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TITLE:

Health related outcomes of patients with serious traumatic injury: results of a longitudinal follow-up program delivered by trauma clinicians.

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ABSTRACT:

Introduction:

The routine collection of long-term patient health outcomes after serious traumatic injury at the health service level is uncommon. In 2019, we implemented the longitudinal Trauma Service Follow Up (TSFU) program at a level I trauma centre. Delivered by the trauma service clinicians involved in inpatient care, it assesses quality of life and disability. This study reports the 6- and 12-month outcomes of the first two years of operation of the TSFU program.

Methods:

This is a prospective cohort study of seriously injured adult trauma patients admitted to a level I trauma centre with 6- and 12-months post-discharge outcome assessments. Outcomes were quality of life and function/disability as measured using the EQ-5D-5L and WHODAS 2.0 validated instruments. Changes from 6 to 12 months were assessed using generalised estimating equations methods. Logistic regression models were used to identify factors associated with ongoing problems at each time point.

Results:

Five-hundred and eight seriously injured patients were eligible for the TSFU program with follow-up rates over 80% at both 6- and 12-month timepoints. At six months, ongoing problems with pain (69.9%), anxiety and depression (49%) and carrying out usual activities (57.5%) were highly prevalent; at 12 months problems with pain (61.4%) and anxiety and depression (43.8%) persisted. Lower extremity and/or pelvic surgery was associated with ongoing pain, odds ratio (OR) = 3.77 (95% CI 1.54-9.21, p = 0.01), anxiety and depression (OR 1.95, 95% CI 1.09-3.48, p = 0.02) and problems carrying out their usual activities (OR 3.19, 95% CI 0.75-13.5, p = 0.11) at six months. These patterns mostly persisted at 12 months. Similar associations between surgical intervention and high levels of disability were evident at both time points.

Conclusion:

Persistent impairments in physical and emotional health continues to affect many people following serious traumatic injury. The collection of longitudinal health outcomes by trauma clinicians enables identification of factors that contribute to disability and a reduction in quality of life. This in turn can drive quality improvement initiatives within the hospital trauma system. Longitudinal follow-up programs may provide a platform to provide ongoing specialist trauma-informed care after hospital discharge.

HIGHLIGHTS:

1. Collection of longitudinal health outcomes of seriously injured trauma patients at a health service level is infrequent.
2. Impairments in physical and emotional health continue to affect many people following serious traumatic injury.
3. Trauma clinicians are uniquely placed to facilitate collection of longitudinal health outcomes of trauma patients.
4. Collection of longitudinal health outcome data at the health service level can drive quality improvement initiatives within trauma systems.
5. Longitudinal follow-up programs are a platform which may provide ongoing specialist trauma informed care after trauma centre discharge.

INTRODUCTION:

There has been a well-documented reduction in mortality rates from serious traumatic physical injuries in countries with advanced trauma systems. Advanced systems deliver the full spectrum of trauma care ranging from pre-hospital treatment and transport, to emergency and acute care, through to rehabilitation and discharge.[1] However, with improved survival, there has been an increase in the number of people affected by long-term disabilities [2].This impacts many aspects of their lives including social, financial and employment, physical and psychological health, and quality of life[3]. Up to 30% of survivors have not returned to work 24 months post injury[4]. The downstream public health impacts of trauma survival are evident. Survivors have an increased use of health services compared to the general population which can persist for several years after injury[5], increasing public healthcare expenditure[6]. In Australia, traumatic injury now accounts for 8% of the total burden of disease (2023) and almost 8% of total health expenditure (2020-2021)[7].

Mortality rates in trauma systems have commonly been used globally as a surrogate measure of the quality of trauma care provided[8]. With most trauma patients now surviving the acute stage, trauma systems need to now measure the quality of trauma survival. This must be done in order to improve care and drive strategies for supporting those recovering from injury[9]. Whilst there is a wealth of literature documenting the ongoing burden of serious traumatic injuries, trauma systems that routinely collect longitudinal outcome data are less frequent. In Australia, a leader in this area is the Victorian State Trauma Outcomes Registry – Monash University (VSTORM), which has collected longitudinal outcomes of major trauma patients injured within the state of Victoria since 2001[10]. The data collected has been used to drive service provision and policy, [11, 12] and improve clinical outcomes as seen in published reports of reduced mortality and disability from major trauma[10]. More recently, in New South Wales, the Institute of Trauma Injury Management (ITIM) launched their statewide longitudinal

outcome data collection as part of their Trauma Outcomes and Quality Registry Evaluation program (TORQUE)[13]. In New Zealand the Trauma Outcomes Project has collected national longitudinal outcomes from 3 out of the 4 trauma regions since 2019[14]. Whilst these programs can provide important information about the trauma system as a whole[4], a significant evidence gap remains as to the role of individual hospital and healthcare services, in the following up their patients and documenting long-term outcomes. This form of clinical activity is arguably more patient-focussed and can help inform day to day clinical practice[15], quality improvement initiatives[16], and ultimately, patient outcomes[17].

In 2019 the Gold Coast University Level 1 Trauma Centre implemented a health service level longitudinal follow-up program for patients affected by serious traumatic injuries – Trauma Service Follow Up (TSFU). By way of the collection of long-term outcome data, the aims of the TSFU were to; (i) provide insight into the long-term outcomes of seriously injured patients and, (ii) identify factors that can inform health-service level quality improvement initiatives in the trauma care provided. The program follows-up patients at 6- and 12- months post injury via telephone and uses validated tools of WHODAS 2.0[18] and EQ-5D-5L[19] to assess their quality of life and functional and disability outcomes respectively. Whilst the design of the Gold Coast program was informed by the VSTORM model, it is notably different in that it is implemented by the clinicians of the trauma service team who are involved in the clinical care of the patient during their hospital admission and who, therefore, have first-hand knowledge and understanding of the patients' journey up, until discharge. Since 2020, the program forms part of the hospital avoidance scheme and provides structured advice to patients who report ongoing issues.

This study reports the 6- and 12-month longitudinal patient reported outcomes of the first two years of operation of the TSFU program.

The study objectives were to firstly, report the 6- and 12-month functional and quality of life outcomes of seriously injured patients who presented to a Level I Trauma Centre in Queensland, Australia. The second objective was to identify demographic and injury related factors associated with ongoing health related quality of life and disability at 6- and 12-months. We hypothesised that our findings would mirror those of others, in relation to a sustained high prevalence (>40%) of pain, and physical and psychological dysfunction at 6- and 12-months post hospital discharge.

METHODS:

Design

A prospective cohort study of seriously injured patients who presented to the Gold Coast Level I Trauma Centre in Queensland was undertaken using data from the first two years of the Trauma Service Follow-Up (TSFU) program (2019 – 2020). The study was reviewed and approved by the Gold Coast Hospital and Health Service HREC committee (LNR/2019/QGC/54318).

Setting and Sample

The study setting was a 750-bed tertiary health service located in Southeast Queensland, Australia. The institution is a level 1 Trauma Centre [(20)] with a local population of 647,000[(21)]. The catchment area crosses state borders, increasing the potential referral population to 625,087 [(22)] which includes both urban and rural locations. The centre receives over 2,000 trauma activations per year where 350 of those are categorised as major trauma (with an Injury Severity Score (ISS) >12 [(23)].

Participants

Consecutive patients were identified from the health service Trauma Registry which is a prospectively collected database of all trauma patients that meet the inclusion criteria of the Trauma Service within the hospital. Patients are admitted to the Trauma Service if any of the

following criteria are met: Activation of a trauma alert/respond; Two or more body systems injured; Chest or abdominal trauma and/or High-risk mechanism of injury. To be eligible for the Trauma Service Follow-Up program, patients must be aged ≥ 18 years at the time of injury; have an Injury Severity Score (ISS) ≥ 12 and survive to discharge from acute care. Patients are excluded if they do not reside in Australia; are identified as homeless at time of screening (as this provided an inability to send program correspondence); have no documented contact details or who didn't speak or understand English or have a relative who spoke/understood English as there are no interpreter services available for the program. All eligible participants who were uncontactable at 6-months postinjury remained eligible for follow-up at 12-months.

Intervention – TSFU program

The TSFU program is delivered by the clinical staff of the multi-disciplinary trauma service (nurses, occupational therapists, and physiotherapists). Survivors to hospital discharge are contacted at both 6- and 12-months since their injury date by a trained member of the clinical Trauma Service team. In addition to the structured questions of the WHODAS 2.0 [(18)] and EQ-5D-5L [(19)] questions relating to current pain levels, work and relationship status are also asked. A detailed description of the TSFU program and the results of the implementation of the follow-up program were published in 2022[(24)].

Data Collection

Demographic data were collected from the electronic medical records and health service Trauma Registry of all eligible patients. This included injury characteristics (type of injury i.e. blunt, penetrating, severity as defined by ISS [(23)] coding, and mechanism of injury); patient characteristics (age, gender, co-morbidities mapped to the American Society of Anaesthesiologists (ASA) physical status classification system [(25)] and geographic remoteness

using the Accessibility/Remoteness Index of Australia (ARIA) [26], mapped to the postcode of the patients place of residence); and hospital characteristics (length of stay, Intensive Care admission; operative procedures).

Functional and Health Related Quality of Life Measures

Health Related Quality of Life (QoL) – EQ-5D-5L

The EQ-5D-5L is a generic measure of health status and collects data about health-related quality of life[27]. Consisting of five domains: mobility, self-care, usual activities, pain or discomfort, and anxiety or depression; participants are asked to select one of five levels of response ranging from no problem to severe problems (scored 1-5).

Also included is a Visual Analogue Scale (EQ VAS) which records the patient's perceived state of health on an analogue scale ranging from 0 (worst imaginable health state) to 100 (best imaginable heath state), both on the day of assessment and how they remember it to be prior to the injury.

Developed in 1990 by the EuroQol group, the EQ-5D-5L is one of the most widely used generic tools owing to its low respondent burden, good psychometric properties, and econometric development[19]; and has been shown to be a valid and reliable outcome measure of health-related quality of life in the adult trauma population[28]. In addition, it is, easy to administer, either in person or virtually, and it demonstrates good responsiveness i.e. it can capture clinically important changes[29, 30]. The EQ-5D-5L collected will provide health related quality of life measurements in our population cohort.

Functional Outcomes – WHODAS 2.0

The WHODAS 2.0 is a uniform, standardised tool to measure health and disability across a range of cohorts at both the population or clinical level[31]; and was specifically developed to reflect the International Classification of Functioning, Disability and Health[18]. In our study

the WHODAS 2.0 was used to provide a detailed insight into the nature and extent of health disabilities following serious injury in our study participants at the 6- and 12-month timepoints. Based on the WHO definition, disabilities is an umbrella term, covering impairments, activity limitations, and or participation restrictions [32]. The WHODAS 2.0 enables measurement of disability across six major life domains: cognition, mobility, self-care, interpersonal relationships, work and household roles, and participation in society. Each of the 12 items on the WHODAS are scored using a 5-point Likert scale which grades the difficulty experienced by a participant in performing a given activity: from 0 to 4, where 0 means 'no disability' and 4 means extreme or complete. Total scores of 1-4 indicate mild disability, 5-9 moderate disability, and 10-48 severe disability[33]. Scores are combined and then expressed as a percentage of the total possible with higher scores reflecting a greater disability[34].

Data Analysis

Simple descriptive statistics were produced to summarize the baseline demographic and clinical profile of participants as well as their hospital management journey grouped by injury severity levels, year of admission and the EQ-5D-5L and WHODAS 2.0 outcomes at both timepoints. Medians, Interquartile ranges, or mean and standard deviation will be presented for the EQ VAS and the combined WHODAS 2.0 percentage.

The proportion and 95% confidence interval of responses in each category for each domain of WHODAS 2.0 six months and one year after discharge was reported. Similarly, the proportion and 95% CI was calculated for each level of response for each dimension of the EQ-5D-5L. As others have published results of the EQ-5D-5L simply as "no problems" and "some" problems, proportions on this dichotomy were similarly calculated. We also calculated the WHODAS 2.0 as a summary score. A simple summary score was obtained by summing each item where 0 corresponds to "none", 1 "mild", 2 "moderate", 3 "severe", and 4 "extreme".

The change in no problems/some problems responses from the 6-month to 12-month assessments for each category of the EQ-5D-5L and WHODAS 2.0 were assessed by use of the generalized estimating equations (GEE) approach with the binomial distribution and logit link. The GEE method considers the correlated nature of the responses from the same individual while not excluding responses from individuals who have only one (6-month or 12-month) response.

The EQ VAS results were compared using a paired t-test when comparing "today" to prior to injury (as all participants completed both parts). When VAS results were compared across 6-month and 12-month time points, GEE was used with the normal distribution and identity link. Changes in EQ VAS were assessed within a variety of demographic and clinically relevant subgroups.

Logistic Regression - Model

For the primary outcomes, the EQ-5D-5L and WHODAS 2.0 [4, 35] , were dichotomised into 'no problems' or 'some problems' (mild/moderate/severe/extreme). Potential predictors of the no-problems/some problems dichotomy of the EQ-5D-5L or WHODAS 2.0 were identified from previously published literature [35, 36].Each potential predictor will be assessed individually (univariate analysis) in a logistic regression for the EQ-5D-5L or WHODAS 2.0 dichotomous outcome at the 6- month and 12- month timepoints. Predictors with overwhelming clinical support in the literature or with $p<0.1$ in our univariate analyses were considered together with other predictors in a multivariable logistic regression model. Predictors with $p<0.05$ were retained in models. (Supplementary Material 1 & 2).

RESULTS:

Figure 1 shows the STROBE flow diagram for the study. There were 4,625 trauma presentations to the Level I trauma centre between January 2019 and December 2020; 508

(11%) were eligible for the TSFU program. At 6-months 7% (n=37) were lost to follow-up and therefore did not proceed to 12-months; 413 participants completed follow-up resulting in a follow-up rate of 81% (n=413). At 12-months 471 participants were eligible with 384 completing follow-up with a follow-up rate of 81%.

Participant Demographics

Table 1 shows the demographic, injury and hospitalisation characteristics of the participants. Participants injured in 2019 accounted for just over half of the total amount of participants (n=273, 53.7%), compared to 2020 (n=235, 46.3%). Irrespective of year of injury, most patients were male (n=376, 74%), with a median age of 49 years (IQR 34-66) and ranged from 18 – 96 years. Around three quarters of participants were categorised as having normal health or mild systemic disease pre-injury (78.3%, n=397) [(25)]. Blunt trauma accounted for 96% (n=487) of participants with transport related and falls being the most common cause of injury. Participants were severely injured (ISS IQR 14-22) with over half (n=285, 56.1 %) having severe chest injuries (AIS ≥3) [(37)]. Almost 40% (n=202) were admitted to ICU, with a median length of stay of 8.8 days (IQR 4 – 27.3). Most participants who completed follow-up either at 6- or 12-months had undergone an operative intervention (83.3% (n=224) and 79.9% (n=215) respectively.

Over the study duration, 18.8% (n=95) of participants were lost to follow-up at 6-months, and 26% (n=124) at 12-months. Participants lost to follow-up were younger, had shorter lengths of acute care hospital stay (6-months p = 0.04; 12-months p = 0.00); if lost to follow-up at 12-months, participants were more likely to have received an operation during the trauma admission (OR 2.41, CI 1.09-2.48, p = 0.02).

Health Related Quality of Life: 6- and 12-month outcomes (EQ-5D-5L)

Table 2 summarises the health related quality of life outcomes for participants who experienced some problems (mild/moderate/severe or extreme) at 6- and 12-month time points.. At 6-months, participants reported some problems in all EQ-5D-5L domains; over 50% reported some problems with pain and/or usual activities and 49% had some problem with anxiety and/or depression. At 12-months, significant improvements occurred across all domains except for anxiety and depression (p = 0.17, CI .697 to 1.07). Whilst a reduction in the number of participants reporting ongoing problems with pain at 12-months was found, the prevalence remained over 60%.

Table 3 outlines mean (SD) VAS scores in relation to participant, injury and hospital characteristics. VAS self-reported health scores, in which participants self-reported overall health out of 100, significantly improved over time with 69.5 (23.4) reported at 6-months, and 72.5 (22.9) reported at 12-months (p = 0.01). There was no improvement between the two time points for female participants, those with severe facial, abdominal and/or extremities injuries, penetrating injuries and those who were discharged from hospital to anywhere except home. For participants discharged from acute care to a mental health facility, the self-reported mean (SD) VAS score remained under 50 at the 6- and 12-month timepoints.

Factors associated with ongoing problems (EQ-5D-5L)

Table 4 outlines the final multivariable logistic regression models for the EQ-5D-5L-outcomes. At 6 months, and after adjusting for covariates, participants who had lower extremity surgery were more likely to experience ongoing problems with pain (OR 3.77, 95% CI 1.54-9.21, *p* = 0.01), anxiety and depression (OR 1.95, 95% CI 1.09-3.48, p = 0.02) and carrying out their usual activities (OR 3.19, 95% CI 0.75-13.5, p = 0.11). This pattern, albeit with lower OR, persisted at 12-months, apart from anxiety and depression. A similar finding was made for participants who had pelvic surgery, where at 6 months, participants were the odds of reporting ongoing problems with pain five were five times greater than those who did not (OR 5.15, 95%

CI 1.52-17.3, p = <0.01). Whilst the impact of pelvic surgery in relation to usual activities did not achieve statistical significance, participants were found to be almost twice as likely to report ongoing problems with their usual activities at both 6- and 12-months. (Supplementary Material 1).

Functional Disability Outcomes (WHODAS 2.0)

Table 5 summarises the WHODAS 2.0 domains for participants with some problems at the 6- and 12-month timepoints, along with the mean (SD) disability scores (for each domain and for the total score). Over three-quarters of participants reported none or mild disability at both timepoints (6-months, n=385 (76%); 12-months n=421 (82.9%). Whilst the incidence of disability for the whole cohort decreased over time, for those participants who were identified as having a severe/very severe disability at 6-months (n=36, 7.1%), the incidence remained the similar at 12-months (n=35, 7.1%). Self-care and life activities domains achieved an improvement over time. Mild disability was found across all domains except within the mobility domain which remained at moderate disability. Results of the multivariate modelling identified that participants with lower extremity injuries or who had undergone lower extremity or pelvic surgery were more likely to have increased disability at both 6- and 12-months. This was similar to the EQ-5D-5L quality-of-life findings. (Supplementary Material 2).

DISCUSSION:

Main Findings

This innovative prospective study reports on the longitudinal functional and quality of life outcomes of 508 seriously injured patients who presented to a Level 1 trauma centre and were followed up by the trauma service clinical team. We found that seriously injured participants continue to experience long-term consequences such as persistent pain and anxiety and depression, which adversely affected their quality of life and functional capacity. Whilst

improvements between 6- and 12-months in both the quality-of-life and disability domains were reported for the full cohort, sub-groups of participants were identified who did not match this trend. Specifically, those who sustained injuries with a penetrating mechanism reported higher rates of psychological health issues and those who had sustained lower limb injuries +/- surgery reported a higher likelihood of pain. Notably, our cohort included moderately injured patients, defined by an ISS of 12 (n=17) who also experienced ongoing longitudinal impacts to their health.

Clinical Significance

Our findings in relation to pelvic and/or lower limb injuries are not dissimilar to other published studies in this area[35, 36, 38-45]. In our study, the increased likelihood of problems was found to be significantly associated with the presence of pelvic and/or lower limb surgery, rather than the injuries alone. This has been reported elsewhere, but more so in relation to orthopaedic surgery predicating severe postoperative pain in the immediate postoperative period[46]; along with age, gender, analgesia type and modality[47]. Surgeries lasting longer than 3 hours also are associated with increased pain and poor functional outcomes at 6 months in the elective surgery population[48]. To our knowledge, our study is the first to report an association between pelvic/lower limb surgery and reduced quality of life and functional longitudinal outcomes, however, the results must be interpreted with caution as our data did not contain analgesia of surgical procedure duration or quantity. Whilst surgery may be indicative of and therefore a proxy for the severity of injury, our understanding of the longer-term impact of orthopaedic surgical procedures on specific types of traumatic injuries is not clear. Further work is planned to examine this finding in more detail with a view to enabling risk stratification and producing clinically informative results[49].

Our study design identified factors associated with a reduction in quality of life and psychological health. This prompted the TSFU program to implement evidence-based

interventions to help improve the outcomes of this cohort of patients. Within Australia and New Zealand there is currently a deficit in services that offer ongoing psychological support [50] and as such, few trauma follow-up services can provide ongoing access to specialist psychological care[51]. This deficit also applies to our TSFU program where the trauma service clinicians can only advise participants to access psychological care via a referral from the General Practitioner who is linked with government led programs such as the Better Access Initiative which can offer access to mental health services, often at a reduced cost[52]. Whilst these initiatives are beneficial, many survivors of serious traumatic injury are not currently working, therefore, accessing psychological care can be out of financial reach. Additionally, depending upon a participant's geographical location, accessing these services locally may not be feasible. Recently the TSFU program has engaged with a local academic partner (Griffith University[53]) and established referral pathways for psychology services (either in person or online) at a significantly reduced financial cost by utilising supervised student clinics. With the incidence of psychological health issues following traumatic injury ranging between 10-50% [54] and the results from this study, this domain remains a central priority of our program.

Health Service Level

Previous studies have collected health outcomes from longitudinal follow-up[35, 55]; however, these have been 'one-off' or standalone research projects. Few trauma follow-up services contain a longitudinal component which persists past the immediate post discharge period (8 weeks) [50] although, anecdotally, we are aware of one other trauma service led that provides ongoing support, including psychological care, to both the patient and their family up to 2 years post injury[56]. Reasons for the absence of long-term outcomes collection in healthcare is hindered by factors such as time, resources, skills, attitudes, and clinician reluctance to change practice [57].

Our TSFU program, embedded at the health service level, is uniquely placed to inform quality improvement initiatives at the health service level which are the hallmark of a well-functioning trauma system[58]. The data collected using the standardised validated tools [18, 19] provides a structured standardised format which ensures the service provided is equitable to all, irrespective of patient or injury demographics. The 12-month duration provides a capability to monitor disease progression which can facilitate benchmarking of the patient centred care provided[15]. During implementation of the TSFU program, the trauma service clinicians actively engaged with the participants by spontaneously providing advice and guidance[24]. This 'active' participation facilitates engagement in patient reported outcome measure programs as clinicians feel like they are participating in care, rather than simply a 'hands-off' data collection process[58]. The clinician engagement provided a patient-centred focus to the TSFU program which may have contributed to successful follow-up rates.

Trauma System Level

In Australia, the system to support people with injury related disability has been recognised as being deeply flawed[59]. Embedding collection of important outcomes at designated time points in the patients' recovery at the health service level, can facilitate the understanding of injury outcomes and burden, and provide critical data for informing interventions and services capable of delivering improved long-term outcomes[9]; this is especially important in the ongoing management of injury sequalae, which is frequently provided by primary care. Problems continue to exist in relation to the misperception of traumatic injury. For example the non-specialist medical community, still considers injuries as an 'accident' and ras a list of injuries[60], rather than acknowledging the complex inter-related and chronic series of health problems requiring long term management.

To change trauma systems to encompass longitudinal care and health outcomes will require different approaches by health and policy makers[60]. Currently, the professional standards and

guidance available to trauma clinicians are silent on the collection of longitudinal outcome data[20]. Other areas of medicine that manage chronic disease have already developed programs that involve ongoing coordination and care in the community after hospital discharge. The approach to traumatic injury should therefore be no different[61].

Current and Future Plans

Since the introduction of the TSFU program that identified ongoing physical and psychological health issues in the participant cohort, the TSFU program now incorporates additional components such as consistent, evidence informed and structured advice to all participants. In addition, internal referral pathways have been developed which direct patients to either the trauma Nurse Practitioner clinic for management of acute injury related issues or to the trauma Nurse Navigator clinic, for management of more complex, long standing health issues. This divergence may limit the comparability of our results to other epidemiological trauma outcome studies. However, this proactive approach to patient care, informed by research, can ensure our patients receive the care that they need. It may well herald the next steps in the way trauma outcome research is approached.

Despite the advantages of having these resources at the health level available to the TSFU program, a gap remains in terms on ongoing trauma care within the community. To date we have had limited encounters with primary care providers to develop the knowledge and understanding of the long-term health issues encountered by patients who have experienced serious traumatic injury. The findings of this research have reinforced the need to formalise these partnerships and ensure that the ongoing care required is collaborative, multi-disciplinary, evidence-based and trauma informed.

The TSFU program has now been running for 5-years. An evaluation of the program is planned which will include both a review of the larger cohort of participant outcomes and analysis of

the advice provided, and a review of the criteria and delivery of the program. In its current format there is no capacity to expand to other cohort groups such as moderate or paediatric trauma. Whilst much of the trauma literature focuses on the major trauma cohort, most trauma in Australia is classified as moderate, therefore, collecting and reporting information on this cohort of patients is important. This is demonstrated in previous literature[35]. Based on data from the om the small group of moderately injured trauma patients in our study is is apparent that longitudinal problems are present within this group.

Strengths

To our knowledge this is the first prospective longitudinal follow-up project that is permanently embedded within a trauma service clinical team in Australia, and uses validated patient reported outcome measurement tools. Whilst other studies have previously reported outcomes collected by other trauma services [35, 55] it is our understanding that these were 'project-specific' and not part of usual trauma service business. The trauma clinicians who undertook the follow-up in our study were known to the patients. These pre-established relationships,[24], could have contributed to the study validity by the high rates of successful follow-up at both the 6- and 12-months. Lastly, as our program utilises the same tools as the VSTORM program[10], the foundation for future comparative and collaborative work with the VSTORM team is possible

Limitations

The reporting of these findings from a single centre study means the results should be interpreted with caution. Yet, the physical and emotional health issues identified align with the wider literature in this area, therefore adding to the validity of our work. It is important to acknowledge responder bias with younger patients and those with a shorter length of hospital

stay less likely to complete follow-up. Additionally, the small sample of patients with moderate trauma limits the wider generalisability of the findings in this sub-group.

CONCLUSION:

Persistent impairments in physical and emotional health continue to affect many patients following serious traumatic injury; in particular, lower limb and pelvic injuries/surgery which requires further examination. The collection of longitudinal health outcomes by trauma clinicians enables identification of factors that contribute to a reduction in quality of life and disability. Importantly, this in turn can help to inform quality improvement initiatives within the localised trauma system. Longitudinal follow-up programs delivered by trauma clinicians may provide a platform to provide ongoing specialist trauma informed care after trauma centre discharge.

Credit authorship contribution statement

Elizabeth Wake: Conceptualisation, Formal analysis, Methodology, Project Administration, Writing – original draft, Writing – review & editing; Ian Hughes – Formal analysis, Writing – review and editing; Katharine Heathcote – Methodology, Writing – original draft, Writing – review & editing; Charlotte Winkleman – data collection, Writing – review & editing; Kate Dale – Conceptualisation, Methodology, Writing - review & editing.

Declaration of competing interest

The authors declare no competing interests.

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Figure 1 – STROBE

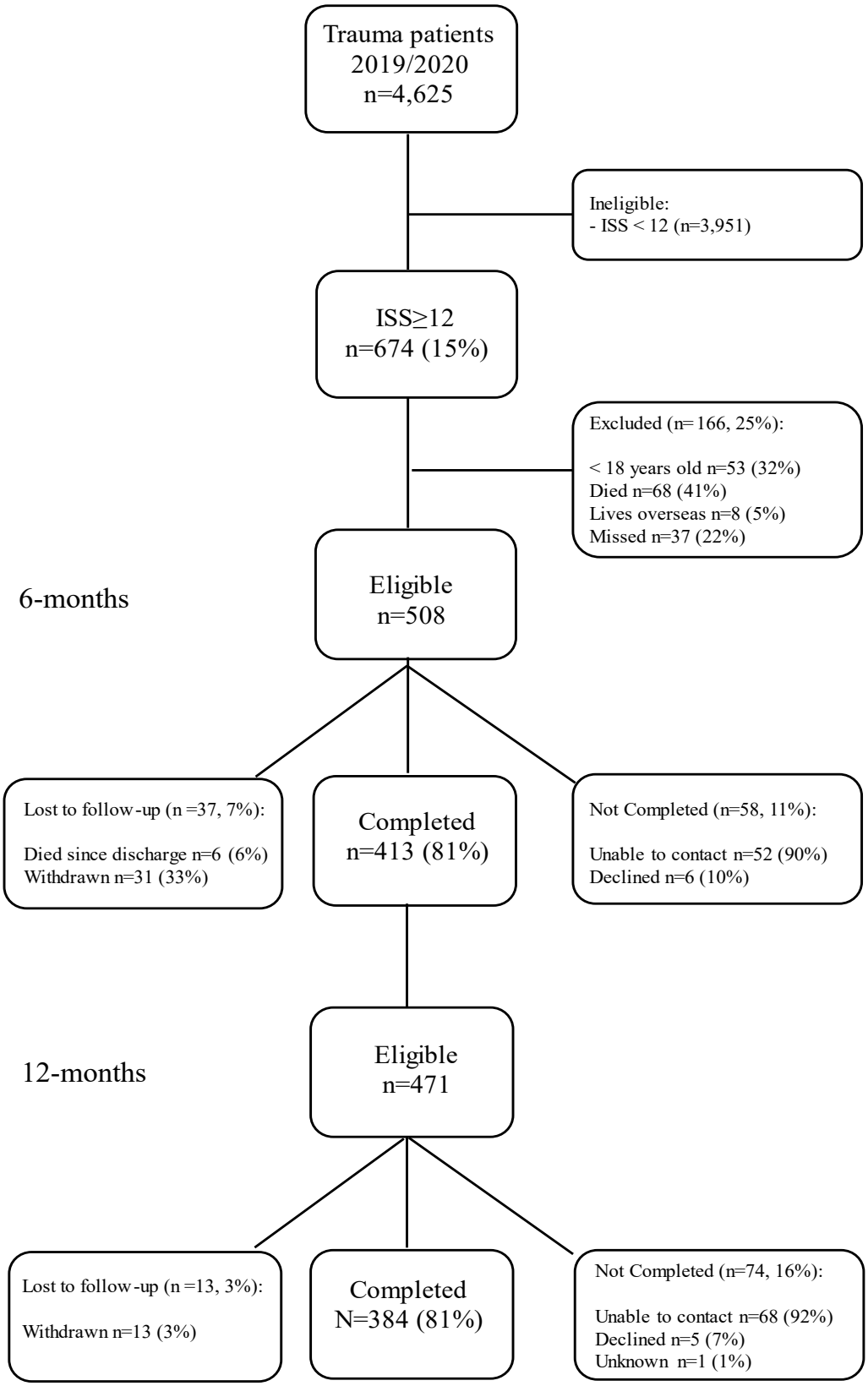

Table 1 Participant Demographics

	Eligible N=508	**6- Months** N=413 (81.3%)	**12 Months** N=384 (75.6%)
Gender (n, %)			
- Male	376 (74%)	309 (74.8%)	285 (74.2%)
Age*	49 (33.5 – 65.5)	50 (34-66)	50.5 (34 – 67.5)
ASA[¥] (n, %)			
- Normal Health	189 (37.3%)	153 (37%)	149 (38.8%)
- Mild Disease	208 (41%)	169 (40.9%)	151 (39.3%)
- Severe disease	98 (19.3%)	82 (19.9%)	75 (19.5%)
- Threat to Life	12 (2.4%)	8 (1.9%)	8 (2.1%)
Region of Residence			
-Major city	284 (55.9%)	231 (55.9%)	211 (54.9%)
-Inner regional	214 (42.1)	174 (42.1%)	165 (42.9%)
-Outer regional	7 (1.4%)	7 (1.7%)	6 (1.6%)
-Remote	3 (0.6%)	1 (0.2%)	2 (0.5%)
-Very remote	0	0	0
MOI			
-Blunt	487 (95.9%)	399 (96.6%)	372 (96.9%)
-Penetrating	19 (3.7%)	12 (2.9%)	10 (2.6%)
-Other	2 (0.4%)	2 (0.5%)	2 (0.5%)
Injury Event			
-Transport Related	240 (47.2%)	196 (47.5%)	185 (48.2%)
-Pedestrian	39 (7.7%)	29 (7%)	31 (8.1%)
-Falls	145 (28.5%)	119 (28.8%)	110 (28.7%)
-Water related	20 (3.9%)	19 (4.6%)	16 (4.2%)
-Assault	32 (6.3%)	23 (5.6%)	16 (4.2%)
-Other	32 (6.3%)	27 (6.5%)	26 (6.8%)
ISS	17 (14-22)	17 (14-22)	17 (14-22)
AIS ≥ 3			
-Head	149 (29.3%)	120 (29.1%)	115 (29.9%)
-Face	19 (3.7%)	13 (3.1%)	13 (3.4%)
-Chest	285 (56.1%)	234 (56.7%)	212 (55.2%)
-Abdomen	92 (18.1%)	79 (19.1%)	72 (18.8%)
-Extremity	105 (20.7%)	88 (21.3%)	86 (22.3%)
-External	3 (0.6%)	2 (0.5%)	3 (0.8%)
ICU LOS (hours)*	61.7 (28 – 190.9)	63.8 (33.4-214.9)	64.1 (31.6-213.7)
Hospital LOS (hours)*	166 (92.7-305.6)	168 (95.6-308.3)	180 (100.4-321.8)
MV Duration (hours)*	86.5 (23.5 – 226.5)	93 (28-238)	109 (35.5-245.5)
Operative Procedure	269 (52.9%)	224 (83.3%)	215 (79.9%)
Discharge Disposition			
- Home	380 (74.8%)	307 (74.3%)	286 (74.5%)
- Rehabilitation	44 (8.7%)	38 (9.2%)	39 (10.2%)
- Other hospital	72 (14.2%)	60 (14.5%)	52 (13.5%)
- Nursing Home	1 (0.2%)	1 (0.24%)	1 (0.3%)
- Mental Health	9 (1.8%)	7 (1.7%)	6 (1.6%)
- Other	2 (0.4%)	0	0

¥ 507 participants

ASA – American Society of Anaesthesiologist; ICU – Intensive Care Unit; LOS - length of stay; MV- Mechanical Ventilation; AIS – Abbreviated Injury Score; MOI - Mechanism of Injury; ISS – Injury Severity Score

Table 2: 6- and 12-month Health Related Quality of Life Outcomes

	6-months N=413	**12-months N=384**	***P* value**
EQ-5D-5L domains			
Mobility			
- Some Problems	163 (39.6%)	129 (33.9%)	**0.01**
- Not answered	1	4	
Self-Care			
- Some Problems	92 (22.3%)	63 (16.6%)	**<0.01**
- Not answered	1	4	
Usual Activities			
- Some Problems	235 (57.5%)	162 (42.9%)	**0.00**
- Not answered	4	6	
Anxiety & Depression			
- Some Problems	201 (49%)	159 (43.8%)	0.17
- Not answered	3	21	
Pain/Discomfort			
- Some Problems	285 (69.9%)	229 (61.4%)	**<0.01**
- Not answered	5	11	
VAS Health State (mean, SD)			
- Today	69.5 (23.4)	72.5 (22.9)	**0.01**
- Prior	83.9 (19.4)	86.7 (15.6)	**0.02**

VAS – visual analogue scale; SD – Standard Deviation; P value reflects overall change in group.

Table 3: Self-Reported Health (VAS) Score and patient, injury and hospital characteristics at 6- and 12-months

	6m	**12m**	**6m/12m Today**
	Today N=399	**Today N=363**	P
Gender			
- Male	68.2 (24.2)	73.4 (21.8)	**<0.01**
-Female	73.7 (20.4)	69.8 (25.6)	0.24
ASA¥			
- Normal Health	74.8 (20.9)	78.8 (19.1)	**0.01**
- Mild Disease	66.2 (23.7)	69.6 (21.8)	**0.04**
- Severe disease	67.8 (24.1)	66.5 (27.7)	0.96
- Threat to Life	54.4 (32)	63.8 (31.9)	0.29
MOI			
-Blunt	70.2 (22.8)	74.7 (18.4)	**0.01**
-Penetrating	51.7 (29.7)	68 (23.6)	0.54
-Other	52.5 (45.9)	68 (19.1)	0.50
AIS ≥ 3			
-Head	67.8 (24.2)	71.2 (23.5)	**0.01**
-Face	64 (26.8)	76.5 (20.1)	0.15
-Chest	69.2 (24.1)	73.3 (23.6)	**0.02**
-Abdomen	69.5 (23)	70.8 (21.2)	0.82
-Extremity	62.3 (25.7)	65.5 (20.8)	0.10
-External	52.5 (10.6)	70 (0)	0.26
LOS			
-< 7 days	73.2 (22.9)	76.2 (21.3)	**0.01**
-≥ 7 days	65.9 (23.2)	69.1 (23.7)	0.13
Discharge Disposition			
- Home	84.1 (17.9)	73.9 (22.3)	**0.02**
- Rehabilitation	87.5 (16.3)	71.3 (25.1)	0.97
- Other hospital	87.3 (15.2)	68.9 (22.2)	0.19
- Nursing Home	-	50 (0)	-
- Mental Health	40 (40.8)	46 (28.2)	0.34

** 507 participants; ASA – American Society of Anaesthesiologists; MOI – mechanism of injury; LOS – length of stay; AIS – Abbreviated Injury Score*

Table 4 Factors associated with ongoing problems (EQ-5D-5L) at 6- and 12-months

		95% CI		
6-months	**OR***	**Lower**	**Upper**	**P Value**
Pain				
Injuries				
- C spine	2.69	1.20	6.01	**0.02**
- L spine	2.49	1.23	5.01	**0.01**
Surgery				
- Pelvis	5.15	1.52	17.3	**0.01**
- Lower extremity	3.77	1.54	9.21	**<0.01**
Usual activities				
Injuries				
- Lower extremity	2.60	0.59	11.5	0.21
Hospital				
- Mv	2.21	1.11	4.39	**0.03**
Surgery				
- Upper extremity	4.15	1.29	13.4	**0.02**
- Lower extremity	3.19	0.75	13.5	0.11
- Pelvis	1.85	0.53	6.45	0.33
Anxiety & depression				
Surgery				
- Lower extremity	1.95	1.09	3.48	**0.02**
		95% CI		
12-months	**OR***	**Lower**	**Upper**	**P Value**
Pain				
Injuries				
- C spine	2.31	1.10	4.83	**0.04**
- L spine	1.87	1.00	3.50	0.06
- Lower extremity	1.95	0.85	4.51	0.11
Surgery				
- Lower extremity	3.70	1.24	1.24	**0.02**
- Pelvis	3.40	1.45	9.31	**0.01**
Usual activities				
Surgery				
- Upper extremity	1.81	0.94	3.50	0.08
- Lower extremity	2.87	1.56	5.27	**0.00**
- Pelvis	1.63	0.79	3.36	0.18
Anxiety & depression				
Patient				
- Female	1.91	1.18	3.09	**0.01**
Hospital	1.62	1.05	2.51	**0.03**
- ICU admission	1.66	0.86	3.18	0.13
Surgery				
- Upper extremity				

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine
** The comparison group refers to the absence of that specific injury*

Table 5: 6- and 12-month Functional Outcomes (WHODAS 2.0)

	6m N=508	**12m N=508**	***P* Value**
WHODAS Domains	N, %	N, %	
Domain 1: Cognition			
Concentrating for 10 minutes			
- Some Problems	108 (26.9%)	84 (22.6%)	0.12
- Not answered	11	13	
Learning a new task		70 (18.9%)	**0.06**
- Some Problems	91 (23.2%)	15	
Not answered	20		
[1]Mean (SD), n of Score=0	3 (1.9), 373	2.8 (2.1), 396	**0.005**
Disability level	Mild	Mild	
[2]Domain Score change			-0.19
Domain 2: Mobility			
Standing for long periods			
- Some Problems	145 (35.5%)	125 (33.2%)	0.54
- Not answered	4	8	
Walking a long distance			
- Some Problems	150 (37%)	116 (31.2%)	**0.01**
- Not answered	8	12	
[1]Mean (SD), n of Score=0	4.7 (2.7), 332	4.5 (2.7), 358	**< 0.0001**
Disability level	Moderate	Moderate	
[2]Domain Score change			-0.31
Domain 3: Self Care			
Washing your whole body			
- Some Problems	83 (20.3%)	50 (13.2%)	**< 0.0001**
- Not answered	4	5	
Getting dressed			
- Some Problems	88 (22.3%)	64 (16.8%)	**0.007**
Not answered	19	4	
[1]Mean (SD), n of Score=0	2.9 (1.5), 400	3.4 (2.6), 439	**0.007**
Disability level	Mild	Mild	
[2]Domain Score change			-0.16
Domain 4: Getting along			
Dealing with people you do not know			
- Some Problems	86 (21.4%)	61 (16.6%)	**0.05**
- Not answered	11	17	
Maintaining friendship			
- Some Problems	93 (23.2%)	74 (19.6%)	0.10
- Not answered	12	7	
[1]Mean (SD), n of Score=0	2.9 (2.1), 385	3.1 (1.9), 413	0.07
Disability level	Mild	Mild	
[2]Domain Score change			-0.14

Domain 5: Life Activities			
Household Responsibilities			
- Some Problems	175 (42.9)	124 (35%)	**0.001**
- Not answered	5	30	
Day to day work			
- Some Problems	192 (48.1%)	142 (38.6%)	**< 0.0001**
- Not answered	14	16	
[1]Mean, SD	3.6 (2.2) 278	3.5 (2.3) 336	**< 0.0001**
Disability level	Mild	Mild	
[2]Domain Score change			-0.45
Domain 6: Participation			
Joining in community activity			
- Some Problems	135 (34%)	112 (30.6%)	0.15
- Not answered	16	18	
Emotional Health			
- Some Problems	248 (61.1%)	201 (54.2%)	**0.02**
- Not answered	7	13	
[1]Mean, SD	3.1 (1.9) 239	3 (2) 286	**0.0001**
Disability level	Mild	Mild	
[2]Domain Score change			-0.33
Mean Disability Score	23.0 (20.2)	21.5 (21.0)	**< 0.0001**
[2]Domain Score change			-3.3

1 Mean and Standard Deviation (SD) of Domain Score of those with problems (Scores 1 to 4). Number with no problems (Score=0).
2 P-value relates to the overall Domain Score change, ie includes both patients with no problems and those reporting problems.

Supplementary Material 1 – EQ-5D-5L – Uni & Multivariate Modelling

Pain & Significant Covariates - Some problems (mild/moderate/severe/extreme)

	6-Months		P value	12-Months		P value
	No Problems	Some Problems		No Problems	Some Problems	
Gender						
- **Male**	97 (78.1%)	209 (73.3%)	0.31	110 (76.4%)	165 (72.1%)	0.35
- **Female**	27 (21.9%)	76 (26.7%)		34 (23.6%)	64 (27.9%)	
Abdominal Injury						
- **Solid organ**	21 (14.6%)	30 (13.1%)	0.69	21 (14.6%)	30 (13.1%)	0.69
- **Hollow organ**	6 (4.2%)	10 (4.4%)	0.93	6 (4.2%)	10 (4.4%)	0.93
- **Vascular**	11 (7.6%)	13 (5.7%)	0.45	11 (7.6%)	13 (5.7%)	0.45
- **L Spine**	17 (11.8%)	49 (21.4%)	**0.01**	17 (11.8%)	49 (21.4%)	**0.01**
Chest Injury						
- **Ribs**	75 (52.1%)	107 (46.7%)	0.31	75 (52.1%)	107 (46.7%)	0.31
- **Sternum**	8 (5.6%)	20 (8.7%)	0.26	8 (5.6%)	20 (8.7%)	0.26
- **Lung**	51 (35.4%)	69 (30.1%)	0.28	51 (35.4%)	69 (30.1%)	0.28
- **Heart**	3 (2.1%)	4 (1.8%)	0.81	3 (2.1%)	4 (1.8%)	0.81
- **Vascular**	2 (1.4%)	1 (0.4%)	0.31	2 (1.4%)	1 (0.4%)	0.31
- **T Spine**	25 (17.4%)	41 (17.9%)	0.89	25 (17.4%)	41 (17.9%)	0.89
Extremity						
- **Upper**	43 (29.8%)	74 (32.3%)	0.61	43 (29.8%)	74 (32.3%)	0.61
- **Lower**	10 (6.9%)	51 (22.3%)	**0.00**	10 (6.9%)	51 (22.3%)	**0.00**
- **Pelvis**	15 (10.4%)	47 (20.5%)	**0.01**	15 (10.4%)	47 (20.5%)	**0.01**
- **Vascular**	0	1 (0.4%)	0.43	0	1 (0.4%)	0.43
Neck						
- **Vascular**	3 (2.1%)	3 (1.3%)	0.56	3 (2.1%)	3 (1.3%)	0.56
- **C Spine**	11 (7.6%)	35 (15.3%)	**0.02**	11 (7.6%)	35 (15.3%)	**0.02**
ICU Admission						
- **Yes**	61 (42.4%)	97 (42.4%)	1.0	61 (42.4%)	97 (42.4%)	1.0
MV						
- **Yes**	27 (44.3%)	53 (54.6%)	0.20	27 (44.3%)	53 (54.6%)	0.20
Surgical Procedure						
- **Yes**	78 (54.2%)	131 (57.2%)	0.57	78 (54.2%)	131 (57.2%)	0.57
Surgical Procedure in 24h						
- **Yes**	24 (16.7%)	49 (21.4%)	0.26	24 (16.7%)	49 (21.4%)	0.26
Surgical Procedure Type						
- **Abdominal**	23 (15.9%)	31 (13.5%)	0.51	23 (15.9%)	31 (13.5%)	0.51
- **Chest**	28 (19.4%)	33 (14.4%)	0.20	28 (19.4%)	33 (14.4%)	0.20
- **Upper Extremity**	15 (10.4%)	29 (12.7%)	0.51	15 (10.4%)	29 (12.7%)	0.51

-	**Lower Extremity**	7 (4.9%)	51 (22.3%)	**0.00**	7 (4.9%)	51 (22.3%)	**0.00**
-	**Pelvic**	5 (3.5%)	31 (13.5%)	**0.00**	5 (3.5%)	31 (13.5%)	**0.00**
-	**Spinal**	3 (2.1%)	3 (1.3%)	0.56	3 (2.1%)	3 (1.3%)	0.56

L Spine – lumbar spine; T spine – thoracic spine; C-Spine – cervical spine; ICU – Intensive Care Unit; MV – mechanical ventilation

EQ-5D-5L/Pain – Multivariate Model Building -6-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
6-months				
- L spine	2.77	1.40	5.47	**0.00**
- L spine	2.73	1.37	5.42	**0.00**
- Lower Extremity	3.12	1.48	6.55	**0.00**
- L spine	2.38	0.18	4.78	**0.02**
- Lower Extremity	2.84	1.33	6.00	**0.00**
- Pelvic Injury	2.19	1.05	4.56	**0.04**
- L spine	2.18	1.08	4.41	**0.03**
- Lower Extremity	2.70	1.27	5.75	**0.01**
- Pelvic Injury	2.30	1.11	4.80	**0.03**
- C-Spine	2.43	1.08	5.42	**0.03**
- L spine	2.26	1.11	4.58	**0.02**
- Lower Extremity	1.69	0.72	3.94	0.22
- Pelvic Injury	2.17	1.03	4.56	**0.03**
- C-Spine	2.50	1.12	5.60	**0.03**
- Lower Extremity Surgery	2.92	1.08	7.83	**0.03**
- L spine	2.35	1.16	4.79	**0.02**
- Pelvic Injury	1.45	0.65	3.22	0.37
- C-Spine	2.71	1.21	6.05	**0.02**
- Lower Extremity Surgery	3.64	1.49	8.92	**0.01**
- Pelvic Surgery	4.18	1.15	15.24	**0.03**
Final Model				
- L spine	2.49	1.23	5.02	**0.01**
- C-Spine	2.69	1.20	6.02	**0.02**
- Lower Extremity Surgery	3.77	1.54	9.21	**0.00**
- Pelvic Surgery	5.15	1.52	17.39	**0.01**

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine; T-Spine – Thoracic Spine

EQ-5D-5L/Pain – Multivariate Model Building -12-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
12-months				
- L spine	2.03	1.11	3.69	**0.02**
- L spine	2.08	1.13	3.81	**0.02**
- Lower Extremity	3.89	1.90	7.98	**0.00**
- L spine	1.85	0.99	3.46	**0.05**
- Lower Extremity	3.68	1.79	7.58	**0.00**
- Pelvic Injury	1.66	0.85	3.20	0.13
- L spine	1.99	1.08	3.67	**0.02**
- Lower Extremity	3.81	1.85	7.83	**0.00**
- C-Spine	1.98	0.95	4.11	**0.06**
- L spine	2.06	1.17	3.81	**0.02**
- Lower Extremity	1.92	0.85	4.37	0.12
- C-Spine	2.13	1.02	4.45	**0.04**
- Lower Extremity Surgery	4.24	1.69	10.6	**0.00**
Final Model				
- L spine	1.88	1.00	3.50	**0.05**
- Lower Extremity	1.95	0.85	4.51	0.11
- C-Spine	2.31	1.10	4.83	**0.03**
- Lower Extremity Surgery	3.71	1.45	9.47	0.01
- Pelvic Surgery	3.40	1.24	9.31	**0.02**

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine

Usual Activities & Significant Covariates - Some Problems (mild/moderate/severe/extreme)

	6-Months		P value	12-Months		P value
	No Problems	Some Problems		No Problems	Some Problems	
Gender						
- **Male**	134 (43.9%)	171 (56.1%)	0.33	163 (58.2%)	117 (41.8%)	0.48
- **Female**	40 (38.5%)	64 (61.5%)		53 (54.1%)	45 (45.9%)	
Abdominal Injury						
- **Solid organ**	28 (51.9%)	26 (48.2%)	0.14	30 (58.8%)	21 (41.2%)	0.79
- **Hollow organ**	2 (11.8%)	15 (88.2%)	0.01	6 (35.3%)	11 (64.7%)	**0.06**
- **Vascular**	6 (24%)	19 (76%)	0.05	10 (41.7%)	14 (58.3%)	0.11
- **L Spine**	25 (35.2%)	46 (64.8%)	0.17	33 (50%)	33 (50%)	0.19
Chest Injury						
- **Ribs**	98 (47.8%)	107 (52.2%)	**0.03**	110 (59.8%)	74 (40.2%)	0.31
- **Sternum**	12 (37.5%)	20 (62.5%)	0.55	14 (50%)	14 (50%)	0.43
- **Lung**	65 (48.5%)	69 (51.5%)	0.09	68 (55.7%)	54 (44.3%)	0.70
- **Heart**	2 (25%)	6 (75%)	0.31	2 (28.6%)	5 (71.4%)	0.12
- **Vascular**	1 (33.3%)	2 (66.7%)	0.75	1 (33.3%)	2 (66.7%)	0.40
- **T Spine**	30 (42.3%)	41 (57.8%)	0.96	36 (54.6%)	30 (45.5%)	0.64
Extremity						
- **Upper**	50 (40.3%)	74 (59.7%)	0.55	72 (61.5%)	45 (38.5%)	0.25
- **Lower**	17 (25.4%)	50 (74.6%)	**0.00**	25 (39.7%)	38 (60.3%)	**0.00**
- **Pelvis**	19 (27.5%)	50 (72.5%)	**0.00**	32 (50.8%)	31 (49.2%)	0.27
- **Vascular**	0	2 (100%)	0.22	1 (50%)	1 (50%)	0.84
Neck						
- **Vascular**	2 (28.6%)	5 (71.4%)	0.45	3 (50%)	3 (50%)	0.72
- **C Spine**	17 (31.5%)	37 (68.5%)	0.08	22 (47.8%)	24 (52.2%)	0.17
ICU Admission						
- **Yes**	64 (38.8%)	101 (61.2%)	0.21	86 (54.8%)	71 (45.2%)	0.43
MV						
- **Yes**	25 (29.4%)	60 (70.6%)	**0.01**	38 (47.5%)	42 (52.5%)	0.06
Surgical Procedure						
- **Yes**	83 (37.4%)	139 (62.6%)	**0.02**	106 (50.2%)	105 (49.8%)	**0.00**
Surgical Procedure in 24h						
- **Yes**	28 (33.3%)	56 (66.7%)	**0.05**	34 (45.9%)	40 (54.1%)	**0.03**
Surgical Procedure Type				25 (45.5%)	30 (54.6%)	**0.05**
- **Abdominal**	25 (42.4%)	34 (57.6%)	0.98	36 (59%)	25 (40.9%)	0.75
- **Chest**	29 (43.3%)	38 (56.7%)	0.89	18 (40%)	27 (60%)	**0.01**
- **Upper Extremity**	11 (24.4%)	34 (75.6%)	**0.01**	19 (32.8%)	39 (67.2%)	**0.00**
- **Lower Extremity**	8 (14.3%)	48 (85.7%)	**0.00**	15 (40.5%)	22 (59.5%)	**0.03**
- **Pelvic**	4 (9.8%)	37 (90.2%)	**0.00**	2 (33.3%)	4 (66.7%)	0.24
- **Spinal**	2 (33.3%)	4 (66.7%)	0.65			

L Spine – lumbar spine; T spine – thoracic spine; C-Spine – cervical spine; ICU – Intensive Care Unit; MV – mechanical ventilation

EQ-5D-5L/Usual Activities – Multivariate Model Building – 6-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
6-months				
- Rib Injury	0.65	0.44	0.96	**0.03**
- Rib Injury	0.60	0.40	0.90	**0.01**
- Lower Extremity	2.68	1.47	4.86	**0.00**
- Rib Injury	0.58	0.38	0.85	**0.01**
- Lower Extremity	2.40	1.31	4.40	**0.00**
- Pelvic Injury	2.16	1.19	3.89	**0.01**
- Rib Injury	0.64	0.31	1.32	0.23
- Lower Extremity	5.71	1.54	21.2	**0.01**
- Pelvic Injury	1.67	0.55	5.06	0.36
- MV	1.91	0.97	3.77	0.06
- Lower Extremity	5.17	1.41	18.2	**0.01**
- Pelvic Injury	1.44	0.49	4.23	0.51
- MV	2.09	1.08	4.04	**0.03**
- Lower Extremity	5.78	1.64	20.3	**0.01**
- MV	2.08	1.08	4.02	**0.03**
- Lower Extremity	5.73	1.60	20.5	**0.01**
- MV	2.07	1.07	4.03	**0.03**
- Surgical Procedure	1.02	0.48	2.17	0.95
- Lower Extremity	5.69	1.61	20.03	0.08
- MV	2.02	1.04	3.94	**0.04**
- Surgical Procedure 24h	1.19	0.59	2.37	0.62
- Lower Extremity	5.57	1.56	19.9	**0.01**
- MV	2.22	1.12	4.39	**0.02**
- Upper Extremity Surgery	5.06	1.61	15.89	**0.01**
- Lower Extremity	3.05	0.72	12.8	0.13
- MV	2.21	1.11	4.38	**0.02**
- Upper Extremity Surgery	4.40	1.37	14.1	**0.01**
- Lower Extremity Surgery	3.31	0.79	13.7	0.10
Final Model				
- Lower Extremity	2.60	0.59	11.5	0.21
- MV	2.20	1.11	4.39	**0.03**
- Upper Extremity Surgery	4.15	1.29	13.4	**0.02**
- Lower Extremity Surgery	3.19	0.75	13.5	0.11
- Pelvic Surgery	1.85	0.53	6.45	0.33

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine

EQ-5D-5L/Usual Activities – Multivariate Model Building – 12-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
12-months				
- Hollow organ	2.54	0.92	7.04	0.07
- Hollow organ	2.13	0.76	6.03	0.15
- Lower Extremity	2.22	1.27	3.89	**0.01**
- Hollow organ	1.72	0.60	4.93	4.93
- Lower Extremity	2.01	1.14	3.54	3.54
- Op Procedure	1.68	1.09	2.58	2.59
- Hollow organ	1.69	0.59	4.85	0.33
- Lower Extremity	2.00	1.13	3.53	**0.02**
- Surgical Procedure	1.56	0.97	2.50	0.07
- Surgical Procedure in 24h	1.25	0.70	2.22	0.45
- Hollow organ	1.54	0.51	4.62	0.44
- Lower Extremity	2.05	1.16	3.63	**0.01**
- Surgical Procedure	1.59	1.00	2.51	**0.05**
- Abdominal Surgery	1.27	0.65	2.43	0.48
- Hollow organ	1.67	0.58	4.82	0.34
- Lower Extremity	2.03	1.15	3.59	**0.01**
- Surgical Procedure	1.50	0.95	2.37	0.08
- Upper Limb Surgery	1.69	0.86	3.34	0.13
- Hollow organ	1.69	0.57	4.97	0.34
- Lower Extremity	1.42	0.73	2.78	0.30
- Upper Limb Surgery	1.86	0.95	3.59	0.07
- Lower Limb Surgery	2.39	1.17	4.85	**0.02**
- Hollow organ	1.53	0.51	4.58	0.44
- Upper Limb Surgery	1.78	0.92	3.45	0.08
- Lower Limb Surgery	2.78	1.51	5.14	**0.00**
- Pelvic Surgery	1.55	0.75	3.24	0.24
Final Model				
- Upper Limb Surgery	1.81	0.94	3.50	0.08
- Lower Limb Surgery	2.87	1.56	5.27	**0.00**
- Pelvic Surgery	1.63	0.79	3.36	0.18

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine; Op - operation

Anxiety/Depression & Significant Covariates - Some Problems (mild/moderate/severe/extreme)

	6-Months		P value	12-Months		P value
	No Problems	Some Problems		No Problems	Some Problems	
Gender						
- **Male**	160 76.6%)	147 (73.1%)	0.42	162 (79.4%)	108 (67.9%)	**0.01**
- **Female**	49 (23.4%)	54 (26.9%)		42 (20.6%)	51 (32.1%)	
Abdominal Injury						
- **Solid organ**	27 (12.9%)	27 (13.4%)	0.88	28 (13.7%)	19 (11.9%)	0.62
- **Hollow organ**	5 (2.4%)	11 (5.5%)	0.11	10 (4.9%)	7 (4.4%)	0.82
- **Vascular**	13 (6.2%)	12 (5.9%)	0.91	12 (5.9%)	12 (7.6%)	0.53
- **L Spine**	30 (14.4%)	42 (20.9%)	0.08	36 (17.7%)	29 (18.2%)	0.88
Chest Injury						
- **Ribs**	113 (54.1%)	92 (45.8%)	0.09	114 (55.9%)	61 (38.4%)	**0.00**
- **Sternum**	18 (8.6%)	14 (6.9%)	0.53	16 (7.8%)	12 (7.6%)	0.92
- **Lung**	65 (31.1%)	70 (34.8%)	0.42	76 (37.3%)	39 (24.5%)	**0.01**
- **Heart**	5 (2.4%)	3 (1.5%)	0.51	4 (1.9%)	3 (1.9%)	0.95
- **Vascular**	2 (0.9%)	1 (0.5%)	0.59	2 (0.9%)	1 (0.6%)	0.71
- **T Spine**	34 (16.3%)	37 (18.4%)	0.57	42 (20.6%)	22 (13.8%)	0.09
Extremity						
- **Upper**	64 (30.6%)	61 (30.4%)	0.95	69 (33.8%)	46 (28.9%)	0.32
- **Lower**	29 (13.9%)	39 (19.4%)	0.13	31 (15.2%)	27 (16.9%)	0.65
- **Pelvis**	32 (15.3%)	37 (18.4%)	0.40	36 (17.7%)	25 (15.7%)	0.62
- **Vascular**	0	1 (0.5%)	0.30	2 (0.98)	0	0.21
Neck						
- **Vascular**	2 (0.9%)	5 (2.5%)	0.23	4 (1.9%)	2 (1.3%)	0.60
- **C Spine**	26 (12.4%)	28 (13.9%)	0.65	30 (14.7%)	15 (9.4%)	0.13
ICU Admission						
- **Yes**	78 (37.3%)	87 (43.3%)	0.21	77 (37.8%)	79 (49.7%)	**0.02**
MV						
- **Yes**	37 (47.4%)	48 (55.2%)	0.32	34 (44.2%)	44 (55.7%)	0.15
Surgical Procedure						
- **Yes**	112 (53.6%)	110 (54.7%)	0.82	108 (52.9%)	94 (59.1%)	0.24
Surgical Procedure in 24h						
- **Yes**	40 (19.1%)	43 (21.4%)	0.57	38 (18.6%)	34 (21.4%)	0.51
Surgical Procedure Type						
- **Abdominal**	30 (14.4%)	28 (13.9%)	0.90	23 (11.3%)	30 (18.9%)	**0.04**
- **Chest**	40 (19.1%)	27 (13.4%)	0.12	36 (17.7%)	22 (13.8%)	0.32
- **Upper Extremity**	21 (10.1%)	23 (11.4%)	0.65	19 (9.3%)	26 (16.4%)	**0.04**
- **Lower Extremity**	21 (10.1%)	36 (17.9%)	**0.02**	27 (13.2%)	29 (18.2%)	0.19
- **Pelvic**	17 (8.1%)	24 (11.9%)	0.19	16 (7.8%)	21 (13.2%)	0.09
- **Spinal**	4 (1.9%)	2 (1%)	0.44	3 (1.5%)	3 (1.9%)	0.76

L Spine – lumbar spine; T spine – thoracic spine; C-Spine – cervical spine; ICU – Intensive Care Unit; MV – mechanical ventilation

EQ-5D-5L/Anxiety & Depression - Multivariate Model Building – 6-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
6-months				
Final Model				
- Lower Limb Surgery	1.95	1.09	3.48	**0.02**

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine; Op - operation

EQ-5D-5L/Anxiety & Depression - Multivariate Model Building – 12-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
12-months				
- Gender				
o Male	0.54	0.34	0.88	**0.01**
o Female	1.82	1.13	2.93	**0.01**
- Female	1.88	1.16	3.05	**0.01**
- Rib Injury	0.48	0.31	0.74	**0.00**
- Female	1.75	1.09	2.84	**0.02**
- Lung Injury	0.56	0.36	0.89	**0.02**
- Female	1.93	0.19	3.12	**0.01**
- ICU Admission	1.72	1.12	2.63	**0.01**
- Female	1.93	1.19	3.15	**0.01**
- ICU Admission	1.55	0.99	2.44	0.06
- Abdominal Surgery	1.55	0.83	2.90	0.17
Final Model				
- Female	1.91	1.18	3.09	**0.01**
- ICU Admission	1.62	1.05	2.51	**0.03**
- Upper Limb Surgery	1.66	0.86	3.18	0.13

CI – Confidence Interval; C Spine – Cervical Spine; L-Spine – Lumbar spine; Op - operation

Supplementary Material 2 – WHODAS 2.0 – Uni & Multivariate Modelling

6 Month Disability Levels – Covariates & Disability levels

	6-Months				12-Months			
		95% CI				95% CI		
	OR	Lower	Higher	P	OR	Lower	Higher	P
Gender								
- **Male**	0.88	0.59	1.32	0.54	0.68	0.45	1.01	0.06
- **Female**	1.13	0.76	1.19	0.54	1.47	0.98	2.19	0.06
-								
ISS	1.04	1.01	1.07	**0.00**	1.05	1.02	1.08	**0.00**
ASA¥								
- Normal Health	0.51	0.35	0.74	**0.00**	0.59	0.41	0.88	**0.01**
- Mild Disease	1.73	1.17	2.59	**0.01**	1.41	0.93	2.12	0.11
- Severe disease	2.50	1.51	4.14	**0.00**	2.39	1.44	3.95	**0.00**
- Threat to Life	2.13	0.65	6.95	0.21	1.57	0.48	5.16	0.45
MOI								
-Blunt	0.91	0.38	2.17	0.82	1.27	0.50	3.20	3.20
-Penetrating	1.12	0.45	2.79	0.81	0.73	0.27	0.27	1.94
-Other	1.00	0.06	16.1	0.99	1.58	0.98	0.98	25.4
Abdominal Injury								
- **Solid organ**	0.81	0.48	1.37	0.42	0.81	0.47	1.41	0.46
- **Hollow organ**	2.37	0.95	5.87	0.06	1.48	0.64	3.44	0.93
- **Vascular**	1.39	0.68	2.83	0.37	0.90	0.43	1.88	0.79
- **L Spine**	1.37	0.85	2.19	0.19	1.27	0.31	0.79	2.05
Chest Injury								
- **Ribs**	1.37	0.86	2.18	0.19	0.79	0.56	1.14	0.22
- **Sternum**	1.26	0.65	2.44	0.50	1.86	0.96	3.60	0.07
- **Lung**	1.09	0.75	1.59	0.64	0.71	0.08	0.48	1.05
- **Heart**	1.26	0.33	4.73	0.74	2.01	0.30	0.54	7.59
- **Vascular**	0.49	0.45	5.52	0.57	3.21	0.29	35.6	0.34
- **T Spine**	0.84	0.53	1.35	0.47	0.86	0.53	1.40	0.56
Extremity								
- **Upper**	0.79	0.54	1.15	0.22	0.70	0.47	1.04	0.08
- **Lower**	2.02	1.24	3.28	**0.01**	1.39	0.87	2.23	0.17
- **Pelvis**	1.28	0.81	2.04	0.29	1.09	0.69	1.74	0.73
- **Vascular**	2.01	0.18	22.3	0.57	0.79	0.71	8.82	0.85
Neck								
- **Vascular**	1.68	0.39	7.10	0.48	1.60	0.39	6.49	0.51
- **C Spine**	0.96	0.58	1.61	0.88	0.89	0.53	1.51	0.67
ICU Admission								
- **Yes**	1.21	0.85	1.74	0.28	1.68	1.17	2.42	**0.01**
MV								
- **Yes**	1.67	0.96	2.92	0.70	1.69	0.97	2.96	0.06
Surgical Procedure								
- **Yes**	1.53	1.08	2.18	**0.02**	1.56	1.09	2.23	**0.02**
Surgical Procedure in 24h	1.72	1.09	2.70	**0.02**	1.57	1.00	2.45	**0.05**

- **Yes**								
Surgical Procedure Type								
- **Abdominal**	1.29	0.79	2.14	0.31	1.16	0.69	1.93	0.56
- **Chest**	1	0.62	1.62	1.00	0.87	0.53	1.44	0.59
- **Upper Extremity**	1.46	0.84	2.52	0.17	1.35	0.28	0.78	2.33
- **Lower Extremity**	1.97	1.17	3.32	**0.01**	2.97	1.76	4.99	**0.00**
- **Pelvic**	2.86	1.47	5.57	**0.00**	2.33	1.27	4.29	**0.01**
- **Spinal**	0.32	0.66	1.64	0.18	0.52	0.15	2.63	0.43

L Spine – lumbar spine; T spine – thoracic spine; C-Spine – cervical spine; ICU – Intensive Care Unit; MV – mechanical ventilation; ASA – American Society of Anaesthesiologists; MOI – mechanism of injury

Multivariate Model Building – 6 & 12-months

		95% CI		
	OR	**Lower**	**Upper**	**p value**
6-months				
- Lower Extremity	2.02	1.24	3.28	**0.01**
- Lower Extremity	1.87	1.14	3.06	**0.01**
- Operative Procedure	1.43	1.00	2.04	**0.05**
- Lower Extremity	1.86	1.14	3.05	**0.01**
- Surgical Procedure	1.26	0.84	1.87	0.26
- Surgical Procedure in 24h	1.44	0.86	2.39	0.16
- Lower Extremity	1.66	0.94	2.94	0.07
- Lower Limb Surgery	1.47	0.79	2.72	0.22
Final Model				
- Lower Extremity	1.89	1.15	3.09	**0.01**
- Pelvic Surgery	2.66	1.36	5.21	**0.00**
12-months				
- ICU Admission	1.68	1.17	2.42	**0.01**
- ICU Admission	1.52	1.04	2.23	**0.03**
- Surgical Procedure	1.37	0.93	2.00	0.11
- ICU Admission	1.56	1.06	2.31	**0.03**
- Surgical Procedure in 24h	1.28	0.79	2.07	0.31
- ICU Admission	1.60	1.11	2.32	**0.01**
- Lower Extremity Surgery	2.84	1.68	4.80	**0.00**
Final Model				
- ICU Admission	1.55	1.06	2.26	**0.02**
- Lower Extremity Surgery	2.63	1.54	4.49	**0.00**
- Pelvic Surgery	1.79	0.95	3.39	0.07

CI – Confidence Interval; ICU – Intensive Care Unit; Op - operation