.5-1.5)	1.2(0.4-2.0)	0.8(0.2-1.5)	1.3(0.4-2.3)	1.1(0.6-1.5)	1.0 (0.5-1.5)	0.1(-0.7-0.9)	0.833
	Child (5-17 years)	2.7(1.6-3.7)	1.1(0.6-1.7)	2.9(2.2-3.6)	4.6(3.5-5.7)	2.1(1.4-2.8)	3.4(2.8-4)	-1.4(-2.3-0.4)	0.006
	Young Adult (18-34 years)	3.3(2.7-3.9)	4.3(3.2-5.4)	5.2(4.7-5.7)	6.9(5.6-8.2)	3.6(3.0-4.1)	5.6(5.1-6)	-2(-2.7-1.3)	< 0.001
	Adult (35-59 years)	3.1(2.7-3.5)	3.4(2.7-4.2)	11.3(10.5-12.2)	9.6(7.4-11.9)	3.2(2.8-3.6)	11.1(10.3-11.9)	-7.9(-8.7-7.1)	< 0.001
	Older Adult (>60 years)	4.4(3.7-5.2)	4.1(2.8-5.4)	16.6(14.1-19.1)	15.1(9.3-20.9)	4.4(3.7-5)	16.4(14.1-18.7)	-12(-13.8-10.3)	< 0.001

Values are mean with 95% Confidence Interval (Mean (95% CI)). MD = Mean Difference between non-traumatic and non-traumatic values.

† Independent sample t-test between participants with non-traumatic and traumatic amputation.

1 participant; ## 2 participants

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Table 2. Distribution by sex and age of persons presenting with traumatic and non-traumatic amputations

		Non-Traumatic A	nputation	Traumatic Ampu	tation	Ratio traumatic:1 non-traumatic amputation	P value†	Total		Grand Total
		Male	Female	Male	Female			Male	Female	Total
Country	Age Group	N(R% C%)	N(R% C%)	N(R% C%)	N(R% C%)			N(R% C%)	N(R% C%)	N(C%)
Overall	Total	5481(72.5)	2075(27.5)	18636(89.2)	2254(10.8)	2.76	<0.001	24117(84.8)	4329(15.2)	28446
	Young Child (<5 years)	19(57.6 0.3)	14(42.4 0.7)	99(58.9 0.5)	69(41.1 3.1)	5.09	0.885	118(58.7 0.5)	83(41.3 1.9)	201(0.7)
	Child (5-17 years)	168(54.2 3.1)	142(45.8 6.8)	1748(77.8 9.4)	500(22.2 22.2)	7.25	< 0.001	1916(74.9 7.9)	642(25.1 14.8)	2558(9.0)
	Young Adult (18-34 years)	753(70.6 13.7)	314(29.4 15.1)	8373(91.3 44.9)	799(8.7 35.4)	8.60	< 0.001	9126(89.1 37.8)	1113(10.9 25.7)	10239(36)
	Adult (35-59 years)	2433(72.0 44.4)	948(28.0 45.7)	7047(90.8 37.8)	711(9.2 31.5)	2.29	< 0.001	9480(85.1 39.3)	1659(14.9 38.3)	11139(39.2
	Older Adult (>60 years)	2108(76.2 38.5)	657(23.8 31.7)	1369(88.7 7.3)	175(11.3 7.8)	0.56	< 0.001	3477(80.7 14.4)	832(19.3 19.2)	4309(15.1)
Afghanistan	Total	1344(67.8)	638(32.2)	9261(89.2)	1121(10.8)	8.50	<0.001	10605(85.8)	1759(14.2)	12364
0	Young Child (<5 years)	9(64.3 0.7)	5(35.7 0.8)	67(56.3 0.7)	52(43.7 4.6)	10.82	0.568	76(57.1 0.7)	57(42.9 3.2)	133(1.1)
	Child (5-17 years)	88(55.7 6.5)	70(44.3 11.0)	1356(79.3 14.6)	354(20.7 31.6)	16.43	< 0.001	1444(77.3 13.6)	424(22.7 24.1)	1868(15.1)
	Young Adult (18-34 years)	226(65.9 16.8)	117(34.1 18.3)	5239(93.0 56.6)	395(7.0 35.2)	3.18	< 0.001	5465(91.4 51.5)	512(8.6 29.1)	5977(48.3)
	Adult (35-59 years)	468(62.0 34.8)	287(38.0 45)	2139(89.0 23.1)	265(11.0 23.6)	0.72	< 0.001	2607(82.5 24.6)	552(17.5 31.4)	3159(25.5)
	Older Adult (>60 years)	553(77.7 41.1)	159(22.3 24.9)	460(89.3 5)	55(10.7 4.9)	10.39	< 0.001	1013(82.6 9.6)	214(17.4 12.2)	1227(9.9)
Cambodia	Total	142(70.0)	61(30.0)	1861(88.2)	248(11.8)	7.60	< 0.001	2003(86.6)	309(13.4)	2312
	Young Child (<5 years)	2(100 1.4)		4(66.7 0.2)	2(33.3 0.8)	12.41	0.346	6(75.0 0.3)	2(25.0 0.6)	8(0.3)
	Child (5-17 years)	3(30.0 2.1)	7(70.0 11.5)	53(69.7 2.8)	23(30.3 9.3)	14.82	0.013	56(65.1 2.8)	30(34.9 9.7)	86(3.7)
	Young Adult (18-34 years)	36(70.6 25.4)	15(29.4 24.6)	551(87.0 29.6)	82(13.0 33.1)	3.66	0.001	587(85.8 29.3)	97(14.2 31.4)	684(29.6)
	Adult (35-59 years)	58(73.4 40.8)	21(26.6 34.4)	1069(91.3 57.4)	102(8.7 41.1)	2.05	< 0.001	1127(90.2 56.3)	123(9.8 39.8)	1250(54.1)
	Older Adult (>60 years)	43(70.5 30.3)	18(29.5 29.5)	184(82.5 9.9)	39(17.5 15.7)	6.33	0.038	227(79.9 11.3)	57(20.1 18.4)	284(12.3)
Iraq	Total	829(72.4)	316(27.6)	2127(90.7)	219(9.3)	13.24	<0.001	2956(84.7)	535(15.3)	3491
	Young Child (<5 years)	1(33.3 0.1)	2(66.7 0.6)	12(63.2 0.6)	7(36.8 3.2)	2.22	0.329	13(59.1 0.4)	9(40.9 1.7)	22(0.6)
	Child (5-17 years)	14(50.0 1.7)	14(50.0 4.4)	122(77.7 5.7)	35(22.3 16.0)	0.38	0.002	136(73.5 4.6)	49(26.5 9.2)	185(5.3)
	Young Adult (18-34 years)	43(68.3 5.2)	20(31.7 6.3)	756(90.6 35.5)	78(9.4 35.6)	3.32	< 0.001	799(89.1 27.0)	98(10.9 18.3)	897(25.7)
	Adult (35-59 years)	376(74.0 45.4)	132(26.0 41.8)	1043(92.5 49.0)	84(7.5 38.4)	2.00	< 0.001	1419(86.8 48.0)	216(13.2 40.4)	1635(46.8)
	Older Adult (>60 years)	395(72.7 47.6)	148(27.3 46.8)	194(92.8 9.1)	15(7.2 6.8)	4.34	< 0.001	589(78.3 19.9)	163(21.7 30.5)	752(21.5)
Myanmar	Total	908(74.5)	311(25.5)	3726(92.0)	322(8.0)	3.41	<0.001	4634(88.0)	633(12.0)	5267
	Young Child (<5 years)	1(50.0 0.1)	1(50.0 0.3)	2(50.0 0.1)	2(50.0 0.6)	0.84	1.000	3(50.0 0.1)	3(50.0 0.5)	6(0.1)
	Child (5-17 years)	12(41.4 1.3)	17(58.6 5.5)	93(73.8 2.5)	33(26.2 10.2)	0.67	0.001	105(67.7 2.3)	50(32.3 7.9)	155(2.9)
	Young Adult (18-34 years)	111(81.0 12.2)	26(19.0 8.4)	1249(92.0 33.5)	109(8.0 33.9)	1.67	< 0.001	1360(91.0 29.3)	135(9 21.3)	1495(28.4)
	Adult (35-59 years)	484(74.0 53.3)	170(26.0 54.7)	2081(93.4 55.9)	147(6.6 45.7)	2.11	< 0.001	2565(89.0 55.4)	317(11.0 50.1)	2882(54.7)
	Older Adult (>60 years)	300(75.6 33)	97(24.4 31.2)	301(90.7 8.1)	31(9.3 9.6)	1.51	< 0.001	601(82.4 13)	128(17.6 20.2)	729(13.8)
Sudan	Total	2258(75.1)	749(24.9)	1661(82.8)	344(17.2)	0.25	<0.001	3919(78.2)	1093(21.8 .)	5012
	Young Child (<5 years)	6(50.0 0.3)	6(50.0 0.8)	14(70.0 0.8)	6(30.0 1.7)	2.76	0.258	20(62.5 0.5)	12(37.5 1.1)	32(0.6)
	Child (5-17 years)	51(60.0 2.3)	34(40.0 4.5)	124(69.3 7.5)	55(30.7 16)	5.09	0.136	175(66.3 4.5)	89(33.7 8.1)	264(5.3)
	Young Adult (18-34 years)	337(71.2 14.9)	136(28.8 18.2)	578(81.1 34.8)	135(18.9 39.2)	7.25	< 0.001	915(77.2 23.3)	271(22.8 24.8)	1186(23.7)
	Adult (35-59 years)	1047(75.6 46.4)	338(24.4 45.1)	715(86.4 43)	113(13.6 32.8)	8.60	< 0.001	1762(79.6 45)	451(20.4 41.3)	2213(44.2)
	Older Adult (>60 years)	817(77.7 36.2)	235(22.3 31.4)	230(86.8 13.8)	35(13.2 10.2)	2.29	0.001	1047(79.5 26.7)	270(20.5 24.7)	1317(26.3)

Values are number of participants (row % | column %). Row% relates to sex distribution. Column% relates to age distribution.

† Chi Square tests between participants by sex and cause (non-traumatic/ traumatic amputation).

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 Table 2 shows that children under 18 attending were represented in low proportions (between 3 and 5.9%) in all countries except Afghanistan (2001 [16.2%] of 12364). Sudan had the highest proportion of PwA attending in ages over 60 (1317 [26.3%] of 5012). Most males entering rehabilitation were of working age (18–59 years) with 2677 (68.3%) of 3919 in Sudan, 2218 (75.0%) of 2956 in Iraq, 8072 (76.1%) of 10605 in Afghanistan, 3925 (84.7%) of 4634 in Myanmar, and 1714 (85.6%) of 2003 in Cambodia. Among women, the working age group (18–59 years) constituted 314 (58.7%) of 535 in Iraq, 1064 (60.5%) of 1759 in Afghanistan, 722 (66.1%) of 1093 in Sudan, 220 (71.2%) of 309 in Cambodia, and 452 (71.4%) of 633 in Myanmar. The proportion of males accessing

rehabilitation was higher in all age groups except children under five in Myanmar (3 [50.0%] of 6). Even in older age groups (>60 years) there was a significant male versus female majority (3477 [80.7%] of 4309) across all countries, relating to traumatic and non-traumatic causes. The majority of users with non-traumatic amputation were aged under 60 years, 3373 (61.5%) of 5481 male and 1418 (68.3%) of 2075 female PwA.

Most PwA reportedly came from rural environment (17202 [60.5%] of 28446; 1996 [7%] unspecified). There was a significantly higher proportion of women (1742 [18.8%] of 9248) in the urban compared to the rural population, (2308 [13.4%] of 17202; p<0.01). Figure 1 illustrates how the registered causes of amputation were categorized. Most amputations were of traumatic origin, 20890 [73.4%] of 28466 (table 3).

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Table 3. Distribution of Amputation Causes by Categories and in Detail, by Country¹

		All count	All countries					Cambodia			
		Total N	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)	
T	otal	28446	24117(84.8)	4329(15.2)	12364()	10605(85.8)	1759(14.2)	2312()	2003(86.6)	309(13.4)	
	Non-trauma	7556	5481(72.5 22.7)	2075(27.5 47.9)	1982(16.0)	1344(67.8 12.7)	638(32.2 36.3)	203(8.8)	142(70.0 7.1)	61(30.0 19.7)	
	Trauma	20890	18636(89.2 77.3)	2254(10.8 52.1)	10382(84.0)	9261(89.2 87.3)	1121(10.8 63.7)	2109(91.2)	1861(88.2 92.9)	248(11.8 80.3)	
C	auses by Sub-Categories										
	Non-trauma NCD/T2D	6999	5114(73.1 21.2)	1885(26.9 43.5)	1750(14.2)	1190(68.0 11.2)	560(32.0 31.8)	192(8.3)	134(69.8 6.7)	58(30.2 18.8)	
	Non-trauma Other	557	367(65.9 1.5)	190(34.1 4.4)	232(1.9)	154(66.4 1.5)	78(33.6 4.4)	11(0.5)	8(72.7 0.4)	3(27.3 1)	
	Trauma Non-conflict Non- accident	1164	930(79.9 3.9)	234(20.1 5.4)	332(2.7)	255(76.8 2.4)	77(23.2 4.4)	320(13.8)	275(85.9 13.7)	45(14.1 14.6)	
ma	Trauma Non-conflict Accident	5925	5015(84.6 20.8)	910(15.4 21)	2245(18.2)	1872(83.4 17.7)	373(16.6 21.2)	501(21.7)	423(84.4 21.1)	78(15.6 25.2)	
rauma	Trauma Conflict Weapon	4482	3872(86.4 16.1)	610(13.6 14.1)	2658(21.5)	2261(85.1 21.3)	397(14.9 22.6)	87(3.8)	62(71.3 3.1)	25(28.7 8.1)	
Τ	Trauma Conflict Weapon contamination	9319	8819(94.6 36.6)	500(5.4 11.6)	5147(41.6)	4873(94.7 46.0)	274(5.3 15.6)	1201(51.9)	1101(91.7 55)	100(8.3 32.4)	
C	auses in Detail										
а	Infectious	3661	2618(71.5 10.9)	1043(28.5 24.1)	1205(9.7)	821(68.1 7.7)	384(31.9 21.8)	161(7)	117(72.7 5.8)	44(27.3 14.2)	
Non-trauma	Metabolic	148	115(77.7 0.5)	33(22.3 0.8)	137(1.1)	110(80.3 1.0)	27(19.7 1.5)				
tra	Vascular	3190	2381(74.6 9.9)	809(25.4 18.7)	408(3.3)	259(63.5 2.4)	149(36.5 8.5)	31(1.3)	17(54.8 0.8)	14(45.2 4.5)	
ö	Cancerous	511	344(67.3 1.4)	167(32.7 3.9)	204(1.6)	144(70.6 1.4)	60(29.4 3.4)	1(0.0)	1(100 0)		
z	Other – Non-Trauma	46	23(50.0 0.1)	23(50.0 0.5)	28(0.2)	10(35.7 0.1)	18(64.3 1)	10(0.4)	7(70.0 0.3)	3(30.0 1.0)	
	Animal bite	203	156(76.8 0.6)	47(23.2 1.1)	15(0.1)	14(93.3 0.1)	1(6.7 0.1)	16(0.7)	11(68.8 0.5)	5(31.3 1.6)	
	Crime	5	5(100 0)		3(0)	3(100 0)					
	Frost bite	48	46(95.8 0.2)	2(4.2 0)	37(0.3)	35(94.6 0.3)	2(5.4 0.1)				
	Other – Trauma	908	723(79.6 3.0)	185(20.4 4.3)	277(2.2)	203(73.3 1.9)	74(26.7 4.2)	304(13.1)	264(86.8 13.2)	40(13.2 12.9)	
	Domestic accident	1388	1019(73.4 4.2)	369(26.6 8.5)	825(6.7)	557(67.5 5.3)	268(32.5 15.2)	52(2.2)	45(86.5 2.2)	7(13.5 2.3)	
	Occupational accident	1191	1096(92.0 4.5)	95(8.0 2.2)	379(3.1)	363(95.8 3.4)	16(4.2 0.9)	93(4)	79(84.9 3.9)	14(15.1 4.5)	
_	Railway accident	227	183(80.6 0.8)	44(19.4 1.0)	10(0.1)	9(90.0 0.1)	1(10.0 0.1)	3(0.1)	2(66.7 0.1)	1(33.3 0.3)	
rauma	RTA	3044	2648(87.0 11.0)	396(13.0 9.1)	1024(8.3)	936(91.4 8.8)	88(8.6 5.0)	349(15.1)	294(84.2 14.7)	55(15.8 17.8)	
raı	Sport accident	75	69(92.0 0.3)	6(8.0 0.1)	7(0.1)	7(100 0.1)		4(0.2)	3(75.0 0.1)	1(25.0 0.3)	
Γ	Blast injury	2319	1980(85.4 8.2)	339(14.6 7.8)	1383(11.2)	1131(81.8 10.7)	252(18.2 14.3)	15(0.6)	11(73.3 0.5)	4(26.7 1.3)	
	GSW	1834	1628(88.8 6.8)	206(11.2 4.8)	1157(9.4)	1037(89.6 9.8)	120(10.4 6.8)	28(1.2)	23(82.1 1.1)	5(17.9 1.6)	
	Other – Conflict	273	218(79.9 0.9)	55(20.1 1.3)	88(0.7)	68(77.3 0.6)	20(22.7 1.1)	25(1.1)	12(48.0 0.6)	13(52.0 4.2)	
	No data [*]	56	46(82.1 0.2)	10(17.9 0.2)	30(0.2)	25(83.3 0.2)	5(16.7 0.3)	19(0.8)	16(84.2 0.8)	3(15.8 1.0)	
	Cluster Munitions	71	69(97.2 0.3)	2(2.8 0)	38(0.3)	37(97.4 0.3)	1(2.6 0.1)	11(0.5)	11(100 0.5)		
	ERW	248	233(94.0 1.0)	15(6.0 0.3)	208(1.7)	197(94.7 1.9)	11(5.3 0.6)	1(0)	1(100 0)		
	Landmines	9000	8517(94.6 35.3)	483(5.4 11.2)	4901(39.6)	4639(94.7 43.7)	262(5.3 14.9)	1189(51.4)	1089(91.6 54.4)	100(8.4 32.4)	

¹the reader is directed to fig. 1 when interpreting this table

Page	15	of	26
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		Iraq			Myanmar			Sudan		
		Total N(C%) Male N(R				Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)
To	otal	3491()	2956(84.7)	535(15.3)	5267()	4634(88.0)	633(12.0)	5012()	3919(78.2)	1093(21.8)
	Non-trauma	1145(32.8)	829(72.4 28)	316(27.6 59.1)	1219(23.1)	908(74.5 19.6)	311(25.5 49.1)	3007(60.0)	2258(75.1 57.6)	749(24.9 68.5)
	Trauma	2346(67.2)	2127(90.7 72)	219(9.3 40.9)	4048(76.9)	3726(92.0 80.4)	322(8.0 50.9)	2005(40.0)	1661(82.8 42.4)	344(17.2 31.5)
Ca	auses by Sub-Categories									
	Non-trauma NCD/T2D	1084(31.1)	790(72.9 26.7)	294(27.1 55.0)	1138(21.6)	846(74.3 18.3)	292(25.7 46.1)	2835(56.6)	2154(76.0 55.0)	681(24.0 62.3)
	Non-trauma Other	61(1.7)	39(63.9 1.3)	22(36.1 4.1)	81(1.5)	62(76.5 1.3)	19(23.5 3)	172(3.4)	104(60.5 2.7)	68(39.5 6.2)
	Trauma Non-conflict Non-	l ì í								
~	accident	32(0.9)	29(90.6 1)	3(9.4 0.6)	76(1.4)	60(78.9 1.3)	16(21.1 2.5)	404(8.1)	311(77.0 7.9)	93(23.0 8.5)
rauma	Trauma Non-conflict Accident	525(15)	446(85 15.1)	79(15 14.8)	1689(32.1)	1469(87.0 31.7)	220(13.0 34.8)	965(19.3)	805(83.4 20.5)	160(16.6 14.6)
raı	Trauma Conflict Weapon	1075(30.8)	978(91 33.1)	97(9.0 18.1)	83(1.6)	77(92.8 1.7)	6(7.2 0.9)	579(11.6)	494(85.3 12.6)	85(14.7 7.8)
-	Trauma Conflict Weapon									
	contamination	714(20.5)	674(94.4 22.8)	40(5.6 7.5)	2200(41.8)	2120(96.4 45.7)	80(3.6 12.6)	57(1.1)	51(89.5 1.3)	6(10.5 0.5)
Ca	auses in Detail									
a	Infectious	367(10.5)	260(70.8 8.8)	107(29.2 20.0)	542(10.3)	387(71.4 8.4)	155(28.6 24.5)	1386(27.7)	1033(74.5 26.4)	353(25.5 32.3)
E	Metabolic				11(0.2)	5(45.5 0.1)	6(54.5 0.9)			
on-trauma	Vascular	717(20.5)	530(73.9 17.9)	187(26.1 35.0)	585(11.1)	454(77.6 9.8)	131(22.4 20.7)	1449(28.9)	1121(77.4 28.6)	328(22.6 30)
Ū	Cancerous	60(1.7)	38(63.3 1.3)	22(36.7 4.1)	74(1.4)	57(77.0 1.2)	17(23.0 2.7)	172(3.4)	104(60.5 2.7)	68(39.5 6.2)
Z	Other – Non-Trauma	1(0)	1(100 0)	**	7(0.1)	5(71.4 0.1)	2(28.6 0.3)			
	Infectious	4(0.1)	3(75 0.1)	1(25.0 0.2)	20(0.4)	13(65.0 0.3)	7(35.0 1.1)	148(3.0)	115(77.7 2.9)	33(22.3 3.0)
	Crime	2(0.1)	2(100 0.1)							
	Frost bite	6(0.2)	6(100 0.2)		3(0.1)	3(100 0.1)		2(0)	2(100 0.1)	
	Other – Trauma	20(0.6)	18(90.0 0.6)	2(10.0 0.4)	53(1)	44(83.0 0.9)	9(17.0 1.4)	254(5.1)	194(76.4 5)	60(23.6 5.5)
	Domestic accident	83(2.4)	66(79.5 2.2)	17(20.5 3.2)	297(5.6)	259(87.2 5.6)	38(12.8 6)	131(2.6)	92(70.2 2.3)	39(29.8 3.6)
	Occupational accident	102(2.9)	95(93.1 3.2)	7(6.9 1.3)	553(10.5)	499(90.2 10.8)	54(9.8 8.5)	63(1.3)	60(95.2 1.5)	3(4.8 0.3)
_	Railway accident	8(0.2)	6(75 0.2)	2(25.0 0.4)	164(3.1)	129(78.7 2.8)	35(21.3 5.5)	42(0.8)	37(88.1 0.9)	5(11.9 0.5)
rauma	RTA	325(9.3)	272(83.7 9.2)	53(16.3 9.9)	637(12.1)	546(85.7 11.8)	91(14.3 14.4)	709(14.1)	600(84.6 15.3)	109(15.4 10)
rau	Sport accident	7(0.2)	7(100 0.2)		38(0.7)	36(94.7 0.8)	2(5.3 0.3)	19(0.4)	16(84.2 0.4)	3(15.8 0.3)
-	Blast injury	844(24.2)	770(91.2 26)	74(8.8 13.8)	17(0.3)	15(88.2 0.3)	2(11.8 0.3)	60(1.2)	53(88.3 1.4)	7(11.7 0.6)
-	GSW	144(4.1)	130(90.3 4.4)	14(9.7 2.6)	60(1.1)	56(93.3 1.2)	4(6.7 0.6)	445(8.9)	382(85.8 9.7)	63(14.2 5.8)
	Other – Conflict	85(2.4)	76(89.4 2.6)	9(10.6 1.7)	4(0.1)	4(100 0.1)		71(1.4)	58(81.7 1.5)	13(18.3 1.2)
	No data [*]	2(0.1)	2(100 0.1)		2(0)	2(100 0)		3(0.1)	1(33.3 0)	2(66.7 0.2)
	Cluster Munitions	2(0.1)	2(100 0.1)		6(0.1)	6(100 0.1)		14(0.3)	13(92.9 0.3)	1(7.1 0.1)
	ERW	38(1.1)	34(89.5 1.2)	4(10.5 0.7)	1(0)	1(100 0)		l `		
	Landmine	674(19.3)	638(94.7 21.6)	36(5.3 6.7)	2193(41.6)	2113(96.4 45.6)	80(3.6 12.6)	43(0.9)	38(88.4 1.0)	5(11.6 0.5)

Categories of amputation causes as illustrated in figure 1 and detailed causes in totals, by sex and by country. Values are number of participants (row % | column%). Row% relates to sex distribution. Column% relates to amputation cause distribution. RTA = road traffic accident; GSW = Gunshot wound; ERW = explosive remnants of war; no data = missing variable (mandatory entry in database) due to software error in the category 'Trauma Conflict Weapon'.

Among all men, 18636 (77.3%) of 24117 had traumatic amputations. Among all women, 2254 (52.1%) of 4329 had traumatic amputation. Sudan had the highest proportion of non-traumatic amputations, 3007 (60.0%) of 5012, outnumbering traumatic amputations across both sexes and had an overall higher female representation of 1093 (21.8%) of 5012 compared to the remaining countries. Despite the high numbers of conflict-related amputation in the overall cohort, 1885 (43.5%) of 4329 females and 5114 (21.2%) of 24117 males presented with a likely T2D related amputation. One third (9319 [32.8%] of 28466) of the overall cohort attended with amputation caused by weapon-contamination. RTA constituted 3044 (10.7%) of all amputation causes. Blast injury caused 2319 (8.2%) and gunshot wound (GSW) 1834 (6.4%) of all amputations. More than half of all men presented with conflict-related traumatic amputations, 12691 (52.7%) of 24117, landmines alone constituted 8571 (35.3%) of all males' amputations. Within women, traumatic amputations were evenly distributed between conflict and nonconflict related (1110 [25.7%] and 1144 [26.4%] of 4329, respectively). Landmines caused 483 (11.2%), RTA 396 (9.1%) and domestic accidents 369 (8.5%) of all females' amputations. Proportions of men compared to women were significantly higher in most traumatic causes. This was even more pronounced in conflict-related causes and highest for landmines, 8517 (94.6%) of 9000. Female proportions compared to men were highest in traumatic amputations caused by animal bite and domestic accident with 47 (23.2%) of 203 and 369 (26.6%) of 1388 respectively. In Myanmar, weapon-contamination caused 2200 (41.8%) of 5267 amputations, in Afghanistan 5147 (41.6%) of 12364, in Iraq 714 (20.5%) of 3491, in Sudan 57 (1.1%) of 5012 and in post-conflict Cambodia 1201 (51.9%) of 2312. Table 4 illustrates amputation characteristics by combinations and levels. Multiple amputations were present in 2014 (8.4%) of 24117 men and 337 (7.8%) of 4329 women. Double LEA was the most common combination occurring in 1575 (6.5%) men and 293 (6.8%) women and more likely in persons with traumatic amputations (1566 [7.5%] of 20890) compared to those with non-traumatic amputations (302 [4.0%] of 7556). In total, 30943 amputations were registered, of which 15399 (49.8%) were transtibial, 8080 (26.1%) transfemoral, 1973 (6.4%) transradial, 1866 (6.0%) partial foot and 1078 (3.5%) transhumeral. Of all non-traumatic amputations, 7680 (98.0% of 7835) were LEA, the majority transtibial (5008 [63.9%]), whereas 2613 (12.0% of 19182) of all traumatic amputations occurred in the upper extremity.

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Table 4. Amputation charasteristics - Combinations and levels of amputation

		All Amputations			Non-Traumatic Amputations			Traumatic Amputations			
Сог	nbinations of amputation(s)	Total SU (C%)	Male N (R% C%)	Female N (R% C%)	Total (C%)	Male N(R% C%)	Female N(R% C%)	Total (C%)	Male N(R% C%)	Female N(R% C%)	
	Total SU	28446	24117 (84.8)	4329 (15.2)	7556(0)	5481(72.5 0)	2075(27.5 0)	20890(0)	18636(89.2 0)	2254(10.8 0)	
	SU with single LEA	22693 (79.8)	19152 (84.4 79.4)	3541 (15.6 81.8)	7049(93.3)	5122(72.7 93.5)	1927(27.3 92.9)	15644(74.9)	14030(89.7 75.3)	1614(10.3 71.6)	
	SU with single UEA	3402 (12.0)	2951 (86.7 12.2)	451 (13.3 10.4)	177(2.3)	110(62.1 2.0)	67(37.9 3.2)	3225(15.4)	2841(88.1 15.2)	384(11.9 17.0)	
	SU with double LEA	1868 (6.6)	1575 (84.3 6.5)	293 (15.7 6.8)	302(4.0)	225(74.5 4.1)	77(25.5 3.7)	1566(7.5)	1350(86.2 7.2)	216(13.8 9.6)	
	SU with double UEA	157 (0.6)	149 (94.9 0.6)	8 (5.1 0.2)	6(0.1)	6(100 0.1)		151(0.7)	143(94.7 0.8)	8(5.3 0.4)	
	SU with single LEA + single UEA	195 (0.7)	177 (90.8 0.7)	18 (9.2 0.4)	15(0.2)	13(86.7 0.2)	2(13.3 0.1)	180(0.9)	164(91.1 0.9)	16(8.9 0.7)	
	SU with double LEA + single UEA	92 (0.3)	80 (87.0 0.3)	12 (13.0 0.3)	3(0)	3(100 0.1)		89(0.4)	77(86.5 0.4)	12(13.5 0.5)	
	SU with single LEA + double UEA	24 (0.1)	22 (91.7 0.1)	2 (8.3 0)	2(0)	1(50 0)	1(50 0)	22(0.1)	21(95.5 0.1)	1(4.5 0)	
	SU with double LEA + double UEA	15 (0.1)	11 (73.3 0)	4 (26.7 0.1)	2(0)	1(50 0)	1(50 0)	13(0.1)	10(76.9 0.1)	3(23.1 0.1)	
Lev	els of amputation(s)	tion(s) Total Amp (C%)		Amp in female SU	Total Amp	Amp in male SU	Amp in female SU	Total Amp	Amp in male SU	Amp in female SU	
	Total amputations	30943	26255 (84.8)	4688 (15.2)	7835	5694 (72.7 0)	2141 (27.3 0)	21795	19384 (88.9 0)	2411 (11.1 0)	
	Total LEA amputations	26862(86.8)	22683(84.4 86.4)	4179(15.6 89.1)	7680(98.0)	5594(72.8 98.2)	2086(27.2 97.4)	19182(88.0)	17089(89.1 88.2)	2093(10.9 86.8)	
	Partial foot amputations	1866(6.0)	1374(73.6 5.2)	492(26.4 10.5)	333(4.3)	241(72.4 4.2)	92(27.6 4.3)	1533(7.0)	1133(73.9 5.8)	400(26.1 16.6)	
	Ankle disarticulations	432(1.4)	349(80.8 1.3)	83(19.2 1.8)	117(1.5)	79(67.5 1.4)	38(32.5 1.8)	315(1.4)	270(85.7 1.4)	45(14.3 1.9)	
	Transtibial amputations	15399(49.8)	13017(84.5 49.6)	2382(15.5 50.8)	5008(63.9)	3665(73.2 64.4)	1343(26.8 62.7)	10391(47.7)	9352(90.0 48.2)	1039(10.0 43.1)	
	Knee disarticulations/										
	Transcondylar amputations	887(2.9)	759(85.6 2.9)	128(14.4 2.7)	164(2.1)	128(78 2.2)	36(22 1.7)	723(3.3)	631(87.3 3.3)	92(12.7 3.8)	
	Transfemoral amputations	8080(26.1)	7019(86.9 26.7)	1061(13.1 22.6)	1983(25.3)	1430(72.1 25.1)	553(27.9 25.8)	6097(28)	5589(91.7 28.8)	508(8.3 21.1)	
	Hip disarticulation/										
	Hemipelvectomy	198(0.6)	165(83.3 0.6)	33(16.7 0.7)	75(1.0)	51(68 0.9)	24(32 1.1)	123(0.6)	114(92.7 0.6)	9(7.3 0.4)	
	Total UEA amputations	4081(13.2)	3572(87.5 13.6)	509(12.5 10.9)	155(2.0)	100(64.5 1.8)	55(35.5 2.6)	2613(12.0)	2295(87.8 11.8)	318(12.2 13.2)	
	Partial hand amputations	322(1.0)	258(80.1 1.0)	64(19.9 1.4)	21(0.3)	12(57.1 0.2)	9(42.9 0.4)	124(0.6)	94(75.8 0.5)	30(24.2 1.2)	
	Wrist disarticulations	436(1.4)	393(90.1 1.5)	43(9.9 0.9)	11(0.1)	8(72.7 0.1)	3(27.3 0.1)	417(1.9)	378(90.6 2.0)	39(9.4 1.6)	
	Transradial amputations	1973(6.4)	1762(89.3 6.7)	211(10.7 4.5)	37(0.5)	23(62.2 0.4)	14(37.8 0.7)	820(3.8)	731(89.1 3.8)	89(10.9 3.7)	
	Elbow disarticulations	151(0.5)	131(86.8 0.5)	20(13.2 0.4)	9(0.1)	6(66.7 0.1)	3(33.3 0.1)	139(0.6)	123(88.5 0.6)	16(11.5 0.7)	
	Transhumeral amputations	1078(3.5)	927(86 3.5)	151(14.0 3.2)	66(0.8)	42(63.6 0.7)	24(36.4 1.1)	1004(4.6)	877(87.4 4.5)	127(12.6 5.3)	
	Shoulder disarticulations	121(0.4)	101(83.5 0.4)	20(16.5 0.4)	11(0.1)	9(81.8 0.2)	2(18.2 0.1)	109(0.5)	92(84.4 0.5)	17(15.6 0.7)	

Values are number of participants and number of amputations, respectively (row % | column %). Row% relates to sex distribution. Column% relates to amputation characteristic distribution. SU = service user; LEA = lower extremity amputation; UEA = upper extremity amputation

DISCUSSION

Traumatic amputation at young adult age has devastating effects on a person's private and professional perspectives. A worrying finding in this study was the delay between amputation and beginning rehabilitation, particularly for those with traumatic amputation, (mean 8.2 years). Ideally, prosthetic fitting happens right after wound healing. Any delay will increase functional limitations and the potential of complications.²⁰ Consequently, duration, costs and complexity of rehabilitation will rise, including prosthetic adjustments. In cases of irreversible limitations PwA may no longer qualify for fitting.⁵ The studied countries are marked either by protracted crisis with recurring flares of acute fighting or post-conflict with weak economy and fragile health systems.¹⁷ These factors result in high numbers of PwA, who face access difficulties to rehabilitation aggravated by compromised infrastructure and security, lack of means or awareness, and critical scarcity or overload of existing rehabilitation workforce and services.^{4,21,22}

The later age observed for non-traumatic amputation is not surprising, but the average age of 48.2 years is very low compared to studies in HIC reporting ages of over 65.^{1,23} Amputations at young age as a complication of underlying health conditions such as T2D reflect the many health system challenges in the studied countries.²⁴ Although this group attends rehabilitation significantly faster than the traumatic group, the delay (mean 3 years) is still considerable and potentially harmful in view of the risks associated with immobility in poorly managed T2D. The difference in delay between the traumatic and non-traumatic cohorts may be explained by the widespread lack of essential healthcare services during past conflict (e.g. Cambodia). This may have led to high mortality rates in persons with conditions like T2D. PwA of traumatic origin may have survived long enough to eventually attend rehabilitation, after years of unavailability or inaccessibility of services. This could explain the considerable backlog of persons with traumatic amputations. A steadfast interpretation of detailed delays is impossible owing to the extremely complex conflict history and uncertain service provision in the studied contexts including displaced populations, persons of a specific ethnicity or with a political or military past unable to cross certain combat zones. What we know for sure is that an amputation at working age and delayed prosthetic fitting and rehabilitation - not counting the unknown numbers of non-attendees - feed into the vicious cycle of disability and poverty, increasing the difficulties PwA face when it comes to reintegrating into society in these contexts.^{22,25}

The proportions of non-traumatic and traumatic amputations are reversed compared to non-conflict countries and disclose the human cost of protracted crises.^{23,26} Amputations as a result of explosive devices lead to complex injuries.^{4,9} Patient outcomes depend on the availability and capacity of specialised emergency and surgical care if the effects of polytraumas are handled optimally. Subject to the extent of injury and the firearm used, amputations from GSW may also be an indicator of delayed trauma- and general poor health-care. In remote areas injured people may reach medical assistance only at a stage when the affected limb can no longer be saved. Furthermore, amputation being less timeconsuming and risky than limb salvage may be indicated to assist higher numbers of people.^{27,28} A person with traumatic amputation needs to cope with the sudden loss when

Page 19 of 26

BMJ Open

 adapting to a life with permanent disability. Rehabilitation outcomes depend on the complexity of polytraumas. The psychological consequences and post-traumatic repercussions, are considerable after traumatic amputation and require specialised multidisciplinary care.^{9,25,29}

Afghanistan, Cambodia and Iraq rank among the most mine-contaminated countries worldwide, (data from Myanmar are unavailable).³⁰ Survivors with amputations from weapon-contamination symbolise the long-term consequences of conflict, which may last for decades and continue producing injuries and disability long after the end of active fighting. Cambodia's almost 30 years of conflict, for instance, ended in 1998. Between 2009 and 2018 more than half of all new registrations attending rehabilitation were male PwA caused by landmines exemplifying the sustained destructive potential of conflict on a society.

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. Likewise, most infections causing non-traumatic amputations were assumed to result from undiagnosed or undocumented T2D with infected ulcer and gangrene.¹² PwA due to T2D in fragile settings are a highly vulnerable group. The amputation will be the consequence of a progressing chronic illness, which might be diagnosed only at the time of complication and which the person will have to cope with on top of the limb loss. If diagnosed, the person's understanding of their health status and its implications for lifestyle changes will be crucial. The risk of complications is considerable as the 39–68% five years mortality rate of diabetic foot shows.³¹

In conflict countries, the comprehensive care required for conditions like T2D is challenged by lack of availability, affordability and access to inter-professional services for diagnosis and long-term management. It is also compromised by the environment as living in displacement and depending on aid do not facilitate the necessary lifestyle adaptations, such as diet and exercise. Deprioritisation of NCD-care in crisis settings in order to address immediate trauma and prevent epidemics puts T2D patients at higher risk of neglect.¹² The consequences of the rocketing prevalence of T2D worldwide are exacerbated in conflict, of which, furthermore, many currently occur in regions such as the Eastern Mediterranean with an increased burden of T2D.^{11,32} Regaining functionality through active rehabilitation may be more demanding compared to someone with traumatic amputation due to age and general health differences between both populations. The fitting process will be more complicated due to the remaining limb's shape and consistency. Complex chronic conditions require a kind of rehabilitation that PRCs in conflict zones may not be organized for.

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. Improved NCD management on primary healthcare level is the first step.³³

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.

The peak of amputation among young adult males and the significant majority of male PwA may be explained by ongoing conflict in most contexts. There is consensus in the literature that worldwide more males than females undergo amputation, but the distribution differs according to age and cause.^{1,34,35} Especially during active age and regardless of conflict, rates are higher in men due to work- or leisure-related accidents.^{26,36} Despite a similar T2D prevalence among sexes, T2D-related amputation rates are higher among men due to higher prevalence of smoking, peripheral vascular disease, neuropathy and diabetic foot ulceration.¹ For certain groups a gender dimension may influence access to rehabilitation. Higher female than male proportions are reported for older persons with traumatic amputations which are unlikely due to combat or occupational risk.^{35,36} This is in contrast to the significant male majority in our study population. Also, our findings revealed that in urban environments, and in contrast to men, female PwA attending rehabilitation constitute a significantly larger proportion than in rural environments. Access barriers to services for women from more remote rural areas may exist such as challenging infrastructure, poverty, insecurity, and cultural factors and warrant further investigation.³⁷

The main limitation of this study is that data is derived from ICRC PRCs only and therefore not representative of population. However, in absence of amputation incidence data this first multi-country analysis offers a unique insight into the population of rehabilitation users with amputations in fragile contexts including (ex-)combatants and civilians of all ages with amputations of all origins. As the data does not represent prevalence, but attendance to rehabilitation, it is difficult to estimate how many PwA do not receive services. Where existing, data was compared to published prevalence studies from similar contexts. The dearth of quality publications in such contexts underlines the mismatch between existing research and where the burden of disease is.¹⁰

CONCLUSION

 This study highlights the persisting burden of amputation in conflict contexts and the consequences of broken health systems and a fragmented continuum of care. Young age and long delays to rehabilitation reveal the hardship in which PwAs live in such settings. The figures of landmine-caused amputations disclose the cruel long-term dimension of conflict. Rehabilitation services are seriously under-resourced as revealed in a recent publication on global estimates of rehabilitation needs.³⁸ Our data have been collected in highly challenging and diverse settings where even basic healthcare is compromised. Providing rehabilitation and collecting data in these underserved, volatile contexts is exceptionally complex.¹⁴ The few PRCs in conflict settings cater for amputations of various causes and PwA of different age, sex, other trauma and co-morbidities including psychological after-effects and future prospects of life with amputation. This requires tailored approaches matched with outcome and impact measurements. Managing these highly diverse processes is the responsibility of a multidisciplinary rehabilitation team including peer-support by other PwA – an enormous challenge in settings with so many needs and so little resources.

 Preventive measures on all levels of healthcare are essential to reduce the number of T2D-caused amputations. Rather than solely managing amputations as the last consequence,
PRCs should get increasingly involved in provision of comprehensive care.
We call out to rehabilitation service providers and healthcare professionals for a stronger and prompt involvement of rehabilitation professionals in all levels of NCD/T2D management. In addition, it is crucial that future research identifies and tests efficient, innovative, context-adapted best practice models including service provision and impact measurement to address the mismatch of rehabilitation needs and resources in fragile settings.

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COMPETING INTERESTS

None declared

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CONTRIBUTORSHIP STATEMENT

All six authors contributed to planning, conduct and reporting of the study.

Specific additional contributions are as follows:

Cornelia A. Barth: literature research, data acquisition and analysis, conception and design, data interpretation

Andreas Wladis: conception and design, data interpretation

Catherine Blake: conception and design, data analysis and interpretation

Sigiriya Aebischer Perone: literature research, data interpretation

Prashant Bhandarkar: data tabulation, analysis and interpretation

Cliona O'Sullivan: literature research, conception and design, data interpretation

DATA AVAILABILITY STATEMENT

All relevant data are included in the tables of this study.

Due to the sensitive nature of this data, data sharing is subject to regulations of ICRC data protection policy.

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Legend for figure 1

All 21 variables on the right are as they appear in mandatory dropdown lists of the database. The database distinguishes between (i) traumatic and all other causes; (ii) conflict-related and all other traumatic causes; (iii) weapon-contamination and all other conflict-related causes; all additional categories were created based on the original 21 variables. NCD/T2D = cause likely linked to non-communicable disease (NCD) or type 2 diabetes mellitus (T2D) complications; RTA= road traffic accident; GSW= Gunshot wound; No data = software error; ERW= explosive remnants of war

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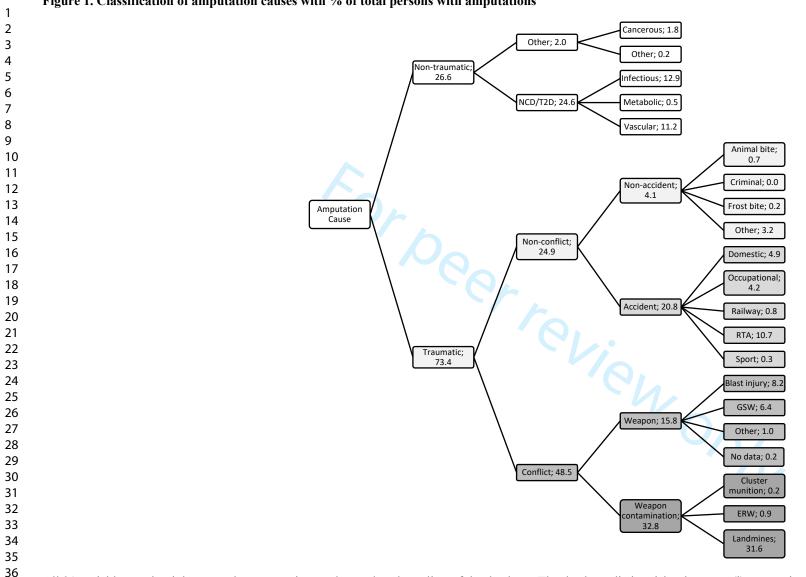


Figure 1. Classification of amputation causes with % of total persons with amputations

All 21 variables on the right are as they appear in mandatory dropdown lists of the database. The database distinguishes between (i) traumatic and all other causes; (ii) conflict-related and all other traumatic causes; (iii) weapon-contamination and all other conflict-related causes; all additional categories were created based on the original 21 variables. NCD/T2D = cause likely linked to non-communicable disease (NCD) or type 2 diabetes mellitus (T2D) complications; RTA= road traffic accident; GSW= Gunshot wound; No data = software error; ERW= explosive remnants of war

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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

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Primary Subject Heading :	Rehabilitation medicine
Secondary Subject Heading:	Global health, Epidemiology, Health services research
Keywords:	REHABILITATION MEDICINE, TRAUMA MANAGEMENT, DIABETES & ENDOCRINOLOGY, EPIDEMIOLOGY, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, PUBLIC HEALTH





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3 4	1	TITLE
5	2	Retrospective observational study of characteristics of persons with amputations accessing
6 7	3	International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and
7 8 9	4	post-conflict countries
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6 7	3	International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and
8	4	post-conflict countries
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10 11	5	ABSTRACT
12	6	Objectives : Limb amputation incidence is particularly high in fragile contexts due to conflict,
13	7	accidents and poorly managed diabetes. The study aim was to analyse i) demographic and
14 15	8	amputation characteristics of persons with any type of acquired amputation (PwA) and ii)
15 16	9	time between amputation and first access to rehabilitation in five countries.
17	5	
18	10	Design: A retrospective, observational study analyzing differences in demographic and
19 20	11	clinical factors and time to access rehabilitation between users with traumatic and non-
21	12	traumatic amputations.
22 23	13	Setting: Five countries with the highest numbers of PwA in the global ICRC database
23 24	14	(Afghanistan, Cambodia, Iraq, Myanmar, Sudan). Cleaned and merged data from 2009-2018
25	15	were aggregated by sex; age at amputation and registration; cause, combination and
26	16	anatomical level of amputation(s); living environment.
27 28	10	
29	17	Participants: all PwA newly attending rehabilitation.
30	18	Results: Data for 28446 individuals were included (4329 [15.2%] female). Most were
31 32	19	traumatic amputations (73.4%, 20890); of these, 48.6% (13801) were conflict related.
33	20	Average age at traumatic amputation for men and women was 26.9 and 24.1 years
34	21	respectively; for non-traumatic amputation it was 49.1 years and 45.9 years respectively. Sex
35 36	22	differences in age were statistically significant for traumatic and non-traumatic causes
37	23	(p<0.001, p=0.003). Delay between amputation and rehabilitation was on average 8.2 years
38	24	for those with traumatic amputation, significantly higher than an average 3 years for those
39 40	25	with non-traumatic amputation (p<0.001).
40 41	25	
42	26	Conclusions : Young age for traumatic and non-traumatic amputations indicates the
43	27	devastating impact of war and fragile health systems on a society. Long delays between
44 45	28	amputation and rehabilitation reveal the mismatch of needs and resources. For
46	29	rehabilitation service providers in fragile settings, it is an enormous task to manage the
47	30	diversity of PwA of various causes, age, sex and additional conditions. Improved
48 49	31	collaboration between primary healthcare, surgical and rehabilitation services, a
50	32	prioritisation of rehabilitation and increased resource provision are recommended to ensure
51	33	comprehensive care for PwA.
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2 3	1	STRENGTHS AND LIMITATIONS OF THIS STUDY
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5	2	• To our knowledge, this is the first large multi-country study on a highly vulnerable and
6 7	3	neglected group of persons with amputations seeking rehabilitation in contexts of
8	4	conflict and post conflict.
9	5	 Data originate from exceptionally challenging and diverse settings where providing
10 11	6	rehabilitation and collecting data is complex and constantly challenged by the volatility
12	7	of the environment.
13	8	Limitations include that data are derived from ICRC supported structures only and
14 15	9	cannot make statements on overall population or on persons not attending services
15 16	10	cumor make statements on overall population of on persons not attemany services
17	11	
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19 20	12	KEYWORDS
20	13	Rehabilitation
22	13 14	Armed Conflicts
23	15	Amputation
24 25	16	Delivery of Health Care
26	17	Diabetes Complications
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3 4	1	INTRODUCTION
5	2	Limb amputation is a life-changing event. Global incidence studies reveal a substantial lack of
6 7	3	data from fragile contexts such as conflict-affected or low- and middle-income countries
8	4	(LMICs), but research has shown that amputation incidence is higher in populations with low
9	5	economic and educational status. This results in limited access to healthcare, even in high
10 11	6	income countries (HIC). ^{1–3} People in fragile contexts are particularly at risk of amputation
12	7	and many of them will have to cope without prosthetic care. ^{4,5} Appropriate rehabilitation
13	8	and assistive technology (AT) have the potential to greatly diminish disability and allow the
14 15	9	person to lead an independent, functional life. It requires the availability of comprehensive,
16	10	costly and lifelong services, which is an enormous challenge in such environments.
17	11	Rehabilitation services should span from early physiotherapy to prosthetic fitting,
18 19	12	psychosocial support and social reintegration measures. A lower extremity amputation (LEA)
20	13	requires prosthetic renewal every three years, for children every six months. ⁶
21	14	The World Health Assembly's 2018 resolution on improving access to AT and the 2021
22 23	15	resolution on the highest attainable standard of health for persons with disabilities indicate
23 24	16	the many shortcomings and the need for increased recognition in this field. ^{5,7}
25	17	Access to appropriate rehabilitation and AT as a human right is integral to the Convention on
26	18	the Rights of Persons with Disabilities, a fact that resulted in publications discussing
27 28	19	implications, implementation and sobering reality-checks in numerous LMICs. ^{8–13}
29	20	Alarming needs and low supply are a well-known reality for global actors playing a key role in
30	21	advocating for and providing rehabilitation in fragile settings including the International
31 32	22	Committee of the Red Cross (ICRC), Humanity and Inclusion and the World Health
33	23	Organisation (WHO). Guidelines, training resources and advocacy papers by such actors,
34	24	often issued collectively, are specifically pointing out the importance and interdependence
35 36	25	of early rehabilitation, AT and rehabilitation across the continuum of care. ^{14–19}
30 37	26	As such initiatives address knowledge gaps in this neglected field, their global
38	27	implementation lags behind, even more so in countries of prolonged conflict or post-conflict
39	28	with fragile health systems and a deprioritisation of rehabilitation services. As a
40 41	29	consequence, there remains a lack of scientific papers on which to base further guideline
42	30	development and research. This starts with affected populations in the countries themselves
43	31	who remain largely unknown, contrary to the well-studied veterans from HIC who sustained
44 45	32	conflict-related amputations abroad. ^{20–22} Complex traumatic amputations and their sequalae
46	33	in conflict- and mine-affected areas are known to be a huge challenge. ^{4,23,24} Adding to this,
47	34	and with profound consequences, is the increasing global burden of type two diabetes
48 49	35	mellitus (T2D). ²⁵
49 50	36	Overstretched health systems, particularly in LMIC, lacking access to basic diabetic care and
51	37	high rates of undiagnosed T2D increase the risk and incidence of amputations. ²⁶ Road traffic
52	38	(RTA) and other accidents are an additional problem in countries with limited traffic and
53 54	39	occupational safety standards. ²⁷
55	40	Persons with amputations (PwA) constitute the biggest cohort of users accessing
56	41	rehabilitation services supported by the ICRC in conflict and post-conflict states. ²⁸ Assisting
57 58	42	conflict affected populations is at the centre of the ICRC's humanitarian mission and serving
59	43	mine victims with limb loss is a core activity since the launch of its physical rehabilitation
60	44	programme (PRP) in 1979. ^{29,30}

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3	1	Currently, the ICRC supports 152 rehabilitation structures in 35 countries offering
4 5	2	multidisciplinary rehabilitation services for persons with physical disabilities and capacity
6	3	building for rehabilitation workforce. With this support, 62172 persons worldwide were
7	4	fitted with prostheses in 2019. ²⁹ There is very little information on the characteristics of PwA
8	5	accessing rehabilitation in fragile contexts.
9 10	6	The overall aim of this study was to analyse characteristics of PwA accessing rehabilitation
11	7	services in five ICRC contexts in 2009-2018 to better understand the needs and deduce
12	8	implications for service provision. Specific aims were to explore differences in sex and age at
13	9	amputation, at registration for rehabilitation, time between amputation and registration
14 15	10	(delay), causes and characteristics of amputations.
16	10	(delay), causes and characteristics of amputations.
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19 20	13	METHODS
21	14	Design and setting
22	15	This retrospective observational study is an analysis of aggregated data. It reflects the
23 24	16	records of all PwA registered from 2009 to 2018 in ICRC-supported physical rehabilitation
24	17	centres (PRCs) in Afghanistan (n=7), Cambodia (n=2), Iraq (n=1), Myanmar (n= 5), and Sudan
26	18	(n= 2). Data were extracted from an ICRC-developed electronic database described in a
27	19	previous study. ²⁸ The five countries representing the highest numbers of PwA attending
28 29	20	PRCs were selected for this study, reflecting 92% of the total number of PwA in the
30	20	database. Besides post-conflict Cambodia, the countries represent contexts of protracted
31	22	crises and are classified by the World Bank as low-income (Afghanistan, Sudan), LMIC
32 33	23	(Cambodia, Myanmar), or upper middle-income (Iraq). ^{31,32} These differences are equally
33 34	23 24	reflected in other indicators as available from open source sites by the United Nations
35		
36	25	Development Programme and the WHO. ^{33,34}
37 38	26	Data reflect representative user populations in the studied countries to varying degrees
39	27	depending on presence of other rehabilitation providers, or data management difficulties.
40	28	All PRCs were located in urban areas.
41	29	
42 43	30	Participants
44	31	Participants include all persons with any type of acquired amputation newly attending for
45	32	prosthetic fitting. Excluded were persons attending with congenital limb loss.
46 47	33	
48	34	Data collection and management
49	35	Upon registration, demographic and clinical characteristics were captured as part of routine
50	36	documentation. The variables retrieved from the database were: country, sex, age at
51 52	37	registration and at amputation, living environment, cause, anatomic level and number of
53	38	amputation(s). PwA's living environment was subject to local definitions of the terms urban
54	39	or rural. The quantitative variables were cleaned, merged, disaggregated by sex and age and
55	40	organized into variables of interest.
56 57	41	Figure 1 lists the causes as retrieved from the database and shows how causes were
58	42	categorised into traumatic or non-traumatic. Traumatic causes were further sub-categorised
59	43	as non-conflict- or conflict-related. We examined non-conflict-related traumatic causes by
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 accidental such as RTA or non-accidental causes such as animal bite. Conflict-related ca were separated into caused by weapons or by weapon-contamination, which encompa the presence of mines, explosive remnants of war (ERW) and other sources of contamination.³⁵ The database offered four labels for non-traumatic causes: cancerous, infectious, meta or vascular. For analysis, these were merged, except cancer (merged with 'other'), and considered related to non-communicable diseases (NCD) notentially T2D 	sses bolic, f LEA We
 were separated into caused by weapons or by weapon-contamination, which encompa the presence of mines, explosive remnants of war (ERW) and other sources of contamination.³⁵ The database offered four labels for non-traumatic causes: cancerous, infectious, meta or vascular. For analysis, these were merged, except cancer (merged with 'other'), and 	sses bolic, f LEA We
 the presence of mines, explosive remnants of war (ERW) and other sources of contamination.³⁵ The database offered four labels for non-traumatic causes: cancerous, infectious, meta or vascular. For analysis, these were merged, except cancer (merged with 'other'), and 	bolic, f LEA We
 ⁷ 4 contamination.³⁵ ⁸ 5 The database offered four labels for non-traumatic causes: cancerous, infectious, meta ⁹ 6 or vascular. For analysis, these were merged, except cancer (merged with 'other'), and 	f LEA We
 The database offered four labels for non-traumatic causes: cancerous, infectious, meta or vascular. For analysis, these were merged, except cancer (merged with 'other'), and 	f LEA We
$_{10}^{9}$ 6 or vascular. For analysis, these were merged, except cancer (merged with 'other'), and	f LEA We
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13 8 For amputation characteristics, male and female PWA were counted by combinations of	
14 9 and upper extremity amputations (UAE) and by non-traumatic versus traumatic causes.	nd
15 10 distinguished six levels of UEA and six levels of LEA counting number of amputations (and the second	
16 17 11 not persons) per level.	
18 12	
19 13 Data analysis	
²⁰ 14 The delay between amputation and registration to rehabilitation was calculated by	
 subtracting the self-reported amputation date from the registration date as noted on the 	ıe
23 16 user file.	
²⁴ 17 Age at registration was grouped into young child: under 5; child: 5–17; young adult: 18-	-34;
25	
26 18 adult. 35–39, older adult. over 60. Besides hving environment an selected variables we 27 19 mandatory for data entry. Where software issues led to missing data, these were labell	
28 20 'no data' in the tables.	
29 21 Data analysis comprised of descriptive statistics. The software nackages used were Mic	rosoft
 22 Office Excel 2016, R (version 3.6.1), R Studio for Windows (version 1.2.5001) and SPSS (I 32 23 SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). Categorical data weil 	
 ³³ 24 summarised as counts and percentages across rows (sex) and columns (groups). Age at 	
³⁴ 25 time of amputation registration and delay intervals were presented as means with 95%	
 25 confidence intervals. Differences between groups were assessed using Chi Square and 	
Mann-Whitney U tests. P values below 0.05 were considered statistically significant.	
38 28	
³⁹ 29 Potential bias	
 40 41 30 Data depended on the accuracy of self-report and recording of observations and 	
42 31 assessments by PRC staff with varying professional training and subject to interpretatio	n,
⁴³ 32 hereby presenting potential biases. Variables such as sex and age are deemed robust.	
44 22 Challenges exist when recording the cause of non-traumatic amputation presentations	as
 45 46 34 46 46 47 48 49 49 40 40 41 41 42 43 44 44 45 46 46 47 48 49 49 40 40 40 40 40 41 41 42 42 43 44 44 45 46 47 48 49 49 40 40 40 40 40 40 40 41 41 41 41 41 41 41 42 41 42 42 43 44 4	
 47 35 Unless a PwA checks in with externally confirmed T2D diagnosis, PRC staff rely on findir 	IS
$\frac{48}{10}$ 36 from their own assessment. They record non-traumatic causes as predefined in the	55
49	ic' or
 50 37 database, which does not one r2D as a stand-alone variable, but infectious, metabolicities 51 38 'vascular' presentations. Chronic, often unknown health conditions in the studied countries 	
52 39 lead to such presentations defined by PRC staff as amputation cause and are most likely	
⁵³ 40 related to NCD/T2D. ^{36–38} Considering the dimension and consequences of T2D prevalen	
⁵⁴ 41 we merged causes under this heading despite absence of confirmed diagnosis	
55 41 We merged causes under this heading despite absence of committee diagnosis. 56 42	
57 43 Ethical approval and data sharing	
⁵⁸ 44 Ethical exemption to conduct analysis on de-identified data was granted by the Swiss Et	hics
59	
₆₀ 45 Committee Geneva [Reference number: REQ-2019-00027]. Data sharing agreements	

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2 3	4	hat was the ICDC Light size University and University Callers Dublic was assessed by
4	1	between the ICRC, Linköping University and University College Dublin were approved by
5	2	each institution.
6	3	
7 8	4	Patient and public involvement
9	5	For this retrospective study of routinely collected data, patient involvement in study design
10	6	did not apply. However, consultation with key stakeholders (PRC managers and personnel
11	7	and ICRC expatriate staff) was conducted regarding study design and feasibility and
12 13	8	contextual analysis of findings. Interpretation of the data was based on these stakeholders'
14	9	profound understanding of the respective contexts. The main author presented and
15	10	discussed preliminary research results in an ongoing process, online and in person during
16	11	project visits where involved rehabilitation providers did and will continue to play an active
17 18	12	role in dissemination of the findings of this research.
10 19	13	
20	14	The methods used and findings from the study are reported in line with the GATHER
21	15	guidelines. ³⁹
22	16	guidelines.
23 24		
25	17	
26	18	RESULTS
27 28	19	PwA characteristics
20 29	20	A total of 28446 individual user files were analysed with 4329 (15.2%) female PwA. Most
30	21	data relate to Afghanistan (12364 [43.5%]), followed by Myanmar (5267 [18.5%]), Sudan
31	22	(5012 [17.6%]), Iraq (3491 [12.3%]), and Cambodia (2312 [8.1%]).
32 33	23	(3012 [17.070]), had (3431 [12.370]), and camboula (2312 [0.170]).
33 34	23 24	Age at time of amputation, age at registration, delay between amputation and registration
35		
36	25	Average age for traumatic amputation was 26.9 years in male, 24.1 years in female. For non-
37 38	26	traumatic amputation it was 49.1 years in male, 45.9 years in female PwA. Average delay
39	27	was significantly shorter in the non-traumatic group with 3 years compared to 8.2 years for
40	28	those with traumatic amputation, (Table 1, Figure 2). In all countries, delay was lowest in
41	29	young children (0.0–2.5 years) and highest for males over 60 with traumatic amputations
42 43	30	(16.6–22.5 years), except for Afghanistan (10.5 years for males aged 35–59 and 10.3 years
44	31	for those over 60).
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1 Table 1. Age at time of amputation, age at registration, delay between amputation and registration

		umatic Amputation		matic Amputation			Total – by		1	
Country Variables	Male	Female	P value†	Male	Female	P value†	Non-Trauma	Trauma	MD (95% CI)	P value
Total	Mean (9			Mean (9			Mean (9			
Age at amputation	49.1(48.6-49.6)	45.9(45.1-46.7)	< 0.001	26.9(26.7-27.1)	24.1(23.3-24.8)	< 0.001	48.2(47.8-48.6)	26.6(26.4-26.8)	21.7(21.3-22.1)	<0.0
Age at registration	52.2(51.8-52.7)	48.6(47.8-49.4)	< 0.001	35.2(35-35.4)	31.6(30.9-32.3)	< 0.001	51.2(50.8-51.6)	34.8(34.6-35)	16.4(16.0-16.9)	<0.0
Delay all PwAs (y)	3.2(3.0-3.4)	2.7(2.4-3)	0.009	8.3(8.1-8.4)	7.5(7.1-8)	0.119	3.0(2.9-3.2)	8.2(8-8.3)	-5.1(-5.4-4.9)	<0.0
Delay by PwA age group (age at registration)										
Young child (<5 y)	0.9(0.4-1.4)	1.3(0.8-1.8)	0.200	0.9(0.7-1.1)	1.0 (0.7-1.2)	0.745	1.1(0.7-1.4)	0.9(0.8-1.1)	0.1(-0.3-0.6)	0.3
Child (5-17 y)	2.2(1.6-2.8)	2.2(1.5-2.8)	0.563	2.0 (1.9-2.2)	3.9(3.5-4.3)	< 0.001	2.2(1.8-2.6)	2.4(2.3-2.6)	-0.3(-0.7-0.2)	0.0
Young Adult (18-34 y)	3.2(2.8-3.6)	3.1(2.5-3.7)	0.987	3.8(3.6-3.9)	7.2(6.6-7.8)	< 0.001	3.1(2.8-3.5)	4.1(3.9-4.2)	-0.9(-1.3-0.5)	0.0
Adult (35-59 y)	2.9(2.7-3.2)	2.6(2.1-3)	0.022	13.7(13.4-14)	9.9(9-10.8)	< 0.001	2.8(2.6-3.1)	13.3(13.1-13.6)	-10.5(-10.9-10.1)	<0.0
Older Adult (>60 y)	3.5(3.1-3.9)	3(2.3-3.7)	0.071	16.9(16-17.7)	12.1(9.9-14.4)	< 0.001	3.4(3.1-3.7)	16.3(15.5-17.1)	-12.9(-13.7-12.2)	<0.0
Afghanistan										
Age at amputation	48.8(46.2-51.4)	42.7(39.4-46)	< 0.001	24.8(24.3-25.3)	20.6(19.4-21.8)	< 0.001	46.8(44.8-48.9)	24.3(23.9-24.8)	22.5(21.7-23.2)	<0.0
Age at registration	50.3(49.2-51.3)	44.0 (42.5-45.4)	< 0.001	29.7(29.4-30)	26.6(25.6-27.6)	< 0.001	48.3(47.4-49.1)	29.4(29.1-29.7)	18.9(18.1-19.6)	<0.0
Delay all PwAs (y)	1.6(1.3-1.9)	1.3(1.0-1.6)	0.318	4.9(4.8-5.1)	6.0 (5.5-6.6)	< 0.001	1.5(1.2-1.7)	5.0 (4.9-5.2)	-3.6(-4.0-3.2)	<0.0
Delay by PwA age group (age at registration)										
Young child (<5 y)	0.5(-0.2-1.2)	1.3(0.3-2.2)	0.214	0.9(0.6-1.1)	0.9(0.6-1.2)	0.829	0.8(0.2-1.3)	0.9(0.7-1.1)	-0.1(-0.8-0.5)	0.0
Child (5-17 y)	1.1(0.6-1.7)	1.6(0.8-2.4)	0.948	1.8(1.6-2.0)	3.9(3.4-4.4)	< 0.001	1.3(0.9-1.8)	2.2(2.1-2.4)	-0.9(-1.5-0.3)	<0.
Young Adult (18-34 y)	3.0(2.2-3.8)	2.1(1.2-2.9)	0.827	3.1(2.9-3.2)	7.8(6.9-8.7)	< 0.001	2.7(2.0-3.3)	3.4(3.2-3.5)	-0.7(-1.4-0.1)	<0.0
Adult (35-59 y)	1.4(0.9-1.9)	1(0.6-1.4)	0.551	10.5(10.0-11.0)	7.6(6.2-9.0)	< 0.001	1.2(0.9-1.6)	10.1(9.7-10.6)	-8.9(-9.8-8.0)	<0.0
Older Adult (>60 y)	1.3(0.7-1.8)	1.1(0.3-1.9)	0.781	10.3(9.1-11.6)	4.6(2.3-6.8)	0.004	1.2(0.8-1.7)	9.7(8.5-10.9)	-8.5(-9.6-7.4)	<0.0
Cambodia	````´	, , ,		· · · · ·	· · ·			· · · · · ·	, , , , , , , , , , , , , , , , , , , ,	
Age at amputation	46(38.5-53.6)	41.6(31.1-52.0)	0.189	28.6(27.2-29.9)	31.3(27.3-35.3)	0.100	44.7(38.6-50.8)	28.9(27.6-30.2)	15.8(13.7-17.9)	<0.
Age at registration	48.9(45.9-51.9)	45.3(40.3-50.3)	0.235	42.7(42.0-43.3)	40.3(38-42.7)	0.006	47.8(45.2-50.4)	42.4(41.8-43.0)	5.4(3.2-7.6)	<0.
Delay all PwAs (y)	2.9(1.8-4.0)	3.8(1.5-6.1)	0.285	14.0 (13.4-14.6)	9.3(7.8-10.8)	< 0.001	3.2(2.2-4.2)	13.4(12.9-14.0)	-10.2(-12.0-8.5)	<0.
Delay by PwA age group (age at registration)	· · · · · · · · · · · · · · · · · · ·	, , , , , , , , , , , , , , , , , , ,		· · · · · · · · · · · · · · · · · · ·	<u>, </u>			· · · · · · · · · · · · · · · · · · ·		
Young child (<5 y)	2.5(1.5-3.5)##			1.0 (0.2-1.8)	0.0(0.0-0.0)##	0.267	2.5(1.5-3.5)	0.7(0.0-1.3)	1.8(0.2-3.4)	0.0
Child (5-17 y)	9.5(-5.2-24.2)	4.6(0.4-8.7)	0.500	3.1(1.7-4.4)	3.7(1.3-6.2)	0.685	5.7(1.4-9.9)	3.2(2.1-4.4)	2.4(-1.2-6.0)	0.
Young Adult (18-34 y)	4.3(2.0-6.6)	3.9(-0.1-7.8)	0.991	4.7(4.1-5.3)	6.2(4.2-8.1)	0.938	4.2(2.2-6.1)	4.9(4.3-5.5)	-0.7(-2.9-1.5)	0.4
Adult (35-59 y)	3.2(1.2-5.1)	3.1(0.4-5.8)	0.213	18.6(17.9-19.3)	10.9(8.7-13.2)	< 0.001	3.1(1.5-4.8)	17.9(17.2-18.5)	-14.7(-17.2-12.2)	<0.0
Older Adult (>60 y)	1.2(0.0.3-2)	4.3(-1.9-10.6)	0.785	19.7(17.7-21.7)	15.2(9.9-20.5)	0.021	2.1(0.1-4.1)	18.9(17-20.8)	-16.8(-20.5-13.1)	<0.
Iraq	``````````````````````````````````````	, , , ,		, , , , , , , , , , , , , , , , , , , ,	· · · · ·			, , ,		
Age at amputation	54.4(50.7-58.2)	53.9(48-59.9)	0.826	26.8(25.7-28.0)	25.6(22.2-29.0)	0.023	54.3(51.2-57.5)	26.7(25.6-27.8)	27.6(26.6-28.6)	<0.
Age at registration	56.6(55.7-57.6)	55.3(53.5-57.1)	0.541	39.1(38.5-39.8)	33.6(31.3-35.8)	< 0.001	56.3(55.4-57.1)	38.6(38-39.2)	17.7(16.6-18.7)	<0.
Delay all PwAs (y)	2.2(1.8-2.7)	1.7(1-2.3)	0.007	12.3(11.8-12.8)	8.1(6.7-9.6)	< 0.001	2.1(1.7-2.4)	11.9(11.5-12.4)	-9.9(-10.6-9.1)	<0.
Delay by PwA age group (age at registration)	/ _ / _ / _ / _ / _ / _ / _ / _									
Young child (<5 y)	0.0(0.0-0.0)#	2.0(2.0-2.0)##	1.000	1.0 (0.4-1.6)	1.0(0.1-1.9)	0.961	1.0(-1.0-3.0)	1.0(0.5-1.5)	0(-1.7-1.7)	1.
Child (5-17 y)	4.1(1.2-7.1)	2.1(0-4.2)	0.285	2.9(2.2-3.5)	2.6(1.4-3.8)	0.756	3.1(1.3-5.0)	2.8(2.2-3.4)	0.3(-1.3-1.9)	0.3
Young Adult (18-34 y)	3.8(1.8-5.7)	1.3(0.2-2.3)	0.044	5.7(5.2-6.2)	7.6(5.5-9.7)	0.595	3.0(1.6-4.4)	5.9(5.4-6.3)	-2.8(-4.7-1.0)	<0.

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Adult (35-59 y)	2.0(1.5-2.6)	1.4(0.7-2.1)	0.268	16.7(16-17.4)	11.0(8.1-13.9)	< 0.001	1.9(1.4-2.3)	16.3(15.6-17.0)	-14.4(-15.5-13.3)	<(
Older Adult (>60 y)	2.2(1.5-2.8)	1.9(0.8-3.0)	0.043	21.2(19.1-23.2)	10.9(5.2-16.5)	0.008	2.1(1.6-2.7)	20.4(18.4-22.4)	-18.3(-19.8-16.8)	<
Myanmar										
Age at amputation	46.7(43.7-49.8)	47.4(42.2-52.7)	0.069	29.6(28.6-30.5)	28.0 (25-31.1)	0.015	46.9(44.3-49.5)	29.4(28.5-30.3)	17.5(16.6-18.3)	<
Age at registration	52.0(51.0-52.9)	51.8(50-53.6)	0.615	40.7(40.3-41.2)	38.3(36.6-40)	0.006	51.9(51.1-52.8)	40.5(40.1-40.9)	11.4(10.5-12.3)	<
Delay all PwAs (y)	5.3(4.8-5.8)	4.3(3.4-5.3)	<.001	11.2(10.8-11.5)	10.3(9.0-11.6)	0.007	5.0 (4.6-5.5)	11.1(10.8-11.5)	-6.1(-6.7-5.4)	<
Delay by PwA age group (age at registration)										
Young child (<5 y)	$1.0(1.0-1.0)^{\#}$	2.0(2.0-2.0)#	1.000	2.0 (2.0-2.0)##	2.5(1.0.5-3.5)##	0.667	1.5(0.5-2.5)	2.3(1.8-2.7)	-0.8(-2.1-0.6)	
Child (5-17 y)	4.5(2.3-6.7)	5.6(3.0-8.2)	0.879	2.4(1.8-3.1)	3.9(2.5-5.3)	0.073	5.1(3.4-6.9)	2.8(2.2-3.4)	2.3(0.8-3.8)	
Young Adult (18-34 y)	2.6(2.0-3.2)	2.5(0.9-4.0)	0.278	4.5(4.2-4.8)	6.1(4.6-7.5)	0.713	2.6(2-3.2.0)	4.6(4.3-4.9)	-2(-3.0-1.1)	
Adult (35-59 y)	4.7(4.1-5.3)	4.3(2.9-5.6)	0.001	13.9(13.5-14.4)	13.1(11.0-15.1)	0.092	4.6(4.0-5.2)	13.9(13.4-14.3)	-9.3(-10.2-8.4)	<
Older Adult (>60 y)	7.3(6.0-8.5)	4.8(2.8-6.8)	0.014	22.5(20.9-24.1)	19.3(13.2-25.3)	0.072	6.7(5.6-7.7)	22.2(20.7-23.8)	-15.6(-17.4-13.7)	<
Sudan										
Age at amputation	48.5(46.5-50.5)	45(41.8-48.2)	< 0.001	30.5(29.1-32)	25.9(23.1-28.6)	< 0.001	47.6(45.9-49.3)	29.7(28.4-31.1)	17.9(16.9-18.9)	<
Age at registration	52.1(51.4-52.7)	48.7(47.4-50)	< 0.001	39.7(38.9-40.5)	34(32.2-35.9)	< 0.001	51.2(50.6-51.8)	38.7(38.0-39.5)	12.5(11.5-13.4)	<
Delay all PwAs (y)	3.6(3.3-4.0)	3.7(3.1-4.3)	0.053	9.2(8.7-9.8)	8.2(7.1-9.3)	0.525	3.6(3.3-3.9)	9.1(8.6-9.6)	-5.4(-6.0-4.9)	<
Delay by PwA age group (age at registration)										
Young child (<5 y)	1.0(0.5-1.5)	1.2(0.4-2.0)	0.699	0.8(0.2-1.5)	1.3(0.4-2.3)	0.385	1.1(0.6-1.5)	1.0 (0.5-1.5)	0.1(-0.7-0.9)	
Child (5-17 y)	2.7(1.6-3.7)	1.1(0.6-1.7)	0.117	2.9(2.2-3.6)	4.6(3.5-5.7)	0.004	2.1(1.4-2.8)	3.4(2.8-4)	-1.4(-2.3-0.4)	
Young Adult (18-34 y)	3.3(2.7-3.9)	4.3(3.2-5.4)	0.004	5.2(4.7-5.7)	6.9(5.6-8.2)	0.013	3.6(3.0-4.1)	5.6(5.1-6)	-2(-2.7-1.3)	<
Adult (35-59 y)	3.1(2.7-3.5)	3.4(2.7-4.2)	0.064	11.3(10.5-12.2)	9.6(7.4-11.9)	0.047	3.2(2.8-3.6)	11.1(10.3-11.9)	-7.9(-8.7-7.1)	<
Older Adult (>60 y)	4.4(3.7-5.2)	4.1(2.8-5.4)	0.653	16.6(14.1-19.1)	15.1(9.3-20.9)	0.656	4.4(3.7-5)	16.4(14.1-18.7)	-12(-13.8-10.3)	<

Values are mean with 95% Confidence Interval (Mean (95% CI)). MD = Mean Difference between non-traumatic and non-traumatic values. л-u.

† Mann-Whitney U test between male and female participants

†† Mann-Whitney U test between participants with non-traumatic and traumatic amputation

5 y = years6

1 participant; ## 2 participants 7

BMJ Open

		Non-Traumatic A	mutation	Traumatic Ampu	tation	Ratio traumatic:1 non-traumatic amputation	P value†	Total		Grand Total	
		Male	Female	Male	Female			Male	Female	Tota	
Country	Age Group	N(R% C%)	N(R% C%)	N(R% C%)	N(R% C%)			N(R% C%)	N(R% C%)	N(C	
Overall	Total	5481(72.5)	2075(27.5)	18636(89.2)	2254(10.8)	2.76	<0.001	24117(84.8)	4329(15.2)	2844	
	Young Child (<5 y)	19(57.6 0.3)	14(42.4 0.7)	99(58.9 0.5)	69(41.1 3.1)	5.09	0.885	118(58.7 0.5)	83(41.3 1.9)	201(
	Child (5-17 y)	168(54.2 3.1)	142(45.8 6.8)	1748(77.8 9.4)	500(22.2 22.2)	7.25	< 0.001	1916(74.9 7.9)	642(25.1 14.8)	2558	
	Young Adult (18-34 y)	753(70.6 13.7)	314(29.4 15.1)	8373(91.3 44.9)	799(8.7 35.4)	8.60	< 0.001	9126(89.1 37.8)	1113(10.9 25.7)	1023	
	Adult (35-59 y)	2433(72.0 44.4)	948(28.0 45.7)	7047(90.8 37.8)	711(9.2 31.5)	2.29	< 0.001	9480(85.1 39.3)	1659(14.9 38.3)	1113	
	Older Adult (>60 y)	2108(76.2 38.5)	657(23.8 31.7)	1369(88.7 7.3)	175(11.3 7.8)	0.56	< 0.001	3477(80.7 14.4)	832(19.3 19.2)	4309	
Afghanistan	Total	1344(67.8)	638(32.2)	9261(89.2)	1121(10.8)	8.50	<0.001	10605(85.8)	1759(14.2)	1236	
	Young Child (<5 y)	9(64.3 0.7)	5(35.7 0.8)	67(56.3 0.7)	52(43.7 4.6)	10.82	0.568	76(57.1 0.7)	57(42.9 3.2)	133(
	Child (5-17 y)	88(55.7 6.5)	70(44.3 11.0)	1356(79.3 14.6)	354(20.7 31.6)	16.43	< 0.001	1444(77.3 13.6)	424(22.7 24.1)	1868	
	Young Adult (18-34 y)	226(65.9 16.8)	117(34.1 18.3)	5239(93.0 56.6)	395(7.0 35.2)	3.18	< 0.001	5465(91.4 51.5)	512(8.6 29.1)	5977	
	Adult (35-59 y)	468(62.0 34.8)	287(38.0 45)	2139(89.0 23.1)	265(11.0 23.6)	0.72	< 0.001	2607(82.5 24.6)	552(17.5 31.4)	3159	
	Older Adult (>60 y)	553(77.7 41.1)	159(22.3 24.9)	460(89.3 5)	55(10.7 4.9)	10.39	< 0.001	1013(82.6 9.6)	214(17.4 12.2)	1227	
Cambodia	Total	142(70.0)	61(30.0)	1861(88.2)	248(11.8)	7.60	< 0.001	2003(86.6)	309(13.4)	2312	
	Young Child (<5 y)	2(100 1.4)		4(66.7 0.2)	2(33.3 0.8)	12.41	0.346	6(75.0 0.3)	2(25.0 0.6)	8(0.3	
	Child (5-17 y)	3(30.0 2.1)	7(70.0 11.5)	53(69.7 2.8)	23(30.3 9.3)	14.82	0.013	56(65.1 2.8)	30(34.9 9.7)	86(3	
	Young Adult (18-34 y)	36(70.6 25.4)	15(29.4 24.6)	551(87.0 29.6)	82(13.0 33.1)	3.66	0.001	587(85.8 29.3)	97(14.2 31.4)	684(2	
	Adult (35-59 y)	58(73.4 40.8)	21(26.6 34.4)	1069(91.3 57.4)	102(8.7 41.1)	2.05	< 0.001	1127(90.2 56.3)	123(9.8 39.8)	1250	
	Older Adult (>60 y)	43(70.5 30.3)	18(29.5 29.5)	184(82.5 9.9)	39(17.5 15.7)	6.33	0.038	227(79.9 11.3)	57(20.1 18.4)	284(
Iraq	Total	829(72.4)	316(27.6)	2127(90.7)	219(9.3)	13.24	< 0.001	2956(84.7)	535(15.3)	3491	
	Young Child (<5 y)	1(33.3 0.1)	2(66.7 0.6)	12(63.2 0.6)	7(36.8 3.2)	2.22	0.329	13(59.1 0.4)	9(40.9 1.7)	22(0.	
	Child (5-17 y)	14(50.0 1.7)	14(50.0 4.4)	122(77.7 5.7)	35(22.3 16.0)	0.38	0.002	136(73.5 4.6)	49(26.5 9.2)	185(5	
	Young Adult (18-34 y)	43(68.3 5.2)	20(31.7 6.3)	756(90.6 35.5)	78(9.4 35.6)	3.32	< 0.001	799(89.1 27.0)	98(10.9 18.3)	897(2	
	Adult (35-59 y)	376(74.0 45.4)	132(26.0 41.8)	1043(92.5 49.0)	84(7.5 38.4)	2.00	< 0.001	1419(86.8 48.0)	216(13.2 40.4)	1635	
	Older Adult (>60 y)	395(72.7 47.6)	148(27.3 46.8)	194(92.8 9.1)	15(7.2 6.8)	4.34	< 0.001	589(78.3 19.9)	163(21.7 30.5)	752(2	
Myanmar	Total	908(74.5)	311(25.5)	3726(92.0)	322(8.0)	3.41	<0.001	4634(88.0)	633(12.0)	5267	
	Young Child (<5 y)	1(50.0 0.1)	1(50.0 0.3)	2(50.0 0.1)	2(50.0 0.6)	0.84	1.000	3(50.0 0.1)	3(50.0 0.5)	6(0.1	
	Child (5-17 y)	12(41.4 1.3)	17(58.6 5.5)	93(73.8 2.5)	33(26.2 10.2)	0.67	0.001	105(67.7 2.3)	50(32.3 7.9)	155(2	
	Young Adult (18-34 y)	111(81.0 12.2)	26(19.0 8.4)	1249(92.0 33.5)	109(8.0 33.9)	1.67	< 0.001	1360(91.0 29.3)	135(9 21.3)	1495	
	Adult (35-59 y)	484(74.0 53.3)	170(26.0 54.7)	2081(93.4 55.9)	147(6.6 45.7)	2.11	< 0.001	2565(89.0 55.4)	317(11.0 50.1)	2882	
	Older Adult (>60 y)	300(75.6 33)	97(24.4 31.2)	301(90.7 8.1)	31(9.3 9.6)	1.51	< 0.001	601(82.4 13)	128(17.6 20.2)	729(
Sudan	Total	2258(75.1)	749(24.9)	1661(82.8)	344(17.2)	0.25	<0.001	3919(78.2)	1093(21.8 .)	5012	
	Young Child (<5 y)	6(50.0 0.3)	6(50.0 0.8)	14(70.0 0.8)	6(30.0 1.7)	2.76	0.258	20(62.5 0.5)	12(37.5 1.1)	32(0.	
	Child (5-17 y)	51(60.0 2.3)	34(40.0 4.5)	124(69.3 7.5)	55(30.7 16)	5.09	0.136	175(66.3 4.5)	89(33.7 8.1)	264(
	Young Adult (18-34 y)	337(71.2 14.9)	136(28.8 18.2)	578(81.1 34.8)	135(18.9 39.2)	7.25	< 0.001	915(77.2 23.3)	271(22.8 24.8)	1186	
	Adult (35-59 y)	1047(75.6 46.4)	338(24.4 45.1)	715(86.4 43)	113(13.6 32.8)	8.60	< 0.001	1762(79.6 45)	451(20.4 41.3)	2213	
	Older Adult (>60 y)	817(77.7 36.2)	235(22.3 31.4)	230(86.8 13.8)	35(13.2 10.2)	2.29	0.001	1047(79.5)26.7)	270(20.5 24.7)	1317	

2 Values are number of participants (row % | column %). Row% relates to sex distribution. Column% relates to age distribution.

3 † Chi Square tests between participants by sex and cause (non-traumatic/ traumatic amputation).

y = years

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2 3		
5 4	1	Distribution by sex and age of persons presenting with traumatic and non-traumatic
5	2	amputations
6	3	Table 2 shows that children under 18 attending were represented in low proportions (3 -
7	4	5.9%) in all countries except Afghanistan (2001 [16.2%] of 12364). Sudan had the highest
8 9	5	proportion of PwA attending in ages over 60 (1317 [26.3%] of 5012).
, 10	6	Most men entering rehabilitation were of working age (18–59 years) ranging from 68.3%
11	7	(Sudan) to 85.6% (Cambodia) of total males. Among women, the working age group (18–59
12	8	years) constituted between 58.7% (Iraq) and 71.4% (Myanmar) of total females.
13 14	9	The proportion of males accessing rehabilitation was higher in all age groups except children
14	10	under five in Myanmar (3 [50.0%] of 6). Even in older age groups (>60 years) there was a
16	10	significant male versus female majority (3477 [80.7%] of 4309) across all countries, relating
17		
18	12	to traumatic and non-traumatic causes. The majority of users with non-traumatic
19 20	13	amputation were aged under 60 years, 3373 (61.5%) of 5481 male and 1418 (68.3%) of 2075
21	14	female PwA.
22	15	
23	16	Distribution of amputation causes by categories and in detail, by country
24 25	17	Figure 1 illustrates how the registered causes of amputation were categorized. Most
26	18	amputations were of traumatic origin, 20890 [73.4%] of 28466 (table 3).
27	19	Among all men, 18636 (77.3%) of 24117 had traumatic amputations. Among all women,
28	20	2254 (52.1%) of 4329 had traumatic amputation.
29	21	Sudan had the highest proportion of non-traumatic amputations, 3007 (60.0%) of 5012,
30 31	22	outnumbering traumatic amputations across both sexes and had an overall higher female
32	23	representation of 1093 (21.8%) of 5012 compared to the remaining countries.
33	24	Despite the high numbers of conflict-related amputation in the overall cohort, 1885 (43.5%)
34	25	of 4329 females and 5114 (21.2%) of 24117 males presented with a likely T2D related
35 36	26	amputation.
37	20	One third (9319 [32.8%] of 28466) of the overall cohort attended with amputation caused by
38		
39	28	weapon-contamination. RTA constituted 3044 (10.7%) of all amputation causes. Blast injury
40	29	caused 2319 (8.2%) and gunshot wound (GSW) 1834 (6.4%) of all amputations.
41 42	30	More than half of all men presented with conflict-related traumatic amputations, 12691
43	31	(52.7%) of 24117, landmines alone constituted 8571 (35.3%) of all males' amputations.
44	32	Within women, traumatic amputations were evenly distributed between conflict and non-
45	33	conflict related (1110 [25.7%] and 1144 [26.4%] of 4329, respectively). Landmines caused
46 47	34	483 (11.2%), RTA 396 (9.1%) and domestic accidents 369 (8.5%) of all females' amputations.
48	35	Proportions of men compared to women were significantly higher in most traumatic causes.
49	36	This was even more pronounced in conflict-related causes and highest for landmines, 8517
50	37	(94.6%) of 9000. In Myanmar, weapon-contamination caused 2200 (41.8%) of 5267
51 52	38	amputations, in Afghanistan 5147 (41.6%) of 12364, in Iraq 714 (20.5%) of 3491, in Sudan 57
52 53	39	(1.1%) of 5012 and in post-conflict Cambodia 1201 (51.9%) of 2312.
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Table 3. Distribution of amputation causes by categories and in detail, by country¹

		All countr	ries		Afghanistan			Cambodia		
		Total N	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)
To	otal	28446	24117(84.8)	4329(15.2)	12364()	10605(85.8)	1759(14.2)	2312()	2003(86.6)	309(13.4)
	Non-trauma	7556	5481(72.5 22.7)	2075(27.5 47.9)	1982(16.0)	1344(67.8 12.7)	638(32.2 36.3)	203(8.8)	142(70.0 7.1)	61(30.0 19.7)
	Trauma	20890	18636(89.2 77.3)	2254(10.8 52.1)	10382(84.0)	9261(89.2 87.3)	1121(10.8 63.7)	2109(91.2)	1861(88.2 92.9)	248(11.8 80.3)
Ca	auses by Sub-Categories									
	Non-trauma NCD/T2D	6999	5114(73.1 21.2)	1885(26.9 43.5)	1750(14.2)	1190(68.0 11.2)	560(32.0 31.8)	192(8.3)	134(69.8 6.7)	58(30.2 18.8)
	Non-trauma Other	557	367(65.9 1.5)	190(34.1 4.4)	232(1.9)	154(66.4 1.5)	78(33.6 4.4)	11(0.5)	8(72.7 0.4)	3(27.3 1)
_	Trauma Non-conflict Non- accident	1164	930(79.9 3.9)	234(20.1 5.4)	332(2.7)	255(76.8 2.4)	77(23.2 4.4)	320(13.8)	275(85.9 13.7)	45(14.1 14.6)
m	Trauma Non-conflict Accident	5925	5015(84.6 20.8)	910(15.4 21)	2245(18.2)	1872(83.4 17.7)	373(16.6 21.2)	501(21.7)	423(84.4 21.1)	78(15.6 25.2)
Trauma	Trauma Conflict Weapon	4482	3872(86.4 16.1)	610(13.6 14.1)	2658(21.5)	2261(85.1 21.3)	397(14.9)22.6)	87(3.8)	62(71.3 3.1)	25(28.7 8.1)
L	Trauma Conflict Weapon contamination	9319	8819(94.6 36.6)	500(5.4 11.6)	5147(41.6)	4873(94.7 46.0)	274(5.3 15.6)	1201(51.9)	1101(91.7 55)	100(8.3 32.4)
Ca	auses in Detail									
a	Infectious	3661	2618(71.5 10.9)	1043(28.5 24.1)	1205(9.7)	821(68.1 7.7)	384(31.9 21.8)	161(7)	117(72.7 5.8)	44(27.3 14.2)
um	Metabolic	148	115(77.7 0.5)	33(22.3 0.8)	137(1.1)	110(80.3 1.0)	27(19.7 1.5)		l	
tra	Vascular	3190	2381(74.6 9.9)	809(25.4 18.7)	408(3.3)	259(63.5 2.4)	149(36.5 8.5)	31(1.3)	17(54.8 0.8)	14(45.2 4.5)
Non-trauma	Cancerous	511	344(67.3 1.4)	167(32.7 3.9)	204(1.6)	144(70.6 1.4)	60(29.4 3.4)	1(0.0)	1(100 0)	
z	Other – Non-Trauma	46	23(50.0 0.1)	23(50.0 0.5)	28(0.2)	10(35.7 0.1)	18(64.3 1)	10(0.4)	7(70.0 0.3)	3(30.0 1.0)
	Animal bite	203	156(76.8 0.6)	47(23.2 1.1)	15(0.1)	14(93.3 0.1)	1(6.7 0.1)	16(0.7)	11(68.8 0.5)	5(31.3 1.6)
	Crime	5	5(100 0)		3(0)	3(100 0)				
	Frost bite	48	46(95.8 0.2)	2(4.2 0)	37(0.3)	35(94.6 0.3)	2(5.4 0.1)			
	Other – Trauma	908	723(79.6 3.0)	185(20.4 4.3)	277(2.2)	203(73.3 1.9)	74(26.7 4.2)	304(13.1)	264(86.8 13.2)	40(13.2 12.9)
	Domestic accident	1388	1019(73.4 4.2)	369(26.6 8.5)	825(6.7)	557(67.5 5.3)	268(32.5 15.2)	52(2.2)	45(86.5 2.2)	7(13.5 2.3)
	Occupational accident	1191	1096(92.0 4.5)	95(8.0 2.2)	379(3.1)	363(95.8 3.4)	16(4.2 0.9)	93(4)	79(84.9 3.9)	14(15.1 4.5)
-	Railway accident	227	183(80.6 0.8)	44(19.4 1.0)	10(0.1)	9(90.0 0.1)	1(10.0 0.1)	3(0.1)	2(66.7 0.1)	1(33.3 0.3)
Trauma	RTA	3044	2648(87.0 11.0)	396(13.0 9.1)	1024(8.3)	936(91.4 8.8)	88(8.6 5.0)	349(15.1)	294(84.2 14.7)	55(15.8 17.8)
raı	Sport accident	75	69(92.0 0.3)	6(8.0 0.1)	7(0.1)	7(100 0.1)		4(0.2)	3(75.0 0.1)	1(25.0 0.3)
L	Blast injury	2319	1980(85.4 8.2)	339(14.6 7.8)	1383(11.2)	1131(81.8 10.7)	252(18.2 14.3)	15(0.6)	11(73.3 0.5)	4(26.7 1.3)
	GSW	1834	1628(88.8 6.8)	206(11.2 4.8)	1157(9.4)	1037(89.6 9.8)	120(10.4 6.8)	28(1.2)	23(82.1 1.1)	5(17.9 1.6)
	Other – Conflict	273	218(79.9 0.9)	55(20.1 1.3)	88(0.7)	68(77.3 0.6)	20(22.7 1.1)	25(1.1)	12(48.0 0.6)	13(52.0 4.2)
	No data [*]	56	46(82.1 0.2)	10(17.9 0.2)	30(0.2)	25(83.3 0.2)	5(16.7 0.3)	19(0.8)	16(84.2 0.8)	3(15.8 1.0)
	Cluster Munitions	71	69(97.2 0.3)	2(2.8 0)	38(0.3)	37(97.4 0.3)	1(2.6 0.1)	11(0.5)	11(100 0.5)	
	ERW	248	233(94.0 1.0)	15(6.0 0.3)	208(1.7)	197(94.7 1.9)	11(5.3 0.6)	1(0)	1(100 0)	
	Landmines	9000	8517(94.6 35.3)	483(5.4 11.2)	4901(39.6)	4639(94.7 43.7)	262(5.3 14.9)	1189(51.4)	1089(91.6 54.4)	100(8.4 32.4)

¹the reader is directed to fig. 1 when interpreting this table

		Iraq			Myanmar			Sudan		
		Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%
To	otal	3491()	2956(84.7)	535(15.3)	5267()	4634(88.0)	633(12.0)	5012()	3919(78.2)	1093(21.8)
	Non-trauma	1145(32.8)	829(72.4 28)	316(27.6 59.1)	1219(23.1)	908(74.5 19.6)	311(25.5 49.1)	3007(60.0)	2258(75.1 57.6)	749(24.9 68.5)
	Trauma	2346(67.2)	2127(90.7 72)	219(9.3 40.9)	4048(76.9)	3726(92.0 80.4)	322(8.0 50.9)	2005(40.0)	1661(82.8 42.4)	344(17.2 31.5)
Ca	auses by Sub-Categories									
	Non-trauma NCD/T2D	1084(31.1)	790(72.9 26.7)	294(27.1 55.0)	1138(21.6)	846(74.3 18.3)	292(25.7 46.1)	2835(56.6)	2154(76.0 55.0)	681(24.0 62.3)
	Non-trauma Other	61(1.7)	39(63.9 1.3)	22(36.1 4.1)	81(1.5)	62(76.5 1.3)	19(23.5 3)	172(3.4)	104(60.5 2.7)	68(39.5 6.2)
	Trauma Non-conflict Non-									
-	accident	32(0.9)	29(90.6 1)	3(9.4 0.6)	76(1.4)	60(78.9 1.3)	16(21.1 2.5)	404(8.1)	311(77.0 7.9)	93(23.0 8.5)
m	Trauma Non-conflict Accident	525(15)	446(85 15.1)	79(15 14.8)	1689(32.1)	1469(87.0 31.7)	220(13.0 34.8)	965(19.3)	805(83.4 20.5)	160(16.6 14.6)
I rauma	Trauma Conflict Weapon	1075(30.8)	978(91 33.1)	97(9.0 18.1)	83(1.6)	77(92.8 1.7)	6(7.2 0.9)	579(11.6)	494(85.3 12.6)	85(14.7 7.8)
_	Trauma Conflict Weapon									
	contamination	714(20.5)	674(94.4 22.8)	40(5.6 7.5)	2200(41.8)	2120(96.4 45.7)	80(3.6 12.6)	57(1.1)	51(89.5 1.3)	6(10.5 0.5)
Ca	auses in Detail									
Ia	Infectious	367(10.5)	260(70.8 8.8)	107(29.2 20.0)	542(10.3)	387(71.4 8.4)	155(28.6 24.5)	1386(27.7)	1033(74.5 26.4)	353(25.5 32.3)
m	Metabolic				11(0.2)	5(45.5 0.1)	6(54.5 0.9)			
-ura	Vascular	717(20.5)	530(73.9 17.9)	187(26.1 35.0)	585(11.1)	454(77.6 9.8)	131(22.4 20.7)	1449(28.9)	1121(77.4 28.6)	328(22.6 30)
Non-trauma	Cancerous	60(1.7)	38(63.3 1.3)	22(36.7 4.1)	74(1.4)	57(77.0 1.2)	17(23.0 2.7)	172(3.4)	104(60.5 2.7)	68(39.5 6.2)
4	Other – Non-Trauma	1(0)	1(100 0)		7(0.1)	5(71.4 0.1)	2(28.6 0.3)			
	Infectious	4(0.1)	3(75 0.1)	1(25.0 0.2)	20(0.4)	13(65.0 0.3)	7(35.0 1.1)	148(3.0)	115(77.7 2.9)	33(22.3 3.0)
	Crime	2(0.1)	2(100 0.1)							
	Frost bite	6(0.2)	6(100 0.2)		3(0.1)	3(100 0.1)		2(0)	2(100 0.1)	
	Other – Trauma	20(0.6)	18(90.0 0.6)	2(10.0 0.4)	53(1)	44(83.0 0.9)	9(17.0 1.4)	254(5.1)	194(76.4 5)	60(23.6 5.5)
	Domestic accident	83(2.4)	66(79.5 2.2)	17(20.5 3.2)	297(5.6)	259(87.2 5.6)	38(12.8 6)	131(2.6)	92(70.2 2.3)	39(29.8 3.6)
	Occupational accident	102(2.9)	95(93.1 3.2)	7(6.9 1.3)	553(10.5)	499(90.2 10.8)	54(9.8 8.5)	63(1.3)	60(95.2 1.5)	3(4.8 0.3)
-	Railway accident	8(0.2)	6(75 0.2)	2(25.0 0.4)	164(3.1)	129(78.7 2.8)	35(21.3 5.5)	42(0.8)	37(88.1 0.9)	5(11.9 0.5)
I rauma	RTA	325(9.3)	272(83.7 9.2)	53(16.3 9.9)	637(12.1)	546(85.7 11.8)	91(14.3 14.4)	709(14.1)	600(84.6 15.3)	109(15.4 10)
rai	Sport accident	7(0.2)	7(100 0.2)		38(0.7)	36(94.7 0.8)	2(5.3 0.3)	19(0.4)	16(84.2 0.4)	3(15.8 0.3)
_	Blast injury	844(24.2)	770(91.2 26)	74(8.8 13.8)	17(0.3)	15(88.2 0.3)	2(11.8 0.3)	60(1.2)	53(88.3 1.4)	7(11.7 0.6)
	GSW	144(4.1)	130(90.3 4.4)	14(9.7 2.6)	60(1.1)	56(93.3 1.2)	4(6.7 0.6)	445(8.9)	382(85.8 9.7)	63(14.2 5.8)
	Other – Conflict	85(2.4)	76(89.4 2.6)	9(10.6 1.7)	4(0.1)	4(100 0.1)		71(1.4)	58(81.7 1.5)	13(18.3 1.2)
	No data*	2(0.1)	2(100 0.1)		2(0)	2(100 0)		3(0.1)	1(33.3 0)	2(66.7 0.2)
	Cluster Munitions	2(0.1)	2(100 0.1)		6(0.1)	6(100 0.1)		14(0.3)	13(92.9 0.3)	1(7.1 0.1)
	ERW	38(1.1)	34(89.5 1.2)	4(10.5 0.7)	1(0)	1(100 0)				
	Landmine	674(19.3)	638(94.7 21.6)	36(5.3 6.7)	2193(41.6)	2113(96.4 45.6)	80(3.6 12.6)	43(0.9)	38(88.4 1.0)	5(11.6 0.5)

Categories of amputation causes as illustrated in figure 1 and detailed causes in totals, by sex and by country. Values are number of participants (row % | column%). Row% relates to sex distribution. Column% relates to amputation cause distribution. RTA = road traffic accident; GSW = Gunshot wound; ERW = explosive remnants of war; no data = missing variable (mandatory entry in database) due to software error in the category 'Trauma Conflict Weapon'.

1	Table 4. Amputation characteristics - combinations and levels of amputation
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		All Amputations		No	n-Traumatic Amp	utations		Traumatic Amputati	ons
Combinations of amputation(s)	Total PwA (C%)	Male N (R% C%)	Female N (R% C%)	Total (C%)	Male N(R% C%)	Female N(R% C%)	Total (C%)	Male N(R% C%)	Female N(R% C%)
Total participants	28446	24117 (84.8)	4329 (15.2)	7556(0)	5481(72.5 0)	2075(27.5 0)	20890(0)	18636(89.2 0)	2254(10.8 0)
Persons with single LEA	22693 (79.8)	19152 (84.4 79.4)	3541 (15.6 81.8)	7049(93.3)	5122(72.7 93.5)	1927(27.3 92.9)	15644(74.9)	14030(89.7 75.3)	1614(10.3 71.6
Persons with single UEA	3402 (12.0)	2951 (86.7 12.2)	451 (13.3 10.4)	177(2.3)	110(62.1 2.0)	67(37.9 3.2)	3225(15.4)	2841(88.1 15.2)	384(11.9 17.0)
Persons with double LEA	1868 (6.6)	1575 (84.3 6.5)	293 (15.7 6.8)	302(4.0)	225(74.5 4.1)	77(25.5 3.7)	1566(7.5)	1350(86.2 7.2)	216(13.8 9.6)
Persons with double UEA	157 (0.6)	149 (94.9 0.6)	8 (5.1 0.2)	6(0.1)	6(100 0.1)		151(0.7)	143(94.7 0.8)	8(5.3 0.4)
Persons with single LEA + single UEA	195 (0.7)	177 (90.8 0.7)	18 (9.2 0.4)	15(0.2)	13(86.7 0.2)	2(13.3 0.1)	180(0.9)	164(91.1 0.9)	16(8.9 0.7)
Persons with double LEA + single UEA	92 (0.3)	80 (87.0 0.3)	12 (13.0 0.3)	3(0)	3(100 0.1)		89(0.4)	77(86.5 0.4)	12(13.5 0.5)
Persons with single LEA + double UEA	24 (0.1)	22 (91.7 0.1)	2 (8.3 0)	2(0)	1(50 0)	1(50 0)	22(0.1)	21(95.5 0.1)	1(4.5 0)
Persons with double LEA + double UEA	15 (0.1)	11 (73.3 0)	4 (26.7 0.1)	2(0)	1(50 0)	1(50 0)	13(0.1)	10(76.9 0.1)	3(23.1 0.1)
Levels of amputation(s)	Total Amp	Amp in male	Amp in female		Amp in male	Amp in female		Amp in male	Amp in femal
Levels of amputation(s)	(C%)	PwA	PwA	Total Amp	PwA	PwA	Total Amp	PwA	PwA
Total amputations	30943	26255 (84.8)	4688 (15.2)	7835	5694 (72.7 0)	2141 (27.3 0)	21795	19384 (88.9 0)	2411 (11.1 0)
Total LEA	26862(86.8)	22683(84.4 86.4)	4179(15.6 89.1)	7680(98 .0)	5594(72.8 98.2)	2086(27.2 97.4)	19182(88.0)	17089(89.1 88.2)	2093(10.9 86.8
Partial foot amputation	1866(6.0)	1374(73.6 5.2)	492(26.4 10.5)	333(4.3)	241(72.4 4.2)	92(27.6 4.3)	1533(7.0)	1133(73.9 5.8)	400(26.1 16.6)
Ankle disarticulation	432(1.4)	349(80.8 1.3)	83(19.2 1.8)	117(1.5)	79(67.5 1.4)	38(32.5 1.8)	315(1.4)	270(85.7 1.4)	45(14.3 1.9)
Transtibial amputation	15399(49.8)	13017(84.5 49.6)	2382(15.5 50.8)	5008(63.9)	3665(73.2 64.4)	1343(26.8 62.7)	10391(47.7)	9352(90.0 48.2)	1039(10.0 43.)
Knee disarticulation/ Transcondylar				164(2.1)					
amputation	887(2.9)	759(85.6 2.9)	128(14.4 2.7)		128(78 2.2)	36(22 1.7)	723(3.3)	631(87.3 3.3)	92(12.7 3.8)
Transfemoral amputation	8080(26.1)	7019(86.9 26.7)	1061(13.1 22.6)	1983(25.3)	1430(72.1 25.1)	553(27.9 25.8)	6097(28)	5589(91.7 28.8)	508(8.3 21.1)
Hip disarticulation/ Hemipelvectomy	198(0.6)	165(83.3 0.6)	33(16.7 0.7)	75(1.0)	51(68 0.9)	24(32 1.1)	123(0.6)	114(92.7 0.6)	9(7.3 0.4)
Total UEA	4081(13.2)	3572(87.5 13.6)	509(12.5 10.9)	155(2.0)	100(64.5 1.8)	55(35.5 2.6)	2613(12.0)	2295(87.8 11.8)	318(12.2 13.2)
Partial hand amputation	322(1.0)	258(80.1 1.0)	64(19.9 1.4)	21(0.3)	12(57.1 0.2)	9(42.9 0.4)	124(0.6)	94(75.8 0.5)	30(24.2 1.2)
Wrist disarticulation	436(1.4)	393(90.1 1.5)	43(9.9 0.9)	11(0.1)	8(72.7 0.1)	3(27.3 0.1)	417(1.9)	378(90.6 2.0)	39(9.4 1.6)
Transradial amputation	1973(6.4)	1762(89.3 6.7)	211(10.7 4.5)	37(0.5)	23(62.2 0.4)	14(37.8 0.7)	820(3.8)	731(89.1 3.8)	89(10.9 3.7)
Elbow disarticulation	151(0.5)	131(86.8 0.5)	20(13.2 0.4)	9(0.1)	6(66.7 0.1)	3(33.3 0.1)	139(0.6)	123(88.5 0.6)	16(11.5 0.7)
Transhumeral amputation	1078(3.5)	927(86 3.5)	151(14.0 3.2)	66(0.8)	42(63.6 0.7)	24(36.4 1.1)	1004(4.6)	877(87.4 4.5)	127(12.6 5.3)
Shoulder disarticulation	121(0.4)	101(83.5 0.4)	20(16.5 0.4)	11(0.1)	9(81.8 0.2)	2(18.2 0.1)	109(0.5)	92(84.4 0.5)	17(15.6 0.7)

2 Values are number of participants and number of amputations, respectively (row % | column %). Row% relates to sex distribution. Column% relates to amputation

3 characteristic distribution. LEA = lower extremity amputation; UEA = upper extremity amputation

Amputation characteristics - combinations and levels of amputation

Table 4 illustrates amputation characteristics by combinations and levels. Multiple amputations were present in 2014 (8.4%) of 24117 men and 337 (7.8%) of 4329 women. Double LEA was the most common combination occurring in 1575 (6.5%) men and 293 (6.8%) women and more likely in persons with traumatic amputations (1566 [7.5%] of 20890) compared to those with non-traumatic amputations (302 [4.0%] of 7556). In total, 30943 amputations were registered, of which 15399 (49.8%) were transtibial. Of all non-traumatic amputations, 7680 (98.0% of 7835) were LEA, the majority transtibial (5008 [63.9%]), whereas 2613 (12.0% of 19182) of all traumatic amputations occurred in the upper extremity. Living environment Most PwA reportedly came from rural environment (17202 [60.5%] of 28446; 1996 [7%] unspecified). There was a significantly higher proportion of women (1742 [18.8%] of 9248) in the urban compared to the rural population, (2308 [13.4%] of 17202; p<0.01). DISCUSSION Traumatic amputation at young adult age has devastating effects on a person's private and professional perspectives. A worrying finding in this study was the delay between amputation and beginning rehabilitation, particularly for those with traumatic amputation. Ideally, prosthetic fitting happens right after wound-healing. Any delay will increase functional limitations and the potential of complications.⁴⁰ Consequently, duration, costs and complexity of rehabilitation will rise, including prosthetic adjustments. In cases of irreversible limitations PwA may no longer qualify for fitting.⁶ The studied countries are marked either by protracted crisis with recurring flares of acute fighting or post-conflict with weak economy and fragile health systems.³¹ These factors result in high numbers of PwA, who face access difficulties to rehabilitation aggravated by compromised infrastructure and security, lack of means or awareness, and critical scarcity or overload of existing rehabilitation workforce and services.4,41,42 The later age observed for non-traumatic amputation is not surprising, but the average age of 48.2 years is very low compared to studies in HIC reporting ages of over $65^{1,43}$ Amputations at young age as a complication of underlying health conditions such as T2D reflect the many health system challenges in the studied countries.⁴⁴ Although this group attends rehabilitation significantly faster than the traumatic group, the delay is still considerable and potentially harmful in view of the risks associated with immobility in poorly managed T2D. The difference in delay between the traumatic and non-traumatic cohorts may be explained by the widespread lack of essential healthcare services during past conflict (e.g. Cambodia).⁴⁵ This may have led to high mortality rates in persons with conditions like T2D. PwA of traumatic origin may have survived long enough to eventually attend rehabilitation, after years of unavailability or inaccessibility of services, a possible explanation for the considerable backlog of persons with traumatic amputations. A steadfast interpretation of detailed delays is impossible owing to the extremely complex conflict

Page 17 of 31

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history and uncertain service provision in the studied contexts including displaced populations, persons of a specific ethnicity or with a political or military past unable to cross certain combat zones. What we know for sure is that an amputation at working age and delayed prosthetic fitting and rehabilitation - not counting the unknown numbers of non-attendees - feed into the vicious cycle of disability and poverty, increasing the difficulties PwA face when it comes to reintegrating into society in these contexts.^{42,46} The proportions of non-traumatic and traumatic amputations are reversed compared to non-conflict countries and disclose the human cost of protracted crises.^{43,47} Explosive devices as amputation cause lead to complex injuries.^{4,23} Patient outcomes depend on the availability and capacity of specialised emergency and surgical care if the effects of polytraumas are handled optimally. Subject to the extent of injury and the firearm used, amputations from GSW may also be an indicator of delayed trauma- and general poor health-care. In remote areas injured people may reach medical assistance only at a stage when the affected limb can no longer be saved. Furthermore, amputation being less time-consuming and risky than limb salvage may be indicated to assist higher numbers of people.^{48,49} A person with traumatic amputation needs to cope with the sudden loss when adapting to a life with permanent disability. Rehabilitation outcomes depend on the complexity of polytraumas. The psychological consequences and post-traumatic repercussion are considerable after traumatic amputation and require specialised multidisciplinary care.23,46,50 The studied countries rank among the most mine-contaminated contexts worldwide.⁵¹ Survivors with amputations from weapon-contamination symbolise the long-term consequences of conflict, which may last for decades and continue producing injuries and disability long after the end of active fighting. Cambodia's almost 30 years of conflict, for instance, ended in 1998. Between 2009 and 2018 more than half of all new registrations attending rehabilitation were male PwA caused by landmines exemplifying the sustained destructive potential of conflict on a society. 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 PwA due to T2D in fragile settings are a highly vulnerable group. The amputation will be the consequence of a progressing chronic illness, which might be diagnosed only at the time of complication and which the person will have to cope with on top of the limb loss. If diagnosed, the person's understanding of their health status and its implications for lifestyle changes will be crucial. The risk of complications is considerable as the 39–68% five years mortality rate of diabetic foot shows.⁵² In conflict countries, the comprehensive care required for conditions like T2D is challenged by lack of availability, affordability and access to inter-professional services for diagnosis and long-term management. It is also compromised by the environment as living in

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displacement and depending on aid do not facilitate the necessary lifestyle adaptations, such as diet and exercise. Deprioritisation of NCD-care in crisis settings in order to address immediate trauma and prevent epidemics puts T2D patients at higher risk of neglect.²⁶ Regaining functionality through active rehabilitation may be more demanding compared to someone with traumatic amputation due to age and general health differences between both populations. The fitting process will be more complicated due to the remaining limb's shape and consistency. Complex chronic conditions require a kind of rehabilitation that PRCs in conflict zones may not be organized for. 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. The peak of amputation among young adult males and the significant majority of male PwA may be explained by ongoing conflict in most contexts. There is consensus in the literature that worldwide more males than females undergo amputation, but the distribution differs according to age and cause.^{1,55,56} Especially during active age and regardless of conflict, rates are higher in men due to work- or leisure-related accidents.^{47,57} Despite a similar T2D prevalence among sexes, T2D-related amputation rates are higher among men due to higher prevalence of smoking, peripheral vascular disease, neuropathy and diabetic foot ulceration.¹ For certain groups a gender dimension may influence access to rehabilitation. Higher female than male proportions are reported for older persons with traumatic amputations which are unlikely due to combat or occupational risk.^{56,57} This is in contrast to the significant male majority in our study population. Also, our findings revealed that in urban environments, and in contrast to men, female PwA attending rehabilitation constitute a significantly larger proportion than in rural environments. Access barriers to services for women from more remote rural areas may exist such as challenging infrastructure, poverty, insecurity, and cultural factors and warrant further investigation.⁵⁸ The main limitation of this study is that data is derived from ICRC PRCs only and therefore not representative of population. However, in absence of amputation incidence data this first multi-country analysis offers a unique insight into the population of rehabilitation users with amputations in fragile contexts including (ex-)combatants and civilians of all ages with amputations of all origins. As the data does not represent prevalence, but attendance to rehabilitation, it is difficult to estimate how many PwA do not receive services. Where existing, data was compared to published prevalence studies from similar contexts. The dearth of quality publications in such contexts underlines the mismatch between existing research and where the burden of disease is.²⁴

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4 5	2	In conclusion, this study highlights the persisting burden of amputation in conflict contexts
6	3	and the consequences of broken health systems and a fragmented continuum of care. Young
7	4	age and long delays to rehabilitation reveal the hardship in which PwAs live in such settings.
8 9	5	The figures of landmine-caused amputations disclose the cruel long-term dimension of
10	6	conflict.
11	7	Rehabilitation services are seriously under-resourced as revealed in a recent publication on
12	8	global estimates of rehabilitation needs. ⁵⁹ Our data have been collected in highly challenging
13 14	9	and diverse settings where even basic healthcare is compromised. Providing rehabilitation
15	10	and collecting data in these underserved, volatile contexts is exceptionally complex. ²⁸ The
16 17	11	few PRCs in conflict settings cater for amputations of various causes and PwA of different
18	12	age, sex, other trauma and co-morbidities including psychological after-effects and future
19	13	prospects of life with amputation. This requires tailored approaches matched with outcome
20	14	and impact measurements. Managing these highly diverse processes is the responsibility of a
21 22	15	multidisciplinary rehabilitation team including peer-support by other PwA – an enormous
23	16	challenge in settings with so many needs and so little resources.
24	17	Preventive measures on all levels of healthcare are essential to reduce the number of T2D-
25 26	18	caused amputations. Rather than solely managing amputations as the last consequence,
20 27	19	rehabilitation professionals should get increasingly involved in provision of comprehensive
28	20	care.
29	21	We call out to rehabilitation service providers and healthcare professionals for a
30 31	22	prioritisation of rehabilitation and a stronger and prompt involvement of rehabilitation
32	23	professionals on all levels of the continuum of care. This includes international humanitarian
33	23	interventions as well as local health system governance. In addition, it is crucial that future
34 35	24 25	research identifies and tests efficient, innovative, context-adapted best practice models
36	26	including service provision and impact measurement to address the mismatch of
37		
38	27	rehabilitation needs and resources in fragile settings.
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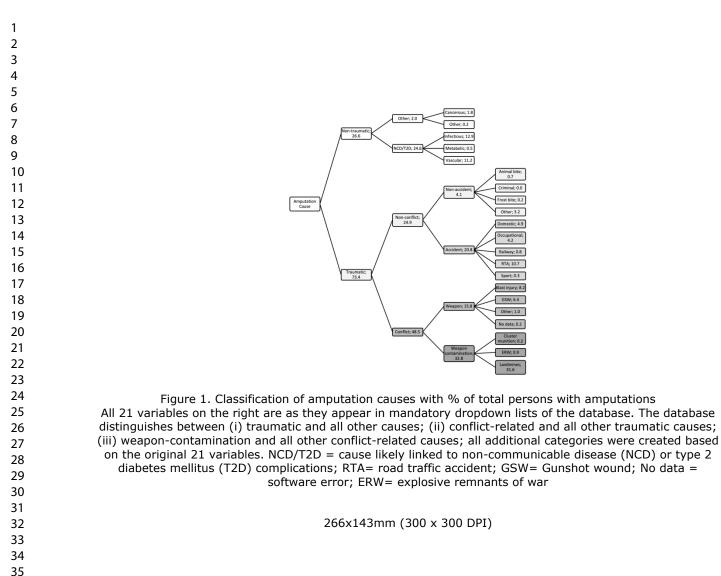
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27 28	17	All six authors contributed to planning, conduct and reporting of the study.
29	18	An six authors contributed to planning, conduct and reporting of the study.
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31 32	20	specific additional contributions are as follows.
33	21	Cornelia A. Barth: literature research, data acquisition and analysis, conception and design,
34 35	22	data interpretation
36	23	
37	24	Andreas Wladis: conception and design, data interpretation
38 39	25	
40	26	Catherine Blake: conception and design, data analysis and interpretation
41	27	
42 43	28	Sigiriya Aebischer Perone: literature research, data interpretation
44	29	
45	30	Prashant Bhandarkar: data tabulation, analysis and interpretation
46 47	31	
48	32	Cliona O'Sullivan: literature research, conception and design, data interpretation
49	33	
50		
51 52	34	DATA AVAILABILITY STATEMENT
53	35	All relevant data are included in the tables of this study.
54 55	36	Due to the sensitive nature of this data, data sharing is subject to regulations of ICRC data
56	37	protection policy.
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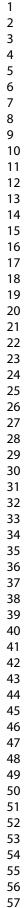
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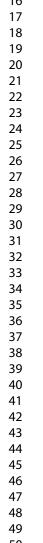
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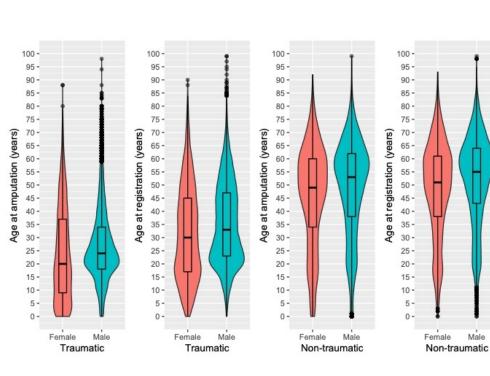


Figure 2. Age patterns of male and female persons with traumatic and non-traumatic amputation Violin plots showing age of all male and female PwA of a) traumatic cause at time of amputation, b) at time of registration, age of male and female PwA of c) non-traumatic cause at time of amputation, d) at time of registration.

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	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstra	ct				
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b)Provide in the abstract an informative and balanced		RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included.	Page 2
		summary of what was done and what was found	Pr ro	RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract.	Page 2
			i elie	RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	-
Introduction					1
Background rationale	2	Explain the scientific background and rationale for the investigation being reported		5/1	Page 4-5
Objectives	3	State specific objectives, including any prespecified hypotheses			Page 5
Methods					
Study Design	4	Present key elements of study design early in the paper			Page 5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			Page 5

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Participants	6	(a) Cohort study - Give the	RECORD 6.1: The methods of study	Page 5
		eligibility criteria, and the	population selection (such as codes or	
		sources and methods of selection	algorithms used to identify subjects)	
		of participants. Describe	should be listed in detail. If this is not	
		methods of follow-up	possible, an explanation should be	
		<i>Case-control study</i> - Give the	provided.	
		eligibility criteria, and the	F	
		sources and methods of case	RECORD 6.2: Any validation studies	-
		ascertainment and control	of the codes or algorithms used to	
		selection. Give the rationale for	select the population should be	
		the choice of cases and controls	referenced. If validation was conducted	
		Cross-sectional study - Give the	for this study and not published	
		eligibility criteria, and the	elsewhere, detailed methods and results	
		sources and methods of selection	should be provided.	
		of participants	should be provided.	
		or participanto	RECORD 6.3: If the study involved	-
		(b) Cohort study - For matched	linkage of databases, consider use of a	
		studies, give matching criteria	flow diagram or other graphical display	
		and number of exposed and	to demonstrate the data linkage	
		unexposed	process, including the number of	
		Case-control study - For	individuals with linked data at each	
		matched studies, give matching	stage.	
		criteria and the number of	suge.	
		controls per case		
Variables	7	Clearly define all outcomes,	RECORD 7.1: A complete list of codes	_
(unue les	,	exposures, predictors, potential	and algorithms used to classify	
		confounders, and effect	exposures, outcomes, confounders, and	
		modifiers. Give diagnostic	effect modifiers should be provided. If	
		criteria, if applicable.	these cannot be reported, an	
			explanation should be provided.	
Data sources/	8	For each variable of interest,		Page 5-6
measurement		give sources of data and details		
		of methods of assessment		
		(measurement).		
		Describe comparability of		
		assessment methods if there is		
		more than one group		
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Bias	9	Describe any efforts to address potential sources of bias		Page 6
Study size	10	Explain how the study size was		Page 5
		arrived at		
Quantitative	11	Explain how quantitative		Page 5-6
variables		variables were handled in the		
		analyses. If applicable, describe		
		which groupings were chosen,		
		and why		
Statistical	12	(a) Describe all statistical		Page 6
methods		methods, including those used to		
		control for confounding		
		(b) Describe any methods used		
		to examine subgroups and		
		interactions		
		(c) Explain how missing data		
		were addressed		
		(d) <i>Cohort study</i> - If applicable,		
		explain how loss to follow-up		
		was addressed	•	
		Case-control study - If		
		applicable, explain how		
		matching of cases and controls		
		was addressed		
		Cross-sectional study - If	Uh.	
		applicable, describe analytical		
		methods taking account of		
		sampling strategy		
		(e) Describe any sensitivity	· 2001/1	
D (1		analyses		
Data access and			RECORD 12.1: Authors should	Page 5-6
cleaning methods			describe the extent to which the	
			investigators had access to the database	
			population used to create the study	
			population.	

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Page 5-6
Linkage				RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	-
Results					
Participants	13	 (a) Report the numbers of individuals at each stage of the study (<i>e.g.</i>, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non- participation at each stage. (c) Consider use of a flow diagram 	or tevie	RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Page 7-15 incl tables
Descriptive data	14	 (a) Give characteristics of study participants (<i>e.g.</i>, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i>, average and total amount) 		201	Page 7-15 incl tables
Outcome data	15	Cohort study - Report numbers of outcome events or summary measures over time Case-control study - Report numbers in each exposure			-

		category, or summary measures of exposure <i>Cross-sectional study</i> - Report numbers of outcome events or		
Main results	16	summary measures(a) Give unadjusted estimatesand, if applicable, confounder-adjusted estimates and theirprecision (e.g., 95% confidenceinterval). Make clear whichconfounders were adjusted forand why they were included(b) Report category boundarieswhen continuous variables werecategorized(c) If relevant, considertranslating estimates of relativerisk into absolute risk for ameaningful time period		Page 7-15 inc tables
Other analyses	17	Report other analyses done— e.g., analyses of subgroups and interactions, and sensitivity analyses	ie.	Page 7-15 inc tables
Discussion				·
Key results	18	Summarise key results with reference to study objectives	0	Page 15-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	RECORD 19.1: Discuss the implications of using data that were created or collected to answer the specific research question(s). Includ discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study bei reported.	e
Interpretation	20	Give a cautious overall interpretation of results considering objectives,		Page 15-17

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Generalisability	21	limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Discuss the generalisability (external validity) of the study		Page 18
Other Informatio	n	results		
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Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		Page 19
Accessibility of protocol, raw data, and programming code			RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Page 19

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. PLoS Medicine 2015; nse. in press.

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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

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Manuscript ID	bmjopen-2021-049533.R2
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Date Submitted by the Author:	13-Oct-2021
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Secondary Subject Heading:	Global health, Epidemiology, Health services research
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7	3	International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and
8 9	4	post-conflict countries
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5 6	2	Retrospective observational study of characteristics of persons with amputations accessing
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10 11	5	ABSTRACT
12	6	Objectives: Limb amputation incidence is particularly high in fragile contexts due to conflict,
13 14	7	accidents and poorly managed diabetes. The study aim was to analyse i) demographic and
15	8	amputation characteristics of persons with any type of acquired amputation (PwA) and ii)
16	9	time between amputation and first access to rehabilitation in five conflict and post-conflict
17 18	10	countries.
19 20	11	Design: A retrospective, observational study analyzing differences in demographic and
20	12	clinical factors and time to access rehabilitation between users with traumatic and non-
22 23	13	traumatic amputations.
24	14	Setting: Five countries with the highest numbers of PwA in the global ICRC database
25 26	15	(Afghanistan, Cambodia, Iraq, Myanmar, Sudan). Cleaned and merged data from 2009-2018
20 27	16	were aggregated by sex; age at amputation and registration; cause, combination and
28 29	17	anatomical level of amputation(s); living environment.
29 30 31	18	Participants: All PwA newly attending rehabilitation.
32	19	Results: Data for 28446 individuals were included (4329 [15.2%] female). Most were
33	20	traumatic amputations (73.4%, 20890); of these, 48.6% (13801) were conflict related.
34 35	21	Average age at traumatic amputation for men and women was 26.9 and 24.1 years
36	22	respectively; for non-traumatic amputation it was 49.1 years and 45.9 years respectively. Sex
37	23	differences in age were statistically significant for traumatic and non-traumatic causes
38	24	(p<0.001, p=0.003). Delay between amputation and rehabilitation was on average 8.2 years
39 40	25	for those with traumatic amputation, significantly higher than an average 3 years for those
41 42	26	with non-traumatic amputation (p<0.001).
43	27	Conclusions: Young age for traumatic and non-traumatic amputations indicates the
44 45	28	devastating impact of war and fragile health systems on a society. Long delays between
45 46	29	amputation and rehabilitation reveal the mismatch of needs and resources. For
47	30	rehabilitation service providers in fragile settings, it is an enormous task to manage the
48	31	diversity of PwA of various causes, age, sex and additional conditions. Improved
49 50	32	collaboration between primary healthcare, surgical and rehabilitation services, a
51	33	prioritisation of rehabilitation and increased resource provision are recommended to ensure
52	34	adequate access to comprehensive rehabilitation care for PwA.
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3	1	STRENGTHS AND LIMITATIONS OF THIS STUDY
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6	2	 To our knowledge, this is the first large multi-country study on a highly vulnerable and
7	3	neglected group of persons with amputations seeking rehabilitation in conflict and post-
8	4	conflict contexts.
9 10	5	 Data originate from exceptionally challenging and diverse settings where providing
11	6	rehabilitation and collecting data is complex and constantly challenged by the volatility
12	7	of the environment.
13	8	Limitations include that data are derived from ICRC supported structures only and
14 15	9	cannot make statements on overall population or on persons not attending services
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18	4.0	
19 20	12	KEYWORDS
21	13	Rehabilitation
22	14	Armed Conflicts
23 24	15	Amputation
24 25	16	Delivery of Health Care
26	17	Diabetes Complications
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3 4	1	INTRODUCTION							
5	2	Limb amputation is a life-changing event. Global incidence studies reveal a substantial lack of							
6 7	3	data from fragile contexts such as conflict-affected or low- and middle-income countries							
8	4	(LMICs), but research has shown that amputation incidence is higher in populations with low							
9	5	economic and educational status. This results in limited access to healthcare, even in high							
10 11	6	income countries (HIC). ^{1–3} People in fragile contexts are particularly at risk of amputation							
12	7	and many of them will have to cope without prosthetic care. ^{4,5} Appropriate rehabilitation							
13	8	and assistive technology (AT) have the potential to greatly diminish disability and allow the							
14	9	person to lead an independent, functional life. ^{6,7} It requires the availability of							
15 16	10	comprehensive, costly and lifelong services, which is an enormous challenge in such							
17	11	environments. Rehabilitation services should span from early physiotherapy to prosthetic							
18	12	fitting, psychosocial support and social reintegration measures. A lower extremity							
19 20	13	amputation (LEA) requires prosthetic renewal every three years, for children every six							
21	14	months. ⁸							
22	15	The World Health Assembly's 2018 resolution on improving access to AT and the 2021							
23 24	16	resolution on the highest attainable standard of health for persons with disabilities indicate							
25	17	the many shortcomings and the need for increased recognition in this field. ^{5,9}							
26	18	Access to appropriate rehabilitation and AT is a human right enshrined in the Convention on							
27 28	19	the Rights of Persons with Disabilities. This recognition has resulted in publications							
29	20	discussing implications, implementation and sobering reality-checks in numerous LMICs. ^{10–15}							
30	21	Alarming needs and low supply are a well-known reality for global actors playing a key role in							
31 32	22	advocating for and providing rehabilitation in fragile settings including the International							
33	23	Committee of the Red Cross (ICRC), Humanity and Inclusion and the World Health							
34	24	Organisation (WHO). Guidelines, training resources and advocacy papers by such actors,							
35 36	25	often issued collectively, are specifically pointing out the importance and interdependence							
30 37	26	of early rehabilitation, AT and rehabilitation across the continuum of care. ^{16–21}							
38	27	As such initiatives address knowledge gaps in this neglected field, their global							
39 40	28	implementation lags behind, even more so in countries of prolonged conflict or post-conflict							
40 41	29	with fragile health systems and a deprioritisation of rehabilitation services. As a							
42	30	consequence, there remains a lack of scientific papers on which to base further guideline							
43	31	development and research. This starts with affected populations in the countries themselves							
44 45	32	who remain largely unknown, contrary to the well-studied veterans from HIC who sustained							
46	33	conflict-related amputations abroad. ^{22–24} Complex traumatic amputations and their sequalae							
47	34	in conflict- and mine-affected areas are known to be a huge challenge. ^{4,25,26} Adding to this,							
48 49	35	and with profound consequences, is the increasing global burden of type two diabetes							
50	36	mellitus (T2D). ²⁷							
51	37	Overstretched health systems, particularly in LMIC, lacking access to basic diabetic care and							
52 53	38	high rates of undiagnosed T2D increase the risk and incidence of amputations. ²⁸ Road traffic							
54	39	(RTA) and other accidents are an additional problem in countries with limited traffic and							
55	40	occupational safety standards. ²⁹							
56 57	41	Persons with amputations (PwA) constitute the biggest cohort of users accessing							
58	42	rehabilitation services supported by the ICRC in conflict and post-conflict states. ³⁰ Assisting							
59	43	conflict affected populations is at the centre of the ICRC's humanitarian mission and serving							
60									

3 4	1	mine victims with limb loss is a core activity since the launch of its physical rehabilitation
5	2	programme (PRP) in 1979. ^{31,32}
6	3	Currently, the ICRC supports 152 rehabilitation structures in 35 countries offering
7	4	multidisciplinary rehabilitation services for persons with physical disabilities and capacity
8 9	5	building for rehabilitation workforce. With this support, 62172 persons worldwide were
9 10	6	fitted with prostheses in 2019. ³¹ There is very little information on the characteristics of PwA
11	7	accessing rehabilitation in fragile contexts.
12	8	The overall aim of this study was to analyse characteristics of PwA accessing rehabilitation
13 14	9	services in five ICRC contexts in 2009-2018 to better understand their healthcare needs and
15	10	deduce implications for service provision. Specific aims were to explore differences in sex
16	11	and age at amputation, at registration for rehabilitation, time between amputation and
17	12	registration (delay), causes and characteristics of amputations.
18 19	13	registration (delay), causes and characteristics of amputations.
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21	14	
22	15	METHODS
23 24	16	Design and setting
25	17	This retrospective observational study is an analysis of aggregated data. It reflects the
26	18	records of all PwA registered from 2009 to 2018 in ICRC-supported physical rehabilitation
27 28	19	centres (PRCs) in Afghanistan (n=7), Cambodia (n=2), Iraq (n=1), Myanmar (n= 5), and Sudan
20 29	20	(n= 2). Data were extracted from an ICRC-developed electronic database described in a
30	21	previous study. ³⁰ The five countries representing the highest numbers of PwA attending
31	22	PRCs were selected for this study, reflecting 92% of the total number of PwA in the
32 33	23	database. Besides post-conflict Cambodia, the countries represent contexts of protracted
34	24	crises and are classified by the World Bank as low-income (Afghanistan, Sudan), LMIC
35	25	(Cambodia, Myanmar), or upper middle-income (Iraq). ^{33,34} These differences are equally
36 37	26	reflected in other indicators as available from open source sites by the United Nations
37 38	20	Development Programme and the WHO. ^{35,36}
39		
40	28	Data reflect representative user populations in the studied countries to varying degrees
41 42	29	depending on presence of other rehabilitation providers, or data management difficulties.
43	30	All PRCs were located in urban areas.
44	31	
45	32	Participants
46 47	33	Participants include all persons with any type of acquired amputation newly attending for
48	34	prosthetic fitting. Excluded were persons attending with congenital limb loss.
49	35	
50	36	Data collection and management
51 52	37	Upon registration, demographic and clinical characteristics were captured as part of routine
53	38	documentation. The variables retrieved from the database were: country, sex, age at
54	39	registration and at amputation, living environment, cause, anatomic level and number of
55	40	amputation(s). PwA's living environment was subject to local definitions of the terms urban
56 57	41	or rural. The quantitative variables were cleaned, merged, disaggregated by sex and age and
58	42	organized into variables of interest.
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3	1	Figure 1 lists the causes as retrieved from the database and shows how causes were
4	2	categorised into traumatic or non-traumatic. Traumatic causes were further sub-categorised
5 6	3	as non-conflict- or conflict-related. We examined non-conflict-related traumatic causes by
7	4	accidental such as RTA or non-accidental causes such as animal bite. Conflict-related causes by
8		
9	5	were separated into caused by weapons or by weapon-contamination, which encompasses
10	6	the presence of mines, explosive remnants of war (ERW) and other sources of
11 12	7	contamination. ³⁷
13	8	The database offered four labels for non-traumatic causes: cancerous, infectious, metabolic,
14	9	or vascular. For analysis, these were merged, except cancer (merged with 'other'), and
15	10	considered related to non-communicable diseases (NCD), potentially T2D.
16 17	11	For amputation characteristics, male and female PwA were counted by combinations of LEA
18	12	and upper extremity amputations (UEA) and by non-traumatic versus traumatic causes. We
19	13	distinguished six levels of UEA and six levels of LEA counting number of amputations (and
20	14	not persons) per level.
21 22	15	
23	16	Data analysis
24	17	The delay between amputation and registration to rehabilitation was calculated by
25	18	subtracting the self-reported amputation date from the registration date as noted on the
26 27	19	user file.
28	20	Age at registration was grouped into young child: under 5; child: 5–17; young adult: 18–34;
29	20	adult: 35–59; older adult: over 60. Besides 'living environment' all selected variables were
30	21	mandatory for data entry. Where software issues led to missing data, these were labelled
31 32		'no data' in the tables.
33	23	
34	24	Data analysis comprised of descriptive statistics. The software packages used were Microsoft
35	25 26	Office Excel 2016, R (version 3.6.1), R Studio for windows (version 1.2.5001) and SPSS (IBM
36 37	26	SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). Categorical data were summarised as counts and percentages across rows (sex) and columns (groups). Age at the
38	27 28	time of amputation, registration and delay intervals were presented as means with 95%
39	28 29	confidence intervals. Differences between groups were assessed using Chi Square and
40	29 30	Mann-Whitney U tests. P values below 0.05 were considered statistically significant.
41 42	30 31	Wann-Whitney O tests. F values below 0.05 were considered statistically significant.
43	32	Potential bias
44	33	Data depended on the accuracy of self-report and recording of observations and
45	34	assessments by PRC staff with varying professional training and subject to interpretation,
46 47	35	hereby presenting potential biases. Variables such as sex and age are deemed robust.
48		
49	36	Challenges exist when recording the cause of non-traumatic amputation presentations as
50	37	PRCs are rarely attached to a medical service to diagnose underlying conditions.
51 52	38	Unless a PwA checks in with externally confirmed T2D diagnosis, PRC staff rely on findings
53	39	from their own assessment. They record non-traumatic causes as predefined in the
54	40	database, which does not offer T2D as a stand-alone variable, but 'infectious', 'metabolic' or
55	41	'vascular' presentations. Chronic, often unknown health conditions in the studied countries
56 57	42	lead to such presentations defined by PRC staff as amputation cause and are most likely
58	43	related to NCD/T2D. ^{38–40} Considering the dimension and consequences of T2D prevalence
59	44 45	we merged causes under this heading despite absence of confirmed diagnosis.
60	45	

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4	1	Ethical approval and data sharing
5	2	Ethical exemption to conduct analysis on de-identified data was granted by the Swiss Ethics
6	3	Committee Geneva [Reference number: REQ-2019-00027]. Data sharing agreements
7	4	between the ICRC, Linköping University and University College Dublin were approved by
8 9	5	each institution.
10	6	
11	7	Patient and public involvement
12	8	For this retrospective study of routinely collected data, patient involvement in study design
13	9	did not apply. However, consultation with key stakeholders (PRC managers and personnel
14 15	10	and ICRC expatriate staff) was conducted regarding study design and feasibility and
16		
17	11	contextual analysis of findings. Interpretation of the data was based on these stakeholders'
18	12	profound understanding of the respective contexts. The main author CAB presented and
19 20	13	discussed preliminary research results in an ongoing process, online and in person during
20	14	project visits where involved rehabilitation providers did and will continue to play an active
22	15	role in dissemination of the findings of this research.
23	16	
24	17	The methods used and findings from the study are reported in line with the GATHER
25 26	18	guidelines. ⁴¹
20	19	
28	20	
29	21	RESULTS
30 31		
32	22	Participant characteristics
	22 23	Participant characteristics A total of 28446 individual user files were analysed with 4329 (15.2%) female PwA. Most
32 33 34		
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	Non-Traumatic Amputation			Trau	matic Amputation		Total – by cause			
Country Variables	Male	Female	P value*	Male	Female	P value†	Non-Trauma	Trauma	MD (95% CI)	P valu
Total	Mean (9	5% CI)		Mean (9	5% CI)		Mean (9	95% CI)		
Age at amputation	49.1(48.6-49.6)	45.9(45.1-46.7)	< 0.001	26.9(26.7-27.1)	24.1(23.3-24.8)	< 0.001	48.2(47.8-48.6)	26.6(26.4-26.8)	21.7(21.3-22.1)	<0
Age at registration	52.2(51.8-52.7)	48.6(47.8-49.4)	< 0.001	35.2(35-35.4)	31.6(30.9-32.3)	< 0.001	51.2(50.8-51.6)	34.8(34.6-35)	16.4(16.0-16.9)	<0
Delay all PwAs (y)	3.2(3.0-3.4)	2.7(2.4-3)	0.009	8.3(8.1-8.4)	7.5(7.1-8)	0.119	3.0(2.9-3.2)	8.2(8-8.3)	-5.1(-5.4-4.9)	<0
Delay by PwA age group (age at registration)										
Young child (<5 y)	0.9(0.4-1.4)	1.3(0.8-1.8)	0.200	0.9(0.7-1.1)	1.0 (0.7-1.2)	0.745	1.1(0.7-1.4)	0.9(0.8-1.1)	0.1(-0.3-0.6)	0.
Child (5-17 y)	2.2(1.6-2.8)	2.2(1.5-2.8)	0.563	2.0 (1.9-2.2)	3.9(3.5-4.3)	< 0.001	2.2(1.8-2.6)	2.4(2.3-2.6)	-0.3(-0.7-0.2)	0.
Young Adult (18-34 y)	3.2(2.8-3.6)	3.1(2.5-3.7)	0.987	3.8(3.6-3.9)	7.2(6.6-7.8)	< 0.001	3.1(2.8-3.5)	4.1(3.9-4.2)	-0.9(-1.3-0.5)	0.
Adult (35-59 y)	2.9(2.7-3.2)	2.6(2.1-3)	0.022	13.7(13.4-14)	9.9(9-10.8)	< 0.001	2.8(2.6-3.1)	13.3(13.1-13.6)	-10.5(-10.9-10.1)	<0
Older Adult (>60 y)	3.5(3.1-3.9)	3(2.3-3.7)	0.071	16.9(16-17.7)	12.1(9.9-14.4)	< 0.001	3.4(3.1-3.7)	16.3(15.5-17.1)	-12.9(-13.7-12.2)	<0
Afghanistan										
Age at amputation	48.8(46.2-51.4)	42.7(39.4-46)	< 0.001	24.8(24.3-25.3)	20.6(19.4-21.8)	< 0.001	46.8(44.8-48.9)	24.3(23.9-24.8)	22.5(21.7-23.2)	<0
Age at registration	50.3(49.2-51.3)	44.0 (42.5-45.4)	< 0.001	29.7(29.4-30)	26.6(25.6-27.6)	< 0.001	48.3(47.4-49.1)	29.4(29.1-29.7)	18.9(18.1-19.6)	<0
Delay all PwAs (y)	1.6(1.3-1.9)	1.3(1.0-1.6)	0.318	4.9(4.8-5.1)	6.0 (5.5-6.6)	< 0.001	1.5(1.2-1.7)	5.0 (4.9-5.2)	-3.6(-4.0-3.2)	<0
Delay by PwA age group (age at registration)										
Young child (<5 y)	0.5(-0.2-1.2)	1.3(0.3-2.2)	0.214	0.9(0.6-1.1)	0.9(0.6-1.2)	0.829	0.8(0.2-1.3)	0.9(0.7-1.1)	-0.1(-0.8-0.5)	0.
Child (5-17 y)	1.1(0.6-1.7)	1.6(0.8-2.4)	0.948	1.8(1.6-2.0)	3.9(3.4-4.4)	< 0.001	1.3(0.9-1.8)	2.2(2.1-2.4)	-0.9(-1.5-0.3)	<0
Young Adult (18-34 y)	3.0(2.2-3.8)	2.1(1.2-2.9)	0.827	3.1(2.9-3.2)	7.8(6.9-8.7)	< 0.001	2.7(2.0-3.3)	3.4(3.2-3.5)	-0.7(-1.4-0.1)	<0
Adult (35-59 y)	1.4(0.9-1.9)	1(0.6-1.4)	0.551	10.5(10.0-11.0)	7.6(6.2-9.0)	< 0.001	1.2(0.9-1.6)	10.1(9.7-10.6)	-8.9(-9.8-8.0)	<0
Older Adult (>60 y)	1.3(0.7-1.8)	1.1(0.3-1.9)	0.781	10.3(9.1-11.6)	4.6(2.3-6.8)	0.004	1.2(0.8-1.7)	9.7(8.5-10.9)	-8.5(-9.6-7.4)	<0
Cambodia	· · ·	· · ·								
Age at amputation	46(38.5-53.6)	41.6(31.1-52.0)	0.189	28.6(27.2-29.9)	31.3(27.3-35.3)	0.100	44.7(38.6-50.8)	28.9(27.6-30.2)	15.8(13.7-17.9)	<0.
Age at registration	48.9(45.9-51.9)	45.3(40.3-50.3)	0.235	42.7(42.0-43.3)	40.3(38-42.7)	0.006	47.8(45.2-50.4)	42.4(41.8-43.0)	5.4(3.2-7.6)	<0
Delay all PwAs (y)	2.9(1.8-4.0)	3.8(1.5-6.1)	0.285	14.0 (13.4-14.6)	9.3(7.8-10.8)	< 0.001	3.2(2.2-4.2)	13.4(12.9-14.0)	-10.2(-12.0-8.5)	<0
Delay by PwA age group (age at registration)										
Young child (<5 y)	2.5(1.5-3.5)##			1.0 (0.2-1.8)	$0.0(0.0-0.0)^{\#}$	0.267	2.5(1.5-3.5)	0.7(0.0-1.3)	1.8(0.2-3.4)	0.
Child (5-17 y)	9.5(-5.2-24.2)	4.6(0.4-8.7)	0.500	3.1(1.7-4.4)	3.7(1.3-6.2)	0.685	5.7(1.4-9.9)	3.2(2.1-4.4)	2.4(-1.2-6.0)	0.
Young Adult (18-34 y)	4.3(2.0-6.6)	3.9(-0.1-7.8)	0.991	4.7(4.1-5.3)	6.2(4.2-8.1)	0.938	4.2(2.2-6.1)	4.9(4.3-5.5)	-0.7(-2.9-1.5)	0.
Adult (35-59 y)	3.2(1.2-5.1)	3.1(0.4-5.8)	0.213	18.6(17.9-19.3)	10.9(8.7-13.2)	< 0.001	3.1(1.5-4.8)	17.9(17.2-18.5)	-14.7(-17.2-12.2)	<0.
Older Adult (>60 y)	1.2(0.0.3-2)	4.3(-1.9-10.6)	0.785	19.7(17.7-21.7)	15.2(9.9-20.5)	0.021	2.1(0.1-4.1)	18.9(17-20.8)	-16.8(-20.5-13.1)	<0.
Iraq										
Age at amputation	54.4(50.7-58.2)	53.9(48-59.9)	0.826	26.8(25.7-28.0)	25.6(22.2-29.0)	0.023	54.3(51.2-57.5)	26.7(25.6-27.8)	27.6(26.6-28.6)	<0
Age at registration	56.6(55.7-57.6)	55.3(53.5-57.1)	0.541	39.1(38.5-39.8)	33.6(31.3-35.8)	< 0.001	56.3(55.4-57.1)	38.6(38-39.2)	17.7(16.6-18.7)	<0
Delay all PwAs (y)	2.2(1.8-2.7)	1.7(1-2.3)	0.007	12.3(11.8-12.8)	8.1(6.7-9.6)	< 0.001	2.1(1.7-2.4)	11.9(11.5-12.4)	-9.9(-10.6-9.1)	<0
Delay by PwA age group (age at registration)										
Young child (<5 y)	0.0(0.0-0.0)#	2.0(2.0-2.0)##	1.000	1.0 (0.4-1.6)	1.0(0.1-1.9)	0.961	1.0(-1.0-3.0)	1.0(0.5-1.5)	0(-1.7-1.7)	1.
Child (5-17 y)	4.1(1.2-7.1)	2.1(0-4.2)	0.285	2.9(2.2-3.5)	2.6(1.4-3.8)	0.756	3.1(1.3-5.0)	2.8(2.2-3.4)	0.3(-1.3-1.9)	0
Young Adult (18-34 y)	3.8(1.8-5.7)	1.3(0.2-2.3)	0.044	5.7(5.2-6.2)	7.6(5.5-9.7)	0.595	3.0(1.6-4.4)	5.9(5.4-6.3)	-2.8(-4.7-1.0)	<0

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Adult (35-59 y)	2.0(1.5-2.6)	1.4(0.7-2.1)	0.268	16.7(16-17.4)	11.0(8.1-13.9)	< 0.001	1.9(1.4-2.3)	16.3(15.6-17.0)	-14.4(-15.5-13.3)	<(
Older Adult (>60 y)	2.2(1.5-2.8)	1.9(0.8-3.0)	0.043	21.2(19.1-23.2)	10.9(5.2-16.5)	0.008	2.1(1.6-2.7)	20.4(18.4-22.4)	-18.3(-19.8-16.8)	<0
Myanmar										
Age at amputation	46.7(43.7-49.8)	47.4(42.2-52.7)	0.069	29.6(28.6-30.5)	28.0 (25-31.1)	0.015	46.9(44.3-49.5)	29.4(28.5-30.3)	17.5(16.6-18.3)	<0
Age at registration	52.0(51.0-52.9)	51.8(50-53.6)	0.615	40.7(40.3-41.2)	38.3(36.6-40)	0.006	51.9(51.1-52.8)	40.5(40.1-40.9)	11.4(10.5-12.3)	<0.
Delay all PwAs (y)	5.3(4.8-5.8)	4.3(3.4-5.3)	<.001	11.2(10.8-11.5)	10.3(9.0-11.6)	0.007	5.0 (4.6-5.5)	11.1(10.8-11.5)	-6.1(-6.7-5.4)	<0.
Delay by PwA age group (age at registration)										
Young child (<5 y)	1.0(1.0-1.0)#	2.0(2.0-2.0)#	1.000	2.0 (2.0-2.0)##	2.5(1.0.5-3.5)##	0.667	1.5(0.5-2.5)	2.3(1.8-2.7)	-0.8(-2.1-0.6)	0.
Child (5-17 y)	4.5(2.3-6.7)	5.6(3.0-8.2)	0.879	2.4(1.8-3.1)	3.9(2.5-5.3)	0.073	5.1(3.4-6.9)	2.8(2.2-3.4)	2.3(0.8-3.8)	0.
Young Adult (18-34 y)	2.6(2.0-3.2)	2.5(0.9-4.0)	0.278	4.5(4.2-4.8)	6.1(4.6-7.5)	0.713	2.6(2-3.2.0)	4.6(4.3-4.9)	-2(-3.0-1.1)	0.
Adult (35-59 y)	4.7(4.1-5.3)	4.3(2.9-5.6)	0.001	13.9(13.5-14.4)	13.1(11.0-15.1)	0.092	4.6(4.0-5.2)	13.9(13.4-14.3)	-9.3(-10.2-8.4)	<0
Older Adult (>60 y)	7.3(6.0-8.5)	4.8(2.8-6.8)	0.014	22.5(20.9-24.1)	19.3(13.2-25.3)	0.072	6.7(5.6-7.7)	22.2(20.7-23.8)	-15.6(-17.4-13.7)	<0
Sudan										
Age at amputation	48.5(46.5-50.5)	45(41.8-48.2)	< 0.001	30.5(29.1-32)	25.9(23.1-28.6)	< 0.001	47.6(45.9-49.3)	29.7(28.4-31.1)	17.9(16.9-18.9)	<0
Age at registration	52.1(51.4-52.7)	48.7(47.4-50)	< 0.001	39.7(38.9-40.5)	34(32.2-35.9)	< 0.001	51.2(50.6-51.8)	38.7(38.0-39.5)	12.5(11.5-13.4)	<0
Delay all PwAs (y)	3.6(3.3-4.0)	3.7(3.1-4.3)	0.053	9.2(8.7-9.8)	8.2(7.1-9.3)	0.525	3.6(3.3-3.9)	9.1(8.6-9.6)	-5.4(-6.0-4.9)	<0
Delay by PwA age group (age at registration)										
Young child (<5 y)	1.0(0.5-1.5)	1.2(0.4-2.0)	0.699	0.8(0.2-1.5)	1.3(0.4-2.3)	0.385	1.1(0.6-1.5)	1.0 (0.5-1.5)	0.1(-0.7-0.9)	0.
Child (5-17 y)	2.7(1.6-3.7)	1.1(0.6-1.7)	0.117	2.9(2.2-3.6)	4.6(3.5-5.7)	0.004	2.1(1.4-2.8)	3.4(2.8-4)	-1.4(-2.3-0.4)	0.
Young Adult (18-34 y)	3.3(2.7-3.9)	4.3(3.2-5.4)	0.004	5.2(4.7-5.7)	6.9(5.6-8.2)	0.013	3.6(3.0-4.1)	5.6(5.1-6)	-2(-2.7-1.3)	<0
Adult (35-59 y)	3.1(2.7-3.5)	3.4(2.7-4.2)	0.064	11.3(10.5-12.2)	9.6(7.4-11.9)	0.047	3.2(2.8-3.6)	11.1(10.3-11.9)	-7.9(-8.7-7.1)	<0
Older Adult (>60 y)	4.4(3.7-5.2)	4.1(2.8-5.4)	0.653	16.6(14.1-19.1)	15.1(9.3-20.9)	0.656	4.4(3.7-5)	16.4(14.1-18.7)	-12(-13.8-10.3)	<0.

Values are mean with 95% Confidence Interval (Mean (95% CI)). MD = Mean Difference between non-traumatic and non-traumatic values.

† Mann-Whitney U test between male and female participants

†† Mann-Whitney U test between participants with non-traumatic and traumatic amputation

y = years6 # 1 partici

6 # 1 participant; ## 2 participants7

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		Non Traumatic A	mutation	Traumatic Ampu	tation	Ratio traumatic:1 non-traumatic amputation	P value†	Total		Gra Tota
		Non-Traumatic Amputation Male Female		Male	Female	amputation	<u> </u>	Male Female		Total
Country	Age Group	N(R% C%)	N(R% C%)	N(R% C%)	N(R% C%)			N(R% C%)	N(R% C%)	N(C
Overall	Total	5481(72.5)	2075(27.5)	18636(89.2)	2254(10.8)	2.76	<0.001	24117(84.8)	4329(15.2)	2844
	Young Child (<5 y)	19(57.6 0.3)	14(42.4 0.7)	99(58.9 0.5)	69(41.1 3.1)	5.09	0.885	118(58.7 0.5)	83(41.3 1.9)	201(
	Child (5-17 y)	168(54.2 3.1)	142(45.8 6.8)	1748(77.8 9.4)	500(22.2 22.2)	7.25	< 0.001	1916(74.9 7.9)	642(25.1 14.8)	2558
	Young Adult (18-34 y)	753(70.6 13.7)	314(29.4 15.1)	8373(91.3 44.9)	799(8.7 35.4)	8.60	< 0.001	9126(89.1 37.8)	1113(10.9 25.7)	1023
	Adult (35-59 y)	2433(72.0 44.4)	948(28.0 45.7)	7047(90.8 37.8)	711(9.2 31.5)	2.29	< 0.001	9480(85.1 39.3)	1659(14.9 38.3)	1113
	Older Adult (>60 y)	2108(76.2 38.5)	657(23.8 31.7)	1369(88.7 7.3)	175(11.3 7.8)	0.56	< 0.001	3477(80.7 14.4)	832(19.3 19.2)	4309
Afghanistan	Total	1344(67.8)	638(32.2)	9261(89.2)	1121(10.8)	8.50	<0.001	10605(85.8)	1759(14.2)	1236
	Young Child (<5 y)	9(64.3 0.7)	5(35.7 0.8)	67(56.3 0.7)	52(43.7 4.6)	10.82	0.568	76(57.1 0.7)	57(42.9 3.2)	133(
	Child (5-17 y)	88(55.7 6.5)	70(44.3 11.0)	1356(79.3 14.6)	354(20.7 31.6)	16.43	< 0.001	1444(77.3 13.6)	424(22.7 24.1)	1868
	Young Adult (18-34 y)	226(65.9 16.8)	117(34.1 18.3)	5239(93.0 56.6)	395(7.0 35.2)	3.18	< 0.001	5465(91.4 51.5)	512(8.6 29.1)	5977
	Adult (35-59 y)	468(62.0 34.8)	287(38.0 45)	2139(89.0 23.1)	265(11.0 23.6)	0.72	< 0.001	2607(82.5 24.6)	552(17.5 31.4)	3159
	Older Adult (>60 y)	553(77.7 41.1)	159(22.3 24.9)	460(89.3 5)	55(10.7 4.9)	10.39	< 0.001	1013(82.6 9.6)	214(17.4 12.2)	1227
Cambodia	Total	142(70.0)	61(30.0)	1861(88.2)	248(11.8)	7.60	<0.001	2003(86.6)	309(13.4)	2312
	Young Child (<5 y)	2(100 1.4)		4(66.7 0.2)	2(33.3 0.8)	12.41	0.346	6(75.0 0.3)	2(25.0 0.6)	8(0.3
	Child (5-17 y)	3(30.0 2.1)	7(70.0 11.5)	53(69.7 2.8)	23(30.3 9.3)	14.82	0.013	56(65.1 2.8)	30(34.9 9.7)	86(3
	Young Adult (18-34 y)	36(70.6 25.4)	15(29.4 24.6)	551(87.0 29.6)	82(13.0 33.1)	3.66	0.001	587(85.8 29.3)	97(14.2 31.4)	684(
	Adult (35-59 y)	58(73.4 40.8)	21(26.6 34.4)	1069(91.3 57.4)	102(8.7 41.1)	2.05	< 0.001	1127(90.2 56.3)	123(9.8 39.8)	1250
	Older Adult (>60 y)	43(70.5 30.3)	18(29.5 29.5)	184(82.5 9.9)	39(17.5 15.7)	6.33	0.038	227(79.9 11.3)	57(20.1 18.4)	284(
Iraq	Total	829(72.4)	316(27.6)	2127(90.7)	219(9.3)	13.24	<0.001	2956(84.7)	535(15.3)	3491
•	Young Child (<5 y)	1(33.3 0.1)	2(66.7 0.6)	12(63.2 0.6)	7(36.8 3.2)	2.22	0.329	13(59.1 0.4)	9(40.9 1.7)	22(0
	Child (5-17 y)	14(50.0 1.7)	14(50.0 4.4)	122(77.7 5.7)	35(22.3 16.0)	0.38	0.002	136(73.5 4.6)	49(26.5 9.2)	185(
	Young Adult (18-34 y)	43(68.3 5.2)	20(31.7 6.3)	756(90.6 35.5)	78(9.4 35.6)	3.32	< 0.001	799(89.1 27.0)	98(10.9 18.3)	897(
	Adult (35-59 y)	376(74.0 45.4)	132(26.0 41.8)	1043(92.5 49.0)	84(7.5 38.4)	2.00	< 0.001	1419(86.8 48.0)	216(13.2 40.4)	1635
	Older Adult (>60 y)	395(72.7 47.6)	148(27.3 46.8)	194(92.8 9.1)	15(7.2 6.8)	4.34	< 0.001	589(78.3 19.9)	163(21.7 30.5)	752(
Myanmar	Total	908(74.5)	311(25.5)	3726(92.0)	322(8.0)	3.41	<0.001	4634(88.0)	633(12.0)	5267
	Young Child (<5 y)	1(50.0 0.1)	1(50.0 0.3)	2(50.0 0.1)	2(50.0 0.6)	0.84	1.000	3(50.0 0.1)	3(50.0 0.5)	6(0.1
	Child (5-17 y)	12(41.4 1.3)	17(58.6 5.5)	93(73.8 2.5)	33(26.2 10.2)	0.67	0.001	105(67.7 2.3)	50(32.3 7.9)	155(
	Young Adult (18-34 y)	111(81.0 12.2)	26(19.0 8.4)	1249(92.0 33.5)	109(8.0 33.9)	1.67	< 0.001	1360(91.0 29.3)	135(9 21.3)	1495
	Adult (35-59 y)	484(74.0 53.3)	170(26.0 54.7)	2081(93.4 55.9)	147(6.6 45.7)	2.11	< 0.001	2565(89.0 55.4)	317(11.0 50.1)	2882
	Older Adult (>60 y)	300(75.6 33)	97(24.4 31.2)	301(90.7 8.1)	31(9.3 9.6)	1.51	< 0.001	601(82.4 13)	128(17.6 20.2)	729(
Sudan	Total	2258(75.1)	749(24.9)	1661(82.8)	344(17.2)	0.25	<0.001	3919(78.2)	1093(21.8 .)	501
	Young Child (<5 y)	6(50.0 0.3)	6(50.0 0.8)	14(70.0 0.8)	6(30.0 1.7)	2.76	0.258	20(62.5 0.5)	12(37.5 1.1)	32(0
	Child (5-17 y)	51(60.0 2.3)	34(40.0 4.5)	124(69.3 7.5)	55(30.7 16)	5.09	0.136	175(66.3 4.5)	89(33.7 8.1)	264(
	Young Adult (18-34 y)	337(71.2 14.9)	136(28.8 18.2)	578(81.1 34.8)	135(18.9 39.2)	7.25	< 0.001	915(77.2 23.3)	271(22.8 24.8)	1186
	Adult (35-59 y)	1047(75.6 46.4)	338(24.4 45.1)	715(86.4 43)	113(13.6 32.8)	8.60	< 0.001	1762(79.6 45)	451(20.4 41.3)	2213
	Older Adult (>60 y)	817(77.7 36.2)	235(22.3 31.4)	230(86.8 13.8)	35(13.2 10.2)	2.29	0.001	1047(79.5 26.7)	270(20.5 24.7)	1317

2 Values are number of participants (row % | column %). Row % relates to sex distribution. Column % relates to age distribution.

3 † Chi Square tests between participants by sex and cause (non-traumatic/ traumatic amputation).

y = years

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2 3		
4	1	Distribution by sex and age of persons presenting with traumatic and non-traumatic
5	2	amputations
6	3	Table 2 shows that children under 18 attending were represented in low proportions (3 -
7	4	5.9%) in all countries except Afghanistan (2001 [16.2%] of 12364). Sudan had the highest
8 9	5	proportion of PwA attending in ages over 60 (1317 [26.3%] of 5012).
10	6	Most men entering rehabilitation were of working age (18–59 years) ranging from 68.3%
11	7	(Sudan) to 85.6% (Cambodia) of total males. Among women, the working age group (18–59
12	8	years) constituted between 58.7% (Iraq) and 71.4% (Myanmar) of total females.
13 14	9	The proportion of males accessing rehabilitation was higher in all age groups except children
14	10	under five in Myanmar (3 [50.0%] of 6). Even in older age groups (>60 years) there was a
16		significant male versus female majority (3477 [80.7%] of 4309) across all countries, relating
17	11	
18	12	to traumatic and non-traumatic causes. The majority of users with non-traumatic
19 20	13	amputation were aged under 60 years, 3373 (61.5%) of 5481 male and 1418 (68.3%) of 2075
20	14	female PwA.
22	15	
23	16	Distribution of amputation causes by categories and in detail, by country
24 25	17	Figure 1 illustrates how the registered causes of amputation were categorized. Most
26	18	amputations were of traumatic origin, 20890 [73.4%] of 28466 (table 3).
27	19	Among all men, 18636 (77.3%) of 24117 had traumatic amputations. Among all women,
28	20	2254 (52.1%) of 4329 had traumatic amputation.
29	21	Sudan had the highest proportion of non-traumatic amputations, 3007 (60.0%) of 5012,
30 31	22	outnumbering traumatic amputations across both sexes and had an overall higher female
32	23	representation of 1093 (21.8%) of 5012 compared to the remaining countries.
33	24	Despite the high numbers of conflict-related amputation in the overall cohort, 1885 (43.5%)
34	25	of 4329 females and 5114 (21.2%) of 24117 males presented with a likely T2D related
35 36	26	amputation.
37	20	One third (9319 [32.8%] of 28466) of the overall cohort attended with amputation caused by
38		
39	28	weapon-contamination. RTA constituted 3044 (10.7%) of all amputation causes. Blast injury
40 41	29	caused 2319 (8.2%) and gunshot wound (GSW) 1834 (6.4%) of all amputations.
41	30	More than half of all men presented with conflict-related traumatic amputations, 12691
43	31	(52.7%) of 24117, landmines alone constituted 8571 (35.3%) of all males' amputations.
44	32	Within women, traumatic amputations were evenly distributed between conflict and non-
45	33	conflict related (1110 [25.7%] and 1144 [26.4%] of 4329, respectively). Landmines caused
46 47	34	483 (11.2%), RTA 396 (9.1%) and domestic accidents 369 (8.5%) of all females' amputations.
48	35	Proportions of men compared to women were significantly higher in most traumatic causes.
49	36	This was even more pronounced in conflict-related causes and highest for landmines, 8517
50	37	(94.6%) of 9000. In Myanmar, weapon-contamination caused 2200 (41.8%) of 5267
51 52	38	amputations, in Afghanistan 5147 (41.6%) of 12364, in Iraq 714 (20.5%) of 3491, in Sudan 57
52 53	39	(1.1%) of 5012 and in post-conflict Cambodia 1201 (51.9%) of 2312.
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Table 3. Distribution	of amputation	causes by categories	and in detail, by country ¹

		All countr	ies		Afghanistan			Cambodia		
		Total N	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)
Tot	al	28446	24117(84.8)	4329(15.2)	12364()	10605(85.8)	1759(14.2)	2312()	2003(86.6)	309(13.4)
	Non-trauma	7556	5481(72.5 22.7)	2075(27.5 47.9)	1982(16.0)	1344(67.8 12.7)	638(32.2 36.3)	203(8.8)	142(70.0 7.1)	61(30.0 19.7)
	Trauma	20890	18636(89.2 77.3)	2254(10.8 52.1)	10382(84.0)	9261(89.2 87.3)	1121(10.8 63.7)	2109(91.2)	1861(88.2 92.9)	248(11.8 80.3)
Cau	ises by Sub-Categories									
	Non-trauma NCD/T2D	6999	5114(73.1 21.2)	1885(26.9 43.5)	1750(14.2)	1190(68.0 11.2)	560(32.0 31.8)	192(8.3)	134(69.8 6.7)	58(30.2 18.8)
	Non-trauma Other	557	367(65.9 1.5)	190(34.1 4.4)	232(1.9)	154(66.4 1.5)	78(33.6 4.4)	11(0.5)	8(72.7 0.4)	3(27.3 1)
	Trauma Non-conflict Non- accident	1164	930(79.9 3.9)	234(20.1 5.4)	332(2.7)	255(76.8 2.4)	77(23.2 4.4)	320(13.8)	275(85.9 13.7)	45(14.1 14.6)
ma	Trauma Non-conflict Accident	5925	5015(84.6 20.8)	910(15.4 21)	2245(18.2)	1872(83.4 17.7)	373(16.6 21.2)	501(21.7)	423(84.4 21.1)	78(15.6 25.2)
Trauma	Trauma Conflict Weapon	4482	3872(86.4 16.1)	610(13.6 14.1)	2658(21.5)	2261(85.1 21.3)	397(14.9 22.6)	87(3.8)	62(71.3 3.1)	25(28.7 8.1)
	Trauma Conflict Weapon contamination	9319	8819(94.6 36.6)	500(5.4 11.6)	5147(41.6)	4873(94.7 46.0)	274(5.3 15.6)	1201(51.9)	1101(91.7 55)	100(8.3 32.4)
Cau	ıses in Detail							, í.,		,
а	Infectious	3661	2618(71.5 10.9)	1043(28.5 24.1)	1205(9.7)	821(68.1 7.7)	384(31.9 21.8)	161(7)	117(72.7 5.8)	44(27.3 14.2)
Non-trauma	Metabolic	148	115(77.7 0.5)	33(22.3 0.8)	137(1.1)	110(80.3 1.0)	27(19.7 1.5)		l	
tra	Vascular	3190	2381(74.6 9.9)	809(25.4 18.7)	408(3.3)	259(63.5 2.4)	149(36.5 8.5)	31(1.3)	17(54.8 0.8)	14(45.2 4.5)
le l	Cancerous	511	344(67.3 1.4)	167(32.7 3.9)	204(1.6)	144(70.6 1.4)	60(29.4 3.4)	1(0.0)	1(100 0)	
z r	Other - Non-Trauma	46	23(50.0 0.1)	23(50.0 0.5)	28(0.2)	10(35.7 0.1)	18(64.3 1)	10(0.4)	7(70.0 0.3)	3(30.0 1.0)
	Animal bite	203	156(76.8 0.6)	47(23.2 1.1)	15(0.1)	14(93.3 0.1)	1(6.7 0.1)	16(0.7)	11(68.8 0.5)	5(31.3 1.6)
	Crime	5	5(100 0)	**	3(0)	3(100 0)				
	Frost bite	48	46(95.8 0.2)	2(4.2 0)	37(0.3)	35(94.6 0.3)	2(5.4 0.1)			
	Other – Trauma	908	723(79.6 3.0)	185(20.4 4.3)	277(2.2)	203(73.3 1.9)	74(26.7 4.2)	304(13.1)	264(86.8 13.2)	40(13.2 12.9)
	Domestic accident	1388	1019(73.4 4.2)	369(26.6 8.5)	825(6.7)	557(67.5 5.3)	268(32.5 15.2)	52(2.2)	45(86.5 2.2)	7(13.5 2.3)
	Occupational accident	1191	1096(92.0 4.5)	95(8.0 2.2)	379(3.1)	363(95.8 3.4)	16(4.2 0.9)	93(4)	79(84.9 3.9)	14(15.1 4.5)
	Railway accident	227	183(80.6 0.8)	44(19.4 1.0)	10(0.1)	9(90.0 0.1)	1(10.0 0.1)	3(0.1)	2(66.7 0.1)	1(33.3 0.3)
l m	RTA	3044	2648(87.0 11.0)	396(13.0 9.1)	1024(8.3)	936(91.4 8.8)	88(8.6 5.0)	349(15.1)	294(84.2 14.7)	55(15.8 17.8)
Trauma	Sport accident	75	69(92.0 0.3)	6(8.0 0.1)	7(0.1)	7(100 0.1)		4(0.2)	3(75.0 0.1)	1(25.0 0.3)
	Blast injury	2319	1980(85.4 8.2)	339(14.6 7.8)	1383(11.2)	1131(81.8 10.7)	252(18.2 14.3)	15(0.6)	11(73.3 0.5)	4(26.7 1.3)
	GSW	1834	1628(88.8 6.8)	206(11.2 4.8)	1157(9.4)	1037(89.6 9.8)	120(10.4 6.8)	28(1.2)	23(82.1 1.1)	5(17.9 1.6)
	Other – Conflict	273	218(79.9 0.9)	55(20.1 1.3)	88(0.7)	68(77.3 0.6)	20(22.7 1.1)	25(1.1)	12(48.0 0.6)	13(52.0 4.2)
	No data*	56	46(82.1 0.2)	10(17.9 0.2)	30(0.2)	25(83.3 0.2)	5(16.7 0.3)	19(0.8)	16(84.2 0.8)	3(15.8 1.0)
	Cluster Munitions	71	69(97.2 0.3)	2(2.8 0)	38(0.3)	37(97.4 0.3)	1(2.6 0.1)	11(0.5)	11(100 0.5)	
	ERW	248	233(94.0 1.0)	15(6.0 0.3)	208(1.7)	197(94.7 1.9)	11(5.3 0.6)	1(0)	1(100 0)	
	Landmines	9000	8517(94.6 35.3)	483(5.4 11.2)	4901(39.6)	4639(94.7 43.7)	262(5.3 14.9)	1189(51.4)	1089(91.6 54.4)	100(8.4 32.4)

¹the reader is directed to fig. 1 when interpreting this table

		Iraq			Myanmar			Sudan		
		Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%)	Total N(C%)	Male N(R% C%)	Female N(R% C%
Total		3491()	2956(84.7)	535(15.3)	5267()	4634(88.0)	633(12.0)	5012()	3919(78.2)	1093(21.8)
	Non-trauma	1145(32.8)	829(72.4 28)	316(27.6 59.1)	1219(23.1)	908(74.5 19.6)	311(25.5 49.1)	3007(60.0)	2258(75.1 57.6)	749(24.9 68.5)
	Trauma	2346(67.2)	2127(90.7 72)	219(9.3 40.9)	4048(76.9)	3726(92.0 80.4)	322(8.0 50.9)	2005(40.0)	1661(82.8 42.4)	344(17.2 31.5)
Ca	uses by Sub-Categories	, , ,			, , ,			, í		
	Non-trauma NCD/T2D	1084(31.1)	790(72.9 26.7)	294(27.1 55.0)	1138(21.6)	846(74.3 18.3)	292(25.7 46.1)	2835(56.6)	2154(76.0 55.0)	681(24.0 62.3)
[Non-trauma Other	61(1.7)	39(63.9 1.3)	22(36.1 4.1)	81(1.5)	62(76.5 1.3)	19(23.5 3)	172(3.4)	104(60.5 2.7)	68(39.5 6.2)
	Trauma Non-conflict Non-									
.	accident	32(0.9)	29(90.6 1)	3(9.4 0.6)	76(1.4)	60(78.9 1.3)	16(21.1 2.5)	404(8.1)	311(77.0 7.9)	93(23.0 8.5)
	Trauma Non-conflict Accident	525(15)	446(85 15.1)	79(15 14.8)	1689(32.1)	1469(87.0 31.7)	220(13.0 34.8)	965(19.3)	805(83.4 20.5)	160(16.6 14.6)
1 1	Trauma Conflict Weapon	1075(30.8)	978(91 33.1)	97(9.0 18.1)	83(1.6)	77(92.8 1.7)	6(7.2 0.9)	579(11.6)	494(85.3 12.6)	85(14.7 7.8)
- [Trauma Conflict Weapon									
	contamination	714(20.5)	674(94.4 22.8)	40(5.6 7.5)	2200(41.8)	2120(96.4 45.7)	80(3.6 12.6)	57(1.1)	51(89.5 1.3)	6(10.5 0.5)
Ca	uses in Detail									
Non-trauma	Infectious	367(10.5)	260(70.8 8.8)	107(29.2 20.0)	542(10.3)	387(71.4 8.4)	155(28.6 24.5)	1386(27.7)	1033(74.5 26.4)	353(25.5 32.3)
	Metabolic				11(0.2)	5(45.5 0.1)	6(54.5 0.9)			
	Vascular	717(20.5)	530(73.9 17.9)	187(26.1 35.0)	585(11.1)	454(77.6 9.8)	131(22.4 20.7)	1449(28.9)	1121(77.4 28.6)	328(22.6 30)
	Cancerous	60(1.7)	38(63.3 1.3)	22(36.7 4.1)	74(1.4)	57(77.0 1.2)	17(23.0 2.7)	172(3.4)	104(60.5 2.7)	68(39.5 6.2)
-	Other – Non-Trauma	1(0)	1(100 0)		7(0.1)	5(71.4 0.1)	2(28.6 0.3)			
	Infectious	4(0.1)	3(75 0.1)	1(25.0 0.2)	20(0.4)	13(65.0 0.3)	7(35.0 1.1)	148(3.0)	115(77.7 2.9)	33(22.3 3.0)
	Crime	2(0.1)	2(100 0.1)							
	Frost bite	6(0.2)	6(100 0.2)		3(0.1)	3(100 0.1)		2(0)	2(100 0.1)	
	Other – Trauma	20(0.6)	18(90.0 0.6)	2(10.0 0.4)	53(1)	44(83.0 0.9)	9(17.0 1.4)	254(5.1)	194(76.4 5)	60(23.6 5.5)
[Domestic accident	83(2.4)	66(79.5 2.2)	17(20.5 3.2)	297(5.6)	259(87.2 5.6)	38(12.8 6)	131(2.6)	92(70.2 2.3)	39(29.8 3.6)
[Occupational accident	102(2.9)	95(93.1 3.2)	7(6.9 1.3)	553(10.5)	499(90.2 10.8)	54(9.8 8.5)	63(1.3)	60(95.2 1.5)	3(4.8 0.3)
, [Railway accident	8(0.2)	6(75 0.2)	2(25.0 0.4)	164(3.1)	129(78.7 2.8)	35(21.3 5.5)	42(0.8)	37(88.1 0.9)	5(11.9 0.5)
	RTA	325(9.3)	272(83.7 9.2)	53(16.3 9.9)	637(12.1)	546(85.7 11.8)	91(14.3 14.4)	709(14.1)	600(84.6 15.3)	109(15.4 10)
	Sport accident	7(0.2)	7(100 0.2)		38(0.7)	36(94.7 0.8)	2(5.3 0.3)	19(0.4)	16(84.2 0.4)	3(15.8 0.3)
	Blast injury	844(24.2)	770(91.2 26)	74(8.8 13.8)	17(0.3)	15(88.2 0.3)	2(11.8 0.3)	60(1.2)	53(88.3 1.4)	7(11.7 0.6)
	GSW	144(4.1)	130(90.3 4.4)	14(9.7 2.6)	60(1.1)	56(93.3 1.2)	4(6.7 0.6)	445(8.9)	382(85.8 9.7)	63(14.2 5.8)
	Other – Conflict	85(2.4)	76(89.4 2.6)	9(10.6 1.7)	4(0.1)	4(100 0.1)		71(1.4)	58(81.7 1.5)	13(18.3 1.2)
	No data*	2(0.1)	2(100 0.1)		2(0)	2(100 0)		3(0.1)	1(33.3 0)	2(66.7 0.2)
	Cluster Munitions	2(0.1)	2(100 0.1)		6(0.1)	6(100 0.1)		14(0.3)	13(92.9 0.3)	1(7.1 0.1)
[ERW	38(1.1)	34(89.5 1.2)	4(10.5 0.7)	1(0)	1(100 0)				
	Landmine	674(19.3)	638(94.7 21.6)	36(5.3 6.7)	2193(41.6)	2113(96.4 45.6)	80(3.6 12.6)	43(0.9)	38(88.4 1.0)	5(11.6 0.5)

Categories of amputation causes as illustrated in figure 1 and detailed causes in totals, by sex and by country. Values are number of participants (row % | column%). Row% relates to sex distribution. Column% relates to amputation cause distribution. RTA = road traffic accident; GSW = Gunshot wound; ERW = explosive remnants of war; no data = missing variable (mandatory entry in database) due to software error in the category 'Trauma Conflict Weapon'.

1	Table 4. Amputation characteristics - combinations and levels of amputation
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		All Amputations		No	n-Traumatic Amp	utations	Traumatic Amputations		
Combinations of amputation(s)	Total	Male N	Female N	Total	Male	Female			Female
Combinations of amputation(s)	PwA (C%)	(R% C%)	(R% C%)	(C%)	N(R% C%)	N(R% C%)	Total (C%)	Male N(R% C%)	N(R% C%)
Total participants	28446	24117 (84.8)	4329 (15.2)	7556(0)	5481(72.5 0)	2075(27.5 0)	20890(0)	18636(89.2 0)	2254(10.8 0)
Persons with single LEA	22693 (79.8)	19152 (84.4 79.4)	3541 (15.6 81.8)	7049(93.3)	5122(72.7 93.5)	1927(27.3 92.9)	15644(74.9)	14030(89.7 75.3)	1614(10.3 71.
Persons with single UEA	3402 (12.0)	2951 (86.7 12.2)	451 (13.3 10.4)	177(2.3)	110(62.1 2.0)	67(37.9 3.2)	3225(15.4)	2841(88.1 15.2)	384(11.9 17.0
Persons with double LEA	1868 (6.6)	1575 (84.3 6.5)	293 (15.7 6.8)	302(4.0)	225(74.5 4.1)	77(25.5 3.7)	1566(7.5)	1350(86.2 7.2)	216(13.8 9.6)
Persons with double UEA	157 (0.6)	149 (94.9 0.6)	8 (5.1 0.2)	6(0.1)	6(100 0.1)		151(0.7)	143(94.7 0.8)	8(5.3 0.4)
Persons with single LEA + single UEA	195 (0.7)	177 (90.8 0.7)	18 (9.2 0.4)	15(0.2)	13(86.7 0.2)	2(13.3 0.1)	180(0.9)	164(91.1 0.9)	16(8.9 0.7)
Persons with double LEA + single UEA	92 (0.3)	80 (87.0 0.3)	12 (13.0 0.3)	3(0)	3(100 0.1)		89(0.4)	77(86.5 0.4)	12(13.5 0.5)
Persons with single LEA + double UEA	24 (0.1)	22 (91.7 0.1)	2 (8.3 0)	2(0)	1(50 0)	1(50 0)	22(0.1)	21(95.5 0.1)	1(4.5 0)
Persons with double LEA + double UEA	15 (0.1)	11 (73.3 0)	4 (26.7 0.1)	2(0)	1(50 0)	1(50 0)	13(0.1)	10(76.9 0.1)	3(23.1 0.1)
I mult of an anticipation (a)	Total Amp	Amp in male	Amp in female		Amp in male	Amp in female		Amp in male	Amp in fema
Levels of amputation(s)	(C%)	PwA	PwA	Total Amp	PwA	PwA	Total Amp	PwA	PwA
Total amputations	30943	26255 (84.8)	4688 (15.2)	7835	5694 (72.7 0)	2141 (27.3 0)	21795	19384 (88.9 0)	2411 (11.1 0)
Total LEA	26862(86.8)	22683(84.4 86.4)	4179(15.6 89.1)	7680(98.0)	5594(72.8 98.2)	2086(27.2 97.4)	19182(88.0)	17089(89.1 88.2)	2093(10.9 86
Partial foot amputation	1866(6.0)	1374(73.6 5.2)	492(26.4 10.5)	333(4.3)	241(72.4 4.2)	92(27.6 4.3)	1533(7.0)	1133(73.9 5.8)	400(26.1 16.6
Ankle disarticulation	432(1.4)	349(80.8 1.3)	83(19.2 1.8)	117(1.5)	79(67.5 1.4)	38(32.5 1.8)	315(1.4)	270(85.7 1.4)	45(14.3 1.9)
Transtibial amputation	15399(49.8)	13017(84.5 49.6)	2382(15.5 50.8)	5008(63.9)	3665(73.2 64.4)	1343(26.8 62.7)	10391(47.7)	9352(90.0 48.2)	1039(10.0 43
Knee disarticulation/ Transcondylar			6	164(2.1)					
amputation	887(2.9)	759(85.6 2.9)	128(14.4 2.7)		128(78 2.2)	36(22 1.7)	723(3.3)	631(87.3 3.3)	92(12.7 3.8)
Transfemoral amputation	8080(26.1)	7019(86.9 26.7)	1061(13.1 22.6)	1983(25.3)	1430(72.1 25.1)	553(27.9 25.8)	6097(28)	5589(91.7 28.8)	508(8.3 21.1)
Hip disarticulation/ Hemipelvectomy	198(0.6)	165(83.3 0.6)	33(16.7 0.7)	75(1.0)	51(68 0.9)	24(32 1.1)	123(0.6)	114(92.7 0.6)	9(7.3 0.4)
Total UEA	4081(13.2)	3572(87.5 13.6)	509(12.5 10.9)	155(2.0)	100(64.5 1.8)	55(35.5 2.6)	2613(12.0)	2295(87.8 11.8)	318(12.2 13.2
Partial hand amputation	322(1.0)	258(80.1 1.0)	64(19.9 1.4)	21(0.3)	12(57.1 0.2)	9(42.9 0.4)	124(0.6)	94(75.8 0.5)	30(24.2 1.2)
Wrist disarticulation	436(1.4)	393(90.1 1.5)	43(9.9 0.9)	11(0.1)	8(72.7 0.1)	3(27.3 0.1)	417(1.9)	378(90.6 2.0)	39(9.4 1.6)
Transradial amputation	1973(6.4)	1762(89.3 6.7)	211(10.7 4.5)	37(0.5)	23(62.2 0.4)	14(37.8 0.7)	820(3.8)	731(89.1 3.8)	89(10.9 3.7)
Elbow disarticulation	151(0.5)	131(86.8 0.5)	20(13.2 0.4)	9(0.1)	6(66.7 0.1)	3(33.3 0.1)	139(0.6)	123(88.5 0.6)	16(11.5 0.7)
Transhumeral amputation	1078(3.5)	927(86 3.5)	151(14.0 3.2)	66(0.8)	42(63.6 0.7)	24(36.4 1.1)	1004(4.6)	877(87.4 4.5)	127(12.6 5.3)
Shoulder disarticulation	121(0.4)	101(83.5 0.4)	20(16.5 0.4)	11(0.1)	9(81.8 0.2)	2(18.2 0.1)	109(0.5)	92(84.4 0.5)	17(15.6 0.7)

2 Values are number of participants and number of amputations, respectively (row % | column %). Row% relates to sex distribution. Column% relates to amputation

3 characteristic distribution. LEA = lower extremity amputation; UEA = upper extremity amputation

Amputation characteristics - combinations and levels of amputation

Table 4 illustrates amputation characteristics by combinations and levels. Multiple amputations were present in 2014 (8.4%) of 24117 men and 337 (7.8%) of 4329 women. Double LEA was the most common combination occurring in 1575 (6.5%) men and 293 (6.8%) women and more likely in persons with traumatic amputations (1566 [7.5%] of 20890) compared to those with non-traumatic amputations (302 [4.0%] of 7556). In total, 30943 amputations were registered, of which 15399 (49.8%) were transtibial. Of all non-traumatic amputations, 7680 (98.0% of 7835) were LEA, the majority transtibial (5008 [63.9%]), whereas 2613 (12.0% of 19182) of all traumatic amputations occurred in the upper extremity. Living environment Most PwA reportedly came from rural environment (17202 [60.5%] of 28446; 1996 [7%] unspecified). There was a significantly higher proportion of women (1742 [18.8%] of 9248) in the urban compared to the rural population, (2308 [13.4%] of 17202; p<0.01). DISCUSSION Traumatic amputation at young adult age has devastating effects on a person's private and professional perspectives. A worrying finding in this study was the delay between amputation and beginning rehabilitation, particularly for those with traumatic amputation. Ideally, prosthetic fitting happens right after wound-healing. Any delay will increase functional limitations and the potential of complications.⁴² Consequently, duration, costs and complexity of rehabilitation will rise, including prosthetic adjustments. In cases of irreversible limitations PwA may no longer qualify for fitting.⁸ The studied countries are marked either by protracted crisis with recurring flares of acute fighting or post-conflict with weak economy and fragile health systems.³³ These factors result in high numbers of PwA, who face access difficulties to rehabilitation aggravated by compromised infrastructure and security, lack of means or awareness, and critical scarcity or overload of existing rehabilitation workforce and services.4,43,44 The later age observed for non-traumatic amputation is not surprising, but the average age of 48.2 years is very low compared to studies in HIC reporting ages of over $65^{1,45}$ Amputations at young age as a complication of underlying health conditions such as T2D reflect the many health system challenges in the studied countries.⁴⁶ Although this group attends rehabilitation significantly faster than the traumatic group, the delay is still considerable and potentially harmful in view of the risks associated with immobility in poorly managed T2D. The difference in delay between the traumatic and non-traumatic cohorts may be explained by the widespread lack of essential healthcare services during past conflict (e.g. Cambodia).⁴⁷ This may have led to high mortality rates in persons with conditions like T2D. PwA of traumatic origin may have survived long enough to eventually attend rehabilitation, after years of unavailability or inaccessibility of services, a possible explanation for the considerable backlog of persons with traumatic amputations. A steadfast interpretation of detailed delays is impossible owing to the extremely complex conflict

Page 17 of 32

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history and uncertain service provision in the studied contexts including displaced populations, persons of a specific ethnicity or with a political or military past unable to cross certain combat zones. What we know for sure is that an amputation at working age and delayed prosthetic fitting and rehabilitation - not counting the unknown numbers of non-attendees - feed into the vicious cycle of disability and poverty, increasing the difficulties PwA face when it comes to reintegrating into society in these contexts.^{44,48} The proportions of non-traumatic and traumatic amputations are reversed compared to non-conflict countries and disclose the human cost of protracted crises.^{45,49} Explosive devices as amputation cause lead to complex injuries.^{4,25} Patient outcomes depend on the availability and capacity of specialised emergency and surgical care if the effects of polytraumas are handled optimally. Subject to the extent of injury and the firearm used, amputations from GSW may also be an indicator of delayed trauma- and general poor health-care. In remote areas injured people may reach medical assistance only at a stage when the affected limb can no longer be saved. Furthermore, amputation being less time-consuming and risky than limb salvage may be indicated to assist higher numbers of people.^{50,51} A person with traumatic amputation needs to cope with the sudden loss when adapting to a life with permanent disability. Rehabilitation outcomes depend on the complexity of polytraumas. The psychological consequences and post-traumatic repercussion are considerable after traumatic amputation and require specialised multidisciplinary care.^{25,48,52} The studied countries rank among the most mine-contaminated contexts worldwide.⁵³ Survivors with amputations from weapon-contamination symbolise the long-term consequences of conflict, which may last for decades and continue producing injuries and disability long after the end of active fighting. Cambodia's almost 30 years of conflict, for instance, ended in 1998. Between 2009 and 2018 more than half of all new registrations attending rehabilitation were male PwA caused by landmines exemplifying the sustained destructive potential of conflict on a society. 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.³⁹ Likewise, most infections causing non-traumatic amputations were assumed to result from undiagnosed or undocumented T2D with infected ulcer and gangrene.^{28,38} Common etiologies of diabetes foot ulcer include neuropathic (approximately 55%), arterial (10%) and neuroischemic causes (approximately 35%).⁴⁰ PwA due to T2D in fragile settings are a highly vulnerable group. The amputation will be the consequence of a progressing chronic illness, which might be diagnosed only at the time of complication and which the person will have to cope with on top of the limb loss. If diagnosed, the person's understanding of their health status and its implications for lifestyle changes will be crucial. The risk of complications is considerable as the 39–68% five years mortality rate of diabetic foot shows.⁵⁴ In conflict countries, the comprehensive care required for conditions like T2D is challenged by lack of availability, affordability and access to inter-professional services for diagnosis and long-term management. It is also compromised by the environment as living in

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displacement and depending on aid do not facilitate the necessary lifestyle adaptations, such as diet and exercise. Deprioritisation of NCD-care in crisis settings in order to address immediate trauma and prevent epidemics puts T2D patients at higher risk of neglect.²⁸ Regaining functionality through active rehabilitation may be more demanding compared to someone with traumatic amputation due to age and general health differences between both populations. The fitting process will be more complicated due to the remaining limb's shape and consistency. Complex chronic conditions require a kind of rehabilitation that PRCs in conflict zones may not be organized for. 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".⁵⁵ Improved NCD management on primary healthcare level is the first step.⁵⁶ 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. The peak of amputation among young adult males and the significant majority of male PwA may be explained by ongoing conflict in most contexts. There is consensus in the literature that worldwide more males than females undergo amputation, but the distribution differs according to age and cause.^{1,57,58} Especially during active age and regardless of conflict, rates are higher in men due to work- or leisure-related accidents.^{49,59} Despite a similar T2D prevalence among sexes, T2D-related amputation rates are higher among men due to higher prevalence of smoking, peripheral vascular disease, neuropathy and diabetic foot ulceration.¹ For certain groups a gender dimension may influence access to rehabilitation. Higher female than male proportions are reported for older persons with traumatic amputations which are unlikely due to combat or occupational risk.^{58,59} This is in contrast to the significant male majority in our study population. Also, our findings revealed that in urban environments, and in contrast to men, female PwA attending rehabilitation constitute a significantly larger proportion than in rural environments. Access barriers to services for women from more remote rural areas may exist such as challenging infrastructure, poverty, insecurity, and cultural factors and warrant further investigation.⁶⁰ The main limitation of this study is that data is derived from ICRC PRCs only and therefore not representative of population. However, in absence of amputation incidence data this first multi-country analysis offers a unique insight into the population of rehabilitation users with amputations in fragile contexts including (ex-)combatants and civilians of all ages with amputations of all origins. As the data does not represent prevalence, but attendance to rehabilitation, it is difficult to estimate how many PwA do not receive services. Where existing, data was compared to published prevalence studies from similar contexts. The dearth of quality publications in such contexts underlines the mismatch between existing research and where the burden of disease is.²⁶

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5	2	CONCLUSION
6	3	In conclusion, this study highlights the persisting burden of amputation in conflict contexts
7	4	and the consequences of broken health systems and a fragmented continuum of care. Young
8 9	5	age and long delays to rehabilitation reveal the hardship in which PwAs live in such settings.
10	6	The figures of landmine-caused amputations disclose the cruel long-term dimension of
11	7	conflict.
12	8	Rehabilitation services are seriously under-resourced as revealed in a recent publication on
13 14	9	global estimates of rehabilitation needs. ⁶¹ Our data have been collected in highly challenging
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16	10	and diverse settings where even basic healthcare is compromised. Providing rehabilitation
17	11	and collecting data in these underserved, volatile contexts is exceptionally complex. ³⁰ The
18	12	few PRCs in conflict settings cater for amputations of various causes and PwA of different
19 20	13	age, sex, other trauma and co-morbidities including psychological after-effects and future
20	14	prospects of life with amputation. This requires tailored approaches matched with outcome
22	15	and impact measurements. Managing these highly diverse processes is the responsibility of a
23	16	multidisciplinary rehabilitation team including peer-support by other PwA – an enormous
24 25	17	challenge in settings with so many needs and so little resources.
25 26	18	Preventive measures on all levels of healthcare are essential to reduce the number of T2D-
27	19	caused amputations. ^{62,63} Rather than solely managing amputations as the last consequence,
28	20	rehabilitation professionals should get increasingly involved in provision of comprehensive
29		care.
30 21	21	
31 32	22	We call out to rehabilitation service providers and healthcare professionals for a
33	23	prioritisation of rehabilitation in fragile settings and a stronger and prompt involvement of
34	24	rehabilitation professionals on all levels of the continuum of care. This includes international
35	25	humanitarian interventions as well as local health system strengthening interventions. In
36 37	26	addition, it is crucial that future research identifies and tests efficient, innovative, context-
38	27	adapted best practice models including service provision and impact measurement to
39	28	address the mismatch of rehabilitation needs and resources in fragile settings.
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27 28	47	All six such and send with stand to relative and send the set of the study.
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30	18	
31	19	Specific additional contributions are as follows:
32	20	
33 34	21	Cornelia A. Barth: literature research, data acquisition and analysis, conception and design,
35	22	data interpretation
36	23	
37	24	Andreas Wladis: conception and design, data interpretation
38	25	
39 40		Catherine Blake: conception and design, data analysis and interpretation
40 41	26	Catherine Blake. conception and design, data analysis and interpretation
42	27	
43	28	Sigiriya Aebischer Perone: literature research, data interpretation
44	29	
45 46	30	Prashant Bhandarkar: data tabulation, analysis and interpretation
46 47	31	
48	32	Cliona O'Sullivan: literature research, conception and design, data interpretation
49	33	
50		
51 52	34	DATA AVAILABILITY STATEMENT
53	35	All relevant data are included in the tables of this study.
54 55	36	Due to the sensitive nature of this data, data sharing is subject to regulations of ICRC data
56	37	protection policy.
57	57	
58 59 60	38	

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Legends for figures

registration

ERW= explosive remnants of war

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Figure 1. Classification of amputation causes with % of total persons with amputations

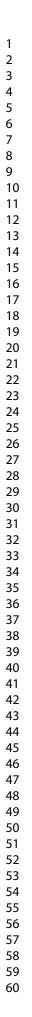
All 21 variables on the right are as they appear in mandatory dropdown lists of the database. The database distinguishes between (i) traumatic and all other causes; (ii) conflict-related and all other traumatic causes; (iii) weapon-contamination and all other conflict-related causes; all additional categories were created based on the original 21 variables. NCD/T2D = cause likely linked to non-communicable disease (NCD) or type 2 diabetes mellitus (T2D) complications; RTA= road traffic accident; GSW= Gunshot wound; No data = software error;

Figure 2. Age patterns of male and female persons with traumatic and non-traumatic amputation

Violin plots showing age of all male and female PwA of a) traumatic cause at time of amputation, b) at time of registration, age of male and female PwA of c) non-traumatic cause at time of amputation, d) at time of

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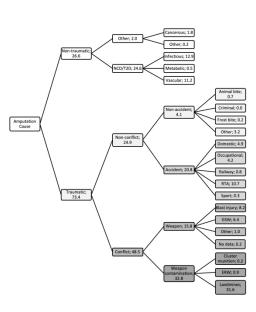
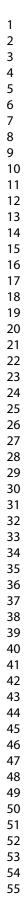
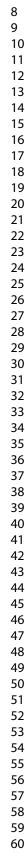


Figure 1. Classification of amputation causes with % of total persons with amputations All 21 variables on the right are as they appear in mandatory dropdown lists of the database. The database distinguishes between (i) traumatic and all other causes; (ii) conflict-related and all other traumatic causes; (iii) weapon-contamination and all other conflict-related causes; all additional categories were created based on the original 21 variables. NCD/T2D = cause likely linked to non-communicable disease (NCD) or type 2 diabetes mellitus (T2D) complications; RTA= road traffic accident; GSW= Gunshot wound; No data = software error; ERW= explosive remnants of war

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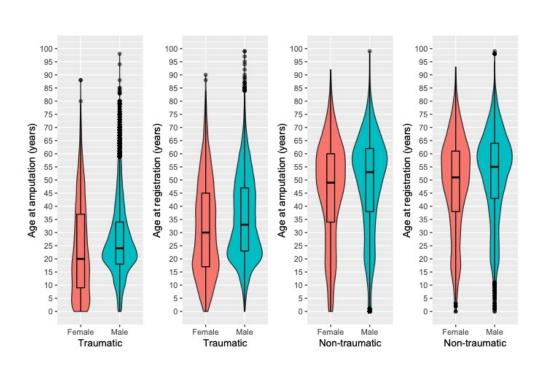


Figure 2. Age patterns of male and female persons with traumatic and non-traumatic amputation Violin plots showing age of all male and female PwA of a) traumatic cause at time of amputation, b) at time of registration, age of male and female PwA of c) non-traumatic cause at time of amputation, d) at time of registration.

242x155mm (72 x 72 DPI)

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstra	ct		•		
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b)Provide in the abstract an informative and balanced		RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included.	Page 2
		summary of what was done and what was found	Pr to	RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract.	Page 2
			i evie	RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	-
Introduction	1-				
Background rationale	2	Explain the scientific background and rationale for the investigation being reported		5/1	Page 4-5
Objectives	3	State specific objectives, including any prespecified hypotheses		<u>J</u>	Page 5
Methods			_		_
Study Design	4	Present key elements of study design early in the paper			Page 5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			Page 5

The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

Participants	6	(a) Cohort study - Give the	RECORD 6.1: The methods of study	Page 5
1		eligibility criteria, and the	population selection (such as codes or	C
		sources and methods of selection	algorithms used to identify subjects)	
		of participants. Describe	should be listed in detail. If this is not	
		methods of follow-up	possible, an explanation should be	
		<i>Case-control study</i> - Give the	provided.	
		eligibility criteria, and the	provided.	
		sources and methods of case	RECORD 6.2: Any validation studios	
		ascertainment and control	RECORD 6.2: Any validation studies	-
		selection. Give the rationale for	of the codes or algorithms used to	
			select the population should be	
		the choice of cases and controls	referenced. If validation was conducted	
		<i>Cross-sectional study</i> - Give the	for this study and not published	
		eligibility criteria, and the	elsewhere, detailed methods and results	
		sources and methods of selection	should be provided.	
		of participants		
			RECORD 6.3: If the study involved	-
		(b) Cohort study - For matched	linkage of databases, consider use of a	
		studies, give matching criteria	flow diagram or other graphical display	
		and number of exposed and	to demonstrate the data linkage	
		unexposed	process, including the number of	
		Case-control study - For	individuals with linked data at each	
		matched studies, give matching	stage.	
		criteria and the number of		
		controls per case		
Variables	7	Clearly define all outcomes,	RECORD 7.1: A complete list of codes	-
		exposures, predictors, potential	and algorithms used to classify	
		confounders, and effect	exposures, outcomes, confounders, and	
		modifiers. Give diagnostic	effect modifiers should be provided. If	
		criteria, if applicable.	these cannot be reported, an	
			explanation should be provided.	
Data sources/	8	For each variable of interest,		Page 5-6
measurement	-	give sources of data and details		0
		of methods of assessment		
		(measurement).		
		Describe comparability of		
		assessment methods if there is		
		more than one group		

Bias	9	Describe any efforts to address		Page 6
Study size	10	potential sources of biasExplain how the study size wasarrived at		Page 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why		Page 5-6
Statistical methods	12	 (a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data 	ronj	Page 6
Data access and cleaning methods			RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study	Page 5-6

Page 31 of 32

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			RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Page 5-6
Linkage			RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	-
Results				1
Participants	13	 (a) Report the numbers of individuals at each stage of the study (<i>e.g.</i>, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non- participation at each stage. (c) Consider use of a flow diagram 	RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Page 7-15 inclusion
Descriptive data	14	 (a) Give characteristics of study participants (<i>e.g.</i>, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i>, average and total amount) 	201	Page 7-15 incl tables
Outcome data	15	Cohort study - Report numbersof outcome events or summarymeasures over timeCase-control study - Reportnumbers in each exposure		-

		category, or summary measures of exposureCross-sectional study - Report numbers of outcome events or summary measures			
Main results	16	 (a) Give unadjusted estimates and, if applicable, confounder- adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period 			Page 7-15 incl tables
Other analyses	17	Report other analyses done— e.g., analyses of subgroups and interactions, and sensitivity analyses	6/6		Page 7-15 incl tables
Discussion			-		
Key results	18	Summarise key results with reference to study objectives		0	Page 15-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Page 17-18
Interpretation	20	Give a cautious overall interpretation of results considering objectives,			Page 15-17

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		limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			
Generalisability	21	Discuss the generalisability (external validity) of the study results			Page 18
Other Information	n				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based			Page 19
Accessibility of protocol, raw data, and programming code		- Deer	6	RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Page 19

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. PLoS Medicine 2015; ense. in press.

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