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Title page

Biopsychosocial factors impacting recovery after a minor transport-related injury: protocol for a systematic review

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Abstract:

Introduction: Globally, road transport accidents contribute substantially to the number of deaths and to the burden of disability. Up to 50 million people suffer a transport-related non-fatal injury each year, which often leads to long-term disability. Most frequently reported injuries following traffic accidents are minor injuries such as whiplash, contusion, concussion, sprain and strain.

It has been shown that significant numbers of people with minor injuries struggle to recover although the facts for this are still not well explored.

Despite the high prevalence, little is known about the factors facilitating or hindering recovery following minor transport-related injuries. The aim of this systematic review is to understand biological, psychological and social factors related to protracted recovery and identify current gaps in the literature.

Methods and Analysis: The review will be conducted in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A search of the electronic databases, MEDLINE, EMBASE, Cochrane Central Register of Controlled trials (CENTRAL), will be undertaken, in addition to Google Scholar and grey literature to identify studies for the period January 2006 to December 2016. Quantitative and qualitative research articles describing and identifying biopsychosocial factors impacting recovery and health outcomes such as functional recovery, disability, pain intensity, health-related quality of life, mental health outcomes, and social outcomes will be included. A conceptual framework, developed to identify biopsychosocial factors, will be applied to assure defined criterion.

A narrative synthesis based on study findings will be conducted. However, there is little anticipation for meta-analyses due to the heterogeneity of outcomes and profile of those injured. After testing for heterogeneity, results will be reported accordingly.

Ethics and Dissemination: Ethical approval is not required as primary data will not be collected. Review results will be published as a part of a thesis, peer-reviewed journal and conference papers.

Strengths and limitations of the study

This is the first systematic review that evaluates all relevant factors (biological, psychological and social) impacting recovery across the different types of minor transport-related injuries.

The review has distinct inclusion criteria and clearly outlines how the items will be selected and abstracted.

The review aims to systematically structure all the evidence available for biopsychosocial factors impacting recovery regardless of patient's compensation status after minor transport-related injury**.**

However, some relevant articles may be missed due to the heterogeneity of the tools used to determine severity of injury and because of the nonexistence of a gold standard definition for minor injuries.

Introduction

Worldwide, road transport accidents contribute substantially to the number of deaths and also to the burden of disability. The World Health Organisation (WHO) estimates that by 2020 road accidents will be the third leading cause of disability (1). According to WHO data, deaths from road transport injuries account for around 25% of all deaths from injury (2).

Minor injuries are the most recurrently reported injuries following a transport-related accident (3). While the number will fluctuate between countries, the literature suggests that the total incidence of minor injuries (musculoskeletal and soft tissue) has increased in the last 30 years. Whiplash Associated Disorder (WAD) is the most frequently reported minor injury following a transport accident (3-9). Other minor injuries include contusions, concussions, skin abrasions, lacerations, nerve damages, sprains and strains which sometimes require medical attention and hospitalisation (10). Despite a substantial amount of WAD epidemiology and treatment research, understanding factors that facilitate or hinder recovery is sparse (4).

The complexity and heterogeneity of the profile of those suffering minor injuries, are reasons to explain why many people do not recover as expected (11). It has been estimated that approximately half of the patients with minor injuries may never completely recover (12).

In Victoria, while preventive measures have been directed to patients with major injuries there are no current preventive recommendations and rehabilitative guidelines for patients with minor injuries. Nevertheless, there is much to be achieved by understanding factors and interventions aimed at reducing long-term disability, and improving recovery for patients who have sustained minor injuries (13). It is important to note there are various complexities in treating and managing patients with minor injuries. Although it is expected that not everyone who sustains a minor injury will develop persistent symptoms, cautious consideration is required to understand and identify in a timely manner those patients with minor injuries who are at high risk of prolonged recovery.

Epidemiology of minor transport-related musculoskeletal injuries

Patients are classified as sustaining a minor, moderate or severe injury according to their level of consciousness at the time of the initial assessment. In practice, the most widely used measure is the Glasgow Coma Scale (GCS). GCS scores range from 3 to 15, with scores between 13 and 15 indicating a minor injury, between 9 and 12 indicating a moderate injury, and between 3 and 8 indicating a severe injury (14).

The most common types or minor transport-related injuries are musculoskeletal and/or soft tissue injuries (15). Musculoskeletal injuries refer to those which affect muscles, bones, joints, tendons, ligaments, cartilage and spinal discs. Soft tissue injuries can occur in any soft tissue in the body. If they occur in the skin they are called contusions, in the muscle they are known as strains, and in the tendons and ligaments they are called sprains (16). While some of these injuries are benign and do not require complex treatments, others may lead to chronic and persistent challenges (17, 18). The cause of protracted symptoms are thought to be complex and multifactorial. According to the literature, these injuries are often shown to be painful and sometimes require medical intervention.

Minor injuries are usually treated in general practices. However some require specialist intervention, treatment and, in some cases, hospitalisation (19).

Rationale and Objectives

There is a paucity of research into factors and determinants of recovery following minor injuries. In clinical practice there remains a lack of recognition that patients with minor injury may have a slow recovery and long-term adverse biopsychosocial consequences (3). Previous research demonstrates differences in patient's recovery outcomes and identifies a number of predicting factors leading to long-term disability and poor health outcomes (20-24). It is evident that more research is needed to understand and investigate whether specific management of patients with minor injuries could reduce chronicity and long-term disability. These patients should be identified as early as possible in their injury trajectory so that active support and management can be provided. It is believed that the quality of management of the most common types of minor injuries should be improved (25).

The objectives of this systematic review are to comprehensively examine and identify recovery outcomes, biopsychosocial factors, predictors of recovery and determine the benefits of using Biopsychosocial model (BPS) on improving recovery after minor transport-related injury.

Methods and Design:

A detailed description on population, intervention, comparison and outcome (PICO) of the systematic review is outlined in Table 1 and described below:

Inclusion criteria

Studies will be included if they are:

- Investigating patients who have sustained minor transport-related injury
- Assessing biological and/or psychological and/or social factors

- Using BPS as a core model (approach) for identifying health outcomes
- Published in English language
- Published from 1st January 2006 to 05th December 2016.

Exclusion criteria

Studies will be excluded if they are:

- Published in a language other than English
- Published prior to 1st January 2006 or after 05th December 2016
- Describing work-related injury
- Involving children and describing paediatrics injuries
- Describing moderate and severe or fatal transport-related injuries
- Investigating other type of outcomes (e.g. compensation outcomes such as cost or impact on cost and quality of compensation systems or services)
- Unpublished manuscripts, dissertations, books and book chapters, conference proceedings, meeting abstracts, and guideline statements.

Study design

Quantitative (e.g. cohort, longitudinal, case studies, prospective, retrospective) and qualitative studies (e.g. ethnography, phenomenological, grounded theory, case report) exploring biopsychosocial factors impacting recovery and related health outcomes in patients with minor transport-related injury will be included. Mixed methods research articles will also be included in the review.

Comparator(s)/control

Comparators such as positive factors and factors facilitating recovery after minor transport-related accident will be considered for inclusion.

Context

This review will include injured persons who were involved in a transport accident, whose injuries were classified as minor, who are over 18 years of age, and are English-speaking. Minor injuries to be included in this review are whiplashes, contusions, abrasions, lacerations, back pain, sprains, strains, and concussions. Severe and moderate injuries will be excluded from this review. Children younger than 18 years of age will also be excluded.

Outcome measures/Outcome of interest

The following outcomes will be investigated:

- Functional recovery (e.g. return to work, or independence, or usual activities)
- Disability (e.g. temporary, long-term, permanent)
- Pain intensity (e.g. low, moderate, severe)
- Health-related quality of life (e.g. poor, good)
- Psychological outcomes (e.g. depression, fear, sleep disorder, anxiety, PTSD)
- Social outcomes (e.g. socioeconomics, family and community support, quality of health care)

Search methods

The database records and details of how the search was undertaken will be maintained at each stage of the review process. A senior medical librarian (LR) will assist in the final draft of the search strategy.

This review will search the following electronic databases: MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL).Google Scholar and other Grey literature sources will also be included. The search strategy will be developed in Medline and then adapted to the other databases.

It will include the subject headings (MeSH) specific to each database and free text words specific to the review inclusion criteria. Libraries containing the results of the searches will be created using EndNote X7.

Study screening and selection

A three-phase screening process will be applied. In phase one, an experienced medical librarian (LR) and a researcher (SS) will conduct the initial search. In a second phase, two researches (SS, SE) will independently screen the tittles and abstracts of all articles identified in the search strategy to determine eligibility and classify studies as relevant, possibly relevant and irrelevant. During the last phase, the researches (SS, RR) will independently review the full text to make a final determination of eligibility. The PRISMA-P methodology, checklist and standard search strategy using pre-defined inclusion and exclusion criteria and structured data abstraction tools will be used.

Data extraction

Data from the relevant articles will be assessed based on the Cochrane data abstraction form (supplementary documents -2). Evidence will be synthesised based on the following information:

- Study period (start and end date)
- Study population (number of participants)
- Type of study (quantitative or qualitative)
- Injury studied (type and severity of injury)
- The outcomes/s of interest
- The type of model or tools used to identify outcomes
- The type of factors (biological, psychological and social)
- The effect and directions of biopsychosocial factors on outcome/s (positive impact, negative impact)
- Limitations of study

- Key findings and recommendations

Data management

The relevant review documentation and search results will be uploaded and saved in Faculty-allocated network storage ("S-drive") located in Monash University and will be backed up on Faculty-allocated network storage. The data will be accessed only by the reviewers.

Study quality and assessing risk of bias

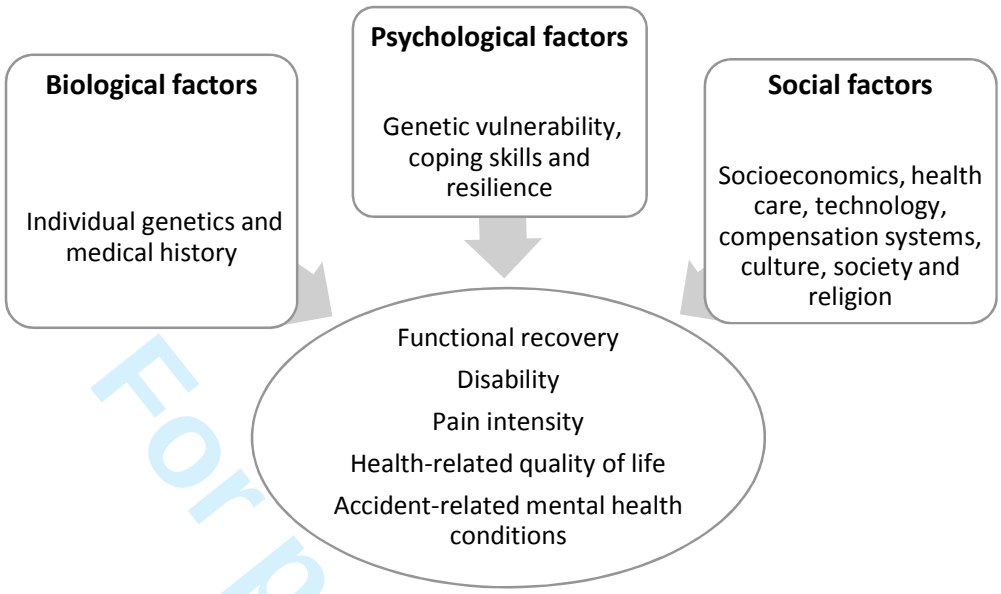
The bias will be assessed using the Scottish Intercollegiate Guideline Network (SIGN) criteria for systematic reviews, randomized controlled trials, cohort studies and case-control studies. This criteria will assist with the evaluation of the impact of selection bias, information bias, and confounding on the results of the study. Two review authors (SS, RR) will independently assess the risk of bias in included studies based on the criteria shown in supplementary document 3.

Analysis

Descriptive analysis

The conceptual framework has been developed to identify biopsychosocial factors impacting recovery and relevant health outcomes (Figure 1). The Cochrane data abstraction criteria will be used to synthesise the results of the included studies.

Figure 1: Conceptual framework for identifying factors impacting recovery based on the biopsychosocial model of health (26).



Statistical analysis

It is predicted that there will be limited capacity to undertake a meta-analysis because of the range of heterogeneity of the factors impacting recovery and the profile of those who have sustained a minor transport-related injury.

Discussion

This review aims to improve methodological understanding of recovery after minor injuries and its associated factors. The review will systematically assess the best available evidence of the biopsychosocial factors hindering recovery following a minor transport-related accident. It aims to provide a detailed description of the range of biological, psychological and social factors and explain in a comprehensive manner why some people with minor injuries do not recover as expected. It will also give a clearer picture of potentially modifiable factors.

The results of this study should form the basis to better understand recovery after minor injury and inform health policy and clinical management about current evidence in the literature.

However, it is to note that there will be challenges in the review process and also in interpreting findings. Firstly, the evaluation of the primary outcomes will depend on the intervention and tools

used to identify these outcomes. Secondly, as some minor injuries do not require hospitalisation, less physical evidence will be available for this group. Thirdly, data on compensation status may not be investigated as it may not be reported in a sufficient number of studies.

Ethics and Dissemination: Ethical approval is not required as primary data will not be collected. Review results will be published as a part of thesis, peer-reviewed journal and conferences.

Conclusion

This systematic review will identify gaps in the current knowledge and provide a comprehensive summary of why people with minor injuries do not recover as expected based on the biopsychosocial model of health.

Systematic Review Trial Registration number: Systematic review protocol was registered in International Prospective Register for Systematic Reviews (PROSPERO) on 14 December 2016. Registration number CRD42016052276.

Supplementary documents:

1. Search strategy
2. Data extraction tool
3. Criteria for assessing the quality and selection bias of the study adapted from SIGN checklist.

Ethics Approval and Dissemination:

Ethics approval is not required for systematic review as primary data will not be collected. The review results will be published as a part of thesis, peer reviewed journal and conference.

Funding

SS, Monash ID 26381494 has received CMCRC living allowance and CREPS tuition fee scholarship for conducting this PhD study. No funding bodies had any role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests

All the authors declare that they have no competing interests.

Authors' contributions

SS, SE, and RR have contributed in developing the idea and methodology for the systematic review. SS registered the protocol with PROSPERO and drafted the first manuscript which was reviewed by all the authors. The constructive feedback was given from SE and RR and encompassed in the final version. The final version was critically revised by all the authors and finalised by SS. All authors read and approved the final manuscript.

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Table 1: Description of the population, intervention, comparison and outcome (PICO) of the Systematic Review

Sl#	PICO	Descriptions
1	Population	• Injured people who were involved in a transport accident and have sustained one or more minor injuries (e.g. whiplash, contusion, sprain, strain, abrasion, laceration, concussion)
2	Intervention	The main phenomena of interest are articles identifying biopsychosocial factors related to prolonged recovery with following inclusion and exclusion criteria: Articles will be included if they were: • Describing minor transport-related injuries • Describing either biological, psychological and social factors impacting recovery • Identifying related health outcomes using one or more BPS models or tools Articles will be excluded if they were: • Written in a language other than English

		• Written prior to 1st January 2000 or after 05th December 2016 • Describing work-related injury, articles on moderate and severe or fatal transport-related injuries • Involving children and describing paediatrics injury • Investigating other type of outcomes (e.g. compensation outcomes, cost-associated outcomes) or the impact on cost and quality of compensation systems
3	Comparison	Comparators: • Articles on factors facilitating recovery and health outcomes • Studies without a comparator will be included
4	Outcome	Primary outcome measure is: • Functional recovery Secondary outcome measures are: • Disability • Pain intensity • Health-related quality of life • Accident-related mental health outcomes • Social outcomes

Final search MEDLINE

Concept A

Minor injuries (Musculoskeletal and soft tissue)

# ▲	Searches	Results	Type	Actions	Annotations
1	arm injuries/ or forearm injuries/ or wrist injuries/ or back injuries/ or fractures, cartilage/ or hand injuries/ or finger injuries/ or lacerations/ or leg injuries/ or ankle injuries/ or foot injuries/ or knee injuries/ or neck injuries/ or whiplash injuries/ or soft tissue injuries/ or "sprains and strains"/ or tendon injuries/ or contusions/ or head injuries, closed/ or brain concussion/	102856	Advanced	Display Results More	
2	exp Musculoskeletal System/in [Injuries]	101016	Advanced	Display Results More	
3	exp Whiplash Injuries/	3136	Advanced	Display Results More	
4	((head* or neck* or shoulder* or arm* or forearm* or wrist* or hand* or finger* or upper limb* or upper extremit* or back* or pelvis* or pelvic* or leg* or knee* or foot* or ankle* or feet* or lower limb* or lower extremit* or toe*) adj3 (injur* or contusion or concussion* or abrasion* or laceration* or sprain* or strain*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	120673	Advanced	Display Results More	
5	whiplash*.mp.	3531	Advanced	Display Results More	
6	(minor adj (injur* or contusion or concussion* or abrasion* or laceration* or sprain* or strain*)).mp.	1796	Advanced	Display Results More	
7	1 or 2 or 3 or 4 or 5 or 6	220258	Advanced	Display Results More	

Contract

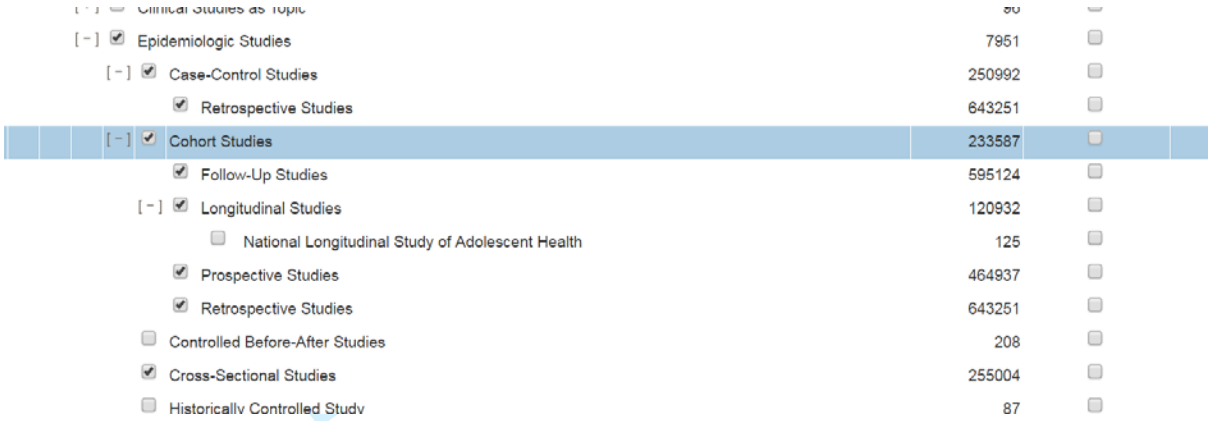
Concept B

Transport-related accident/injury

8	Accidents, Traffic/	40111	Advanced	Display Results More	
9	((car or cars or truck or trucks or automobile* or cyclist* or cycling* or cycle* or pedestrian* or passenger* or driver* or motor* or vehicle* or vehicul* or transport* or traffic*) adj3 (accident* or collision* or crash* or smash*)).mp.	49562	Advanced	Display Results More	
10	8 or 9	49562	Advanced	Display Results More	

Concept C

Types of studies including limitations to English language and year 2000 – current



[-]		Epidemiologic Studies	7951		
[-]		Case-Control Studies	250992		
		Retrospective Studies	643251		
[-]		Cohort Studies	233587		
		Follow-Up Studies	595124		
[-]		Longitudinal Studies	120932		
		National Longitudinal Study of Adolescent Health	125		
		Prospective Studies	464937		
		Retrospective Studies	643251		
		Controlled Before-After Studies	208		
		Cross-Sectional Studies	255004		
		Historically Controlled Study	87		

	11	7 and 10	10964	Advanced	Display Results More	
	12	epidemiologic studies/ or case-control studies/ or retrospective studies/ or cohort studies/ or follow-up studies/ or longitudinal studies/ or prospective studies/ or cross-sectional studies/	2109829	Advanced	Display Results More	
	13	qualitative research/	33787	Advanced	Display Results More	
	14	case control.mp.	277453	Advanced	Display Results More	
	15	((follow up or followup) adj (study or studies)).mp.	612199	Advanced	Display Results More	
	16	(observational adj (study or studies)).mp.	82240	Advanced	Display Results More	
	17	((observational or prospective or retrospective) adj (study or studies)).mp.	1191717	Advanced	Display Results More	
	18	Cross sectional.mp.	324661	Advanced	Display Results More	
	19	(cohort adj (study or studies)).mp.	296992	Advanced	Display Results More	
	20	(qualitative adj (study or studies)).mp.	23731	Advanced	Display Results More	
	21	12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20	2331533	Advanced	Display Results More	
	22	11 and 21	3108	Advanced	Display Results More	
	23	limit 22 to (english language and humans and yr="2006 -Current")	1401	Advanced	Display Results More	

The Cochrane Public Health Group

Data Extraction and Assessment Template

This form suggests elements which should be addressed in your review and is to be modified in keeping with the following instructions. Some questions may be changed from open-ended questions to specific data items where appropriate. Refer to the Cochrane Handbook when undertaking modifications to this form.

Sections can be expanded and irrelevant sections can be removed. It is difficult to design a single form that meets the needs of all reviews. It is therefore important that you consider your needs carefully prior to data extraction and pilot your process. Elements within the template are not intended for use as a scoring system. The components of the *Risk of Bias Table* have been incorporated into this form. Criteria for judging risk of bias as well as examples of appropriate methods of addressing each form of bias are provided in Chapter 8 of the Cochrane Handbook, particularly Table 8.5.c. For tips on how to enter data into RevMan 5, see "Risk of Bias" tables in the RevMan User Guide. If you are using an additional quality assessment tool you will need to add appropriate questions to reflect the additional components.

Notes on using a data extraction form:

- Pilot the Data Extraction Form you plan on using (and note in your protocol that it will, or has, been piloted)
- Be consistent in the order and style you use to describe the information. This will make it easier to complete the Table of Included Studies, prevent you from overlooking information and make reading of the review easier.
- Highlight any missing information as unclear or not described, to make it clear to the reader of your review that the information was not included in the description of the study, not that you forgot to extract it.
- You should include instructions and decision rules on the data collection form. It is crucial that you practice using the form and receive, or give, training if the form was designed by someone other than the person using it.

Cochrane Public Health Group Data Extraction and Assessment Template (*modify* to suit your review)

Study ID:	**Report ID :**	Date form completed:
First author:	Year of study:	Data extractor:
Citation:		

1. General Information

Publication type	Journal Article ☐ Abstract ☐ Other (specify e.g. book chapter)_____
Country of study:	
Funding source of study:	Potential conflict of interest from funding? Y / N / unclear

2. Study Eligibility

Study Characteristics			**Page/ Para/ Figure #**
Type of study (Review authors to add/remove designs based on criteria specified in protocol)	☐ Randomised Controlled Trial (RCT) ☐ Cluster Randomised Controlled Trial (cluster RCT)	☐ Controlled Before and After (CBA) study • Contemporaneous data collection • Comparable control site • At least 2 x intervention and 2 x control clusters	
	☐ Interrupted Time Series (ITS) • At least 3 time points before and 3 after the intervention • Clearly defined intervention point	☐ Other design (specify):	
	☐ A process evaluation of an included study design	*Does the study design meet the criteria for inclusion?* Yes ☐ No ☐ →**Exclude** Unclear ☐	
	Description in text:		
Participants (Review authors insert inclusion criteria as defined in Protocol)	Describe the participants included:		
	Are participants defined as a group having specific social or cultural characteristics?	Yes ☐ No ☐ Unclear ☐ Details:	
	How is the geographic boundary defined?	Details: Specific location (e.g. state / country):	
	Do the participants meet the criteria for inclusion?	Yes ☐ No ☐ →**Exclude** Unclear ☐	

Types of intervention (Review authors insert inclusion criteria as defined in Protocol)	Strategies included in the intervention			
	Focus of the intervention			
	Does the intervention meet the criteria for inclusion?		Yes ☐ No ☐ →**Exclude** Unclear ☐	
Duration of intervention	Start date:	Stop date:	Intervention duration:	
	Is the duration of intervention adequate for inclusion?		Yes ☐ No ☐ →**Exclude** Unclear ☐	
Types of outcome measures (Review authors insert inclusion criteria as defined in Protocol)	List outcomes:			
	Outcome measured at a population level or individual level?		Details:	
	Do the outcome measures meet the criteria for inclusion?		Yes ☐ No ☐ →**Exclude** Unclear ☐	

Summary of Assessment for Inclusion

Include in review ☐	**Exclude from review** ☐
Independently assessed, and then compared? Yes ☐ No ☐	Differences resolved Yes ☐ No ☐
Request further details? Yes ☐ No ☐	Contact details of authors:
Notes:	

DO NOT PROCEED IF PAPER EXCLUDED FROM REVIEW

3. Study details

Study intention	**Descriptions as stated in the report/paper**	**Page/ Para/ Figure #**
Aim of intervention	*What was the problem that this intervention was designed to address?*	
Aim of study	*What was the study designed to assess? Are these clearly stated?*	
Equity pointer: Social context of the study	*e.g. was study conducted in a particular setting that might target/exclude specific population s? See also Inclusion/exclusion criteria under Methods, below.*	
Start and end date of the study	*Identify which elements of planning of the intervention should be included*	
Total study duration		

Methods	**Descriptions as stated in the report/paper**	**Page/ Para/ Figure #**
Method/s of recruitment of participants *(How were potential participants approached and invited to participate? Where were participants recruited from? Does this differ from the intervention setting?)*		
Inclusion/exclusion criteria for participation in study		
Representativeness of sample: Are participants in the study likely to be representative of the target population?		
Total number of intervention groups		
Assumed risk estimate (*e. .baseline or population risk noted in Background)*	*References:*	
Sample size calculation: What assumptions were made? Were these assumptions appropriate?	*(Yes/No/Unclear)*	

What was the unit of randomisation? Allocation by individuals or cluster/groups		
What was the unit of analysis? **Is this the same as the unit of randomisation?**	*(Yes/No/Unclear)*	
Statistical methods used and appropriateness of these methods	*(Check with your statistician if unsure about appropriateness)*	

Results

Participants *Include if relevant*	**Include information for each group (i.e. intervention and controls) under study**	**Page/ Para/ Figure #**
• What percentage of selected individuals agreed to participate?		
• Total number randomised (or total pop. at start of study for NRCTs)		
• Number allocated to each intervention group (no. of individuals)		
• For cluster trials, number of clusters, number of people per cluster		
• Where there any significant baseline imbalances?	Yes ☐ No ☐ Unclear ☐ Details:	
• Number and reason for (and sociodemographic differences of) withdrawals and exclusions for each intervention group		
• Were patients who entered the study adequately accounted for?		
• What percentage of patients completed the study?		
• What percentage of participants received the allocated intervention or exposure of interest?		
• Is the analysis performed by intervention allocation status (intention to treat) rather than the actual intervention received? Have any attempts been made to impute missing data?		
• Age (median, mean and range if possible)		
• Sex		

• Race/Ethnicity		
• Principal health problem (incl. stage of illness)		
• Diagnostic criteria		
• Co-morbidity		
• Other sociodemographics (eg. Educational level, literacy level, soci-economic status, first language. Also consider possible proxies for these e.g. low baseline nutritional status)		
• PROGRESS categories reported at baseline (indicate letters of those reported: Place of residence, race, occupation, gender, religion, education, SES, social capital)		
Subgroups	*Enter a description of any participant subgroups from this paper to be analysed in the review.*	

Intervention Group 1

(copy and paste table for each Intervention group)

Group name:	*(State brief name for this intervention group.)*	**Page/ Para/ Figure #**
Details of intervention or control condition *(Include if relevant in sufficient detail for replication)*		
• Setting *eg multicentre, university teaching hospitals, rural, metropolitan, school, workplace, community, GP clinic, etc.*		
• Theoretical basis (include key references)		
• Content (list the strategies intended and delivered)		
• Did the intervention include strategies to address diversity/disadvantage?	*Enter a description of any relevant strategies*	
• Delivery (eg. Stages (sequential or simultaneous), timing, frequency, duration, intensity,		

fidelity – process indicators)		
• Providers (who, number, education/training in intervention delivery, ethnicity etc. if potentially relevant to acceptance and uptake by participants		
• Co-interventions		
Duration of intervention		
Duration of follow-up		
Was sustainability discussed by the authors? Was is a consideration in study development?		
Economic variables ie costs of the intervention, and changes in other (eg health care) costs as result of intervention♠	Yes ☐ →**List in Outcome section if appropriate** No ☐ Unclear ☐ Details:	
Other economic information (from a societal, non-healthcare view – e.g. lost wages, time)	Yes ☐ No ☐ Details:	
Resource requirements to replicate intervention (e.g. staff numbers, hours of implementation, equipment?)		
Subgroups	*Enter a description of any intervention subgroups from this report to be analysed in the review.*	
What are the moderators/mediators of changes stated in the study?		
Do the authors describe any political or organisational context?	*List relevant dot points*	
Were any partnerships referred to?	*List these as dot points*	
Was a process evaluation conducted?	*What components were included in the process evaluation? (eg. dose, frequency, consistency, implemented as intended etc)*	
Control/comparison (what information is provided about what the control or comparison group received?)	*Enter a description of what was provided for the control group, if applicable*	

Outcomes

(This table is set up for 2 outcome measure to save spaces, copy and paste table as often as required)

♠ Costs associated with the intervention can be linked with provider or participant outcomes in an economic evaluation (depends on the type of economic evaluation)

Question	Outcome 1	Page/ Para/ Figure #	Outcome 2	Page/ Para/ Figure #
Is there an analytic framework applied (e.g. logic model, conceptual framework)?				
Outcome definition (with diagnostic criteria if relevant)				
Type of outcome: Is this a modifiable variable (Community level, neighbourhood level, individual level) or desired health outcome				
Time points measured				
Time points reported				
Is there adequate latency for the outcome to be observed?				
Is the measure repeated on the same individuals or redrawn from the population / community for each time point?				
Unit of measurement (if relevant)				
For scales – upper and lower limits and indicate whether high or low score is good				
How is the measure applied? Telephone survey, mail survey, in person by trained assessor, routinely collected data, other				
How is the outcome reported? Self or study assessor				
Is this outcome/tool validated?				
…And has it been used as validated?				
Is it a reliable outcome measure?				
Is there adequate power for this outcome?				

Were PROGRESS categories analysed by outcome? Indicate the letters of those that outcomes were analysed by (place of residence, race, occupation, gender, religion, education, SES, social capital)				

Results

Copy and paste the appropriate table for each outcome and subgroup at each timepoint, including baseline

For RCT/CCT

Dichotomous outcome

page/para/fig

Comparison					
Outcome					
Subgroup					
Timepoint					
Results	**Intervention**		**Comparison**		
	Events	No. participants	Events	No. participants	
No. of missing participants and reasons					
Any other results reported					
Reanalysis required? (specify - (e.g. correlation adjustment)					
Reanalysis possible?	*yes/no/unclear*				
Reanalysed results					

For RCT/CCT

Continuous outcome

page/para/fig

Comparison							
Outcome							
Subgroup							
Timepoint							
Post-intervention or change from baseline?							
Results	**Intervention**			**Comparison**			
	Mean	SD (or other variance)	No. participants	Mean	SD (or other variance)	No. participants	
No. missing participants and reasons							

Any other results reported		
Reanalysis required? (specify)		
Reanalysis possible?	*yes/no/unclear*	
Reanalysed results		

For RCT/CCT
Generic inverse variance method

Page/para/figure

Comparison					
Outcome					
Subgroup					
Timepoint					
Results	Effect estimate	SE (or other variance)	Intervention no.	Control no.	
No. missing participants and reasons					
Any other results reported					
Reanalysis required? (specify)					
Reanalysis possible?	*yes/no/unclear*				
Reanalysed results					

For CBA

Page/para/fig

Comparison			
Assignment	How were control and treatment groups selected?? Is there likely to be an effect if these were the opposite way?		
	Contemporaneous data collection?		
Outcome			
Subgroup			
Timepoint			
Post-intervention or change from baseline?			
	Intervention	**Comparison**	
No. participants measured			

No. missing participants and reasons			
Baseline result (with variance measure)			
Post-intervention results (with variance measure)			
Change (Post – baseline) (with variance measure)			
Difference in change (intervention – control) (with variance measure)			
Any other results reported			
Reanalysis required? (specify)			
Reanalysis possible?	*yes/no/unclear*		
Reanalysed results			

For ITS

Generic inverse variance method

Page/para/fig

Comparison			
Outcome			
Subgroup			
Length of timepoints measured			
Snapshot or interval measured			
No. participants measured			
No. missing participants and reasons			
	Pre-intervention	Post-intervention	
No. of timepoints measured			

Mean value (with variance measure)					
Difference in means (post – pre)					
Percent relative change					
Result reported by authors (with variance measure)					
Reanalysis required? (specify)					
Reanalysis possible?	*yes/no/unclear*				
Individual time point results					
Read from figure?	*yes/no*				
Reanalysed results	Change in level	SE	Change in slope	SE	

Other relevant information

Were outcomes relating to harms/unintended effects of the intervention described? Include any data for these in the outcomes tables above		
Potential for author conflict *ie. evidence that author or data collectors would benefit if results favoured the intervention under study or the control*		
Key conclusions of the study authors		
Could the inclusion of this study potentially bias the generalisability of the review? Equity pointer: Remember to consider whether disadvantaged populations may have been excluded from the study.		
Is there potential for differences in relative effects between advantaged and disadvantaged populations? (e.g. are children from lower income families less likely to wear bicycle helmets)		
Are interventions likely to be aimed at the disadvantaged? (e.g. school meals aimed at poor children).		
Issues affecting directness (*Note any aspects of population, intervention, etc. that affect this study's direct applicability to the review question)*		
References to other relevant studies		
Additional notes by review authors		
Correspondence required for further study information (from whom, what and when)		

Risk of bias assessment

Please refer to Chapter 8 - *Table 8.5.c: Criteria for judging risk of bias in the 'Risk of bias' assessment tool and to the Cochrane EPOC Group's guidance for assessing* **Risk of bias for studies with a separate control group (RCTs, CCTs, CBAs) and Risk of bias for interrupted time series studies** (Appendix 3) for additional guidance for scoring Yes/No/Unclear. Note that the table below includes items from both EPOC tools. The ITS tool has been incorporated into the bottom of the table and all items for ITS studies are denoted by ITS preceding the risk of bias question.

Domain	Review authors' judgement*	Description	Page/ Para/ Figure #
Was the allocation sequence adequately generated?	**Yes / No / Unclear**	***Describe the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.***	
Was allocation adequately concealed?	**Yes / No / Unclear**	***Describe the method used to conceal the allocation sequence in sufficient detail to determine whether intervention allocations could have been foreseen in advance of, or during, enrolment.***	
Were baseline outcome measurements similar?	**Yes/No/Unclear**	***Note whether baseline outcome measurements were reported and whether there were any important differences between groups. If there were important differences between groups, note whether appropriate adjusted analysis was performed to account for this.***	
Were baseline characteristics similar?	**Yes/No/Unclear**	***Note whether baseline characteristics were reported and whether there were any important differences between groups.***	
Were incomplete outcome data adequately addressed? ***Assessments should be made for each main outcome (or class of outcomes).***	**Yes / No / Unclear**	***Describe the completeness of outcome data for each main outcome, including attrition and exclusions from the analysis. State whether attrition and exclusions were reported, the numbers in each intervention group (compared with total randomized participants), reasons for attrition/exclusions where reported, and any re-inclusions in analyses performed by the review authors.***	
Was knowledge of the allocated intervention adequately prevented during the study? ***Separate assessments should be made for***	**Yes / No / Unclear**	***Describe all measures used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective, or whether blinding was appropriate.*** • Participants – yes, no, unclear *[record supporting statement from study].* • Investigators – yes, no, unclear *[record supporting statement from study].*	

relevant groups of people involved in the study i.e participants, outcome assessors, investigators, data assessors etc		• Outcomes assessors – yes, no, unclear *[record supporting statement from study].* Data assessors – yes, no, unclear *[record supporting statement from study].*	
Was the study adequately protected against contamination?	**Yes/No/Unclear**	***State whether and how the possibility of contamination was minimised by the study design/implementation.***	
Are reports of the study free of suggestion of selective outcome reporting? ***Assessments should be made for each main outcome (or class of outcomes).***	**Yes / No / Unclear**	***State how the possibility of selective outcome reporting was examined by the review authors, and what was found.***	
Other sources of bias •	**Yes / No / Unclear**	***State any important concerns about bias not addressed in the other domains in the tool.***	
ITS: Was the intervention independent of other changes?	**Yes/No/Unclear**	***Describe whether or not the intervention occurred independently of other changes over time and whether or not the outcomes may have been influenced by other confounding variables/historic events during the study period.***	

ITS: Was the shape of the intervention effect pre-specified?	**Yes/No/Unclear**	***State whether or not the point of analysis was the point of intervention. If not, describe whether a rationale for the shape of the intervention effect was given by the study authors.***	
ITS: Was the intervention unlikely to affect data collection?	**Yes/No/Unclear**	***Describe whether or not the intervention was likely to affect data collection and what the potential impact might have been.***	
ITS: Was knowledge of the allocated interventions adequately prevented during the study? ***Separate assessments should be made for relevant groups of people involved in the study i.e participants, outcome assessors, investigators, data assessors etc***	**Yes/No/Unclear**	***Describe all measures used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective, or whether blinding was appropriate.*** • Participants – yes, no, unclear *[record supporting statement from study].* • Investigators – yes, no, unclear *[record supporting statement from study].* • Outcomes assessors – yes, no, unclear *[record supporting statement from study].* Data assessors – yes, no, unclear *[record supporting statement from study].*	
ITS: Was incomplete outcome data adequately addressed? ***Assessments should be made for each main outcome (or class of outcomes).***	**Yes/No/Unclear**	***Describe the completeness of outcome data for each main outcome, including attrition and exclusions from the analysis. State whether attrition and exclusions were reported, the numbers in each intervention group (compared with total randomized participants), reasons for attrition/exclusions where reported, and any re-inclusions in analyses performed by the review authors.***	
ITS: Was the study free from selective reporting?	**Yes/No/Unclear**	***State how the possibility of selective outcome reporting was examined by the review authors, and what was found.***	

ITS: Was the study free from other risks of bias?	**Yes/No/Unclear**	***State any important concerns about bias not addressed in the other domains in the tool.***	

* Note: For each section above 'Yes' indicates a 'low risk of bias'; 'No' indicates a 'high risk of bias'; 'Unclear' indicates an 'uncertain risk of bias'. When entering the data into RevMan, the options to choose from will be 'Low', 'High' and 'Unclear'

Results

Comparison:

Outcome:

Subcategory:

Treatment group:		**Control group:**	
Observed (n)	total (N)	observed (n)	total (N)

	Treatment group:	**Control group:**
Total randomised		
excluded*		
Observed		
lost to follow up*		

*Reasons for loss/exclusion:

Subcategory:

Treatment group:		**Control group:**	
Observed (n)	total (N)	observed (n)	total (N)

	Treatment group:	**Control group:**
Total randomised		
excluded*		
Observed		
lost to follow up*		

*Reasons for loss/exclusion

SIGN

Methodology Checklist 1: Systematic Reviews and Meta-analyses

SIGN gratefully acknowledges the permission received from the authors of the AMSTAR tool to base this checklist on their work: *Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C,. et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Medical Research Methodology 2007, **7**:10 doi:10.1186/1471-2288-7-10. Available from http://www.biomedcentral.com/1471-2288/7/10 [cited 10 Sep 2012]*

Study identification (*Include author, title, year of publication, journal title, pages*)

Guideline topic:	Key Question No:

Before completing this checklist, consider:

Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO reject. IF YES complete the checklist.

Checklist completed by:

Section 1: Internal validity

	In a well conducted systematic review:	***Does this study do it?***
1.1	The research question is clearly defined and the inclusion/ exclusion criteria must be listed in the paper.	Yes ☐ No ☐ **If no reject**
1.2	A comprehensive literature search is carried out.	Yes ☐ No ☐ Not applicable ☐ **If no reject**
1.3	At least two people should have selected studies.	Yes ☐ No ☐ Can't say ☐
1.4	At least two people should have extracted data.	Yes ☐ No ☐ Can't say ☐
1.5	The status of publication was not used as an inclusion criterion.	Yes ☐ No ☐
1.6	The excluded studies are listed.	Yes ☐ No ☐
1.7	The relevant characteristics of the included studies are provided.	Yes ☐ No ☐

1.8	The scientific quality of the included studies was assessed and reported.	Yes ☐ No ☐
1.9	Was the scientific quality of the included studies used appropriately?	Yes ☐ No ☐
1.10	Appropriate methods are used to combine the individual study findings.	Yes ☐ No ☐ Can't say ☐ Not applicable ☐
1.11	The likelihood of publication bias was assessed appropriately.	Yes ☐ No ☐ Not applicable ☐
1.12	Conflicts of interest are declared.	Yes ☐ No ☐
SECTION 2: OVERALL ASSESSMENT OF THE STUDY		
2.1	What is your overall assessment of the methodological quality of this review?	High quality (++) ☐ Acceptable (+) ☐ Low quality (-)☐ Unacceptable – reject 0 ☐
2.2	Are the results of this study directly applicable to the patient group targeted by this guideline?	Yes ☐ No ☐
2.3	**Notes:**	

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Yes
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Yes
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Yes
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Yes
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Yes
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Yes
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Yes
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Yes
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Yes
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Yes
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Yes
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Yes
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

BMJ Open

Biopsychosocial factors impacting recovery after a minor transport-related injury: protocol for a systematic review

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Primary Subject Heading:	Rehabilitation medicine
Secondary Subject Heading:	Public health, Epidemiology
Keywords:	EPIDEMIOLOGY, PREVENTIVE MEDICINE, TRAFFIC ACCIDENTS, INJURY

Title page

Biopsychosocial factors impacting recovery after a minor transport-related injury: protocol for a systematic review

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Abstract:

Introduction: Globally, road transport accidents contribute substantially to the number of deaths and also to the burden of disability. Up to 50 million people suffer a transport-related non-fatal injury each year, which often leads to long-term disability.

It has been shown that substantial number of people with minor injuries struggles to recover and the reasons are still not well explored.

Despite the high prevalence, little is known about the factors facilitating or hindering recovery following minor transport-related injuries. The aim of this paper is to present a protocol for the systematic review aiming to understand biopsychosocial factors related to protracted recovery and identify current gaps in the literature.

Methods and analysis: The review will be conducted in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA -P) guidelines. A search of the electronic databases, MEDLINE, EMBASE, Cochrane Central Register of Controlled trials (CENTRAL), will be undertaken, in addition to Google Scholar and grey literature to identify studies in period from 2006 to 2016. Quantitative and qualitative research articles describing and identifying biopsychosocial factors impacting recovery and health outcomes such as functional recovery, disability, pain intensity, health-related quality of life, psychological and social outcomes will be included. A conceptual framework developed to identify biopsychosocial factors will be applied to assure defined criterion.

A narrative synthesis based on study findings will be conducted. At present, there is little anticipation for meta-analyses due to the heterogeneity of factors and outcomes assessed.

Ethics and dissemination: Ethical approval is not required as primary data will not be collected. Review results will be published as a part of thesis, peer-reviewed journal and conferences.

Strengths and limitations of the study

This will be the first systematic review evaluating all associated biopsychosocial factors impacting recovery across the different types of minor transport-related injuries.

The review has distinct inclusion criteria and clearly outlines how the items will be selected and abstracted.

The review aims to offer highest level of evidence on factors deterring recovery after minor traffic-related injuries.

However, due to the variety of factors and relevant outcomes, comparison of the outcomes may not be possible.

The potential issue of heterogeneity across the studies may affect the study results.

Introduction

Worldwide, road transport accidents contribute substantially to the number of deaths and also to the burden of disability. The World Health Organisation (WHO) estimates that by 2020 road accidents will be the third leading cause of disability (1). According to WHO data, deaths from road traffic injuries account for around 25% of all deaths from injury (2).

Minor injuries are the most recurrently reported injuries following a transport-related accident (3). While the number will fluctuate between countries, the literature suggest that the total incidence of minor injuries (musculoskeletal and soft tissue) has increased in the last 30 years (4). Whiplash and Whiplash Associated Disorder (WAD) are the most frequently reported minor injuries following a transport accident (3, 5-10). Other minor injuries include whiplash, contusions, skin abrasions, lacerations, sprains and strains, as defined by Minor Injury Guidelines. The guideline defines a Minor injury as follows: “minor injury means a sprain, strain, whiplash associated disorder, contusion, abrasion, laceration or subluxation and any clinically associated sequelae. This term is to be interpreted to apply where a person sustains any one or more of these injuries” (11). Despite a substantial amount of WAD epidemiology and treatment research, understanding factors that facilitate or hinder recovery for WAD and other minor injuries is scant (5).

The complexity, and heterogeneity of the profile, of those suffering minor injuries are reasons to explain why many people do not recover as expected (12). It has been estimated that approximately

half of the patients with minor injuries may never completely recover (13) and large proportion of people with Whiplash Associated Disorder (WAD) would suffer psychological distress for at least 3 years post-accident (14).

In Victoria, while preventive methods have been directed to patients with major injuries there are no preventive recommendations and rehabilitative guidelines for patients with minor injuries. Yet, it is believed that there is much to be achieved by understanding factors and interventions aimed at reducing long-term disability, and improving recovery for those who have sustained minor injuries (15). It is also important to note that there are various complexities in treating and managing patients with minor injuries. Although it is expected that not everyone who sustains a minor injury will develop persistent symptoms, cautious consideration is required to understand and identify in a timely manner those patients with minor injuries who are at high risk of protracted recovery.

Minor transport-related musculoskeletal injuries

The severity of injuries between different groups and patients are compared according to different scales. Numerous injury severity scales exist in practice and in the literature. However, the assessment of motor vehicle injuries relies mainly on the Abbreviated Injury Scale (AIS) (16). AIS is the first broadly implemented injury severity scale used in practice and is primarily an anatomical measure of injury severity. It classifies severity on the basis of the region of the body injured and the degree of the injury in that particular body region. For example, an AIS score of 1 interprets a minor injury, while an AIS score of 6 is considered as a non-survivable injury. It is important to note that the scores from 1 to 6 do not reflect an interval scale, and comparable AIS scores may not be similar across different body regions. In summary, a higher severity score indicates a gradually more severe injury (17).

The most common types or minor transport-related injuries are musculoskeletal and/or soft tissue injuries (18). Musculoskeletal injuries refer to those which affect muscles, bones, joints, tendons, ligaments, cartilage and spinal discs. Soft tissue injuries can arise in any soft tissue in the body. If

they occur in the skin they are known as contusions, in the muscle they are identified as strains, and in the tendons and ligaments they are recognized as sprains (19). While some of these injuries are benign and do not require complex treatments, others may lead to chronic and persistent challenges (20, 21). The cause of protracted symptoms are thought to be complex and multifactorial. According to the literature, these conditions are often shown to be painful and require medical intervention. Minor injuries are usually treated in primary health care. However some require specialist intervention, treatment and, in some cases, hospitalisation (22). It is to note that there is no current evidence of types and number of medical treatments which would be most beneficial for patients with minor traffic-related injuries.

Rationale and objectives

There is still paucity of research into predictors and determinants of recovery following minor injuries. In clinical practice there remains a lack of recognition that patients with minor injury may have a slow recovery and long-term adverse biopsychosocial consequences (3). Previous research demonstrates differences in patient's recovery outcomes and identifies a number of factors leading to long-term disability and poor health outcomes (23-27). However, the results are not consisted and generalisable to larger population. It is evident that more research is needed to understand and investigate whether early identification of the most predictive factors could reduce chronicity and long-term disability. It is also believed that the quality of management of the most common types of minor injuries should be improved (28). In conclusion, these patients should be identified as early as possible in their injury trajectory so that active support and management can be provided.

The objectives of the proposed systematic review are to identify and assess biopsychosocial factors and relevant predictors of recovery and determine the benefits of using Biopsychosocial model (BPS) or approach on identifying health outcomes after minor transport-related injury.

Methods and analyses:

A detailed description on population, intervention, comparison and outcome (PICO) of the systematic review is outlined in Table 1 and described below:

Inclusion criteria:

Articles will be included if they are:

- Investigating patients sustained minor transport-related injury
- Assessing biological, psychological and social factors as defined by Biopsychosocial model of health (29)
- Using Biopsychosocial model of health as a core model or approach for identifying health outcomes
- Published in English language
- Published in the last decade (from 1st January 2006 to 05th December 2016).

Exclusion criteria:

Articles will be excluded if they were:

- Published in a language other than English
- Published prior to 1st January 2006 or after 05th December 2016
- Describing work-related injury
- Involving children and describing paediatrics injuries
- Describing moderate and severe or fatal transport-related injuries (based on Abbreviated Injury Scale scores of 2-6)
- Investigating other type of outcomes (e.g. compensation outcomes such as cost or impact on cost and quality of compensation systems or services)
- Unpublished manuscripts, dissertations, books and book chapters, conference proceedings, meeting abstracts, and guideline statements will be excluded.

Study design

Quantitative (e.g. cohort, longitudinal, case studies, prospective and retrospective) and qualitative studies (e.g. ethnography, phenomenological, grounded theory and case report) exploring biopsychosocial factors impacting recovery and related health outcomes in patients with minor transport-related injury will be included. Mixed methods research articles will also be included in the review.

Comparator(s)/control

Comparators such as positive factors and factors enabling recovery after minor transport-related accident will be considered for inclusion.

Context

Studies conducted in the clinical environments such as acute care (emergency departments), and sub-acute care (primary health care, pain clinics, rehabilitation centres) will be included. Settings such as insurance databases and registries will also be included.

Outcome measure/outcome of interest

The following outcomes will be investigated:

- Functional recovery (e.g. return to work, or independence, or usual activities)
- Disability (e.g. temporary, long-term, permanent)
- Pain intensity (e.g. low, moderate, severe)
- Health-related quality of life (e.g. poor, good)
- Psychological outcomes (e.g. depression, fear, sleep disorder, anxiety, PTSD)
- Social outcomes (e.g. socioeconomics, return to work, family and community support, quality of health care)

Search methods

The database records and details of how the search was undertaken will be maintained at each stage of the review process. A senior medical librarian (LR) will assist in the final draft of the search strategy.

The suggested review will search the following electronic databases: MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), and the Google Scholar. If relevant, grey literature may also be included. The search strategy will be developed in Medline and then adopted to the other databases. It will include the subject headings (MeSH) specific to each database and a free text word specific to review inclusion criteria. The complete search strategy can be seen in Appendix 1. Databases containing the results of the searches will be created using EndNote X7.

Study screening and selection

A three-phase screening process will be applied. In phase one, an experienced medical librarian (LR) and a researcher (SS) will conduct the initial search. In a second phase, two researches (SS, SME) will independently screen the tittles and abstracts of all articles identified in the search strategy to determine eligibility and classify studies as relevant, possibly relevant and irrelevant. During the last phase, the researches (SS, RR) will independently review the full text to make a final determination of eligibility. Any disagreements that arise between the reviewers will be resolved through a discussion and consensus. The PRISMA-P methodology, checklist and standard search strategy using pre-defined inclusion and exclusion criteria and structured data abstraction tools will be used.

Data extraction

Data from the relevant articles will be assessed based on the Cochrane data abstraction form (30). The data will be extracted by two reviewers (SS, RR) and any inconsistencies arising will be identified and resolved through discussion with a third reviewer. Evidence will be synthesised based on the following information:

- Study period (start and end date)

- Study population (number of participants)
- Type of study (quantitative or qualitative)
- Injury studied (type and severity of injury)
- The outcomes/s of interest
- Tools used to identify outcomes
- The type of factors (biological, psychological and social)
- The effect and directions of biopsychosocial factors on outcome/s (prediction and impact)
- Limitations of study
- Key findings and recommendations

Data management

The relevant review documentation and search results will be uploaded and saved in Faculty-allocated network storage ("S-drive") located in Monash University and will be backed up on Faculty-allocated network storage. The data will be accessed only by the reviewers.

Study quality and assessing risk of bias

The bias will be assessed using the Scottish Intercollegiate Guideline Network (SIGN) criteria (31). This criteria will assist with the evaluation of the impact of selection bias, information bias, and confounding on the results of the study. Two review authors (SS, RR) will independently assess the risk of bias in included studies. Qualitative studies will be assessed by Cochrane guidance for inclusion of qualitative research in systematic reviews (32). The core elements such as credibility, transferability, dependability and confirmability will be assessed and reported accordingly. Any discrepancies arising will be discussed between the reviewers.

Analysis

Descriptive analysis

The conceptual framework has been developed to identify biopsychosocial factors impacting recovery and relevant health outcomes (Figure 1). The Cochrane data abstraction criteria (30) will be used to synthesise the results of the included studies.

Figure 1: Conceptual framework for identifying factors impacting recovery after traffic-related accident.

Statistical analysis

Unavoidably, number of different studies brought together will differ and high variability is expected for the proposed review. It is anticipated that there will be limited capacity to undertake a meta-analysis because of the range and the heterogeneity of the factors, outcomes and profile of those who have sustained a minor transport-related injury. However, careful consideration will be undertaken involving a consultation with a systematic review experts based on the attributes of the included studies. If a decision is made to conduct a meta-analysis, reviewers will consider recommendations on selecting an appropriate method for dealing with heterogeneity in meta-analysis outlined by Schroll et al (33). We will likely consider random effect meta-analysis as it is highly unlikely that all studies will be functionally equal. If we determined that heterogeneity is too large and decide not to pursue meta-analysis, we will present descriptive analyses for the included studies.

Discussion

The proposed review aims to improve understanding of recovery after minor injuries and its associated factors. It intends to assess the best available evidence of the biopsychosocial factors hindering recovery following a minor transport-related accident. The review main aim is to provide a

detailed description of a range of biological, psychological and social factors and explain why some people with minor injuries do not recover as expected.

The results of this study should form the basis to better understand recovery after minor injury and inform health policy and clinical management about current evidence in the literature.

However, it is to note that there will be challenges in the review process and also in interpreting findings. Firstly, the evaluation of the primary outcomes will depend on the intervention and tools used to identify these outcomes. Secondly, as some minor injuries do not require hospitalisation, less physical proof will be available for this group. Thirdly, data on social outcomes may not be representative as it may not be reported in a sufficient number of studies.

Ethics and Dissemination: Ethical approval is not required as primary data will not be collected. Review results will be published as a part of thesis, peer-reviewed journal and conferences.

Conclusion

The proposed systematic review will aim to identify gaps in the current knowledge and provide a detailed summary of factors deterring recovery at different time points after traffic-related accident based on the biopsychosocial model of health.

Systematic Review Trial Registration number: Systematic review protocol was registered in International Prospective Register for Systematic Reviews (PROSPERO) on 14 December 2016. Registration number CRD42016052276.

Supplementary documents:

1. Search strategy (Appendix1)
2. Figure 1: Conceptual framework

Ethics Approval and Dissemination:

Ethics approval is not required for systematic review as primary data will not be collected. The review results will be published as a part of thesis, peer reviewed journal and conference.

Funding

SS, Monash ID 26381494 has received CMCRC/TAC living allowance for conducting this study. No funding bodies had any role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests

All the authors declare that they have no competing interests

Authors' contributions

SS, SME, and RR have contributed in developing the idea and methodology for systematic review. SS registered the protocol with PROSPERO and drafted the first manuscript which was reviewed by all the authors. The constructive feedback was given from SME and RR and encompassed in the final version. The final version was critically revised by all the authors and finalised by SS. All authors read and approved the final manuscript.

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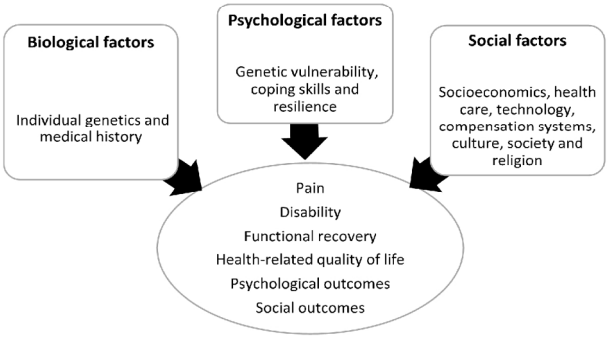
Table 1: Description of the population, intervention, comparison and outcome (PICO) of the Systematic Review

Sl#	PICO	Descriptions
1	Population	• Injured people who were involved in a transport accident and have sustained one or more minor injuries (e.g. whiplash, contusion, sprain, strain, abrasion, and laceration)
2	Intervention	The main phenomena of interest are articles identifying biopsychosocial factors impacting recovery (3, 6, 12, 24, and 48 months post-accident) with following inclusion and exclusion criteria: Articles will be included if they were: • Describing minor transport-related injuries • Describing either biological, psychological and social factors impacting recovery • Identifying related health outcomes using one or more BPS models or tools Articles will be excluded if they were: • Written in a language other than English • Written prior to 1st January 2006 or after 05th December 2016 • Describing work-related injury, articles on moderate and severe or fatal transport-related injuries • Investigating other type of outcomes (e.g. compensation outcomes, cost-associated outcomes) or the impact on cost and quality of compensation systems.
3	Comparison	Comparators: • Articles on factors facilitating recovery and health outcomes

		• Studies without a comparator will be considered for inclusion
4	Outcome	Primary outcome measure is: • Pain • Disability Secondary outcome measures are: • Functional recovery • Health-related quality of life • Psychological outcomes (Depression, anxiety, PTSD, sleeping disorders, fear of movement, coping skills, pain catastrophizing) • Social outcomes (RTW, return to usual daily activities, self-reported driving difficulty, and procedural, interactional and informational justice)



Conceptual framework

146x197mm (300 x 300 DPI)

Search strategy

Concept A
Minor injuries (Musculoskeletal and soft tissue)

Search History (24)

# ▲	Searches	Results
1	arm injuries/ or forearm injuries/ or wrist injuries/ or back injuries/ or fractures, cartilage/ or hand injuries/ or finger injuries/ or lacerations/ or leg injuries/ or ankle injuries/ or foot injuries/ or knee injuries/ or neck injuries/ or whiplash injuries/ or soft tissue injuries/ or "sprains and strains"/ or tendon injuries/ or contusions/	93220
2	exp Musculoskeletal System/in [Injuries]	864[illegible]
3	exp Whiplash Injuries/	3[illegible]8
4	((neck* or shoulder* or arm* or forearm* or wrist* or hand* or finger* or upper limb* or upper extremit* or back* or pelvis* or pelvic* or leg* or knee* or foot* or ankle* or feet* or lower limb* or lower extremit* or toe*) adj3 (injur* or contusion* or abrasion* or laceration* or sprain* or strain*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	954[illegible]5
5	whiplash*.mp.	34[illegible]8
6	(minor adj (injur* or contusion* or abrasion* or laceration* or sprain* or strain*)).mp.	18[illegible]6
7	1 or 2 or 3 or 4 or 5 or 6	183[illegible]9

Concept B
Transport-related accident/injury

8	Accidents, Traffic/	395[illegible]8
9	((car or cars or truck or trucks or automobile* or cyclist* or cycling* or cycle* or pedestrian* or passenger* or driver* or motor* or vehicle* or vehicul* or transport* or traffic*) adj3 (accident* or collision* or crash* or smash*)).mp.	489[illegible]8
10	8 or 9	489[illegible]5
11	7 and 10	87[illegible]9

Concept C
Types of studies including limitations to English language and year 2000 – current

12	epidemiologic studies/ or case-control studies/ or retrospective studies/ or cohort studies/ or follow-up studies/ or longitudinal studies/ or prospective studies/ or cross-sectional studies/	2060898
13	qualitative research/	33890
14	case control.mp.	263597
15	((follow up or followup) adj (study or studies)).mp.	602425
16	(observational adj (study or studies)).mp.	85293
17	((observational or prospective or retrospective) adj (study or studies)).mp.	1188696
18	Cross sectional.mp.	310974
19	(cohort adj (study or studies)).mp.	272736
20	(qualitative adj (study or studies)).mp.	23495
21	12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20	2275656
22	11 and 21	2418
23	limit 22 to (english language and humans and yr="2006 -Current")	1110

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item
ADMINISTRATIVE INFORMATION		
Title:		
Identification	1a	Identify the report as a protocol of a systematic review **YES Line 57-59 Page 3**
Update	1b	If the protocol is for an update of a previous systematic review, identify as such
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number **YES Line 279-281 Page 12**
Authors:		
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author **YES Page 1**
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review **YES Line 294 Page 13**
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments
Support:		
Sources	5a	Indicate sources of financial or other support for the review **YES Line 312-314 Page 14**
Sponsor	5b	Provide name for the review funder and/or sponsor **YES Line 312-314 Page 14**
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol **YES**
INTRODUCTION		
Rationale	6	Describe the rationale for the review in the context of what is already known **YES Line 134 Page 6**
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) **YES Line 409 Page 16**
METHODS		
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review **YES Line 151 Line 160 Page 7**
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage **YES Line 196 Page 9**
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated **YES Appendix 1**
Study records:		
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review **YES Line 228 Page 10**

Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) **YES Line 213 Page 9**
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators **YES Line 238 Page 9**
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications **YES Line 218 Page 9**
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale **YES Line 185 Page 8**
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis **YES Line 232 Page 10**
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised **YES Line 249 Page 11**
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ) **YES Line 255 Page 11**
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) **YES**
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned **YES Line 241 Page 10**
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) **YES**
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE) **YES Line 233 Page 10**

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

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Biopsychosocial factors associated with non-recovery after a minor transport-related injury: protocol for a systematic review

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Keywords:	EPIDEMIOLOGY, PREVENTIVE MEDICINE, TRAFFIC ACCIDENTS, INJURY

Title page

Biopsychosocial factors associated with non-recovery after a minor transport-related injury: protocol for a systematic review

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Abstract:

Introduction: Globally, road transport accidents contribute substantially to the number of deaths and also to the burden of disability. Up to 50 million people suffer a transport-related non-fatal injury each year, which often leads to long-term disability.

It has been shown that substantial number of people with minor injuries struggles to recover and the reasons are still not well explored.

Despite the high prevalence, little is known about the factors hindering recovery following minor traffic-related injuries. The aim of this paper is to present a protocol for the systematic review aiming to understand biopsychosocial factors related to non- recovery and identify current gaps in the literature.

Methods and analysis: The review will be conducted in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA -P) guidelines. A search of the electronic databases, MEDLINE, EMBASE, Cochrane Central Register of Controlled trials (CENTRAL), will be undertaken, in addition to Google Scholar and grey literature to identify studies in period from 2006 to 2016. Quantitative and qualitative research articles describing and identifying biopsychosocial factors associated with non-recovery and health outcomes such as pain, disability, functional recovery, health-related quality of life, post-traumatic stress disorder, depression, anxiety, and return to work will be included. A conceptual framework developed to identify biopsychosocial factors will be applied to assure defined criterion.

At present, there is little anticipation for meta-analyses due to the heterogeneity of factors and outcomes assessed. Therefore, a narrative synthesis based on study findings will be conducted

Ethics and dissemination: Ethical approval is not required as primary data will not be collected. Review results will be published as a part of thesis, peer-reviewed journal and conferences.

Systematic Review Trial Registration number: Systematic review protocol was registered in International Prospective Register for Systematic Reviews (PROSPERO) on 14 December 2016. Registration number CRD42016052276.

Strengths and limitations of the study

This will be the first systematic review evaluating biopsychosocial factors associated with non-recovery across the different types of minor transport-related injuries.

The review has distinct inclusion criteria and clearly outlines how the items will be selected and abstracted.

The review aims to offer highest level of evidence on factors deterring recovery after minor traffic-related injuries.

However, due to the variety of factors and relevant outcomes, comparison of the outcomes may not be possible.

The potential issue of heterogeneity across the studies may affect the study results.

Introduction

Worldwide, road transport accidents contribute substantially to the number of deaths and also to the burden of disability. The World Health Organisation (WHO) estimates that by 2020 road accidents will be the third leading cause of disability (1). According to WHO data, deaths from road traffic injuries account for around 25% of all deaths from injury (2).

Minor injuries are the most recurrently reported injuries following a transport-related accident (3). While the number will fluctuate between countries, the literature suggest that the total incidence of minor injuries (musculoskeletal and soft tissue) has increased in the last 30 years (4). Whiplash and Whiplash Associated Disorder (WAD) are the most frequently reported minor injuries following a transport accident (3, 5-10). Other minor injuries include contusions, skin abrasions, lacerations, sprains and strains, as defined by Minor Injury Guidelines. The guideline defines a Minor injury as follows: “minor injury means a sprain, strain, whiplash associated disorder, contusion, abrasion, laceration or subluxation and any clinically associated sequelae. This term is to be interpreted to apply where a person sustains any one or more of these injuries”(11). Despite a substantial amount

of WAD epidemiology and treatment research, understanding factors that hinder and obstruct recovery for WAD and other minor injuries is scant (5).

The complexity, and heterogeneity of the profile, of those suffering minor traffic-related injuries are reasons to explain why many people do not recover as expected (12). It has been estimated that approximately half of the patients with minor injuries may never completely recover (13) and large proportion of people with Whiplash Associated Disorder (WAD) would suffer psychological distress for at least 3 years post-accident (14).

In Victoria, while preventive methods have been directed to patients with major injuries there are no preventive recommendations and rehabilitative guidelines for patients with minor injuries. Yet, it is believed that there is much to be achieved by understanding factors and interventions aimed at reducing long-term disability, and improving recovery for those who have sustained minor injuries (15). It is also important to note that there are various complexities in treating and managing patients with minor injuries. Although it is expected that not everyone who sustains a minor injury will develop persistent symptoms, cautious consideration is required to understand and identify in a timely manner those patients with minor injuries who are at high risk of protracted recovery.

Minor transport-related musculoskeletal injuries

The severity of injuries between different groups and patients are compared according to different scales. Numerous injury severity scales exist in practice and in the literature. However, the assessment of motor vehicle injuries relies mainly on the Abbreviated Injury Scale (AIS) (16). AIS is the first broadly implemented injury severity scale used in practice and is primarily an anatomical measure of injury severity. It classifies severity on the basis of the region of the body injured and the degree of the injury in that particular body region. For example, an AIS score of 1 interprets a minor injury, while an AIS score of 6 is considered as a non-survivable injury. It is important to note that the scores from 1 to 6 do not reflect an interval scale, and comparable AIS scores may not be similar

across different body regions. In summary, a higher severity score indicates a gradually more severe injury (17).

The most common types or minor transport-related injuries are musculoskeletal and/or soft tissue injuries (18). Musculoskeletal injuries refer to those which affect muscles, bones, joints, tendons, ligaments, cartilage and spinal discs. Soft tissue injuries can arise in any soft tissue in the body. If they occur in the skin they are known as contusions, in the muscle they are identified as strains, and in the tendons and ligaments they are recognized as sprains (19). While some of these injuries are benign and do not require complex treatments, others may lead to chronic and persistent challenges (20, 21). The cause of protracted symptoms are thought to be complex and multifactorial. According to the literature, these conditions are often shown to be painful and require medical intervention. Minor injuries are usually treated in primary health care. However some require specialist intervention, treatment and, in some cases, hospitalisation (22). It is to note that there is no current evidence of types and number of medical treatments which would be most beneficial for patients with minor traffic-related injuries.

Rationale and objectives

There is still paucity of research into predictors and determinants of recovery following minor injuries. In clinical practice there remains a lack of recognition that patients with minor injury may have a slow recovery and long-term adverse biopsychosocial consequences (3). Previous research demonstrates differences in patient's recovery outcomes and identifies a number of factors leading to long-term disability and poor health outcomes (23-27). However, the results are not consisted and generalisable to larger population. It is evident that more research is needed to understand and investigate whether early identification of the most predictive factors could reduce chronicity and long-term disability. It is also believed that the quality of management of the most common types of minor injuries should be improved (28). In conclusion, these patients should be identified as early as possible in their injury trajectory so that active support and management can be provided.

The objectives of the proposed systematic review are to identify and assess biopsychosocial factors and relevant predictors of non-recovery and determine the benefits of using biopsychosocial model (BPS) or approach on identifying health outcomes after minor transport-related injury.

Methods and analyses:

A detailed description on population, intervention, comparison and outcome (PICO) of the systematic review is outlined in Table 1 and described below:

Inclusion criteria:

Articles will be included if they are:

- Investigating patients sustained minor transport-related injury
- Assessing biological, psychological and social factors as defined by biopsychosocial model of health (29)
- Using biopsychosocial model of health as a core model or approach for identifying health outcomes
- Published in English language
- Published in the last decade (from 1st January 2006 to 05th December 2016).

Exclusion criteria:

Articles will be excluded if they were:

- Published in a language other than English
- Published prior to 1st January 2006 or after 05th December 2016
- Describing work-related injury
- Not using validated tools to measure recovery outcomes
- Involving children and describing paediatrics injuries

- Describing moderate and severe or fatal transport-related injuries (based on Abbreviated Injury Scale scores of 2-6)
- Investigating other type of outcomes (e.g. compensation outcomes such as cost, time to claim closure, impact on cost and quality of compensation systems or services)
- Unpublished manuscripts, dissertations, books and book chapters, conference proceedings, meeting abstracts, and guideline statements will be excluded.

Study design

Quantitative (e.g. cohort, longitudinal, case studies, prospective and retrospective) and qualitative studies (e.g. ethnography, phenomenological, grounded theory and case report) exploring biopsychosocial factors impacting recovery and related health outcomes in patients with minor transport-related injury will be included. Mixed methods research articles will also be included in the review.

Comparator(s)/control

Comparators such as positive factors and factors enabling recovery after minor transport-related accident will be considered for inclusion.

Context

Studies conducted in the clinical environments such as acute care (emergency departments), and sub-acute care (primary health care, pain clinics, rehabilitation centres) will be included. Settings such as insurance databases and registries will also be included.

Outcome measure/outcome of interest

The following outcomes will be investigated:

- Functional recovery (e.g. return to pre-accident level of functionality, or independence, or usual activities)

- Disability (e.g. temporary, long-term, permanent)
- Pain intensity (e.g. low, moderate, severe)
- Health-related quality of life (e.g. poor, good)
- Psychological outcomes (e.g. depression, fear, sleep disorder, anxiety, PTSD)
- Social outcomes (e.g. socioeconomics, return to work, family and community support, quality of health care)

Search methods

The database records and details of how the search was undertaken will be maintained at each stage of the review process. A senior medical librarian (LR) will assist in the final draft of the search strategy.

The suggested review will search the following electronic databases: MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), and the Google Scholar. If relevant, grey literature such as government reports may also be included. The search strategy will be developed in Medline and then adopted to the other databases. It will include the subject headings (MeSH) specific to each database and a free text word specific to review inclusion criteria. The complete search strategy can be seen in Appendix 1. Databases containing the results of the searches will be created using EndNote X7.

Study screening and selection

A three-phase screening process will be applied. In phase one, an experienced medical librarian (LR) and a researcher (SS) will conduct the initial search. In a second phase, two researches (SS, SME) will independently screen the tittles and abstracts of all articles identified in the search strategy to determine eligibility and classify studies as relevant, possibly relevant and irrelevant. During the last phase, the researches (SS, RR) will independently review the full text to make a final determination

of eligibility. Any disagreements that arise between the reviewers will be resolved through a discussion and consensus. The PRISMA-P methodology, checklist and standard search strategy using pre-defined inclusion and exclusion criteria and structured data abstraction tools will be used.

Data extraction

Data from the relevant articles will be assessed based on the Cochrane data abstraction form (30). The data will be extracted by two reviewers (SS, RR) and any inconsistencies arising will be identified and resolved through discussion with a third reviewer. Evidence will be synthesised based on the following information:

- Study period (start and end date)
- Study population (number of participants)
- Type of study (quantitative or qualitative)
- Injury studied (type and severity of injury)
- The outcomes/s of interest
- Tools used to identify outcomes
- The type of factors (biological, psychological and social)
- The effect and directions of biopsychosocial factors on outcome/s (prediction and impact)
- Limitations of study
- Key findings and recommendations

Data management

The relevant review documentation and search results will be uploaded and saved in Faculty-allocated network storage ("S-drive") located in Monash University and will be backed up on Faculty-allocated network storage. The data will be accessed only by the reviewers.

Study quality and assessing risk of bias

A critical appraisal for quantitative studies will be made using the Scottish Intercollegiate Guideline Network (SIGN) tool to assess risk of bias for individual quantitative studies included in the review (31). SIGN provide checklists to assess the quality of: systematic reviews and meta-analyses, randomised-control trials, cohort studies, case-control studies, diagnostic studies, and economic studies. This criteria will assist with the evaluation of the impact of detection, selection, performance, information bias, and confounding on study results. Two review authors (SS, RR) will independently appraise the methodology of the included studies and categorise the study as being of high (++), acceptable (+) or unacceptable (0) quality. Qualitative studies will be assessed based on the Cochrane guidance for inclusion of qualitative research in systematic reviews (32). Core elements of credibility, transferability, dependability and confirmability will be assessed and reported. The Standards for Reporting Qualitative Research (SRQR) (33) tool covers all the recommended criteria for assessing risk of bias in qualitative studies and will be used for critically appraising methodology of qualitative studies. Any discrepancies arising will be discussed between the reviewers.

Analysis

Descriptive analysis

The conceptual framework has been developed to identify biopsychosocial factors impacting recovery and relevant health outcomes (Figure 1). The Cochrane data abstraction criteria (30) will be used to synthesise the results of the included studies.

Figure 1: Conceptual framework for identifying factors impacting recovery after traffic-related accident.

Statistical analysis

Unavoidably, number of different studies brought together will differ and high variability is expected for the proposed review. It is anticipated that there will be limited capacity to undertake a meta-

analysis because of the range and the heterogeneity of the factors, outcomes and profile of those who have sustained a minor transport-related injury. However, careful consideration will be undertaken involving a consultation with a systematic review experts based on the attributes of the included studies. If a decision is made to conduct a meta-analysis, reviewers will consider recommendations on selecting an appropriate method for dealing with heterogeneity in meta-analysis outlined by Schroll et al (34). We will likely consider random effect meta-analysis as it is highly unlikely that all studies will be functionally equal. If we determined that heterogeneity is too large and decide not to pursue meta-analysis, we will present descriptive analyses of the included studies.

Discussion

The proposed review aims to improve understanding of non-recovery after minor injuries and its associated factors. It intends to assess the best available evidence of the biopsychosocial factors hindering recovery following a minor transport-related accident. The review main aim is to provide a detailed description of a range of biological, psychological and social factors and explain why some people with minor injuries do not recover as expected.

The results of this study should form the basis to better understand recovery after minor injury and inform health policy and clinical management about current evidence in the literature.

However, it is to note that there will be challenges in the review process and also in interpreting findings. Firstly, the evaluation of the primary outcomes will depend on the intervention and tools used to identify these outcomes. Secondly, as some minor injuries do not require hospitalisation, less physical proof will be available for this group. Thirdly, data on social outcomes may not be representative as it may not be reported in a sufficient number of studies.

In conclusion, the proposed systematic review will aim to identify gaps in the current knowledge and provide a detailed summary of factors deterring recovery at different time points after traffic-related injury based on the biopsychosocial model of health.

Ethics and Dissemination: Ethical approval is not required as primary data will not be collected. Review results will be published as a part of thesis, peer-reviewed journal and conferences.

Supplementary documents:

1. Search strategy (Appendix1)
2. Figure 1: Conceptual framework

Ethics Approval and Dissemination:

Ethics approval is not required for systematic review as primary data will not be collected. The review results will be published as a part of thesis, peer reviewed journal and conference.

Funding

SS, Monash ID 26381494 has received CMCRC/TAC living allowance for conducting this study. No funding bodies had any role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests

All the authors declare that they have no competing interests

Authors' contributions

SS, SME, and RR have contributed in developing the idea and methodology for systematic review. SS registered the protocol with PROSPERO and drafted the first manuscript which was reviewed by all the authors. The constructive feedback was given from SME and RR and encompassed in the final

version. The final version was critically revised by all the authors and finalised by SS. All authors read and approved the final manuscript.

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Table 1: Description of the population, intervention, comparison and outcome (PICO) of the Systematic Review

Sl#	PICO	Descriptions
1	Population	• Injured people who were involved in a transport accident and have sustained one or more minor injuries (e.g. whiplash, contusion, sprain, strain, abrasion, and laceration)
2	Intervention	The main phenomena of interest are articles identifying biopsychosocial factors impacting recovery (3, 6, 12, 24, and 48 months post-accident) with following inclusion and

		exclusion criteria: Articles will be included if they were: • Describing minor transport-related injuries • Describing either biological, psychological and social factors impacting recovery • Identifying related health outcomes using one or more BPS models or tools Articles will be excluded if they were: • Written in a language other than English • Written prior to 1st January 2006 or after 05th December 2016 • Describing work-related injury, articles on moderate and severe or fatal transport-related injuries • Investigating other type of outcomes (e.g. compensation outcomes, cost-associated outcomes) or the impact on cost and quality of compensation systems.
3	Comparison	Comparators: • Articles on factors facilitating recovery and health outcomes • Studies without a comparator will be considered for inclusion
4	Outcome	Primary outcome measure is: • Pain • Disability Secondary outcome measures are: • Functional recovery • Health-related quality of life • Psychological outcomes (Depression, anxiety, PTSD, sleeping disorders, fear of movement, coping skills, pain catastrophizing) • Social outcomes (RTW, return to usual daily activities, self-reported driving difficulty, and procedural, interactional and informational justice)

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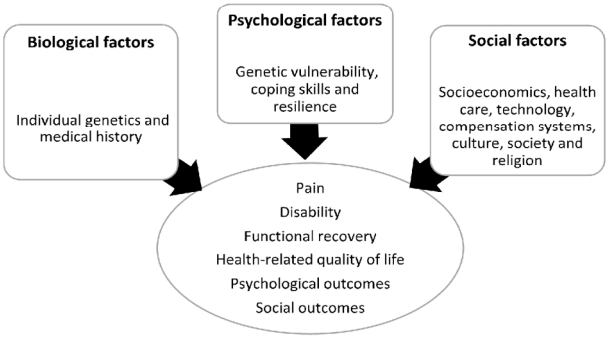

Conceptual framework

146x197mm (300 x 300 DPI)

Search strategy

Concept A
Minor injuries (Musculoskeletal and soft tissue)

Search History (24)

# ▲	Searches	Results
1	arm injuries/ or forearm injuries/ or wrist injuries/ or back injuries/ or fractures, cartilage/ or hand injuries/ or finger injuries/ or lacerations/ or leg injuries/ or ankle injuries/ or foot injuries/ or knee injuries/ or neck injuries/ or whiplash injuries/ or soft tissue injuries/ or "sprains and strains"/ or tendon injuries/ or contusions/	93220
2	exp Musculoskeletal System/in [Injuries]	864[illegible]
3	exp Whiplash Injuries/	3[illegible]8
4	((neck* or shoulder* or arm* or forearm* or wrist* or hand* or finger* or upper limb* or upper extremit* or back* or pelvis* or pelvic* or leg* or knee* or foot* or ankle* or feet* or lower limb* or lower extremit* or toe*) adj3 (injur* or contusion* or abrasion* or laceration* or sprain* or strain*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	954[illegible]5
5	whiplash*.mp.	3[illegible]8
6	(minor adj (injur* or contusion* or abrasion* or laceration* or sprain* or strain*)).mp.	18[illegible]6
7	1 or 2 or 3 or 4 or 5 or 6	183[illegible]9

Concept B
Transport-related accident/injury

8	Accidents, Traffic/	395[illegible]8
9	((car or cars or truck or trucks or automobile* or cyclist* or cycling* or cycle* or pedestrian* or passenger* or driver* or motor* or vehicle* or vehicul* or transport* or traffic*) adj3 (accident* or collision* or crash* or smash*)).mp.	489[illegible]8
10	8 or 9	489[illegible]5
11	7 and 10	87[illegible]9

Concept C
Types of studies including limitations to English language and year 2000 – current

12	epidemiologic studies/ or case-control studies/ or retrospective studies/ or cohort studies/ or follow-up studies/ or longitudinal studies/ or prospective studies/ or cross-sectional studies/	2060898
13	qualitative research/	33890
14	case control.mp.	263597
15	((follow up or followup) adj (study or studies)).mp.	602425
16	(observational adj (study or studies)).mp.	85293
17	((observational or prospective or retrospective) adj (study or studies)).mp.	1188696
18	Cross sectional.mp.	310974
19	(cohort adj (study or studies)).mp.	272736
20	(qualitative adj (study or studies)).mp.	23495
21	12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20	2275656
22	11 and 21	2418
23	limit 22 to (english language and humans and yr="2006 -Current")	1110

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item
ADMINISTRATIVE INFORMATION		
Title:		
Identification	1a	Identify the report as a protocol of a systematic review **YES Line 57-59 Page 3**
Update	1b	If the protocol is for an update of a previous systematic review, identify as such
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number **YES Line 279-281 Page 12**
Authors:		
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author **YES Page 1**
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review **YES Line 294 Page 13**
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments
Support:		
Sources	5a	Indicate sources of financial or other support for the review **YES Line 312-314 Page 14**
Sponsor	5b	Provide name for the review funder and/or sponsor **YES Line 312-314 Page 14**
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol **YES**
INTRODUCTION		
Rationale	6	Describe the rationale for the review in the context of what is already known **YES Line 134 Page 6**
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) **YES Line 409 Page 16**
METHODS		
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review **YES Line 151 Line 160 Page 7**
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage **YES Line 196 Page 9**
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated **YES Appendix 1**
Study records:		
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review **YES Line 228 Page 10**

Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) **YES Line 213 Page 9**
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators **YES Line 238 Page 9**
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications **YES Line 218 Page 9**
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale **YES Line 185 Page 8**
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis **YES Line 232 Page 10**
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised **YES Line 249 Page 11**
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ) **YES Line 255 Page 11**
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) **YES**
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned **YES Line 241 Page 10**
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) **YES**
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE) **YES Line 233 Page 10**

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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