




BMJ Open Research priorities for the management of complex fractures: a UK priority setting partnership with the James Lind Alliance

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ABSTRACT

Objective To determine research priorities for the management of complex fractures, which represent the shared priorities of patients, their families, carers and healthcare professionals.

Design/setting A national (UK) research priority setting partnership.

Participants People who have experienced a complex fracture, their carers and relatives, and relevant healthcare professionals and clinical academics involved in treating patients with complex fractures. The scope includes open fractures, fractures to joints broken into multiple pieces, multiple concomitant fractures and fractures involving the pelvis and acetabulum.

Methods A multiphase priority setting exercise was conducted in partnership with the James Lind Alliance over 21 months (October 2019 to June 2021). A national survey asked respondents to submit their research uncertainties which were then combined into several indicative questions. The existing evidence was searched to ensure that the questions had not already been sufficiently answered. A second national survey asked respondents to prioritise the research questions. A final shortlist of 18 questions was taken to a stakeholder workshop, where a consensus was reached on the top 10 priorities.

Results A total of 532 uncertainties, submitted by 158 respondents (including 33 patients/carers) were received during the initial survey. These were refined into 58 unique indicative questions, of which all 58 were judged to be true uncertainties after review of the existing evidence. 136 people (including 56 patients/carers) responded to the interim prioritisation survey and 18 questions were taken to a final consensus workshop between patients, carers and healthcare professionals. At the final workshop, a consensus was reached for the ranking of the top 10 questions.

Conclusions The top 10 research priorities for complex fracture include questions regarding rehabilitation, complications, psychological support and return to life-roles. These shared priorities will now be used to guide funders and teams wishing to research complex fractures over the coming decade.

Strengths and limitations of this study

- Use of established and transparent James Lind Alliance methodology.
- Survey responses were received from across the UK and from a range of patients and healthcare providers.
- The SARS-CoV-2 pandemic limited the use of volunteers to gather in-person responses from patients.

BACKGROUND

Complex fractures are injuries that involve severe breaks to a bone or multiple bones. They can involve skin loss and compound injuries of nerves, blood vessels and other tissues. They often require specialist treatment and can be associated with prolonged rehabilitation and disability.^{1–3} The National Institute for Health and Care Excellence (NICE) guidance on complex fractures encompasses fractures of the pelvis, fractures to joints broken into multiple pieces, and open fractures in which skin loss or significant tissue damage occurs.⁴

Complex fractures make up the minority of the two million fractures treated in England each year but are associated with significant morbidity and are a large burden on healthcare resources.⁵ They often involve high-energy transfer mechanisms, such as road traffic accidents.⁶ Multiple injuries or fractures can be sustained at the same time. In elderly patients, the same spectrum of severe injuries can occur with lower-energy transfer accidents such as trips and falls from standing height.^{7,8} The treatment of complex fractures is often complicated and usually involves multiple healthcare professionals and specialists.¹⁴

High-quality research into complex fractures is lacking, this is partly because they are less common and often have concomitant injuries and/or comorbidities. The introduction of the UK Major Trauma Network, utilisation of the Trauma Audit and Research Network and the development of novel methodical approaches have seen a rise in the number of trials in urgent or emergency care conducted in the National Health Service over the last 5 years.^{9 10} The UK now has the infrastructure to deliver high-quality research in the emergency setting, and so there is a pressing need to determine the research priorities for patients with complex fractures and their families.^{9 11} This Priority Setting Partnership (PSP) is the first to investigate these priorities systematically.

The James Lind Alliance (JLA) is an independent, non-profit organisation hosted by the National Institute for Health Research (NIHR). The JLA is committed to the principles of inclusivity, transparency and equal involvement of patients, carers and health professionals in research prioritisation.¹² The aim of this work was to

establish the research priorities for adults with complex fractures which represent the shared interests and priorities of patients, their families and friends, carers and healthcare professionals.

METHODS

The Complex Fractures PSP was conducted in accordance with the JLA process¹² and was undertaken over 21 months (October 2019 to June 2021) (see [figure 1](#)).

Steering group and partner organisations

Steering group members were recruited from professional and charitable organisations, including patients, doctors, clinical academics and allied healthcare professionals from around the UK. A JLA advisor (JG) guided the process, acting as a neutral facilitator to promote equal contributions from patients and healthcare professionals and to ensure JLA principles and methodology were followed. The information specialist (CPB) designed the

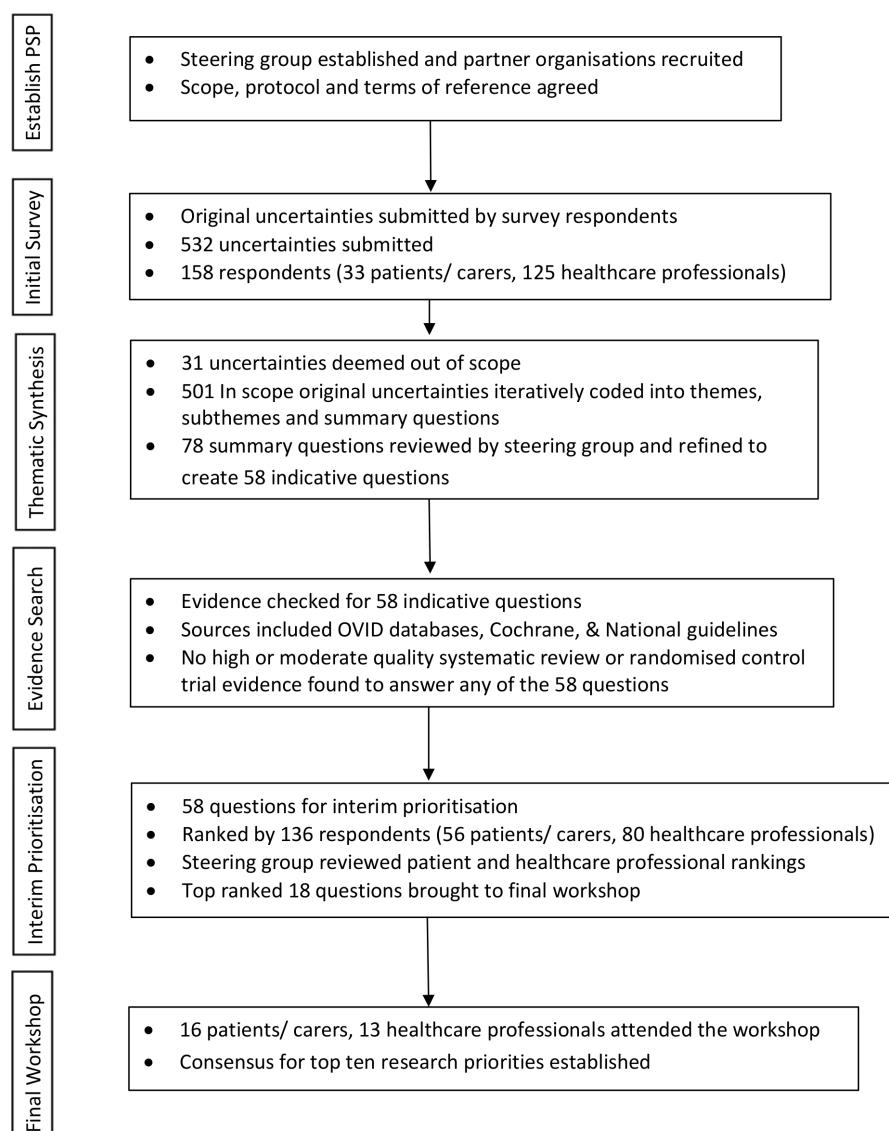


Figure 1 Flow chart of priority setting partnership process. PSP, Priority Setting Partnership

surveys, managed the data and performed the analysis. Each step was overseen by the steering group.

Scope

The scope of the PSP mirrored the conditions included in the NICE guidance for Complex Fractures.⁴ This included but was not limited to open fractures, fractures to joints broken into multiple pieces, multiple concomitant fractures and fractures involving the pelvis and acetabulum. Fractures associated with neurological injury, vascular injury or compartment syndrome were also included. Fractures included in the NICE guidelines for non-complex fractures were excluded.¹³ Fractures in children, emergency department and prehospital care and isolated hand injuries were also excluded as these fall within existing or planned PSPs. Decisions about whether submissions were in or out-of-scope were made by the information specialist and verified by the steering group.

Initial survey and identification of themes

The steering group designed an initial survey, asking respondents to submit their free-text research uncertainties for complex fractures, prompting them to consider early treatment and aspects of recovery up until 12 months from injury. Demographic information was also collected. The survey was available in paper and online formats (see online supplemental file 1A 'Initial Survey'). The survey was launched at the multi-disciplinary UK Trauma Trials Day and Orthopaedic Trauma Society conference on 15 January 2020. The survey was disseminated through partner organisations, social media and to patients in hospital wards and clinics (see online supplemental file 2 'Partner organisations'). Face-to-face patient participation was initially challenging due to the SARS-CoV-2 pandemic and so the initial survey remained open till August 2020.

All submissions were analysed by the information specialist, first splitting longer submissions into discrete components based on topic transitions. After a period of data immersion, responses were coded into themes, subthemes and then into summary questions. Each initial submission and its corresponding theme and summary question were verified by at least two members of the steering group, including a patient representative. This verification process involved reading each initial submission and corresponding summary question to ensure the summary question reflected the initial submission, any disagreements were discussed at a steering group meeting to reach consensus.

Creation of indicative questions and evidence checking

The steering group met to review all the themes and summary questions in turn. Similar questions were amalgamated into 'indicative questions', ensuring each of the original submissions were represented. Each indicative question was reviewed during the steering group meeting for readability and to ensure the language was understandable to patients and stakeholder groups.

A literature review was undertaken to ensure each indicative question was a 'true' uncertainty and had not already been sufficiently answered by research. HAC searched PubMed, Cumulative Index Nursing Allied Health, British Nursing Index, Embase, Medline, PsycINFO, Google Scholar, the WHO International Clinical Trials Registry Platform Search Portal, the US National Institute of Health Trials Registry, ISRCTN Registry and Published UK national guidelines⁴ (see search strategy in online supplemental file 3 'Question verification form').

The indicative questions were considered to be 'unanswered' if no recent (within the past 5 years) systematic reviews of research evidence or randomised controlled trials demonstrating high-quality or moderate-quality evidence for the question existed.¹⁴ The steering group reviewed each indicative question and the available summarised evidence to verify it was a true uncertainty. Where there were ongoing randomised controlled trials, two academic surgeons (WE and XLG) reviewed the studies to determine if they were likely to provide definitive evidence for the indicative question.

Interim prioritisation

A second survey asked respondents to pick their top 10 priorities from the indicative questions. The survey was distributed in online and paper formats through the same channels as the initial survey between 12 January 2021 and 1 April 2021 (see online supplemental file 1B) 'Interim Survey'). Separate rankings for patients (and their relatives and carers) and healthcare professionals were generated to account for a disparate proportion of responses and promote equal weighting between the stakeholder groups. The geometric means were calculated and combined to give the interim rankings. The steering group reviewed the rankings and chose a manageable list of questions to discuss at the final workshop.

Final consensus workshop

On 8 June 2021, a virtual 1-day workshop brought together patients, carers and healthcare professionals to determine the 'Top 10' research priorities for complex fractures. A sampling framework was used to invite and finally select participants from earlier stages of the PSP and additional volunteers from patient organisations. Within the sampling framework age, gender, geography, ethnicity and professional and personal experience were taken into consideration.

Prior to the workshop, participants were sent introductory materials and videos and asked to rank the questions from highest to lowest priority. During the workshop, participants were split into four groups of 7–8 comprising an equal distribution of patient representatives and healthcare professionals. Each group was facilitated by a JLA advisor who asked participants to list their highest and lowest priorities and discuss their rationale. An iterative ranking process continued with participants allocated to new, equally balanced small groups to exchange views, with all participants encouraged to contribute. During the

breaks, JLA advisors combined the rankings for each group to generate an updated list for subsequent discussion. After the final round, the JLA advisors presented the final combined rankings, and the participants reflected on the final consensus priorities.

Patient and public involvement

Patient and carer representatives were engaged throughout the process. They helped define the scope and were involved in the review of all patient-facing media. They were involved in all steering group meetings and decisions. They collaborated with patient organisations and helped to reach a diverse range of patient and carers groups for the surveys and final workshop. Two patient steering group members attended the final workshop to help link the indicative questions to the underlying submissions from which they were derived. Patient representatives will help disseminate the PSP findings and work with patient and charitable organisations to develop discrete research questions from the final priorities to take forward for funding.

RESULTS

Initial survey and evidence checking

A total of 158 responses were received from 26 Patients, 7 relatives/carers, 119 healthcare professions and 6 preferred not to say. The median age of respondents was 45 (range 24–73), 91 (57.6%) were male, 55 (34.8%) were female, 12 (7.6%) preferred not to say. A total of 113 identified as white (71.5%), 26 (16.5%) as minority ethnic, 19 (12.0%) preferred not to say. Respondents were from England (118), Wales (2), Northern Ireland (3) and Scotland (3), with 31 unknown. They submitted a total of 532 unique research uncertainties. After removal of out-of-scope submissions 501 remained. Out-of-scope submissions can be viewed in online supplemental file 4 'Out-of-scope initial submissions'.

A total of 78 summary questions were reviewed by the steering group and consolidated to create 58 indicative questions. No questions were found to be sufficiently answered by existing research during evidence checking and all progressed to interim prioritisation.

Interim survey

A total of 136 responses were received from 80 (58.8%) healthcare professionals, 53 (39.0%) patients and 3 (2.2%) relatives/carers. 72 (52.9%) female, 62 (45.6%) male, 2 (1.5%) preferred to self-describe. 116 (85.3%) identified as white, 17 (12.5%) as minority ethnic, 3 (2.2%) preferred not to say. There were responses from across the UK including England (94), Wales (7), Northern Ireland (4) and Scotland (2), with 29 unknown.

The steering group reviewed the rankings and based on previous experience of PSP workshops it was agreed that 18 questions would be taken forwards to the final workshop. There was similarity between the top ranked questions for healthcare professionals and patients,

Box 1 Top 10 UK research priorities for complex fractures

1. What is the best way to reduce the risk of infection after complex fractures?
2. What is the optimal outpatient rehabilitation strategy for patients with complex fractures?
3. What psychological support would be useful for patients with complex fractures and when?
4. Is it possible to determine which patients will develop complications, arthritis and poor functional outcomes after complex fractures?
5. What are the options for preventing and treating chronic (long-term) pain after complex fractures?
6. What is important to patients recovering from complex fractures?
7. What additional care and support is helpful for patients being discharged from hospital after a complex fracture?
8. When is it better to replace, fix or fuse fractures around the ankle, knee or acetabulum (hip socket)?
9. Can peer support (from other patients) be used to help patients with complex fractures?
10. Can patients be provided with expected recovery times for functional recovery and return to life roles after complex fractures?

with 9 of the top 10 ranked questions for both groups featuring in the 18 questions taken to the final prioritisation workshop.

Final consensus workshop

The final workshop was attended by 13 healthcare professionals (including surgeons (n=5), psychologists (n=2), physiotherapists (n=2), orthogeriatricians (n=2), an anaesthetist and an occupational therapist) and 16 patient representatives (14 had personal experience of complex fractures and 2 were relatives/carers). This included 4 healthcare professionals and 2 patient representatives from the steering group.

The order of the final 10 priorities was agreed by consensus. They are shown in [box 1](#): final top 10 research priorities. The full list of the top 18 can be viewed in online supplemental file 5: 'Indicative questions 1–18 and evidence summary'. The indicative questions that fell outside of the 18 discussed at the priority setting workshop can be viewed in online supplemental file 6: 'Indicative Questions 19–58'.

DISCUSSION

We have reported the results of a UK Priority Setting Partnership to establish the top ten priorities for research in complex fractures. This JLA process has helped ensure the top ten reflect the shared priorities of patients, their carers and relatives, and healthcare professionals. The questions reflect a shift in priorities seen in other musculoskeletal PSP's,^{15 16} in which the traditional researcher-led questions comparing surgical techniques have been largely replaced by holistic, patient-centric questions. Greater attention to psychological support, informing expectations for recovery and ensuring research outcomes are important to patients are commonly featured priorities.

The prevention and treatment of infection, minimising its significant morbidity, is another common shared priority.

The strengths of this study are that it followed the robust JLA methodology with independent facilitation by a JLA Adviser, maintaining the principles of transparency and equal inclusion.¹² This is the first study that has sought to understand what makes a fracture ‘complex’ and reports national research priorities for their treatment and ongoing care. It builds on the NICE description of ‘complex fractures’, refining the definition to be more than a set of individual fractures. Rather, the definition used in this study identifies patients that are likely to require numerous treatments, over prolonged periods, with input from multiple healthcare teams and services.⁴ The respondents, the steering group and the approach taken by this priority setting partnership reflect the multi-disciplinary approach required to care for patients with these challenging injuries. The recent advent of the UK Major Trauma network allowed wide dissemination of the surveys and the resulting broad geographical spread of responses ensures that the priorities are representative of a national viewpoint.⁹

This study has limitations. First, previous PSPs have used patient volunteers to disseminate the survey and gather research uncertainties,¹⁵ the use of these in-person methods was not possible due to the SARS-CoV-2 pandemic. Other challenges included engaging patients during outpatient appointments: Most fracture-related and musculoskeletal conditions have high volume follow-up clinics, however, complex fracture clinics typically have fewer, longer appointments, in which patients have multiple outcome surveys to complete, and so survey burden becomes an issue.⁹ The number of patient responses is, therefore, lower than other musculoskeletal PSPs.^{15 16} This partly reflects the lower incidence of complex fractures compared with ‘non-complex’ fractures. To limit bias from the disproportionate representation of healthcare professionals, we used separate rankings and combining of geometric means for the interim rankings. We also ensured a balanced composition of participants at the final workshop.

Discussions at the final workshop recognised that there may be some challenges with addressing these research priorities and that going forwards early international collaboration may be advisable and future PSP’s may wish to consider this at the priority setting stage. Lessons learnt from conducting the Complex Fractures PSP during a pandemic may be transferable to future, international PSP’s. We found arranging for steering group members and workshop participants to share their biographies in advance saved time during virtual meetings and enhanced interaction. Having a wide geographic range of enthusiastic collaborators to approach patients in their local hospital appeared more effective than engagement through online methods. Finally, having a General Data Protection Regulation compliant method for collecting respondent details to enable recontact for later phases

was crucial, especially when gathering patient responses proved challenging.

This PSP has highlighted new research priorities for complex fractures. Investigating these questions will require a range of research methodologies, beyond conventional Randomised Controlled Trials comparing implant A versus implant B. The steering group will disseminate these findings widely and work with research funding bodies and charitable organisations to develop research questions in partnership with patient representatives who contributed to identifying the priorities. The results of this priority setting partnership can be used to guide research funding bodies and the wider research community in advancing the quality of care for patients with complex fractures.

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Contributors All authors (CPB, HAC, JG, SM, AT, LJ, LS, RSK, MB, PD, VG, XLG and WE) made significant contributions to the design, implementation and delivery of this research. HAC conducted the evidence searching. CPB analysed the data and prepared the initial manuscript. All authors have read and approved the final version of this manuscript. CPB is responsible for the overall content as the guarantor.

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Competing interests RSK is a member of the UK NIHR HTA CET board, NIHR ICA Doctoral panel, chair of the NIHR RfPB board and holder of a NIHR Senior Fellowship award. RSK has been awarded current and previous NIHR and vs Arthritis research grants. RSK is co-investigator on an NIHR funded study receiving additional support from Stryker Ltd. XLG is funded by an NIHR Clinician Scientist Award.

Patient consent for publication Not required.

Ethics approval This work did not require ethics approval as per the guidance published by the NHS National Patient Safety Agency National Research Ethics Service. Participant informed consent for survey respondents and workshop attendees was not required or obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as online supplemental information. Online supplemental data including all indicative questions and out of scope submissions can be found on the JLA website at: <https://www.jla.nihr.ac.uk/priority-setting-partnerships/complex-fractures/>

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Supplementary file 1A – Initial Survey

ABOUT YOU (optional)

It is important that we know a little bit about you so that we can ensure we have collected the views from a wide range of people with different experiences.

Which broken bone/fracture(s) are you most interested in?

(Please tick the relevant blue circle on the front cover)

Why are you interested in these fractures?

- ☐ I have previously suffered a complex fracture(s)
 - ☐ I know someone who suffered the above fracture
 - ☐ I am or have been, a carer for someone with a complex fracture
 - ☐ I am a healthcare professional treating people with these fractures
- If so, what is your role?

Are you?

Male ☐ Female ☐ Prefer to self-describe ☐ Prefer not to say ☐

What is your age?

How old were you / the injured person at the time of injury?

What is your ethnic group?

White ☐ Asian / Asian British ☐ Arab ☐ Black/Black British ☐
Mixed / multiple ethnic groups ☐ Prefer not to say ☐
Other ethnic group (please describe)

What is the first half of your postcode? (e.g. SR4)

THANK YOU for completing this survey. Please hand it back to a staff member or return it to: **Sunderland Royal Hospital, Room 251 Trust HQ, Kayll Road, Sunderland, SR4 7TP** using the envelope provided.

To find out more about this project visit
<https://www.ndorms.ox.ac.uk/complexfractures>

COMPLEX FRACTURES



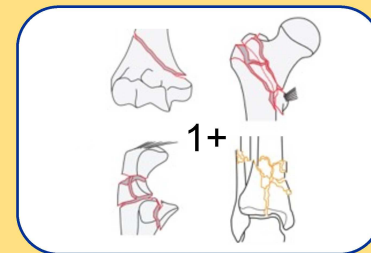
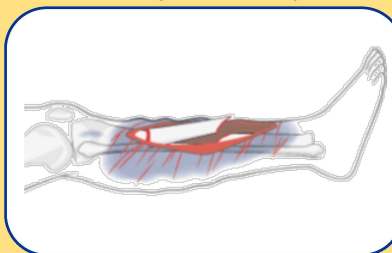
Have you ever had to stay overnight in hospital because of a broken bone, or are you a friend, carer or healthcare professional for someone who has?



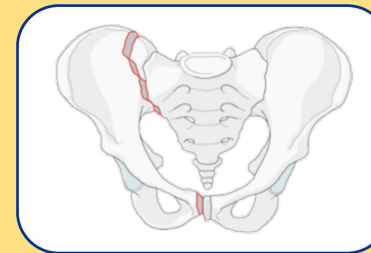
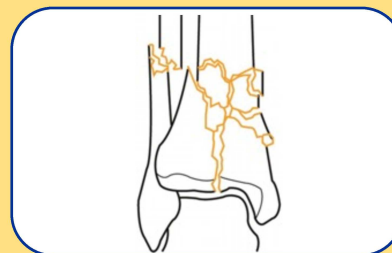
Can you help us decide the big questions that should be answered by research?

We are interested in patients who have had:

- ☐ Open fractures (broken bone coming through the skin)
- ☐ More than one fracture at the same time



- ☐ Fractures to a joint of the leg broken into multiple pieces
- ☐ Fractures of the pelvis or acetabulum (hip socket):



Who are we?

We are a group of patients, clinicians and researchers who want to help improve the care and quality of life of patients who suffer complex fractures.

What is a complex fracture?

It is a severe break to a bone or several bones that requires special treatment. Examples are on the front page. While they are not as common as more simple fractures, they usually need extra care to recover from. Most of the time patients need to stay in a hospital ward for several days after sustaining a complex fracture.

They could be the result of a major accident such as a car crash, but can also occur from falls, especially in the elderly or those with weaker bones.

Why do we need your help?

We are asking everyone involved – patients, their carers/ relatives, and healthcare professionals – about what questions need answering the most if we are going to improve care and recovery. We want your views to guide research and for you to have a voice in shaping the next generation of research advances in this area.

What will we do with your survey results?

We will combine your responses into a list. We then ask patients, their carers and healthcare professionals to rank which of these they think are the most important research priorities. We will then tell the people who fund research what the questions are that need to be answered.

Want to contact us?

If you would like to take part in the second survey for this project or join in a workshop please email Christopher.Bretherton@ndorms.ox.ac.uk

YOU CAN COMPLETE THIS SURVEY ONLINE AT

"Link and QR code redacted as now inactive"

Or you can use this form – please continue on to the survey opposite.

By participating in this survey you give us, and partner organisations, permission to publish your answers for the Priority Setting Partnership, but the information you give will be anonymised (so your name will not be published and you will not be identifiable from what you have told us).

THE SURVEY – What are your top questions that you would like to see answered by research? We would like to know what was most important to you in **the first twelve months** after injury.

Your questions can be about any aspect of living with, caring for, or treating these injuries. In this work, we are not considering injuries in children, isolated hand injuries, treatment pre-hospital, or in A&E.

Please write your questions in the boxes below. We have divided it up to focus on **each part of the first 12 months after injury**:

The in-hospital treatment (e.g. treatment of bones, soft tissue or other health aspects, medicines, operation, or other treatment)

Rehabilitation (e.g. mental and physical support including physiotherapy)

Return to function (e.g. expectations for return to work, driving, hobbies)

Is there anything else you would like to tell us? (e.g. personal experiences)

Supplementary file 1B – Interim Survey

COMPLEX FRACTURES



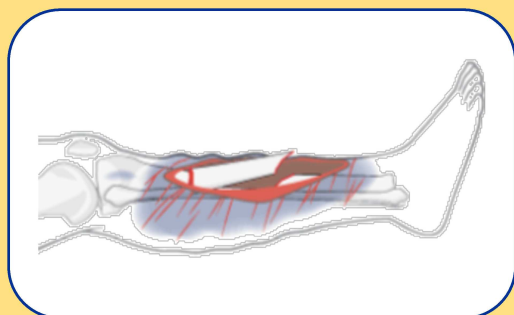
Have you ever had to stay overnight in hospital because of a broken bone, or are you a friend, carer or healthcare professional for someone who has?

Can you help us decide the big questions that should be answered by research?

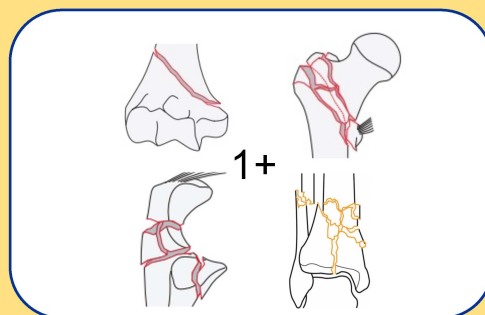
We are interested in patients who have had:



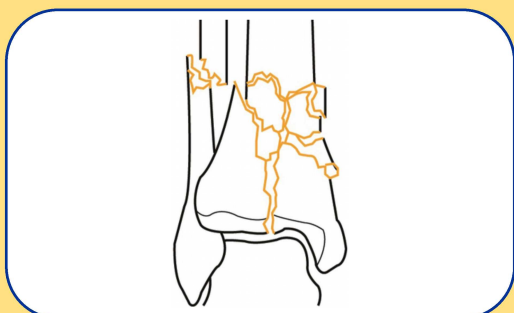
Broken bone coming through the skin



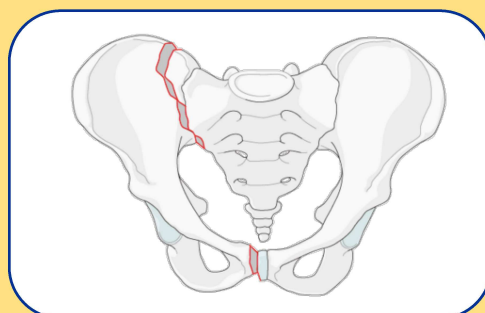
More than one fracture at the same time



Fractures to a joint of the leg broken into multiple pieces



Fractures of the pelvis or acetabulum (hip socket):



YOU CAN COMPLETE THIS SURVEY ONLINE AT
"Link and QR code redacted as now inactive"

Or you can use this paper form



Who are we?

We are a group of patients, clinicians and researchers who want to help improve the care and quality of life of patients who suffer complex fractures.

What is a complex fracture?

It is a severe break to a bone or several bones that requires special treatment. Examples are on the front page. Most of the time patients need to stay in a hospital ward for several days after sustaining a complex fracture.

They could be the result of a major accident such as a car crash, but can also occur from falls, especially in the elderly or those with weaker bones.

What is this survey for?

We recently asked patients, carers and healthcare professionals to tell us their comments and questions about complex fractures. Thank you to everyone who sent comments and questions.

We have taken all the responses into account and summarised them into 58 representative questions, grouped into 6 themes related to complex fractures. We now need your help to decide the most important questions to take forward.

What will we do with your survey results?

We will use your survey responses to take to the next stage of the process. This will involve a combined workshop on June 8th 2021 between patients, carers and healthcare professionals where the Top Ten research questions will be decided (we would love to invite you to this, see last page of survey). We will then pass these on to the people who fund research so that your priorities drive the research.

What are we asking you to do...

We would like you to pick your Top Ten questions that you would like to see answered by research.

To find out more about this project visit:

<https://www.ndorms.ox.ac.uk/complexfractures>

Or contact us:

Christopher.Bretherton@ndorms.ox.ac.uk

By participating in this survey you give us, and partner organisations, permission to publish your answers for the Priority Setting Partnership, but the information you give will be anonymised (so your name will not be published and you will not be identifiable from what you have told us).

What are your top questions that you would like answered by research?

It may be that most of the ones you feel are most important are in the same section, or alternatively they may be spread evenly across all 6 themes.

***Please only tick 10 out of 58 across all pages**

Bleeding/ Bloods vessels/ Nerves

- ☐ What is the best way to control bleeding in complex fractures e.g. pelvic fractures?
- ☐ What is the best management strategy for a patient who is bleeding or has bled in the context of complex fractures?
- ☐ How do pre-existing clotting disorders impact on patients with complex fractures?
- ☐ What is the best strategy for preventing blood clots after complex fractures?
- ☐ What is the best way to diagnose and treat compartment syndrome (severe muscle swelling causing reduced blood flow)?
- ☐ How can we prevent and treat fat embolism (lumps of fat in the blood stream) related to complex fractures?
- ☐ What is the best way to predict which fracture-associated nerve injuries will recover without treatment?

In-hospital/ Non-operative management

- ☐ What is the best dressing to use on complex wounds?
- ☐ What is the best way to reduce the risk of infection after complex fractures?
- ☐ What are the options for relief of acute (immediate) pain in patients with complex fractures?
- ☐ What are the options for preventing and treating chronic (long-term) pain after complex fractures?
- ☐ Are traction splints of benefit in the treatment of common fractures and what sort do patients prefer?
- ☐ What is the impact of frailty on outcome after sustaining a complex fracture?
- ☐ How can we avoid missing other injuries/ problems for patients that have sustained complex fractures?
- ☐ What is the best strategy for improving nutrition for patients with complex fractures?
- ☐ How can we assess and improve bone health after complex fractures to promote healing and prevent future fractures?
- ☐ What are the implications for child-bearing during/ after a pelvic fracture?
- ☐ What specific training would be useful for staff treating patients with complex fractures?
- ☐ What is the best way to monitor healing for complex fractures?
- ☐ What is the best way to promote healing for complex fractures (e.g. external stimulation devices)?
- ☐ What is the effectiveness of current regional trauma networks for provision of care for complex fractures?
- ☐ Could a national registry and artificial intelligence modelling improve care and research related to complex fractures?

In-hospital/ Surgical management

- ☐ What is the best treatment strategy for frail patients with fractures of the pelvis and acetabulum (hip socket)?
- ☐ When is it better to replace, fix or fuse fractures around the ankle, knee or acetabulum (hip socket)?
- ☐ Which surgical implants are best for treating fractures around the knee and ankle?
- ☐ Which patients will benefit from early amputation after complex fractures?
- ☐ What is the best strategy and timing for debridement, fixation and soft tissue reconstruction for open fractures?
- ☐ What is the best bone defect reconstruction option in the acute treatment of complex fractures?
- ☐ In patients with multiple injuries, which fractures need fixing and when?
- ☐ Should metalwork routinely be removed after surgery and when?
- ☐ What type of flap (skin and muscle tissue) is best for treating open fractures?

Rehabilitation

- ☐ How should expectations be managed to improve patient outcomes after complex fractures?
- ☐ How can NHS and private services best integrate for the rehabilitation of complex fractures?
- ☐ How can we promote lasting adherence to rehabilitation, exercise and healthy lifestyle behaviours after complex fractures?
- ☐ Is recovery from complex fractures enhanced by personalised rehabilitation with patient-specific goals?
- ☐ Why do we have joint stiffness after healing of the fracture?
- ☐ What is the optimal in-patient rehabilitation strategy for patients with complex fractures?
- ☐ What is the optimal outpatient rehabilitation strategy for patients with complex fractures?
- ☐ When is it safe to start weight-bearing and joint movement after a complex fracture?
- ☐ How can we improve coordination of rehabilitation and multi-disciplinary care for patients with complex fractures?
- ☐ What additional care and support is helpful for patients being discharged from hospital after a complex fracture?
- ☐ Could Ambulatory Care Pathways or Day-case operating reduce inpatient stays for patient with complex fractures?
- ☐ Would specialist regional rehabilitation centres improve recovery for patients with complex fractures?
- ☐ How can community rehabilitation, follow-up and continuity of care be improved for patients recovering from complex fractures?

Psychology

- ☐ What psychological support would be useful for patients with complex fractures and when?
- ☐ What are the psychosocial barriers and facilitators for recovery after a complex fracture?
- ☐ What are the long-term psychological consequences of complex fractures?
- ☐ How common is Post-Traumatic Stress Disorder (PTSD) after complex fractures and how can it be prevented or treated?

Return to function

- ☐ Can patients be provided with expected recovery times for functional recovery and return to life roles after complex fractures?
- ☐ Is it possible to determine which patients will develop complications, arthritis and poor functional outcomes after complex fractures?
- ☐ What is the best way to support patients returning to driving after sustaining a complex fracture?
- ☐ What is the best way to support patients when returning to work after sustaining a complex fracture?
- ☐ How can we best advise patients with a non-union (delayed bone healing) on what to expect and how to function in their daily lives?
- ☐ Is social rehabilitation useful for patients recovering from complex fractures?
- ☐ What information would be helpful to give to patients sustaining complex fractures and how would this be best delivered?
- ☐ What is important to patients recovering from complex fractures?
- ☐ How can patients with complex fractures be supported in decision-making for medico-legal and insurance claims?
- ☐ Can peer support (from other patients) be used to help patients with complex fractures?

Thank you for your responses!

***Please ensure you have only ticked 10 across all pages**



ABOUT YOU (optional)

It is important that we know a little bit about you so that we can ensure we have collected the views from a wide range of people with different experiences.

Which broken bone/fracture(s) are you most interested in?

(Please tick the relevant blue circle on the front cover)

Why are you interested in these fractures?

- ☐ I have previously suffered a complex fracture(s)
- ☐ I know someone who suffered the above fracture
- ☐ I am or have been, a carer for someone with a complex fracture
- ☐ I am a healthcare professional treating people with these fractures

If so, what is your role?

.....

Are you?

Male ☐ Female ☐ Prefer to self-describe ☐ Prefer not to say ☐

What is your age?

Under 20 ☐ 20-29 ☐ 30-49 ☐ 50-69 ☐ 70-79 ☐ 80+ ☐

What is your ethnic group?

Asian / Asian British ☐ Black/Black British ☐ White ☐

Mixed / multiple ethnic groups ☐ Prefer not to say ☐

Other ethnic group (please describe)

.....

What is the first half of your postcode? (e.g. OX3)

.....

THANK YOU for completing this survey. Please hand it back to a staff member or return it to: **Oxford Trauma – Kadoorie Centre, John Radcliffe Hospital, Headley Way, Oxford, OX3 9DU**

Keep in Touch

Would you like to hear the outcome of the Top 10 priorities or join the final prioritisation workshop on June 8th 2021 (this may be face-to-face or virtual)? If so please provide your name and either your postal address or an email so that we can contact you. These contact details will be kept confidentially and securely and will be removed from our records after the end of the project.

Name.....

Email Address (or postal address if preferred)

.....

Supplementary file 2 - Partner organisations:**Charities/ Patient Organisations**

After Trauma
Association of Carers
Day One Trauma Support
People in Research
TraumaCareUK
Versus Arthritis

Professional Organisations

AOUK & Ireland
Association of Anaesthetists of Great Britain and Ireland (AAGBI)
Association of Trauma and Orthopaedic Chartered Physiotherapists (ATOCP)
British Association of Occupational Therapists (BAOT)
British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS)
British Geriatric Society (BGS)
British Limb Reconstruction Society (BLRS)
British Orthopaedic Association (BOA)
British Orthopaedic Research Society (BORS)
British Trauma Society (BTS)
The Cochrane Bone, Joint & Muscle Trauma Group (BJMT)
Fragility Fracture Network (FFN)
National Trauma Research & Innovation Collaborative (NaTRIC)
NIHR Trauma and Emergency Care Network (TEC)
Orthopaedic Trauma Society (OTS)
Plastic Surgery Trainees Association (PLASTA)
Reconstructive Surgery Trials Network (RSTN)
Royal College of Surgeons of Edinburgh
Royal College of Surgeons of England
The Association of Surgeons in Training (ASiT)
The British Orthopaedic Trainees' Association (BOTA)
The Chartered Society of Physiotherapy (CSP)
Trauma Audit and Research Network (TARN)
Wessex Trauma Network

Hospitals

Basingstoke and North Hampshire Hospital, Basingstoke
James Cook University Hospital, Middlesbrough
John Radcliffe Hospital, Oxford
Kings College Hospital, London
Leeds General Infirmary, Leeds
Royal London Hospital, London
Royal Victoria Infirmary, Belfast
Salford Royal Hospital, Greater Manchester
Sheffield Teaching Hospitals, Sheffield
Southmead Hospital, Bristol
University Hospital Southampton, Southampton
University Hospitals Coventry and Warwickshire, Coventry

Supplementary file 3 - Question verification form

The purpose of this Question Verification Form is to enable Priority Setting Partnerships (PSPs) to describe clearly how they checked that their questions were unanswered, before starting the interim prioritisation stage of the process.

The JLA requires PSPs to be transparent and accountable in defining their own scope and evidence checking process. This will enable researchers and other stakeholders to understand how individual PSPs decided that their questions were unanswered, and any limitations of their evidence checking.

Name of the PSP
Complex Fractures
Please describe the scope of the PSP
<p>The PSP aim is to identify the unanswered questions about complex fractures from the patient, carer, and clinical perspectives.</p> <p>The PSP definition of a complex fracture will mirror the scope of the NICE guidelines for complex fractures: https://www.nice.org.uk/guidance/ng37. This will include:</p> <ul style="list-style-type: none"> • Pelvis and acetabular fractures • Extremity fractures associated with <ul style="list-style-type: none"> ◦ More than one fracture ◦ Open fractures ◦ Comminuted (broken into multiple pieces) intra-articular fractures of the lower limb <p>The PSP scope will include the following aspects of care in the first 12 months following injury:</p> <ul style="list-style-type: none"> • Both operative and non-operative care of bony and soft tissue injuries, wounds, and incisions • Rehabilitation both physical and mental, including occupational therapy and return to work • Service design and delivery <p>The PSP excludes from its scope questions about:</p> <ul style="list-style-type: none"> • Fractures in children and younger people (less than 18 years old) • Emergency department and pre-hospital care • Isolated Hand injuries
Please provide a brief overview of your approach to checking whether the questions were unanswered
<p>Questions submitted by patients and clinicians to the survey were collated and categorised into indicative questions. These preliminary questions were agreed on by the Steering Group. The verification process aimed to determine which of these questions are unanswered by research to date.</p> <p>Our search strategy was stepwise starting with the most reliable sources and working down. This enabled answered questions to be identified efficiently.</p> <p>The following process was followed for each question:</p> <ol style="list-style-type: none"> 1. Guidelines (NICE, SIGN, Royal College, or Professional association) were reviewed to determine whether they covered that question. If they did, then evidence behind the guidelines was reviewed. Where this evidence was low-quality, e.g. observational research or expert consensus, this was discussed with the steering group to determine whether to consider the question answered or unanswered. 2. Cochrane reviews were searched using keywords specific to each question. Where a review called for further research, the question was not considered answered. If the systematic review was older than 5 years old, recent RCTs were also searched to ensure the question had not been answered more recently. 3. Database searches on OVID and Google Scholar were conducted using keywords specific to each question. Randomised controlled trials (RCTs) were reviewed and if no strong conclusion could be drawn from the study, the question was considered unanswered. 4. Ongoing and future trials were reviewed on registries. These were used to identify questions that may be answered in the coming years. The aim was not to exclude questions at this stage but to take these in to account to help refine the questions for the interim workshops and prioritise those taken to the final workshop.
Please list the type(s) of evidence you used to verify your questions as unanswered

<ul style="list-style-type: none"> National Guidelines (NICE, SIGN, Royal College, or Professional association) Systematic Reviews (including Cochrane) If systematic reviews were older than 5 years, recent RCTs were reviewed If no systematic reviews available, any RCTs were reviewed Ongoing and future trials were logged
Please list the sources that you searched in order to identify that evidence
Systematic review or RCT evidence found via: <ul style="list-style-type: none"> Cochrane Central Register of Controlled Trials (https://www.cochranelibrary.org) OVID (databases included Pubmed, CINAHL, AMED, BNI, EMBASE, HBE, Medline, and PschINFO); Google Scholar (https://scholar.google.co.uk); the WHO International Clinical Trials Registry Platform Search Portal (http://www.who.int/ictpr/en), Current Controlled trials (http://www.isrctn.com), the US National Institute of Health Trials Registry (https://clinicaltrials.gov) Published UK national guidelines – NICE, SIGN, BOA, BAPRAS
What search terms did you use?
Keywords of each question were used in each database and tailored to each question. Examples of keywords were: <ul style="list-style-type: none"> exp "Bones of Lower Extremity"/ OR exp "Bones of Upper Extremity"/ OR pelvi*.ti,ab.OR acetabul*.ti,ab. AND exp Fractures, Bone/ OR fractur*.ti,ab. OR (broke or broken or break*).ti,ab.
Please describe the parameters of the search (eg time limits, excluded sources, country/language) and the rationale for any limitations
<ul style="list-style-type: none"> All guidelines were in English. All studies were included however, recent evidence in the last 5 years was seen to be stronger than older evidence. The search was limited to English only for clinical guidelines. No language limitation for systematic reviews or studies.
Names of individuals who undertook the evidence checking
<ul style="list-style-type: none"> Harry Claireaux. Uncertainties were discussed with the Steering Group.
On what date was the question verification process completed?
<ul style="list-style-type: none"> 24 Nov 2020
Any other relevant information
<ul style="list-style-type: none"> Consultant surgeons from 2 academic centres (WE and XG) confirmed no significant papers were missed which could provide answers to the shortlisted questions.

Version 1.0 Date 24NOV2020

Supplementary file 4 - Out-of-scope initial submissions

ID	Original Response	Out of Scope Theme
61.1	Should posterior malleolar fractures be fixed	Ankle Fractures
62.7	After breaking my ankle I can walk but I ache and I don't trust myself to walk down a slope. It's probably "all in my head" but no one knows this as part of my outcome as I'm long since discharged.	Ankle Fractures
37.1	figure of 8 bandage for clavicle fracture ?Functional rehab	Clavicle Fractures
21.3	Ideal treatment for Lisfranc injuries - ORIF/ CRIF/ Fusion	Foot Fractures
24.1	Mild shaft ulna fracture with minimum displacement - fix not not to fix	Forearm Fractures
155.4	What are the statistics re nerve damage and hip weakness in fractured NOFs	Hip Fractures
24.2	Hemi's Vs Total in NOF fracture	Hip Fractures
24.3	Physio post hip fracture as outpatient	Hip Fractures
90.1	Impact of regular assessment of mental health and focused treatment post fractured NoF	Hip Fractures
35.4	90% of these injuries occur in lower-middle income countries, 2% of research is done there!	Low and Middle Income Countries
106.2	Regular physiotherapy was advised.	Miscellaneous
133.2	I have had a positive outcome on the treatment and recovery and from start to finish I have had minimal pain if any at all	Miscellaneous
106.3	Pt explained and advised to return to work after 4 months	Miscellaneous
7.2	I have +40 patients a month - I can't answer the above for them individually using this form. I would say all of the above feature in many sessions	Miscellaneous
104.1	N/A - as I have not suffered this injury but do treat them	Miscellaneous
106.1	Was involved in surgery for the injury and looked after the patient	Miscellaneous
151.4	Multiple publications on fractures in sport	Miscellaneous
99.1	Paediatric open fracture treatment	Paediatric Fractures
36.1	Emergency practise paed trauma and pain management. Do we give the right amount at the right time	Paediatric Fractures
116.1	What is the evidence of psychological complications following these injuries in children and what support do centres in the UK provide	Paediatric Fractures
62.6	My daughters ACL is long since repaired and her instability reduced so she can function at work but she only started to feel better when she received an apology through mediation with those whose negligence put her in harms way precipitating her injury that deprived her of the enjoyment of her years at university.	Paediatric Fractures

67.5	Who should treat periprosthetic fractures I would call those complex some do better with revision surgery some better with fixation.	Periprosthetic Fractures
67.7	I have fixed a fracture in a patient with a loose hip, the patient survived and functions well 8 years after, now suffering from Parkinson's disease. Some elderly patients may not survive revision surgery but we have no evidence to guide us either way.	Periprosthetic Fractures
68.6	Peru prosthetic fractures.	Periprosthetic Fractures
113.1	Pre hospital care	Pre-hospital Care
32.3	More research to have a secondary aspect exploring consultant compliance to randomised treatment (i.e. did they comply)	Research Methods
34.1	Will taking part in a research study improve outcomes?	Research Methods
34.2	Can taking part provide benefit in Rehab	Research Methods
34.3	As a research nurse i have found that patients find it beneficial having further input that comes with the study	Research Methods
78.4	Pragmatic trials do not give the whole answer. I want to be treated in a system that demands excellence, not the lowest common denominator	Research Methods
98.1	Which patients do well with a sub-acromial decompression	Shoulder Surgery

Supplementary file 5 - Indicative questions 1-18 and evidence summary

PSP Name	Rank of uncertainty	Uncertainty	Explanatory note	Evidence summary	Evidence	Evidence	True Uncertainty?
Top 10 priorities - Final workshop 08 Jun 2021							
Complex fractures	1	What is the best way to reduce the risk of infection after complex fractures?	Infection may cause significant morbidity and mortality in patients with complex fractures.	All studies referenced in NG37 were of low quality and high risk of bias. There is moderate-certainty evidence that NPWT is not a cost-effective treatment for open fracture wounds. No other relevant trial evidence Cochrane/PUBMED since 2015.	Effect of Incisional Negative Pressure Wound Therapy vs Standard Wound Dressing on Deep Surgical Site Infection After Surgery for Lower Limb Fractures Associated With Major Trauma The WHIST Randomized Clinical Trial	NICE Guideline 37 Fractures (complex): assessment and management	Yes
Complex fractures	2	What is the optimal outpatient rehabilitation strategy for patients with complex fractures?	Patients with complex fractures may spend significant amounts of time completing rehabilitation over months or years. This may be very challenging and involve many trips to the rehabilitation facility.	NG37 and NG39 – discuss patient rehabilitation in the context of providing adequate information. They state that this is very important to patients citing the qualitative study listed here. No other relevant trial evidence Cochrane/PUBMED since 2015.	Improving recovery-Learning from patients' experiences after injury: a qualitative study	NICE Guideline 37 Fractures (complex): assessment and management NICE Guideline 39 Major trauma: assessment and initial management	Yes
Complex fractures	3	What psychological support would be useful for patients with complex fractures and when?	Complex fractures may lead to psychological morbidity in multiple ways. Firstly, the index injury may have been psychologically traumatic. Second, scarring and deformity may lead to issues with body image. Third, challenges may relate to changes in function and knock-on effects around work and leisure.	Psychological wellbeing is mentioned in NG37 as a study outcome. The guideline also advises mental health team involvement for patients with psychological or psychiatric risk factors though there is no evidence supplied relating to this. No other relevant trial evidence Cochrane/PUBMED since 2015.	NICE Guideline 37 Fractures (complex): assessment and management	-	Yes
Complex fractures	4	Is it possible to determine which patients will develop complications, arthritis, and poor functional outcomes after complex fractures?	Complex fractures may involve significant complications and there is relatively little recent high-quality evidence to help us prognosticate who will develop complications and how these could be prevented and managed.	Complications are discussed in both NG37 and NG39 as the outcomes of studies that have been reviewed. However, there is no evidence supplied on prediction of complications. Several studies use development of complications as a primary outcome measure when comparing treatments such as operative versus non-operative management of a fracture. However, no studies were found aiming to understand prognosis in these injuries. No other relevant trial evidence Cochrane/PUBMED since 2015.	NICE Guideline 37 Fractures (complex): assessment and management	NICE Guideline 39 Major trauma: assessment and initial management	Yes
Complex fractures	5	What are the options for preventing and treating chronic (long-term) pain after complex fractures?	Pain affects patients at the time of injury and in some cases for the remainder of the patients life. This causes significant morbidity and may reduce quality of life and negatively impact work and leisure.	NG193 has been published (Apr 2021) since the evidence checking process for this JLA PSP was conduct (Oct 2020). Chronic pain related to fractures is not referenced. No other relevant trial evidence Cochrane/PUBMED since 2015.	NICE Guideline 193 Chronic pain (primary and secondary) in over 16s: assessment of all chronic pain and management of chronic primary pain	-	Yes
Complex fractures	6	What is important to patients recovering from complex fractures?		Not mentioned in NICE guidelines specifically. No other relevant trial evidence Cochrane/PUBMED since 2015.	Nil	-	Yes
Complex fractures	7	What additional care and support is helpful for patients being discharged from hospital after a complex fracture?	Patients with complex fractures receive supportive care from a multidisciplinary team that may be dispersed across different service organisations.	Not mentioned in NICE guidelines specifically. No other relevant trial evidence Cochrane/PUBMED since 2015.	Nil	-	Yes
Complex fractures	8	When is it better to replace, fix or fuse fractures around the ankle, knee or acetabulum (hip socket)?	Joint replacement, fixation with metalwork, and fusion with screws are all methods of treating fractures around joints. It is not well understood which injury pattern at each joint may benefit from each intervention. Furthermore, it is not known which patients may benefit from each.	No specific NICE guidance exists on this question. A Cochrane review and several randomised controlled trials have been conducted to answer specific questions that fall under this uncertainty. Further studies are ongoing, none are likely to answer the question entirely.	The Ankle Injury Management (AIM) Trial	Effect of Locking Plate Fixation vs Intramedullary Nail Fixation on 6-Month Disability Among Adults With Displaced Fracture of the Distal Tibia The UK FixDT Randomized Clinical Trial	Yes
			-	-	Cochrane Review: Interventions for treating fractures of the distal femur in adults	Fractures of the posterior wall of the acetabulum: Treatment using internal fixation of two parallel reconstruction plates Trial	-
			-	-	Single versus double column fixation in transverse fractures of the acetabulum: A randomised controlled trial	AceFIT – a study comparing three methods of treatment of acetabular fractures (a type of hip fracture) in older patients; surgical fixation versus surgical fixation and hip replacement versus non-surgical treatment	-
Complex fractures	9	Can peer support (from other patients) be used to help	-	Not mentioned in NICE guidelines specifically. No other relevant trial evidence Cochrane/PUBMED since 2015.	Nil	-	Yes

		patients with complex fractures?					
Complex fractures	10	Can patients be provided with expected recovery times for functional recovery and return to life roles after complex fractures?	The rehabilitation journey after complex fractures can be very long and demanding for patients. There is frequently concern relating to returning to work, caring responsibilities, and leisure.	Not mentioned in NICE guidelines specifically. No other relevant trial evidence Cochrane/PUBMED since 2015.	Nil	-	Yes
Indicative questions 11-18 discussed at final workshop 08 Jun 2021							
Complex fractures	11	When is it safe to start weight-bearing and joint movement after a complex fracture?	For some types of fracture surgeons may decide to restrict movement and weight-bearing after surgical fixation to reduced a perceived risk of impairment of healing. However, this may result in longer patient stays in hospital, dependence on care services, and muscle loss leading to poor patient outcome.	NG37 and 39 mention weight-bearing in terms of an outcome from studies they have reviewed. However, these guidelines offer no specific advice. The WAX Weightbearing in Ankle Fractures trial will report in 2022 but will not entirely answer this question in the context of complex fractures. No other relevant trial evidence Cochrane/PUBMED since 2015.	NICE Guideline 37 Fractures (complex): assessment and management	NICE Guideline 39 Major trauma: assessment and initial management	Yes
			-	-	WAX Weightbearing in Ankle Fractures Randomised Controlled Trial (ongoing)	-	-
Complex fractures	12	What information would be helpful to give to patients sustaining complex fractures and how would this be best delivered?	Information may be given to patients with injuries may vary in terms of timing, content, and media used.	NG37 reported that the qualitative evidence was generally good quality and gives detailed guidance on important information to give to patients with complex fractures. NG39 makes a brief mention of leaflets on complications such as compartment syndrome though does not link this with specific evidence. No other relevant trial evidence Cochrane/PUBMED since 2015.	NICE Guideline 37 Fractures (complex): assessment and management	NICE Guideline 39 Major trauma: assessment and initial management	Yes
			-	-	Impact of Psychoeducational Video on Adjustment to Open Fracture Randomised Controlled Trial (ongoing)	-	-
Complex fractures	13	In patients with multiple injuries, which fractures need fixing and when?	Relatively little is known about which injuries are best treated with early vs late fixation and how patient and injury factors influence this.	NICE offer no specific guidance on this uncertainty. A randomised controlled trial has been conducted looking at this question in femoral shaft fractures in multiply injured patients. More broadly this question remains an uncertainty. No other relevant trial evidence Cochrane/PUBMED since 2015.	Randomized, controlled, two-arm, interventional, multicenter study on risk-adapted damage control orthopedic surgery of femur shaft fractures in multiple-trauma patients	-	Yes
Complex fractures	14	What is the best way to predict which fracture-associated nerve injuries will recover without treatment?	Patients with complex fractures may sustain injuries to various nerves resulting in sensory loss to the skin, weakness of muscles, and altered joint position sense. There are various ways in which nerve injuries can be treated including watchful waiting, active rehabilitation, and surgical repair	NG37 describes the importance of documentation in the management of patients with nerve injuries but offers no specific guidance on treatment or prognostication. No other relevant trial evidence Cochrane/PUBMED since 2015.	NICE Guideline 37 Fractures (complex): assessment and management	-	Yes
Complex fractures	15	How can we assess and improve bone health after complex fractures to promote healing and prevent future fractures?	Bone health depends on hormonal, nutritional, and mechanical factors. Patients and clinicians were interested in questions relating to better understanding these factors and potential targets for treatment in the context of complex fractures.	Several studies have been carried out on caloric and other supplementation in fractures generally, but not specifically complex fractures. No other relevant trial evidence Cochrane/PUBMED since 2015.	-	-	Yes
Complex fractures	16	What is the best strategy for preventing blood clots after complex fractures?	Patients with complex fractures are at an increased risk of venous thrombo-embolism (VTE) (ie blood clots) whereby blood clots may form at peripheral sites and move in the circulation to block blood flow. In some cases, this may result in cardiac arrest and death.	NG89 includes a review of 15 studies, 13 of which were randomised controlled trials. Where pharmacological or mechanical prophylaxis was compared with no prophylaxis, there were better outcomes in the group receiving an intervention. The NICE committee considered that the evidence sufficiently supported the use of Low Molecular Weight Heparin and Fondaparinux. The listed randomised controlled trial supports use of aspirin alone, however NICE committee felt inadequate evidence on bleeding risk and therefore this was listed as a research recommendation. There was a lack of evidence evaluating Direct Oral Anticoagulants in this review population. A 2020 Randomised Controlled Trial linked here by Haac et al. found no evidence of superiority between Low Molecular Weight Heparin or Aspirin for VTE prevention in fracture patients. Non-pharmaceutical method of VTE prophylaxis exist and include patient hydration, early mobilisation, and compression stockings.	NICE Guideline 89 Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism	Aspirin versus low-molecular-weight heparin for venous thromboembolism prophylaxis in orthopaedic trauma patients: A patient-centered randomized controlled trial	Yes
Complex fractures	17	What is the best bone defect reconstruction option in the	Complex fractures may result in bone defects whereby a region of bone is destroyed or must be excised by the treating surgeon as it has lost its blood supply. Several	NG37 examined the evidence for staging and treating Pilon fractures. Evidence for all outcomes included in the review was very imprecise.	NICE Guideline 37 Fractures (complex): assessment and management	An International, Multicenter, Prospective Registry on Post-traumatic Long Bones Defects (registry data)	Yes

		acute treatment of complex fractures?	treatment options exist for these situations such as fixation with new morphology, cadaveric bone graft, autologous bone graft, or bone free flaps.	Overall, the NICE committee felt the Low quality of the evidence underlined the need for research in this area.			
			-	-	Enhancement of Bone Regeneration and Healing in the Extremities by the Use of Autologous BonoFill-II (single group assignment trial in non-complex fractures)	-	
Complex fractures	18	Should metalwork routinely be removed after surgery and when?	Complex fractures may be treated using internal fixation with nails, plates, and screws. This metalwork may be left in situ forever or removed after a period of time. Some patients report problems with plates and screws close to the skin, ligaments, or tendons in areas such as the outside of the ankle.	No relevant guideline or trial evidence.	Nil	-	Yes

Supplementary file 6 - Indicative questions 19-58**Unanswered Indicative questions discovered by the PSP that fell outside of the 18 discussed at the priority setting workshop (In alphabetical order)**

Are traction splints of benefit in the treatment of common fractures and what sort do patients prefer?
Could a national registry and artificial intelligence modelling improve care and research related to complex fractures?
Could Ambulatory Care Pathways or Day-case operating reduce inpatient stays for patient with complex fractures?
How can community rehabilitation, follow-up and continuity of care be improved for patients recovering from complex fractures?
How can NHS and private services best integrate for the rehabilitation of complex fractures?
How can patients with complex fractures be supported in decision-making for medico-legal and insurance claims?
How can we avoid missing other injuries/ problems for patients that have sustained complex fractures?
How can we best advise patients with a non-union (delayed bone healing) on what to expect and how to function in their daily lives?
How can we improve coordination of rehabilitation and multi-disciplinary care for patients with complex fractures?
How can we prevent and treat fat embolism (lumps of fat in the blood stream) related to complex fractures?
How can we promote lasting adherence to rehabilitation, exercise and healthy lifestyle behaviours after complex fractures?
How common is Post-Traumatic Stress Disorder (PTSD) after complex fractures and how can it be prevented or treated?
How do pre-existing clotting disorders impact on patients with complex fractures?
How should expectations be managed to improve patient outcomes after complex fractures?
Is recovery from complex fractures enhanced by personalised rehabilitation with patient-specific goals?
Is social rehabilitation useful for patients recovering from complex fractures?
What are the implications for child-bearing during/ after a pelvic fracture?
What are the long-term psychological consequences of complex fractures?
What are the options for relief of acute (immediate) pain in patients with complex fractures?
What are the psychosocial barriers and facilitators for recovery after a complex fracture?
What is the best dressing to use on complex wounds?
What is the best management strategy for a patient who is bleeding or has bled in the context of complex fractures?
What is the best strategy and timing for debridement, fixation and soft tissue reconstruction for open fractures?
What is the best strategy for improving nutrition for patients with complex fractures?
What is the best treatment strategy for frail patients with fractures of the pelvis and acetabulum (hip socket)?

What is the best way to control bleeding in complex fractures e.g. pelvic fractures?
What is the best way to diagnose and treat compartment syndrome (severe muscle swelling causing reduced blood flow)?
What is the best way to monitor healing for complex fractures?
What is the best way to promote healing for complex fractures (e.g. external stimulation devices)?
What is the best way to support patients returning to driving after sustaining a complex fracture?
What is the best way to support patients when returning to work after sustaining a complex fracture?
What is the effectiveness of current regional trauma networks for provision of care for complex fractures?
What is the impact of frailty on outcome after sustaining a complex fracture?
What is the optimal in-patient rehabilitation strategy for patients with complex fractures?
What specific training would be useful for staff treating patients with complex fractures?
What type of flap (skin and muscle tissue) is best for treating open fractures?
Which patients will benefit from early amputation after complex fractures?
Which surgical implants are best for treating fractures around the knee and ankle?
Why do we have joint stiffness after healing of the fracture?
Would specialist regional rehabilitation centres improve recovery for patients with complex fractures?