

Malawi - TRAUMA Multi-method evaluation of the trauma care health system serving Karonga, Malawi

John Whitaker

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Overview

Identification

ID NUMBER
MWI-MEIRU-TRAUMA-2019-v1

Version

VERSION DESCRIPTION

PRODUCTION DATE
2019-09-17

NOTES
v1: Edited data, first version, for internal use only

Overview

ABSTRACT

This study is an exploratory convergent parallel design mixed method assessment of the trauma healthcare system serving the population under demographic surveillance in Karonga, Northern Malawi. The Methodologies used are numbered as follows 1) community focus group discussions; 2) community photovoice study; 3) household survey; 4) verbal autopsy database analysis; 5) geographic information system analysis; 6) a survey of facility healthcare workers; 7) clinical vignettes for care process quality assessment of healthcare workers; 8) process mapping study of the care pathway and barriers following injury; 9) facility assessment survey.

The findings from each study component are to be assessed for convergence, divergence or silence with those from the other relevant studies within an analytical matrix.

The study is therefore an indepth injury care health system assessment for this population, aiming to provide generalizable methodological insight for application in other LMIC injury care health system assessments.

Approval Number: NHSRC #19/03/2263

UNITS OF ANALYSIS
Individual

Scope

NOTES
The study scope is to describe and evaluate the barriers driving delays to seeking, reaching and receiving injury care within the health system.

TOPICS

Topic	Vocabulary	URI
Developing Countries	MeSH	
Wounds and Injuries	MeSH	
Delivery of Health Care	MeSH	
Patient Acceptance of Health Care	MeSH	

Health Care Quality, Access, and Evaluation	MeSH	
Malawi	MeSH	
Health Services Accessibility	MeSH	
Quality of Health Care	MeSH	

Coverage

GEOGRAPHIC COVERAGE

MEIRU

UNIVERSE

The DSS community (1,2,3,4)

The geography around the DSS (5)

Facility based health care workers (6,7,8)

Healthcare facilities (9)

Producers and Sponsors

PRIMARY INVESTIGATOR(S)

Name	Affiliation
John Whitaker	1 - King's College London, 2 - UK Defence Medical Service.

OTHER PRODUCER(S)

Name	Affiliation	Role
Prof Mia Crampin	London School of Hygiene and Tropical Medicine	Co-applicant
Albert Dube	MEIRU	Co-applicant

FUNDING

Name	Abbreviation	Role
Royal College of Surgeons of England	RCSEng	Partial funder
Drummond charitable foundation	NA	Funding household survey
King's Centre for Global Health and Health Partnerships	KCGHHP	Partial Funder

OTHER ACKNOWLEDGEMENTS

Name	Affiliation	Role
NA	NA	NA

Metadata Production

METADATA PRODUCED BY

Name	Abbreviation	Affiliation	Role
Themba Chirwa	TC	MEIRU	Metadata entry and editing Officer
Elizabeth Munthali	EM	MEIRU	Metadata Supervisor

Chifundo Kanjala	CK	MEIRU	Data Documentation project management
Estelle McLean	EM	LSHTM and MEIRU	Production of the documentation used to create this DDI document
John Whitaker	JW	1 - King's College London, 2 - UK Defence Medical Service.	Study level metadata
Malawi Epidemiology and Intervention Research Unit	MEIRU		Agency

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2019-10-17

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DDI-MWI-MEIRU-TRUAMA-2019-v01

Sampling

Sampling Procedure

1 and 2 - purposive sampling of 3 groups of 6-8 DSS adult members with recent injury (past 12/12), without recent injury and community leaders.

3 - Random sample of 2,200 households identified. Out of 2200 households visited, 1819 (82.7%) households completed the survey.

4 - All Trauma deaths available within the DSS VA database.

6 - Surveys were completed by 228 health care workers. All available staff members who had been involved in the management of an injured person in the preceding 12 months were eligible and approached to take part in the survey. Eligible participants included those staff groups who provide direct care as well as technical and administrative staff, who might share insight into barriers and delays experienced by injured persons.

7 - All clinicians (Doctors, Clinical Officers and Medical Assistants) who would be involved in the treatment of the injured and were available (e.g. not on leave) during the facility visit were invited to take part. We employed a pragmatic, purposive, opportunistic sampling strategy, comparable with that adopted by others using vignettes. No clinicians declined to participate. Eighty five clinicians completed the vignettes; 14 generalist Doctors, 51 Clinical Officers, and 20 Medical Assistants

8 - Health Care Workers (HCWs) in each facility identified as serving injured patients from the Karonga Demographic and Surveillance site population of interest were invited to participate in process mapping workshops. Between 4 and 8 participants, per facility, were requested to be identified to take part. A senior staff member identified suitable participants in each facility. Participants were eligible if they were able to share insight into the process of care for patients following injury to deciding to seek care, successfully reaching care and receiving good quality care. Participants could be of any staff cadre, not limited to clinicians, who might be able to understand aspects of these processes.

9 - All facilities identified as potentially providing injury care to the DSS population were assessed using a facility assessment survey.

Deviations from Sample Design

NA

Response Rate

3 - 82.7%

Other studies N/A

Questionnaires

Overview

Study 1

Three community Focus Group Discussions (FGDs) were undertaken. Eight adults (>18 years) were purposively selected for each. The first (FGD 1) consisted of members of the general public who had recently (within the past 12 months) sustained an injury with a minimum severity of preventing usual activity for > 1 day, or accessed formal injury care. These participants were identified through the Karonga DSS key informant network embedded within the local community whose role is describe in detail elsewhere. The second (FGD 2) consisted of adult members of the general public without experience of significant injury. They were identified from households close to those of the first focus group participants. The third (FGD 3) consisted of community leaders identified through the traditional authority network within the DSS. Candidates were selected from those potentially eligible to cover a range of gender, age, mechanism of injury (for FGD1) and location within the DSS. Eight participants were invited to each discussion group,

Two native Chitumbuka speaking research assistants visited these individuals in their communities to explain about the project using the participant information sheet at least 24 hours in advance of the discussion group meetings. These same research assistants assisted the authors (JW and ET) in conducting the group discussion.

Following initial training and practice, FGDs were facilitated by a research assistant, in the local language, following a discussion guide translated in advance. Discussions took place at a building in a central location in the DSS (Uliwa trading centre) convenient for participants. Present at each discussion workshop were two native Chitumbuka speaking employed research assistants, one male one female, trained and experienced in qualitative research within the specific community and 2 project researchers non-native speakers (JW male British and ET female Nigerian) trained in qualitative research as part of ongoing full studies towards PhD and MSc in Global Health systems research. Participants were not specifically known to the research team in advance of the study.

Research assistants contextualised the participants by providing examples of potential physical injuries by mechanisms and symptoms using the sentinel conditions used throughout this mixed method assessment. Then they asked participants to describe, in order, potential barriers then facilitators to care seeking (delay 1), reaching care (delay 2) or receiving quality care (delay 3) following injury within their community. They were asked to rank the most important barrier or facilitator for each delay and across all delays. To aid discussion and visually representation “spidergrams” were created upon which the barriers and facilitators were placed. Discussions lasted approximately 90 minutes. FGDs were audio recorded and subsequently transcribed and translated into English by MEIRU trained staff. The “spidergrams” were photographed for use in analysis as field notes. Discussions continued until no additional factors acting as either a barrier or a facilitator to injury care were proposed, this was deemed to represent conceptual saturation for each discussion group.

Study 2

Participants from the FGD1 were then invited to continue into a second phase of the study using photovoice methodology. Participants were provided with a basic digital camera for use during the study to be returned to the research team on completion. They participated in a training session on the use of the provided camera, basic principles of photography, the ethical implications of taking photos of people, the principles of photovoice, and the study aims. Participants were asked to use the medium of photography to illustrate what they believe to be important barriers to seeking, reaching and receiving good quality health care after injury. Participants were provided with a physical training manual for reference and given one week in which to take the photos. Midway through the week the research team visited participants at home to ensure progress and identify and resolve any problems or misunderstandings. After one week participants were visited and selected 3 images that best illustrated the barriers they wished to discuss and provided titles for the images. The research team printed these photos on A4 laminate paper. A follow up discussion group was then held with all the photovoice participants the following day.

During this follow up discussion meeting participants were asked to explain the meaning behind each photo and the reason they took it and wish to highlight it. Participants discussed how each photo might be mapped to the “Three Delays” conceptual framework and each photo was placed onto a Venn Diagram of 3 overlapping circles representing each delay. The meeting was audio recorded. Where photos selected involved identifiable people, those individuals were identified, visited and specific written consent for use of the images sought. If individuals could not be located then faces within the images were to be blurred to make the individuals unrecognisable. Translation and transcription of all audio recordings was conducted by trained native Chitumbuka speakers fluent in English. It was not possible to confirm transcriptions with participants for practical reasons.

Study 3

The survey was adapted from the WHO Guidelines for conducting community surveys on injuries and violence. Additional questions were included to capture health seeking behaviour and preferences, experience of and reasons for delays to seeking, reaching and receiving health care and experienced healthcare quality. The survey was translated into the vernacular language Chitumbuka by trained native speakers. It was then back translated to confirm accuracy of meaning.

The survey was divided into 2 sections. The first 7 questions were asked of all households. The second section was only applicable if the household reported at least 1 non-fatal injury in the preceding 12 months.

In the first section of the survey the informant was asked the following; which facility they would prefer to go to if they were to suffer an injury, with allowed categories of named local facilities and other specified; to estimate how long it would take to get to their preferred facility in an emergency in minutes; whether this was the closest facility, and if not, which facility was closest (named facility or other specified) and how long it would take to get to their closest facility in an emergency in minutes; How long in minutes it would take to get to both Karonga District Hospital and Mzuzu Central Hospital; Whether or not there had been either a fatal or non-fatal injury in the preceding 12 months, and if so, how many.

For households without any non-fatal injuries in the preceding 12 months the survey ended. For households with at least one non-fatal injury reported, section 2 of the survey questionnaire was completed for each injured person. A non-fatal injury was required to have been serious enough to prevent the injured person from performing their usual activities for at least 1 day. If an individual had suffered more than one injury in the preceding 12 months, only the most severe injury, defined as that with the largest number of days unable to perform usual activities, was recorded.

In the second section of the survey the informant was asked; how long ago the injury occurred (in months via exclusive twelve 1 month intervals), sex, the age of the injured person in years and whether this was an exact or estimated figure, whether or not the injured person has returned to full activity (exclusive categories of yes fully, yes but only partially and no) and how long in total they were not able to perform normal activities in days.

The informant were asked in what way the injured person was physically disabled (able to select multiple categories from "unable to use their hand or arm", "difficulty in using their hand or arm", "unable to walk", "difficulty in walking", loss of hearing", "loss of vision", "weakness or shortness of breath", "less able to remember things", "unable to eat without assistance", and any other specified with free text). Mechanism of injury was recorded (exclusive categories of "road traffic accident", "fall", "struck/hit by person or object", "stab", "gunshot", "fire, flames or heat", "drowning or near-drowning", "poisoning", "animal bite", "electricity shock", other specified with free text or unknown). The physical injuries sustained were recorded (able to select multiple categories from "a fracture", "a sprain or strain", "joint dislocation", "cut, bite or other open wound", "burn", "poisoning", "concussion or head injury", "internal injury or internal organ injury to their chest", "internal injury or internal organ injury to their abdomen or pelvis", or other specified with free text). Informants were asked whether the injured person sought medical attention or treatment outside of the household. If the answer was yes, a series of questions about health system utilisation were asked, if the answer was no a series of questions about health seeking choices was asked.

For those injured persons who had sought medical treatment the informants were asked where (named facility or other specified with free text), whether they attended a second facility and if yes where (named facility or other specified with free text). How long after injury the person decided to seek care, how long it took to reach care after deciding to seek, and how long it took before starting to receive treatment once at a facility (exclusive categories of "<1 hour", "1-2 hours", "2-4 hours", "4-6 hours", "6-12 hours", "12-24 hours", ">24 hours") were recorded. Informants were asked whether the injured person stayed overnight in a health facility and if yes for how many days; How satisfied the treated person was that the care received was good quality was recorded (exclusive categories of "very satisfied", "satisfied", "neither satisfied nor dissatisfied", "dissatisfied" or "very dissatisfied").

For those injured persons who had not sought medical care the reasons why were asked (able to select multiple categories from "The injury was not serious enough to need medical care", "The person or family had other priorities or responsibilities", "It was too difficult to get transport to health facility", "The family member responsible for decisions about seeking care did not want the injured person to seek care", "The financial cost of seeking care was too much", "The health facility was too far away", "The injured person prefers to see traditional healers for health problems", "The health facility would not provide effective treatment for this problem", "The injured person did not believe that it was right to seek care following an injury", "The health facility would not treat the injured person with respect", "The injured person did not know health care was available", "People fear the consequences of helping an injured person (e.g. being accused of causing the injury)", "The health facility would not communicate well with the injured person and family" and other specified with free text). From the same reasons the most important was also identified by participants.

Participants were asked whether or not the injured person lost their job as a result of the injury (mutually exclusive categories "yes", "no, kept the job" and "no, did not have a job to lose") and whether anyone else in the household lost days

away from normal activities including work or school to take care of them.

Study 4 & 5

N/A

Study 6

The administered survey was conducted between July and October 2019 in the vernacular language (Chitumbuka) by 2 native speakers (TN and VK) at a convenient time for each participant, in a quiet private location within the facility. Survey responses were collected onto electronic tablets using REDCap Mobile App and uploaded onto the REDCap server database at the end of each facility visit. Each survey took approximately 30 minutes to complete.

The survey contained questions on sex, frequency of caring for an injured person (mutually exclusive categories of daily, weekly, monthly, quarterly and annually), the name of their place of work, job role (categorised as doctor, nurse, clinical officer, pre-hospital worker, medical assistant or other which was then specified) level of training in injury care (mutually exclusive categories of “no formal training in the care of the injured”, “training received during primary health care qualification”, “post qualification training through a course up to less than 10 days in total”, or “significant post qualification training including formal post graduate qualifications, placements, fellowships or courses more than 10 days”) and time since last injury training (mutually exclusive categories of “less than 1 year ago”, “between 1 and 3 years ago” and “more than 3 years ago”).

Participants were asked their perceptions on the importance of each of the three delays. Participants estimated which of Delays 1-3 affected the largest and smallest number of people, caused the most and least delays to those affected, were the easiest and most difficult to change to improve injury care, and overall which were the most and least important.

Participants were asked to estimate how many patients (mutually exclusive categories of “almost all patients (81-100%)”, “more than half but not all patients (61-80%)”, “about half (41-60%)”, “some, but less than half (21-40%)”, “few (1-20%)” and “none”) experienced any delay seeking care, delay reaching care (specified as reaching care within 24, 12, 6, 2 and 1 hours), or any delay receiving care.

Participants were asked to estimate typical delays in seeking and receiving injury care with mutually exclusive categories of “<1 hour”, “>1 but <2 hours”, “>2 but <4 hours”, “>4 but <6 hours”, “>6 but <12 hours”, “>12 but <24 hours” and “>24 hours”.

Participants were also asked to estimate how much harm came to patients who had experienced delays seeking care, delays reaching care (of between 1-4 hours and more than 4 hours), and delays receiving care, (mutually exclusive categories “no or minimal harm”, “minor harm, slightly prolonged pain or suffering but very low risk of long term consequences”, “significant harm that poses a small or moderate risk to causing long term harm or a small risk to life” and “very significant harm, likely to cause high risk of long term harm or high risk to life”).

Participants were presented with previously identified theoretical barriers to care for each delay. They were asked to put them in order (from most to least) of a) affecting the largest number and b) causing the longest amount of delay to those affected. Participants could also propose additional barriers using free text and indicate where they would place them in the above order. Participants were further asked to indicate which of all the barriers they considered to be the three most important overall from across all conceptual delays.

Study 7

Vignettes were conducted in English as Malawian clinicians are fluent, with English the language of University clinical education. They took place at participants' convenience, in quiet private locations. One author (JW) conducted each vignette, taking approximately 30 minutes each.

Participants were asked how frequently they provided injury care (at least daily, weekly, monthly, quarterly, or annually) and their level of formal injury care training (none, training received during qualification, post-qualification training totalling less than 10 days, or substantial post-qualification training including formal qualifications, placements, fellowships, or courses more than 10 days). Each scenario was read to participants who freely explained their actions to assess, diagnose, treat, and further manage the patient. The scenario was available in written form throughout to allow clarification.

Predefined important aspects of care mentioned were noted on scoresheets. Participants were encouraged to mention anything they would ideally do but were unable and provide reasons. Prompting was avoided, although clarifications were asked if descriptions were unclear.

Once participants were satisfied they had mentioned everything they would do, additional clinical information was provided for scenarios 1, 2, and 3. All information was provided upfront for scenario 4 as important care aspects were not dependent on additional assessment findings. All additional information was provided, whether or not the participant had described prerequisite assessment.

Vignettes were conducted between July and November 2019. Site visits to facilities took a maximum of 5 consecutive days. The scoring scheme was not revealed to participants. Scoresheets were entered into a REDCap database, rechecked by one author (JW).

Study 8

Process mapping visually demonstrates the steps and decisions in a process and relationships between steps. Developed from engineering it has been adopted in business management and more recently health care with the aim to achieve improvements through making processes visible. Process mapping has been highlighted as a methodology useful for applying systems thinking to health systems research. It has been suggested as having utility for describing a systems boundaries, analysing stakeholder relationships and engagement and identifying problems and their solutions. Process mapping has been used to evaluate surgical patient care for conditions such as small bowel obstruction and arthroplasty and for addressing surgical site infections in Ethiopia. Process mapping is credited with being low cost and limited in training burden to facilitate. A previous exercise of process mapping was used in Ghana to map emergency care patient flow, improvement ideas were naturally generated by participants interviewed during the mapping process and then shared more widely during the feedback of results.

Health Care Workers (HCWs) in each facility identified as serving injured patients from the Karonga Demographic and Surveillance site population of interest were invited to participate in process mapping workshops. Between 4 and 8 participants, per facility, were requested to be identified to take part. A senior staff member identified suitable participants in each facility. Participants were eligible if they were able to share insight into the process of care for patients following injury to deciding to seek care, successfully reaching care and receiving good quality care. Participants could be of any staff cadre, not limited to clinicians, who might be able to understand aspects of these processes.

Identified participants were invited to take part in a facilitated group mapping session lasting approximately 1.5-2 hours. The process mapping group facilitation was undertaken at a convenient time and quiet location in each facility. The workshops were facilitated in English by the author (JW). Workshops began with a presentation introducing the Three Delays framework, processing mapping as a concept with examples of similar studies and specific instructions for the conduct of this study.

Post it notes were applied to a horizontally orientated A1 paper on a table surface. The three delays were employed as “lanes” for structuring the maps. Delay 1 was created on the top 1/3 of the paper, Delay 2 on the middle 1/3 and Delay 3 on the bottom third. Orange square post it notes were used to signify the start and end of processes. A drawn arrow indicated the direction of a process. A blue square post it note designated an action, a diamond orientated green post it identified a decision and a purple diamond orientated post it signified a barrier causing delay within the process. Image 1 illustrates an example of the workshop in action.

Four maps were created in each facility with specific reference to 4 sentinel injury conditions used throughout this mixed method study. Specifically these four conditions are as follows; Scenario 1 - an adult male sustaining a blunt chest injury following being kicked by a cow, Scenario 2 - a young adult male suffering a penetrating abdominal injury following being stabbed at a bar, Scenario 3 - a young adult female sustaining a head injury following a fall from height at home with evidence of reduced consciousness, and Scenario 4 - an adult male motorcyclist in collision with a taxi on a main road sustaining a lower limb injury. The boundaries for describing the process of care were the patient journey, highlighting system barriers within 3-delay framework. The focus of the exercise was to identify the “as is” process of care, along with barriers to care that might cause delay within the patient journey. Each of the 4 scenarios were discussed in turn. More time was spent discussing the first scenario, with subsequent scenario discussions focussed on adjusting the maps to highlight and capture any differences between the scenarios possibly driven by the setting, mechanism or injury sustained.

The “as is” map for each scenario in each facility was photographed. The author then translated these photographic images into a flow diagram using PowerPoint (Microsoft). Conversion into an electronic format took place as soon as possible following the workshop, usually within 24 hours, always within 72. Each participant was sent an electronic copy of the map they co-created for comments, suggestions for alteration, or validation that the maps represented the content of the map creation exercise.

Study 9

The facility lead identified the most suitable person or persons to advise on completion of the facility assessment survey. This was conducted in English by the lead author JW. The Survey was based on the WHO Essential Trauma Care Guidelines and associated checklist.

Data Collection

Data Collection Dates

Start	End	Cycle
2019-07-01	2019-07-15	1&2
2019-10-21	2020-02-06	3
2019-07-16	2019-10-31	6,7,8,9

Data Collection Mode

Face-to-face [f2f]

Data Collection Notes

Study 1

Three community Focus Group Discussions (FGDs) were undertaken. Eight adults (>18 years) were purposively selected for each. The first (FGD 1) consisted of members of the general public who had recently (within the past 12 months) sustained an injury with a minimum severity of preventing usual activity for > 1 day, or accessed formal injury care. These participants were identified through the Karonga DSS key informant network embedded within the local community whose role is describe in detail elsewhere. The second (FGD 2) consisted of adult members of the general public without experience of significant injury. They were identified from households close to those of the first focus group participants. The third (FGD 3) consisted of community leaders identified through the traditional authority network within the DSS. Candidates were selected from those potentially eligible to cover a range of gender, age, mechanism of injury (for FGD1) and location within the DSS. Eight participants were invited to each discussion group,

Two native Chitumbuka speaking research assistants visited these individuals in their communities to explain about the project using the participant information sheet at least 24 hours in advance of the discussion group meetings. These same research assistants assisted the authors (JW and ET) in conducting the group discussion.

Following initial training and practice, FGDs were facilitated by a research assistant, in the local language, following a discussion guide translated in advance. Discussions took place at a building in a central location in the DSS (Uliwa trading centre) convenient for participants. Present at each discussion workshop were two native Chitumbuka speaking employed research assistants, one male one female, trained and experienced in qualitative research within the specific community and 2 project researchers non-native speakers (JW male British and ET female Nigerian) trained in qualitative research as part of ongoing full studies towards PhD and MSc in Global Health systems research. Participants were not specifically known to the research team in advance of the study.

Research assistants contextualised the participants by providing examples of potential physical injuries by mechanisms and symptoms using the sentinel conditions used throughout this mixed method assessment. Then they asked participants to describe, in order, potential barriers then facilitators to care seeking (delay 1), reaching care (delay 2) or receiving quality care (delay 3) following injury within their community. They were asked to rank the most important barrier or facilitator for each delay and across all delays. To aid discussion and visually representation “spidergrams” were created upon which the barriers and facilitators were placed. Discussions lasted approximately 90 minutes. FGDs were audio recorded and subsequently transcribed and translated into English by MEIRU trained staff. The “spidergrams” were photographed for use in analysis as field notes. Discussions continued until no additional factors acting as either a barrier or a facilitator to injury care were proposed, this was deemed to represent conceptual saturation for each discussion group.

Study 2

Participants from the FGD1 were then invited to continue into a second phase of the study using photovoice methodology. Participants were provided with a basic digital camera for use during the study to be returned to the research team on completion. They participated in a training session on the use of the provided camera, basic principles of photography, the ethical implications of taking photos of people, the principles of photovoice, and the study aims. Participants were asked to use the medium of photography to illustrate what they believe to be important barriers to seeking, reaching and receiving good quality health care after injury. Participants were provided with a physical training manual for reference and given one week in which to take the photos. Midway through the week the research team visited participants at home to ensure progress and identify and resolve any problems or misunderstandings. After one week participants were visited and selected 3 images that best illustrated the barriers they wished to discuss and provided titles for the images. The research team

printed these photos on A4 laminate paper. A follow up discussion group was then held with all the photovoice participants the following day.

During this follow up discussion meeting participants were asked to explain the meaning behind each photo and the reason they took it and wish to highlight it. Participants discussed how each photo might be mapped to the “Three Delays” conceptual framework and each photo was placed onto a Venn Diagram of 3 overlapping circles representing each delay. The meeting was audio recorded. Where photos selected involved identifiable people, those individuals were identified, visited and specific written consent for use of the images sought. If individuals could not be located then faces within the images were to be blurred to make the individuals unrecognisable. Translation and transcription of all audio recordings was conducted by trained native Chitumbuka speakers fluent in English. It was not possible to confirm transcriptions with participants for practical reasons.

Study 3

The survey was adapted from the WHO Guidelines for conducting community surveys on injuries and violence. Additional questions were included to capture health seeking behaviour and preferences, experience of and reasons for delays to seeking, reaching and receiving health care and experienced healthcare quality. The survey was translated into the vernacular language Chitumbuka by trained native speakers. It was then back translated to confirm accuracy of meaning.

Ten professional research fieldworkers, native Chitumbuka speakers, were trained over the course of a week in administering the survey. The survey was piloted within the local community on a sample of households not included in the formal study sample, known to include individuals with recent experience of an injury. Following piloting, minor adjustments were made to question layout and Chitumbuka phrasing to improve comprehension and clarity.

The survey was administered using REDCap data collection mobile application using password protected tablets. Data was uploaded to a central secure server held at MEIRU's Chilumba research site every evening after field work and the tablet reset.

Any household member present aged over 18 was eligible to act as a proxy informant to complete the survey on behalf of the household. If no such household member was present, fieldworkers enquired from neighbours if they were somewhere close by, for example working in a nearby field, in which case they visited them there. If fieldworkers were unable to locate household members close by, they undertook one further visit while working in the same household cluster. If there was still no adult household member at this second visit, the household was marked as missing. If more than one adult over 18 was present during the fieldworker visit and willing to participate, the one most able to answer questions on recent injuries within the household was selected.

Study 4 & 5

N/A

Study 6

The health care worker survey was constructed around a Three Delays framework. The survey was developed based upon the findings of a published Delphi study which identified conceptual barriers to injury care important to assess. The survey further incorporated barriers identified from a qualitative study conducted within the same community. The survey was translated from English to the vernacular language (Chitumbuka) and back translated to confirm accuracy and retention of meaning. The survey was piloted amongst 4 native speaking health care workers not working at the included facilities and minor adjustments made to improve comprehension.

Identified facilities were visited with the permission of the senior clinical authority at each location. All available staff members who had been involved in the management of an injured person in the preceding 12 months were eligible and approached to take part in the survey. Eligible participants included those staff groups who provide direct care as well as technical and administrative staff, who might share insight into barriers and delays experienced by injured persons.

The administered survey was conducted between July and October 2019 in the vernacular language (Chitumbuka) by 2 native speakers (TN and VK) at a convenient time for each participant, in a quiet private location within the facility. Survey responses were collected onto electronic tablets using REDCap Mobile App and uploaded onto the REDCap server database at the end of each facility visit. Each survey took approximately 30 minutes to complete.

Study 7

We developed vignettes between January and March 2019 using Primary Trauma Care (PTC) principles. PTC, based on Advanced Trauma Life Support guidelines, focusses on low resource setting care. We created four hypothetical scenarios: blunt chest injury causing tension pneumothorax, penetrating abdominal injury with hypovolaemic shock, severe head

injury, and lower limb isolated open fracture. These life or limb threatening injuries test a range of diagnostic and management skills for individual patient care. They cover 8 of WHO's Essential Trauma Care 11 "specific medical goals", and 2 Lancet Commission on Global Surgery "bellwether" surgical procedures. Important aspects constituting good quality care were identified from PTC principles and incorporated into the scenarios.

Two senior experienced trauma providers, 1 male and 1 female, based in South Africa, reviewed the scenarios for applicability to LMIC settings. Following revision, they were piloted with providers experienced with trauma care in UK (5 male), Sierra Leone (1 male), the Democratic Republic of Congo (DRC) (1 female) and Malawi (1 male), prompting minor adjustments. All were purposively sampled from the authors' network of trauma and research contacts.

All facilities likely to care for injured people were identified by DSS staff. Clinical leads for each facility were approached for permission to conduct the study. All clinicians (Doctors, Clinical Officers and Medical Assistants) who would be involved in the treatment of the injured and were available (e.g. not on leave) during the facility visit were invited to take part. We employed a pragmatic, purposive, opportunistic sampling strategy, comparable with that adopted by others using vignettes as a marker of care quality across LMIC facilities.

Vignettes were conducted in English as Malawian clinicians are fluent, with English the language of University clinical education. They took place at participants' convenience, in quiet private locations. One author (JW) conducted each vignette, taking approximately 30 minutes each.

Vignettes were conducted between July and November 2019. Site visits to facilities took a maximum of 5 consecutive days. The scoring scheme was not revealed to participants. Scoresheets were entered into a REDCap database, rechecked by one author (JW).

Study 8

Process mapping visually demonstrates the steps and decisions in a process and relationships between steps. Developed from engineering it has been adopted in business management and more recently health care with the aim to achieve improvements through making processes visible. Process mapping has been highlighted as a methodology useful for applying systems thinking to health systems research. It has been suggested as having utility for describing a systems boundaries, analysing stakeholder relationships and engagement and identifying problems and their solutions. Process mapping has been used to evaluate surgical patient care for conditions such as small bowel obstruction and arthroplasty and for addressing surgical site infections in Ethiopia. Process mapping is credited with being low cost and limited in training burden to facilitate. A previous exercise of process mapping was used in Ghana to map emergency care patient flow, improvement ideas were naturally generated by participants interviewed during the mapping process and then shared more widely during the feedback of results.

Health Care Workers (HCWs) in each facility identified as serving injured patients from the Karonga Demographic and Surveillance site population of interest were invited to participate in process mapping workshops. Between 4 and 8 participants, per facility, were requested to be identified to take part. A senior staff member identified suitable participants in each facility. Participants were eligible if they were able to share insight into the process of care for patients following injury to deciding to seek care, successfully reaching care and receiving good quality care. Participants could be of any staff cadre, not limited to clinicians, who might be able to understand aspects of these processes.

Identified participants were invited to take part in a facilitated group mapping session lasting approximately 1.5-2 hours. The process mapping group facilitation was undertaken at a convenient time and quiet location in each facility. The workshops were facilitated in English by the author (JW). Workshops began with a presentation introducing the Three Delays framework, processing mapping as a concept with examples of similar studies and specific instructions for the conduct of this study.

Post it notes were applied to a horizontally orientated A1 paper on a table surface. The three delays were employed as "lanes" for structuring the maps. Delay 1 was created on the top 1/3 of the paper, Delay 2 on the middle 1/3 and Delay 3 on the bottom third. Orange square post it notes were used to signify the start and end of processes. A drawn arrow indicated the direction of a process. A blue square post it note designated an action, a diamond orientated green post it identified a decision and a purple diamond orientated post it signified a barrier causing delay within the process. Image 1 illustrates an example of the workshop in action.

Four maps were created in each facility with specific reference to 4 sentinel injury conditions used throughout this mixed method study. Specifically these four conditions are as follows; Scenario 1 - an adult male sustaining a blunt chest injury following being kicked by a cow, Scenario 2 - a young adult male suffering a penetrating abdominal injury following being stabbed at a bar, Scenario 3 - a young adult female sustaining a head injury following a fall from height at home with evidence of reduced consciousness, and Scenario 4 - an adult male motorcyclist in collision with a taxi on a main road sustaining a lower limb injury. The boundaries for describing the process of care were the patient journey, highlighting system barriers within 3-delay framework. The focus of the exercise was to identify the "as is" process of care, along with

barriers to care that might cause delay within the patient journey. Each of the 4 scenarios were discussed in turn. More time was spent discussing the first scenario, with subsequent scenario discussions focussed on adjusting the maps to highlight and capture any differences between the scenarios possibly driven by the setting, mechanism or injury sustained.

The “as is” map for each scenario in each facility was photographed. The author then translated these photographic images into a flow diagram using PowerPoint (Microsoft). Conversion into an electronic format took place as soon as possible following the workshop, usually within 24 hours, always within 72. Each participant was sent an electronic copy of the map they co-created for comments, suggestions for alteration, or validation that the maps represented the content of the map creation exercise.

Study 9

The facility lead identified the most suitable person or persons to advise on completion of the facility assessment survey. This was conducted in English by the lead author JW. The Survey was based on the WHO Essential Trauma Care Guidelines and associated checklist.

Questionnaires

Study 1

Three community Focus Group Discussions (FGDs) were undertaken. Eight adults (>18 years) were purposively selected for each. The first (FGD 1) consisted of members of the general public who had recently (within the past 12 months) sustained an injury with a minimum severity of preventing usual activity for > 1 day, or accessed formal injury care. These participants were identified through the Karonga DSS key informant network embedded within the local community whose role is describe in detail elsewhere. The second (FGD 2) consisted of adult members of the general public without experience of significant injury. They were identified from households close to those of the first focus group participants. The third (FGD 3) consisted of community leaders identified through the traditional authority network within the DSS. Candidates were selected from those potentially eligible to cover a range of gender, age, mechanism of injury (for FGD1) and location within the DSS. Eight participants were invited to each discussion group,

Two native Chitumbuka speaking research assistants visited these individuals in their communities to explain about the project using the participant information sheet at least 24 hours in advance of the discussion group meetings. These same research assistants assisted the authors (JW and ET) in conducting the group discussion.

Following initial training and practice, FGDs were facilitated by a research assistant, in the local language, following a discussion guide translated in advance. Discussions took place at a building in a central location in the DSS (Uliwa trading centre) convenient for participants. Present at each discussion workshop were two native Chitumbuka speaking employed research assistants, one male one female, trained and experienced in qualitative research within the specific community and 2 project researchers non-native speakers (JW male British and ET female Nigerian) trained in qualitative research as part of ongoing full studies towards PhD and MSc in Global Health systems research. Participants were not specifically known to the research team in advance of the study.

Research assistants contextualised the participants by providing examples of potential physical injuries by mechanisms and symptoms using the sentinel conditions used throughout this mixed method assessment. Then they asked participants to describe, in order, potential barriers then facilitators to care seeking (delay 1), reaching care (delay 2) or receiving quality care (delay 3) following injury within their community. They were asked to rank the most important barrier or facilitator for each delay and across all delays. To aid discussion and visually representation “spidergrams” were created upon which the barriers and facilitators were placed. Discussions lasted approximately 90 minutes. FGDs were audio recorded and subsequently transcribed and translated into English by MEIRU trained staff. The “spidergrams” were photographed for use in analysis as field notes. Discussions continued until no additional factors acting as either a barrier or a facilitator to injury care were proposed, this was deemed to represent conceptual saturation for each discussion group.

Study 2

Participants from the FGD1 were then invited to continue into a second phase of the study using photovoice methodology. Participants were provided with a basic digital camera for use during the study to be returned to the research team on completion. They participated in a training session on the use of the provided camera, basic principles of photography, the ethical implications of taking photos of people, the principles of photovoice, and the study aims. Participants were asked to use the medium of photography to illustrate what they believe to be important barriers to seeking, reaching and receiving good quality health care after injury. Participants were provided with a physical training manual for reference and given one week in which to take the photos. Midway through the week the research team visited participants at home to ensure progress and identify and resolve any problems or misunderstandings. After one week participants were visited and selected 3 images that best illustrated the barriers they wished to discuss and provided titles for the images. The research team printed these photos on A4 laminate paper. A follow up discussion group was then held with all the photovoice participants

the following day.

During this follow up discussion meeting participants were asked to explain the meaning behind each photo and the reason they took it and wish to highlight it. Participants discussed how each photo might be mapped to the “Three Delays” conceptual framework and each photo was placed onto a Venn Diagram of 3 overlapping circles representing each delay. The meeting was audio recorded. Where photos selected involved identifiable people, those individuals were identified, visited and specific written consent for use of the images sought. If individuals could not be located then faces within the images were to be blurred to make the individuals unrecognisable. Translation and transcription of all audio recordings was conducted by trained native Chitumbuka speakers fluent in English. It was not possible to confirm transcriptions with participants for practical reasons.

Study 3

The survey was adapted from the WHO Guidelines for conducting community surveys on injuries and violence. Additional questions were included to capture health seeking behaviour and preferences, experience of and reasons for delays to seeking, reaching and receiving health care and experienced healthcare quality. The survey was translated into the vernacular language Chitumbuka by trained native speakers. It was then back translated to confirm accuracy of meaning.

The survey was divided into 2 sections. The first 7 questions were asked of all households. The second section was only applicable if the household reported at least 1 non-fatal injury in the preceding 12 months.

In the first section of the survey the informant was asked the following; which facility they would prefer to go to if they were to suffer an injury, with allowed categories of named local facilities and other specified; to estimate how long it would take to get to their preferred facility in an emergency in minutes; whether this was the closest facility, and if not, which facility was closest (named facility or other specified) and how long it would take to get to their closest facility in an emergency in minutes; How long in minutes it would take to get to both Karonga District Hospital and Mzuzu Central Hospital; Whether or not there had been either a fatal or non-fatal injury in the preceding 12 months, and if so, how many.

For households without any non-fatal injuries in the preceding 12 months the survey ended. For households with at least one non-fatal injury reported, section 2 of the survey questionnaire was completed for each injured person. A non-fatal injury was required to have been serious enough to prevent the injured person from performing their usual activities for at least 1 day. If an individual had suffered more than one injury in the preceding 12 months, only the most severe injury, defined as that with the largest number of days unable to perform usual activities, was recorded.

In the second section of the survey the informant was asked; how long ago the injury occurred (in months via exclusive twelve 1 month intervals), sex, the age of the injured person in years and whether this was an exact or estimated figure, whether or not the injured person has returned to full activity (exclusive categories of yes fully, yes but only partially and no) and how long in total they were not able to perform normal activities in days.

The informant were asked in what way the injured person was physically disabled (able to select multiple categories from “unable to use their hand or arm”, “difficulty in using their hand or arm”, “unable to walk”, “difficulty in walking”, loss of hearing”, “loss of vision”, “weakness or shortness of breath”, “less able to remember things”, “unable to eat without assistance”, and any other specified with free text). Mechanism of injury was recorded (exclusive categories of “road traffic accident”, “fall”, “struck/hit by person or object”, “stab”, “gunshot”, “fire, flames or heat”, “drowning or near-drowning”, “poisoning”, “animal bite”, “electricity shock”, other specified with free text or unknown). The physical injuries sustained were recorded (able to select multiple categories from “a fracture”, “a sprain or strain”, “joint dislocation”, “cut, bite or other open wound”, “burn”, “poisoning”, “concussion or head injury”, “internal injury or internal organ injury to their chest”, “internal injury or internal organ injury to their abdomen or pelvis”, or other specified with free text). Informants were asked whether the injured person sought medical attention or treatment outside of the household. If the answer was yes, a series of questions about health system utilisation were asked, if the answer was no a series of questions about health seeking choices was asked.

For those injured persons who had sought medical treatment the informants were asked where (named facility or other specified with free text), whether they attended a second facility and if yes where (named facility or other specified with free text). How long after injury the person decided to seek care, how long it took to reach care after deciding to seek, and how long it took before starting to receive treatment once at a facility (exclusive categories of “<1 hour”, “1-2 hours”, “2-4 hours”, “4-6 hours”, “6-12 hours”, “12-24 hours”, “>24 hours”) were recorded. Informants were asked whether the injured person stayed overnight in a health facility and if yes for how many days; How satisfied the treated person was that the care received was good quality was recorded (exclusive categories of “very satisfied”, “satisfied”, “neither satisfied nor dissatisfied”, “dissatisfied” or “very dissatisfied”).

For those injured persons who had not sought medical care the reasons why were asked (able to select multiple categories from “The injury was not serious enough to need medical care”, “The person or family had other priorities or

responsibilities”, “It was too difficult to get transport to health facility”, “The family member responsible for decisions about seeking care did not want the injured person to seek care”, “The financial cost of seeking care was too much”, “The health facility was too far away”, “The injured person prefers to see traditional healers for health problems”, “The health facility would not provide effective treatment for this problem”, “The injured person did not believe that it was right to seek care following an injury”, “The health facility would not treat the injured person with respect”, “The injured person did not know health care was available”, “People fear the consequences of helping an injured person (e.g. being accused of causing the injury)”, “The health facility would not communicate well with the injured person and family” and other specified with free text). From the same reasons the most important was also identified by participants.

Participants were asked whether or not the injured person lost their job as a result of the injury (mutually exclusive categories “yes”, “no, kept the job” and “no, did not have a job to lose”) and whether anyone else in the household lost days away from normal activities including work or school to take care of them.

Study 4 & 5

N/A

Study 6

The administered survey was conducted between July and October 2019 in the vernacular language (Chitumbuka) by 2 native speakers (TN and VK) at a convenient time for each participant, in a quiet private location within the facility. Survey responses were collected onto electronic tablets using REDCap Mobile App and uploaded onto the REDCap server database at the end of each facility visit. Each survey took approximately 30 minutes to complete.

The survey contained questions on sex, frequency of caring for an injured person (mutually exclusive categories of daily, weekly, monthly, quarterly and annually), the name of their place of work, job role (categorised as doctor, nurse, clinical officer, pre-hospital worker, medical assistant or other which was then specified) level of training in injury care (mutually exclusive categories of “no formal training in the care of the injured”, “training received during primary health care qualification”, “post qualification training through a course up to less than 10 days in total”, or “significant post qualification training including formal post graduate qualifications, placements, fellowships or courses more than 10 days”) and time since last injury training (mutually exclusive categories of “less than 1 year ago”, “between 1 and 3 years ago” and “more than 3 years ago”).

Participants were asked their perceptions on the importance of each of the three delays. Participants estimated which of Delays 1-3 affected the largest and smallest number of people, caused the most and least delays to those affected, were the easiest and most difficult to change to improve injury care, and overall which were the most and least important.

Participants were asked to estimate how many patients (mutually exclusive categories of “almost all patients (81-100%)”, “more than half but not all patients (61-80%)”, “about half (41-60%)”, “some, but less than half (21-40%)”, “few (1-20%)” and “none”) experienced any delay seeking care, delay reaching care (specified as reaching care within 24, 12, 6, 2 and 1 hours), or any delay receiving care.

Participants were asked to estimate typical delays in seeking and receiving injury care with mutually exclusive categories of “<1 hour”, “>1 but <2 hours”, “>2 but <4 hours”, “>4 but <6 hours”, “>6 but <12 hours”, “>12 but <24 hours” and “>24 hours”.

Participants were also asked to estimate how much harm came to patients who had experienced delays seeking care, delays reaching care (of between 1-4 hours and more than 4 hours), and delays receiving care, (mutually exclusive categories “no or minimal harm”, “minor harm, slightly prolonged pain or suffering but very low risk of long term consequences”, “significant harm that poses a small or moderate risk to causing long term harm or a small risk to life” and “very significant harm, likely to cause high risk of long term harm or high risk to life”).

Participants were presented with previously identified theoretical barriers to care for each delay. They were asked to put them in order (from most to least) of a) affecting the largest number and b) causing the longest amount of delay to those affected. Participants could also propose additional barriers using free text and indicate where they would place them in the above order. Participants were further asked to indicate which of all the barriers they considered to be the three most important overall from across all conceptual delays.

Study 7

Vignettes were conducted in English as Malawian clinicians are fluent, with English the language of University clinical education. They took place at participants' convenience, in quiet private locations. One author (JW) conducted each vignette, taking approximately 30 minutes each.

Participants were asked how frequently they provided injury care (at least daily, weekly, monthly, quarterly, or annually) and their level of formal injury care training (none, training received during qualification, post-qualification training totalling less than 10 days, or substantial post-qualification training including formal qualifications, placements, fellowships, or courses more than 10 days). Each scenario was read to participants who freely explained their actions to assess, diagnose, treat, and further manage the patient. The scenario was available in written form throughout to allow clarification.

Predefined important aspects of care mentioned were noted on scoresheets. Participants were encouraged to mention anything they would ideally do but were unable and provide reasons. Prompting was avoided, although clarifications were asked if descriptions were unclear.

Once participants were satisfied they had mentioned everything they would do, additional clinical information was provided for scenarios 1, 2, and 3. All information was provided upfront for scenario 4 as important care aspects were not dependent on additional assessment findings. All additional information was provided, whether or not the participant had described prerequisite assessment.

Vignettes were conducted between July and November 2019. Site visits to facilities took a maximum of 5 consecutive days. The scoring scheme was not revealed to participants. Scoresheets were entered into a REDCap database, rechecked by one author (JW).

Study 8

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Data Collectors

Name	Abbreviation	Affiliation
Malawi Epidemiology and Intervention Research Unit	MEIRU	

Data Processing

Data Editing

Studies 1 & 2 careful translation and transcription of audio recordings by native Chitumbuka speakers.

Study 3 - data entered on tablet REDCap database at point of survey completion. The data base was subsequently cleaned by JW using SPSS (secondary editing and structural checking).

Study 4 and 5 N/A

Study 6 - data entered on tablet REDCap database at point of survey completion. The data base was subsequently cleaned by JW using SPSS (secondary editing and structural checking).

Study 7 - Data double entered by JW from paper forms to electronic database. The data base was subsequently cleaned by JW using SPSS (secondary editing and structural checking).

Study 8 - Data was electronically captured as photographs and transferred to electronic line diagrams by JW. These were shared with co-creators to validate accuracy of representation.

Study 9 - Data double entered by JW from paper forms to electronic database. The data base was subsequently cleaned by JW using SPSS (secondary editing and structural checking).

Other Processing

Analytical recoding of variables has been subsequently done for studies 3, 6, 7 and 9.

Data Appraisal

No content available

