

Victorian Orthopaedic Trauma Outcomes Registry (VOTOR)



Annual Report July 2014 – June 2015



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1. Foreword

The 3rd annual report of the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR) presents a comprehensive analysis of the outcomes of orthopaedic trauma patients from the four participating hospitals (the Alfred, Royal Melbourne Hospital, University Hospital Geelong and the Northern Hospital). The VOTOR steering group consists of dedicated personnel from Monash University of Epidemiology and Preventive Medicine along with orthopaedic surgeons who have a strong interest in trauma and achieving the best outcomes for patients. The steering group meets regularly and oversees the research projects involving VOTOR data. There are currently ten research projects being undertaken and there have been five publications and one major report published this past year. The Registry is funded by the Transport Accident Commission (TAC) through the Institute for Safety, Compensation and Recovery Research (ISCRR) and is now recognized as one of the leading Trauma Registries in the world.

Orthopaedic trauma patients often involve complex care pathways with a multidisciplinary approach. While there are many excellent clinical trials involving orthopaedic trauma patients, the value of registries and long-term observational studies is becoming increasingly important. VOTOR's strengths include a robust governance system, experienced follow-up staff and, most importantly, a focus on patient-centred outcomes to complement more traditional clinician-led outcomes. As the Registry matures it is an increasingly important source of valuable information. It is clear that many patients still have substantial disability up to 24 months following their accident and further research is clearly needed in some of the areas that VOTOR has identified in this report.

I whole-heartedly recommend this annual report to all people interested in the care of orthopaedic trauma patients. VOTOR welcomes collaborations with other interested groups who have the same objectives in improving care of our patients.

Professor Richard de Steiger

**Epworth Victor Smorgon Chair of Surgery
University of Melbourne
Chairman Musculoskeletal Clinical Institute**

2. Executive Summary

This report provides a detailed overview of data from the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR) from July 2009 to June 2015. The data provided in this report focuses on: providing an overview of the VOTOR population and their outcomes over time; comparing the profile of VOTOR patients by participating hospital; and describing the long-term outcomes of orthopaedic trauma patients managed at the VOTOR participating hospitals. For the first time, this report provides 24-month follow-up data in addition to 6-month and 12-month data. Also, a new measure of quality of life, the European Quality of Life - Five Dimensions (EQ-5D) questionnaire, has been introduced, allowing better comparison with other registries and patient populations worldwide. Less than 2 per cent of cases have opted-off from the registry and an average of 91 per cent of patients were successfully followed-up at 6-months, 90 per cent at 12-months and 81 per cent at 24 months, ensuring robust coverage of the patient population and their outcomes.

From July 1 2009 to June 30 2015, 35,525 cases were registered by VOTOR (54% male; mean age 56.7 years). The number of registered patients per year rose from 5,827 in 2013-14 to 6,236 patients in 2014-15. In 2014-15, there was a notable increase in VOTOR patients registered by the Royal Melbourne Hospital and a decrease in patients at University Hospital Geelong from the previous year. The mean age of patients rose from 55.8 years in 2009-10 to 57.6 years in 2013-14, but stabilised in 2014-15 at 57.4 years.

Consistent with previous reports, in 2014-15, most cases were the result of a low fall (40%) or road trauma (29%). Isolated lower extremity (38%) and isolated upper extremity (19%) injuries were predominant with neck of femur (17%) and forearm fractures (15%) the most common fractures sustained. Markers of injury severity have also remained consistent over time. The in-hospital death rate remained at 2 per cent in 2014-15, the rate of admission to an intensive care unit was 9 per cent in 2014-15 compared to 10 per cent in previous years, and the median (IQR) hospital length was consistent with previous years at 4.8 (2.4-8.9) days.

The proportion of patients being discharged home has decreased (62 per cent in 2010-11 to 57 per cent in 2014-15) and the proportion of patients discharged to inpatient rehabilitation has increased (24 per cent in 2010-11 to 31 per cent in 2014-15). Considering that there has been little change in the profile and severity of injuries sustained by VOTOR patients during this period, there is scope for further investigation into reasons for this change and its influence on health outcomes.

Newly available 24-month follow-up data confirm that patients' function, return to work rates, pain and health-related quality of life continue to improve up to 24-months post-injury. Patients with poorer long-term outcomes, or who are slower to improve, included those with multiple orthopaedic injuries and injuries involving the spine, while those with better outcomes include patients with soft tissue injuries and isolated upper and lower extremity injuries. Long-term outcomes were generally better for patients admitted for soft tissue and isolated limb injuries.

Adjusting for a range of demographic and injury factors, in 2013-14 the typical VOTOR patient's probability of a complete functional recovery was 26 per cent at 12-months post-injury. The probability of returning to work was 82 per cent at 12-months. The probability of

return to work has remained consistent over time but the probability of a complete functional recovery at 12-months has declined from 32 per cent in 2010-11 to 26 per cent in 2013-14. The reasons for this are not immediately evident but will be investigated further. In contrast, several domains of function and health-related quality of life measured by the EQ-5D have improved over the past five years, including pain/discomfort, usual activities and anxiety/depression domains.

Data collected by VOTOR provides arguably the most comprehensive collection of outcomes data relating to orthopaedic trauma worldwide, offering an important means of monitoring the care and outcomes of patients admitted to hospital with orthopaedic trauma. The high incidence and long-term burden of orthopaedic trauma support the ongoing need for VOTOR which provides a platform for research aimed at improving patient outcomes, and the capacity to evaluate the impact of changes in clinical practice over time.

3. About this report

This is the third annual report prepared for public release by the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR). Data collected during the period of 1st July 2009 to 30th June 2015 is reflected in this report with a particular focus on the period of 1st July 2014 to 30th June 2015. The report provides an overview of the profile, treatment and outcomes of orthopaedic admissions in the 2014-15 financial year. Comparisons with previous years are also presented. As data continue to be updated for all timeframes, slight differences in case numbers are expected when compared with previous reports.

4. About the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR)

4.1 About VOTOR

The Victorian Orthopaedic Trauma Outcomes Registry is a sentinel site, clinical quality registry, developed and managed through a collaboration between hospitals and academic institutions. The registry is a comprehensive database of orthopaedic injuries, treatment, complications and outcomes based on admissions to the Alfred, Royal Melbourne, University Hospital Geelong and the Northern Hospital. The Victorian Orthopaedic Trauma Outcomes Registry first started as a collaborative project between The Alfred and Royal Melbourne Hospital and the Department of Epidemiology and Preventive Medicine at Monash University in 2003 and in 2007 was expanded to include University Hospital Geelong and the Northern Hospital. The registry is a robust monitoring system for orthopaedic trauma in Victoria, and is funded by the Transport Accident Commission (TAC) through the Institute for Safety, Compensation and Recovery Research (ISCRR).

The Victorian Orthopaedic Trauma Outcomes Registry provides a mechanism to monitor the profile of orthopaedic injuries admitted to the participating hospitals, including how they are treated and the short and long-term outcomes of these injuries. The registry also provides the opportunity to identify injuries, procedures and patient populations who are at risk for poorer outcomes, as well as quantify variations in clinical practice and their impact on patient outcomes.

4.2 Eligible patients

The Victorian Orthopaedic Trauma Outcomes Registry captures data about all patients with an emergency admission (>24 hours) to the participating hospital for an orthopaedic injury. Patients with a pathological fracture related to metastatic disease are excluded. Eligible patients are identified by the discharge diagnosis through ICD-10-AM reports from the hospitals.

INCLUSION	EXCLUSION
<p>All patients admitted with a new orthopaedic (bone or soft tissue) injury with a length of stay >24 hours</p> <p>Death after injury</p>	<p>Pathological fracture related to metastatic disease, and/or</p> <p>Age < 16 years</p> <p>Isolated soft tissue injury managed non-operatively</p>

4.3 Data collection

Data are obtained as electronic files from the participating hospitals. The data collected include information about the patient's demographics, how they were injured, the injuries sustained, how the injuries were managed, any complications or pre-existing conditions and short-term outcomes such as how long the patient stayed in hospital and their discharge destination.

In addition to the data received from the participating hospitals, further data about the outcomes of injury are collected by trained VOTOR staff using a standardised telephone interview which is completed at 6 and 12-months after injury. At the start of the 2013-14 financial year, 24-month follow-up phone calls were also commenced. The data collected by telephone interview include the patient's level of disability and work status prior to injury, pain levels at follow-up, whether they have returned to work and any work disability still experienced, health-related quality of life and levels of physical functioning. All patients are followed up to 24-months post-injury, except hip fracture patients aged ≥ 60 years injured via a low fall and those patients aged ≥ 80 years injured via a low fall.

4.4 Patient confidentiality

The registry was established under the National Statement on Ethical Conduct in Human Research of the National Health and Medical Research Council (NHMRC) to ensure confidentiality and patient privacy are maintained at all times. Ethics approval for VOTOR was granted by the Human Research Ethics Committees at each of the participating hospitals and Monash University.

5. Patients registered by VOTOR in 2014-15

The registry collected data for 6,236 orthopaedic trauma patients in 2014-15. Figure 1 shows the number of patients registered for each hospital, and overall, from July 2009 to June 2015. There was a steady, linear increase from 2009-10 to 2011-12, followed by a decline in numbers up until 2013-14 and then a recovery in 2014-15 to previous levels. The Alfred contributed the highest number of cases, followed by the RMH, UHG and the Northern Hospital, and this pattern has been consistent for the past six years of the registry. The number of patients registered at RMH has increased in the past year, while the number of patients from UHG has decreased.

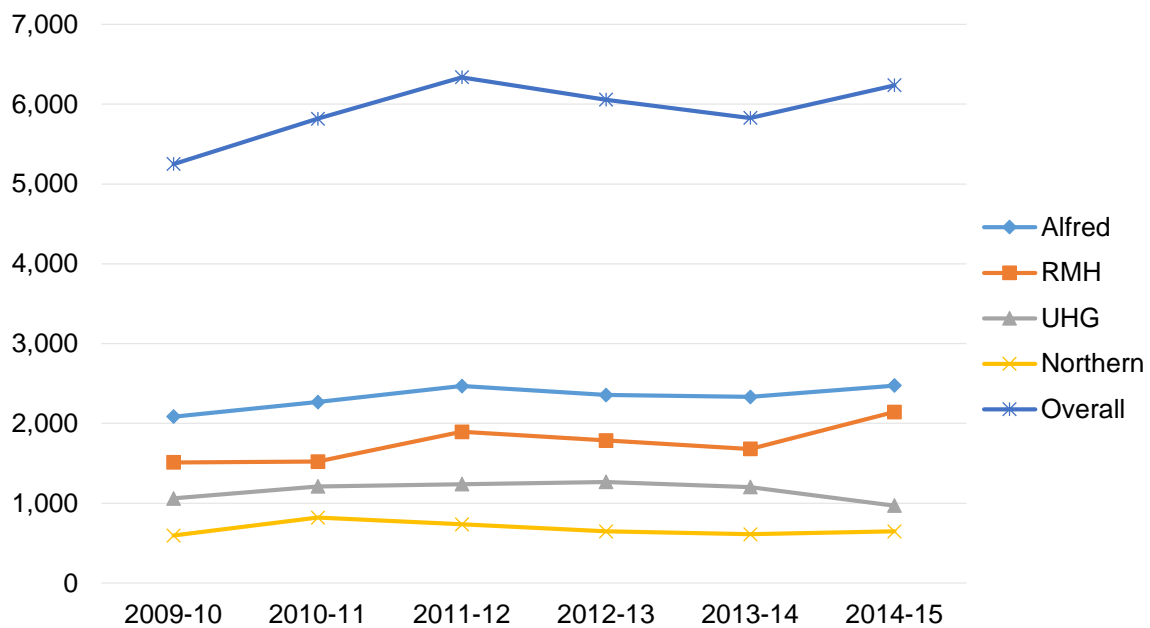


Figure 1: Number of registered VOTOR patients over time

6. Age and gender profile of patients registered by VOTOR

During 2014-15, over half of registered patients were male (53 per cent, n=3,317). The mean (SD) age of VOTOR patients was 57.4 (23.6) years in 2014-15, which is an increase of 1.6 years compared to the mean age observed in 2009-10. The mean (SD) age of male patients was 48.7 (21.8) years compared to 66.0 (21.9) years for female patients. The gender distribution of VOTOR patients has not changed over the past six years (Table 1).

Table 1: Demographic profile of VOTOR patients over time

n (%)	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Hospital						
Alfred	2085 (40)	2267 (39)	2469 (39)	2356 (39)	2332 (40)	2474 (40)
RMH	1511 (29)	1,521 (26)	1894 (30)	1787 (30)	1681 (29)	2144 (34)
UHG	1060 (20)	1,210 (21)	1238 (20)	1266 (21)	1202 (21)	971 (16)
Northern	595 (11)	820 (14)	736 (12)	647 (11)	612 (11)	647 (10)
Total	5251 (100)	5818 (100)	6337 (100)	6056 (100)	5827 (100)	6236 (100)
Gender						
Male	2837 (54)	3135 (54)	3424 (54)	3242 (54)	3063 (53)	3317 (53)
Female	2414 (46)	2683 (46)	2913 (46)	2814 (46)	2764 (47)	2919 (47)
Age (yrs)						
Mean (SD)	55.8 (23.3)	56.1 (23.5)	56.4 (23.7)	56.9 (23.3)	57.6 (23.5)	57.4 (23.6)

Compared to the major trauma service hospitals (The Alfred and RMH), the proportion of female patients, and the average age of patients managed at UHG and the Northern Hospital were higher (Table 2). This is consistent with previous reports.

Table 2: Demographic profile of VOTOR patients by hospital 2014-15

Descriptor n (%)	Alfred (n=2474)	RMH (n=2144)	UHG (n=971)	Northern (n=647)	Overall (n=6236)
Gender					
Male	1436 (58)	1216 (57)	403 (42)	262 (40)	3317 (53)
Female	1038 (42)	928 (43)	568 (59)	385 (60)	2919 (47)
Age (yrs)					
Mean (SD)	56.1 (23.4)	53.1 (23.5)	65.2 (22.3)	64.8 (22.0)	57.4 (23.6)

7. Cause and location of injuries sustained by VOTOR patients

7.1 Cause of injury

This section describes the causes of orthopaedic trauma admitted to the VOTOR participating hospitals (The Alfred, RMH, Northern and Geelong). In 2014-15, 40 per cent of cases were the result of a low fall (defined as a fall from standing or <1m), followed by motor vehicle crashes, and high falls (falls from height >1m) (Figure 2). In total, road trauma (motor vehicle, motorcycle, pedal cyclist and pedestrian events) contributed to 29% of VOTOR cases.

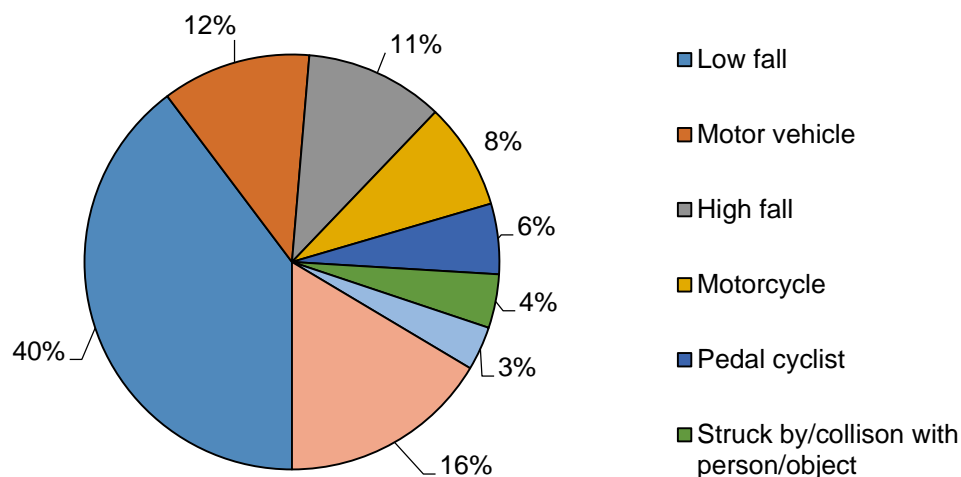


Figure 2: Cause of injury of VOTOR patients 2014-15

The pattern of causes of injury over the past six years is shown in Table 3 and has remained consistent over time, with low falls, motor vehicle crashes and high falls predominant in each year.

Table 3: Cause of VOTOR patients over time

Cause of injury n (%)*	2009-10 (n=5251)	2010-11 (n=5818)	2011-12 (n=6337)	2012-13 (n=6056)	2013-14 (n=5827)	2014-15 (n=6171)
Low fall	2212 (42)	2551 (44)	2674 (42)	2439 (40)	2344 (40)	2453 (40)
Motor vehicle	674 (13)	732 (13)	840 (13)	715 (12)	771 (13)	716 (12)
High fall	654 (12)	632 (11)	733 (12)	789 (13)	709 (12)	667 (11)
Motorcycle	501 (10)	450 (8)	526 (8)	497 (8)	520 (9)	513 (8)
Pedal cyclist	248 (5)	297 (5)	287 (5)	409 (7)	315 (5)	339 (5)
Struck by/collision with person/object	199 (4)	238 (4)	276 (4)	220 (4)	209 (4)	259 (4)
Pedestrian	244 (5)	232 (4)	258 (4)	220 (4)	224 (4)	211 (3)
Other	519 (10)	686 (12)	743 (12)	767 (13)	735 (13)	1013 (16)

*<1% missing data

Low falls continue to be the most prevalent cause of injury at each VOTOR hospital, with the proportion of low falls related cases approximately two-fold higher at the Northern Hospital and UHG compared to the major trauma service hospitals (Table 4). The vast majority of road trauma (motor vehicle, pedestrian, pedal cyclist and motorcycle) patients were managed at The Alfred and RMH, reflecting the pre-hospital triage guidelines for the Victorian State Trauma System.

Table 4: Cause of VOTOR patients by hospital 2014-15

Cause of injury n (%)*	Alfred (n=2453)	RMH (n=2123)	UHG (n=960)	Northern (n=635)
Low fall (<1m)	670 (27)	742 (35)	654 (68)	387 (61)
Motor vehicle	358 (15)	311 (15)	35 (4)	12 (2)
High fall	251 (10)	276 (13)	59 (6)	81 (13)
Motorcycle	236 (10)	224 (11)	21 (2)	32 (5)
Pedestrian	95 (4)	103 (5)	5 (1)	8 (1)
Pedal cyclist	163 (7)	149 (7)	18 (2)	9 (1)
Struck by/ collision with person/object	99 (4)	85 (4)	45 (5)	30 (5)
Other	581 (24)	233 (11)	71 (7)	76 (12)

*<1% missing data

7.2 Location of injury

This section describes the place of injury for orthopaedic trauma patients admitted to VOTOR participating hospitals. During 2014-15, the most common places where VOTOR patients sustained their injuries were at home (34%) and on a street or highway (33%). Residential institutions (8%) represented the third most common place of injury (Figure 3).

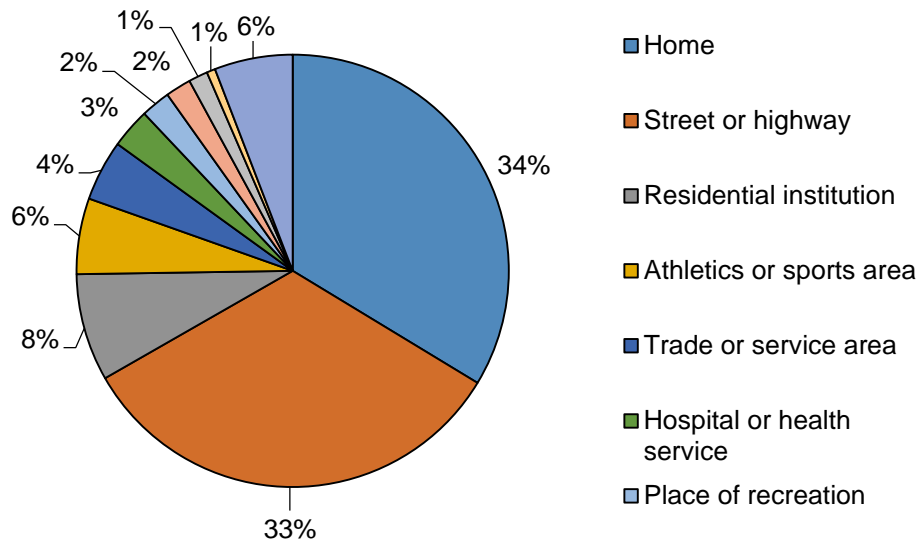


Figure 3: Place of injury of VOTOR patients 2014-15*

*13% missing data

Table 5 shows that, over the past six years, the most common places of injury have been a street or highway and the home. The high number of home-based injuries reflects the prevalence of injuries related to low falls shown in Table 3.

Table 5: Place of injury of VOTOR patients over time

Place of injury n (%)*	2009-10 (n=5251)	2010-11 (n=5818)	2011-12 (n=6337)	2012-13 (n=6056)	2013-14 (n=5827)	2014-15 (6236)
Street or highway	1637 (36)	1689 (34)	1856 (34)	1787 (34)	1772 (34)	1796 (33)
Home	1453 (32)	1656 (33)	1841 (33)	1736 (33)	1697 (33)	1830 (34)
Residential institution	393 (9)	452 (9)	471 (9)	477 (9)	427 (8)	436 (8)
Athletics or sports area	263 (6)	283 (6)	343 (6)	315 (6)	259 (5)	308 (6)
Trade or service area	219 (5)	228 (5)	244 (4)	233 (4)	256 (5)	247 (5)
Hospital or health service	144 (3)	155 (3)	171 (3)	187 (4)	183 (4)	162 (3)
Industrial or construction	92 (2)	96 (2)	99 (2)	78 (2)	86 (2)	104 (2)
Farm	80 (2)	69 (1)	79 (1)	87 (2)	78 (2)	78 (1)
Place of recreation	30 (1)	44 (1)	46 (1)	91 (2)	66 (1)	120 (2)
School, other institution	20 (<1)	26 (1)	38 (1)	19 (<1)	35 (1)	35 (1)
Other	257 (6)	289 (6)	359 (7)	267 (5)	334 (6)	328 (6)

*13% missing data

The proportion of patients injured on a street or highway was higher at The Alfred (44%) and RMH (40%) when compared to UHG (12%) and the Northern Hospital (12%). This is consistent with the higher proportion of road trauma managed at the major trauma service hospitals. Half of all patients managed at UHG (50%) and 55 per cent of patients at the Northern Hospital were injured at home (Table 6). Admissions to hospital for orthopaedic trauma sustained at residential institutions were higher at UHG and the Northern Hospital when compared to the major trauma services, consistent with the older age of patients and the preponderance of low fall related injuries presenting to these hospitals (Table 6).

Table 6: Place of injury of VOTOR patients by hospital 2014-15

Place of injury n (%)**	Alfred (n=2474)	RMH (n=2144)	UHG (n=971)	Northern (n=647)
Street or highway	903 (44)	726 (40)	112 (12)	55 (12)
Home	629 (28)	490 (27)	451 (50)	260 (55)
Residential institution	159 (7)	96 (5)	111 (12)	70 (15)
Athletics or sports area	122 (5)	112 (6)	50 (6)	24 (5)
Trade or service area	96 (4)	69 (4)	66 (7)	16 (3)
Hospital or health service	52 (2)	60 (3)	13 (1)	37 (8)
Industrial or construction	31 (1)	42 (2)	27 (3)	*
Farm	46 (2)	29 (2)	*	*
Place of recreation	81 (4)	25 (1)	14 (2)	*
School, other institution	8 (<1)	21 (1)	6 (1)	*
Other	117 (5)	147 (8)	56 (6)	8 (2)

*denotes <5 cases **13% missing data

8. Types of injuries sustained by VOTOR patients

The ICD-10-AM classification is used to describe injuries sustained by VOTOR patients. In 2014-15, 57 per cent of patients were admitted for management of an isolated extremity injury, with 38 per cent of all registered patients sustaining an isolated lower extremity injury (Figure 4). Patients with spinal injuries only accounted for 19 per cent of cases, while 13 per cent of patients had sustained injuries to multiple body regions (Figure 4).

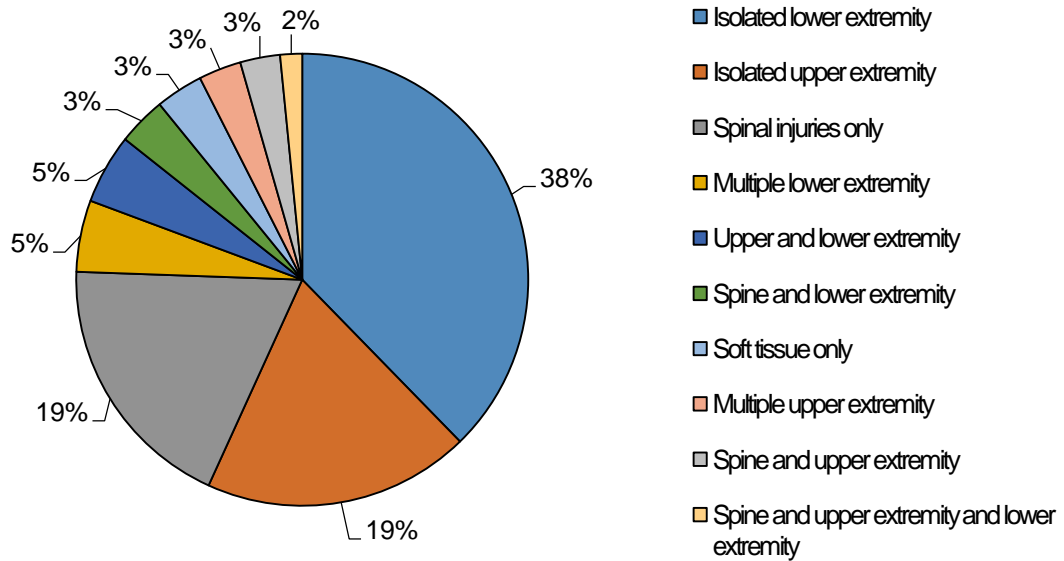


Figure 4: Orthopaedic injury profile of VOTOR patients 2014-15

The pattern of orthopaedic and associated non-orthopaedic injuries sustained by VOTOR patients has remained consistent over the past six years (Table 7). In 2014-15, 22 per cent of all VOTOR patients sustained an associated non-orthopaedic injury, including chest injuries (14 per cent of all patients), head injuries (12%), abdominal injuries (4%) and burns (<1%).

Table 7: Injury profile of VOTOR patients over time

Descriptor	2009-10 (n=5251)	2010-11 (n=5818)	2011-12 (n=6337)	2012-13 (n=6056)	2013-14 (n=5827)	2014-15 (n=6236)
Orthopaedic injuries						
n (%)						
Isolated lower extremity	1996 (38)	2263 (39)	2386 (38)	2242 (36)	2263 (39)	2351 (38)
Isolated upper extremity	1089 (21)	1228 (21)	1239 (20)	1251 (21)	1114 (19)	1191 (19)
Isolated spinal injuries	761 (14)	811 (14)	1004 (16)	976 (16)	979 (17)	1170 (19)
Multiple lower extremity	351 (7)	366 (6)	403 (6)	368 (6)	334 (6)	319 (5)
Upper and lower extremity	243 (5)	258 (4)	299 (5)	308 (5)	283 (5)	311 (5)
Soft tissue injury	206 (4)	248 (4)	264 (4)	214 (4)	171 (3)	212 (3)
Spine and lower extremity	189 (4)	171 (3)	235 (4)	217 (4)	219 (4)	216 (3)
Multiple upper extremity	153 (3)	186 (3)	192 (3)	187 (3)	195 (3)	190 (3)
Spine and upper extremity	176 (3)	184 (3)	196 (3)	189 (3)	176 (3)	178 (3)
Spine, upper and lower extremity	87 (2)	103 (2)	119 (2)	104 (2)	93 (2)	98 (2)
Associated injuries						
n (%)						
Chest injury	788 (15)	758 (13)	927 (15)	883 (15)	816 (14)	857 (14)
Skull fracture and/or intracranial injury	794 (15)	763 (13)	939 (15)	778 (13)	769 (13)	717 (12)
Abdominal injury	255 (5)	243 (4)	318 (5)	281 (5)	264 (5)	228 (4)

Consistent with the Victorian State Trauma System triage guidelines and the higher prevalence of road transport-related injuries, the proportion of isolated extremity fractures was lower at the major trauma service hospitals when compared to the Northern Hospital and UHG (Table 8). Similarly, the prevalence of associated non-orthopaedic injuries was substantially lower at UHG and the Northern Hospital compared to the major trauma service hospitals (Table 8). Isolated extremity fractures accounted for 80 per cent of the Northern Hospital patients and 77 per cent of UHG patients, compared to 47 per cent of cases at The Alfred, and 53 per cent at RMH (Table 6). The UHG and the Northern Hospital also managed a much lower proportion of patients with spinal injuries when compared to major trauma services (Table 8). These findings are consistent with previous reports.

Table 8: Injury profile of VOTOR patients by hospital 2014-15

Descriptor	Alfred (n=2474)	RMH (n=2144)	UHG (n=971)	Northern (n=647)	Overall (n=6236)
Orthopaedic injuries n (%)					
Isolated lower extremity	706 (29)	750 (35)	502 (52)	393 (61)	2351 (38)
Isolated upper extremity	440 (18)	388 (18)	243 (25)	120 (19)	1191 (19)
Spinal injuries only	602 (24)	445 (21)	82 (8)	41 (6)	1170 (19)
Multiple lower extremity	143 (6)	99 (5)	47 (5)	30 (5)	319 (5)
Upper and lower extremity	152 (6)	112 (5)	30 (3)	17 (3)	311 (5)
Soft tissue injury	67 (3)	99 (5)	23 (2)	23 (4)	212 (3)
Spine and lower extremity	119 (5)	88 (4)	7 (1)	*	216 (3)
Multiple upper extremity	81 (3)	63 (3)	27 (3)	19 (3)	190 (3)
Spine and upper extremity	113 (5)	57 (3)	7 (1)	*	178 (3)
Spine, upper and lower extremity	51 (2)	43 (2)	*	*	98 (2)
Associated injuries n (%)					
Chest injury	485 (20)	326 (15)	32 (3)	14 (2)	857 (14)
Skull fracture and/or intracranial injury	421 (17)	260 (12)	29 (3)	7 (1)	717 (12)
Abdominal injury	150 (6)	74 (3)	*	*	228 (4)

*denotes <5 cases

Hip fractures, forearm fractures and tibial fractures have been the three most common types of fractures documented in the VOTOR database over the past six years (Table 9). In 2013-14 and 2014-15, there was a slightly higher proportion of hip fractures relative to forearm fractures but in general, the pattern of fractures sustained has not changed over time (Table 9).

Table 9: Ten most common fractures sustained by VOTOR patients over time

Descriptor n (%)	2009-10 (n=5251)	2010-11 (n=5818)	2011-12 (n=6337)	2012-13 (n=6056)	2013-14 (n=5827)	2014-15 (n=6236)
Hip fracture	903 (17)	962 (17)	1027 (16)	1015 (17)	1025 (18)	1053 (17)
Forearm fracture	913 (17)	1040 (18)	1055 (17)	1046 (17)	922 (16)	944 (15)
Tibia fracture	775 (15)	878 (15)	943 (15)	899 (15)	883 (15)	890 (14)
Thoracic spine	523 (10)	583 (10)	704 (11)	676 (11)	665 (11)	763 (12)
Lumbar spine	535 (10)	532 (9)	663 (10)	635 (10)	619 (11)	701 (11)
Pelvis fracture	552 (11)	603 (10)	733 (12)	674 (11)	643 (11)	678 (11)
Cervical spine	465 (9)	481 (8)	586 (9)	537 (9)	538 (9)	592 (9)
Humerus fracture	403 (8)	459 (8)	507 (8)	467 (8)	487 (8)	500 (8)
Clavicle fracture	319 (6)	321 (6)	355 (6)	378 (6)	307 (5)	380 (6)
Foot fracture	363 (7)	349 (6)	386 (6)	378 (6)	353 (6)	343 (6)

Consistent with the previous annual report, the proportion of spinal and pelvic fractures was higher at the major trauma services when compared to UHG and the Northern Hospital (Table 10). Hip fractures accounted for 27 per cent of all fractures at UHG and 29 per cent at the Northern Hospital, compared to 14 per cent of fractures at RMH and 12 per cent of fractures at The Alfred (Table 10).

Table 10: Most common fractures sustained by VOTOR patients by hospital 2014-15

Descriptor n (%)	Alfred (n=2474)	RMH (n=2144)	UHG (n=971)	Northern (n=647)	Overall (n=6236)
Hip fracture	308 (12)	300 (14)	260 (27)	185 (29)	1,053 (17)
Forearm fracture	352 (14)	330 (15)	184 (19)	78 (12)	944 (15)
Tibia fracture	297 (12)	333 (16)	135 (14)	125 (19)	890 (14)
Thoracic spine	421 (17)	282 (13)	44 (5)	16 (2)	763 (12)
Lumbar spine	350 (14)	277 (13)	44 (5)	30 (5)	701 (11)
Pelvis fracture	323 (13)	230 (11)	87 (9)	38 (6)	678 (11)
Cervical spine	329 (13)	239 (11)	21 (2)	3 (0)	592 (9)
Humerus fracture	210 (8)	142 (7)	84 (9)	64 (10)	500 (8)
Clavicle fracture	141 (6)	136 (6)	36 (4)	30 (5)	343 (6)
Foot fracture	144 (7)	24 (2)	11 (2)	380 (6)	201 (8)

9. In-hospital outcomes of VOTOR patients

Of the 6,236 VOTOR patients registered by VOTOR in 2014-15, 129 (2%) died during their hospital stay. Nine per cent of patients required an admission to an intensive care unit (ICU) during their hospital stay, and the median (IQR) hospital length of stay (LOS) was 4.8 (2.4-8.9) days. The in-hospital death rate, ICU admission rate, and hospital LOS have remained consistent over the past six years (Table 11).

Of the patients who survived to hospital discharge, more than half (57%, n=3,505) were discharged directly to home. These patients had a median (IQR) length of stay of 3.0 (1.9-5.6) days in hospital whereas patients who were discharged elsewhere or who died had a median (IQR) length of stay of 8.2 (5.1-13.4) days. Almost a third (31%, n=1,915) of patients were discharged to inpatient rehabilitation and this proportion has increased over time (Table 11). Other discharge destinations included nursing homes, hospitals for convalescence and aged care facilities.

Table 11: In-hospital outcomes of VOTOR patients over time

Descriptor		2009-10 (n=5251)	2010-11 (n=5818)	2011-12 (n=6337)	2012-13 (n=6056)	2013-14 (n=5827)	2014-15 (n=6236)
ICU^a stay	n (%) yes	530 (10)	582 (10)	656 (10)	625 (10)	603 (10)	562 (9)
LOS^b days	Median (IQR)	4.9 (2.4-9.4)	5 (2.4-9.6)	4.9 (2.4-9.5)	4.8 (2.5-9.1)	4.8 (2.6-8.8)	4.8 (2.4-8.9)
In-hospital death	n (%) yes	129 (2)	139 (2)	156 (2)	142 (2)	113 (2)	129 (2)
Discharge destination n (%)	Home	3045 (59)	3495 (62)	3705 (60)	3490 (59)	3227 (56)	3505 (57)
	Inpatient rehab	1447 (28)	1347 (24)	1508 (24)	1520 (26)	1657 (29)	1915 (31)
	Other	626 (12)	836 (15)	968 (16)	904 (15)	830 (15)	687 (11)

^a ICU, intensive care unit; ^b LOS, length of hospital stay; ^c Survivors to hospital discharge only

The in-hospital outcomes of VOTOR patients differed substantially between hospitals, reflecting the variation in case-mix of orthopaedic trauma patients managed at each hospital. The proportion of patients admitted to intensive care was highest at the Alfred (14%), followed by RMH (8%) and lowest at the Northern Hospital and UHG (2%). The median length of stay ranged from 4.6 days at the Alfred to 5.0 days at the Northern Hospital. A lower proportion of UHG and the Northern Hospital orthopaedic trauma patients were discharged to inpatient rehabilitation centres when compared to the major trauma hospitals, with the Alfred discharging the highest proportion of patients to inpatient rehabilitation (43%) (Table 12). The in-hospital death rate was consistent between the Alfred, RMH and UHG but lower at the Northern Hospital (<1%). While the Alfred and RMH patients were more severely injured, they were also younger and likely to be at lower risk of mortality related to pre-existing conditions.

Table 12: In-hospital outcomes of VOTOR patients by hospital 2014-15

Descriptor		Alfred (n=2474)	RMH (n=2144)	UHG (n=971)	Northern (n=647)	Overall (n=6236)
ICU^a stay	n (%) yes	357 (14)	171 (8)	19 (2)	15 (2)	562 (9)
LOS^b days	Median (IQR)	4.6 (2.4 -8.1)	4.9 (2.3-10.0)	4.7 (2.1-8.9)	5.0 (2.9-7.9)	4.8 (2.4-8.9)
In-hospital death	n (%) yes	62 (3)	34 (2)	31 (3)	2 (<1)	129 (2)
Discharge destination^c	Home	1313 (54)	1258 (60)	626 (67)	308 (48)	3505 (57)
n (%)	Inpatient rehab	1048 (43)	659 (31)	182 (19)	26 (4)	1915 (31)
	Other	51 (2)	193 (9)	132 (14)	311 (48)	687 (11)

^a ICU, intensive care unit; ^b LOS, length of hospital stay; ^c Survivors to hospital discharge only

10. Longer term outcomes of VOTOR patients

This section describes longer term patient outcomes following orthopaedic trauma. The primary outcome measure used is the patient's level of function according to the Glasgow Outcome Scale – Extended (GOS-E). The GOS-E classifies patients into eight levels of function, from death to upper good recovery. The GOS-E can be administered by proxy if the patient is not able to participate in the interview.

Health-related quality of life is measured using European Quality of Life - Five Dimensions (EQ-5D) questionnaire. This is a standardised questionnaire that asks patients to describe their health-related quality of life across five dimensions (mobility, self-care, usual activity, pain/discomfort and anxiety), with three scoring levels per dimension: 'No Problems', 'Some Problems' and 'Severe Problems'. An EQ-5D summary score is also reported which provides a single score summarising all five domains, normalised to age-adjusted population tariffs.

Other outcomes include pain, which is self-reported at each time point via a numerical rating scale (NRS) from zero to 10, and return to work status. Information about whether the patient was working prior to injury and their capacity for return to work are collected at each time point.

The focus of this section of the report was patients with a date of admission between July 1 2009 and June 30 2014, who survived to hospital discharge and were eligible for 6-month, 12-month and 24-month follow-up. **All patients, except those aged ≥ 60 years with a hip fracture (neck of femur and trochanteric fractures) resulting from a low fall and those aged ≥ 80 years injured via a low fall, are followed-up until 24-months post-injury. To ensure consistency in the patient cohort presented across 6, 12 and 24-month time points, only patients eligible for 24-month follow-up were included in the following section, representing 78 per cent of total VOTOR patients over five years (n=22,871).** Their demographic profile is presented in Table 13. This cohort of patients are younger and more commonly male, compared to the total VOTOR population (see Table 1).

Table 13: Demographic profile of VOTOR patients eligible for 24-month follow-up

n (%)	2009-10	2010-11	2011-12	2012-13	2013-14
Hospital					
Alfred	1694 (41)	1857 (41)	2043 (41)	1941 (41)	1963 (43)
RMH	1271 (31)	1324 (29)	1606 (33)	1521 (32)	1385 (31)
UHG	692 (17)	805 (18)	802 (16)	854 (18)	808 (18)
Northern	465 (11)	529 (12)	482 (10)	437 (9)	392 (9)
Total	4122 (100)	4515 (100)	4933 (100)	4753 (100)	4548 (100)
Gender					
Male	2540 (62)	2781 (62)	3035 (62)	2890 (61)	2704 (60)
Female	1582 (38)	1734 (38)	1898 (39)	1863 (39)	1844 (41)
Age (yrs)					
Mean (SD)	47.9 (19.9)	47.8 (19.9)	48.4 (20.4)	49.3 (20.3)	49.9 (20.7)

10.1 Follow-up rates

Between 2009-10 and 2013-14, 6-month follow-up rates consistently exceeded 80 per cent for all hospitals and the average was 91 per cent. Twelve-month follow-up rates were greater than 85 per cent for all hospitals and the average was 90 per cent. Twenty-four-month follow up calls commenced in July 2013 and hence data are available for patients injured from 2011-12 to 2012-13. The average 24-month follow rate across these years was 81 per cent, ranging from 74 per cent to 83 per cent between hospitals. Twenty-four-month follow-up rates were lowest for the Northern Hospital (Figure 5).

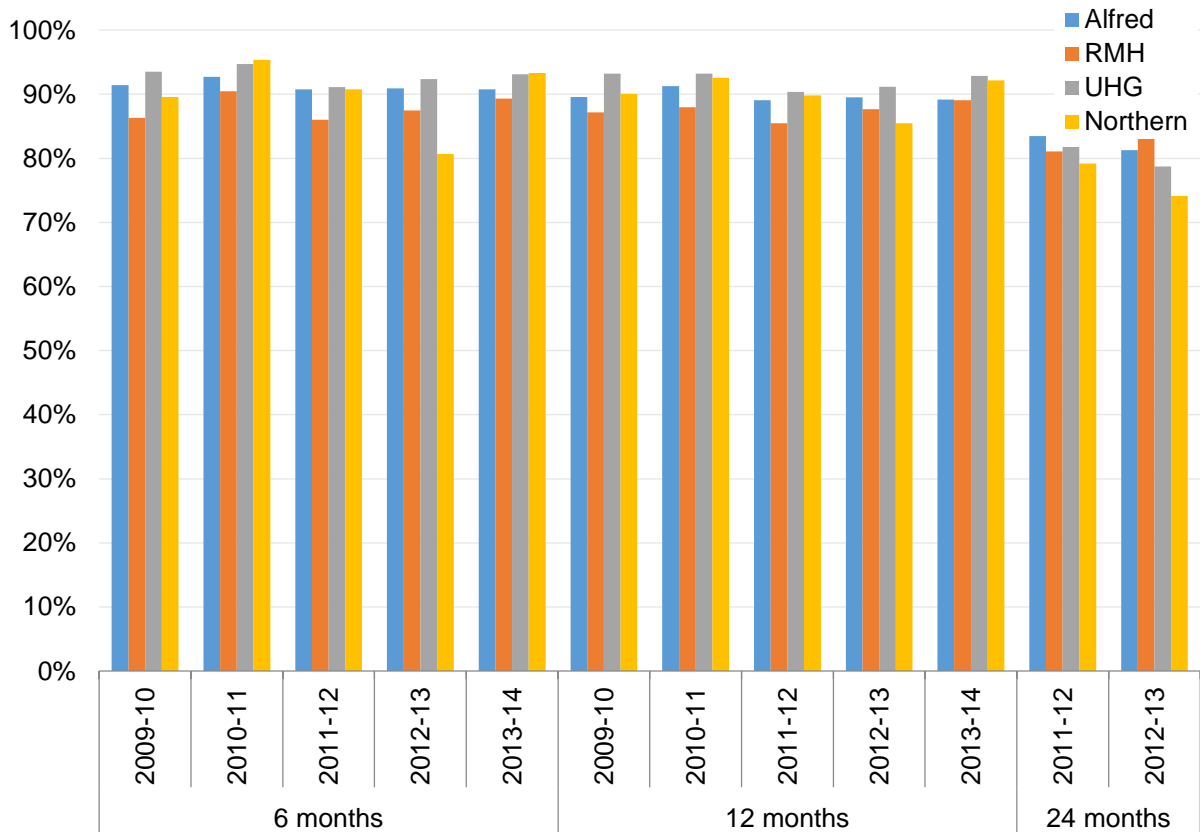


Figure 5: Follow-up rates over time

10.2 Function

The Glasgow Outcomes Scale – Extended (GOS-E) rates the function of the patient into eight categories ranging from death (GOS-E=1) to upper good recovery (GOS-E=8). A score of 8 (upper good recovery) indicates a complete return to normal activities of daily life, including occupational and social activities, without any residual deficits related to their injury. This approximates a complete functional recovery. The proportion of patients achieving a complete functional recovery at 12-months has decreased from 31 per cent in 2009-10 to 26 per cent in 2013-14 (Figure 6). However, there is a clear improvement in patient function over time, with the proportion of recovered patients in 2012-13 increasing from 21 per cent at 6-months to 28 per cent at 12-months to 34 per cent at 24-months.

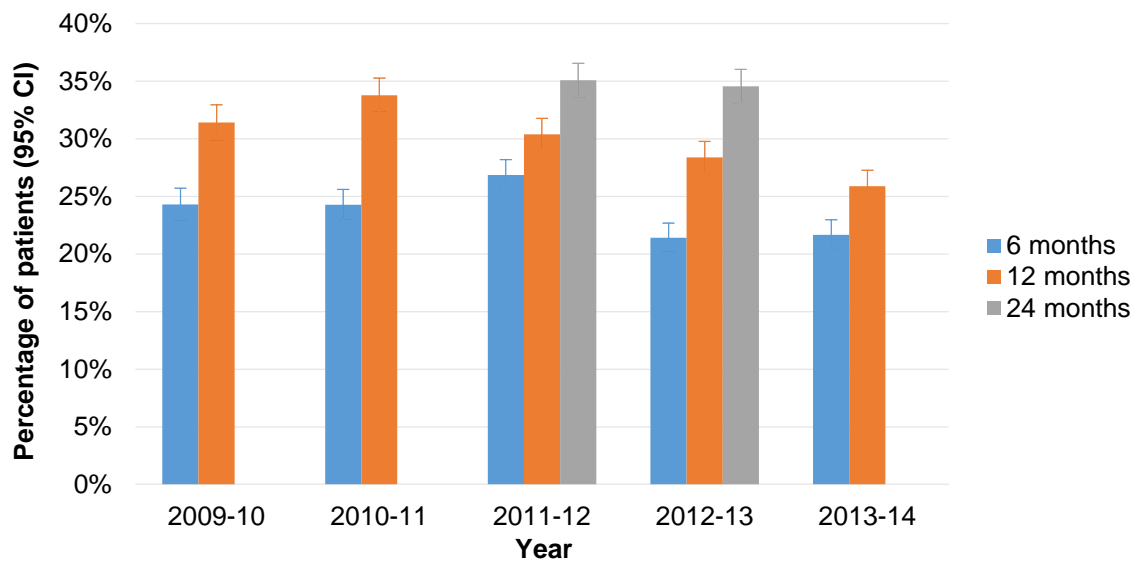


Figure 6: Percentage of patients (95% CI) achieving a complete functional recovery by year

The proportion of 2013-14 patients reporting a complete functional recovery on the GOS-E scale in each injury group, at 6-months and 12-months post-injury, are shown in Figure 7. For all injury groups, except soft tissue injuries, the proportion fully recovered increased from 6-months to 12-months post-injury. Overall, 12-month functional outcomes were best for isolated upper extremity and multiple upper extremity fractures, and poorest for patients who had sustained combined upper and lower extremity injuries with or without spinal injuries (Figure 7).

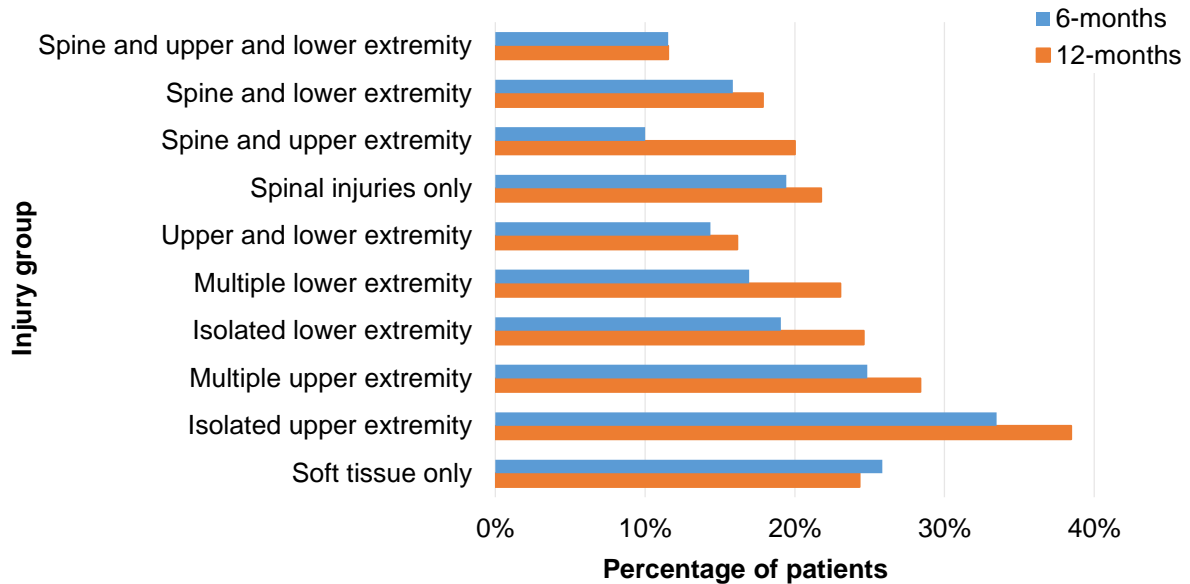


Figure 7. Functional recovery outcomes of VOTOR patients by orthopaedic injury group 2013-14

Taking into account factors such as age, gender, pre-existing comorbidities, pre-injury disability, compensable status, types of injuries and mechanism of injury, the probability of experiencing a complete functional recovery can be predicted for a typical VOTOR patient. For each financial year, the predicted probability of a complete functional recovery has increased from 6 to 12 to 24-months post injury for the typical VOTOR patient (Figure 8). Since 2009-10, the predicted probability of a complete functional recovery at 6-months post-injury has fluctuated within the range of 20 to 26 per cent. At 12-months post-injury, there has been a decline in the predicted probability of a complete functional recovery from 32 per cent in 2010-11 to 26 per cent in 2013-14. The reasons for this are not immediately evident but will be further investigated.

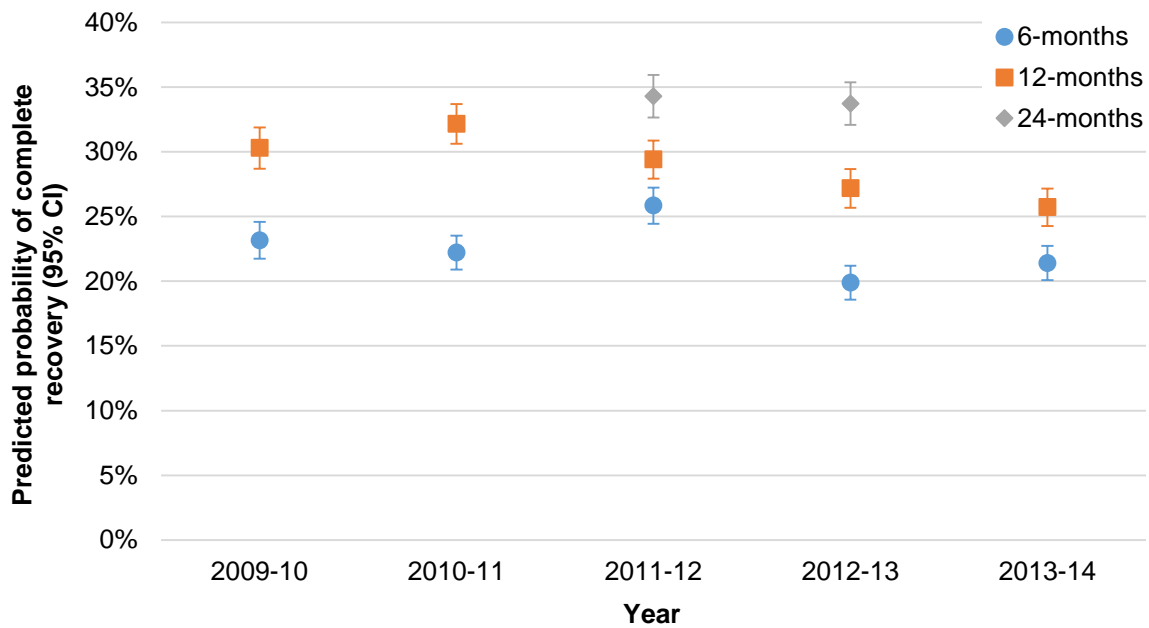


Figure 8. Predicted probability (95% CI) of a complete functional recovery for VOTOR patients adjusted for demographic and injury factors

10.3 Return to work

The proportion of VOTOR patients who were working prior to injury has remained fairly consistent over time; 52 per cent (n=2,360) in 2009-10, 52 per cent (n=2,696) in 2010-11, 52 per cent (n=2,873) in 2011-12, 50 per cent (n=2,648) in 2012-13 and 50 per cent (n=2,509) in 2013-14. The proportion of patients returning to work has also remained consistent for both the 6-month and 12-month time points over the past five years (Figure 9). In 2013-14, the 6-month return to work rate was 73 per cent (n=1,707) and 79 per cent (n=1,846) had returned to work at 12-months. Over the last five years the proportion of patients who returned to work was higher at 12-months than at 6-months post-injury and for 2011-12 and 2012-13 was higher at 24-months than 12-months post-injury (Figure 9).

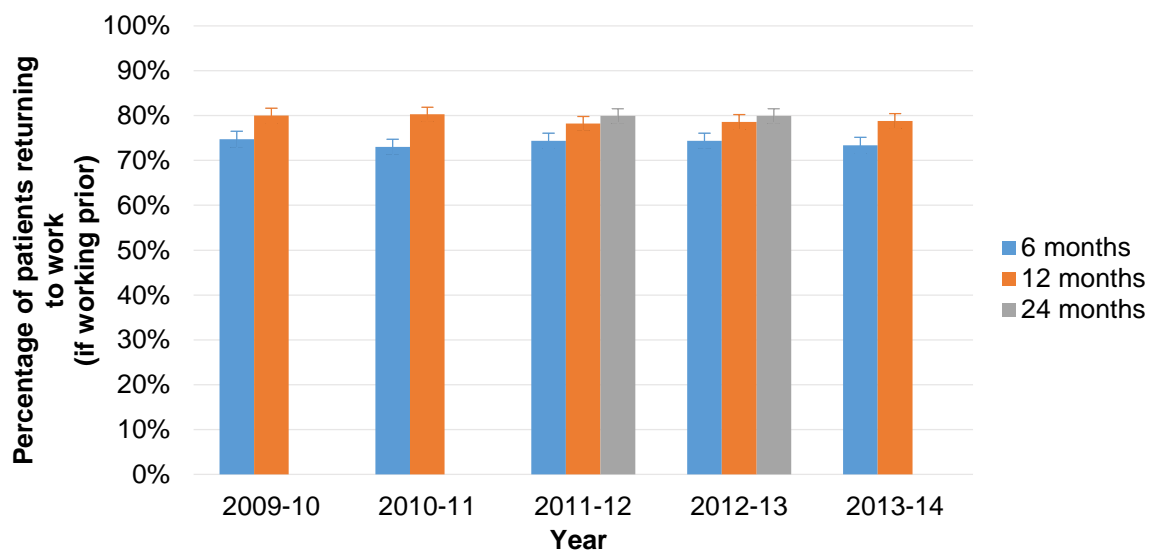


Figure 9: Return to work outcomes of VOTOR patients over time (95%CI)

In 2013-14, 85 per cent (n=1,455) of patients returning to work at 6-months, and 84 per cent (n=1,547) of patients returning to work at 12-months, had returned to the same role within their pre-injury workplace. These proportions have remained fairly consistent over time (Table 14).

Table 14: VOTOR patients returning to same role by year

Descriptor	n (%)*	2009-10	2010-11	2011-12	2012-13	2013-14
6-months	Returned to role	1426 (88)	1643 (88)	1657 (85)	1579 (88)	1455 (85)
12-months	Returned to role	1433 (82)	1683 (83)	1691 (84)	1607 (85)	1547 (84)
24-months	Returned to role	-	-	1568 (79)	1462 (79)	-

* Proportion of those patients who had returned to work

The return to work rate at 6 and 12-months, for patients injured in 2013-14, was highest for soft tissue injuries, isolated upper extremity fractures and isolated lower extremity fractures (Figure 10). Consistent with functional outcomes, return to work rates were lower for patients with orthopaedic injuries in more than one body region (Figure 10).

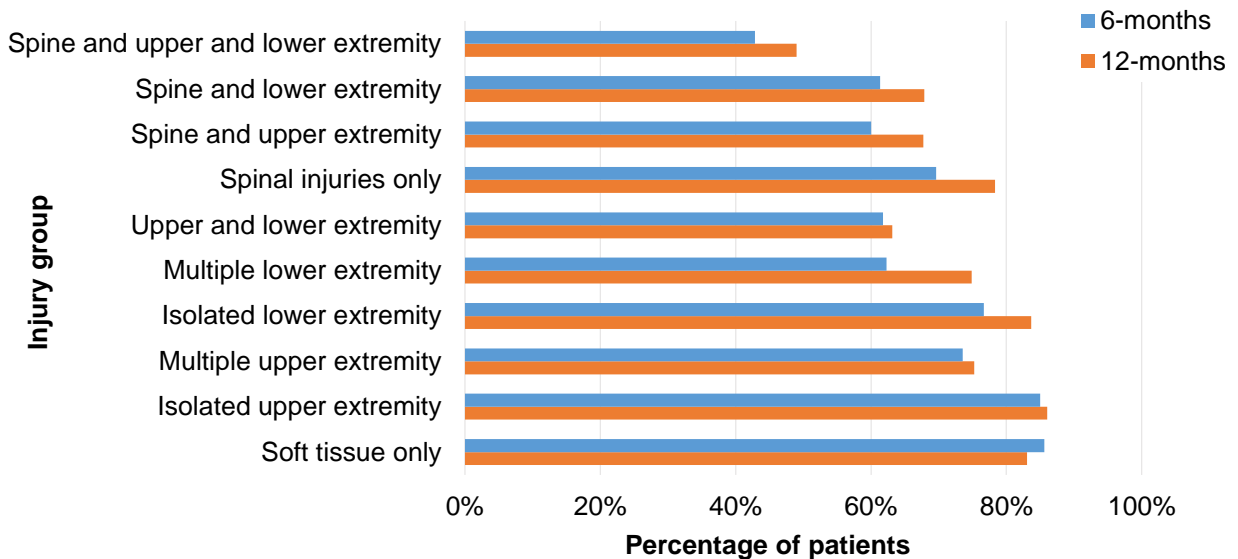


Figure 10: Return to work outcomes of VOTOR patients by orthopaedic injury group 2013-14

Adjusting for age, gender, pre-existing comorbidities, pre-injury disability, compensable status, types of injuries and mechanism of injury, the probability of returning to work for a typical VOTOR patient is shown in Figure 11. Each year, the predicted probability of returning to work has increased from 6 to 12 to 24-months post injury for the typical VOTOR patient (Figure 11). Since 2009-10, the predicted probability of returning to work at 6-months post-injury has ranged from 75 to 79 per cent, and at 12-months has ranged from 81 to 84 per cent.

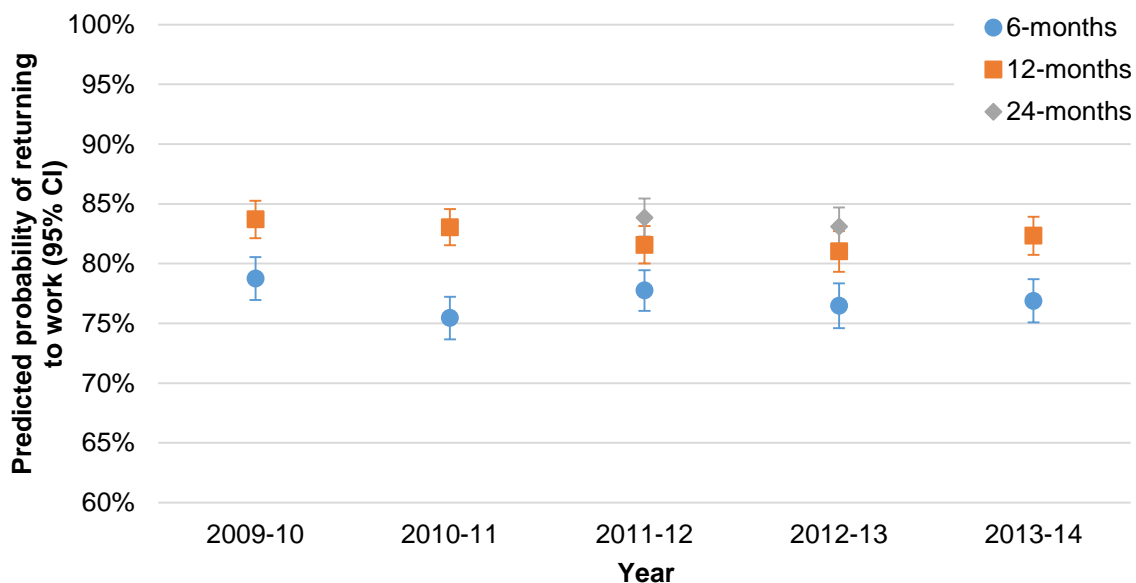


Figure 11. Predicted probability (95% CI) of returning to work for VOTOR patients adjusted for demographic and injury factors

10.4 Pain

A numerical rating scale (NRS) is used to collect information about pain at follow-up. The patient is asked to describe their pain at the time of interview on a scale from zero (no pain at all) to 10 (worst possible pain). A score of five or higher represents moderate to severe persistent pain. The proportion of patients reporting moderate to severe persistent pain at 6-months and 12-months following injury has remained relatively stable since 2009-10 (Table 15). The proportion of 2011-12 patients reporting moderate to severe persistent pain decreased from 6-months to 24-months following injury but remained fairly consistent over time for 2012-13 patients.

Table 15: Pain outcomes of VOTOR patients by year

Descriptor	n (%)	2009-10	2010-11	2011-12	2012-13	2013-14
6-months	Mean (SD) score	2.0 (2.7)	1.9 (2.6)	1.9 (2.7)	1.7 (2.5)	2.0 (2.6)
	None/Mild pain	2030 (79)	2654 (80)	2653 (80)	2531 (83)	2387 (80)
	Moderate/Severe	538 (21)	647 (20)	659 (20)	531 (17)	591 (20)
12-months	Mean (SD) score	1.8 (2.6)	1.7 (2.6)	1.8 (2.7)	1.6 (2.5)	1.7 (2.5)
	None/Mild pain	2178 (81)	2707 (82)	2460 (80)	2475 (84)	2309 (83)
	Moderate/Severe	522 (19)	591 (18)	599 (20)	473 (16)	488 (17)
24-months	Mean (SD) score	-	-	1.5 (2.5)	1.5 (2.5)	-
	None/Mild pain	-	-	2474 (84)	2294 (83)	-
	Moderate/Severe	-	-	461 (16)	457 (17)	-

Table 15 summarises VOTOR patient pain scores over time, and Table 16 shows the profile of pain scores at 6-months and 12-months according to hospital of definitive care during 2013-14. Mean pain scores were fairly consistent between hospitals, despite more severely injured patients being admitted to the Alfred and RMH. The University Hospital of Geelong patients reported the lowest proportion of moderate to severe persistent pain at 6-months and this proportion remained the same at 12-months. At each other hospital, there was a decrease in the prevalence of moderate to severe persistent pain from 6 to 12-months (Table 16).

Table 16: Pain outcomes of VOTOR patients by hospital 2013-14

Descriptor	n (%)	Alfred	RMH	UHG	Northern	Overall
6-months	Mean (SD) score	1.9 (2.6)	2.1 (2.7)	1.8 (2.5)	2.2 (2.8)	2.0 (2.6)
	None/Mild pain	1030 (81)	703 (78)	478 (85)	176 (76)	2387 (80)
	Moderate/Severe Pain	250 (20)	199 (22)	87 (15)	57 (24)	591 (20)
12-months	Mean (SD) score	1.6 (2.4)	1.8 (2.6)	1.5 (2.4)	1.9 (2.6)	1.7 (2.5)
	None/Mild pain	981 (84)	696 (80)	462 (85)	170 (80)	2309 (83)
	Moderate/Severe Pain	189 (16)	175 (20)	81 (15)	43 (20)	488 (17)

The proportion of patients reporting moderate to severe persistent pain in each injury group is shown in Figure 12. Most groups showed a decrease in the prevalence of moderate to severe persistent pain from 6 to 12-months post injury. At 6-months post-injury, patients with injuries involving the spine had the highest prevalence of moderate to severe pain. At 12-months, the prevalence was highest for patients who had sustained spine and upper extremity injuries. The group reporting the lowest prevalence of moderate to severe pain at 6 and 12-months were those with soft tissue injuries (Figure 12).

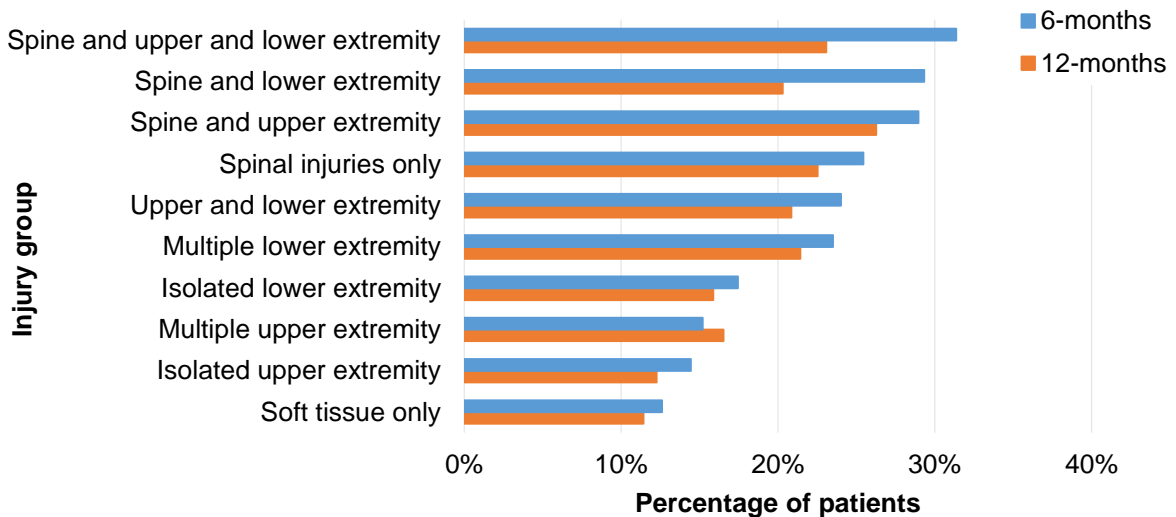


Figure 12: 6-month and 12-month moderate/severe pain outcomes by injury group 2013-14

Taking into account factors such as age, gender, pre-existing comorbidities, pre-injury disability, compensable status, types of injuries and mechanism of injury, the probability of experiencing moderate to severe pain for a typical VOTOR patient is shown in Figure 13. For each financial year, there has been a decrease in the probability of experiencing moderate to severe pain from six to 12 to 24-months post injury for the typical VOTOR patient (Figure 13). The predicted probability of experiencing moderate to severe pain at 6-months post-injury has ranged from 16 to 19 per cent, and at 12-months has ranged from 15 to 18 per cent. After 24-months, the adjusted proportion experiencing moderate to severe pain for the typical VOTOR patient has ranged from 13 to 14 per cent.

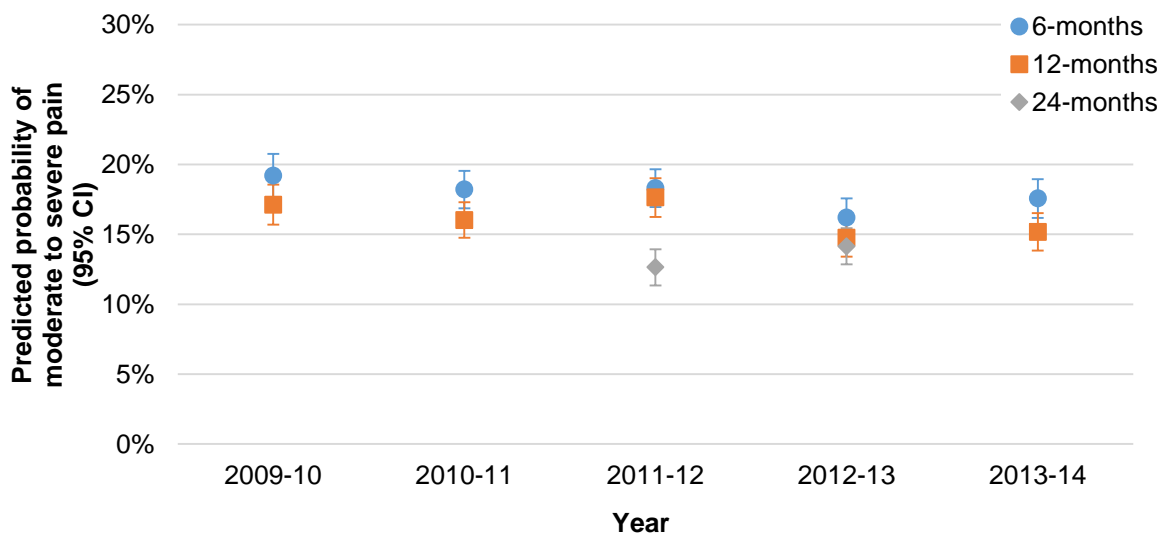
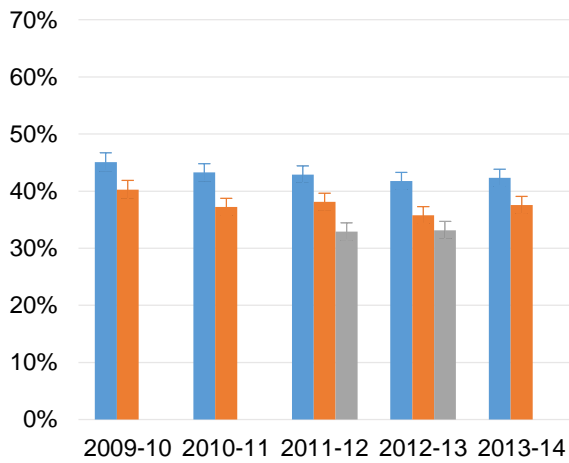


Figure 13. Predicted probability (95% CI) of moderate to severe pain for VOTOR patients adjusted for demographic and injury factors

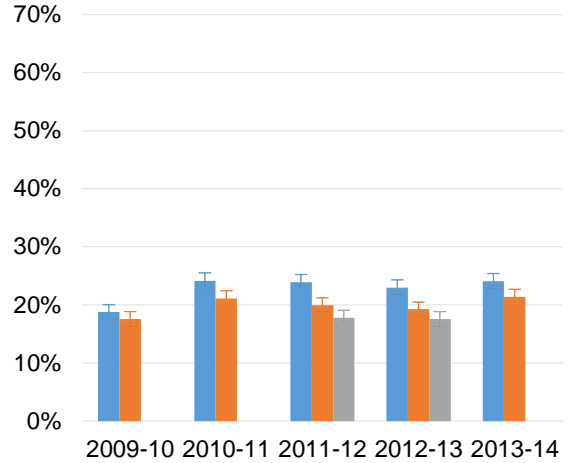
10.5 Health-related quality of life

Health-related quality of life was measured using the EQ-5D, which asks patients to describe their level of problems across five domains (mobility, self-care, usual activities, pain/discomfort and anxiety/depression). Patient responses were then dichotomised for analysis into: 'No Problems' and 'Problems'.

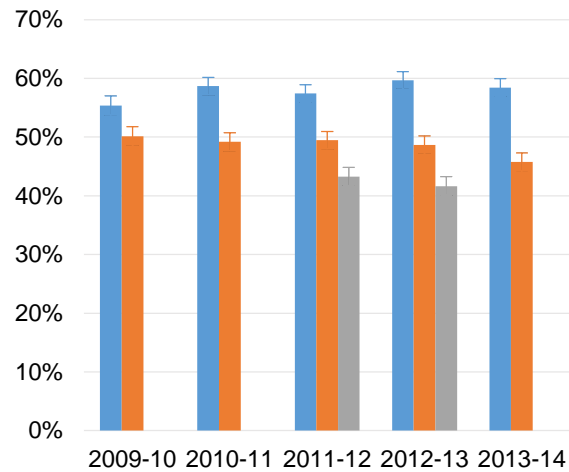
Figure 14 shows the percentage of patients reporting problems within each of the five domains over time. At 6, 12 and 24-months post-injury, there was a higher prevalence of problems with usual activities and pain/discomfort and mobility than self-care or anxiety/depression. For each domain, and year, there was a clear improvement over time, with fewer patients reporting problems at 24-months than 12 and 6-months. Improvements over time were not as marked for self-care and anxiety/depression domains. From 2009-10 to 2013-14, problems with pain/discomfort and anxiety/depression were less prevalent.



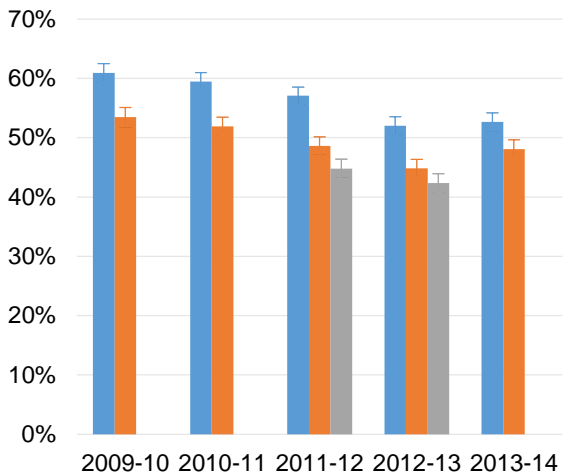
14.1: Percentage of patients reporting problems with mobility



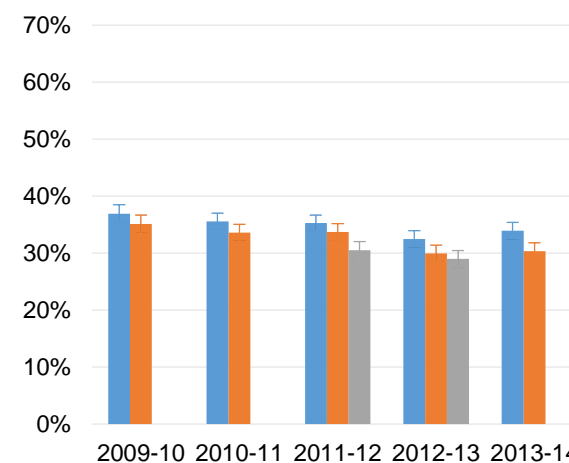
14.2: Percentage of patients reporting problems with self-care



14.3: Percentage of patients reporting problems with usual activities



14.4: Percentage of patients reporting problems with pain/discomfort

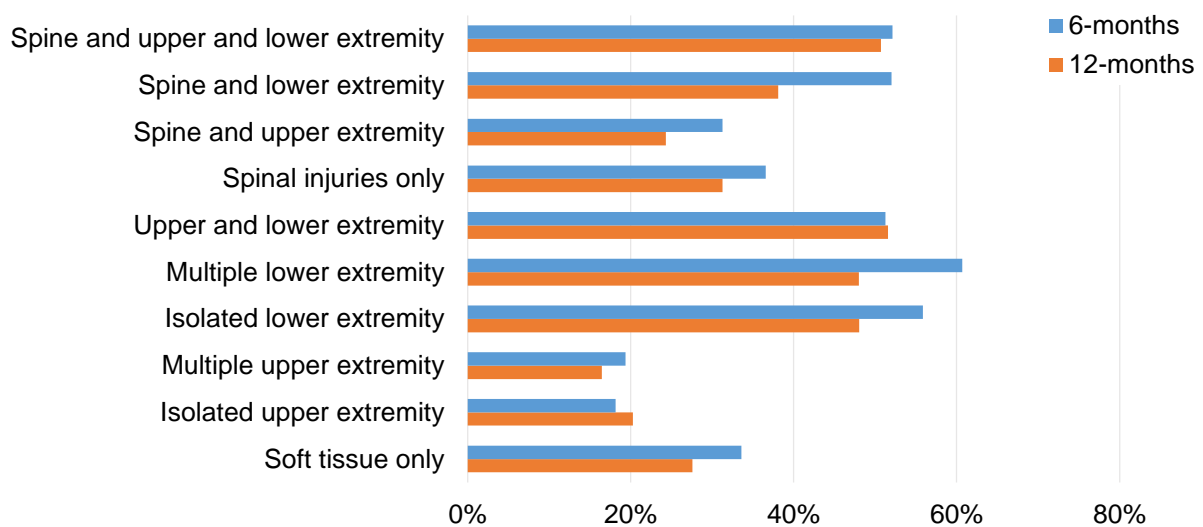


14.5: Percentage of patients reporting problems with anxiety/depression

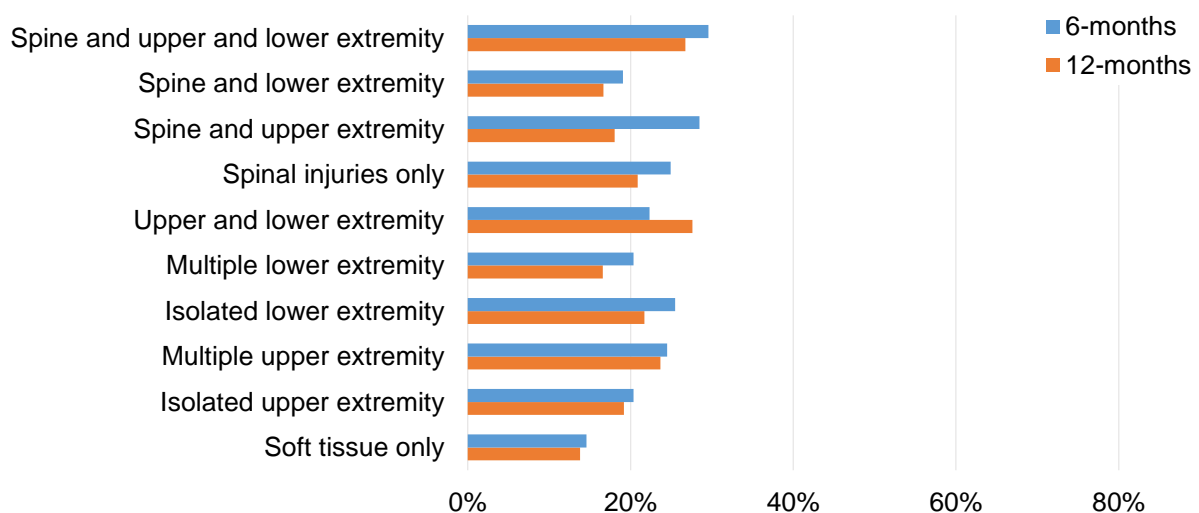
■ 6 months
 ■ 12 months
 ■ 24 months

Figure 14: EQ-5D outcomes of VOTOR patients over time (95% CI)

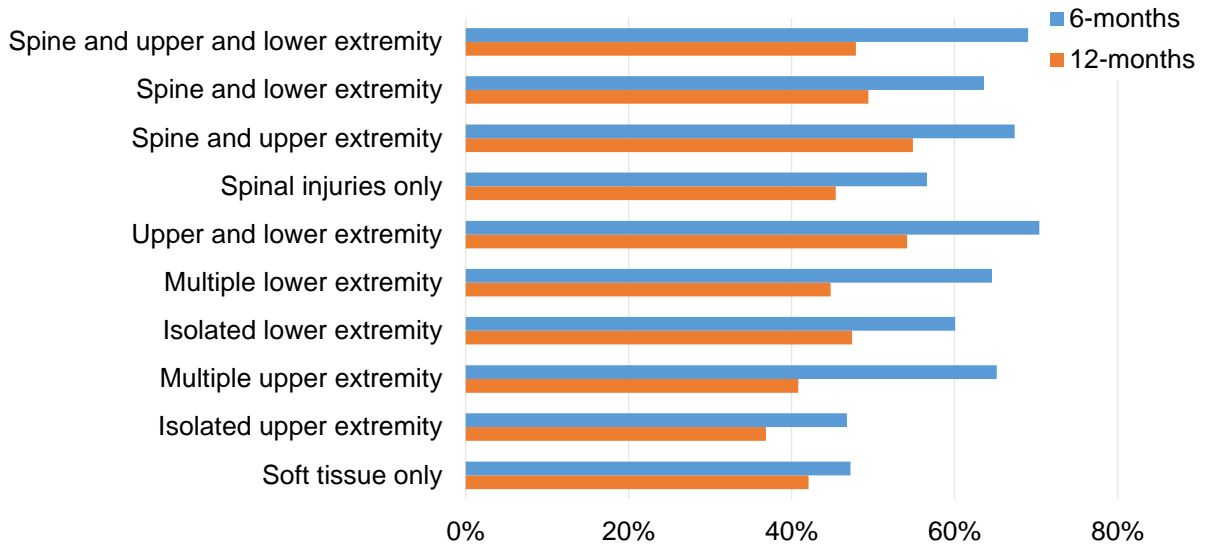
Figure 15 shows the prevalence of problems within each domain across injury groups for patients injured in 2013-14. For the mobility domain, patients more commonly reported problems if their injuries involved the lower limb compared to those without lower limb involvement. For self-care, the highest prevalence of problems was reported by patients with spine and upper and lower extremity injuries and lowest by patients with soft tissue injuries. For the usual activities domain, there was a marked improvement from 6-months to 12-months post-injury across all injury groups and, at 12-months, problems were most commonly reported in the upper and lower extremity and the spine and upper extremity groups. There was a high prevalence of pain and discomfort amongst all patients and improvements over time were less noticeable. For the anxiety/depression domain, patients with upper and lower extremity injuries had the highest prevalence of problems at 12-months post-injury and those with soft tissue injuries the lowest.



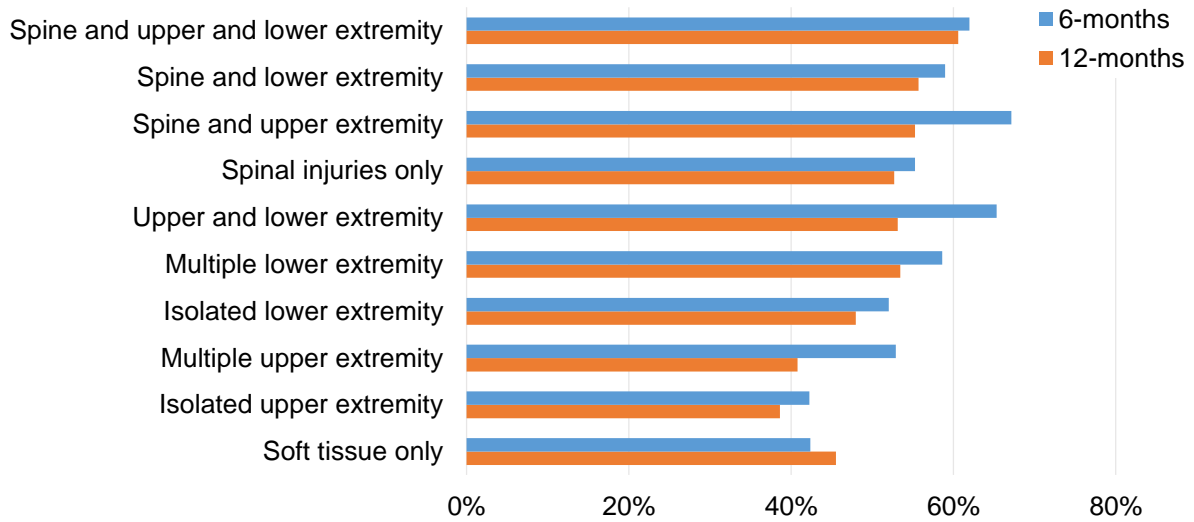
15.1: Percentage of patients reporting problems with mobility



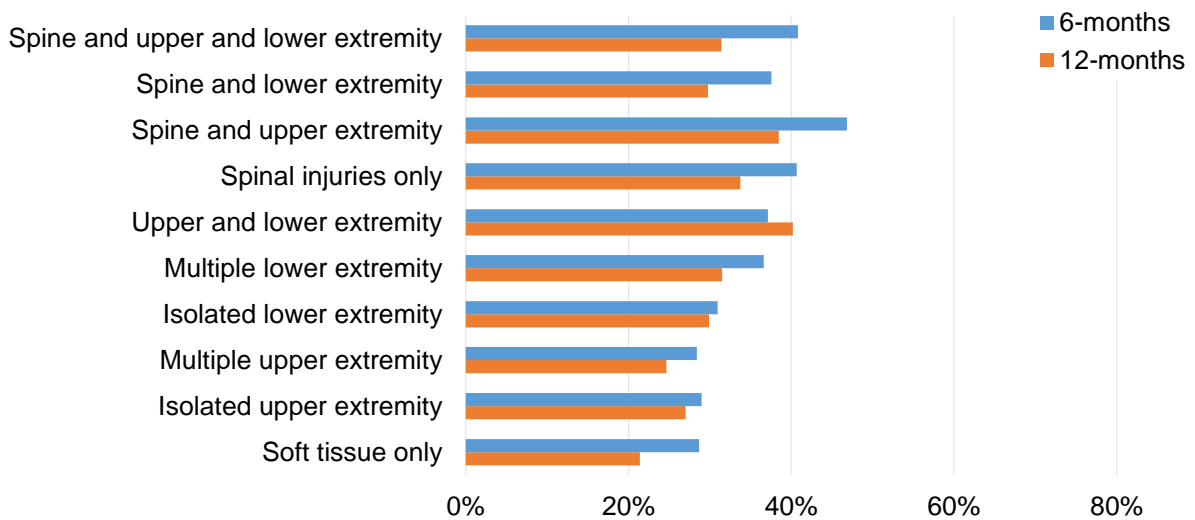
15.2: Percentage of patients reporting problems with self-care



15.3: Percentage of patients reporting problems with usual activities



15.4: Percentage of patients reporting problems with pain/discomfort



15.5: Percentage of patients reporting problems with anxiety/depression

Figure 15: EQ-5D outcomes of VOTOR patients by injury group 2013-14

The EQ-5D summary score provides a single score summarising all five quality of life domains. The EQ-5D summary score is normalised to population scores, ranging from -0.59 to 1 with scores <0 = health state worse than death, 0 = equivalent to death and 1 = perfect health. Overall, mean EQ-5D summary scores were less than 1.0 at all time points, ranging from 0.68 to 0.77 (Figure 16). However, there was an increase in mean scores from 2009-10 to 2013-14, reflecting improvements in patients' overall health-related quality of life over the past five years. These improvements relate to improvements in the pain/discomfort, anxiety/depression and usual activities domains seen in Figure 14. Following injury, patients demonstrated clear improvement in health-related quality of life over time, with mean EQ-5D summary scores increasing from 6 to 12 to 24-months post-injury.



Figure 16: Mean EQ-5D summary scores of VOTOR patients over time

Figure 17 presents mean EQ-5D summary scores, normalised to population scores, for 2013-14 VOTOR patients according to injury group. Again, across all injury groups, EQ-5D scores were lower than 1.0, ranging from 0.65 to 0.80. Except for patients with combined upper and lower extremity injuries, all groups improved to some extent from 6 to 12-months post-injury. These improvements were particularly noticeable for patients with injuries involving the spine and upper extremity and the spine and lower extremity. Quality of life was highest in patients with soft tissue injuries, isolated upper extremity injuries and multiple upper extremity injuries, and lowest in patients with spine and upper and lower extremity injuries.

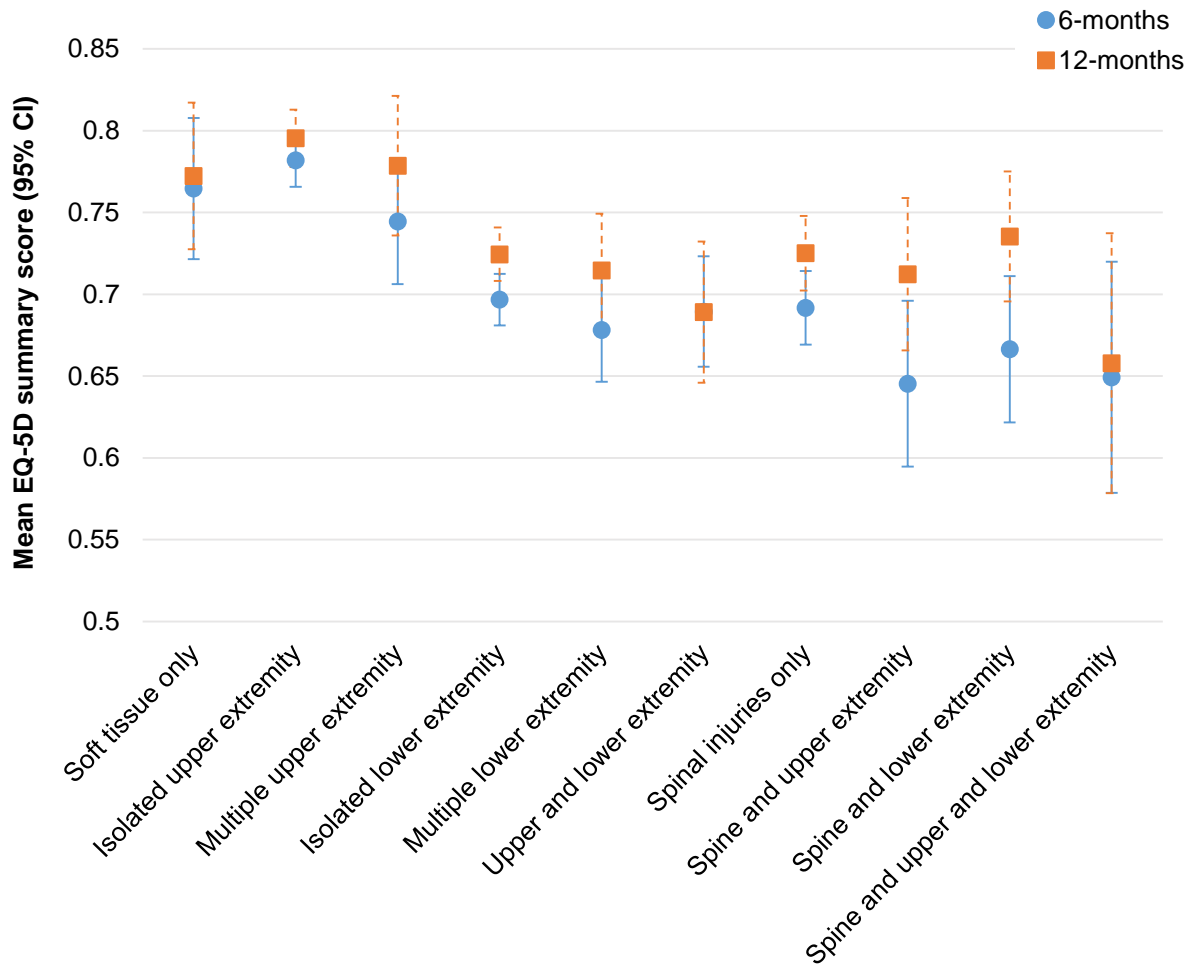


Figure 17: Mean EQ-5D summary scores of VOTOR patients by injury group 2013-14

11. Summary

The number of orthopaedic trauma patients registered by VOTOR has increased substantially over time. In 2014-15, there was a notable increase in VOTOR patients at the Royal Melbourne Hospital and a decrease in patients at University Hospital Geelong from the previous year.

Up until 2014-15, there was an increase in the average age of VOTOR patients each year. However, this year that trend has stabilised. Over time, there has been little change in the pattern of causes of injury, with the most common causes of injury continuing to be falls and road trauma. There has also been little change in the types of injuries sustained, with isolated lower extremity and isolated upper extremity injuries continuing to account for more than half of the cases. Markers of injury severity, such as hospital length of stay and the in-hospital death-rate, have also remained consistent over time. However, there has been an increase in the proportion of patients discharged to inpatient rehabilitation over time. There is scope to investigate the factors driving this change in discharge practice and the influence of this change on the health outcomes of VOTOR patients.

This was the first VOTOR annual report to provide long-term patient outcomes up to 24-months post-injury, with previous reports presenting 6 and 12-month data only. These data confirm that patients continue to improve their function, return to work rates, pain and health-related quality of life up to 24-months post-injury.

Adjusting for a range of demographic and injury factors, the typical VOTOR patient has a predicted probability of a complete functional recovery of 26 to 32 per cent at 12-months post-injury, a probability of returning to work of 81 to 84 per cent at 12-months and a probability of experiencing moderate to severe pain of approximately 15 to 18 per cent at 12-months post-injury. Return to work and pain outcomes have remained consistent over time but functional outcomes have worsened over the past five years, declining from a predicted probability of a complete recovery at 12-months of 32 per cent in 2010-11 to 26 per cent in 2013-14. The reasons for this are currently unclear and are worthy of further investigation.

Overall, VOTOR is a valuable source worldwide, providing an important means of monitoring the care and outcomes of patients admitted to hospital with orthopaedic trauma. The high incidence and long-term burden of orthopaedic trauma support the ongoing need for VOTOR which provides a platform for research aimed at improving patient outcomes, and the capacity to evaluate the impact of changes in clinical practice over time.

12. Appendix A - Investigators and Staff

Investigators:

Professor Belinda Gabbe

Professor Peter Cameron

Associate Professor Elton Edwards

Professor Richard de Steiger

Associate Professor Martin Richardson

Associate Professor Sue Liew

Professor Richard Page

Associate Professor Raphael Hau

Associate Professor Andrew Bucknill

Mr Andrew Oppy

Project Coordinator:

Ms Melissa Hart

Staff:

Dr Christina Ekegren

Ms Mimi Morgan

Mr Adrian Buzgau

Follow up Staff

13. Appendix B – Publication and presentation list for 2014-2015

Articles

1. Gabbe BJ, Simpson PM, Cameron PA, Ekegren CL, Edwards ER, Page R, Liew S, Bucknill A, de Steiger R. Association between perception of fault for the crash and function, return to work and health status 1 year after road traffic injury: a registry-based cohort study. *BMJ Open* 2015; doi:10.1136/bmjopen-2015-009907.
2. Ekegren CL, Hart MJ, , Brown A, Gabbe BJ. Inter-rater agreement on assessment of outcome within a trauma registry. *Injury* 2015; doi:<http://dx.doi.org/10.1016/j.injury.2015.08.002>.
3. Gabbe BJ, McDermott E, Simpson PM, Derrett S, Ameratunga S, Polinder S, Lyons RA, Rivara FP, Harrison JE. Level of agreement between patient-reported EQ-5D responses and EQ-5D responses mapped from the SF-12 in an injury population. *Population Health Metrics* 2015; 13:14 doi:10.1186/s12963-015-0047-z.
4. Kirby JC, Edwards E, Kamali Moaveni A. Management and functional outcomes following sternoclavicular joint dislocation. *Injury* 2015;46(10):1906-13.
5. Arora V, Kimmel LA, Yu K, Gabbe BJ, Liew SM, Kamali Moaveni A. Trampoline related injuries in adults. *Injury* 2015; doi: 10.1016/j.injury.2015.09.002.

Reports

1. Gabbe BJ, Edwards ER, de Steiger RN, Ekegren CL. Incidence and costs of non-union, delayed union and mal-union 2 years following fractures of the humerus, tibia and femur. Report for Zimmer, Submitted 16 Nov 2015.

Conference presentations

1. Arora V, Kimmel, LA, Yu K, Gabbe BJ, Liew SM, Kamali Moaveni A. Trampoline related injuries in adults. Australian Orthopaedic Association ASM. 11-15 October 2015, Brisbane
2. Kimmel L. Holland A. Hart M. Edwards E. Page R. Hau R. Bucknill A. Gabbe B. Discharge from the acute hospital: Trauma patients' perceptions of care. Trauma 2016. Gold Coast 2-4th October. 2015
3. Kimmel L, Holland A, Sayer J, Keating L, Liew S. High intensity physiotherapy following hip fracture is safe and effective in reducing hospital length of stay. Australian Orthopaedic Association. Brisbane. Oct 11-15 2015
4. Kimmel L, Holland A, Sayer J, Keating L, Liew S. High intensity physiotherapy following hip fracture is safe and effective in reducing hospital length of stay. 11th National Allied Health Conference. Melbourne. November 10 - 12th. 2015
5. Salipas A, Kimmel L, Edwards E, Rakhra S, Miller R, Kamali Moaveni A. Epidemiology and Outcome of Medical Clavicle Fractures Managed at a Level I Trauma Centre. Australian Orthopaedic Association ASM. 11-15 October 2015, Brisbane

6. Gabbe B, Simpson B. Association between fault status and 12 month outcomes after road transport-related orthopaedic trauma. Trauma 2015 Gold Coast 2-4 October 2015 (Awarded Best Free Paper Non-medical Presentation).
7. Ekegren CL, Gabbe BJ, Page R, Oppy A, Edwards E, de Steiger R, Liew S, Hau R, Bucknill A, Hart M. Functional outcomes of hip fracture patients in an orthopaedic trauma registry. Oral presentation given at Australian Injury Prevention Network Conference; 2015 Nov 25-27; Sydney, Australia.