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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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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

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

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 mine-affected 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).

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

		Non-Traumatic 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)	<0.001
	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)	<0.001
	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)	<0.001
	Delay by user age group (age at registration)								
	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)	0.528
	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)	0.269
	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)	<0.001
	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)	<0.001
	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)	<0.001
Afghanistan									
	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)	<0.001
	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)	<0.001
	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)	<0.001
	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)	0.688
	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)	0.003
	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)	0.035
	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)	<0.001
	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)	<0.001
Cambodia									
	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)	<0.001
	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)	<0.001
	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)	<0.001
	Delay by user age group (age at registration)								
	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)	0.031
	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)	0.180
	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)	0.520
	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)	<0.001
	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)	<0.001
Iraq									
	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)	<0.001
	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)	<0.001
	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)	<0.001
	Delay by user age group (age at registration)								
	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)	1.000
	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)	0.669
	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)	0.002
	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)	<0.001
	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)	<0.001
Myanmar									
	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)	<0.001
	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)	<0.001

	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

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

		Non-Traumatic Amputation		Traumatic Amputation		Ratio traumatic:1 non-traumatic amputation	P value†	Total		Grand Total
Country	Age Group	Male N(R%|C%)	Female N(R%|C%)	Male N(R%|C%)	Female N(R%|C%)			Male N(R%|C%)	Female N(R%|C%)	Total 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**
	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).

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).

Table 3. Distribution of Amputation Causes by Categories and in Detail, by Country[1]

		All countries			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%)**
Total		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)
Causes 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	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)
Trauma	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	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)
Causes in Detail										
Non-trauma	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)	..	..	..
Non-trauma	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)	..
Non-trauma	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)
Trauma	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)
Trauma	Crime	5	5(100|0)	..	3(0)	3(100|0)	..	..	..	..
Trauma	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)	..	..	..
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)	..
Trauma	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)	..
Trauma	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)

[1]the 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)
Causes 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	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	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)
Trauma	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	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)
Causes 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)
Non-trauma	Metabolic	..	..	..	11(0.2)	5(45.5|0.1)	6(54.5|0.9)	..	..	..
Non-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)
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)
Non-trauma	Other – Non-Trauma	1(0)	1(100|0)	..	7(0.1)	5(71.4|0.1)	2(28.6|0.3)	..	..	..
Trauma	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)
Trauma	Crime	2(0.1)	2(100|0.1)	..	..	..	..	..	..	..
Trauma	Frost bite	6(0.2)	6(100|0.2)	..	3(0.1)	3(100|0.1)	..	2(0)	2(100|0.1)	..
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	ERW	38(1.1)	34(89.5|1.2)	4(10.5|0.7)	1(0)	1(100|0)	..	..	..	..
Trauma	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 non-conflict 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.

Table 4. Amputation charasteristics - Combinations and levels of amputation

	All Amputations			Non-Traumatic Amputations			Traumatic Amputations		
Combinations 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)
Levels of amputation(s)	**Total Amp (C%)**	**Amp in male SU**	**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 time-consuming 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

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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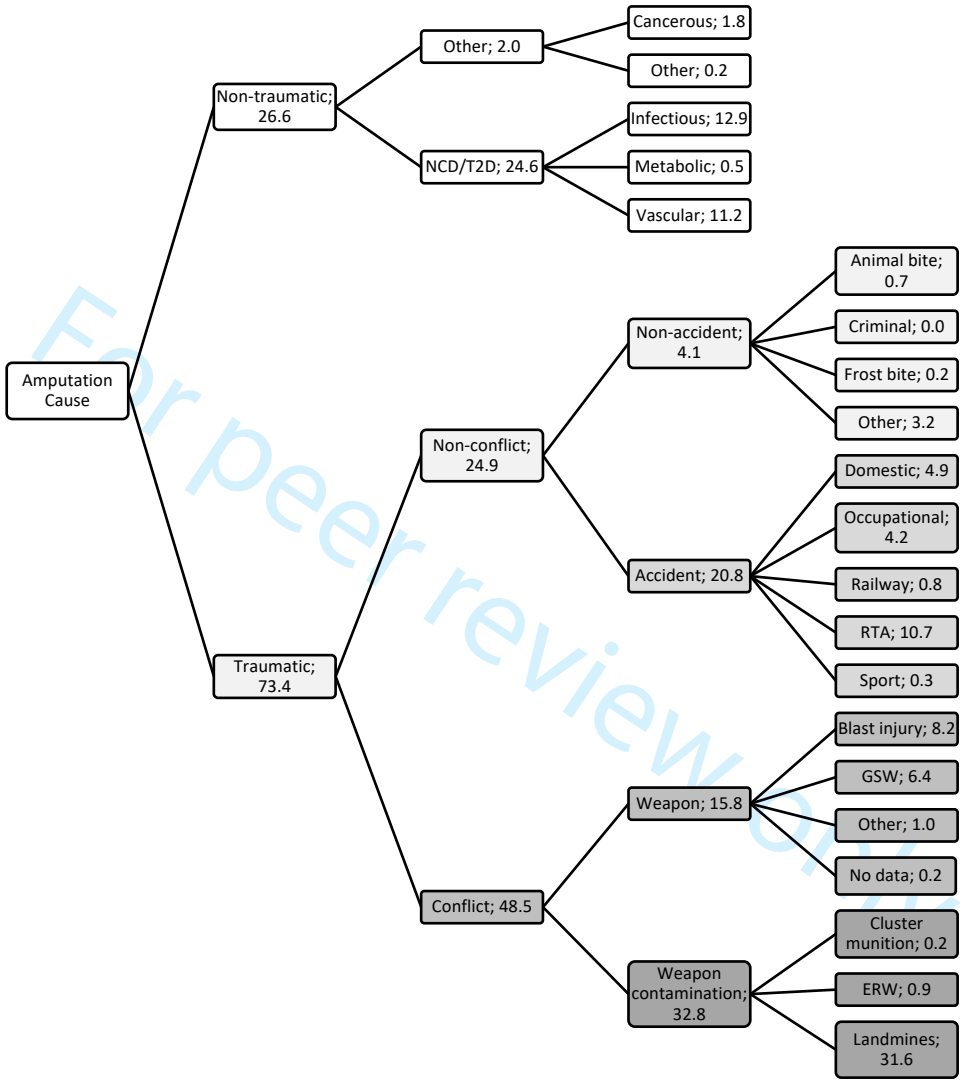
Legend for figure 1

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

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



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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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TITLE

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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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

ABSTRACT

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

Design: A retrospective, observational study analyzing differences in demographic and clinical factors and time to access rehabilitation between users with traumatic and non-traumatic amputations.

Setting: Five countries with the highest numbers of PwA in the global ICRC database (Afghanistan, Cambodia, Iraq, Myanmar, Sudan). Cleaned and merged data from 2009-2018 were aggregated by sex; age at amputation and registration; cause, combination and anatomical level of amputation(s); living environment.

Participants: all PwA newly attending rehabilitation.

Results: Data for 28446 individuals were included (4329 [15.2%] female). Most were traumatic amputations (73.4%, 20890); of these, 48.6% (13801) were conflict related. Average age at traumatic amputation for men and women was 26.9 and 24.1 years respectively; for non-traumatic amputation it was 49.1 years and 45.9 years respectively. Sex differences in age were statistically significant for traumatic and non-traumatic causes ($p<0.001$, $p=0.003$). Delay between amputation and rehabilitation was on average 8.2 years for those with traumatic amputation, significantly higher than an average 3 years for those with non-traumatic amputation ($p<0.001$).

Conclusions: 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, a prioritisation of rehabilitation and increased resource provision are recommended to ensure comprehensive care for PwA.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- To our knowledge, this is the first large multi-country 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

KEYWORDS

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INTRODUCTION

Limb amputation is a life-changing event. Global incidence studies reveal a substantial lack of data from fragile contexts such as conflict-affected or low- and middle-income countries (LMICs), but research has shown that amputation incidence is higher in populations with low economic and educational status. This results 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.[4,5] Appropriate rehabilitation and assistive technology (AT) have the potential to greatly diminish disability and allow the person to lead an independent, functional life. It requires the availability of comprehensive, costly and lifelong services, which is an enormous challenge 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.[6]

The World Health Assembly's 2018 resolution on improving access to AT and the 2021 resolution on the highest attainable standard of health for persons with disabilities indicate the many shortcomings and the need for increased recognition in this field.[5,7]

Access to appropriate rehabilitation and AT as a human right is integral to the Convention on the Rights of Persons with Disabilities, a fact that resulted in publications discussing implications, implementation and sobering reality-checks in numerous LMICs.[8–13]

Alarming needs and low supply are a well-known reality for global actors playing a key role in advocating for and providing rehabilitation in fragile settings including the International Committee of the Red Cross (ICRC), Humanity and Inclusion and the World Health Organisation (WHO). Guidelines, training resources and advocacy papers by such actors, often issued collectively, are specifically pointing out the importance and interdependence of early rehabilitation, AT and rehabilitation across the continuum of care.[14–19]

As such initiatives address knowledge gaps in this neglected field, their global implementation lags behind, even more so in countries of prolonged conflict or post-conflict with fragile health systems and a deprioritisation of rehabilitation services. As a consequence, there remains a lack of scientific papers on which to base further guideline development and research. This starts with affected populations in the countries themselves who remain largely unknown, contrary to the well-studied veterans from HIC who sustained conflict-related amputations abroad.[20–22] Complex traumatic amputations and their sequalae in conflict- and mine-affected areas are known to be a huge challenge.[4,23,24] Adding to this, and with profound consequences, is the increasing global burden of type two diabetes mellitus (T2D).[25]

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.[26] Road traffic (RTA) and other accidents are an additional problem in countries with limited traffic and occupational safety standards.[27]

Persons with amputations (PwA) constitute the biggest cohort of users accessing rehabilitation services supported by the ICRC in conflict and post-conflict states.[28] 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.[29,30]

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.[29] 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

Design and setting

This retrospective observational study is an 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.[28] The five countries representing the highest numbers of PwA attending PRCs were selected for this study, reflecting 92% of the total number of PwA in the database. Besides post-conflict Cambodia, the countries represent contexts of protracted crises and are classified by the World Bank as low-income (Afghanistan, Sudan), LMIC (Cambodia, Myanmar), or upper middle-income (Iraq).[31,32] These differences are equally reflected in other indicators as available from open source sites by the United Nations Development Programme and the WHO.[33,34]

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

Participants include all persons with any type of acquired amputation newly attending for prosthetic fitting. Excluded were persons attending with congenital limb loss.

Data collection and management

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, living environment, cause, anatomic level and number of amputation(s). PwA's living environment was subject to local definitions of the terms urban or rural. The quantitative variables were cleaned, merged, disaggregated by sex and age and organized into variables of interest.

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 such as RTA or non-accidental causes such as animal bite. 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.[35]

The database offered four labels for non-traumatic causes: cancerous, infectious, 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, male and female PwA were counted by combinations of LEA and upper extremity amputations (UAE) and by non-traumatic versus traumatic causes. We distinguished six levels of UEA and six levels of LEA counting number of amputations (and not persons) per level.

Data analysis

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 'living environment' all selected variables were mandatory for data entry. Where software issues led to missing data, these were labelled 'no data' in the tables.

Data analysis comprised of descriptive statistics. The software packages used were 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 Mann-Whitney U tests. P values below 0.05 were considered statistically significant.

Potential bias

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

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

Ethical approval and data sharing

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 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.

The methods used and findings from the study are reported in line with the GATHER guidelines.[39]

RESULTS

PwA characteristics

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%]).

Age at time of amputation, age at registration, delay between amputation and registration

Average age for traumatic amputation was 26.9 years in male, 24.1 years in female. 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, Figure 2). 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).

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

	Non-Traumatic Amputation			Traumatic Amputation			Total – by cause			
Country | Variables	**Male**	**Female**	**P value†**	**Male**	**Female**	**P value†**	**Non-Trauma**	**Trauma**	**MD (95% CI)**	**P value††**
Total	**Mean (95% CI)**			**Mean (95% CI)**			**Mean (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)	<0.001
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)	<0.001
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)	<0.001
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)	0.327
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)	0.092
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)	0.002
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	0.618
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	0.071
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)	0.115
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)	0.470
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	1.000
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)	0.316
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)	<0.001

	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)	<0.001
	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)	<0.001
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)	<0.001
	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)	<0.001
	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)	<0.001
	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)	0.267
	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)	0.010
	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)	0.001
	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)	<0.001
	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)	<0.001
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)	<0.001
	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)	<0.001
	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)	<0.001
	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)	0.545
	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)	0.005
	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)	<0.001
	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)	<0.001
	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)	<0.001

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 = years
# 1 participant; ## 2 participants

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

		Non-Traumatic Amputation		Traumatic Amputation		Ratio traumatic:1 non-traumatic amputation	P value†	Total		Grand Total
Country	Age Group	Male N(R%|C%)	Female N(R%|C%)	Male N(R%|C%)	Female N(R%|C%)			Male N(R%|C%)	Female N(R%|C%)	Total 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 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(0.7)
	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(9.0)
	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)	10239(36)
	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)	11139(39.2)
	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(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**
	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(1.1)
	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(15.1)
	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(48.3)
	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(25.5)
	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(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 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(3.7)
	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(29.6)
	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(54.1)
	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(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 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(0.6)
	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(5.3)
	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(25.7)
	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(46.8)
	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(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 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(2.9)
	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(28.4)
	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(54.7)
	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(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 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(0.6)
	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(5.3)
	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(23.7)
	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(44.2)
	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(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).

y = years

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

Table 2 shows that children under 18 attending were represented in low proportions (3 - 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 men entering rehabilitation were of working age (18–59 years) ranging from 68.3% (Sudan) to 85.6% (Cambodia) of total males. Among women, the working age group (18–59 years) constituted between 58.7% (Iraq) and 71.4% (Myanmar) of total females.

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.

Distribution of amputation causes by categories and in detail, by country

Figure 1 illustrates how the registered causes of amputation were categorized. Most amputations were of traumatic origin, 20890 [73.4%] of 28466 (table 3).

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 non-conflict 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. 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 3. Distribution of amputation causes by categories and in detail, by country[1]

		All countries			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%)**
Total		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)
Causes 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	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)
Trauma	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	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)
Causes in Detail										
Non-trauma	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)	..	..	..
Non-trauma	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)	..
Non-trauma	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)
Trauma	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)
Trauma	Crime	5	5(100|0)	..	3(0)	3(100|0)	..	..	..	..
Trauma	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)	..	..	..
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)	..
Trauma	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)	..
Trauma	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)

[1]the 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)
Causes 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	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	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)
Trauma	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	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)
Causes 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)
Non-trauma	Metabolic	..	..	..	11(0.2)	5(45.5|0.1)	6(54.5|0.9)	..	..	..
Non-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)
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)
Non-trauma	Other – Non-Trauma	1(0)	1(100|0)	..	7(0.1)	5(71.4|0.1)	2(28.6|0.3)	..	..	..
Trauma	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)
Trauma	Crime	2(0.1)	2(100|0.1)	..	..	..	..	..	..	..
Trauma	Frost bite	6(0.2)	6(100|0.2)	..	3(0.1)	3(100|0.1)	..	2(0)	2(100|0.1)	..
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	ERW	38(1.1)	34(89.5|1.2)	4(10.5|0.7)	1(0)	1(100|0)	..	..	..	..
Trauma	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'.

Table 4. Amputation characteristics - combinations and levels of amputation

	All Amputations			Non-Traumatic Amputations			Traumatic Amputations		
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 (C%)**	**Amp in male PwA**	**Amp in female PwA**	**Total Amp**	**Amp in male PwA**	**Amp in female PwA**	**Total Amp**	**Amp in male PwA**	**Amp in female 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|43.1)
Knee disarticulation/ Transcondylar amputation	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 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)

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

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

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]

In 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.[59] 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.[28] 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, rehabilitation professionals should get increasingly involved in provision of comprehensive care.

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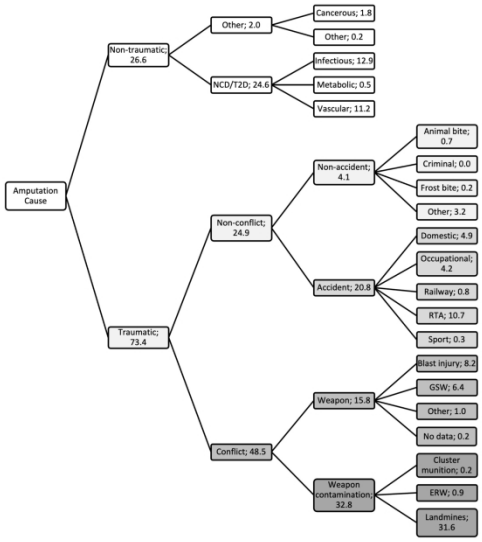

Figure 1. Classification of amputation causes with % of total persons with amputations
All 21 variables on the right are as they appear in mandatory dropdown lists of the database. The database distinguishes between (i) traumatic and all other causes; (ii) conflict-related and all other traumatic causes; (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

266x143mm (300 x 300 DPI)

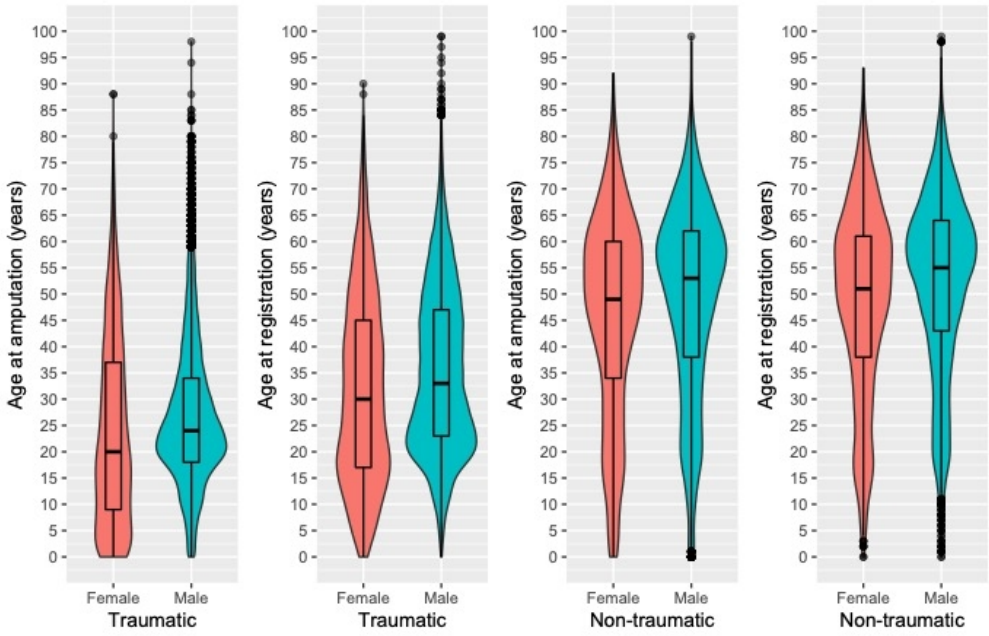

Figure 2. Age patterns of male and female persons with traumatic and non-traumatic amputation
Violin plots showing age of all male and female PwA of a) traumatic cause at time of amputation, b) at time of registration, age of male and female PwA of c) non-traumatic cause at time of amputation, d) at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

242x155mm (72 x 72 DPI)

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

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	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 summary of what was done and what was found		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. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Page 2 Page 2 -
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			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

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

Bias	9	Describe any efforts to address potential sources of bias			Page 6
Study size	10	Explain how the study size was arrived 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 were addressed (d) *Cohort study* - 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 applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			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 population.	Page 5-6

				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 (*e.g.*, 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.e.,* 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 (*e.g.*, 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) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)			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 *Cross-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			Page 7-15 incl tables
Discussion					
Key results	18	Summarise key results with reference to study objectives			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

		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					
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; 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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TITLE

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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TITLE

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

ABSTRACT

Objectives: Limb amputation incidence is particularly high in fragile contexts due to conflict, accidents and poorly managed diabetes. The study aim was to analyse i) demographic and amputation characteristics of persons with any type of acquired amputation (PwA) and ii) time between amputation and first access to rehabilitation in five conflict and post-conflict countries.

Design: A retrospective, observational study analyzing differences in demographic and clinical factors and time to access rehabilitation between users with traumatic and non-traumatic amputations.

Setting: Five countries with the highest numbers of PwA in the global ICRC database (Afghanistan, Cambodia, Iraq, Myanmar, Sudan). Cleaned and merged data from 2009-2018 were aggregated by sex; age at amputation and registration; cause, combination and anatomical level of amputation(s); living environment.

Participants: All PwA newly attending rehabilitation.

Results: Data for 28446 individuals were included (4329 [15.2%] female). Most were traumatic amputations (73.4%, 20890); of these, 48.6% (13801) were conflict related. Average age at traumatic amputation for men and women was 26.9 and 24.1 years respectively; for non-traumatic amputation it was 49.1 years and 45.9 years respectively. Sex differences in age were statistically significant for traumatic and non-traumatic causes ($p<0.001$, $p=0.003$). Delay between amputation and rehabilitation was on average 8.2 years for those with traumatic amputation, significantly higher than an average 3 years for those with non-traumatic amputation ($p<0.001$).

Conclusions: 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, a prioritisation of rehabilitation and increased resource provision are recommended to ensure adequate access to comprehensive rehabilitation care for PwA.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- To our knowledge, this is the first large multi-country study on a highly vulnerable and neglected group of persons with amputations seeking rehabilitation in conflict and post-conflict contexts.
- 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

KEYWORDS

Rehabilitation
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INTRODUCTION

Limb amputation is a life-changing event. Global incidence studies reveal a substantial lack of data from fragile contexts such as conflict-affected or low- and middle-income countries (LMICs), but research has shown that amputation incidence is higher in populations with low economic and educational status. This results 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.[4,5] Appropriate rehabilitation and assistive technology (AT) have the potential to greatly diminish disability and allow the person to lead an independent, functional life.[6,7] It requires the availability of comprehensive, costly and lifelong services, which is an enormous challenge 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.[8]

The World Health Assembly's 2018 resolution on improving access to AT and the 2021 resolution on the highest attainable standard of health for persons with disabilities indicate the many shortcomings and the need for increased recognition in this field.[5,9]

Access to appropriate rehabilitation and AT is a human right enshrined in the Convention on the Rights of Persons with Disabilities. This recognition has resulted in publications discussing implications, implementation and sobering reality-checks in numerous LMICs.[10–15]

Alarming needs and low supply are a well-known reality for global actors playing a key role in advocating for and providing rehabilitation in fragile settings including the International Committee of the Red Cross (ICRC), Humanity and Inclusion and the World Health Organisation (WHO). Guidelines, training resources and advocacy papers by such actors, often issued collectively, are specifically pointing out the importance and interdependence of early rehabilitation, AT and rehabilitation across the continuum of care.[16–21]

As such initiatives address knowledge gaps in this neglected field, their global implementation lags behind, even more so in countries of prolonged conflict or post-conflict with fragile health systems and a deprioritisation of rehabilitation services. As a consequence, there remains a lack of scientific papers on which to base further guideline development and research. This starts with affected populations in the countries themselves who remain largely unknown, contrary to the well-studied veterans from HIC who sustained conflict-related amputations abroad.[22–24] Complex traumatic amputations and their sequalae in conflict- and mine-affected areas are known to be a huge challenge.[4,25,26] Adding to this, and with profound consequences, is the increasing global burden of type two diabetes mellitus (T2D).[27]

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.[28] Road traffic (RTA) and other accidents are an additional problem in countries with limited traffic and occupational safety standards.[29]

Persons with amputations (PwA) constitute the biggest cohort of users accessing rehabilitation services supported by the ICRC in conflict and post-conflict states.[30] 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.[31,32]
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.[31] 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 their healthcare 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

Design and setting

This retrospective observational study is an 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.[30] The five countries representing the highest numbers of PwA attending PRCs were selected for this study, reflecting 92% of the total number of PwA in the database. Besides post-conflict Cambodia, the countries represent contexts of protracted crises and are classified by the World Bank as low-income (Afghanistan, Sudan), LMIC (Cambodia, Myanmar), or upper middle-income (Iraq).[33,34] These differences are equally reflected in other indicators as available from open source sites by the United Nations Development Programme and the WHO.[35,36]

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

Participants include all persons with any type of acquired amputation newly attending for prosthetic fitting. Excluded were persons attending with congenital limb loss.

Data collection and management

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, living environment, cause, anatomic level and number of amputation(s). PwA's living environment was subject to local definitions of the terms urban or rural. The quantitative variables were cleaned, merged, disaggregated by sex and age and organized into variables of interest.

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 such as RTA or non-accidental causes such as animal bite. 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.[37]

The database offered four labels for non-traumatic causes: cancerous, infectious, 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, male and female PwA were counted by combinations of LEA and upper extremity amputations (UEA) and by non-traumatic versus traumatic causes. We distinguished six levels of UEA and six levels of LEA counting number of amputations (and not persons) per level.

Data analysis

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 'living environment' all selected variables were mandatory for data entry. Where software issues led to missing data, these were labelled 'no data' in the tables.

Data analysis comprised of descriptive statistics. The software packages used were 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 Mann-Whitney U tests. P values below 0.05 were considered statistically significant.

Potential bias

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

Unless a PwA checks in with externally confirmed T2D diagnosis, PRC staff rely on findings from their own assessment. They record non-traumatic causes as predefined in the database, which does not offer T2D as a stand-alone variable, but 'infectious', 'metabolic' or 'vascular' presentations. Chronic, often unknown health conditions in the studied countries lead to such presentations defined by PRC staff as amputation cause and are most likely related to NCD/T2D.[38–40] Considering the dimension and consequences of T2D prevalence we merged causes under this heading despite absence of confirmed diagnosis.

Ethical approval and data sharing

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 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 CAB 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.

The methods used and findings from the study are reported in line with the GATHER guidelines.[41]

RESULTS

Participant characteristics

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%]).

Age at time of amputation, age at registration, delay between amputation and registration

Average age for traumatic amputation was 26.9 years in male, 24.1 years in female. 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, Figure 2). 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).

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

	Non-Traumatic Amputation			Traumatic Amputation			Total – by cause			
Country | Variables	**Male**	**Female**	**P value†**	**Male**	**Female**	**P value†**	**Non-Trauma**	**Trauma**	**MD (95% CI)**	**P value††**
Total	**Mean (95% CI)**			**Mean (95% CI)**			**Mean (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)	<0.001
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)	<0.001
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)	<0.001
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)	0.327
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)	0.092
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)	0.002
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	0.618
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	0.071
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)	0.115
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)	0.470
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	<0.001
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)	1.000
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)	0.316
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)	<0.001

	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)	<0.001
	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)	<0.001
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)	<0.001
	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)	<0.001
	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)	<0.001
	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)	0.267
	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)	0.010
	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)	0.001
	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)	<0.001
	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)	<0.001
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)	<0.001
	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)	<0.001
	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)	<0.001
	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)	0.545
	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)	0.005
	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)	<0.001
	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)	<0.001
	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)	<0.001

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 = years
# 1 participant; ## 2 participants

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

		Non-Traumatic Amputation		Traumatic Amputation		Ratio traumatic:1 non-traumatic amputation	P value†	Total		Grand Total
Country	Age Group	Male N(R%|C%)	Female N(R%|C%)	Male N(R%|C%)	Female N(R%|C%)			Male N(R%|C%)	Female N(R%|C%)	Total 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 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(0.7)
	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(9.0)
	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)	10239(36)
	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)	11139(39.2)
	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(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**
	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(1.1)
	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(15.1)
	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(48.3)
	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(25.5)
	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(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 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(3.7)
	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(29.6)
	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(54.1)
	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(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 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(0.6)
	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(5.3)
	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(25.7)
	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(46.8)
	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(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 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(2.9)
	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(28.4)
	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(54.7)
	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(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 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(0.6)
	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(5.3)
	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(23.7)
	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(44.2)
	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(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).

y = years

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

Table 2 shows that children under 18 attending were represented in low proportions (3 - 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 men entering rehabilitation were of working age (18–59 years) ranging from 68.3% (Sudan) to 85.6% (Cambodia) of total males. Among women, the working age group (18–59 years) constituted between 58.7% (Iraq) and 71.4% (Myanmar) of total females.

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.

Distribution of amputation causes by categories and in detail, by country

Figure 1 illustrates how the registered causes of amputation were categorized. Most amputations were of traumatic origin, 20890 [73.4%] of 28466 (table 3).

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 non-conflict 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. 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 3. Distribution of amputation causes by categories and in detail, by country[1]

		All countries			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%)**
Total		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)
Causes 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	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)
Trauma	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	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)
Causes in Detail										
Non-trauma	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)	..	..	..
Non-trauma	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)	..
Non-trauma	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)
Trauma	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)
Trauma	Crime	5	5(100|0)	..	3(0)	3(100|0)	..	..	..	..
Trauma	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)	..	..	..
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)	..
Trauma	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)	..
Trauma	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)

[1]the 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)
Causes 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	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	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)
Trauma	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	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)
Causes 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)
Non-trauma	Metabolic	..	..	..	11(0.2)	5(45.5|0.1)	6(54.5|0.9)	..	..	..
Non-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)
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)
Non-trauma	Other – Non-Trauma	1(0)	1(100|0)	..	7(0.1)	5(71.4|0.1)	2(28.6|0.3)	..	..	..
Trauma	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)
Trauma	Crime	2(0.1)	2(100|0.1)	..	..	..	..	..	..	..
Trauma	Frost bite	6(0.2)	6(100|0.2)	..	3(0.1)	3(100|0.1)	..	2(0)	2(100|0.1)	..
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	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)
Trauma	ERW	38(1.1)	34(89.5|1.2)	4(10.5|0.7)	1(0)	1(100|0)	..	..	..	..
Trauma	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'.

Table 4. Amputation characteristics - combinations and levels of amputation

	All Amputations			Non-Traumatic Amputations			Traumatic Amputations		
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 (C%)**	**Amp in male PwA**	**Amp in female PwA**	**Total Amp**	**Amp in male PwA**	**Amp in female PwA**	**Total Amp**	**Amp in male PwA**	**Amp in female 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|43.1)
Knee disarticulation/ Transcondylar amputation	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 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)

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

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

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]

CONCLUSION

In 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.[61] 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.[30] 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.[62,63] Rather than solely managing amputations as the last consequence, rehabilitation professionals should get increasingly involved in provision of comprehensive care.

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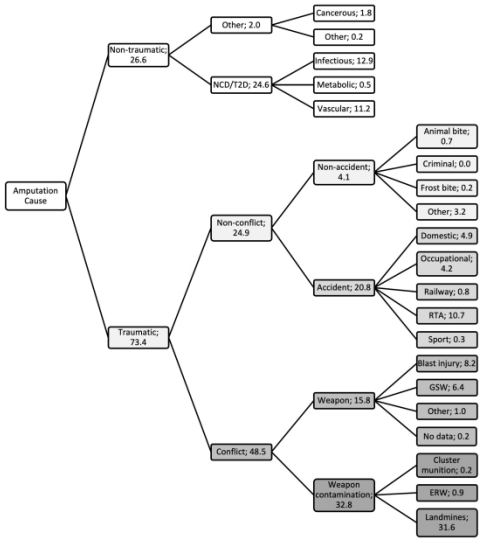
Legends for figures

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

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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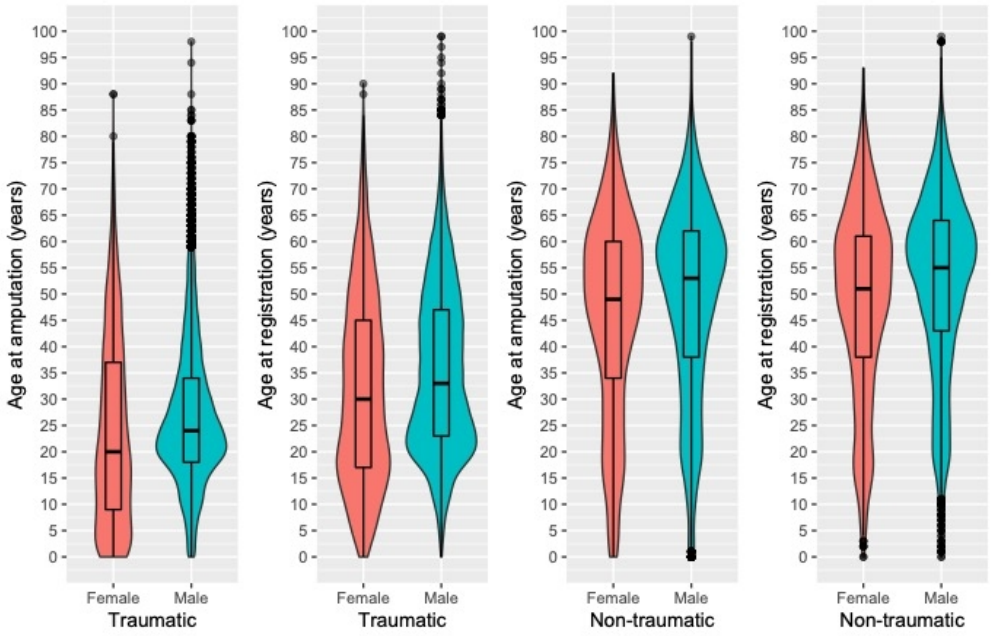
266x143mm (330 x 330 DPI)



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242x155mm (72 x 72 DPI)

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

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	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 summary of what was done and what was found		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. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Page 2 Page 2 -
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			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

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

Bias	9	Describe any efforts to address potential sources of bias			Page 6
Study size	10	Explain how the study size was arrived 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 were addressed (d) *Cohort study* - 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 applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			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 population.	Page 5-6

				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 (*e.g.*, 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.e.,* 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 (*e.g.*, 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) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)			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 *Cross-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			Page 7-15 incl tables
Discussion					
Key results	18	Summarise key results with reference to study objectives			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

		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					
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; in press.