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Health related quality of life following injury in low-and middle-income countries: A review of measures and concepts

Iris WAINIQOLO,[1] Bridget KOOL,[2] Vili NOSA,[3] Shanthi AMERATUNGA[1]

ABSTRACT

Introduction: Health-related quality of life (HRQoL) is an important aspect to consider when assessing the non-fatal impact of injuries. The aim of this review was to critically appraise the range of generic instruments employed in the assessment of HRQoL following injury in low-and-middle-income countries (LMICs). As a prelude to subsequent research examining longer-term outcomes following motor vehicle crash injuries in Fiji, we also examined how commonly used measures align with the List of All Deficits (LOAD) framework for injury and the Fonofale model of Pacific health and well-being.

Methods: A systematic search of four databases was conducted to identify injury outcome studies undertaken in low-and-middle-income countries (LMICs) that used a generic health status outcome measure(s). Two separate content analyses were undertaken, to assess how identified HRQoL measures aligned with the LOAD framework and the Fonofale model.

Findings: Thirty-two studies from thirteen LMICs examined variably defined aspects of HRQoL following a range of traumatic injuries (e.g. spinal cord, brain). The measures most commonly focused on the 'impact on individual' aspect of the LOAD framework and the 'physical and mental' aspects of the Fonofale model. While the emerging literature from LMICs provides valuable information about the HRQoL of trauma patients, the commonly used generic measures provided limited insights regarding societal impacts, culture and spirituality, domains of relevance to injury research and Pacific health and well-being.

Conclusion: Theoretical frameworks relevant to Pacific contexts should be considered when selecting appropriate outcome measures for injury studies in the region.

Keywords: Injury, outcome assessment (healthcare), quality of life, low-and-middle-income countries, Pacific islands countries and territories.

INTRODUCTION

Traditional health and medical services typically view health outcomes in terms of mortality and morbidity. Recent decades have seen a paradigm shift with researchers developing new quantitative methods to measure levels of wellness and their determinants.[1-5] This approach acknowledges that the personal burden of illness is not only about disease status, but also other dimensions such as psychosocial factors (e.g. pain, anxiety), limitations in activity and participation, personal and family responsibilities, and financial burden. Health-related quality of life (HRQoL) is a multi-dimensional concept that assesses objective functioning alongside the reflections of patients (and their caregivers) on the effects of illness and

Corresponding author: Iris Wainiqolo i.wainiqolo@auckland.ac.nz

1. Section of Epidemiology and Biostatistics, School of Population Health, University of Auckland, Auckland, New Zealand
2. Faculty of Medical and Health Sciences, University of Auckland, Auckland.
3. Section of Pacific Health, School of Population Health, University of Auckland, Auckland.

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treatment on overall health status and wellbeing.[3]

The instruments used for HRQoL measurement can be generic (e.g. Medical Outcomes Study 36 item Short Form Health Survey [SF-36]) or condition-specific (e.g. Burn Specific Health Scale-Brief, BSHS-B) to measure outcomes for people with a particular health condition.[3, 6-8] A HRQoL measure consists at a minimum of the physical, mental health and social health dimensions reflective of the World Health Organization (WHO) definition of health.[4, 9] Other dimensions such as impairment, functional states (e.g. activity and participation), perceptions and social opportunities are also important areas to capture.[10, 11]

In 2010, the Global Burden of Disease study estimated that injuries accounted for over 278 million disability-adjusted life years (DALYs) with over 90% of these occurring in low and middle-income countries (LMICs). In the context of higher injury risks, lower income, poorly developed emergency first-response, trauma care and rehabilitation services,[12-15] the burden of injury has substantial impacts on productivity and economic development in these settings.[12, 16] HRQoL measures are valuable for capturing health impacts to support burden of injury estimates that can inform and allocate resources for the design and delivery of health services and advocate for responsive policies and legislation.[2, 4, 17]

The key attributes of effective HRQoL measures include the performance of the instrument (e.g. validity, reliability, responsiveness) and usability of the instrument (e.g. language, respondent and administrative burden, acceptability, meaning of scores).[18-25] An important aspect of HRQoL assessment is that the results must reflect patient values and preferences of perceived well-being alongside objective measurement of function.[24]

From an injury perspective, it is unclear to what extent existing HRQoL measures capture the full range of negative effects that injury may have on health and well-being. A useful starting point may be to determine the degree to which existing health outcome instruments measure concepts of injury. The injury List of all Deficits (LOAD) framework offers a guide to a comprehensive and integrative understanding of the trauma experience,[26] recognising the multidimensional nature of the injury burden. The framework aims to capture and categorise direct and indirect impacts of injury to facilitate a cohesive approach to injury burden studies. The impacts are grouped into three key domains those affecting the individual (I), the family/carer (F) and society (S).

The measurement of health outcomes is based on an individual's perceptions of their life in the context of the culture and values systems in which they live.[17] In light of this, and as a prelude to subsequent research examining longer-term outcomes following car crash injuries in Fiji, a Pacific Island country, we examined the extent to which commonly used outcome measures capture concepts of Pacific health and well-being.

The Pacific Islands Countries and Territories (PICTs) is made up of 22 island nations, the majority of which are classified as LMICs. Although divided into Melanesia, Polynesia and Micronesia, the people share similar cultural characteristics and value systems.[27] The Fonofale model[28] developed after wide consultation with Pacific communities, provides a succinct summary of what Pacific peoples consider important for their overall health and well-being. The analogy of health and well-being is presented as a traditional house (fale). The foundation represents the 'family and support networks'; the roof represents the 'cultural values and beliefs' that is the shelter for the family. The four posts connecting the roof and the foundation represent the 'spiritual' 'physical', 'mental' and 'Other' (e.g. age, gender, socioeconomic status) dimensions of health and well-being. These dimensions not only relate to the roof and foundation of the house, but they also interact with one another. The house is in a setting defined by the dimensions of 'environment', 'time' and 'context'.

The aim of this literature review was to critically appraise the range of generic instruments employed in the assessment of HRQoL following injury in LMICs. In addition, the review also examines how commonly used HRQoL measures align with the injury LOAD framework and the Fonofale model of health and well-being.

METHODS

Data sources and search strategy

MEDLINE, EMBASE, CINAHL and Psych INFO electronic databases were searched using a pre-determined strategy. The following medical subject heading (MeSH) and text word terms were used to locate potentially relevant studies: 'wounds and injury', 'health-related quality of life', 'quality of life assessments', 'developing countries', 'low-and middle-income countries', 'third world countries. A comprehensive list of specific LMICS was also included in the search. Identified studies between 1 January 1980 and 30 June 2018, published in peer-reviewed journals, and written in the English language were included.

Study selection criteria and procedures

Located studies were screened initially by title and abstract and then more thoroughly in full text. The inclusion criteria were: adult (≥18 years old) studies presenting data on HRQoL following injury, using a generic instrument and in a LMIC setting (The World Bank, 2016).[29] Studies on interventions and economic evaluations were excluded. Included studies were critically appraised using an existing HRQoL tool to measure instrument quality in terms of face validity and parsimony.21

Data extraction

Information on the included study characteristics (authors, year of publication, setting, study type, sample size), study population (injury type), and the HRQoL measures used (instrument type, English or translated version, modifications, method of administration) were extracted and summarised (Table 1). Data synthesis and summary scores provided qualitative and quantitative appraisal of each outcome measure and their alignment with the LOAD framework and the Fonofale model.

Assessing the quality of included studies

The quality of identified studies was assessed using pre-defined criteria described by Gill et al.[21] (Table 2). Compliance with selected criteria was based on the total number of elements of the criteria covered by each study.

LOAD framework and Fonofale model content analysis

Two separate content analyses were undertaken, for the LOAD framework and the Fonofale model. Using the principle of face validity and parsimony, the alignment of the items of each outcome measure to one or more LOAD categories or concepts was assessed. This process was repeated for the Fonofale model. The content density of the two instruments was also assessed to evaluate the ratio of the number of LOAD or Fonofale concepts contained in each instrument in relation to the total number of items (questions) in the instrument.[30] A content density of: <1 indicates that there are fewer and less complex items captured by the instrument (making it straight forward to use); equal to one indicates that each item in the measure represents one LOAD or Fonofale concept; > 1 indicates that each item measures more than one concept in either framework/model.

RESULTS

Thirty-two studies from 13 LMICs published during the review period met the inclusion criteria. Of these, 24 were undertaken in upper middle-income countries, while LMICs contributed five[31-35] and three studies[36-38] respectively (Table 1). Almost a third of the HRQoL studies (n=10) came from Asia,[32, 34, 36, 37, 39-44], 13 from the Middle-East,[33, 45-53] five from the Americas,[54-58] and the remainder from Africa[31, 35, 38] and Europe.[59] HRQoL assessments were conducted for spinal cord injury (SCI) (n=14),[37, 39, 40, 42, 43, 49, 52, 55-57, 59] war-related injuries (n=7),[45-48, 51, 53] traumatic brain injury (TBI) (n=4),[31, 41, 54, 58] mixed injuries (n=3),[32, 36, 60] and one each for facial trauma,[35] femur fractures[38] occupational injuries[33] and burn injury.[61] No studies were located that had conducted in the Pacific Islands.

The Medical Outcomes Study (MOS) measures (SF-36) was used in 20 studies, [39-43, 45-49, 51-59, 61, 62] while five studies utilised the WHOQOL-BREF.[35, 40, 42, 43, 59] Other QoL measures identified included the European Quality of Life Five Dimensions (EQ-5D),[33, 38] the Health Utilities Index, Mark 3 (HUI3),[32] the Indonesian HRQoL questionnaire,[60] the Life Situation Survey (LSS),[39] an untested QoL Visual Analogue Scale (VAS),[31] and the Quality of Life Questionnaire (QoLQ).[53] Each of these measures was used once in six separate studies.

The majority of included studies were cross-sectional (n=23), eight were cohort studies, and one was a case series. There was considerable variation in follow-up periods for prospective cohort studies (12 weeks to 3 years) and timings of assessments. Where outcome measures were adapted, this was done by selective use of domains and changing of questions to suit the local context. The adapted versions limited comparability with other studies and as such the heterogeneity of the data prevented any possible meta-analysis.

Table 1. HRQOL outcomes measures used for injury assessments in LMICs

Author, year, country	Study design, (Number of participants)	Study population	Health Related Quality of Life (HRQOL) instrument (Mode of administration)
1. Oh SJ et al.,[63] (2005), *South Korea*	Prospective cohort study (n=282)	Spinal cord injury (SCI) of 12 months duration or longer in patients 18 years or older with neurogenic bladder (n=132) and compared with control subjects (n=150)	Short Form-36 Medical Outcomes Survey (SF-36) *(Interviewer-administered)*
2. Ham OK.,[36] (2008), *South Korea*	Cross-sectional study, (n=24,327)	19-65 year olds with unintentional injuries (n=2861) that required hospitalisation at least once in their lifetime were compared with those who have not had that experience (n=21,466)	Modified SF-36 *(Interviewer-administered)*
3. Xie et al.,[44] (2012), *China*	Cross-sectional study (n=1401)	Patients (18 years or older) who survived severe extensive burns (n=20) were compared with a healthy Chinese population (n=1316) and a group of Chinese patients on hemodialysis (n=65)	SF-36 – validated Chinese version Brief Version of Burns Specific Health Scale - adapted Chinese version - (ACV BSHS-B-) *(Both forms were self-administered)*
4. Hu et al.,[41] (2012), *China*	Prospective cohort study (n=358)	Patients with moderate-to-severe traumatic brain injury (TBI) followed up at six months, one year, and two years following discharge	SF-36 *(interviewer-administered)*
5. Blanes et al.,[56] (2009), *Brazil*	Cross-sectional study (n=60)	SCI out-patients with paraplegia (18-60 years old), Sao Paulo Hospital	SF-36 *(interviewer-administered)*
6. Lima et al.,[58] (2007), *Brazil*	Cross-sectional Study (n=39)	Adults with Mild Head Trauma (MHT)	SF-36 (*self-administered or helped by the researcher if illiterate)*
7. Arango-Lasprilla et al.,[54] (2012), *Colombia*	Cross-sectional study (n=92)	31 moderate-to-severe TBI individuals (18-65 years old) at least six months post-injury, compared to 61 healthy controls	SF-36 (validated Spanish version) *(interviewer-administered)*
8. Arango-Lasprilla et al.,[55] (2010), *Colombia*	Cross-sectional study (n=82)	40 SCI individuals (18 years and older) at least six months post-injury compared to 42 healthy controls	SF-36 (validated Spanish version) *(interviewer-administered)*

9. Coleman et al.,[57] (2015), *Colombia*	Cross-sectional study (n=40)	Individuals (18 years and older) diagnosed with traumatic SCI for a minimum of six months	SF-36 (validated Spanish version) *(interviewer-administered)*
10. Ebrahimzadeh et al.,[47] (2013), *Iran*	Cross-sectional study (n=76)	Veterans from the Iran-Iraq war (1980-88) with hip disarticulation or trans-pelvic amputations	SF-36 (validated Persian version) *(interviewer-administered)*
11. Ebrahimzadeh et al.,[49] (2014), *Iran*	Cross-sectional study (n=4852)	Iran-Iraq war veterans with chronic SCI (n=52) were compared with the/a normal population (n=4800)	SF-36 *(Interviewer-administered)*
12. Asadollahi et al.,[45] (2010), *Iran*	Cross-sectional study (n=497)	137 adult victims with landmine injury ≥ six months compared with 360 uninjured controls	SF-36 (validated Persian version) *(interviewer-administered)*
13. Ebadi et al.,[46] (2014), *Iran*	Cross-sectional study (n=242)	Patients aged 25-62 years who had chemical injury (lung damage) during the Iran-Iraq war (1980-88)	SF-36 (validated Persian version) *(interviewer-administered)*
14. Saadat et al.,[52] (2010), *Iran*	Cross-sectional study (n=102)	Comparison between Iran war veterans (n=39) and non-veteran males (n=63) with SCI	SF-36 (validated Persian version) *(interviewer-administered)*
15. Ebrahimzadeh.,[48] (2015), *Iran*	Cross-sectional study (n=291)	Iran-Iraq war veterans with war-related bilateral lower limb amputations	SF-36 (validated Persian version) *(interviewer- administered)*
16. Amini et al.,[64] (2010), *Iran*	Cross-sectional study (n=248)	Iran-Iraq war blind survivors	SF-36 *(interviewer-administered)*
17. Ghazwin et al.,[65] (2015), *Iran*	Cross-sectional study (n=153)	Hospital-referred male patients with traumatic SCI	SF-36 (validated Persian version) *(interviewer-administered)*
18. Moghimian et al.,[66] (2015), *Iran*	Cross-sectional study (n=106)	Hospital-referred patients with SCI	SF-36 (validated Persian version) *(interviewer-administered)*
19. Sabour et al.,[67] (2015), *Iran*	Cross-sectional study (n=104)	Patients with SCI referred to the Brain and Spinal Injury Research Centre	SF-36 (validated Persian version) *(interviewer-administered)*
20. Masoumi et al.,[51] (2014), *Iran*	Cross-sectional study (n=76)	War-related injured individuals with hip disarticulation	SF-36 (validated Persian version) *(interviewer-administered)*
21. Wen H. et al.,[43] (2013), *China*	Prospective cohort study (n=26)	SCI-related pain and treatment in victims (>18 years old) of the 2008 Sichuan earthquake was assessed 4 times over a 3 year period (2009 - 2012).	The 26-item World Health Organization Quality of Life Questionnaire (WHO QOL-BREF); *(Interviewer-administered)*

22. Hu et al.,[40] (2012), *China*	Prospective cohort study (n=26)	Wenchuan earthquake survivors (18 years and older) with SCI. Comparison of QOL at hospital discharge and 1-year follow-up in the community	WHOQOL-BREF *(interviewer-administered)*
23. Luo et al.,[42] (2012), *China*	Cross-sectional study (n=180)	Individuals who developed SCI following the 2008 Wenchuan earthquake	WHOQOL-BREF (validated Chinese version) *(interviewer-administered)*
24. Ukpong et al.,[35] (2007), *Nigeria*	Prospective cohort study (n=252)	Patients (18 years and older) with facial trauma (n=126), matched with 126 healthy controls and assessed 3 times over a 12 week period	WHO QOL-BREF *(Interviewer-administered)*
25. Jovanovic et al.,[59] (2012), *Serbia*	Cross-sectional study (n=495)	Adults with neuro-disabilities, including a group with SCI (n=99) were compared to a group of adult healthy controls	WHOQOL-DIS, a specific supplement of the WHOQOL-BREF *(Interviewer-administered)*
26. Sudaryo et al.,[34] (2012), *Indonesia*	Prospective cohort study (n= 277)	Two cohorts of injured (n=184) and non-injured (n=93) adult survivors of the 2009 earthquake in Padang who were assessed twice in a 6 months follow-up	Indonesia Health Related Quality of Life Questionnaire (I-HRQOL); a variant of the EQ-5D *(Interviewer-administered)*
27. Eldin et al.,[68] (2012), *Egypt*	Cross-sectional study (n=131)	Adults with occupational injuries, on leave for 6 months	European Quality of Life Five Dimensions (EQ-5D) – Arabic translation *(Interviewer-administered)*
28. Ibrahim et el.,[38] (2018), *Tanzania*	Prospective cohort study (n=272)	Adults undergoing operative fixation for diaphyseal femur fractures; assessed at 2 weeks, 6 weeks, 3 months, 6 months and 1 year	European Quality of Life Five Dimensions (EQ-5D) – Swahili translation *(Interviewer-administered)*
29. Nguyen et al.,[32] (2018), *Vietnam*	Prospective cohort study (n=892)	Patients admitted to Thai Binh General Hospital due to an injury, hospitalised for at least one day, and residing within the area of Thai Binh province. Assessed at home at 1, 2, 4, and 12 months after hospital discharge.	Health Utilities Index (HUI3) – Vietnamese translation *(Interviewer-administered)*
30. Hampton et al.,[39] (2001), *China*	Cross-sectional study (n=231)	Adults with SCI (n=119) for 2 years or more compared to a group of university students (n=112)	Life Situation Survey (LSS) – Chinese version *(Self -administered)*
31. Fourtassi et al.,[31] (2011), *Morocco*	Case series (n=42)	Adult patients who sustained mild TBI (mTBI), assessed one year following injury	Quality of life visual analogue scale (VAS) *(interviewer-administered)*
32. Yazicioglu et al.,[53] (2006), *Turkey*	Cross-sectional study (n=79)	Veterans (21-34 years old) hospitalised in a rehabilitation centre with SCI (n=20), orthopedic injuries (n=54), brain injuries (n=2), total blindness (n=3)	Quality of Life questionnaire (QOLQ, validated Turkish version) – a 24-item Likert-type scale that covers living situation, finances, leisure, family relations, social life, health, and access to healthcare. *(self-administered or assisted)*

Generic measure appraisal - compliance with pre-defined criteria

More than half of the included studies conceptually defined QoL (n=19) and identified the domains intended for measurement (n=17), 17 studies provided aggregate scores for QoL and over a third (n=11) provided a reason for the choice of QoL instrument(s) utilised (**Table 2**). With the exception of six studies which distinguished between QoL and HRQoL, and one that specifically used the term HRQoL,[32] the remaining 25 studies used these terms interchangeably. Patients were invited to offer a global rating for their QoL in only five studies.[31-33, 38, 40] A supplemental response from patients to stipulated items was noted in only one study.[56]

Table 2. Quality of life assessment criteria and frequency of compliance of measures

Criteria	Item or Question	Compliance No. of compliant studies/Eligible studies
Investigator-specific criteria		
1	Did the Investigators conceptually identify what they meant by quality of life?	19/32
2	Did they state the domains they wanted to measure as components of quality of life?	17/32
3	Did the investigators give reasons for choosing the instruments they used?	11/32
4	Did the investigations aggregate the results from multiple items, domains, or instruments into a single composite score for quality of life?	17/32
Instrument-specific criteria		
5	Were patients asked to give their own global rating for quality of life?	5/32
6	Was the overall quality of life distinguished from HRQOL?	6/32
7	Were patients invited to supplement the items (or questions) listed in the instrument(s) offered by the investigators?	1/32
8	If so, were these supplemental items/questions incorporated into the final rating?	0/32
9	Were patients asked to indicate where items/questions (either specified by the investigator or added by the patients) were personally important to them?	0/32
10	If so, were these importance ratings incorporated into the final rating?	0/32

Source: Gill et al.[21]

Content analyses with LOAD and Fonofale frameworks

Six multidimensional outcome measures identified in this review were mapped for content analysis, namely the SF-36, WHOQOL-BREF, EQ-5D, QLQ, LSS and the HUI3. Excluded from this analysis were the one-item VAS [31] and the Indonesian HRQoL [60] instruments because the former had not been tested and the latter was unable to be accessed.

Degree to which measures covered domains contained in the LOAD framework

The SF-36 was the most commonly used tool, but represented the smallest content density (0.19) (**Table 3**). The content density reflects the depth of the measure and in this case the items and their concepts measured the same LOAD category - 'impact of injury on the individual'. Meanwhile, the QLQ, LSS and HUI3 although less frequently used than SF-36, had two to three times the content density demonstrating a better capture of the injury deficits of the LOAD framework. The EQ-5D, used in two studies, had the highest content density (1.00) demonstrating that each item represents one LOAD category. The most assessed LOAD category across all the generic measures was the 'impact on individual' domain. The 'impact on society' domain and the 'concomitant diseases' sub-category within the 'impact on individual' domain were the least captured by these generic measures. Items related to 'environment factors' were not represented in the LOAD framework so that aspects of this captured by WHOQOL-BREF, QLQ and LSS were not classified in this analysis (**Table 3**).

Table 3. Content analysis of generic health-related quality of life measures and the LOAD framework

LOAD Framework	SF-36	WHOQOL-BREF	EQ-5D	QLQ	LSS	HUI3
SOCIETY						
S1 Society fear of injuries						
S2 Psychological consequences in observers						
S3 Copycat events						
S4 Direct medical costs		x		x	x	
S5 Indirect costs						
Total impact on 'society' categories captured	0	1	0	1	1	0
INDIVIDUAL						
I1 Death: Individual and fetal						
I2 Pain and discomfort	x	x	x			x
I3 Reduced short term physical activity	x	x	x	x	x	x
I4 Long term physical disability	x	x	x	x	x	x
I5 Psychological disability	x	x	x	x	x	x
I6 Concomitant diseases						
I7 Development of secondary conditions	x					
I8 Behavioural change and secondary health loss	x					
I9 Fear of repeated injury		x				
I10 Tangible costs		x		x	x	
I11 Intangible costs						
I12 Diminished quality of life	x	x	x	x	x	x
Total impact on 'individual' categories captured	7	7	5	5	5	5
FAMILY						
F1 Observer consequences		x		x	x	
F2 Carer consequences				x	x	
F3 Dependent consequences				x		
Total impact on 'family' categories captured	0	1	0	3	2	0
CONTENT ANALYSIS						
Number of studies cited in	20	5	2	1	1	1
Number of items in measure	36	26	5	24	20	8
Overall number of LOAD categories	7	9	5	9	8	5
Content density	0.19	0.35	1	0.38	0.4	0.63

Source: Lyons et al.[26]

Degree to which measures covered concepts contained in Fonofale model

The SF-36 had two and four times less the content density of WHOQOL-BREF and EQ-5D when assessed against the Fonofale model (Table 4). Less frequently used scales such as the HUI3 or QLQ had higher content densities compared to the SF-36. In this analysis, the most frequently measured domains were those of the physical, mental health and time components. What was absent in these measures was the assessment of the spiritual and cultural aspects of the Fonofale model.

Table 4. Content analysis of health-related quality of life measures and the Fonofale Model of Health and Wellbeing

Fonofale Model		**SF-36**	**WHOQOL-BREF**	**EQ-5D**	**QLQ**	**LSS**	**HUI3**
House parts	***Characteristic***						
Foundation	**Family** - extended, nuclear	x	x		x		
Roof	**Culture**: values, beliefs and identity				x		
Post 1	**Spiritual** - Christianity or traditional that relates to spirits, language, nature, beliefs etc...						
Post 2	**Physical** - biological or physical well-being…refers to function & structure; also food, water, air, medications that can impact positively or negatively on well-being	x	x	x	x	x	x
Post 3	**Mental** - health of the mind or well-being…involves thinking and emotions and the behaviours expressed	x	x	x	x	x	x
Post 4	**Other** - variables that can impact on health such as gender, sexuality or sexual orientation, age, SES..etc.		x		x	x	
Setting	**Environment** - relationship with physical environment, rural or urban		x		x	x	
Setting	**Time** - actual specific time in history that impacts individuals	x	x	x	x	x	x
Setting	**Context** - this dimension relates to the where/how/what and meaning it has on the individual. Context can be PI-reared vs NZ-born; or country of residence, legal, politics, socioeconomics	x	x		x	x	
	CONTENT ANALYSIS						
	Number of studies cited in	20	5	2	1	1	1
	Number of items in measure	36	26	5	24	20	8
	Fonofale dimensions	5	7	3	8	6	3
	Content density	0.14	0.27	0.6	0.33	0.3	0.38

Source: Pulotu-Endermann et al.[28]

DISCUSSION

This review aimed to critically appraise the range of generic instruments employed in the assessment of HRQoL following injury in LMICs. As a prelude to subsequent research examining longer-term outcomes following car crash injuries in Fiji, we also examined how commonly used measures align with the List of All Deficits (LOAD) framework for injury[26] and the Fonofale model of Pacific health and well-being.[28]

Among available generic instruments, the SF-36 and WHOQOL were the most frequently used in LMICs. The most commonly assessed injury types in the studies reviewed were SCIs, war-related injuries, and TBIs. This review found a lack of clarity and consistency in the application of definitions and measurement of QoL. Content analysis demonstrated that while the SF-36 was the most frequently used generic measure in HRQoL studies in LMICs, the tool covered the least amount of concepts contained in the LOAD framework, compared to the other generic measures (EQ-5D, LSS, QLQ, HUI3 and WHOQOL-BREF). The same pattern was noted in the comparison based with the Fonofale model. The SF-36 captured the least number of Pacific health and well-being concepts while the EQ-5D captured the highest. The content analysis also found that the LOAD framework lacked an "environmental domain" so that items relating to this topic in the generic measures were dropped in the analysis.

The strengths of this study include the use of a systematic search strategy. However, we excluded non-English studies, and therefore may have missed studies that were relevant to this review. The search was restricted to published literature in the electronic databases, therefore selection bias may be present. The review was restricted to generic outcome measures used in injury studies among adults. We acknowledge that assessing the face validity of identified HRQoL measures relative to the LOAD framework and the Fonofale model was a subjective exercise. Therefore, we expect that the conclusions reached by us may not be in agreement with other researchers. The concepts around environment in some of the generic measures could not be linked to the LOAD framework resulting in these concepts not being assessed. This exercise highlighted gaps in the identified measures that were unable to describe the impacts of injury in the contexts of the LOAD framework and the Pacific Fonofale model.

Measuring the population burden of injury is complex and this task is made more problematic when there is lack of clarity or consistency regarding the meaning and measurement of QoL. [69] This review found that in many injury outcome studies, researchers had not made explicit their definitions of QoL or HRQoL and what they were intending to measure. The two are not the same and require researchers to explicitly define and identify the underlying QoL construct.

The content analysis undertaken illustrated the breadth of health dimensions measured as well as the depth and precision of the measurement. For example, this review found that while SF-36 was commonly used, it captures only a small proportion of the range of injury categories of the LOAD framework. Similar results for SF-36 have been reported in previous injury studies[30, 70] that undertook content analysis in relation to the International Classification of Functioning, Disability and Health (ICF) framework, a WHO approved approach that captures human experiences of health impacts on function and disability.[71] This review found that less frequently used measures such as EQ-5D and WHOQOL-BREF captured more concepts of the injury LOAD framework. The linkage also revealed that items related to "environment factors" in several outcome measures (e.g. WHOQOL-BREF, QLQ, LSS) were not covered by the LOAD. This raises the question of whether an addition or adaptation should be made to the LOAD framework.

Overall, because the outcome measures are generic instruments, it is expected that they would lack the range and depth of measurement required for effective decision making on injury. The use of the LOAD framework (injury) and the Fonofale model (Pacific health/well-being) as reference tools for comparison can be of special importance in differentiating the precision of measurement among the identified instruments. For researchers intending to undertake burden of injury studies, this finding may assist them in making informed decisions on the choice of generic outcome measures to employ either alone or together with other measures depending on the objective of the measurement.

An outcome measure that was notably absent in this review and that may be well suited for injury outcome studies is the WHO Disability Assessment Schedule 2.0 (WHODAS 2.0).[71] Like the WHOQOL-BREF, this instrument was developed cross culturally so that assessments are sensitive to many settings. It may be better suited than WHOQOL-BREF because this instrument goes further than general QOL assessment to measure difficulties due to health conditions and also to monitor the impact of programs through its domains for activity limitation and participation restriction as described in the ICF framework.[17, 72, 73] Unlike WHOQOL-BREF, it does not measure the impact of environmental factors on life and this limits its use when assessing such things as injury-related disability as defined by the ICF framework.[71, 74, 75]

The content analysis of the health outcome measures in relation to the Fonofale model demonstrated that the 'cultural values and beliefs' and 'spiritual' domains were either scarcely or not represented at all in the five instruments. It would be important to include spirituality or personal beliefs scales (e.g. Spirituality Index of Well-being Scale, WHO Quality of Life-Spirituality, Religion and Personal Beliefs (WHOQOL-SRPB), Functional Assessment of Chronic Illness Therapy-spiritual well-being (*FACIT-Sp)*)[76-79] when considering a burden of injury study in the Pacific setting.

There are still gaps in our understanding about the impacts of injury as illustrated by the content analysis undertaken in this review. The content comparison of instruments based on the LOAD illustrated that concepts of the environment contained in items of some of the HRQoL instruments could not be linked to the LOAD framework. This raises the question as to whether a fourth domain of 'environment' should be added to the LOAD framework, or whether the existing 'societal' domain should be considered as the 'environment' domain incorporating physical, social and attitudinal barriers that also contribute to the negative consequences of injury.

Lastly, HRQoL assessment following injury is overdue in the Pacific setting and the results of this content analysis can help guide the selection of instruments, being mindful that societal impacts, environmental aspects, comorbidities and spirituality are assessed to ensure that the measurement cover significant domains important to injury and culture.

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REFERENCES

1. Bullinger M. Measuring health related quality of life. Adamantiades-Behçet's Disease: Springer; 2003. p. 113-22.
2. Centers for Disease Control and Prevention. Measuring Healthy Days. Atlanta, Georgia: CDC; November 2000. Available from: http://www.cdc.gov/hrqol/pdfs/mhd.pdf.
3. Kaplan RM. The significance of quality of life in health care. Quality of Life Research,. 2003;12(1):3-16.
4. Kaplan RM, Ries AL. Quality of life: concept and definition. COPD: Journal of Chronic Obstructive Pulmonary Disease. 2007;4(3):263-71.
5. Segui-Gomez M, MacKenzie EJ. Measuring the public health impact of injuries. Epidemiologic Reviews. 2003;25(1):3-19.
6. Beaton DE, Bombardier C, Guillemin F ea. Guidelines for the process of cross-

cultural adaptation of self-report measures. Spine. 2000;25(24):3186-91.

7. Guyatt GH, Feeny DH, Patrick DL. Measuring Health-Related Quality of Life. Annals of Internal Medicine. 1993;118(8):622-9.
8. Kildal M, Andersson G, Fugl-Meyer AR, Lannerstam K, Gerdin B. Development of a brief version of the Burn Specific Health Scale (BSHS-B). Journal of Trauma and Acute Care Surgery. 2001;51(4):740-6.
9. Basic Documents. Constitution of the World Health Organization. Supplement, October2006.
10. Namjoshi MA, Buesching DP. A review of the health-related quality of life literature in bipolar disorder. Quality of Life Research,. 2001;10(2):105-15.
11. Patrick DL, Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. Medical care. 1989:S217-S32.
12. Ivers R, Bhandari M, Norton R. A call to research: Documenting the non-fatal outcomes of injury. Injury. 2014;45(6):921-2.
13. Guyatt GH, Kirshner B, Jaeschke R. Measuring health status: What are the necessary measurement properties? Journal of Clinical Epidemiology. 1992 1992/12/01;45(12):1341-5.
14. Guyatt G, Walter S, Norman G. Measuring change over time: Assessing the usefulness of evaluative instruments. Journal of Chronic Diseases. 1987 1987/01/01;40(2):171-8.
15. Sethi D, Aljunid S, Sulong SB, Zwi AB. Injury care in low- and middle-income countries: identifying potential for change. Injury Control and Safety Promotion. 2000 2000/09/01;7(3):153-64.
16. Krug EG, Sharma GK, Lozano R. The global burden of injuries. American Journal of Public Health. 2000;90(4):523-6.
17. WHOQOL - Measuring Quality of Life [Internet]. WHO. 1997 [cited 21 July 2015]. Available from: http://www.who.int/mental_health/publications/whoqol/en/.
18. Both H, Essink-Bot M-L, Busschbach J, Nijsten T. Critical review of generic and dermatology-specific health-related quality of life instruments. Journal of Investigative Dermatology. 2007;127(12):2726-39.
19. Eiser C, Morse R. Quality-of-life measures in chronic diseases of childhood. Health Technology Assessment. 2001 2001/02/28;5(4):156.
20. Gholami A, Jahromi LM, Zarei E, Dehghan A. Application of WHOQOL-BREF in measuring quality of life in health-care staff. International Journal of Preventive Medicine. 2013;4(7):809.
21. Gill TM, Feinstein AR. A critical appraisal of the quality of quality-of-life measurements. JAMA. 1994;272(8):619-26.
22. Guyatt GH, Veldhuyzen Van Zanten SJ, Feeny DH, Patrick DL. Measuring quality of life in clinical trials: a taxonomy and review. CMAJ: Canadian Medical Association Journal. 1989;140(12):1441-8.
23. Lin X-J, Lin IM, Fan S-Y. Methodological issues in measuring health-related quality of life. Tzu Chi Medical Journal. 2013 3//;25(1):8-12.
24. Muldoon MF, Barger SD, Flory JD, Manuck SB. What are quality of life measurements measuring? British Medical Journal. 1998;316(7130):542-5.
25. Schmidt L, Garratt A, Fitzpatrick R. Child/parent-assessed population health outcome measures: a structured review. Child: Care, Health and Development. 2002;28(3):227-37.
26. Lyons RA, Finch CF, McClure R, van Beeck E, Macey S. The injury list of all deficits (LOAD) framework–conceptualising the full range of deficits and adverse outcomes following injury and violence. International Journal of Injury Control and Safety Promotion. 2010;17(3):145-59.
27. Russell L. Poverty, Climate Change and Health in Pacific Island Countries2009 1 Sep 2016. Available from: http://ussc.edu.au/ussc/assets/media/d

ocs/publications/0904_pacificislandspaper_russell.pdf.

28. Pulotu-Endemann FK. Fonofale Model of Health2001 1 Sep 2016. Available from: http://www.hauora.co.nz.
29. New country classifications by income level: 2016-2017 [Internet]. 2016 [cited 31 August 2016]. Available from: https://blogs.worldbank.org/opendata/new-country-classifications-2016.
30. Hoffman K, Cole E, Playford ED, Grill E, Soberg HL, et al. Health outcome after major trauma: what are we measuring? PloS one. 2014;9(7):e103082.
31. Fourtassi M, Hajjioui A, Ouahabi AE, Benmassaoud H, Hajjaj-Hassouni N, et al. Long term outcome following mild traumatic brain injury in Moroccan patients. Clinical Neurology & Neurosurgery. 2011;113(9):716-20.
32. Nguyen H, Ivers R, Cuong P. Health-related quality of life and recovery patterns among hospitalised injury patients in Vietnam. Qual Life Res. 2018;27:619-29. English.
33. Salah Eldin W, Hirshon JM, Smith GS, Kamal AA, Abou-El-Fetouh A, et al. Health-related quality of life after serious occupational injury in Egyptian workers: a cross-sectional study. BMJ Open. 2012;2(6):e-000413.
34. Sudaryo MK, Besral, Endarti AT, Rivany R, Phalkey R, et al. Injury, disability and quality of life after the 2009 earthquake in Padang, Indonesia: a prospective cohort study of adult survivors. Global Health Action. 2012;5:1-11.
35. Ukpong DI, Ugboko VI, Ndukwe KC, Gbolahan OO. Health-related quality of life in Nigerian patients with facial trauma and controls: a preliminary survey. British Journal of Oral and Maxillofacial Surgery. 2008 6//;46(4):297-300.
36. Ham OK. Psychosocial factors associated with lifetime experience of serious unintentional injury in South Korea. Public Health Nursing. 2008;25(1):37-45.
37. Oh SJ, Ku JH, Jeon HG, Shin HI, Paik NJ, et al. Health-related quality of life of patients using clean intermittent catheterization for neurogenic bladder secondary to spinal cord injury. Urology. 2005;65(2):306-10.
38. Ibhrahim John M, Conway Devin, Haonga Billy T, Eliezer Edmund N, Morshed S, et al. Predictors of lower health-related quality of life after operative repair of diaphyseal femur fractures in a low-resource setting. Injury. 2018;49(7):1330-5.
39. Hampton NZ. Disability status, perceived health, social support, self-efficacy, and quality of life among people with spinal cord injury in the People's Republic of China. International Journal of Rehabilitation Research. 2001;24(1):69-71.
40. Hu X, Zhang X, Gosney JE, Reinhardt JD, Chen S, et al. Analysis of functional status, quality of life and community integration in earthquake survivors with spinal cord injury at hospital discharge and one-year follow-up in the community. Journal of Rehabilitation Medicine. 2012;44(3):200-5.
41. Hu XB, Feng Z, Fan YC, Xiong ZY, Huang QW. Health-related quality-of-life after traumatic brain injury: a 2-year follow-up study in Wuhan, China. Brain Injury. 2012;26(2):183-7.
42. Luo DY, Ding MF, He CQ, Zhang HC, Dai Y, et al. Bladder management of patients with spinal cord injuries sustained in the 2008 Wenchuan earthquake. Kaohsiung Journal of Medical Sciences. 2012;28(11):613-8.
43. Wen H, Reinhardt JD, Gosney JE, Baumberger M, Zhang X, et al. Spinal cord injury-related chronic pain in victims of the 2008 Sichuan earthquake: a prospective cohort study. Spinal Cord. 2013 11//print;51(11):857-62.
44. Xie B, Xiao S-c, Zhu S-h, Xia Z-f. Evaluation of long term health-related quality of life in extensive burns: A 12-year experience in a burn center. Burns. 2012 5//;38(3):348-55.
45. Asadollahi R, Saghafinia M, Nafissi N, Montazeri A, Asadollahi M, et al. Anxiety, depression and health-related quality of life in those injured by landmines, Ilam, Islamic Republic of Iran. Eastern

Mediterranean Health Journal. 2010;16(11):1108-14.

46. Ebadi A, Moradian T, Mollahadi M, Saeed Y, Refahi AA. Quality of Life in Iranian Chemical Warfare Veteran's. Iranian Red Crescent Medical Journal. 2014;16(5):e5323.
47. Ebrahimzadeh MH, Kachooei AR, Soroush MR, Hasankhani EG, Razi S, et al. Long-term clinical outcomes of war-related hip disarticulation and transpelvic amputation. Journal of Bone & Joint Surgery - American Volume. 2013;95(16):e114(1-6).
48. Ebrahimzadeh MH, Moradi A, Khorasani MR, Hallaj-Moghaddam M, Kachooei AR. Long-term clinical outcomes of war-related bilateral lower extremities amputations. Injury. 2015;46(2):275-81.
49. Ebrahimzadeh MH, Soltani-Moghaddas SH, Birjandinejad A, Omidi-Kashani F, Bozorgnia S. Quality of life among veterans with chronic spinal cord injury and related variables. Archives of Trauma Research. 2014;3(2):e17917.
50. Elsherbiny OEE, Salem MA, El-Sabbagh AH, Elhadidy MR, Eldeen SMA. Quality of life of adult patients with severe burns. Burns. 2011 8//;37(5):776-89.
51. Masoumi M, Esfandiari E, Mousavi B. Quality of life in war-related hip disarticulation in Iran. Acta Orthopaedica et Traumatologica Turcica. 2014;48(5):527-32.
52. Saadat S, Javadi M, Divshali BS, Tavakoli AH, Ghodsi SM, et al. Health-related quality of life among individuals with long-standing spinal cord injury: a comparative study of veterans and non-veterans. BMC Public Health. 2010;10:6.
53. Yazicioglu K, Duyan V, Karatas K, Ozgu A, Yilmaz B, et al. Effects of sociodemographic characteristics, illness process, and social support on the levels of perceived quality of life in veterans. Military Medicine. 2006;171(11):1083-8.
54. Arango-Lasprilla JC, Krch D, Drew A, De Los Reyes Aragon CJ, Stevens LF. Health-related quality of life of individuals with traumatic brain injury in Barranquilla, Colombia. Brain Injury. 2012;26(6):825-33.
55. Arango-Lasprilla JC, Nicholls E, Olivera SL, Perdomo JL, Arango JA. Health-related quality of life in individuals with spinal cord injury in Colombia, South America. Neurorehabilitation. 2010;27(4):313-9.
56. Blanes L, Carmagnani MI, Ferreira LM. Quality of life and self-esteem of persons with paraplegia living in Sao Paulo, Brazil. Qual Life Res. 2009;18(1):15-21.
57. Coleman JA, Harper LA, Perrin PB, Olivera SL, Perdomo JL, et al. The relationship between physical and mental health variables in individuals with spinal cord injury from Latin America. Pm & R. 2015;7(1):9-16.
58. Lima DP, Simao Filho C, Abib Sde C, de Figueiredo LF. Quality of life and neuropsychological changes in mild head trauma. Late analysis and correlation with S100B protein and cranial CT scan performed at hospital admission. Injury. 2008;39(5):604-11.
59. Jovanovic M, Lakicevic M, Stevanovic D, Milic-Rasic V, Slavnic S. Community-based study of health-related quality of life in spinal cord injury, muscular dystrophy, multiple sclerosis, and cerebral palsy. Disability & Rehabilitation. 2012;34(15):1284-90.
60. Sudaryo MK, Besral, Endarti AT, Rivany R, Phalkey R, et al. Injury, disability and quality of life after the 2009 earthquake in Padang, Indonesia: a prospective cohort study of adult survivors. Glob Health Action. 2012;5:1-11.
61. Xie B, Xiao SC, Zhu SH, Xia ZF. Evaluation of long term health-related quality of life in extensive burns: a 12-year experience in a burn center. Burns. 2012;38(3):348-55.
62. Zhang LJ, Cao J, Feng P, Huang J, Lu J, et al. Influencing factors of the quality of life in Chinese burn patients: Investigation with adapted Chinese version of the BSHS-B. Burns. 2014;40(4):731-6.
63. Oh S-J, Hyeon Ku J, Gyun Jeon H, Shin H-I, Paik N-J, et al. Health-related quality of life of patients using clean intermittent catheterization for neurogenic bladder

secondary to spinal cord injury. Urology. 2005 2//;65(2):306-10.

64. Amini R, Haghani H, Masoumi M. Quality of life in the Iranian Blind War Survivors in 2007: A cross-sectional study. BMC International Health and Human Rights. 2010;10 (1) (no pagination)(21).
65. Ghazwin MY, Chaibakhsh S, Latifi S, Tavakoli AH, Koushki D. Quality of life in Iranian men with spinal cord injury in comparison with general population. Archives of Neuroscience. 2015;2 (e21529).
66. Moghimian M, Kashani F, Cheraghi MA, Mohammadnejad E. Quality of life and related factors among people with spinal cord injuries in Tehran, Iran. Archives of Trauma Research. 2015 01 Sep;4 (3) (no pagination)(e19280).
67. Sabour H, Soltani Z, Latifi S, Norouzi-Javidan A, Emami-Razavi SH, et al. Injury-related characteristics and quality-of-life among Iranian individuals with spinal cord injury. Iranian Journal of Neurology. 2015;14(3):136-41.
68. Salah Eldin W, Hirshon JM, Smith GS, Kamal A-AM, Abou-El-Fetouh A, et al. Health-related quality of life after serious occupational injury in Egyptian workers: a cross-sectional study. BMJ Open. 2012;2(6):e-000413.
69. Polinder S, Haagsma JA, Belt E, Lyons RA, Erasmus V, et al. A systematic review of studies measuring health-related quality of life of general injury populations. BMC Public Health. 2010;10(1):1-13.
70. Wasiak J, McMahon M, Danilla S, Spinks A, Cleland H, et al. Measuring common outcome measures and their concepts using the International Classification of Functioning, Disability and Health (ICF) in adults with burn injury: A systematic review. Burns. 2011 9//;37(6):913-24.
71. ÜStÜN TB, Chatterji S, Bickenbach J, Kostanjsek N, Schneider M. The International Classification of Functioning, Disability and Health: a new tool for understanding disability and health. Disability and Rehabilitation. 2003 2003/01/01;25(11-12):565-71.
72. Goujon N, Devine A, Baker SM, Sprunt B, Edmonds TJ, et al. A comparative review of measurement instruments to inform and evaluate effectiveness of disability inclusive development. Disability and rehabilitation. 2014;36(10):804-12.
73. Üstün TB, Chatterji S, Kostanjsek N, Rehm J, Kennedy C, et al. Developing the World Health Organization disability assessment schedule 2.0. Bulletin of the World Health Organization. 2010;88(11):815-23.
74. Cieza A, Stucki G. Content comparison of health-related quality of life (HRQOL) instruments based on the international classification of functioning, disability and health (ICF). Qual Life Res. 2005;14(5):1225-37.
75. World Health Organization. WHOQOL-BREF: introduction, administration, scoring and generic version of the assessment: field trial version, December 1996. 1996.
76. Daaleman TP, Frey BB. The Spirituality Index of Well-Being: A New Instrument for Health-Related Quality-of-Life Research. Annals of Family Medicine. 2004;2(5):499-503.
77. Whoqol Srpb Group. A cross-cultural study of spirituality, religion, and personal beliefs as components of quality of life. Social Science & Medicine. 2006;62(6):1486-97.
78. Peterman AH, Reeve CL, Winford EC, Salsman JM, Tsevat J, et al. Measuring Meaning and Peace With the FACIT–Spiritual Well-Being Scale: Distinction Without a Difference? Psychological assessment. 2014;26(1):127-37.
79. Brady MJ, Peterman AH, Fitchett G, Mo M, Cella D. A case for including spirituality in quality of life measurement in oncology. Psychooncology. 1999 Sep-Oct;8(5):417-28.