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Pain, psychological distress and deteriorated family economy follow traumatic amputation among war casualties in Gaza

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Keywords: amputees; Gaza; GHQ-12; poverty; Israel; military incursion; Palestine; rehabilitation; trauma; unemployment, global health

ABSTRACT

Objectives: The aim of this study was to explore determinants of psychosocial distress and pain in patients who have survived severe extremity amputation in Gaza.

Setting: This study was conducted in a secondary care rehabilitation center in Gaza, Palestine. The clinic is Gaza's sole provider of artificial limbs.

Participants: We included 254 civilian Palestinians who had survived but lost one or more limb(s) during military incursions from 2006-2016. We included patients with surgically treated amputation injuries who attended physical rehabilitation at a specialist prosthesis center in Gaza. Amputees with injuries prior to 2006 or non-military related injuries were excluded.
We assessed their pain and psychological stress using the General Health Questionnaire (GHQ-12). We used income, amputation severity scored by proximity to torso, current employment status, loss of family-members and loss of home as independent variables.

Results: The amputees median age was 23 years at the time of trauma, while a median of 4.3 years had passed from trauma to study inclusion. Nine of ten were male, while 43 were children when they were amputated (17 % ≤ 18 years). One hundred and ninety-one (75 %) were unemployed and 112 (44 %) reported unemployment caused by being amputated. Pain was the most frequent complaint, and 80 amputees (32 %) reported to suffer from daily pain. Family income was significantly correlated with the physical pain (Odds ratio (OR) = 0.54, CI = 0.36 to 0.80, p= 0.002). Psychological distress was higher among unemployed amputees (β 0.31, CI 0.07 to 0.54, p = 0.011). We found no association between psychological distress (GHQ-scores) and the extent of the initial amputation.

Conclusion: Pain and psychological distress following war-related extremity amputation of one or more limbs correlated stronger with deteriorated family economy and being unemployed than with the anatomical and medical severity of extremity amputations.

Summary box

Strengths and limitations of this study

- The use of self-reported reasons for unemployment is a potential weakness in this study.
- The lack of longitudinal data also poses limitations. The most recent cases we included were in an early stage of treatment and rehabilitation and would probably be more unlikely to be able to work.
- We also have a potential risk of selection bias as some amputees sustained fatal injuries while others with minor injuries (like finger/toe amputations) may not have been referred for rehabilitation.
- Strengths of this study include a representative sample of the patients attending rehabilitation in Gaza, a response rate of 99 %, the close cooperation with the local staff and the conduction of the study in Arabic.

BACKGROUND

War- and armed conflict-related injuries can cause increased mortality, morbidity and disability.[1] Poverty resulting from physical war injuries is frequent and further amplifies the burden of trauma for victims and families.[2] Injuries from wars and conflicts are contributing to the global burden of disease and pose important public health problems in particular in low and middle-income countries (LMIC), such as in Palestine.[1-3] Increasing numbers of survivors with conflict-related extremity amputations are living in a number of countries, and their injuries remain a significant problem to health services following wars.[4-5] Limb loss due to military attacks is a sudden, brutal life changing event for both amputees and families. As stated by Clasper and colleagues: Traumatic amputations remain one of the most emotionally disturbing wounds of conflict. [5] These wounds may be followed not only by pain and loss of function, but also decreased chances of being employed with ensuing loss of income and poverty. [6-7]

This study was conducted in the Gaza Strip which has seen four major military incursions since 2006 (Operation Summer Rain 2006, Operation Cast Lead 2008-09, Operation Pillar of Defense 2012, Operation Protective Edge 2014).[8-10] According to the Palestinian Central Bureau of Statistics (PCBS), 10369 Palestinians have been killed from 2000 to 2016.[11]

A shattered local economy, very high unemployment rates and increasing number of traumatic injuries from recurrent military attacks on Gaza is aggravated by the siege enforced by military blockade since 2007.

Loss of income and poverty predicts poor outcomes after trauma-related amputations.[6, 12-13] The negative impact of traumatic life events, such as war, is more severe among the Palestinians in Gaza who also have a low family income.[14]

Life satisfaction following traumatic limb amputation is closely related both to the ability to return to work and to adequate rehabilitation. [15-16]

We wanted to study the impact of psychosocial factors (income, unemployment) on psychological distress and pain in Palestinian patients who had sustained traumatic extremity amputations and were attending rehabilitation in Gaza.

MATERIAL AND METHODS

Study participants

We included 254 extremity amputees from Gaza in a cross-sectional study. Inclusion criteria were one or several extremity amputations during 2006-2016 due to a military attack and being a Palestinian resident above the age of 16 years at the time of inclusion. We screened 1170 patient records and excluded 915 amputees whose amputations were not related to war or was sustained before 2006. The study was conducted at The Artificial Limb and Polio Center (ALPC) in Gaza City which is the sole place in the Gaza Strip where limb prostheses are tailored and fitted.[17]

We conducted a pilot study from June-Nov in 2014 where the first 90 patients who met the inclusion criteria participated. The pilot study response rate was 99 %, and we followed up by including all registered patients from ALPC who met the inclusion criteria. [18] The decision to use ALPC as a study center had numerous advantages: It is located in central Gaza City, has good facilities with running water and generators supplying electricity during the daily power outages. It is a relatively safe place where the researchers and patients could meet without travelling to other areas of Gaza during ongoing military incursions. The center provides gratis services for the amputation patients, which was an important asset and prevented recruitment of patients from being biased by patients' financial situation.

Patients' medical history was taken the patient filled in a printed questionnaire in Arabic. Questionnaires were designed for yes/no or Likert-scale graded answers. Illiterate patients had the questions read out loud in Arabic. We used 12-question General Health Quality survey (GHQ-12), a well validated questionnaire to assess mental health.[19-20] The questionnaires were completed before each included patient underwent a detailed clinical medical examination by an experienced physician.

Level of amputation and severity of injury

We classified the amputations with the commonly used orthopaedic terms: above or below the extremity joints (reference). Every amputation was pictured by hand by the examiner on an anatomical sketch in addition to being photographed. The amputations were classified in an ordinal scale by an increasing order of severity based on proximity to the torso and number of affected limbs. The ordinal scale was as follows: 1 = finger/toes/hands/feet; 2 = below knee or below elbow; 3 = above knee or elbow; and 4 = bilateral amputation or amputation in both lower and upper extremities or unilateral amputation at hip-level/shoulder-level

Pain

The patients provided details on the frequency of their pain during an average week. The ordinal scale was as follows: 0= never pain, 1= pain one day a week or less, 2= pain two-three days a week, 3= pain four-six days a week, and 4= pain every day.

Mental health

To assess mental wellbeing, we were advised by local Palestinian psychologists at the Gaza Community Mental Health Center (GCMHC) to use the validated questionnaire GHQ-12. The questionnaire is a 12-questions screening tool in Arabic commonly used to assess mental distress in the general population in a community. It is self-administrated and easy to complete. The Arabic version has been validated for use in Arab-speaking patients, and has been used in previous studies in Gaza.[19-20]

Family income

We recorded family income from each patient's self-reported questionnaires which included the following alternatives: a total family income per month 0 = less than 700 New Israeli Shekels* (NIS) 1 = 800-1600 NIS 2 = 1700-2500 NIS 3= 2600-3400 NIS, and 4 = more than 3500 NIS.

* (100 NIS= 32 USD)

Employment status

The self-reported employment status and patients perceived reason(s) for unemployment (employed, no available job, student/housewife, unemployed due to injury) were documented.

Ethics, consent and permission

We chose the ALPC as our local study base in agreement with the local health authorities, the board of Gaza`s main hospital, Al-Shifa Hospital (Gaza's trauma center), and the Director of the ALPC. All patient completed written consent prior to participating. The study was approved by the Regional Ethical Committee (approval number: 2016/1265/REK Nord) in Norway and the Committee for Helsinki ethics approvals in Gaza. We reimbursed all participants' roundtrip travel expenses to ALPC.

Statistics

Descriptive statistics are reported as mean and standard deviation (SD) for parametric data, median and interquartile range (IQR) for non-parametric data. We consider a p-value <0·05 statistically significant. Frequencies are reported as percentage of the total study population for groups and subgroups. Logistic and ordinal regressions were used for multivariate analysis. Scoring methods for GHQ-12 were bi-modal (0-0-1-1).

Data analysis is conducted in SPSS Statistics version 22.0 (SPSS Inc., Chicago, IL, USA) and STATA 15 (StataCorp. 2015. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LP).

RESULTS

Patient demographics

Two-hundred and fifty-four patients participated in the study. Most of them were males in their 20-ies, all Palestinians from Gaza. All participants were registered as patient at the ALPC and had sustained one or more traumatic extremity amputations. Nearly nine of ten patients had major amputations (*n*= 216, with 85 % above wrist or ankle). Seventeen percent (*n*=43) had been hit and sustained amputation(s) during childhood (aged 18 years or younger, Seventy-five percent (191) of the amputees were unemployed at the time of inclusion in the study.

Thirty per cent of the amputees (76/254) were surviving on less than 700 New Israeli Shekel monthly at the time of inclusion.

Table 1 summarizes the patient characteristics.

Psychological distress and unemployment

Among the 191 (75 %) unemployed patients, 112 (44 %) reported that their unemployment was a direct result of the amputation injury. More than half of the amputees (55 %, n=135) had GHQ-scores above the cut-off of 3 points indicative of psychological distress. Also, we found psychological distress to be higher among amputees who considered themselves unemployed due to the injury

(β= 0.31, CI =0.07 to 0.54, p=0.011), bud we did not find any association between the level of extremity amputation and level of psychological distress (GHQ-scores) (Table 2).

Pain and poverty

Every third amputee (n=80, 32%) studied reported that they suffered from daily pain.

The frequency of physical pain correlated with low family income, also when adjusted for the severity of the injury (OR= 0.54, CI = 0.36 to 0.80, p= 0.002, see Table 3 and Figure 1).

Psychological distress and pain

The frequency of pain was significantly associated with the level of psychological distress (GHQ) among the participants. GHQ 12 scores increased among patients with frequent pain (β= 0.30, CI = 0.12 to 0.49, p = 0.002). Also, self-reported pain increased among patients with higher levels of psychological distress (OR = 2.40, CI= 1.48 to 3.39, p= 0.000).

DISCUSSION

More than half of the traumatic amputees in this cross-sectional study from Gaza's main rehabilitation clinic reported psychological distress with GHQ-12 scores above the cut-off. Psychological distress was clearly associated with financial deterioration following their loss of work due to their extremity amputations. The frequency of pain was also higher among the poorest patients, and increased with decreasing family income. On the other hand, the anatomical extent and severity of the initial physical amputation trauma did not affect GHQ-scores or the frequency of pain experienced by the amputees.

Unemployment due to injury and mental distress

The psychological distress increased significantly among the amputees who were unable to continue work as a result of their limb loss. This finding is supported by WHOs previous findings in Gaza, where GHQ-levels were higher among unemployed.[21]

Three out of four patients in this study were unemployed. Close to half of them reported that they currently were unemployed as a consequence of their physical disabilities caused by the loss of limb(s). Unemployment was a major risk factor for depression and anxiety in Jordanian amputees. [22] The long-term outcomes in 146 traumatic amputees in USA, showed that 75 % had sustained change in occupation after amputation with more than half reporting to be less paid in their new positions. [23]

The unemployment among local Palestinian documented in our study is adding up to an already exceptionally high unemployment rate in Gaza, reaching 43·6 % in 2018. [24-25] The increased poverty that followed after severe extremity amputation injury in this cohort of amputees in Gaza, appears to be more important for psychological well-being than the extent of the amputation.

Pain and low family income

We also found that low family income was the main predictor to determine how often the amputees experienced pain. The frequency of pain increased among amputees who lived in families with low income. Surprisingly, neither pain nor psychological distress were affected by the extent of the initial physical trauma. Our findings are supported by the conclusion in the study by Husum and colleagues on chronic pain in land mine accident survivors in Cambodia and Kurdistan, where patient-related loss of income correlated with the rate of chronic pain syndrome.[7] Ferguson and colleagues studied the psychological adjustment after amputation in landmine victims and found that the amputees recovery and acceptance of limb loss were dependent on the patients economic situation.[26] In the context of living with

disabilities in a society where siege, occupation and recurrent military attacks are part of everyday life, it is also important to acknowledge the effects of fundamental psychosocial determinants of pain and psychological distress.

The most important factor to improve mental health among civilians in Gaza, is end the occupation.[27]

Social suffering such as unemployment and poverty are effects of the long-lasting siege of Gaza which adds burdens to the lives of the amputees and their families. To ameliorate the needs of the population of amputees, these issues requires a shift in the emphasis from narrow medical indicators, injury and illness to the lack of human security and human rights violations experienced by ordinary Palestinians.[28]

Limitations and strengths

The use of self-reported reasons for unemployment is a potential weakness in this study. The lack of longitudinal data also poses limitations. The most recent cases we included were in an early stage of treatment and rehabilitation and would probably be more unlikely to be able to work. We also have a potential risk of selection bias as some amputees sustained fatal injuries while others with minor injuries (like finger/toe amputations) may not have been referred for rehabilitation. However, due to the ongoing conflict, the lack of infrastructure and sometimes incomplete medical records, it would be close to impossible to obtain a completely representative set of data from the whole population of amputees.

Strengths of this study include a representative sample of the patients attending rehabilitation at ALPC with a response rate of 99 %, the close cooperation with the local staff and the conduction of the study in Arabic.

INTERPRETATION

More physical pain and decreased mental wellbeing correlated significantly with the more unemployment and less family income (poverty) following traumatic extremity amputations among Palestinians in Gaza. Poverty and unemployment after traumatic amputations and disability are heavy, extra burdens adding to the trauma of the physical extremity amputation itself.

DECLERATIONS

Ethics, consent and permission

All patient completed written consent prior to participating. The study was approved by the Regional Ethical Committee (approval number: 2016/1265/REK Nord) in Norway and the Committee for Helsinki ethics approvals in Gaza.

Consent to publish

Not applicable.

Availability of data and materials

The datasets used during the current study are not publically available as the authors did not apply any ethical committees for the permission to share the data. In this particular context, sharing of data could raise safety concerns for the participants in the study and thus considered unethical.

Patients and Public Involvement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Competing interests

We declare no competing interests.

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Authors' contributions

Hanne Heszlein-Lossius contributed study design, data collection, data entry, data analysis, interpretation of the results, the primary draft of the manuscript writing, editing the manuscript, literature search and final approval of the manuscript.

Yahya Al-Borno contributed to study design, patient inclusion, data collection, data transfer, revising the manuscript and final approval of the manuscript.

Samar Shaqqoura contributed to study design, patient inclusion, data collection, data transfer, revising the manuscript and final approval of the manuscript.

Nashwa Skaik contributed to study design, patient inclusion, data collection, data transfer, revising the manuscript and final approval of the manuscript.

Lasse Melvaer Giil contributed to the statistical analysis, interpretation of the results, visualization of the data in figures, editing and revising and manuscript, and final approval of the manuscript.

Mads Gilbert contributed the original research idea, the study design, interpretation of the results, revising and editing the manuscript, and final approval of the manuscript.

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Table 1. Characteristics of study participants [a] (N = 254)

Demographics	Patients (N)	Statistics (%)
Palestinian	254	100
Male	234	92
Children	43	17
Female	20	8
Refugee status[b]	154	57
Age –Inclusion, years		28 [10]*
Age-Injury, years		23 [9]*
Family income, NIS		
< 700	76	30
800-1600	105	42
>1700	50	28
Employment		
Unemployed	191	75
Unemployed due to amputation	112	44
≥ 3 unemployed family members	152	61
≥ 3 persons economically dependent on amputee	160	64

a Number of participants: 254, from 0-2 % of the participants had missing data on any variable.
b Refugee = patient is from a family who has formal UN refugee status as of 1948
NIS= New Israeli Shekel. 1 NIS equals 0,26 US Dollar.
* median and interquartile range, otherwise percentage.

Table 2. Psychological distress

	GHQ total score			GHQ total score		
	β	95 % CI	P	β	95 % CI	P
Unemployment due to trauma	0.308	0.071 to 0.545	**0.011**	0.329	0.093 to 0.564	**0.006**
Pain	0.306	0.112 to 0.499	**0.002**	0.320	0.125 to 0.515	**0.001**
Severity of injury				-0.035	-0.130 to 0.060	0.32
Family income				-0.040	-0.216 to 0.135	0.65
Loss of family members				0.054	-0.208 to 0.317	0.68

Abbreviations: β, regression coefficient beta; CI, confidence interval; GHQ, General Health Questionnaire
[a] Crude model: Logistic regression adjusted for age and gender, with GHQ > 3 points as the dependent variable.
[b] Adjusted model: severity of injury, pain frequency and severity of injury added to the model described in [a]
* p-value < 0.05

Table 3. Pain after amputation

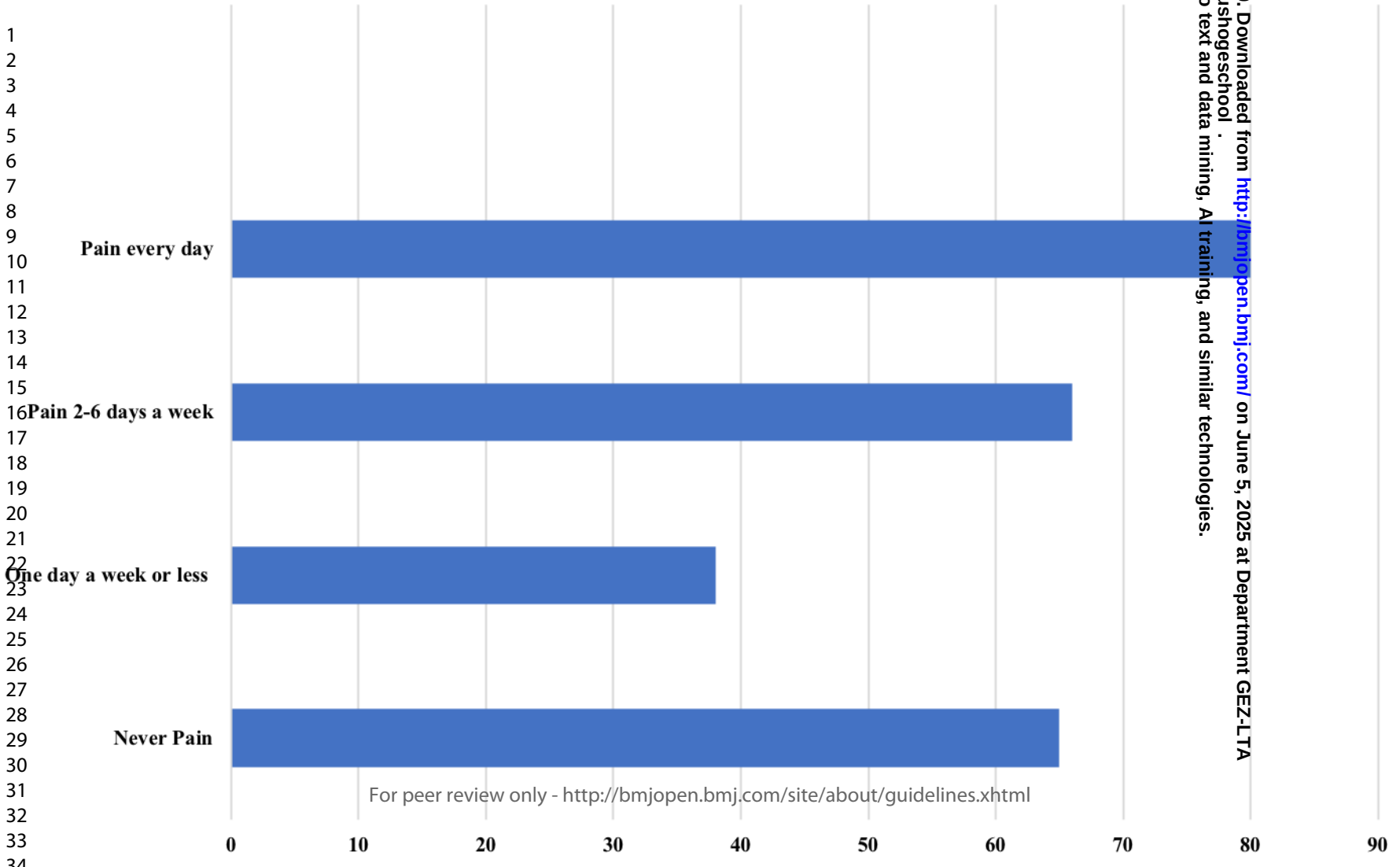
	Pain severity			Pain severity		
	OR	95 % CI	P	OR	95 % CI	P
Family income	0.535	0.359 to 0.797	**0.002**	0.551	0.346 to 0.876	**0.012**
Psychological distress	2.395	1.476 to 3.388	**0.000**	2.386	1.417 to 4.017	**0.001**
Severity of injury				0.242	0.257 to 1.408	0.134
Unemployment due to trauma				0.913	0.441 to 1.892	0.808
Loss of family members				1.489	0.725 to 3.057	0.277

Abbreviations: β, regression coefficient beta; CI, confidence interval.
[a] Crude model: Ordinal logistic regression adjusted for age and gender, with Pain as the dependent variable.
[b] Adjusted model: severity of injury, psychological distress and severity of injury added to the model described in [a]

* p-value < 0.05

Figure 1. Frequency of pain after amputation trauma

Number of participants: 249. Five (1,96 %) participants had missing data.



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Primary Subject Heading:	Global health
Secondary Subject Heading:	Emergency medicine, Global health, Mental health, Surgery
Keywords:	GHQ-12, military, amputation, pain, unemployment, Gaza

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ABSTRACT

Objectives: The aim of this study was to explore determinants of psychosocial distress and pain in patients who have survived severe extremity amputation in Gaza.

Setting: This study was conducted in a secondary care rehabilitation center in Gaza, Palestine. The clinic is Gaza's sole provider of artificial limbs.

Participants: We included 254 civilian Palestinians who had survived but lost one or more limb(s) during military incursions from 2006-2016. We included patients with surgically treated amputation injuries who attended physical rehabilitation at a specialist prosthesis center in Gaza. Amputees with injuries prior to 2006 or non-military related injuries were excluded.
We assessed their pain and psychological stress using the General Health Questionnaire (GHQ-12). We used income, amputation severity scored by proximity to torso, current employment status, loss of family-members and loss of home as independent variables.

Results: The amputees median age was 23 years at the time of trauma, while a median of 4.3 years had passed from trauma to study inclusion. Nine of ten were male, while 43 were children when they were amputated (17 % ≤ 18 years). One hundred and ninety-one (75 %) were unemployed and 112 (44 %) reported unemployment caused by being amputated. Pain was the most frequent complaint, and 80 amputees (32 %) reported to suffer from daily pain. Family income was significantly correlated with the physical pain (Odds ratio (OR) = 0.54, CI = 0.36 to 0.80, p= 0.002). Psychological distress was higher among unemployed amputees (OR= 1,36, CI 1.07 to 1.72, p = 0.011). We found no association between psychological distress (GHQ-scores) and the extent of the initial amputation.

Conclusion: Pain and psychological distress following war-related extremity amputation of one or more limbs correlated stronger with deteriorated family economy and being unemployed than with the anatomical and medical severity of extremity amputations.

Summary box

Strengths and limitations of this study

- The use of self-reported reasons for unemployment is a potential weakness in this study.
- The lack of longitudinal data also poses limitations. The most recent cases we included were in an early stage of treatment and rehabilitation and would probably be more unlikely to be able to work.
- We also have a potential risk of selection bias as some amputees sustained fatal injuries while others with minor injuries (like finger/toe amputations) may not have been referred for rehabilitation.
- Strengths of this study include a representative sample of the patients attending rehabilitation in Gaza, a response rate of 99 %, the close cooperation with the local staff and the conduction of the study in Arabic.

BACKGROUND

During the last decade Gaza has experienced four large scale military incursions, leaving thousands of Palestinians injured, disabled and displaced. The number of civilians surviving with traumatic war-related amputations are increasing. The traumatic injuries from the recurrent military incursions on Gaza are aggravated by a siege enforced by military blockade since 2007, a shattered local economy, and high unemployment rates. According to the Palestinian Central Bureau of Statistics (PCBS), 10369 Palestinians have been killed from 2000 to 2016.[1]

Limb loss is associated with a number of secondary conditions, including psychological distress and pain, which may affect the long term outcome for the patients.[2]

The risk factors for such complications among traumatic amputees in Gaza are relatively unknown, and has to our knowledge, not been studied before. To understand and establish knowledge of common complications like pain and psychological distress, and the risk factors for these complications, is important and may result in better outcomes for the amputees in Gaza.

Poverty is known to follow physical war injuries and further amplifies the burden of trauma for victims and families.[2] The public health problems posed from war and conflict injuries are more common in low and middle-income countries (LMIC), such as Palestine.[3-5]

Limb loss due to military attacks is a sudden, brutal life changing event for both amputees and families. As stated by Clasper and colleagues: Traumatic amputations remain one of the most emotionally disturbing wounds of conflict.[6] These wounds may be followed not only by pain and loss of function, but also poverty if the ability to carry on with everyday work is lost,[7-8] and poverty predicts poorer outcomes after trauma-related amputations.[7, 9-10] The negative impact of traumatic life events, such as war, are more severe among Palestinians in Gaza with a low family income.[11] Life satisfaction following traumatic limb amputation is closely related both to the ability to return to work and to adequate rehabilitation. [12-13]

We wanted to find out whether psychosocial factors (family income, unemployment) were significant predictors of the level of psychological distress and of the presence or absence of pain in Palestinian patients who had suffered traumatic extremity amputations and were attending rehabilitation in Gaza.

MATERIAL AND METHODS

Study participants

This study was conducted in the Gaza Strip which has seen four major military incursions since 2006 (Operation Summer Rain 2006, Operation Cast Lead 2008-09, Operation Pillar of Defense 2012, Operation Protective Edge 2014).[14-16]

We included 254 extremity civilian amputees from Gaza in a cross-sectional study. Inclusion criteria were one or several extremity amputations during 2006-2016 due to a military attack and being a Palestinian resident above the age of 16 years at the time of inclusion. We screened 1170 patient records and excluded 915 amputees whose amputations were not related to war or was sustained before 2006. The study was conducted at The Artificial Limb and Polio Center (ALPC) in Gaza City which is the sole place in the Gaza Strip where limb prostheses are tailored and fitted.[17] There were no major differentiation between the patients. We conducted a pilot study from June-Nov in 2014 where the first 90 patients who met the inclusion criteria participated. The pilot study response rate was 99 %, and we followed up by including all registered patients from ALPC who met the inclusion criteria. This pilot was followed by an in-depth descriptive study [18] The decision to use ALPC as a study center had numerous advantages: It is located in central Gaza City, has good facilities with running water and generators supplying electricity during the daily power outages. It is a relatively safe place where the researchers and patients could meet without travelling to other areas of Gaza during ongoing military incursions. The center provides gratis services for the amputation patients, which was an important asset and prevented recruitment of patients from being biased by patients' financial situation.

Patients' medical history was taken the patient filled in a printed questionnaire in Arabic. Questionnaires were designed for yes/no or Likert-scale graded answers. Illiterate patients had the questions read out loud in Arabic. We used 12-question General Health Quality survey (GHQ-12), a well validated questionnaire to assess mental health.[19-20] The questionnaires were completed before each included patient underwent a detailed clinical medical examination by an experienced physician.

Level of amputation and severity of injury

We classified the amputations with the commonly used orthopaedic terms: above or below the extremity joints (reference). Every amputation was pictured by hand by the examiner on an anatomical sketch in addition to being photographed. The amputations were classified in an ordinal scale by an increasing order of severity based on proximity to the torso and number of

affected limbs. The ordinal scale was as follows: 1 = finger/toes/hands/feet; 2 = below knee or below elbow; 3 = above knee or elbow; and 4 = bilateral amputation or amputation in both lower and upper extremities or unilateral amputation at hip-level/shoulder-level. Various weapon deliverers had caused the amputations in all cases. [21]

Pain

The patients provided details on the frequency of their pain during an average week. The ordinal scale was as follows: 0= never pain, 1= pain one day a week or less, 2= pain two-three days a week, 3= pain four-six days a week, and 4= pain every day.

Mental health

To assess mental wellbeing, we were advised by local Palestinian psychologists at the Gaza Community Mental Health Center (GCMHC) to use the validated questionnaire GHQ-12. The questionnaire is a 12-questions screening tool in Arabic commonly used to assess mental distress in the general population in a community. It is self-administrated and easy to complete. The Arabic version has been validated for use in Arab-speaking patients, and has been used in previous studies in Gaza.[19-20,22] Scoring methods for GHQ-12 were bi-modal (0-0-1-1). We used a cutoff of 3 when we scored the GHQ-scores in accordance with a previous study conducted in Gaza by the World Health Organization (WHO) [22]. Cronbach's alfa was 0.72 for the GHQ-items 1 through 12. The use of a cut-off value is only relevant if the investigators are screening for "caseness", which was our intention in this study [23].

Family income

We recorded family income from each patient's self-reported questionnaires which included the following alternatives: a total family income per month 0 = less than 700 New Israeli Shekels* (NIS) 1 = 800-1600 NIS 2 = 1700-2500 NIS 3= 2600-3400 NIS, and 4 = more than 3500 NIS.

* (100 NIS= 32 USD)

Employment status

The self-reported employment status and patients perceived reason(s) for unemployment (employed, no available job, student/housewife, unemployed due to injury) were documented.

Ethics, consent and permission

We chose the ALPC as our local study base in agreement with the local health authorities, the board of Gaza`s main hospital, Al-Shifa Hospital (Gaza's trauma center), and the Director of the ALPC. All patient completed written consent prior to participating. The study was approved by the Regional Ethical Committee (approval number: 2016/1265/REK Nord) in Norway and the Regional Ethics Committee in Gaza, named Helsinki approval, from the local Health authorities in Gaza. We reimbursed all participants' roundtrip travel expenses to ALPC.

Statistics

Descriptive statistics are reported as mean and standard deviation (SD) for parametric data, median and interquartile range (IQR) for non-parametric data. We consider a p-value <0·05 statistically significant. Frequencies are reported as percentage of the total study population for groups and subgroups. Logistic regression was used to assess association with a binary categorization of the GHQ-12 score (bimodal 0-0-1-1), as described by WHO [22]. Ordinal regressions was used for multivariate analysis with pain, a scale described above of increasing pain frequency from 0 till 4, as the outcome. Both models were first assessed with age gender and the independent variable of interest, before adjusting for additional variables.

Data analysis is conducted in SPSS Statistics version 22.0 (SPSS Inc., Chicago, IL, USA) and STATA 15 (StataCorp. 2015. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LP).

RESULTS

Patient demographics

Two-hundred and fifty-four patients participated in the study. Most of them were males in their 20-ies, all Palestinians from Gaza. All participants were registered as patient at the ALPC and had sustained one or more traumatic extremity amputations. Nearly nine of ten patients had major amputations (n = 216, with 85 % above wrist or ankle). Seventeen percent (n = 43) had been hit and sustained amputation(s) during childhood (aged 18 years or younger, Seventy-five percent (191) of the amputees were unemployed at the time of inclusion in the study.

Thirty per cent of the amputees (76/254) were surviving on less than 700 New Israeli Shekel monthly at the time of inclusion.

Table 1 summarizes the patient characteristics.

Psychological distress and unemployment

Among the 191 (75 %) unemployed patients, 112 (44 %) reported that their unemployment was a direct result of the amputation injury. More than half of the amputees (55 %, n = 135) had GHQ-scores above the cut-off of 3 points indicative of psychological distress.

We found psychological distress to be higher among amputees who considered themselves unemployed due to the injury (OR= 1,36, CI 1.07 to 1.72, p = 0.011). In contrast, we did not find any association between the level of extremity amputation and level of psychological distress as assessed by GHQ-scores (Table 2).

Pain and poverty

Every third amputee (n = 80, 32%) studied reported that they suffered from daily pain.

The frequency of physical pain correlated with low family income, also when adjusted for the severity of the injury (OR = 0.54, CI = 0.36 to 0.80, p = 0.002, see Table 3 and Figure 1).

Psychological distress and pain

The frequency of pain was significantly associated with the level of psychological distress (GHQ) among the participants. GHQ 12 scores increased among patients with frequent pain (OR = 1.35, CI = 1.12 to 1.65, p = 0.002). Also, self-reported pain increased among patients with higher levels of psychological distress (OR = 2.40, CI = 1.48 to 3.39, p < 0.001).

DISCUSSION

More than half of the traumatic amputees in this cross-sectional study from Gaza's main rehabilitation clinic reported psychological distress with GHQ-12 scores above the cut-off. Psychological distress was clearly associated with financial deterioration following their loss of work due to their extremity amputations. The frequency of pain was also higher among the poorest patients, and increased with decreasing family income. On the other hand, the anatomical extent and severity of the initial physical amputation trauma did not affect GHQ-scores or the frequency of pain experienced by the amputees.

Unemployment due to injury and mental distress

The psychological distress increased significantly among the amputees who were unable to continue work as a result of their limb loss. This finding is supported by WHOs previous findings in Gaza, where GHQ-levels were higher among unemployed.[24]

Three out of four patients in this study were unemployed. Close to half of them reported that they currently were unemployed as a consequence of their physical disabilities caused by the loss of limb(s). Unemployment was a major risk factor for depression and anxiety in Jordanian amputees. [25] The long-term outcomes in 146 traumatic amputees in USA, showed that 75 % had sustained change in occupation after amputation with more than half reporting to be less paid in their new positions. [26]

The unemployment among local Palestinian documented in our study is adding up to an already exceptionally high unemployment rate in Gaza, reaching 43·6 % in 2018. [27-28]

The increased poverty that followed after severe extremity amputation injury in this cohort of amputees in Gaza, appears to be more important for psychological well-being than the extent of the amputation.

Pain and low family income

We also found that low family income was the main predictor to determine how often the amputees experienced pain. The frequency of pain increased among amputees who lived in families with low income. Surprisingly, neither pain nor psychological distress were affected by the extent of the initial physical trauma. Our findings are supported by the conclusion in the study by Husum and colleagues on chronic pain in land mine accident survivors in Cambodia and Kurdistan, where patient-related loss of income correlated with the rate of chronic pain syndrome.[7] Ferguson and colleagues studied the psychological adjustment after

amputation in landmine victims and found that the amputees recovery and acceptance of limb loss were dependent on the patients economic situation.[29] In the context of living with disabilities in a society where siege, occupation and recurrent military attacks are part of everyday life, it is also important to acknowledge the effects this may have on fundamental psychosocial determinants of pain and psychological distress.

The most important factor to improve mental health among civilians in Gaza, is end the occupation.[30]

Social suffering such as unemployment and poverty are effects of the long-lasting siege of Gaza which adds burdens to the lives of the amputees and their families. The unemployment rate in Palestine was 31 percent in 2018. In Gaza 52 percent of the labor force was unemployed [31]. In order for the Palestinian economy to improve, the World Bank stresses the need for a political solution allowing the Palestinian economy to expand through access to the regional and international markets with export of Palestinian products and services. This requires an immediate end to the siege of Gaza [31].

To ameliorate the needs of the population of amputees, these issues requires a shift in the emphasis from narrow medical indicators, injury and illness to the lack of human security and human rights violations experienced by ordinary Palestinians.[32]

Limitations and strengths

The use of self-reported reasons for unemployment is a potential weakness in this study. The lack of longitudinal data also poses limitations. The most recent cases we included were in an early stage of treatment and rehabilitation and would probably be more unlikely to be able to work. We also have a potential risk of selection bias as some amputees sustained fatal injuries while others with minor injuries (like finger/toe amputations) may not have been referred for rehabilitation. However, due to the ongoing conflict, the lack of infrastructure and sometimes incomplete medical records, it would be close to impossible to obtain a completely representative set of data from the whole population of amputees.

Strengths of this study include a representative sample of the patients attending rehabilitation at ALPC with a response rate of 99 %, the close cooperation with the local staff and the conduction of the study in Arabic.

INTERPRETATION

More physical pain and decreased mental wellbeing correlated significantly with the more unemployment and less family income (poverty) following traumatic extremity amputations among Palestinians in Gaza. Poverty and unemployment after traumatic amputations and disability are heavy, extra burdens adding to the trauma of the physical extremity amputation itself.

DECLERATIONS

Ethics, consent and permission

All patient completed written consent prior to participating. The study was approved by the Regional Ethical Committee (approval number: 2016/1265/REK Nord) in Norway and the Committee for Helsinki ethics approvals in Gaza.

Consent to publish

Not applicable.

Availability of data and materials

The datasets used during the current study are not publicly available as the authors did not apply any ethical committees for the permission to share the data. In this particular context, sharing of data could raise safety concerns for the participants in the study and thus considered unethical.

Patients and Public Involvement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Competing interests

We declare no competing interests.

Funding

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Authors' contributions

Hanne Heszlein-Lossius contributed study design, data collection, data entry, data analysis, interpretation of the results, the primary draft of the manuscript writing, editing the manuscript, literature search and final approval of the manuscript.

Yahya Al-Borno contributed to study design, patient inclusion, data collection, data transfer, revising the manuscript and final approval of the manuscript.

Samar Shaqqoura contributed to study design, patient inclusion, data collection, data transfer, revising the manuscript and final approval of the manuscript.

Nashwa Skaik contributed to study design, patient inclusion, data collection, data transfer, revising the manuscript and final approval of the manuscript.

Lasse Melvaer Giil contributed to the statistical analysis, interpretation of the results, visualization of the data in figures, editing and revising and manuscript, and final approval of the manuscript.

Mads Gilbert contributed the original research idea, the study design, interpretation of the results, revising and editing the manuscript, and final approval of the manuscript.

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Table 1. Characteristics of study participants [a] (N = 254)

Demographics	**Patients (N)**	**Statistics (%)**
Palestinian	254	100
Male	234	92
Children[b]	43	17
Female	20	8
Refugee status[c]	154	57
Age –Inclusion, years		28 [10][e]
Age-Injury, years		23 [9][e]
Family income, NIS/US Dollar[d]		
< 700/ 220	76	30
800-1600/ 252-504	105	42
>1700/ 535	50	28
Employment		
Unemployed	191	75
Unemployed due to amputation	112	44
≥ 3 unemployed family members	152	61
≥ 3 persons economically dependent on amputee	160	64

a Number of participants: 254, from 0-2 % of the participants had missing data on any variable.

b Children refers to participant that were amputated at the age of 18 years old or younger.

c Refugee = patient is from a family who has formal UN refugee status as of 1948

d NIS= New Israeli Shekel. 1 NIS equals 0,26 US Dollar.

e median and interquartile range.

Table 2. Psychological distress

	Crude model [a]			Adjusted model [b]		
	OR	95 % CI	p	OR	95 % CI	p
Unemployment due to trauma	1.36	1.07 – 1.72	0.011*	1.39	1.10 – 1.76	0.006*
Pain	1.35	1.12 – 1.65	0.002*	1.38	1.13 – 1.67	0.001*
Severity of injury				0.97	0.88 – 1.06	0.324
Family income				0.96	0.81 – 1.14	0.653
Loss of family members				1.06	0.80 – 1.37	0.687

Note: Psychological distress indicated by a binary cut-off at a GHQ-score ≥ 3.

Abbreviations: CI, confidence interval; GHQ, General Health Questionnaire; OR, odds ratio.

[a] Logistic regression adjusted for age and gender, with GHQ > 3 points as the dependent variable.

[b] Severity of injury, pain frequency and severity of injury added to the model described in [a]

* p-value < 0.05

Table 3. Pain severity after amputation

	Crude model [a]			Adjusted model [b]		
	OR	95 % CI	p	OR	95 % CI	p
Family income	0.54	0.36 - 0.80	0.002*	0.55	0.35 - 0.88	0.012*
Psychological distress	2.40	1.48 - 3.39	<0.001**	2.39	1.42 - 4.02	0.001*
Severity of injury				0.24	0.26 - 1.41	0.134
Unemployment due to trauma				0.91	0.44 - 1.89	0.808
Loss of family members				1.49	0.73 - 3.06	0.277

Note: Ordinal weekly pain scale from 0 to 4: never, 1 day a week or less, 2-3 days, 4-6 days and daily.

Abbreviations: CI, confidence interval; OR, odds ratio.

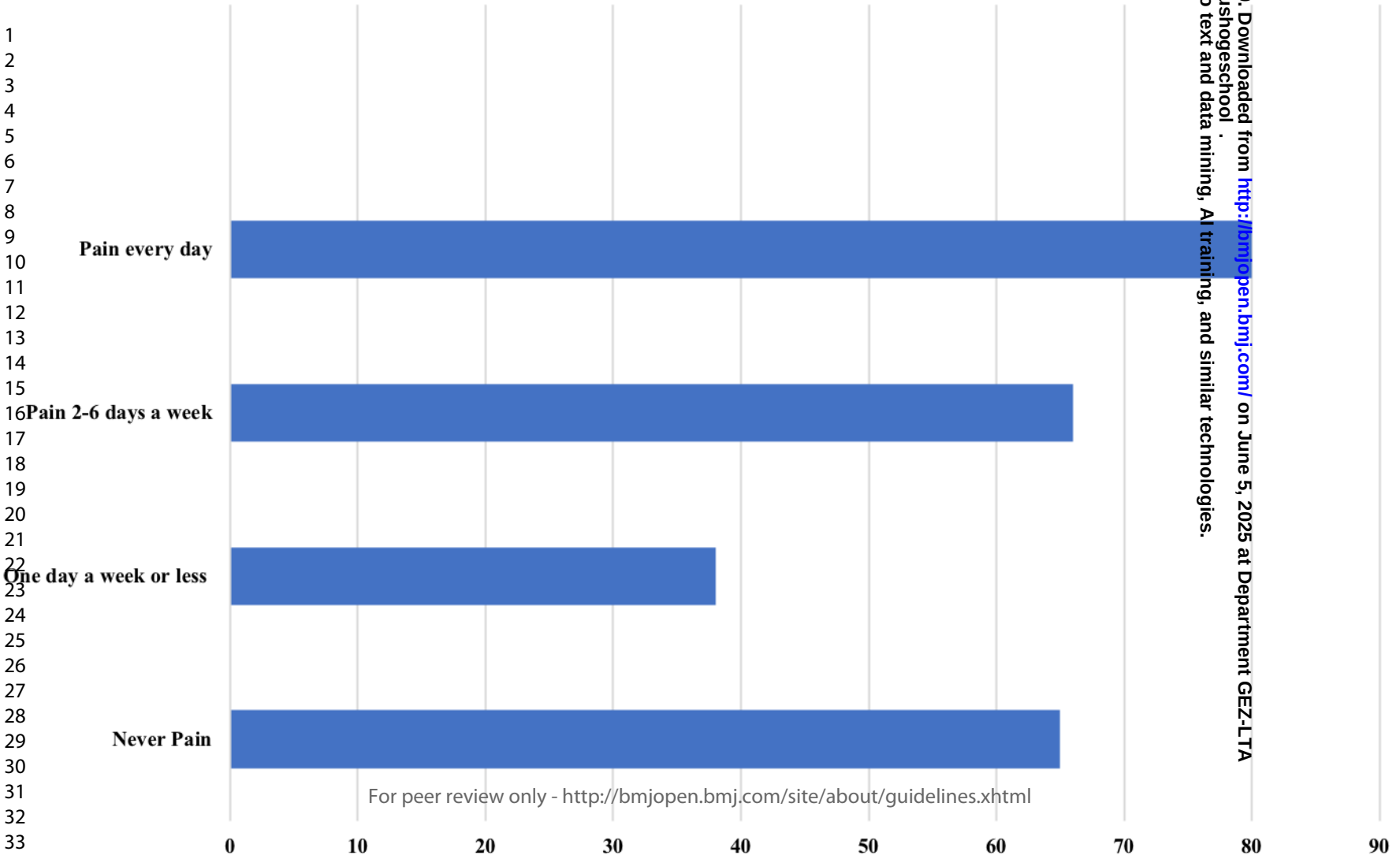
[a] Crude model: Ordinal logistic regression adjusted for age and gender, with Pain as the dependent variable.

[b] Adjusted model: severity of injury, psychological distress and severity of injury added to the model described in [a]

* p-value < 0.05, ** < 0.001

Figure 1. Frequency of pain after amputation trauma

Number of participants: 249. Five (1,96 %) participants had missing data.



STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract OK Page 1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found OK page 2
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported page 4
Objectives	3	State specific objectives done in page 4 in background. including any prespecified hypotheses N/A
Methods		
Study design	4	Present key elements of study design early in the paper ok page 1,4 and 5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection ok page 5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants ok page 5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable page 5-6
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 ok page 5-6
Bias	9	Describe any efforts to address potential sources of bias ok page 3
Study size	10	Explain how the study size was arrived at ok page 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why ok page 7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding page 5 and 7
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed ok page 5
		(b) Give reasons for non-participation at each stage ok page 5
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders page 5 and in page 3
		(b) Indicate number of participants with missing data for each variable of interest ok done in table 1-3.
Outcome data	15*	Report numbers of outcome events or summary measures done in results
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included ok

		(*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 N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives done under discussion page 10.
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 page 1 and 11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence done in results and discussion and limitations.
Generalisability	21	Discuss the generalisability (external validity) of the study results
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 ok done in the end of the paper under funding

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.