The Development of Impairment-Related Injury Outcome Indicators

Injury Prevention Research Unit

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UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo

The development of impairment-related injury outcome indicators

This study was funded and supported by the Accident Compensation Corporation (ACC), Wellington, New Zealand. Views and / or conclusions in this report are those of the project team and may not reflect the position of the ACC.

Colin Cryer
Pauline Gulliver
Daniel Russell
Gabrielle Davie
John Langley

Injury Prevention Research Unit
Department of Preventive and Social Medicine
University of Otago
P O Box 913
Dunedin
New Zealand

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Abbreviations

A&E	Hospital Accident and Emergency
ACC	Accident Compensation Corporation
AIS	Abbreviated Injury Scale
AMA4	American Medical Association Guides to the Evaluation of Permanent Impairment - 4th edition
DRE	Diagnosis-related estimate
ED	Emergency Department
GP	General (Medical) Practitioner
ICD-10	WHO International Classification of Diseases 10th Revision
ICD-10-AM	WHO International Classification of Diseases 10th Revision, Australian Modification
ICISS	ICD-based Injury Severity Score
IPRC Act	Injury Prevention, Rehabilitation and Compensation Act 2001
IPRU	Injury Prevention Research Unit, University of Otago
LSP	Lump Sum Payment
NMDS	National Minimum Data Set of hospital discharges
NZHIS	New Zealand Health Information Service
NZIPS	New Zealand Injury Prevention Strategy
PTSD	Post-traumatic stress disorder
TOI	Threat of Impairment
TTL	Threat to Life
WHO	World Health Organisation
WPI	Whole Person Impairment

Executive Summary Report

Background

The Injury Prevention Research Unit (IPRU, University of Otago) recently developed serious injury outcome indicators for the New Zealand Injury Prevention Strategy (NZIPS). These indicators were either based on deaths, or on serious injury incidence, where “serious” was defined in terms of threat to life. When we presented the NZIPS indicators to the Accident Compensation Corporation (ACC) Senior Management Group in 2004, a question was asked: why can't ACC's lump sum payment (LSP) scheme data be used to produce indicators reflecting impairment? That was the origin of this impairment indicators project - the purpose of which was to investigate whether we can produce valid indicators based on the ACC's LSP data (essentially a feasibility study).

The ACC Lump Sum Payment Scheme

The Injury Prevention, Rehabilitation and Compensation (IPRC) Act 2001 reintroduced lump sum payments for permanent impairment for injuries that occurred on or after 1 April 2002. This replaced the Independence Allowance, which continues to be available for injuries that were sustained before 1 April 2002.

The lump sum payment is based on an assessment of whole-person impairment, carried out by an appointed assessor using an approved assessment tool. That assessment tool comprises the American Medical Association Guides to the Evaluation of Permanent Impairment - 4th edition (AMA4) and the ACC User Handbook to AMA4. The scale of lump sum payment is set out in the Injury Prevention, Rehabilitation, and Compensation (Lump Sum and Independence Allowance) Regulation 2002

Potential Approaches

Potential approaches to identifying impairment-related indicators include:

1. using the ACC lump sum data directly to derive rates and numbers of people with impairments resulting from injury (approach 1); and
2. linking ACC lump sum payment data to hospital admissions, and then deriving estimates of threat of impairment measures (using methods similar to those for the NZIPS serious [threat to life] injury indicators) for each ICD-10-AM diagnostic code (approach 2).

Approach 1

If we could assume that all persons in New Zealand eligible for a lump sum payment from the ACC made a claim and were paid, then reliable injury impairment-related indicators would simply be derived from the incident data collected on lump sum payments. If the assumption does not hold – and not all eligible persons make a claim and receive a lump sum payment – then we would need to find a more sophisticated method of deriving valid indicators using these data, or abandon the quest of using ACC data.

Previous work has identified that an injury, even a serious or fatal injury, does not inevitably lead to a claim to the ACC. Our starting point was an assumption that this is the case for lump sum payments also. We hypothesised that the greater the WPI, the greater the likelihood of a lump sum claim being made and paid. We proposed that reliable indicators be sought through the identification of an impairment threshold (T1) – not previously identified - beyond which we would expect an ACC claim for LSP to be made and paid for those who qualify for it. If such a threshold exists, then in a similar way to the NZIPS serious non-fatal injury indicators, cases that exceed that threshold would provide the basis for a further set of valid indicators.

Approach 2

This part of the feasibility work had a goal of deriving a threat of impairment severity measure based on diagnosis-specific probability of impairment - in a similar way to ICD-based Injury Severity Scores (ICISS), but based on probability of impairment rather than probability of death.

Such an approach is dependent on the existence data that has accurate and stable coding of diagnosis over time. Although ACC captures data on diagnosis. We had been informed by officers in ACC that the diagnostic data that is captured on claims is often derived from an initial assessment of injury diagnosis - rather than final diagnosis. If true, this will inevitably lead to error in diagnosis classification. (The correspondence of ACC coding of diagnosis with NMDS principal diagnosis was considered as part of the work for this report and is reported in the body of the report.) An alternative was to consider just cases admitted to hospital, and to use the more reliable hospital diagnosis at discharge, through linkage of ACC lump sum data to NZHIS hospitalisations[a]. This is the approach that was pursued.

[a] IPRU has shown that ICD-9 diagnoses are coded to a good standard of accuracy. ICD-10 diagnostic coding accuracy is currently being investigated by IPRU.

We proposed an approach that was based on identifying a threat of impairment (TOI) severity threshold (T2) as follows: for each 10% band of WPI (ie. 10-20%, 20-30%, etc), we would identify the proportion of cases that can be linked to NZHIS hospitalisation data. We hypothesised that for those injuries that carry a lower WPI value, the likelihood of admission would be lower than for those with a higher WPI, and hence the linkage rates would be lower for lower WPI. We also hypothesised that there exists a point above which almost all cases with a lump sum payment above the threshold T2 are admitted and thus would link to the NZHIS hospitalisation data. If such a point exists, it would become the threshold for the TOI measure.

Aims and research questions

Aim 1: To investigate and assess the feasibility of methods to develop valid impairment-related indicators (approach 1 above)

Associated research questions:

a) Do injuries that result in assessed whole person impairment (WPI) that are above a given impairment threshold (threshold T1 – to be determined) almost always result in a claim?
b) What is that impairment threshold T1?

Aim 2: To investigate and assess the feasibility of methods to derive valid threat of impairment measures (approach 2 above)

Associated research questions:

a) Do injuries that result in assessed WPI above a given impairment threshold (threshold T2 – to be determined), that result in a claim, almost always get admitted to hospital.
b) What is that impairment threshold T2?

Process used to progress the research

A priori, the general approach that was proposed for this work was as follows.

- IPRU would carry out an exploratory analysis of the ACC lump sum payment data (on its own), as well as these data linked to NZHIS NMDS of hospital discharges.
- The findings of this work would be shared and discussed with an Expert Group at 3 to 4 meetings – the Expert Group would advise the research team regarding the ACC LSP assessment process, claims-making behaviour, and ACC data capture and quality.
- An outcome of the early Expert Group meetings would be the identification of further exploratory work that could inform the development process.
- Expected outcomes of later meetings would be the identification of WPI thresholds that can be used to develop valid impairment and threat of impairment indicators.

This last step had to be modified due to the limitations of the data. Instead, the third meeting aimed at identifying injury diagnoses that if sustained and assessed would attract ACC lump sum payment (LSP), and would almost certainly be admitted to hospital. These diagnoses formed the basis of the threat of impairment indicators.

Results

Aim 1 was to investigate the development of valid impairment-related injury indicators. We identified the following threats to the method:

1. Some ACC diagnoses were inaccurate, which resulted in problems in identifying a threshold above which one would expect a LSP to always be assessed and awarded.
2. There were diagnoses identified, that should attract very high LSP, where there appear to have been a significant percentage of cases without LSP.
3. Projects like this one are likely to impact on the likelihood of future assessment and so on the award of a LSP – and hence on a time series based on LSP data.
4. There was a concern that potential future changes to the scheme would bias future time series analyses.

Aim 2 was to investigate the feasibility of deriving a diagnosis-specific threat of impairment measure. A threat to the original proposed method is illustrated by the following:

- The linkage of ACC LSP claims to NMDS was not high (around 70% or less) for any %WPI threshold investigated. A WPI threshold above which almost all LSP cases are admitted to hospital could not be found, therefore.

A modified approach was developed that aimed at the identification of diagnoses of injury that (A) would attract LSP if assessed, as well as (B) have a high probability of admission to hospital. The approach used a mixture of empirical methods and expert opinion. The expert opinion was obtained from the ACC medical advisors, who were members of the Expert Group, and from 3 Emergency Medicine consultants. The diagnoses identified are shown in the table below.

Threat of impairment indicators were developed based on these diagnoses – and were found to satisfy all of the International Collaborative Effort (ICE) on Injury Statistics validity criteria. That is, we identified no threats to the validity of these indicators. The charts below show the trends in the threat of impairment indicators for the period 2000 to 2005 relative to their NZIPS counterparts.

The threat of impairment (TOI) and the NZIPS serious threat to life indicators are complementary in so far as they present two distinct dimensions of serious injury. Nevertheless, the trends shown by these indicators are similar to one another (see overleaf). The NZIPS and TOI indicators both show an increase in the frequency (burden) of serious injury, and they both show little or no change in the rates (risk) since 2000.

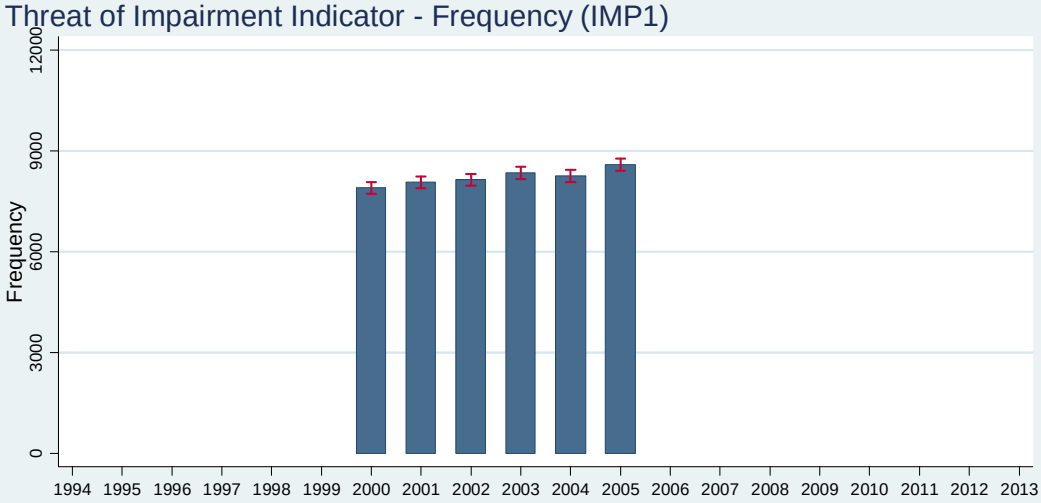
The serious threat of impairment injury indicators are defined by these principal diagnoses (ICD-10-AM).

ICD-10-AM code	Description
S021	Fracture base of skull Fossa: Anterior Middle Posterior Occtiput Orbital roof Sinus Ethmoid Frontal Sphenoid Temporal bone (excluding squamous part) Excludes orbital NOS, orbital floor
S052	Ocular laceration and rupture with prolapse or loss of intraocular tissue
S054	Penetrating wound of orbit with or without foreign body Excludes retained (old) foreign body following penetrating wound of orbit
S055	Penetrating wound of eyeball with foreign body Excludes retained (old) intraocular foreign body
S057	Avulsion of eye Traumatic enucleation
S0623	Multiple intracerebral and cerebellar haematomas 5mLs of blood Multiple intracerebral haemorrhages
S0628	Other diffuse cerebral and cerebellar injury Multiple lacerations of cerebrum and cerebellum
S0631	Focal cerebral contusion <=5 mLs of blood
S0633	Focal cerebral haematoma >5mLs of blood Intracerebral haematoma/haemorrhage
S064	Epidural haemorrhage Epidural [extradural] haematoma Extradural haemorrhage
S065	Traumatic subdural haemorrhage Subdrual haematoma
S066	Traumatic subarachnoid haemorrhage Subarachnoid haematoma
S068	Other intracranial injuries Traumatic haemorrhage/haematoma/contusion: Brain NOS Intracranial NOS
S080	Avulsion of scalp
S1101	Open wound of larynx
S120	Fracture of first cervical vertebra Atlas
S121	Fracture of second cervical vertebra Axis
S1222	Fracture of fourth cervical vertebra

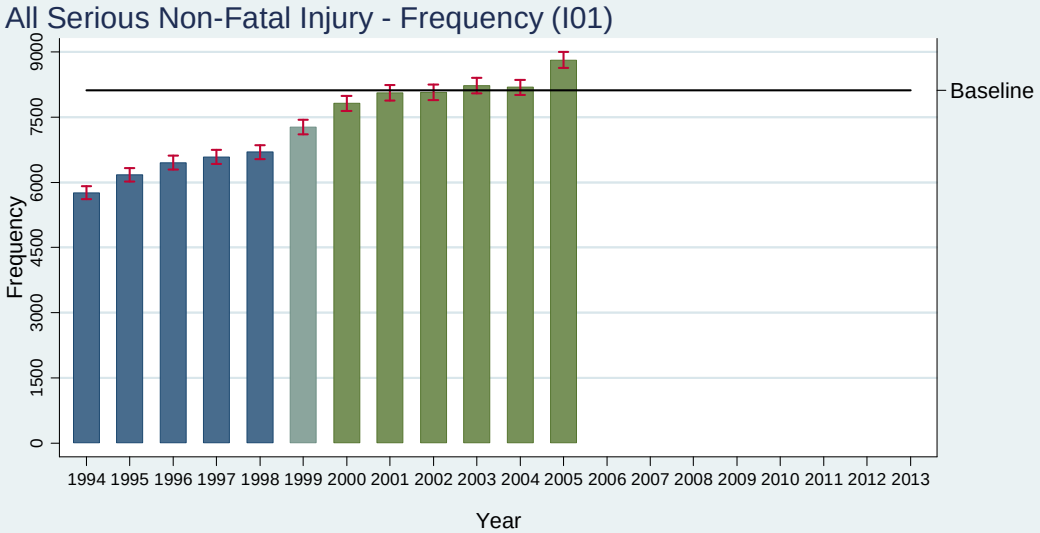
S1223	Fracture of fifth cervical vertebra
S1224	Fracture of sixth cervical vertebra
S127	Multiple fractures of cervical spine Excludes multiple fractures of specified levels of cervical vertebrae.
S1313	Dislocation of C3/C4 cervical vertebrae
S1315	Dislocation of C5/C6 cervical vertebrae
S140	Concussion and oedema of cervical spinal cord
S1410	Injuries of cervical spinal chord, unspecified
S1411	Complete lesion of cervical spinal chord
S1412	Central cord syndrome (incomplete cord injury) of cervical spinal cord
S1413	Other incomplete cord syndrome of cervical spinal cord Anterior cord syndrome Incomplete cervical spinal cord lesion NOS Posterior cord syndrome
S143	Injury of brachial plexus
S2244	Multiple rib fractures, involving four or more ribs Excludes multiple rib fractures involving first rib.
S225	Flail chest
S2410	Injury of thoracic spinal cord, unspecified
S2411	Complete lesion of thoracic spinal cord
S2412	Incomplete cord syndrome of thoracic spinal cord Anterior cord syndrome Central cord syndrome Incomplete thoracic spinal cord lesion NOS Posterior cord syndrome
S2471	Functional spinal cord injury, T1 level
S2474	Functional spinal cord injury, T6/T7 level
S2477	Functional spinal cord injury, T12 level
S250	Injury of thoracic aorta Aorta NOS
S271	Traumatic haemothorax
S272	Traumatic haemopneumothorax
S321	Fracture of sacrum
S323	Fracture of ilium
S324	Fracture of acetabulum
S3283	Fracture of pelvis, part unspecified Fracture of pelvis NOS
S341	Other injury of lumbar spinal cord (conus medullaris) Complete/incomplete lumbar cord lesion
S343	Injury of cauda equine
S3472	Functional spinal cord injury, L2 level
S355	Injury of iliac blood vessels Iliac artery or vein
S3600	Injury of spleen, unspecified
S3604	Massive parenchymal disruption of spleen Rupture of spleen
S3615	Major laceration of liver Laceration with significant disruption of hepatic parenchyma [i.e. 10cm long and 3cm deep]

	Multiple moderate lacerations, with or without haematoma
S3640	Injury of small intestine, unspecified site
S3649	Injury of other and multiple parts of small intestine Injury to ileum Injury to jejunum
S3682	Injury of mesentery
S3683	Injury of retroperitoneum
S3728	Other injury of bladder Laceration of bladder
S396	Injury of intra-abdominal organ(s) with pelvic organ(s)
S447	Injury of multiple nerves at shoulder and upper arm level
S450	Injury of axillary artery
S451	Injury of brachial artery
S551	Injury of radial artery at forearm level
S581	Traumatic amputation at level between elbow and wrist
S650	Injury of ulnar artery at wrist and hand level
S661	Injury of flexor muscle and tendon of other finger at wrist and hand level
S680	Traumatic amputation of thumb (complete)(partial)
S682	Traumatic amputation of 2 or more fingers (complete)(partial)
S683	Combined traumatic amputation of (part of) finger(s) with other parts of wrist and hand
S684	Traumatic amputation of hand at wrist level
S688	Traumatic amputation of other parts of wrist and hand
S7200	Fracture of neck of femur, part unspecified
S7203	Fracture of subcapital section of femur
S7205	Fracture of base of neck of femur Cervicotrochanteric section
S7211	Fracture of intertrochanteric section of femur
S722	Subtrochanteric fracture
S723	Fracture of shaft of femur
S7240	Fracture of lower end of femur, part unspecified
S7241	Fracture of femoral condyle
S7243	Supracondylar fracture of femur
S727	Multiple fractures of femur
S781	Traumatic amputation at level between hip and knee
S789	Traumatic amputation of hip and thigh, level unspecified
S8281	Bimalleolar facture, ankle
S8282	Trimalleolar fracture, ankle
S851	Injury of (anterior)(posterior) tibial artery
S881	Traumatic amputation at level between knee and ankle
T845	Infection and inflammatory reaction due to internal joint prosthesis
T848	Other complications of internal orthopaedic prosthetic devices, implants and grafts
T8578	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts

Threat of impairment indicator of population burden, relative to their NZIPS threat to life counterpart

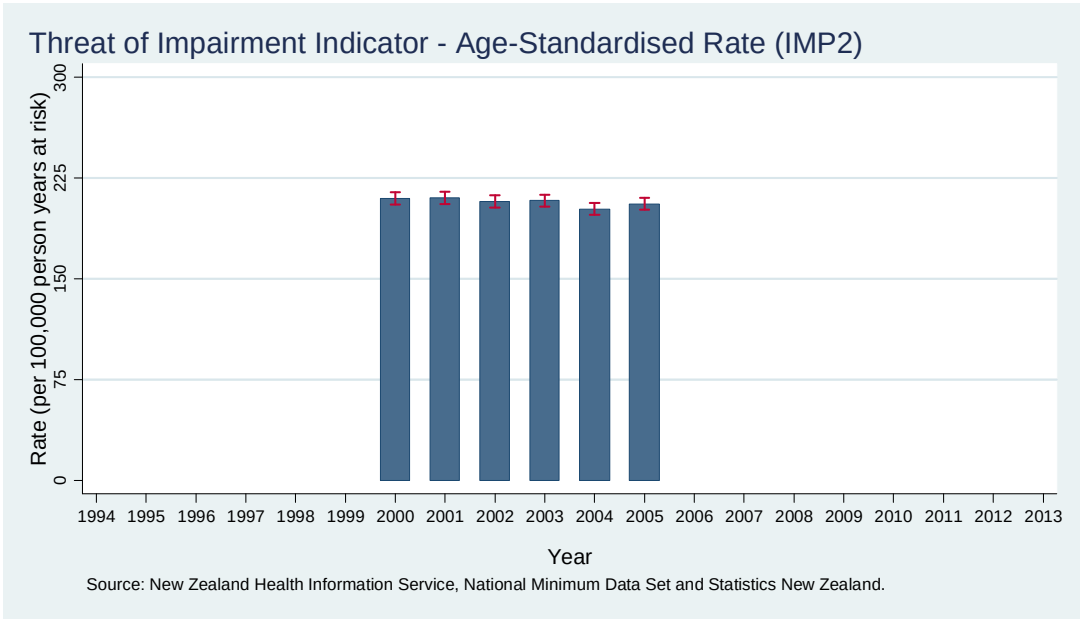


Source: New Zealand Health Information Service, National Minimum Data Set.

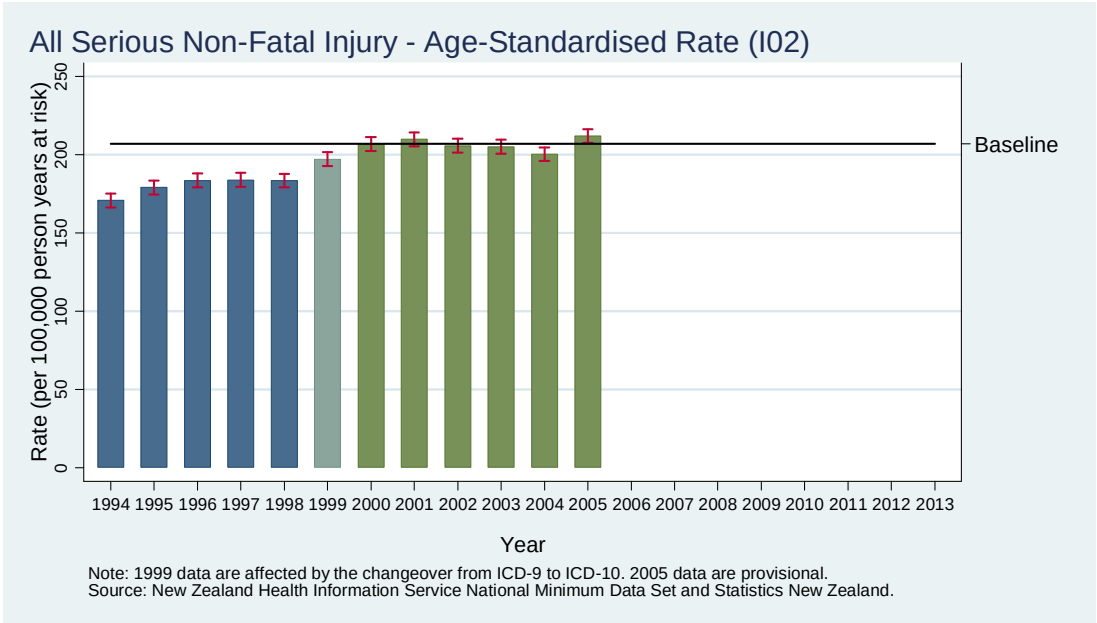


Note: 1999 data are affected by the changeover from ICD-9 to ICD-10. 2005 data are provisional.
Source: New Zealand Health Information Service National Minimum Data Set.

Threat of inpairment indicator of population risk relative to their NZIPS threat to life counterpart



Source: New Zealand Health Information Service, National Minimum Data Set and Statistics New Zealand.



Note: 1999 data are affected by the changeover from ICD-9 to ICD-10. 2005 data are provisional.
Source: New Zealand Health Information Service National Minimum Data Set and Statistics New Zealand.

Discussion

We are aware of no other work that has used national data to develop serious threat of impairment injury indicators. The indicators that we have developed complement the current NZIPS indicators in that they capture serious injuries along an alternative dimension of seriousness to that used for the NZIPS indicators, ie. threat of impairment rather than threat to life. This is demonstrated by the diagnoses that are captured by the threat of impairment but not the threat to life indicators, and vice versa (see Table 4 in the body of the report).

This work has provided a method for the development of serious threat of impairment indicators. The constituent diagnoses identified, that make up the indicators, could be applied by Australia to their hospital data, since NZ like Australia use ICD-10-AM to code diagnosis for hospital discharges. Additionally, it provides other countries who code their hospital discharge data to ICD-10 with the opportunity to investigate the viability of developing indicators based on similar ICD-10 codes.

The study also shows that the threat of impairment and the NZIPS threat to life indicators have similar trends, suggesting that even though threat of impairment and threat to life capture different aspects of severity of injury, that the NZ serious injury rates are pretty much unchanged over the period 2000 to 2005, no matter how “serious injury” is measured.

Recommendations

1. That NZIPS considers the adoption of these threat of impairment indicators now.

2. We recommend that work be commissioned to develop and apply methods for the critierion validation of the indicators.

3. That the international community be made aware of this work (eg. via the International Collaborative Effort on Injury Statistics) and be invited to investigate the validity of modifying to their local conditions the threat of impairment diagnosis list (in particular to the coding frames they use), with a view to generating their own threat of impairment indicators.

4. That the ACC be strongly encouraged to update the diagnosis information on their electronic record, when the initial diagnosis is revised, starting with the most serious cases (eg. those cases that are assessed and awarded LSP for impairment).

5. That work be put in train to develop indicators based on other dimensions of disability, in particular participation restriction. As a starting point, development work could be carried out that focuses on the working population with time off work used as a measure of participation restriction

1. Background and aims

1.1. Background

1.1.1. Introduction

The Injury Prevention Research Unit (IPRU, University of Otago) recently developed serious injury outcome indicators for the New Zealand Injury Prevention Strategy (NZIPS)[b]. [1] These indicators were either based on deaths, or on serious injury incidence, where serious was defined in terms of threat to life. Our IPRU report recommended (recommendation 5) that [1]:

> *Work be commissioned to investigate the means of developing indicators based on threat-of-disablement; focusing initially on ACC data as the primary source.* (p 81)

When we presented the NZIPS indicators to the ACC Senior Management Group in 2004, a question asked was: why can't ACC's lump sum payment (LSP)[c] scheme data be used to produce indicators reflecting impairment? That was the origin of this Impairment Indicators project - the aims of which were to answer whether we can produce valid indicators based on the ACC's LSP data (essentially a feasibility study).

Ideally a complete package of injury outcome indicators includes those that focus on fatal as well as non-fatal outcomes. Amongst the non-fatal, they should ideally include serious injury as defined by threat to life as well as (threat of) disability, as these capture two important and different dimensions of 'seriousness'. To date, the focus of the New Zealand Injury Prevention Strategy (NZIPS) indicators has been the former. The focus of this report is the development of indicators that reflect disability that will complement the existing NZIPS threat to life indicators. Impairment is one dimension of disability. As a starting point, we wish to identify indicators that encompass all persons and all injury.

[b] http://www.nzips.govt.nz/documents/serious-injury-indicators-2004-09.pdf
[c] The ACC LSP is part of the New Zealand no faults compensation scheme. The whole population of New Zealand is eligible for the scheme.

1.1.2. The ACC Lump Sum Payment Scheme

The Injury Prevention, Rehabilitation and Compensation (IPRC) Act 2001 reintroduced lump sum payments for permanent impairment for injuries that occurred on or after 1 April 2002. This replaced the Independence Allowance, which continues to be available for injuries that were sustained before 1 April 2002. The data collected by ACC on lump sum payments give the potential to develop impairment-based and threat of impairment-based indicators as a complement to the NZIPS serious (threat to life) injury indicators.

The lump sum payment is based on an assessment of whole-person impairment, carried out by an appointed assessor using an approved assessment tool. That assessment tool comprises the American Medical Association Guides to the Evaluation of Permanent Impairment - 4th edition (AMA4) and the ACC User Handbook to AMA4. [2] [3] The scale of lump sum payment is set out in the Injury Prevention, Rehabilitation, and Compensation (Lump Sum and Independence Allowance) Regulation 2002.

There is a requirement for the injury to be permanent and stable before the claimant is assessed for lump sum. Assessment can be up to 2 years after the injury. [3] Furthermore, the standard time between completion of an assessment and issuing a decision varies from 3 to 10 weeks[d]. Consequently, even though legislation was in place for lump sum payments commencing 1 April 2002, few lump sum payments were made until 2 or more years had passed. Exceptions were such obvious losses as amputation of a limb.

When formulating the proposal for this work, we extrapolated from the trends in lump sum payments up to December 2004. We assumed that new injury-related lump sum payments would stabilize at around 250 per quarter, ie. 1000 new cases per year. From the Irving 2004 report[a], we assumed that around half would have between 10-20% whole-person impairment (WPI), and a quarter would have between 20-30% WPI, leaving a quarter with over 30% WPI. As we were dealing with relatively small numbers, the proposal and the subsequent work for this report was limited to a consideration of indicators for 'all injury', rather than for the 6 NZIPS priority areas[e].

[d] Irving L. Third evaluation report on lump sum compensation. Report for ACC, October 2004.
[e] The NZIPS 6 priority areas are: assault, workplace injuries, suicide and deliberate self harm, falls, motor vehicle traffic crashes, and drowning and near drowning. It should be noted that, had there been larger numbers, difficulties would remain in identifying indicators for some priority areas. The ability to identify cases belonging to some of the priority areas within ACC is constrained by the coding frames used.

1.1.3. Potential approaches

Potential approaches to identifying impairment-related indicators include:

1. using the ACC lump sum data directly to derive rates and numbers of people with impairments resulting from injury (approach 1); and
2. linking ACC lump sum payment data to hospital admissions, and then deriving estimates of threat of impairment measures (using methods similar to those for the NZIPS serious [threat to life] injury indicators) for each ICD-10 diagnostic code (approach 2). [1]

This work investigates both of these approaches outlined in more detail here.

Approach 1

If we could assume that all persons in New Zealand eligible for a lump sum payment from the ACC made a claim and were paid, then reliable injury impairment-related indicators would simply be derived from the incident data collected on lump sum payments. If the assumption does not hold – and not all eligible persons make a claim and receive a lump sum payment – then we would need to find a more sophisticated method of deriving valid indicators using these data, or abandon the quest of using ACC data.

Previous work has identified that an injury, even a serious or fatal injury, does not inevitably lead to a claim to the ACC. Our starting point was an assumption that this is the case for lump sum payments also. We hypothesised that the greater the WPI, the greater the likelihood of a lump sum claim being made and paid. We proposed that reliable indicators be sought through the identification of an impairment threshold (T1) – not previously identified - beyond which we would expect an ACC claim for LSP to be made and paid for those who qualify for it. If such a threshold exists, then in a similar way to the NZIPS serious non-fatal injury indicators, cases that exceed that threshold would provide the basis for a further set of valid indicators.

Approach 2

This part of the feasibility work had a goal of deriving a threat of impairment severity measure based on diagnosis-specific probability of impairment - in a similar way to ICD-based Injury Severity Scores (ICISS), but based on probability of impairment rather than probability of death.

Such an approach is dependent on the existence data that has accurate and stable coding of diagnosis over time. Although ACC captures data on diagnosis. We had

been informed by officers in ACC that the diagnostic data that is captured on claims is often derived from an initial assessment of injury diagnosis - rather than final diagnosis. If true, this will inevitably lead to error in diagnosis classification. (The correspondence of ACC coding of diagnosis with NMDS principal diagnosis was considered as part of the work for this report and is reported in the body of the report.) An alternative was to consider just cases admitted to hospital, and to use the more reliable hospital diagnosis at discharge, through linkage of ACC lump sum data to NZHIS hospitalisations[f]. This is the approach that was pursued.

We proposed an approach that was based on identifying a threat of impairment (TOI) severity threshold (T2) as follows: for each 10% band of WPI (ie. 10-20%, 20-30%, etc), we would identify the proportion of cases that can be linked to NZHIS hospitalisation data. We hypothesised that for those injuries that carry a lower WPI value, the likelihood of admission would be lower than for those with a higher WPI, and hence the linkage rates would be lower for lower WPI. We also hypothesised that there exists a point above which almost all cases with a lump sum payment above the threshold T2 are admitted and thus would link to the NZHIS hospitalisation data. If such a point exists, it would become the threshold for the TOI measure.

1.2. Aims and Research Questions

Aim 1: To investigate and assess the feasibility of methods to develop valid impairment-related indicators (approach 1 above)

Associated research questions:

c) Do injuries that result in assessed whole person impairment (WPI) that are above a given impairment threshold (threshold T1 - to be determined) almost always result in a claim?
d) What is that impairment threshold T1?

Aim 2: To investigate and assess the feasibility of methods to derive valid threat of impairment measures (approach 2 above)

Associated research questions:

c) Do injuries that result in assessed WPI above a given impairment threshold (threshold T2 – to be determined), that result in a claim, almost always get admitted to hospital.
d) What is that impairment threshold T2?

[f] IPRU has shown that ICD-9 diagnoses are coded to a good standard of accuracy. ICD-10 diagnostic coding accuracy is currently being investigated by IPRU.

1.3. Process used to progress the research

A priori, the general approach that was proposed for this work was as follows.

- IPRU would carry out an exploratory analysis of the ACC lump sum payment data (on its own) as well as these data linked to NZHIS NMDS of hospital discharges.
- The findings of this work would be shared and discussed with an Expert Group at 3 to 4 meetings who would advise the team regarding the assessment process, claims-making behaviour, and ACC data capture and quality.
- An outcome of the early Expert Group meetings would be the identification of further exploratory work that could inform the development process.
- Expected outcomes of later meetings would be the identification of WPI thresholds that can be used to develop valid impairment and threat of impairment indicators.

This last step had to be modified due to the limitations of the data. Instead, the final meeting aimed at identifying injury diagnoses that if sustained and assessed would attract an LSP, and would almost certainly be admitted to hospital. These diagnoses formed the basis of threat of impairment indicators.

2. Methods

2.1. Methodological approach

2.1.1. Injury definitions

This work focused on injury as defined in section 1.3 of the Cryer 2004 report. [1] This is reproduced in Appendix 1.

2.1.2. Approach 1: Feasibility of the development of impairment-related indicators

The approach was outlined in section 1.1.3. We proposed that reliable indicators be sought through the identification of an impairment threshold (T1) beyond which we would expect an ACC claim for LSP to be made and paid for those who qualify for it. If such a threshold exists, then in a similar way to the NZIPS serious non-fatal injury indicators, [1] cases that exceed that threshold would provide the basis for a further set of valid indicators.

We proposed that indicator development, and the assumptions underpinning the approach, be investigated: (i) through consensus methods using an expert group, (ii) using empirical methods. We also proposed that each would feed into the other. They are considered further below.

In regard to the consensus approach, a small Expert Group was convened whose aim was to identify an impairment threshold (if it exists), above which they were confident that almost all impairment that occurs in New Zealand of at least that severity would result in an LSP. It was envisaged that 3 to 4 meetings of the expert group would be required.

2.1.3. Approach 2: Feasibility of threat of impairment measures

The approach was outlined in section 1.1.3. We proposed to identify the threat of impairment (TOI) severity threshold (T2) as follows: for each 10% band of WPI (ie. 10-20%, 20-30%, etc), we would identify the proportion of cases that can be linked to NZHIS hospitalisation data. We hypothesised that for those injuries that carry a lower

WPI value, the likelihood of admission would be lower than for those with a higher WPI, and hence lower WPI would be associated with lower linkage rates between ACC LSP data and New Zealand Health Information Service (NZHIS) National Minimum Data Set (NMDS) of hospital discharges. We also hypothesised that there exists a point above which almost all cases with a lump sum payment above the threshold T2 are admitted and thus would link to the NMDS. If such a point exists, it would become the threshold for the TOI measure. This assumption was subsequently found not to hold and so an alternative approach had to be found. This is described in the results section.

2.2. Source Data

The source data for this work were:

- ACC claims data
- NMDS of hospital discharges[g]

The request for the ACC data is shown in Appendix 2. The request for ACC data was for any claim that met the following criteria:

1. Has an injury event date in the period 1 April 2002 to 31 October 2006.
2. Was awarded a lump sum payment.

The NMDS is requested annually by IPRU and is incorporated into the IPRU's injury data base. The annual request have been for all hospital discharge records that have an external cause code. At the time of the project, discharge data up to 31 December 2005 was available.

2.3. Methods Description

2.3.1. Methods for deriving data

A total of 3395 Lump Sum Payment (LSP) claims were provided to IPRU from ACC. Of these, there were 3340 claims with a final percent whole person impairment (%WPI) recorded, and where there was only one claim per person with a LSP. (Five people had a LSP each for two separate incidents. In order to simplify the analysis, these people were excluded from this work.) Our focus is acute injury. A further 150 claims were thus excluded on the basis that they were the result of a disease / gradual

[g] It was estimated that, in 2002, 99% of all hospital discharges were of publicly funded inpatients. 4. New Zealand Health Information Service, *Selected Morbidity Data for Publicly Funded Hospitals 2001/02*. 2005, Ministry of Health: Wellington. 5. New Zealand Health Information Service, *Selected Morbidity Data for Privately Funded Hospitals 2002.* 2006, Ministry of Health: Wellington.

process, and so did not satisfy our injury definition, leaving 3190 valid claims in the LSP dataset, with a total of 7473 diagnoses recorded. The method for identifying disease / gradual process claims is described in Appendix 4.

ACC and NMDS morbidity files were linked using all available hospital discharges in our database. (This includes only discharges with an ICD external cause code.) A total of 1964 discharges and claims were linked. Details of the linkage methods used are described in Appendix 3.

For some analyses, we restricted the cases considered. That is, in order to optimise the chance that a hospitalisation would link to the LSP dataset, NMDS files were linked to ACC WPI claims for hospital discharges between April 2002 and June 2004. The reason for this is illustrated by the following example. If an injury occurred in June 2004, typically 2 years elapses before assessment. If a further 3 months elapsed before an award was made and the information was captured on the ACC database (ie. September 2006), then that injury discharge would still link to the ACC LSP data. A total of 1562 claims were linked for this more limited dataset.

2.3.2. Methods for producing the ACC ICD-10 codes

ACC diagnosis data contains a mix of data coded using ICD-10, Read codes, and ACC's in-house diagnosis codes. Each of these is recorded in a separate field. A review of these ACC diagnosis fields revealed that the field that was most frequently populated, and potentially had the most useful information, was that containing Read codes[h]. In order to compare between diagnoses as stored in the ACC data set and those stored in the NMDS, we mapped the Read codes to ICD-10 codes. [i] Not all of the Read codes produced intelligible ICD-10 codes and, in some instances, missing data continued to exist. For those that had no Read code, but which included an ICD-10 code in the ACC record, the ICD-10 codes were used.

The descriptors (shown in some of the tables in this report) for diagnoses captured by the ACC data are those provided by ACC with the Read code mappings.

[h] This is a coding frame for primary care that provides codes for diseases and symptoms. Read codes map to ICD codes.
[i] Mapping programme on C:\Documents and Settings\Brandon\My Documents\Projects\Completed Projects\2005\ChartBook\Convert to ICD\Convert ACC Datasets to ICD.sas

2.3.3. Initial analysis of the data

We divided the analysis into ACC cases with a single diagnosis recorded, and the remainder who had multiple diagnoses recorded for an injury event. Also, as a starting point, we considered cases with a %WPI≥40%. The number of cases declines markedly with %WPI. Focusing on this smaller number of cases allowed the team to gain information on aspects of the ACC LSP data; information that was relevant to the whole of the ACC LSP data.

The analysis focused firstly on

a) all eligible ACC cases, and then on
b) ACC cases that linked to NMDS data.

Furthermore, we identified diagnoses that resulted in significant %WPI. For each diagnosis, we identified how many people were discharged from hospital with the particular diagnosis in the period April 2002 and June 2004, compared to how many of these people received ACC LSP. This provided estimates of the likelihood of a successful lump sum payment claim for some of the most frequently occurring serious injuries that resulted in impairment.

2.3.4. The Expert Group

The overall approach to addressing the aims was:

a. For the project team to carry out exploratory analyses of (a) ACC lump sum payment data, and (b) ACC lump sum payment data linked to NMDS .
b. The findings of these analyses were discussed with the Expert Group at 3 separate meetings with a goal of addressing the research questions (see section 1.2), but also with a view to identifying additional approaches to data analysis (or other methods) that could inform this work.

The Expert Group included:

- two ACC medical advisors, responsible for the process of assessment of injured people who may be eligible for LSP
- an ACC person responsible for liaison with (potential) ACC claimants
- the lead information officer within the ACC Injury Prevention Directorate
- two senior members from the New Zealand Injury Prevention Strategy secretariat.

The material prepared for these Expert Group meetings is shown in Appendix 5. Typically, this comprised a Powerpoint presentation, along with tables for discussion.

As a result of each meeting, we produced notes describing the outcomes. Abridged notes are also shown in Appendix 5. A fourth meeting was held that provided feedback of the findings of this work for Expert Group comment. Since this reflects what is in this report, this material has not been included in Appendix 5.

3. Results

Given this was an exploratory analysis, this section is a mix of methods, results, and discussion. Firstly, however, we report the "results" of our enquiries about the nature and characteristics of the ACC LSP scheme.

3.1. Understanding the LSP scheme and the data

The following emerged as part of the discussion at the Expert Group meetings. The Expert Group comprised the following ACC staff:

- Expert Group 1 - Lorna Bunt (Information, Injury Prevention), Kevin Morris (Medical Advisor), Sue North (Claimant Advocacy Liaison), Bhama Rajiv Kumar (NZIPS), Alastair Wilson (Medical Advisor), Geoff Wilson (NZIPS).
- Expert Group 2 - Lorna Bunt, Mark Davis (Claimant Advocacy Liaison), Kevin Morris, Bhama Rajiv Kumar, Alastair Wilson, Geoff Wilson.
- Expert Group 3 - Lorna Bunt, Kevin Morris, Bhama Rajiv Kumar, Geoff Wilson.

3.1.1. Initiating an assessment

Once an ACC claim has been lodged, the individual or their case manager has to take the initiative to secure a LSP assessment. (One might expect, therefore, that some eligible cases will not receive a LSP.)

For those hospitalised for an injury, it is medical personal or the individual that has to initiate a claim. It is unclear how many of these go on to be assessed for LSP.

3.1.2. Assessment

Around 100 assessors are contracted to ACC from around the country to carry out an assessment. A claimant is assigned to an assessor based on geographical region rather than medical specialty. The Expert Group expressed the views that

- ACC does not consider that medical personnel are necessarily qualified to assess whole person impairment, so they are trained by Kevin Morris.
- Assignment on the basis of geographic region is not considered a problem as "generalists often do a better job of assessment than specialists".
- The latter stance has been defended legally.

Assessment of WPI is based on one of two approaches:

1. Diagnosis-related estimate (DRE): The WPI is based on the medical records provided sufficient diagnostic information is available. (A physical assessment of the claimant is also undertaken, however, but this is only carried out as a matter of process.)
2. Physical assessment. Tests are used (eg. range of motion) to determine WPI. Medical records are used to confirm the diagnosis..

Clause 54 of Schedule 1 of the IPRC Act 2001 states that the Corporation is liable to pay the claimant lump sum compensation if

a) the claimant has suffered a personal injury for which he/she has cover

b) the claimant-

i) has survived the personal injury for not less than 28 days

ii) is alive when assessed.

In other words, if the claimant survived a personal injury for less than 28 day, they (or their beneficieries), are not eligible for a LSP claim.

3.1.3. Re- assessment

Re-assessment is not common. All claimants are eligible to request re-assessment under the Act. This more frequently occurs in the cases of progressive illness or development of a mental illness / injury resulting from physical injury. For example, consider a LSP claim for the physical impairment resulting from traumatic amputation of the finger. If the person then suffered post-traumatic stress disorder (PTSD) as a result of the injury, this could result in a new compensated claim for the mental injury, and a re-assessment of the WPI for the individual. From the perspective of the data needs for this project, this could be problematic since the electronic ACC claim record to which the LSP record is linked could be either the claim for the physical injury, or for the mental injury.

3.1.4. Diagnosis recording

The diagnosis recorded in the ACC system is (typically) the first that ACC are advised of. Accuracy may depend on the source of the data:

- Read codes: these are produced by hospital emergency departments (ED), ambulance staff, and GPs, who are provided by ACC with a list of the 200 most common Read codes. Unless they have access to the full list of Read codes, they will use the “closest fit” from this list.

- Hospital inpatients: The diagnoses provided from hospitals are less likely to be based on first contact; they are likely to be up-dated before submitted to the ACC. However, they will not necessarily be the confirmed diagnosis.

The most accurate source of diagnosis data on the ACC claims record is likely to be for patients who are admitted to hospital, then ED, followed by GPs and ambulance staff.

An example of why a preliminary diagnosis may be wrong is as follows. A person has a fall and sustains a head injury. The person is transported to hospital ED by a relative. The ED staff give an early diagnosis of superficial cuts and abrasions to the scalp. The person is then scanned and the diagnosis is now modified to fractured skull with brain injury. The early diagnosis, in many instances, does not necessarily capture the severity of the injury sustained.

Diagnosis information is seldom updated from the original recorded on the electronic ACC record.

The accuracy of diagnosis information for LSP claims may be higher than that for the whole of the ACC claims dataset. For example, almost 70% of all ACC claims are registered by GPs. In contrast, this drops to 55% for LSP claims. In addition, of the GPs that register a claim, 25% do so while working in a public hospital (hence, the recorded diagnosis would be considered more up-to-date). For LSP claims, slightly under 30% of claims are registered at a public or private hospital, and around 25% from ambulance officers. Approximately 2% of LSP claims are registered by orthopaedic surgeons (Lorna Bunt, personal correspondence, 2007)

3.2. Feasibility of an impairment indicator

Aim 1 was to investigate and assess the feasibility of methods to develop valid impairment-related indicators

We identified the following threats to the method:

1. When compared with the diagnoses recorded in the NMDS, some ACC diagnoses were inaccurate, which resulted in problems in identifying a threshold above which one would expect a LSP to always be assessed and awarded.
2. There were diagnoses identified that should attract very high LSP that appear to have a significant percentage of cases without LSP.
3. Projects like this one are likely to impact on the likelihood of assessment and so the award of a LSP for future potential cases – and hence on a time series based on LSP data.
4. There was a concern that potential future changes to the scheme would bias the time series.

The evidence for the above are provided in the following subsections.

3.2.1. Inaccurate ACC diagnosis - leads to problems of setting a threshold.

Evidence

Tables A2 and A3, in Appendix 5, show major mismatches between the diagnosis as recorded on the NMDS and the diagnoses recorded on the ACC claims record.

What Table A2 shows is limited to those cases where the ACC data recorded just one diagnosis. Some examples of a clear mismatch from Table A2 are as follows:

- %WPI=100% - NMDS: Traumatic Subdural Haemorrhage
    - ACC: Concussion
- %WPI=99% - NMDS: Other intracranial injuries
    - ACC: Unspecified injury of head
- %WPI=77% - NMDS: Fracture of the vault of skull
    - ACC: Superficial injury of scalp, contusion.

Table A3 includes the remaining linked cases, ie. those that have multiple ACC diagnoses. Some examples of a clear mismatch from Table A3 are as follows:

- %WPI=100% - NMDS: Multiple intracerebral and cerebellar haematoma

    - ACC1: Superficial injury of head, part unspecified, contusion
    - ACC2: Head (except face) / soft tissue injury
    - ACC3: Head (except face) / concussion
- %WPI=97% - NMDS: Traumatic subdural haemorrhage
    - ACC1: Head (except face) / concussion
    - ACC2: Superficial injury of head, part unspecified, contusion
- %WPI=94% - NMDS: Injury of cervical spinal cord, unspecified
    - ACC1: Contusion of other and unspecified parts of lower leg
    - ACC2: Abrasion of unspecified body region
    - ACC3: Traumatic amputation at knee joint.

Informally, officers in the ACC have indicated that the diagnosis most often captured on their database is the first diagnosis made, eg. by ambulance staff, or by ED staff (see section 3.1.4). Inspection of Tables A2 and A3 suggests that this is likely to be the reason for the mismatch in a number of instances. This represents a problem for setting the threshold T1.

3.2.2. Selected diagnoses that should attract very high LSP appear to have a significant percent of cases without LSP.

Evidence

Table A4a and A5a in Appendix 5 show several diagnoses that one would expect to attract LSP.

Both Table A4a and Table A5a are based on NMDS diagnoses, for discharges between 1 April 2002 and 30 June 2004. These were linked to ACC LSP data. This period was chosen for the LSP data in order to give plenty of time for an assessment to be made, for LSP to be awarded and for the case to be captured on the ACC database.

Table A4a presents those diagnoses that are associated with at least 40% WPI, and includes the top 20 diagnoses amongst those in the linked NMDS-ACC LSP data. To illustrate what is captured by this table, consider the first row – S021: Fracture of the base of skull. There were 570 discharges between 1 April 2002 and 30 June 2004 with a primary diagnosis of S021. Amongst those, 16 cases linked to the ACC's LSP data, representing 3% of these discharges.

Examples that lead one to suspect that not all eligible cases are assessed and awarded LSP (with their linkage rates) are as follows:

- S2411: Complete lesion of thoracic spinal cord (16/21=76%)
- S1411: Complete lesion of cervical spinal cord (11/17=65%)
- S1413: Other incomplete cord syndrome of cervical spinal cord (7/20=35%)
- S581: Traumatic amputation at level between elbow and wrist (6/8=75%)

Table A5a presents the same information as Table A4a, except that this table includes all diagnoses associated with a WPI of at least 10%. A further example that leads one to suspect that not all eligible cases are assessed and awarded LSP (with their linkage rates) is as follows:

- S052: Ocular laceration and rupture with prolapsed or loss of intraocular fluid (25/112=22%).

3.2.3. Projects like this one are likely to impact on the likelihood of assessment and so the award of a LSP – and so impact on a time series based on LSP data.

Evidence

The New Zealand government wishes to minimize the number of unclaimed benefits – and are actively encouraging officers from government departments and national government organisations, such as the ACC, to identify eligible non-claimants. This project has identified cases that should attract LSP, but for which the person has not been assessed and/or awarded LSP. It was the Expert Group's opinion that this project, as well as other projects that highlight unclaimed LSP, are likely to increase the likelihood of a person being assessed and awarded LSP.

3.2.4. Concern that potential future changes to the scheme would bias the time series.

Evidence

The next New Zealand parliamentary general election takes place in 2008. Changes to an ACC LSP scheme have occurred in the past to reflect approaches to accident compensation by different Governments. . For example, there was a change in 1992 to a National Government. Following this, the previous lump sum payment scheme was replaced by an Independence Allowance. Later, an LSP scheme was restored by the current Labour lead government through the introduction of the Injury Prevention, Rehabilitation and Compensation Act 2001.

The time series provided by the current LSP data would be disrupted if history were repeated.

3.3. Feasibility of a threat of impairment indicator

Aim 2 was to investigate and assess the feasibility of methods to derive valid threat of impairment measures.

The *a priori* approach to deriving such indicators is described in section 2.1.2.

A threat to the *a priori* method is illustrated by the following:

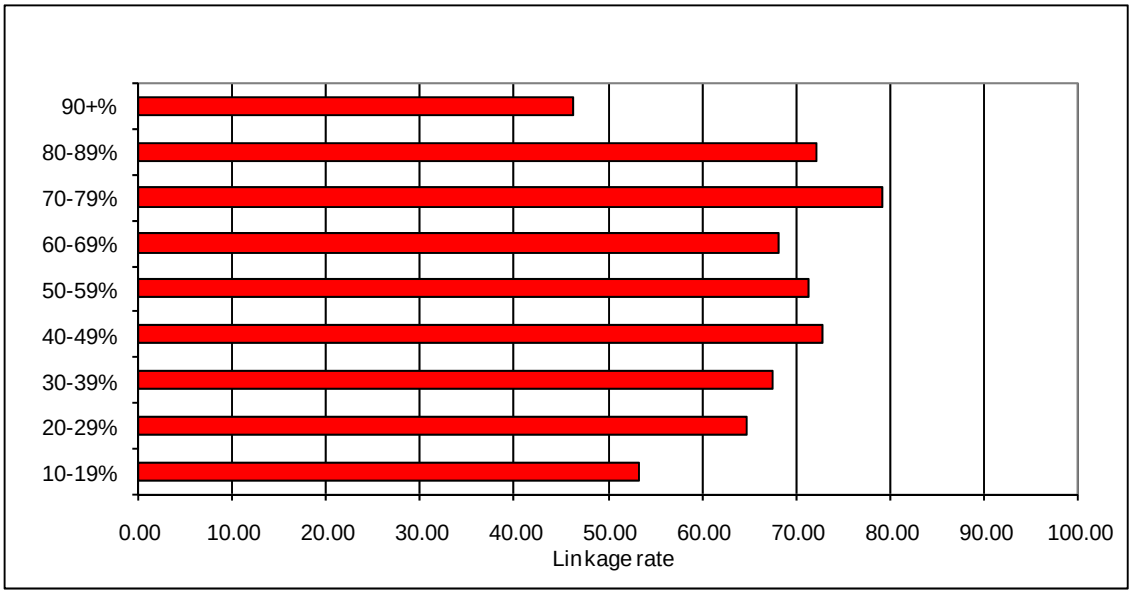
- Linkage of ACC LSP claims to NMDS does not achieve rates of close to 100% for any %WPI threshold.

This is demonstrated as follows. We linked the ACC LSP data to NMDS. The linkage rate overall was around 60% (Table 1 and Figure 1). The linkage rate was 54% for WPI of 10-19%, was 65% for WPI of 20-39%, and was around 70% for thresholds of 40%, 50%, 60%, 70% and 80%.

Table 1: ACC linkage rate by WPI percentage

		Actual WPI%									Total
		10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%	90+%	
Not linked	n	708	268	105	38	28	20	19	24	16	1226
	%	46.03	34.72	32.61	26.76	26.67	29.85	20.21	20.87	45.71	38.43
Linked	n	830	504	217	104	77	47	75	91	19	1964
	%	53.97	65.28	67.39	73.24	73.33	70.15	79.79	79.13	54.29	61.57
Total		1538	772	322	142	105	67	94	115	35	3190
Row pct		48%	24%	10%	4%	3%	2%	3%	4%	1%	100%

Figure 1: ACC linkage rate by WPI percentage



3.4. An alternative method to derive a threat of impairment indicator.

Our investigations suggested an approach based on identification of individual diagnoses that (A) attract LSP (if assessed) and (B) have perceived high probability of admission. The evidence for this was:

- The linkage of ACC claims to NMDS have high rates for certain classes of diagnosis;
- Certain diagnoses were identified during our investigations that were perceived to satisfy conditions (A) and (B).

This is illustrated in the following subsections. It is followed by a description of a modified approach, along with the results.

3.4.1. The linkage of ACC claims to NMDS have high rates for certain classes of diagnosis

Evidence

Table 2 and Figure 2 show the linkage rates, from ACC LSP data to NMDS, associated with the major groups of ACC diagnosis codes.

Table 2: Linkage rates of ACC LSP data to NMDS; by nature of injury

Primary Diagnosis	Linkage Status				Total	
	Non-linked		Linked			
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Amputation	24	9	249	91	273	8
Burns (burn,scald,corrosive Inj'y)	8	16	43	84	51	2
Concussion	21	19	92	81	113	3
Dental Injury	2	40	3	60	5	0
Foreign Body In Orifice/eye	14	31	31	69	45	1
Fracture/dislocation	151	15	845	85	996	31
I/non-i Laceration,puncture,sting	80	22	292	78	372	11
Industrial Deafness	3	100	0	0	3	0
Inhalation/ingestion Specific Occ.	2	100	0	0	2	0
Mental/nervous Shock	85	97	3	3	88	3
Occp.dis (ab/lead,bru,derm,hep,lep	12	100	0	0	12	0
Other	454	68	217	32	671	21
Soft Tissue Inj (contu,str,spr,int	421	68	198	32	619	19
Trauma Induced Hearing Loss	4	100	0	0	4	0

Figure 2: Linkage rates of ACC LSP data to NMDS; by nature of injury

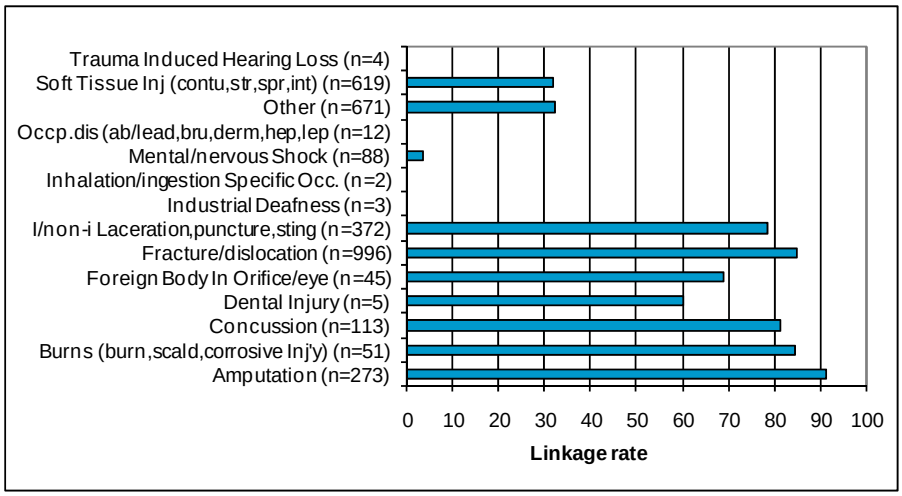


Table 2 and Figure 2 show relatively high linkage rates for amputations, burns, and fractures / dislocations.

3.4.2. Certain diagnoses were identified during our investigations that were perceived to satisfy conditions (A) and (B).

Evidence:

In the judgment of the Expert Group, in meetings 1 and 2, the highlighted diagnoses in Tables A4a and A5a (Appendix 5) were perceived to satisfy conditions (A) and (B).

3.4.3. A modified approach to deriving threat of impairment indicators.

The approach

The approach used for the identification of individual diagnoses that (A) attract LSP (if assessed) and (B) have perceived high probability of admission, was as follows:

- For LSP claims, identify diagnoses as recorded by ACC that have a high linkage rate to NMDS. As seen previously, ACC diagnoses are typically not confirmed diagnoses and so are prone to error.
- Identify NMDS principal diagnoses that are associated with these ACC diagnoses.
    - These were listed.
- Outputs from other analyses (such as Tables A4a and A5a) were used to identify other prospective NMDS diagnoses that might satisfy (A) and (B).
- These lists were presented to the 3rd meeting of the Expert Group for their assessment.

    - Following the meeting, the ACC medical advisors (and members of the Expert Group) Kevin Morris (KM) and Alastair Wilson (AW) independently assessed and made a judgment as to whether each of the diagnoses listed satisfy (A) and (B).
    - There were differences in their judgments; they met and reconciled their differences.
- For the chosen diagnoses, full ICD descriptions were given to KM and AW to re-assess.
- The list of diagnoses that were judged by KM and AW to satisfy conditions (A) and (B) were then assessed by three Emergency Medicine consultants who were asked to judge whether each diagnosis has a high probability of admission, and whether past or likely future management of these injuries has changed / will change to the extent that it affects the probability of admission.

The results

The tables that were presented to the Expert Group are shown in Tables A9 and A10 (A10 without highlighting). Following assessment and reconciliation by KM and AW, and then reassessment, the chosen diagnoses are shown using the yellow highlighting in Table A10.

The highlighted diagnoses were assessed by the three Emergency Medicine consultants and the results are shown in Appendix 6. We have taken a conservative approach to the choice of diagnoses. We have eliminated from our TOI indicator definition any diagnosis that any of the 3 consultants has expressed doubt about its high likelihood of admission, either now or in the future. Those diagnosis descriptions that are not highlighted in Appendix 6 form the basis of the TOI indicator.

3.5. Threat of impairment indicators: specification, validity, and trends

3.5.1. Specification of the threat of impairment indicators

The specifications of the threat of impairment indicators are shown below.

ID: IMP1

Name Serious threat of impairment all injury frequency

Concept of Interest Societal burden of serious threat of impairment injury.

Scope

Area	All Injury
Gender	Both genders
Age	All ages

Source Organisation Developed by IPRU for NZIPS.

Numerator Description Cases hospitalised for injury in a calendar year, who were discharged alive with a primary diagnosis code shown in Table 3.

Details Hospitalisations have been operationally defined as all publicly funded discharges from hospitals in the relevant year. Injury hospitalisations are those hospitalisations with a principal diagnosis in the range S00-T78 and a first external cause code in the range V01-Y36, where diagnoses and external cause code are coded using the ICD-10-AM classification [6]. Readmissions for subsequent treatment and deaths in hospital have been excluded using the methods described in Langley et al. [7]. Serious threat of impairment injury have a principal diagnosis that is included in the list shown in Table 3.

Source NZHIS NMDS

Denominator N/A

Calculation N/A

ID IMP2

Name Serious threat of impairment all injury rate.

Concept of Interest Individual's annual average risk of serious threat of impairment injury.

Scope

Area	All Injury
Gender	Both genders
Age	All ages

Source Organisation Developed by IPRU for NZIPS.

Numerator Description Cases hospitalised for injury in a calendar year, who were discharged alive with a primary diagnosis code shown in Table 3.

Details Hospitalisations have been operationally defined as all publicly funded discharges from hospitals in the relevant year. Injury hospitalisations are those hospitalisations with a principal diagnosis in the range S00-T78 and a first external cause code in the range V01-Y36, where diagnoses and external cause code are coded using the ICD-10-AM classification [6]. Readmissions for subsequent treatment and deaths in hospital have been excluded using the methods described in Langley et al. [7]. Serious threat of impairment injury have a principal diagnosis that is included in the list shown in Table 3.

Source NZHIS NMDS

Denominator Description Estimated total New Zealand population as at 30 June of the relevant year.

Details The estimates used have been published by Statistics New Zealand. They are based on New Zealand Censuses and post-enumeration surveys adjusted for the estimated number of New Zealand residents overseas on census night, estimated natural increase in population and estimated net long term and permanent migration. (ref http://www.stats.govt.nz/tables/nat-pop-est-tables.htm).

Source Statistics New Zealand

Calculation Age standardised rate. Age standardisation was via the direct method with age groups of 0-4, 5-9, 10-14, … 80-84, and 85 and above. The standard population was the estimated New Zealand population as at 30 June 2003. For details of the process of direct standardisation see, for example, Armitage and Berry (1987), Statistical Methods in Medical Research, 2nd ed., pp 399-403.

Table 3: The principal diagnoses (ICD-10-AM) that define the serious threat of impairment injury indicators.

ICD-10-AM code	Description
S021	Fracture base of skull Fossa: Anterior Middle Posterior Occtiput Orbital roof Sinus Ethmoid Frontal Sphenoid Temporal bone (excluding squamous part) Excludes orbital NOS, orbital floor
S052	Ocular laceration and rupture with prolapse or loss of intraocular tissue
S054	Penetrating wound of orbit with or without foreign body Excludes retained (old) foreign body following penetrating wound of orbit
S055	Penetrating wound of eyeball with foreign body Excludes retained (old) intraocular foreign body
S057	Avulsion of eye Traumatic enucleation
S0623	Multiple intracerebral and cerebellar haematomas 5mLs of blood Multiple intracerebral haemorrhages
S0628	Other diffuse cerebral and cerebellar injury Multiple lacerations of cerebrum and cerebellum
S0631	Focal cerebral contusion <=5 mLs of blood
S0633	Focal cerebral haematoma >5mLs of blood Intracerebral haematoma/haemorrhage
S064	Epidural haemorrhage Epidural [extradural] haematoma Extradural haemorrhage
S065	Traumatic subdural haemorrhage Subdrual haematoma
S066	Traumatic subarachnoid haemorrhage Subarachnoid haematoma
S068	Other intracranial injuries Traumatic haemorrhage/haematoma/contusion: Brain NOS Intracranial NOS
S080	Avulsion of scalp
S1101	Open wound of larynx
S120	Fracture of first cervical vertebra Atlas
S121	Fracture of second cervical vertebra Axis
S1222	Fracture of fourth cervical vertebra

S1223	Fracture of fifth cervical vertebra
S1224	Fracture of sixth cervical vertebra
S127	Multiple fractures of cervical spine Excludes multiple fractures of specified levels of cervical vertebrae.
S1313	Dislocation of C3/C4 cervical vertebrae
S1315	Dislocation of C5/C6 cervical vertebrae
S140	Concussion and oedema of cervical spinal cord
S1410	Injuries of cervical spinal chord, unspecified
S1411	Complete lesion of cervical spinal chord
S1412	Central cord syndrome (incomplete cord injury) of cervical spinal cord
S1413	Other incomplete cord syndrome of cervical spinal cord Anterior cord syndrome Incomplete cervical spinal cord lesion NOS Posterior cord syndrome
S143	Injury of brachial plexus
S2244	Multiple rib fractures, involving four or more ribs Excludes multiple rib fractures involving first rib.
S225	Flail chest
S2410	Injury of thoracic spinal cord, unspecified
S2411	Complete lesion of thoracic spinal cord
S2412	Incomplete cord syndrome of thoracic spinal cord Anterior cord syndrome Central cord syndrome Incomplete thoracic spinal cord lesion NOS Posterior cord syndrome
S2471	Functional spinal cord injury, T1 level
S2474	Functional spinal cord injury, T6/T7 level
S2477	Functional spinal cord injury, T12 level
S250	Injury of thoracic aorta Aorta NOS
S271	Traumatic haemothorax
S272	Traumatic haemopneumothorax
S321	Fracture of sacrum
S323	Fracture of ilium
S324	Fracture of acetabulum
S3283	Fracture of pelvis, part unspecified Fracture of pelvis NOS
S341	Other injury of lumbar spinal cord (conus medullaris) Complete/incomplete lumbar cord lesion
S343	Injury of cauda equine
S3472	Functional spinal cord injury, L2 level
S355	Injury of iliac blood vessels Iliac artery or vein
S3600	Injury of spleen, unspecified
S3604	Massive parenchymal disruption of spleen Rupture of spleen
S3615	Major laceration of liver Laceration with significant disruption of hepatic parenchyma [i.e. 10cm long and 3cm deep]

	Multiple moderate lacerations, with or without haematoma
S3640	Injury of small intestine, unspecified site
S3649	Injury of other and multiple parts of small intestine Injury to ileum Injury to jejunum
S3682	Injury of mesentery
S3683	Injury of retroperitoneum
S3728	Other injury of bladder Laceration of bladder
S396	Injury of intra-abdominal organ(s) with pelvic organ(s)
S447	Injury of multiple nerves at shoulder and upper arm level
S450	Injury of axillary artery
S451	Injury of brachial artery
S551	Injury of radial artery at forearm level
S581	Traumatic amputation at level between elbow and wrist
S650	Injury of ulnar artery at wrist and hand level
S661	Injury of flexor muscle and tendon of other finger at wrist and hand level
S680	Traumatic amputation of thumb (complete)(partial)
S682	Traumatic amputation of 2 or more fingers (complete)(partial)
S683	Combined traumatic amputation of (part of) finger(s) with other parts of wrist and hand
S684	Traumatic amputation of hand at wrist level
S688	Traumatic amputation of other parts of wrist and hand
S7200	Fracture of neck of femur, part unspecified
S7203	Fracture of subcapital section of femur
S7205	Fracture of base of neck of femur Cervicotrochanteric section
S7211	Fracture of intertrochanteric section of femur
S722	Subtrochanteric fracture
S723	Fracture of shaft of femur
S7240	Fracture of lower end of femur, part unspecified
S7241	Fracture of femoral condyle
S7243	Supracondylar fracture of femur
S727	Multiple fractures of femur
S781	Traumatic amputation at level between hip and knee
S789	Traumatic amputation of hip and thigh, level unspecified
S8281	Bimalleolar facture, ankle
S8282	Trimalleolar fracture, ankle
S851	Injury of (anterior)(posterior) tibial artery
S881	Traumatic amputation at level between knee and ankle
T845	Infection and inflammatory reaction due to internal joint prosthesis
T848	Other complications of internal orthopaedic prosthetic devices, implants and grafts
T8578	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts

3.5.2. Validity of the TOI indicators

Our goal is to identify indicators that are valid. We have argued in the past that a valid injury outcome indicator should satisfy the following 6 criteria as well as is possible. The criteria are those agreed at an international meeting in Washington DC in 2001. [8]

These 6 criteria can be denoted by the acronym C-SiDARS:

C – Case definition
Si – Serious Injury
D – Data availability
A – Case ascertainment
R – Representativeness
S – Specification

They provide a necessary, but not sufficient, assessment of validity. A more complete assessment of validity should include empirical investigation.

As discussed in our previous 'Measure for measure' paper [9], before newly proposed indicators are promulgated they should be subjected to formal validation. Ideally, this should include the following aspect of validity:

• Face validity: through an assessment of the indicator against explicit validation criteria.

• Criterion validity: estimates of the indicator's characteristics against
- a 'gold standard' measure, or
- a future outcome (if the indicator aims to predict that future outcome)

• Consistency: investigate trends in the indicator against other measures (including a 'gold standard' measure, if it exists) that aim to estimate the same or a similar parameter.

• Completeness and accuracy of the source data: incomplete or inaccurate data would undermine the validity of the indicator, so this type of investigation is an important part of validation.

We use the first of these in this report to assess the validity of indicators. The accuracy of the NMDS diagnosis and external cause codes is being investigated in an ongoing project.

(1) Case definition

• The indicator should reflect the occurrence of injury satisfying some case definition of anatomical and/or physiological damage.

The TOI indicator is defined in terms of ICD-10-AM diagnosis codes. These diagnosis codes describe anatomical and physiological damage

(2) Serious injury

• The injury should be based on events that are associated with significantly increased risk of impairment, disability, functional limitation, or death, decreased quality of life, or increased cost.

The diagnoses that define the indicator have been chosen since they are associated with at least an estimated 10% WPI. Such injuries can therefore be regarded as serious.

(3) Data availability

• It should be possible to use existing data systems, or should be practical to develop new systems, to provide data for computing the indicator.

The derivation of these newly developed indicators was constrained by the existence of, and limitations of, existing data sources. They are based on NMDS and ICD-10-AM diagnosis coding. The methods of collection and coding have been stable since 1999.

(4) Case ascertainment

• The probability of a case being ascertained should be independent of social, economic and demographic factors, as well as service supply and access factors.

Ideally, we want the indicators to measure, in an unbiased way, the incidence of injury rather than the use of services. Use of health services is heavily influenced by factors other than disease incidence. For example, age and social factors appear to influence propensity to admit to hospital, independent of injury severity. The effects of these extraneous factors changes over time. (For examples see Cryer et al. 2004. [1]) In order to reduce the impact of these extraneous demographic and service factors, we

chose injuries that were judged by 2 ACC medical advisors and 3 Emergency Medicine consultants to have a high probability of admission. The choice of such diagnoses increases the likelihood that the probability of case ascertainment will remain stable over time.

(5) Representativeness

• The indicator should be derived from data that are inclusive or representative of the target population that the indicator aims to reflect.

The indicators were derived from a data source, ie. hospital discharges of publicly-funded inpatients, that is representative of the target population (all ages and all circumstances of injury). It was estimated that, in 2002, 99% of all hospital discharges for injury were of publicly funded inpatients. [4] [5]

(6) Indicator specification

• The indicator should be fully specified to allow calculation to be consistent at any place and at any time.

In order to be able to replicate the indicator consistently across populations, places and over time, a comprehensive written specification is required that includes definitions, specification of data sources, and methods of calculating the indicator. If interested in trends over time, then in order to take account of denominator changes over time, typically this will include specification of age-standardised rates. Appropriate indicator specifications are provided in the previous section.

Given that the proposed indicators satisfy each of the above criteria, we have identified no threats to their validity.

3.5.3. Trends in the TOI indicators

Figures 3 to 4 show the TOI indicators relative to their NZIPS counterparts. The specification of the NZIPS indicators can be found in the most recent, published NZIPS indicators all population chartbook [10], which can also be found at the following web address: http://www.nzips.govt.nz/documents/chartbook-serious-indicators.pdf. The NZIPS serious non-fatal injury indicators define "serious" in terms of threat to life (TTL). Cases of serious injury are defined in terms of an ICISS threshold.

The TOI and the TTL indicators are complementary insofar as they present two dimensions of serious injury. Nevertheless, the trends shown by the TOI and the TTL indicators are similar to one another.

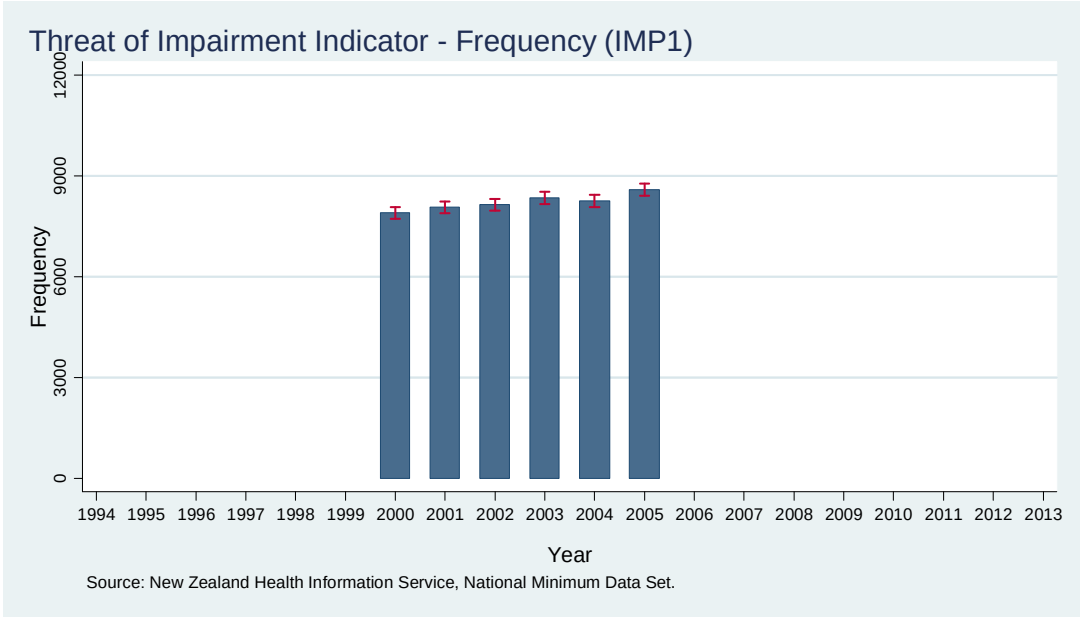
Table 4 shows the 5 most frequently captured diagnoses by:

- Both the TTL and the TOI indicators (7% of discharges in 2005)
- By the TTL, but not the TOI indicators (6%)
- By the TOI, but not the TTL indicators (5%)
- By neither the TTL nor the TOI indicators (81%)

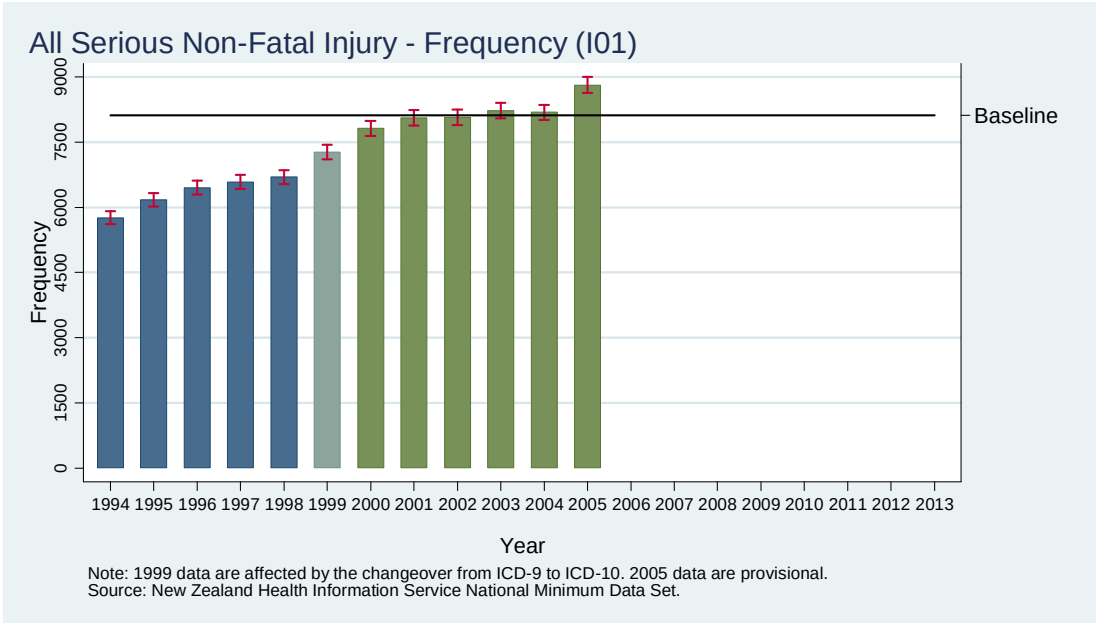
Table 4: The 5 most frequently captured diagnoses by both the TTL and the TOI indicators, by the TTL, but not the TOI indicators, by the TOI, but not the TTL indicators, by neither the TTL nor the TOI indicators

Diagnosis	Description	Frequency	% of injury discharges (2005)
Top five diagnoses captured by both the TTL and TOI indicators			
S7203	Fracture of subcapital section of femur	1348	2.0%
S7211	Fracture of intertrochanteric section of femur	1157	2.0%
S065	Traumatic subdural haemorrhage	283	0.4%
S021	Fracture base of skull	208	0.3%
S7200	Fracture of neck of femur, part unspecified	196	0.3%
Top five diagnoses captured by the TTL but not the TOI indicators			
S0601	Loss of consciousness of unspecified duration	192	0.3%
S024	Fracture of malar and maxillary bones	189	0.3%
S7210	Fracture of trochanteric section of femur, unspecified	167	0.3%
S325	Fracture of pubis	155	0.2%
S020	Fracture of vault of skull	148	0.2%
Top five diagnoses captured by the TOI but not the TTL indicators			
S8281	Bimalleolar facture, ankle	497	0.7%
S661	Injury of flexor muscle and tendon of other finger at wrist and hand	410	0.6%
S723	Fracture of shaft of femur	364	0.5%
S8282	Trimalleolar fracture, ankle	211	0.3%
S722	Subtrochanteric fracture	121	0.1%
Top five diagnoses captured by neither the TTL nor the TOI indicators			
S526	Fracture of lower end of both ulna and radius	1497	2%
S099	Unspecified injury of head	1437	2%
S0602	Loss of consciousness of brief duration [less than 30 minutes]	1374	2%
S5251	Fracture of lower end of radius with dorsal angulation	1051	2%
S010	Open wound of scalp	955	1%

Figure 3: Threat of impairment indicator of population burden relative to its NZIPS threat to life counterpart

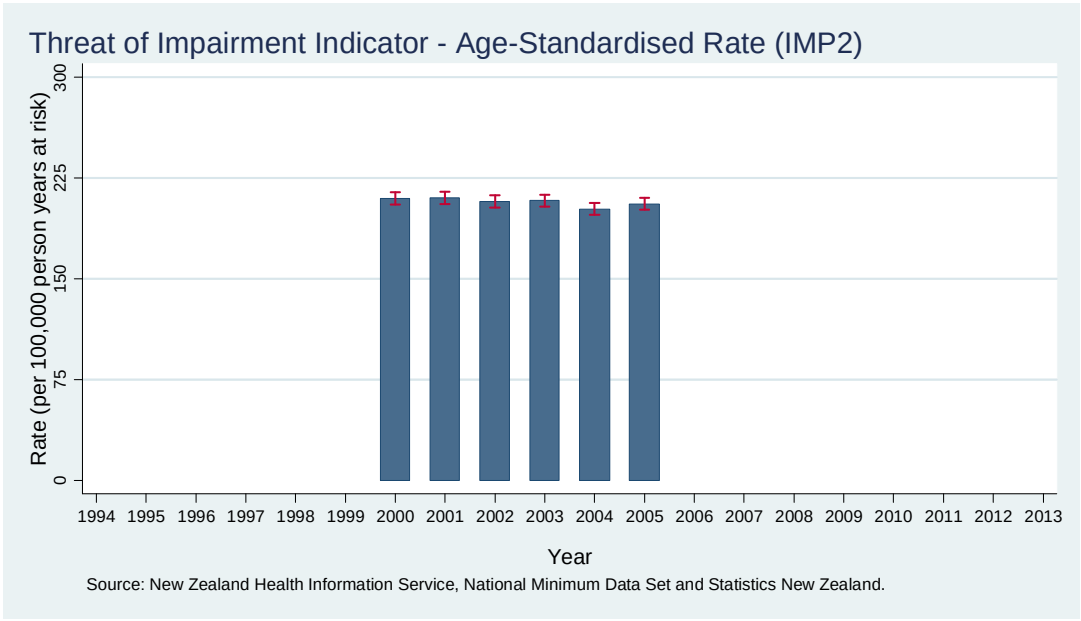


Source: New Zealand Health Information Service, National Minimum Data Set.

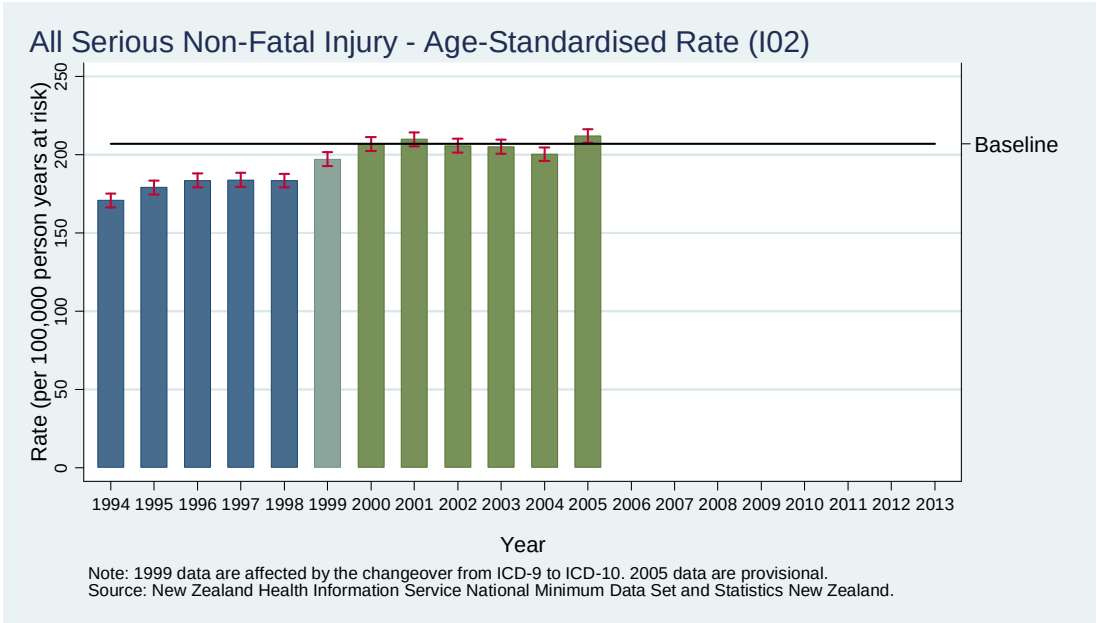


Note: 1999 data are affected by the changeover from ICD-9 to ICD-10. 2005 data are provisional.
Source: New Zealand Health Information Service National Minimum Data Set.

Figure 4: Threat of impairment indicator of population risk relative to its NZIPS threat to life counterpart.



Source: New Zealand Health Information Service, National Minimum Data Set and Statistics New Zealand.



Note: 1999 data are affected by the changeover from ICD-9 to ICD-10. 2005 data are provisional.
Source: New Zealand Health Information Service National Minimum Data Set and Statistics New Zealand.

4. Discussion

This impairment indicators project sought to determine whether valid measures could be developed that are complementary to the current NZIPS TTL indicators.

4.1. Discussion of results

4.1.1. Principal findings

Aim 1 was to investigate the development of valid impairment-related injury indicators. We identified the following threats to the method:

- Some ACC diagnoses were inaccurate, which resulted in problems in identifying a threshold above which one would expect a LSP to always be assessed and awarded.
- There were diagnoses identified, that should attract very high LSP, where there appear to have been a significant percentage of cases without LSP.
- Projects like this one are likely to impact on the likelihood of future assessment and so on the award of a LSP – and hence on a time series based on LSP data.
- There was a concern that potential future changes to the scheme would bias future time series analyses.

Aim 2 was to investigate the feasibility of deriving a diagnosis-specific threat of impairment measure. A threat to the original proposed method is illustrated by the following:

- The linkage of ACC LSP claims to NMDS was not high (around 70% or less) for any %WPI threshold investigated. Consequently, no LSP threshold was associated with a high probability of admission for cases.

A modified approach was developed that aimed at the identification of diagnoses of injury that (A) would attract LSP if assessed, as well as (B) have a high probability of admission to hospital. The approach used a mixture of empirical methods and expert opinion. The expert opinion was obtained from the ACC medical advisors, who were members of the Expert Group, and from 3 Emergency Medicine consultants.

Threat of impairment indicators were developed based on these diagnoses – and were found to satisfy all of the ICE validity criteria. That is, we identified no threats to the validity of these indicators.

4.1.2. Strengths and limitations of the study

Strengths

We are aware of no other work that has used national data to develop serious TOI injury indicators. The indicators that we have developed complement the current NZIPS indicators in that they capture serious injuries along an alternative dimension of seriousness to the NZIPS indicators, ie TOI rather than TTL. This is demonstrated by the diagnoses that are captured by the TTL but not the TOI indicators, and vice versa.

The final list of diagnoses, that define the threat of impairment indicators, is unsurprising. This is a strength, in that indicators based on these diagnoses have high face validity.

Limitations

This work has captured only one dimension of disability, namely impairment. According to one widely accepted model, disability can be measured along three dimensions: impairment, activity limitations, and participation restrictions. [11] We recommend that work be put in train to develop indicators that capture serious injury in terms of these other dimensions. This is because there is likely to be only modest correlation between all three dimensions (e.g. an amputated finger has potentially different degrees of severity in terms of activity and participation for a carpenter compared with a professional concert pianist

We sought to use empirical methods to investigate the feasibility of deriving impairment-related indicators. We found we were able to develop TOI indicators but, in the end, the method used was a mix of an empirical and a consensus approach to identifying diagnoses that define a case for the TOI indicator. Nevertheless, this is the approach that was taken to develop the very successful Abbreviated Injury Scale (AIS) threat to life measure. [12] The AIS (and its derivatives) has been shown to have high predictive validity in terms of death. [13]

We have obtained the views of two ACC medical advisors about which diagnoses would result in a classification of over 10% WPI, if the injury was assessed by ACC, and three Emergency Medicine consultants about which of these diagnoses invariably

result in admission to hospital. One limitation of using anatomical severity based on ICD-10-AM codes is that many of the ICD-10-AM codes designate several subtypes of injuries that are not homogeneous in TOI severity. The case mix captured by each code will determine the likelihood of the second condition being true; ie. that the injuries captured by the diagnosis code have a high probability of admission. This was obviously down to the subjective opinion of the three consultants. We are just embarking on an international collaborative project, however, to estimate ICD-10 diagnosis-specific probabilities of admission for persons who attend ED with an injury. This will provide empirical validation of these choices. Its completion is not scheduled until 2010, however.

On a more general point, the indicators have not been empirically validated. IPRU are currently engaged in some work to examine the accuracy of the ICD-10-AM diagnosis and external cause of injury coding on the NMDS. Results from this work will inform aspects of the validity of the proposed indicators. Major inaccuracies in the data would cast some question on the validity of the indicators. It would also be desirable to carry out critierion validation; however, it is not obvious what specific methods would be used.

The overall linkage rate was 62%. A low rate was expected since not all injuries that result in 10% or greater WPI would be admitted to hospital. The linkage rate is much higher for selected types of injury for which admission to hospital would be expected (eg. amputation – see Table 2 and Figure 2). This rate could be improved, theoretically, by the use of NMDS discharges with a comparable end date to the ACC data, ie. 31 October 2006. This was not practically possible, since NMDS 2006 hospital discharge data was not available to this project. However, it is likely to have only a very small impact on linkage rates given the timings associated with the process of assessment of people for ACC LSP, and the time required for an award and for the data to be captured electronically on ACC systems.

4.1.3. What new knowledge this study brings

This work has provided a method for the development of serious TOI injury indicators. This is an important first step in developing a comprehensive package of threat of disability indicators. Such indicators are a critical complement to the existing threat to life indicators. Together they provide a more valid basis on which the pertinent injury outcomes relating to NZIPS can be monitored. To the best of our knowledge no comparable work has been undertaken in other countries. The constituent diagnoses identified, that make up the indicators, could be applied by Australia to their hospital data, since NZ like Australia use ICD-10-AM to code diagnosis for hospital discharges.

Additionally, it provides other countries who code their hospital discharge data to ICD-10 with the opportunity to investigate the viability of developing indicators based on equivalent ICD-10 codes.

The study also shows that the TOI and the NZIPS TTL indicators have similar trends, suggesting that even though TOI and TTL captures different aspects of severity of injury, that the New Zealand serious injury rates are pretty much unchanged over the period 2000 to 2005 no matter how serious injury is measured.

4.2. Recommendations / Implications

Recommendation 1

That NZIPS considers the adoption of these TOI indicators now.

Recommendation 2

We recommend that work be commissioned to develop and apply methods for the critierion validation of the indicators..

Recommendation 3

That the international community be made aware of this work (eg via the International Collaborative Effort on Injury Statistics) and be invited to investigate the validity of modifying the TOI diagnosis list to their local conditions (in particular to the coding frames they use), with a view to generating their own TOI indicators.

Recommendation 4

In order to improve the quality of ACC diagnosis data, we strongly urge the ACC to update the diagnosis information on their electronic record when the initial diagnosis is revised, starting with the most serious cases; eg. those cases that are assessed and awarded LSP for impairment. (Initial discussions about the quality of ACC data have taken place with the relevant ACC General Manager - Information Management.)

Recommendation 5

That work be put in train to develop indicators based on other dimensions of disability, in particular participation restriction. As a starting point, development work could be carried out that focuses on the working population with time off work used as a measure of participation restriction

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6. Appendix 1: Definition of Injury

The following is reproduced from the Cryer 2004 report. [1]

The NZIPS does not explicitly address the scope of its interest by defining 'injury'. ... As we will show below there are difficulties reconciling common theoretical and operational definitions of injury. Moreover, there is a significant constituency who consider neither the theoretical nor the operational definition, or cover the scope of injury prevention, adequately - this is particularly the case for what is often referred to as psychological injury. ...

Theoretical

We take as the theoretical definition of injury that given by Waller. [14] That is:

"Injury is tissue damage resulting from either the acute transfer to individuals of one of the five forms of physical energy (kinetic or mechanical, thermal, chemical, electrical, or radiation) or from the sudden interruption of normal energy patterns to maintain life processes".

There are several variations that have been quoted by other authors; however, they effectively carry the same message.

As has been argued elsewhere (see "What is an Injury?" [15]), definitions of this nature do not align well with what many in the field consider is the business of injury prevention and control. For example, many consider psychological injury, irrespective of whether there was physical injury, to be a legitimate domain of concern for the field.

The difficulty with such an approach is that no theoretical definition has been proposed and widely accepted which places boundaries on what is to be considered as psychological injury.

Operational

Internationally, the most commonly accepted operational definition of injury [includes] those pathologies in the "Injury" chapter of the International Classification of Disease codes (ICD-codes). ICD codes are used by the New Zealand Health Information Service (NZHIS) to code mortality and hospitalisation data. [6] However, even here

there is some dispute in the international community as to which codes within the ICD injury chapter are in fact injuries. It is of interest to note that the “Injury” chapter of ICD-10 includes “Maltreatment syndromes” (T74). This category includes “Neglect and abandonment”, “Physical abuse”, “Sexual abuse”, and “Psychological abuse” without any reference to physical injury. In other words, some forms of **intentional** psychological harm / injury are covered by the “Injury” chapter of ICD.

For the purposes of this project we accept that intentional psychological injury, as encompassed by the ICD “Injury” chapter, is within the scope of this report.

Some have argued that “Medical injuries” are outside the domain of traditional injury prevention and control. For the purposes of this report, we agree. Using a strict definition of injury, all surgical and some medical procedures can be regarded as injury events, whether or not there are complications. It has been argued that to include complications as being injury events, but to remove surgical incisions as injury events is somewhat arbitrary. [15] The International Collaborative Effort on Injury Statistics recommended that these events be tabulated separately in routine statistics in recognition that these events occur under a very distinct set of circumstances. Within our operational definition we have taken the extra step and excluded them.

The “Injury” chapter of ICD excludes pathologies resulting from chronic exposure to low energy over time e.g. occupational overuse syndrome. These events lie at the interface between injury and disease. To have a theoretical definition of injury that included occupational overuse syndrome would mean changing the theoretical definition from one of tissue damage resulting from acute transfer of energy, to simply tissue damage (whether due to acute energy transfer, or to chronic exposure). Such a change would, for example, also permit cancers resulting from low-level radiation exposure to be included. ...

Finally, we have excluded sequelae of injuries as these relate to the late consequences of an injury, rather than the injury itself. In our indicators, we are focusing on measuring injury incidence (i.e. the injury event itself) and so have excluded episodes of inpatient care resulting from the sequelae of injury. For example, a burn victim often has multiple hospital admissions relating to their treatment and rehabilitation. The first admission would be included. Subsequent admissions would not.

Many of these issues are discussed by Langley in two papers published in 2004. [15] [16].

For the reasons explained in one of our previous publications [7], we also propose to identify cases of injury as those that had a principal diagnosis of injury, and were first admissions.

Consistent with the discussion above, we have used the following code ranges for our operational definition of an injury:

Principal diagnosis: S00-T78
First external cause: V01-Y36.

Although the above operational definition is couched in terms of the coding and classification system used by the NZHIS, it could, in theory, be used to identify cases of injury from ACC data. ...

This definition is likely to exclude many cases of injury that occur whilst in hospital. We cannot identify a case definition, however, that would result in valid indicators of injury occurrence outside of hospital that could also capture injury that occurs whilst in hospital. To measure these latter injuries reliably would require a focussed piece of work.

7. Appendix 2: ACC data request

Investigation of the development of impairment-related injury outcome indicators

Names: Colin Cryer; Daniel Russell
Position: Research Associate Professor; Data Manager
Address: Injury Prevention Research Unit (IPRU), Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago, P O Box 913, Dunedin.
Date: 20 October 2006

This is a request to the ACC for claims data.

Date data required by: 10 November 2006

Case definition:

Any claim that meets all of the following criteria:

1. Has an injury event date in the period 1 April 2002 to date.
2. Was awarded a lump sum payment.

Data required:

We require two SAS (version 9) datasets where the first dataset contains one claim per row and the second contains **all** diagnoses associated with the claim (one to many relationship)

ACC Claims Dataset	**ACC Diagnosis Dataset**
Case ID	Case ID
Person ID	Injury Sequence Number
Claim Date	Primary Injury Indicator
All recorded name fields (e.g. first name, surname, etc)	Read Code (original submitted code)
Last known residential address	ICD-9 Code (original submitted code)
Date of Birth	ICD-10 Code (original submitted code)
Sex	ICD-10 Code (mapped from ICD-9)
Ethnicity	ICD-10 Code (mapped from Read)
NHI Number	ACC Diagnose Code
Resident (R=ordinarily NZ resident; N=NZ citizen, not ordinarily resident in NZ, O=overseas visitor)	Injury Site
ACC 45 Claim Form Number	
Accident Date	
Fatality Indicator	
Activity	
Industry	
Occupation	
Cause	
Contact	
Agency type	
Agency1: Road	
Agency1: External agency other than road	
Agency2: Road	

Sport	
SportInv	
Scene	
Location	
Accident Description	
Number of days on which earnings-related compensation is paid[j]	
Time-off work[k]	
Type of Claim (MOE – Medical treatment only, Entitlement, Other)	
At Work Indicator	
Serious Injury Indicator	
Fund	
Employment Status	
Gradual Process Claim (Y/N)	
Is an eLodgement Claim (Y/N)	
Whole-person impairment – WPI (%)	
Lump sum payment – amount.[l]	
When lump sum payment was made	
WPI schedule to which it relates.	
All nature of impairment information	

[j] Could you please derive a variable that approximates this?
[k] Could you please provide the method used to derive this?
[l] If lump sum payment is paid over several instalments, then we would like lump sum payments in a separate dataset, with the fields: CaseID; Lump sum payment date; WPI%, WPI Schedule; All nature of impairment information.

8. Appendix 3: Record Linkage

Daniel Russell, Data Management, IPRU.

8.1. Preparation of Datasets for Linkage

8.1.1. Data Sources

ACC Work-related Claims

IPRU received two SAS datasets from ACC - a claims data set and a diagnosis data set. The claims data set contained one record per ACC claim for claims that met the following criteria:

1. Has an injury event date between 1 April 2002 and 31 October 2006
2. Was a claim for a lump sum payment.
3. New claims only (as opposed to on-going)

The diagnosis data set contains all ACC diagnosis information for the claims that met the criteria given above.

NZHIS NMDS Discharges

IPRU maintain a collection of almost 30 years of injury related to publicly funded discharges from New Zealand hospitals. These data sets were originally sourced from NZHIS. Discharges between 2002 and 2005, where the ICD-10 principal diagnosis was an ‘S’ or ‘T’ code, were selected for linking to the ACC claims dataset. Readmissions for the same event were excluded.

8.2. Record Linkage Methodology

8.2.1. Data Cleaning

The purpose of the record linkage was, for each ACC claim, to link an ACC work-related claim to a hospital discharge that related to the same injury event. Therefore, the record linkage needed to match both the same person and the same injury event.

Both datasets were cleaned and new variables were created for the purpose of record linkage. Attributes associated with the person's name were stripped of all non-alphabetic characters, including white space, and converted to uppercase. For example, the surname “O’ Conner” was transformed to “OCONNER”. The contents of the ACC Claim Form field in the NZHIS dataset is not validated, and therefore can

contain invalid ACC M45 claim form numbers. Thus values contained in this field, which could not be parsed into a valid ACC Claim Form Number, were set to missing. All other attributes were checked for unusual values and were set to missing if the values were implausible. The first character of the first given name was extracted as a separate variable to aid with blocking strategies in the record linkage process. Finally, to account for possible mis-spellings, the Soundex phonetic algorithm was used to create codes that would allow for the blocking of names based on their sound rather than spelling. A list of fields used in the record linkage is shown in Table 5 below.

Table 5 List of attributes used in the record linkage.

NZHIS Hospital Discharge data set	ACC data set
First given name	First given name
Second given name	Second given name
Third given name	First given initial
Initial of first name	Initial of first name
Soundex of surname	Soundex of surname
Soundex of first given name	Soundex of first given name
Sex	Sex
Date of birth	Date of birth
Year of birth	Year of birth
Month of birth	Month of birth
Day of birth	Day of birth
National Health Index (NHI) number	National Health Index (NHI) number
ACC M45 Claim Form Number	ACC M45 Claim Form Number
Injury date	Injury date
Year of injury	Year of injury
Month of injury	Month of injury
Day of injury	Day of injury

8.2.2. Matching Process

The software used for record linkage was AUTOMATCH. The record linkage process involves selecting a matching and blocking strategy at each pass. AUTOMATCH allows up to 8 passes. Blocking variables reduce the number of record pairs that are examined at each pass. For each pass matching variables are compared within each of the datasets and an overall score is computed that describes the similarity of record-pairs. Scores that are above a user defined maximum threshold are classified as matches, scores below the user defined minimum threshold are classified as non-matches and scores in between the two thresholds are classified as undecided cases. Undecided cases are usually subject to clerical/manual review – however, given the large number of records that may be classified as undecided, the minimum and maximum thresholds were always set as equal at each pass to eliminate manual review. After each pass, the record-pairs were sorted in decreasing score order and a manual scan was conducted to decide on an appropriate cut-off threshold.

Table 6 lists the blocking and matching variables selected at each pass.

Table 6 Blocking and matching variables used at each pass

Pass Number	Blocking variables	Matching variables
1	Surname Initial of first name Sex Date of birth Date of injury	First given name Second given name Third given name NHI ACC M45 Claim Number
2	ACC M45 Claim Number Year of injury	Surname First given name Second given name Third given name NHI Date of injury Date of birth
3	NHI Date of injury	Surname First given name Second given name Third given name ACC M45 Claim Number Date of birth
4	Soundex of surname Soundex of first given name Sex Date of birth	Date of injury
5	Soundex of surname Soundex of first given name Year of injury	Date of injury Date of birth
6	Date of injury Date of birth Soundex of surname Sex	Date of birth Surname First given name Second given name Third given name
7	Date of injury Year of birth Surname Sex	Date of birth First given name Second given name NHI ACC M45 Claim Number
8	Soundex of surname Soundex of first given name ACC M45 Claim Number	Date of injury

9. Appendix 4: The method of classification of ACC claims into gradual process and injury claims.

The definition of “gradual process” and “injury” is provided by the IPRC Act. The definition of gradual process has been operationalised (principally by Andrew Burton [actuary] in consultation with Kevin Morris [Chief Medical Advisor]) in the form of code used by ACC to identify gradual process claims. (Tim Boyd Wilson, ACC, Personal correspondence, 4 October 2006).

Code to classify claims as gradual process claims was supplied to IPRU by ACC (Chris Taylor, personal correspondence). We were informed that this routinely classifies a case as gradual process if any diagnosis on the claims record is a gradual process code. IPRU has amended this code for this project, such that a case is defied as an injury of the primary diagnosis (or in its absence diagnosis 1) was an injury code, even in the presence of a gradual process diagnosis code.

The SAS code supplied by ACC is reproduced below.

```
IF Read THEN Read Code = PUT(Read, Read Code.) ;
  IF Diagnosis in
('11','20','21','22','23','24','25','26','31','60','61','90','91','92','
93','94')
  THEN Grad Proc_Diag = 'Y' ;
  IF  (ICD9Code ne " " and SUBSTR(ICD9Code,3,1) not in (' ','.')) and
     (('010'   le ICD9Code le '018.99') or ('137'    le ICD9Code le
'137.99') or
      ('V01.1' le ICD9Code le 'V01.19') or /*Tuberculosis*/
      ('020'   le ICD9Code le '027.99') or /*Zoonotic bacterial inf*/
      ('022'   le ICD9Code le '022.99') or /*Anthrax*/
      ('023'   le ICD9Code le '023.99') or /*Brucellosis*/
      ('030'   le ICD9Code le '031.99') or /*Leprosy/other
mycobacterium*/
      ('036'   le ICD9Code le '036.99') or /*Meningococcal inf*/
      ('038'   le ICD9Code le '038.99') or /*Septicaemia, various*/
      ('042'   le ICD9Code le '044.99') or (ICD9Code eq '279.10') or
/*HIV/AIDS*/
                                  (ICD9Code eq '482.83') or
/*Legionella*/
      ('051'   le ICD9Code le '051.99') or /*Cowpox/sheep
pox(orf)/paravaccinia*/
```

```
('070'   le ICD9Code le '070.99') or /*Viral Hepatitis*/
('100'   le ICD9Code le '100.99') or /*Leptospirosis*/
('140'   le ICD9Code le '208.99') or /*Malignant cancer*/
('162'   le ICD9Code le '163.99') or /*Lung Cancer/Meso*/
('173'   le ICD9Code le '173.99') or /*Epithelial skin ca*/
('230'   le ICD9Code le '234.99') or /*Carcinoma in situ*/
('331'   le ICD9Code le '332.99') or /*Cerebral
degeneration/Alzheimers/Parkinsons*/
('337.2' le ICD9Code le '337.29') or /*Regional pain syndrome,
autonomic nerv sys*/
('348.3' le ICD9Code le '348.39') or /*Toxic encephalopathy*/
('350'   le ICD9Code le '353.99') or /*Cranial nerve, nerve root
and plexus disorders*/
('354'   le ICD9Code le '355.99') or /*Upper/lower limb
mononeuropathies, incl. Carpal TS*/
('356'   le ICD9Code le '357.99') or /*Peripheral/Toxic
neuropathies*/
('388.1' le ICD9Code le '388.19') or ('389'    le ICD9Code le
'389.99') or /*Hearing Loss*/
('410'   le ICD9Code le '414.99') or /*Ischaemic Heart Disease*/
('443.0' le ICD9Code le '443.09') or /*Raynaud's Phenomenon*/
('481'   le ICD9Code le '482.99') or /*Pneumococcal/other
bacterial pneumonia, incl. Legionnaires*/
('490'   le ICD9Code le '496.99') or /*CORD etc.*/
('495'   le ICD9Code le '495.99') or /*Allergic Alveolitis from
external agents*/
('500'   le ICD9Code le '500.99') or /*Pneumoconiosis from coal*/
('501'   le ICD9Code le '502.99') or /*Pn Asbestos/Silicosis*/
('503'   le ICD9Code le '503.99') or /*Pn Siderosis/other
inorganic*/
('504'   le ICD9Code le '505.99') or /*Pn from organic/other*/
('506'   le ICD9Code le '508.99') or /*Respiratory conditions
from other external agents*/
('570'   le ICD9Code le '573.99') or /*Hepatic disease*/
('571.4' le ICD9Code le '571.49') or ('573.1' le ICD9Code le
'573.39') or /*Chronic Hepatitis*/
('580'   le ICD9Code le '593.99') or /*Renal disease*/
('585'   le ICD9Code le '585.99') or /*Chronic Renal failure*/
('692'   le ICD9Code le '692.99') or /*Contact Dermatitis*/
(ICD9Code eq '709.01')           or /*Vitiligo/Leucoderma*/
```

('710.1' le ICD9Code le '710.19') or /*Scleroderma*/

('719.4' le ICD9Code le '719.49') or /*Arthralgia*/

('720' le ICD9Code le '721.99') or /*Spondylopathy/Spondylitis*/

('722.4' le ICD9Code le '722.79') or /*Intervertebral disc degen/myelopathy*/

('723.1' le ICD9Code le '723.69') or /*Cervical Neuropathy/Neuritis, incl. neck pain*/

('724.1' le ICD9Code le '724.59') or /*Thor, Lumb, Sacc Neuropathy/Neuritis, incl. back pain*/

('725' le ICD9Code le '727.49') or /*Disorders of muscle, synovium, tendon and bursa*/

('727.8' le ICD9Code le '727.89') or /*Transient synovitis*/

('728.6' le ICD9Code le '728.79') or /*Palmar/Plantar fasciitis*/

('729.0' le ICD9Code le '729.19') or /*Rheumatism/Fibromyalgia NOS, pain synd soft tiss*/

('729.2' le ICD9Code le '729.29') or /*Neuropathy/Radiculopathy NOS*/

('980' le ICD9Code le '980.99') or /*Alcohol products*/

('981' le ICD9Code le '981.99') or /*Petroleum products*/

('982' le ICD9Code le '982.99') or /*Non-Petroleum solvent*/

('983' le ICD9Code le '983.99') or /*Corrosives, incl. Phosphorus*/

('984' le ICD9Code le '984.99') or ('E86.15' le ICD9Code le 'E86.15') or /*Lead*/

('985' le ICD9Code le '985.99') or /*Other toxic metals*/

('985.0' le ICD9Code le '985.09') or /*Mercury*/

('985.1' le ICD9Code le '985.19') or /*Arsenic*/

('985.2' le ICD9Code le '985.29') or /*Manganese*/

('985.3' le ICD9Code le '985.39') or /*Beryllium*/

('985.4' le ICD9Code le '985.49') or /*Antimony*/

('985.5' le ICD9Code le '985.59') or /*Cadmium*/

('985.6' le ICD9Code le '985.69') or /*Chromium*/

('985.8' le ICD9Code le '985.99') or /*Other metals*/

('986' le ICD9Code le '986.99') or /*Carbon Monoxide*/

('987' le ICD9Code le '987.99') or /*Other gases/vapours*/

('989' le ICD9Code le '989.49') or /*Other chemicals (not food or animals)*/

('989.6' le ICD9Code le '989.69') or /*Other chemicals (not food or animals)*/

```
      ('989.8' le ICD9Code le '989.99') or /*Other chemicals (not food
       or animals)*/
      ('990'   le ICD9Code le '990.99') or ('E92.63' le ICD9Code le
'E92.69')) /*Radiation*/
  THEN DO ;
    GradProc_Diag = 'Y' ;
    GradProc_Diag_ICD = 'Y' ;
  END ;
  ELSE IF
      ('A788.' le ReadCode le 'A789z') or (ReadCode eq 'ZV01A') or
/*HIV/AIDS*/
      ('A3A4.' le ReadCode le 'A3A4z') or (ReadCode eq 'H22y2') or
/*Legionella*/
      ('A70..' le ReadCode le 'A70zz') or /*Viral Hepatitis*/
      ('B226.' le ReadCode le 'B226z') or (ReadCode eq 'B81y0') or
/*Lung Cancer/Meso*/
      ('14O3.' le ReadCode le '14O3z') or /*Pn Asbestos/Silicosis*/
      (ReadCode eq 'H432.')            or /*Pn Siderosis/other
inorganic*/
      ('U1AA.' le ReadCode le 'U1AAz') or (ReadCode eq 'SM9C.') or
/*Non-Petroleum solvent*/
      (ReadCode eq 'SM58.')            or /*Corrosives, incl.
Phosphorus*/
      (ReadCode eq 'F29y3')            or /*Toxic encephalopathy*/
      ('M295.' le ReadCode le 'M295z')    /*Vitiligo/Leucoderma*/
  THEN DO ;
    GradProc_Diag = 'Y' ;
    GradProc_Diag_ICD = 'Y' ;
  END ;
  ELSE GradProc_Diag_ICD = 'N' ;
  IF GradProc_Diag ne 'Y' THEN GradProc_Diag = 'N' ;
  IF ICD9Code ne " " or ReadCode ne " " THEN Has_Code = 'Y' ;
                                ELSE Has_Code = 'N' ;
  IF (NOT P) and First.Case_ID THEN Primary_ = 'Y' ;
  ELSE IF P and Primary_ eq 'Y' and (NOT First.Case_ID) THEN DO ;
    OUTPUT ChkP ;
    Primary_ = 'N' ;
  END ;
  IF Diagnosis in ('11','60') and GradProc_Diag_ICD eq 'N' THEN
  GradProc_Diag = 'N' ; *ignore nulls/other icd ;
```

```
ELSE IF Diagnosis in ('20','21','22','23','24','31','61','93') and
GradProc_Diag_ICD eq 'N' and Has_Code eq 'Y' THEN
GradProc_Diag = 'N' ; *keep nulls, ignore other icd ;
*keep all for '25','26','90','91','92','94' ;
OUTPUT Inj1 ;
RENAME Primary_ = Primary ;
RUN;
```

10. Appendix 5: Tables presented at, and notes from the Expert Group meetings

10.1. Expert Group – meeting 1

21 May 2007

Key points

Re-assessment process

All claimants are eligible to request re-assessment under the Act. More frequently occurs in the cases of progressive illness or the development of mental illness as a result of a physical illness.

Re-assessment is not common and happens more frequently as a result of historical claims (ie. those that occurred prior to the introduction of this lump sum payment system).

Diagnosis recording

The diagnosis recorded in the ACC system is the first they are advised of. As such, the accuracy will depend on the source.

- Read Codes: Emergency departments, ambulance staff and general practitioners are provided with a list of the 200 most common Read codes, they use the 'closest fit' from the list.
- Some GPs have their own complete list of Read codes – diagnoses from these GPs are likely to be more accurate.
- Hospital diagnoses are likely to be the most accurate source of information (if admitted, the diagnosis is generally updated before ACC receive the claim), followed by GPs and Ambulance staff.

%WPI Assessment

Two approaches are taken

1. DRE (Diagnosis related estimate): A physical assessment of the claimant is undertaken, but this is only a matter of process. The %WPI is based on the medical records where sufficient diagnostic information is available.
2. Physical assessment: Use tests such as range of motion, etc. to determine %WPI. Medical records are used to confirm the diagnosis.

The assessment report is presented to ACC. Case managers will usually just record the %WPI – diagnosis information is seldom up-dated from that originally recorded.

Those hospitalised for an injury. Medical personnel have to initiate a claim for traumatic injury.

- It is possible to check the proportion of those lodged against what ACC would expect from the Acute Public Health Levy
- An audit is conducted at the end of each year to 'balance' the number expected against the number lodged for each hospital. ACC will follow-up on availability of this information.

The individual (or their case manager) has to motivate for a lump sum payment (ie. they require knowledge of the scheme).

Disentangling %WPI from diagnosis

Example: person with 90% WPI whose diagnosis is recorded on ACC and NZHIS data is 'Traumatic amputation of single finger'.

The impairment claim is associated with a claim submitted to the ACC, from which the diagnosis information is obtained. Although this claim is likely to have sparked the impairment assessment, it may not be the only claim making up the %WPI assigned. If the person in the example above suffered post traumatic stress disorder (PTSD) as a result of the injury "we will quite often produce another claim for the mental injury". As such, even though there is another claim contributing to the impairment assessment (ie. the mental injury claim), that diagnostic information is not available as the subsequent claim is not linked to the impairment. The claim to which they link the impairment is arbitrary but is part of the sequence leading up to the assessed impairment level.

Death within 1 month of the injury event is not eligible for a claim. (Needs checking.) However, ACC will make a payment to a person's estate (if they die outside of this period).

Further analysis

Table 1: Why are there still 'gradual process' claims in this table?

Table 2: How does NZHIS decide which is the 'primary' diagnosis.

Tables 4&5: Restrict comparison of numbers in NZHIS NMDS to those injuries recorded between 1 April 2002 and 30 June 2004. Conservative approach to maximize the linkage rate.

1. Check the data set used to produce the table
    a. Check the intent of injuries linked and unlinked
    b. Are unlinked cases self-inflicted?
    c. Identify those individuals who should have attracted a WPI payment (ie. S2411) and see if we can locate them on the ACC data set.
    d. Any clues re why they didn't link?
2. Identify those codes on the list that should attract a lump sum payment (use AMA Guidelines). EG indicated that would expect all of the diagnoses listed in Table 4 to attract WPI.
3. Feed back to Lorna – she has offered to identify people with the correct ICD-10 codes in the ACC databases.
    (a) Question: are there any clues why those with an appropriate ICD-10 diagnosis code, who are recorded on the ACC database are not recorded in the lump sum payment data set?
4. For the diagnoses listed in Table 4, plot diagnosis against %WPI.
    (a) Which diagnosis field should be used? NZHIS or ACC?
        (i) Benefit of using ACC diagnosis field. May be able to identify a %WPI threshold above which all those with a specific diagnosis receive a lump sum payment.
        (ii) Questionable accuracy of ACC diagnosis a disadvantage
        (iii) Benefit of using NZHIS diagnosis is improved accuracy.
        (iv) Potentially not all of the information used to determine the assessed WPI available. There is reason to believe that data are also missing from the ACC diagnosis information.
5. What other diagnoses are associated with this %WPI?

Table A1: ACC cases with single diagnosis		
% WPI	ACC ICD-10	ACC ICD-10 desc
100		
100	S0600	Concussion
100	T149	Injury, unspecified
99	S099	Unspecified injury of head
99	S065	Traumatic subdural haemorrhage
99	S065	Traumatic subdural haemorrhage
99		
99		
99	T149	Injury, unspecified
97		
95		
93	J61	Pneumoconiosis due to asbestos and other mineral fibres
93	T149	Injury, unspecified
92	T149	Injury, unspecified
90	S681	Traumatic amputation of other single finger (complete)(partial)
90	J61	Pneumoconiosis due to asbestos and other mineral fibres
90		
90	T149	Injury, unspecified
89	T149	Injury, unspecified
88		
87	S129	Fracture of neck, part unspecified
87	S1413	Other incomplete cord syndrome of cervical spinal cord
86	S1413	Other incomplete cord syndrome of cervical spinal cord
86		
86		
86	T149	Injury, unspecified
85	C450	Mesothelioma of pleura
85	J61	Pneumoconiosis due to asbestos and other mineral fibres
84	G825	Tetraplegia, unspecified
84	G825	Tetraplegia, unspecified
84	S1411	Complete lesion of cervical spinal cord
84	S129	Fracture of neck, part unspecified
84	S129	Fracture of neck, part unspecified
84	S129	Fracture of neck, part unspecified
84	G825	Tetraplegia, unspecified
84		
84	S132	Dislocation of other and unspecified parts of neck
84		
84	G825	Tetraplegia, unspecified
84	S1411	Complete lesion of cervical spinal cord
84		
83	S0600	Concussion
83	S2200	Fracture of thoracic vertebra, level unspecified
82	J61	Pneumoconiosis due to asbestos and other mineral fibres
81	S2411	Complete lesion of thoracic spinal cord
81	G825	Tetraplegia, unspecified
81	G825	Tetraplegia, unspecified
81	T149	Injury, unspecified
80		
80	J61	Pneumoconiosis due to asbestos and other mineral fibres
80	C450	Mesothelioma of pleura
80		
80	C450	Mesothelioma of pleura
80	C450	Mesothelioma of pleura
80	T149	Injury, unspecified
80	M905/	Undefined

79	I619	Intracerebral haemorrhage, unspecified
78		
77	S0095	Superficial injury of head, part unspecified, contusion
77	S3200	Fracture of lumbar vertebra, level unspecified
77	S0005	Superficial injury of scalp, contusion
76	S2200	Fracture of thoracic vertebra, level unspecified
76	G822	Paraplegia, unspecified
76	G822	Paraplegia, unspecified
75	S2200	Fracture of thoracic vertebra, level unspecified
75		
75		
75		
75		
75		
75		
75	S0600	Concussion
74	G825	Tetraplegia, unspecified
74	T149	Injury, unspecified
74		
73		
70	S333	Dislocation of other and unspecified parts of lumbar spine and pelvis
70		
70		
70		
70	G825	Tetraplegia, unspecified
70	S3200	Fracture of lumbar vertebra, level unspecified
69	S460	Injury of tendon of the rotator cuff of shoulder
69		
68	S0600	Concussion
68	S3350	Sprain and strain of lumbar spine, unspecified
68	M4724	Other spondylosis with radiculopathy, thoracic region
66		
65		
65	C450	Mesothelioma of pleura
64	T599	Gases, fumes and vapours, unspecified
64	G825	Tetraplegia, unspecified
64		
64		
63	S0005	Superficial injury of scalp, contusion
62	S6081	Abrasion of wrist and hand
62	S0005	Superficial injury of scalp, contusion
62	S581	Traumatic amputation at level between elbow and wrist
61	S001	Contusion of eyelid and periocular area
60		
60	J61	Pneumoconiosis due to asbestos and other mineral fibres
60	S47	Crushing injury of shoulder and upper arm
59	S481	Traumatic amputation at level between shoulder and elbow
58	S129	Fracture of neck, part unspecified
58		
58	T149	Injury, unspecified
58	K562	Volvulus
57	S581	Traumatic amputation at level between elbow and wrist
57	S481	Traumatic amputation at level between shoulder and elbow
57	T149	Injury, unspecified
57	S581	Traumatic amputation at level between elbow and wrist
57	T141	Open wound of unspecified body region
57		

56	S684	Traumatic amputation of hand at wrist level
55	S0600	Concussion
55	G825	Tetraplegia, unspecified
55	M4724	Other spondylosis with radiculopathy, thoracic region
55		
55	S684	Traumatic amputation of hand at wrist level
55	G834	Cauda equina syndrome
54	S581	Traumatic amputation at level between elbow and wrist
54	T599	Gases, fumes and vapours, unspecified
54		
54	S540	Injury of ulnar nerve at forearm level
53	S581	Traumatic amputation at level between elbow and wrist
53		
53		
53	E230	Hypopituitarism
52	3307000	Repair of aneurysm in extremity
52		
51	S0095	Superficial injury of head, part unspecified, contusion
50	S410	Open wound of shoulder
50	T742	Sexual abuse
50	S437	Sprain and strain of other and unspecified parts of shoulder girdle
50		
50	S065	Traumatic subdural haemorrhage
50		
50	T290	Burns of multiple regions, unspecified thickness
49	3558000	Repair of cystocele and rectocele
49	S132	Dislocation of other and unspecified parts of neck
48	S134	Sprain and strain of cervical spine
48	S233	Sprain and strain of thoracic spine
48	T149	Injury, unspecified
48	S010	Open wound of scalp
47	T66	Unspecified effects of radiation
45	S6300	Dislocation of wrist, unspecified part
45	S581	Traumatic amputation at level between elbow and wrist
44	3565301	Total abdominal hysterectomy
43	S4223	Fracture of anatomical neck of humerus
43	T149	Injury, unspecified
43	S681	Traumatic amputation of other single finger (complete)(partial)
42	S729	Fracture of femur, part unspecified
42	S0005	Superficial injury of scalp, contusion
42	S729	Fracture of femur, part unspecified
42	J61	Pneumoconiosis due to asbestos and other mineral fibres
42	T094	Injury of unspecified nerve, spinal nerve root and plexus of trunk
42	K922	Gastrointestinal haemorrhage, unspecified
41		
41	S681	Traumatic amputation of other single finger (complete)(partial)
40	S729	Fracture of femur, part unspecified
40	S729	Fracture of femur, part unspecified
40	S3350	Sprain and strain of lumbar spine, unspecified
40	T742	Sexual abuse
40		
40	H938	Other specified disorders of ear
40	S330	Traumatic rupture of lumbar intervertebral disc
40	T149	Injury, unspecified

Table A2: ACC cases (linked to NMDS) with single diagnosis				
%WPI	NZHIS ICD10	NZHIS ICD10 desc	ACC ICD10	ACC ICD10 desc
100	S065	Traumatic subdural haemorrhage	S0600	Concussion |
99	S065	Traumatic subdural haemorrhage	S065	Traumatic subdural haemorrhage |
99	S068	Other intracranial injuries	S099	Unspecified injury of head |
99	T810	Haemorrhage and haematoma complicating a procedure, not elsewhere		
90	S681	Traumatic amputation of other single finger (complete)(partial)	S681	Traumatic amputation of other single finger (complete) (partial)
87	S1411	Complete lesion of cervical spinal cord	S129	Fracture of neck, part unspecified |
87	S1413	Other incomplete cord syndrome of cervical spinal cord	S1413	Other incomplete cord syndrome of cervical spinal cord
86	S1222	Fracture of fourth cervical vertebra	S1413	Other incomplete cord syndrome of cervical spinal cord
86	T2134			|
84	S1221	Fracture of third cervical vertebra		
84	S1313	Dislocation of C3/C4 cervical vertebrae	S132	Dislocation of other and unspecified parts of neck
84	S1410	Injury of cervical spinal cord, unspecified	G825	Tetraplegia, unspecified |
84	S1410	Injury of cervical spinal cord, unspecified	S1411	Complete lesion of cervical spinal cord |
84	S1410	Injury of cervical spinal cord, unspecified	S129	Fracture of neck, part unspecified |
84	S1410	Injury of cervical spinal cord, unspecified	S129	Fracture of neck, part unspecified |
84	S1410	Injury of cervical spinal cord, unspecified	S1411	Complete lesion of cervical spinal cord |
84	S1410	Injury of cervical spinal cord, unspecified		|
84	S1411	Complete lesion of cervical spinal cord	G825	Tetraplegia, unspecified |
84	S1411	Complete lesion of cervical spinal cord	S129	Fracture of neck, part unspecified |
84	S1411	Complete lesion of cervical spinal cord	G825	Tetraplegia, unspecified |
84	T68	Hypothermia	G825	Tetraplegia, unspecified |
83	S065	Traumatic subdural haemorrhage	S0600	Concussion |
83	S3201	Fracture of lumbar vertebra, L1 level	S2200	Fracture of thoracic vertebra, level unspecified |
81	S020	Fracture of vault of skull	S2411	Complete lesion of thoracic spinal cord |
81	S1222	Fracture of fourth cervical vertebra	G825	Tetraplegia, unspecified |
81	S1413	Other incomplete cord syndrome of cervical spinal cord	G825	Tetraplegia, unspecified |
77	S020	Fracture of vault of skull	S0005	Superficial injury of scalp, contusion |
77	S0622	Diffuse cerebellar contusions	S0095	Superficial injury of head, part unspecified, contusion
77	S2206	Fracture of thoracic vertebra, T11 and T12 level	S3200	Fracture of lumbar vertebra, level unspecified |
76	S2410	Injury of thoracic spinal cord unspecified	G822	Paraplegia, unspecified |
76	S2411	Complete lesion of thoracic spinal cord	S2200	Fracture of thoracic vertebra, level unspecified |
76	S2411	Complete lesion of thoracic spinal cord	G822	Paraplegia, unspecified |
75	S021	Fracture of base of skull	S0600	Concussion |
75	S2411	Complete lesion of thoracic spinal cord	S2200	Fracture of thoracic vertebra, level unspecified |
75	S341	Other injury of lumbar spinal cord [conus medullaris]		|
75	T814	Infection following a procedure, not elsewhere classified		
75	T815	Foreign body accidentally left in body cavity or operation wound		
74	S1313	Dislocation of C3/C4 cervical vertebrae	G825	Tetraplegia, unspecified |
74	S781	Traumatic amputation at level between hip and knee	T149	Injury, unspecified |
74	T810	Haemorrhage and haematoma complicating a procedure, not elsewhere		
70	S140	Concussion and oedema of cervical spinal cord	G825	Tetraplegia, unspecified |
70	S2411	Complete lesion of thoracic spinal cord	S3200	Fracture of lumbar vertebra, level unspecified |
70	T813	Disruption of operation wound, not elsewhere classified		
70	T818	Other complications of procedures, not elsewhere classified		
68	S065	Traumatic subdural haemorrhage	S0600	Concussion |
64	S1413	Other incomplete cord syndrome of cervical spinal cord	G825	Tetraplegia, unspecified |
64	T58	Toxic effect of carbon monoxide	T599	Gases, fumes and vapours, unspecified |
63	S066	Traumatic subarachnoid haemorrhage	S0005	Superficial injury of scalp, contusion |
62	S064	Epidural haemorrhage	S0005	Superficial injury of scalp, contusion |
62	S688	Traumatic amputation of other parts of wrist and hand	S581	Traumatic amputation at level between elbow and wrist
61	S010	Open wound of scalp	S001	Contusion of eyelid and periocular area |
60	S519	Open wound of forearm, part unspecified	S47	Crushing injury of shoulder and upper arm |
59	S580	Traumatic amputation at elbow joint	S481	Traumatic amputation at level between shoulder and elbow
58	S1223	Fracture of fifth cervical vertebra	S129	Fracture of neck, part unspecified |
57	S581	Traumatic amputation at level between elbow and wrist	S581	Traumatic amputation at level between elbow and wrist
57	S581	Traumatic amputation at level between elbow and wrist	S481	Traumatic amputation at level between shoulder and elbow
57	S651	Injury of radial artery at wrist and hand level	T141	Open wound of unspecified body region |
57	S684	Traumatic amputation of hand at wrist level	S581	Traumatic amputation at level between elbow and wrist
56	S581	Traumatic amputation at level between elbow and wrist	S684	Traumatic amputation of hand at wrist level |
55	S0623	Multiple intracerebral and cerebellar haematomas	S0600	Concussion |
55	S140	Concussion and oedema of cervical spinal cord	G825	Tetraplegia, unspecified |
55	S581	Traumatic amputation at level between elbow and wrist	S684	Traumatic amputation of hand at wrist level |
54	S684	Traumatic amputation of hand at wrist level	S581	Traumatic amputation at level between elbow and wrist
54	T58	Toxic effect of carbon monoxide	T599	Gases, fumes and vapours, unspecified |
53	S581	Traumatic amputation at level between elbow and wrist	S581	Traumatic amputation at level between elbow and wrist
52	S451	Injury of brachial artery	3307000	Repair of aneurysm in extremity |
52	T810	Haemorrhage and haematoma complicating a procedure, not elsewhere		
51	S0623	Multiple intracerebral and cerebellar haematomas	S0095	Sperficial injury of head, part unspecified, contusion
50	S021	Fracture of base of skull	S065	Traumatic subdural haemorrhage |
50	S143	Injury of brachial plexus	S437	Sprain and strain of other and unspecified parts of shoulder girdle
50	S451	Injury of brachial artery	S410	Open wound of shoulder |
50	T203	Full thickness burn of head and neck	T290	Burns of multiple regions, unspecified thickness |
49	S1314	Dislocation of C4/C5 cervical vertebrae	S132	Dislocation of other and unspecified parts of neck
49	S3738	Injury of other part of urethra	3558000	Repair of cystocele and rectocele |
48	S0188	Open wound of other parts of head	S010	Open wound of scalp |
45	S680	Traumatic amputation of thumb (complete)(partial)	S581	Traumatic amputation at level between elbow and wrist
43	S4221	Fracture of head of humerus	S4223	Fracture of anatomical neck of humerus |
43	S682	Traumatic amputation of two or more fingers alone (complete)(part	S681	Traumatic amputation of other single finger (complete) (partial)
42	S066	Traumatic subarachnoid haemorrhage	S0005	Superficial injury of scalp, contusion |
42	S7203	Fracture of subcapital section of femur	S729	Fracture of femur, part unspecified |
42	S7243	Supracondylar fracture of femur	S729	Fracture of femur, part unspecified |
41	S680	Traumatic amputation of thumb (complete)(partial)	S681	Traumatic amputation of other single finger (complete) (partial)
40	S7211	Fracture of intertrochanteric section of femur	S729	Fracture of femur, part unspecified |

Table A3: ACC cases with multiple diagnoses linked to hospital discharges: %WPI>40%

ipru_id	% WPI	NZHIS ICD10	NZHIS ICD10 desc	ACC ICD10	ACC ICD10 desc	No diags listed	Total no ACC diags for cl	ACC Injury Diagnosis	ACC Injury Site
2498395	100	S0623	Multiple intracerebral and cerebellar haemat	S0095	Superficial injury of head, part unspecified, contusion	3	3		
2498395	100			S099				Soft Tissue Inj (contu,str,spr,int	Head (except Face)
2498395	100							Concussion	Head (except Face)
2640895	100	S021	Fracture of base of skull	S022	Fracture of nasal bones	3	3		
2640895	100			S020	Fracture of vault of skull				
2640895	100			S029	Fracture of skull and facial bones, part unspecified				
1544229	99	S021	Fracture of base of skull	S029	Fracture of skull and facial bones, part unspecified	3	3		
1544229	99			S099	Unspecified injury of head				
1544229	99			S270	Traumatic pneumothorax				
1665895	97	S065	Traumatic subdural haemorrhage			2	2	Concussion	Head (except Face)
1665895	97			S0095	Superficial injury of head, part unspecified, contusion				
485062	96	S1101	Open wound of larynx	S020	Fracture of vault of skull	2	2		
485062	96			S2412	Incomplete cord syndrome of thoracic spinal cord				
2091729	96	S021	Fracture of base of skull	S030		2	2	Fracture/dislocation	Face
2091729	96			S066	Traumatic subarachnoid haemorrhage				
1552562	95	T203	Full thickness burn of head and neck	T2103	Burn of unspecified thickness of abdominal wall	3	7		
1552562	95			T599	Gases, fumes and vapours, unspecified				
1552562	95			T200	Burn of unspecified thickness of head and neck				
836729	94	S1410	Injury of cervical spinal cord, unspecified	S801	Contusion of other and unspecified parts of lower leg	3	6		
836729	94			T1401	Abrasion of unspecified body region				
836729	94			S880	Traumatic amputation at knee joint				
1398395	94	S021	Fracture of base of skull	S020	Fracture of vault of skull	3	3		
1398395	94			T0230	Fractures involving multiple regions of one lower limb, closed				
1398395	94			S020	Fracture of vault of skull				
2616729	94	S1475	Functional spinal cord injury, C5	S2200	Fracture of thoracic vertebra, level unspecified	2	2		
2616729	94			S1413	Other incomplete cord syndrome of cervical spinal cord				
165895	93	S0631	Focal cerebral contusion	G819	Hemiplegia, unspecified	3	4		
165895	93			S0095	Superficial injury of head, part unspecified, contusion				
165895	93			S025	Fracture of tooth				
425062	92	S682	Traumatic amputation of two or more fingers	S0633	Focal cerebral haematoma	2	2		
425062	92			S581	Traumatic amputation at level between elbow and wrist				
1385895	91	S066	Traumatic subarachnoid haemorrhage	S029	Fracture of skull and facial bones, part unspecified	3	3		
1385895	91			S020	Fracture of vault of skull				
1385895	91			S729	Fracture of femur, part unspecified				
2667562	90	S027	Multiple fractures involving skull and facial b	S020	Fracture of vault of skull	3	3		
2667562	90			S729	Fracture of femur, part unspecified				
2667562	90			S524	Fracture of shafts of both ulna and radius				
639229	89	S065	Traumatic subdural haemorrhage	S010	Open wound of scalp	3	11		
639229	89			S0095	Superficial injury of head, part unspecified, contusion				
639229	89			S065	Traumatic subdural haemorrhage				
1325062	88	S0266	Fracture of symphysis of body	T009	Multiple superficial injuries, unspecified	3	12		
1325062	88			T1401	Abrasion of unspecified body region				
1325062	88			S8241	Fracture of upper end of fibula				
67562	87	S7240	Fracture of lower end of femur, part unspecif	T0905	Contusion of trunk, level unspecified	3	4		
67562	87			S029	Fracture of skull and facial bones, part unspecified				
67562	87			T0230	Fractures involving multiple regions of one lower limb, closed				
179229	87	S1411	Complete lesion of cervical spinal cord	S1410	Injury of cervical spinal cord, unspecified	3	4		
179229	87			S010	Open wound of scalp				
179229	87			S134	Sprain and strain of cervical spine				
582562	87	S064	Epidural haemorrhage	S134	Sprain and strain of cervical spine	3	5		
582562	87			S0095	Superficial injury of head, part unspecified, contusion				
582562	87			S134	Sprain and strain of cervical spine				
766729	87	S1411	Complete lesion of cervical spinal cord	G825	Undefined	3	3		
766729	87			S010	Open wound of scalp				
766729	87			S132	Dislocation of other and unspecified parts of neck				
792562	87	S065	Traumatic subdural haemorrhage	S0095	Superficial injury of head, part unspecified, contusion	3	3		
792562	87			S0600	Concussion				
792562	87			S2232	Fracture of one rib, other than first rib				
1471729	87	S199	Unspecified injury of neck	S2200	Fracture of thoracic vertebra, level unspecified	2	2		
1471729	87			G825	Undefined				

Table A4: For selected diagnoses with %WPI≥40%, percentage of NMDS cases that link to ACC lump sum payment data							
		Frequency					
Diagnosis ICD10	Diagnosis ICD10 Description	ACC linked data set	NMDS 2002-2004 data set	% receiving lump sum payment	Mean %WPI	Min %WPI	Max %WPI
		(n)	(N)	(n/N*100)			
S2411	Complete lesion of thoracic spinal cord	21	25	84.00	76.63	75	84
S021	Fracture of base of skull	18	738	2.44	61.00	41	99
S1410	Injury of cervical spinal cord, unspecified	16	83	19.28	82.47	78	87
S020	Fracture of vault of skull	14	499	2.81	57.08	41	81
S1411	Complete lesion of cervical spinal cord	13	20	65.00	84.27	78	87
S065	Traumatic subdural haemorrhage	11	688	1.60	74.55	40	100
S2410	Injury of thoracic spinal cord unspecified	11	29	37.93	72.20	45	82
S1413	Other incomplete cord syndrome of cervical spinal cord	10	27	37.04	74.25	61	84
S2206	Fracture of thoracic vertebra, T11 and T12 level	8	442	1.81	70.88	48	82
S341	Other injury of lumbar spinal cord [conus medullaris]	8	45	17.78	70.17	60	78
S024	Fracture of malar and maxillary bones	7	963	0.73	49.71	40	73
S0631	Focal cerebral contusion	7	212	3.30	61.14	40	93
S1412	Central cord syndrome (incomplete cord injury) of cervical sp	7	27	25.93	77.83	60	84
S581	Traumatic amputation at level between elbow and wrist	7	11	63.64	56.29	53	60
S8221	Fracture of shaft of tibia with fracture of fibula (any part)	7	1262	0.55	53.86	46	71
S0623	Multiple intracerebral and cerebellar haematomas	6	174	3.45	62.20	43	86
S325	Fracture of pubis	5	1494	0.33	57.40	40	84
S680	Traumatic amputation of thumb (complete)(partial)	5	419	1.19	46.00	41	54
S684	Traumatic amputation of hand at wrist level	5	9	55.56	59.00	54	71
T203	Full thickness burn of head and neck	5	75	6.67	69.75	56	95

Table A4a For selected diagnoses with %WPI ≥40%, percentage of NMDS cases (1/4/02-30/6/04) that linked to ACC lump sum payment data

Diagnosis	Description	Frequency ACC linked data set	NMDS Apr2002-June2004	% Receiving lump sum	Mean %WPI	Min %WPI	Max %WPI
S021	Fracture of base of skull	16	570	2.81	61	41	99
S2411	Complete lesion of thoracic spinal cord	16	21	76.19	76.63	75	84
S1410	Injury of cervical spinal cord, unspecified	14	64	21.88	82.36	61	94
S020	Fracture of vault of skull	12	380	3.16	58.03	41	81
S065	Traumatic subdural haemorrhage	12	486	2.47	72	40	100
S1411	Complete lesion of cervical spinal cord	11	17	64.71	84.27	78	87
S2206	Fracture of thoracic vertebrae, T11 and T12 level	8	332	2.41	70.88	48	82
S2410	Injury of thoracic spinal cord, unspecified	8	21	38.10	72	45	82
S0631	Focal cerebral contusion	7	162	4.32	61.1	40	93
S1413	Other incomplete cord syndrom of cervical spinal cord	7	20	35.00	73.43	61	84
S8221	Fracture of shaft of tibia with fracture of fibula (any part)	7	943	0.74	53.86	46	71
S341	Other injury of lumbar spinal cord [conus medullaris]	6	35	17.14	70.17	60	78
S581	Traumatic amputation at level between elbow and wrist	6	8	75.00	56.5	53	60
S024	Fracture of malar and maxillary bones	5	720	0.69	52.2	40	73
S1412	Central cord syndrome (incomplete cord injury) of cervical s	5	22	22.73	76.6	60	84
S272	Traumatic haemopneumothorax	5	123	4.07	57	45	86
S325	Fracture of pubis	5	1136	0.44	57.4	40	84
S680	Traumatic amputation of thumb (complete)(partial)	5	302	1.66	46.8	41	54
S0623	Multiple intracerebral and cerebellar haematomas	4	124	3.23	67	51	86
S066	Traumatic subarachnoid haemorrhage	4	198	2.02	68.25	42	91

Table A5: For selected diagnoses with %WPI≥10%, percentage of NMDS cases that link to ACC lump sum payment data							
		Frequency					
Diagnosis ICD10	Diagnosis ICD10 Description	ACC linked data set	NMDS 2002-2004 data set	% receiving lump sum payment	Mean %WPI	Min %WPI	Max %WPI
		(n)	(N)	(n/N*100)			
S680	Traumatic amputation of thumb (complete)(partial)	72	419	17.18	18.96	10	54
S682	Traumatic amputation of two or more fingers alone (complete)(pa	70	282	24.82	20.81	10	92
S021	Fracture of base of skull	58	738	7.86	32.53	10	99
S681	Traumatic amputation of other single finger (complete)(partial)	58	1,818	3.19	15.50	10	90
S052	Ocular laceration and rupture with prolapsed or loss of	38	150	25.33	28.59	23	61
S065	Traumatic subdural haemorrhage	37	668	5.54	40.29	10	100
S723	Fracture of shaft of femur	36	1,442	2.50	24.32	10	59
S8231	Fracture of lower end of tibia with fracture of fibula (any part)	28	1218	2.30	18.50	10	32
S020	Fracture of vault of skull	24	499	4.81	45.23	15	81
S024	Fracture of malar and maxillary bones	24	963	2.49	30.91	10	73
S8218	Other fracture of upper end of tibia	24	1333	1.80	20.87	10	50
S8221	Fracture of shaft of tibia with fracture of fibula (any part)	24	1262	1.90	31.95	10	71
S920	Fracture of calcaneus	24	603	3.98	17.91	10	42
S2411	Complete lesion of thoracic spinal cord	21	25	84.00	76.23	75	84
S3201	Fracture of lumbar vertebra, L1 level	21	720	2.92	25.16	10	76
S055	Penetrating wound of eyeball with foreign body	20	127	15.75	27.33	19	47
S6261	Fracture of proximal phalanx	19	1398	1.36	16.47	10	26
S053	Ocular laceration without prolapse or loss of intraocular tissue	18	117	15.38	26.23	17	42
S056	Penetrating wound of eyeball without foreign body	18	91	19.78	23.50	18	29
S1410	Injury of cervical spinal cord, unspecified	18	83	21.69	76.06	25	94

Table A5a: For selected diagnoses with %WPI≥10%, percentage of NMDS cases that link to ACC lump sum payment data

Diagnosis ICD10	Diagnosis ICD10 Description	Frequency			Mean %WPI	Min %WPI	Max %WPI
		ACC linked data set (n)	NMDS Apr 2002-June 2004 data set (N)	% receiving lump sum payment (n/N*100)			
S021	Fracture of base of skull	54	570	9.47	32.52	10	99
S682	Traumatic amputation of two or more fingers alone (complete)(part	51	208	24.52	20.55	10	92
S680	Traumatic amputation of thumb (complete)(partial)	49	302	16.23	19.43	10	54
S681	Traumatic amputation of other single finger (complete)(partial)	41	1356	3.02	15.78	10	90
S065	Traumatic subdural haemorrhage	35	486	7.20	40.29	10	100
S723	Fracture of shaft of femur	29	1059	2.74	23.55	10	59
S052	Ocular laceration and rupture with prolapsed or loss of	25	112	22.32	29.08	23	61
S8231	Fracture of lower end of tibia with fracture of fibula (any part)	24	906	2.65	18.42	10	32
S920	Fracture of calcaneus	23	436	5.28	17.91	10	42
S8221	Fracture of shaft of tibia with fracture of fibula (any part)	21	943	2.23	31.95	10	71
S024	Fracture of malar and maxillary bones	20	720	2.78	29.65	10	73
S8218	Other fracture of upper end of tibia	19	990	1.92	21.53	10	50
S020	Fracture of vault of skull	19	380	5.00	46.57	15	81
S3201	Fracture of lumbar vertebra, L1 level	18	451	3.99	25.06	10	76
S325	Fracture of pubis	17	1136	1.50	32.53	12	84
S1410	Injury of cervical spinal cord, unspecified	16	64	25.00	75.56	25	94
S2411	Complete lesion of thoracic spinal cord	16	21	76.19	76.63	75	84
S7203	Fracture of subcapital section of femur	15	3058	0.49	24.87	13	42
S526	Fracture of lower end of both ulna and radius	15	3035	0.49	20.47	10	41
S5250	Fracture of lower end of radius, unspecified	15	1737	0.86	19	10	32

10.2. Expert Group – meeting 2

19 June 2007

Key Points

Once again there was a lot of discussion surrounding why those who should be eligible are not receiving a lump sum payment.

- EG again raised the possibility that LSP relating to the correct diagnosis may be missing because they haven't been linked to the correct claim. "Although I would like to think that linkage between LSP and claim is not an arbitrary process".
- There was substantial concern around the table that ACC has a lot of information relating to each LSP claim, yet that information is not accessible (i.e. not stored on computer).
- Pushing for strong recommendations to come out of this project concerning the need to up-date the diagnosis information.

Contact with the health service
This arose as an issue out of the result that, of the linked cases with diagnoses that we selected to investigate further (highlighted in Table 4), only 47% of those who were labeled as "Discharged Routinely" linked, while over 80% of those who were labeled as "Discharged to another facility" linked.

When is a claimant assigned a case manager?

Claims are screened by their diagnosis when they are lodged.
'High risk' claims (those that are likely to result in time off work) are flagged and they are assigned a case manager.
'Very high risk claims' – those that are likely to result in more than 90 days off work are 'actively managed'.
People with case managers are more likely to be awarded a lump sum payment as they are more likely to be provided with the information required.
As such, the lump sum data set is likely to be heavily biased towards workers.

- Those under 18 and over 65 years are not usually assigned a case manager.
- Member comment: "I wouldn't have expected to see fractured neck of the femur in this data set" (because of the bias in the system outlined above).

Assessment of lump sum claimants
Around 100 assessors are contracted to ACC from around the country.
A claimant is assigned to an assessor based on geographical region rather than medical specialty.

- ACC does not consider that any medical personnel are qualified to assess, so they are trained by ACC.
- Assignment on the basis of geographic region not considered a problem as "generalists often do a better job of assessment than specialists".

- This stance has been defended legally.

Use of ACC diagnosis information as the basis of an Impairment Indicator
The expert group accepted the argument that the ACC diagnosis information, as it stands, is insufficiently accurate to form the basis of an impairment indicator.
Another line of enquiry may be the serious injury profile data set (see further discussion on this below).

- These are considered 'high dependency claims' – those requiring substantial and on-going input from ACC. They are likely to cost a lot of money over a long period of time.
- Would expect all claimants in this dataset to be eligible for a LSP. Lorna is going to check if this is the case.

Proposed threshold (≥70%WPI)
EG members agreed this as a useful threshold. Any reduction is likely to flag diagnoses that would not always result in LSP.
Concern expressed that the diagnoses identified are similar to those used for the serious non-fatal indicators.

- My response: the list of diagnoses is actually more limited than the one put together for the serious-non fatal indicators (I have attached the spreadsheet for your interest).
- The general feeling was that the limited list of diagnoses was possibly a result of the bias towards injuries that impact on a person's ability to return to work.
- 2 EG members also expressed concern about the high threshold, as the aim of this work was to reduce the threshold at which people could be reliably identified. They acknowledged, however, that we are in a catch-22 position. In order to reliably identify individuals that would almost always obtain a LSP because of the severity of their diagnosis, the threshold was pushed higher.

Other interesting points of discussion
How stable is the LSP scheme?

It could change with a change in Government.

Potential for misdiagnosis in the elderly

Example: An elderly person falls. They are more likely to go to their GP in the first instance. It is apparent that they have some minor injuries, which are subsequently patched-up, a claim form is completed and they are sent on their way. A couple of days later they become increasingly confused. On occasions (but not always), the GP will recall the initial fall and will send them to the hospital, where a traumatic haemorrhage will be diagnosed, drained and additional treatment may be provided. It is possible that this person may subsequently become eligible for a lump sum payment. HOWEVER, the lump sum payment is linked to the initial claim, on which the diagnosis (which is unlikely to be up-dated) is recorded as a minor injury.

Future work

1. What would happen to the linkage rate and list of diagnoses if we dropped the threshold to 60% WPI?
2. EG member is going to provide us with an indicator of whether claimants had a case manager and if they had a serious injury profile. The serious injury profile is likely to provide more information on the case, but less likely to be helpful in reducing the threshold.
3. Is there a correlation between %WPI and ICISS? Should this be our next line of investigation, so that we are no longer dependent on the LSP scheme?

Table A6: Accepted Claims registered in 2006 by vocational class and agency type (all claims)

Table of voc_class by agency											
voc_class	agency										Total
	Accident & Medical Clinics	Centre	Community Trust Hospitals	Home Help (Only)	Individual Registration	Not Defined	Other Pharmacy	Private Hospital	Public Hospital	Undefined	
.	0	0	0	0	0	0	0	0	0	42663	42663
Acupuncturist	0	0	0	0	498	0	0	0	0	0	498
Acute Hospitals	0	0	3	0	0	0	0	0	0	0	3
Ambulance Officer	0	30710	0	0	0	0	0	0	9	0	30719
Anaesthetist	0	0	0	0	4	0	0	0	0	1	5
Assessor	0	0	0	0	0	0	0	0	0	26	26
Audiologist	0	0	0	0	62	0	0	0	1	0	63
Cardiothoracic Surgeon	0	0	0	0	1	0	0	0	0	0	1
Chiropractor	0	49	0	0	42710	0	0	0	0	0	42759
Counsellor	0	12	0	1	2457	1	0	0	0	0	2471
Dental Surgeon	0	265	0	0	14141	8640	26	0	109	5552	28733
Dermatologist	0	0	0	0	1	0	0	0	0	0	1
Diagnostic Radiologist	0	7	46	0	3	0	0	0	10471	0	10527
Emergency Medicine	0	0	0	0	0	0	0	0	4421	0	4421
General Practitioner	291896	127168	3376	0	606231	216	0	0	90640	955	1120482
General Surgeon	0	0	0	0	38	10	0	0	4	2	54
Internal Medicine Specialist	0	0	0	0	25	1	0	0	0	2	28
Musculoskeletal Medicine Specialist	0	0	0	0	15	0	0	0	0	0	15
Neurosurgeon	0	0	0	0	1	0	0	0	1	0	2
Nurse	432	475	657	0	21395	42	0	0	2089	3	25093
Obstetrician/Gynaecologist	0	0	0	0	22	0	0	0	0	2	24
Occupational Medicine Specialist	0	0	0	0	12	0	0	0	0	0	12
Occupational Therapist	0	0	1	0	39	0	0	0	0	1	41
Ophthalmologist	0	0	0	0	660	0	0	0	0	52	712
Optometrist	0	0	0	0	486	0	0	0	0	0	486
Orthopaedic Surgeon	0	20	1	0	211	0	0	0	8245	4	8481
Osteopath	0	0	0	0	44347	0	0	0	0	0	44347
Otolaryngologist/Head & Neck Surgeon	0	0	0	0	24	0	0	0	0	1	25
Paediatric Surgeon	0	0	0	0	9	0	0	0	0	0	9
Paediatrician	0	0	0	0	5	0	0	0	8	0	13
Physiotherapist	0	191	0	0	234643	149	0	0	380	0	235363
Plastic & Reconstructive Surgeon	0	0	0	0	19	3	0	0	0	0	22
Podiatrist	0	3	0	0	1604	0	0	0	2	0	1609
Psychiatrist	0	0	0	0	7	0	0	0	0	0	7
Psychologist - Registered	0	0	0	0	21	0	0	0	0	0	21
Psychotherapist	0	0	0	0	1	0	0	0	0	0	1
Radiation Oncologist	0	0	0	0	1	0	0	0	0	0	1
Rehabilitation Medicine Specialist	0	0	0	0	2	0	0	0	0	0	2
Speech Therapist	0	0	0	0	4	0	0	0	0	0	4
Sports Medicine Specialist	0	0	0	0	475	0	0	0	0	0	475
Unspecified Medical Specialist	0	5	0	0	1	14	0	7	59859	0	59886
Urologist	0	0	0	0	8	0	0	0	0	0	8
Total	292,328	158,905	4,084	1	970,183	9,076	26	7	176,239	49,264	1,660,113
	17.61	9.57	0.25	0	58.44	0.55	0	0	10.62	2.97	100

Table A7: Claims registered since 2000 with a readcode in 7L05., 7L050,S1121,S1127,S1111,S1107,S97..,S9702

Table 1 of RegDate by ReadCode									
Controlling for lump_sum=N									
RegDate(	ReadCode(Read code $ReadCode.)								Total
Registrati	7L05.	7L050	S1107	S1111	S1121	S1127	S97..	S9702	
2000	0	0	1	2	0	3	24	0	30
2001	1	0	3	0	0	1	34	1	40
2002	0	0	2	0	1	2	24	0	29
2003	0	0	0	0	0	0	21	0	21
2004	0	0	0	0	0	1	20	0	21
2005	1	0	0	0	1	0	27	0	29
2006	2	0	0	0	0	0	21	0	23
2007	0	0	0	0	0	0	14	1	15
Total	4	0	6	2	2	7	185	2	208

Table 2 of RegDate by ReadCode									
Controlling for lump_sum=Y									
RegDate(	ReadCode(Read code $ReadCode.)								Total
Registrati	7L05.	7L050	S1107	S1111	S1121	S1127	S97..	S9702	
2000	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0
2002	0	1	0	0	0	1	4	1	7
2003	0	0	1	0	0	0	6	0	7
2004	3	0	0	1	2	0	1	0	7
2005	0	0	0	0	0	0	1	0	1
2006	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0
Total	3	1	1	1	2	1	12	1	22

Table A8: Top 15 primary diagnoses sourced from NMDS for ACC lump sum claims with %WPI >70%

ICD-10 Diagnosis	Description	Frequency
S2411	Complete lesion of thoracic spinal cord	16
S1410	Injury of cervical spinal cord, unspecified	13
S1411	Complete lesion of cervical spinal cord	11
S065	Traumatic subdural haemorrhage	7
S2206	Fracture of thoracic vertebrae, T11 and T12 level	6
S2410	Injury of throacic spinal cord, unspecified	6
S021	Fracture of base of skull	5
S1413	Other incomplete cord syndrome of cervical spine	5
S1412	Central cord syndrome (incomplete cord injury) of cervical spine	4
S020	Fracture of vault of skull	3
S068	Other intracranial injuries	3
S1313	Dislocation of c3/c4 cervical vertebrae	3
S341	Other injury of lumbar spinal cord	3
S0622	Diffuse cerebellar contusions	2
S0623	Multiple intracerebral and cerebellar haematomas	2

Table 9: Mean and range %WPI, percentage linked for 'high linked' diagnoses

ICD10 Code	Icd10 description	n	n (NMDS)	n linked	% linked	Mean %WPI	Min %WPI	Max %WPI
S682	Traumatic amputation of 2 or more fingers	39	173	46	27	21	10	92
S681	Traumatic amputation of other single finger	30	902	36	4	16	10	90
S680	Traumatic amputation of thumb	29	231	42	18	19	10	54
S8231	Fracture of lower end of tibia with fracture of fibula	22	798	24	3	18	10	32
S021	Fracture base of skull	21	438	45	10	33	10	99
S723	Fracture of shaft of femur	19	1013	28	3	24	10	59
S920	Fracture of calcaneus	18	359	22	6	18	10	42
S8221	Fracture of shaft of tibia with fracture of fibula (any part)	17	864	21	2	32	10	71
S3201	Fracture of lumbar vertebrae L1 level	12	395	17	4	25	10	76
S7203	Fracture of subcapital section of femur	12	2903	15	1	25	13	42
S2411	Complete lesion of thoracic spinal chord	11	19	14	74	77	75	84
S325	Fracture of pubis	11	1058	16	2	33	12	84
S8218	Other fracture of upper end of tibia	10	857	19	2	22	10	50
S1410	Injuries of cervical spinal chord, unspecified	10	48	13	27	76	25	94
S8281	Bimalleolar facture, ankle	10	954	12	1	19	10	28
S065	Traumatic subdural haemorrhage	9	402	30	7	40	10	100
S7211	Fracture of intertrochanteric section of femur	9	2524	11	0	21	10	40
S1411	Complete lesion of cervical spinal chord	8	15	9	60	84	78	87
S052	Ocular laceration and rupture with prolapse or loss of intraocular tissue	8	106	24	23	29	23	61
S324	Fracture of acetabulum	8	285	12	4	25	10	46
S024	Fracture of malar and maxillary bones	7	541	17	3	30	10	73
S2206	Fracture of thoracic vertebrae T11 and T12 level	7	282	11	4	48	19	82
S5250	Fracture of lower end of radius, unspecified	7	1162	13	1	19	10	32
S6262	Fracture of middle phalanx	7	372	12	3	15	10	27
S825	Fracture of medial malleolus	7	522	8	2	18	11	27
Other diagnoses that have been of interest but were not identified through the analyses that produced the above list								
S020	Fracture of vault of skull	3	292	11	4	47	15	81
S2410	Injury of thoracic spinal chord, unspecified	2	11	3	27	72	45	82
S1413	Other incomplete cord syndrome of cervical spinal cord	5	19	9	47	57	25	84
S1412	Central cord syndrome (incomplete cord injury) of cervical spinal cord	4	22	6	27	67	35	84
S068	Other intracranial injuries	2	38	6	16	58	31	99
S1313	Dislocation of C3/C4 cervical vertebrae	1	3	1	33	79	74	84
S341	Other injury of lumbar spinal cord (conus medullaris)	3	29	7	24	68	31	78
S0622	Diffuse cerebellar contusions (<=5mL blood)	0	4	1	25	78	77	78
S0623	Multiple intracerebral and cerebellar haematomas	5	104	9	9	46	10	86
S056	Penetrating injury of eyeball without foreign body	0	49	8	16	24	18	29
S066	Traumatic subarachnoid haemorrhage	3	185	31	17	49	26	91
S581	Traumatic amputation at level between elbow and wrist	3	9	7	78	57	53	60
S684	Tramatic amputation of hand at wrist level	4	11	8	73	63	54	71

10.3. Expert Group – meeting 3

5 September 2007

A week prior to the third expert group meeting, Pauline sent a spreadsheet to members of the group asking them to comment on the diagnoses listed. The spreadsheet listed is attached. Members were instructed to:

> "Using the 'complete list' worksheet in this workbook, we would like you to go through each of the diagnoses listed and provide us with an estimate of how likely it is that someone with each diagnosis would be admitted to hospital and, if assessed, would get a lump sum payment. If you are unsure of any diagnosis, please note this and we will discuss with you who else may be useful to help us progress with this further."

When we met, group members had not undertaken the required task, and the meeting was used to reiterate what we would like done. Kevin and Alastair met the following week to go through the complete list of diagnoses and, independently, identified those that they considered would always be admitted to hospital and would always meet the criteria for a whole person impairment payment. They then met together to work through those diagnoses where they disagreed. The diagnoses highlighted in yellow on the 'complete list' worksheet are those which were considered as contenders for an impairment indicator. (These are listed in the body of the report.)

Table A10 List of diagnosis codes considered by Expert Group 3, with assessments by KM and AW shown, reconciled.

ICD10 Code	Icd10 description	3 Digit ICD Diagnosis Category
S010	Open wound of scalp	**S01 Open wound of head**
S011	Open wound of eyelid and periocular area	
S0129	Open wound of other and multiple parts of nose	
S0188	Open wound of other parts of head	
S020	Fracture of vault of skull	**S02 Fracture of skull and facial**
S021	Fracture base of skull	**bones**
S022	Fracture of nasal bones	
S023	Fracture of orbital floor	
S024	Fracture of malar and maxillary bones	
S0261	Fracture of condylar process	
S0264	Subcondylar fracture	
S0265	Fracture of angle of jaw	
S029	Fracture of skull and facial bones, part unspecified	
S051	Contusion of eyeball and orbital tissues	**S05 Injury of eye and orbit**
S052	Ocular laceration and rupture with prolapse or loss of intraocular tissue	
S053	Ocular laceration without prolapse or loss of intraocular tissue	
S054	Penetrating wound of orbit with or without foreign body	
S055	Penetrating wound of eyeball with foreign body	
S057	Avulsion of eye	
S058	Other injuries of eye and orbit	
S0600	Concussion	**S06 Intracranial injury**
S0601	Loss of consciousness of unspecified duration	
S0602	Loss of consciousness of brief duration [less than 30 minutes]	
S0623	Multiple intracerebral and cerebellar haematomas	

S0628	Other diffuse cerebral and cerebellar injury	
S0631	Focal cerebral contusion	
S0633	Focal cerebral haematoma	
S064	Epidural haemorrhage	
S065	Traumatic subdural haemorrhage	
S066	Traumatic subarachnoid haemorrhage	
S068	Other intracranial injuries	
S080	Avulsion of scalp	**S08 Traumatic amputation of part of head**
S098	Other specified injuries of head	**S09 Other and unspecified injuries**
S099	Unspecified injury of head	**of head**
S1101	Open wound of larynx	**S11 Open wound of neck**
S120	Fracture of first cervical vertebra	**S12 Fracture of neck**
S121	Fracture of second cervical vertebra	
S1222	Fracture of fourth cervical vertebra	
S1223	Fracture of fifth cervical vertebra	
S1224	Fracture of sixth cervical vertebra	
S127	Multiple fractures of cervical spine	
S1313	Dislocation of C3/C4 cervical vertebrae	**S13 Dislocation, sprain and strain of joints**
S1315	Dislocation of C5/C6 cervical vertebrae	**and ligaments at neck level**
S140	Concussion and oedema of cervical spinal cord	**S14 Injury of nerves and spinal cord at**
S1410	Injuries of cervical spinal chord, unspecified	**neck level**
S1411	Complete lesion of cervical spinal chord	
S1412	Central cord syndrome (incomplete cord injury) of cervical spinal cord	
S1413	Other incomplete cord syndrome of cervical spinal cord	
S143	Injury of brachial plexus	
S2202	Fracture of thoracic vertebra, T3 and T4 level	**S22 Fracture of rib(s), sternum and thoracic**
S2206	Fracture of thoracic vertebrae T11 and T12 level	**spine**

S221	Multiple fractures of thoracic spine	
S222	Fracture of sternum	
S2232	Fracture of one rib, other than first rib	
S2240	Multiple rib fractures, unspecified	
S2242	Multiple rib fractures, involving two ribs	
S2244	Multiple rib fractures, involving four or more ribs	
S225	Flail chest	
S2410	Injury of thoracic spinal chord, unspecified	**S24 Injury of nerves and spinal cord at thorax**
S2411	Complete lesion of thoracic spinal chord	**level**
S2412	Incomplete cord syndrome of thoracic spinal cord	
S2471	Functional spinal cord injury, T1	
S2474	Functional spinal cord injury, T6/T7	
S2477	Functional spinal cord injury, T12	
S250	Injury of thoracic aorta	**S25 Injury of blood vessels of thorax**
S270	Traumatic pneumothorax	**S27 Injury of other and unspecified intrathoracic**
S271	Traumatic haemothorax	**organs**
S272	Traumatic haemopneumothorax	
S3201	Fracture of lumbar vertebrae L1 level	**S32 Fracture of lumbar vertebrae**
S3203	Fracture of lumbar vertebra, L3 level	
S3204	Fracture of lumbar vertebra, L4 level	
S321	Fracture of sacrum	
S323	Fracture of ilium	
S324	Fracture of acetabulum	
S325	Fracture of pubis	
S3283	Fracture of pelvis, part unspecified	
S341	Other injury of lumbar spinal cord (conus medullaris)	**S34 Injury of nerves and lumbar spinal cord**
S343	Injury of cauda equina	**at abdomen, lower back and pelvis**

S3472	Functional spinal cord injury, L2	
S355	Injury of iliac blood vessels	**S35 Injury of blood vessels - abdomen level**
S3600	Injury of spleen, unspecified	**S36 Injury of intra-abdominal organs**
S3604	Massive parenchymal disruption of spleen	
S3615	Major laceration of liver	
S3640	Injury of small intestine, part unspecified	
S3649	Injury of other and multiple parts of small intestine	
S3682	Injury of mesentery	
S3683	Injury of retroperitoneum	
S3728	Other injury of bladder	**S37 Injury of urinary and pelvic organs**
S396	Injury of intra-abdominal organ(s) with pelvic organ(s)	**S39 Other injuries of abdomen, lower back & pelvis**
S4200	Fracture of clavicle, part unspecified	**S42 Fracture of should and upper arm**
S4221	Fracture of head of humerus	
S4224	Fracture of greater tuberosity of humerus	
S423	Fracture of shaft of humerus	
S4240	Fracture of lower end of humerus, part unspecified	
S4242	Fracture of lateral condyle of humerus	
S4244	Fracture of condyle(s) of humerus, unspecified	
S4301	Anterior dislocation of humerus	**S43 Dislocation, sprain and strain of**
S435	Sprain and strain of acromioclavicular joint	**joints and ligaments of shoulder girdle**
S440	Injury of ulnar nerve at upper arm level	**S44 Injury of nerves at shoulder and upper**
S447	Injury of multiple nerves at shoulder and upper arm level	**arm level**
S450	Injury of axillary artery	**S45 Injury of blood vessels at shoulder**
S451	Injury of brachial artery	**and upper arm level**
S5200	Fracture of upper end of ulna, part unspecified	**S52 Fracture of forearm**
S5201	Fracture of olecranon process of ulna	
S5211	Fracture of head of radius	

S5230	Fracture of shaft of radius, part unspecified	
S524	Fracture of shafts of both ulna and radius	
S5250	Fracture of lower end of radius, unspecified	
S5251	Fracture of lower end of radius with dorsal angulation	
S5259	Other and multiple fractures of lower end of radius	
S526	Fracture of lower end of both ulna and radius	
S528	Fracture of other parts of forearm	
S540	Injury of ulnar nerve at forearm level	**S54 Injury of nerves at forearm level**
S541	Injury of median nerve at forearm level	
S551	Injury of radial artery at forearm level	**S55 Injury of blood vessels - forearm**
S568	Injury of other and unspecified muscles and tendons at forearm le	**S56 Injury of mussle and tendon at forearm level**
S581	Traumatic amputation at level between elbow and wrist	**S58 Traumatic amputation of forearm**
S6083	Insect bite of wrist and hand	**S60 Superficial injury of wrist and hand**
S610	Open wound of finger(s) without damage to nail	**S61 Open wound of wrist and hand**
S611	Open wound of finger(s) with damage to nail	
S6188	Open wound of other parts of wrist and hand	
S6232	Fracture of shaft of other metacarpal bone(s)	**S62 Fracture at wrist and hand level**
S6251	Fracture of proximal phalanx of thumb	
S6252	Fracture of distal phalanx of thumb	
S6261	Fracture of proximal phalanx	
S6262	Fracture of middle phalanx	
S6263	Fracture of distal phalanx	
S627	Multiple fractures of fingers	
S6312	Dislocation of interphalangeal (joint), hand	**S63 Dislocation, sprain and strain of joints**
S6350	Sprain and strain of wrist, part unspecified	**and ligaments at wrist and hand level**
S640	Injury of ulnar nerve at wrist and hand level	**S64 Injury of nerves at wrist and hand level**
S641	Injury of median nerve at wrist and hand level	

S643	Injury of digital nerve of thumb	
S644	Injury of digital nerve of other finger	
S648	Injury of other nerves at wrist and hand level	
S650	Injury of ulnar artery at wrist and hand level	**S65 Injury of blood vessels at wrist and hand level**
S661	Injury of flexor muscle and tendon of other finger at wrist and h	**S66 Injury of muscle and tendon at wrist and**
S663	Injury of extensor muscle and tendon of other finger at wrist and	**hand level**
S668	Injury of other muscles and tendons at wrist and hand level	
S670	Crushing injury of thumb and other finger(s)	**S67 Crushing injury of wrist and hand**
S680	Traumatic amputation of thumb	**S68 Traumatic amputation of wrist and hand**
S681	Traumatic amputation of other single finger	
S682	Traumatic amputation of 2 or more fingers	
S683	Combined traumatic amputation of (part of) finger(s) with other p	
S684	Traumatic amputation of hand at wrist level	
S688	Traumatic amputation of other parts of wrist and hand	
S7200	Fracture of neck of femur, part unspecified	**S72 Fracture of femur**
S7203	Fracture of subcapital section of femur	
S7205	Fracture of base of neck of femur	
S7211	Fracture of intertrochanteric section of femur	
S722	Subtrochanteric fracture	
S723	Fracture of shaft of femur	
S7240	Fracture of lower end of femur, part unspecified	
S7241	Fracture of femoral condyle	
S7243	Supracondylar fracture of femur	
S727	Multiple fractures of femur	
S781	Traumatic amputation at level between hip and knee	**S78 Traumatic amputation of hip and thigh**
S789	Traumatic amputation of hip and thigh, level unspecified	
S820	Fracture of patella	**S82 Fracture of lower leg, including ankle**

S8211	Fracture of upper end of tibia with fracture of fibula (any part)	
S8218	Other fracture of upper end of tibia	
S8221	Fracture of shaft of tibia with fracture of fibula (any part)	
S8228	Other fracture of shaft of tibia	
S8231	Fracture of lower end of tibia with fracture of fibula	
S8238	Other fracture of lower end of tibia	
S8242	Fracture of shaft of fibula	
S825	Fracture of medial malleolus	
S826	Fracture of lateral malleolus	
S8281	Bimalleolar facture, ankle	
S8282	Trimalleolar fracture, ankle	
S8288	Fracture of other parts of lower leg	
S829	Fracture of lower leg, part unspecified	
S841	Injury of peroneal nerve at lower leg level	**S84 Injury of nerves at lower leg level**
S851	Injury of (anterior)(posterior) tibial artery	**S85 Injury of blood vessels at lower leg level**
S881	Traumatic amputation at level between knee and ankle	**S88 Traumatic amputation of lower leg**
S9082	Blister of ankle and foot	**S90 Superficial injury of ankle and foot**
S917	Multiple open wounds of ankle and foot	**S91 Open wound of ankle and foot**
S920	Fracture of calcaneus	**S92 Fracture of foot, except ankle**
S921	Fracture of talus	
S9221	Fracture of navicular [scaphoid], foot	
S9222	Fracture of cuboid, foot	
S9228	Fracture of other part of tarsal bone	
S923	Fracture of metatarsal bone	
S924	Fracture of great toe	
S927	Multiple fractures of foot	
S978	Crushing injury of other parts of ankle and foot	**S97 Crushing injury of ankle and foot**

T151	Foreign body in conjunctival sac	**T15 Foreign body on external eye**
T159	Foreign body on external eye, part unspecified	
T233	Full thickness burn of wrist and hand	**T23 Burn of wrist and hand**
T424	Partial thickness [blisters, epidermal loss] burn of hip and lowe	**T42 Poinsoning by antiepileptic drugs etc**
T796	Traumatic ischaemia of muscle	**T79 Certain early complications of trauma**
T814	Infection following a procedure, not elsewhere classified	**T81 Complications of procedures, NEC**
T845	Infection and inflammatory reaction due to internal joint prosthe	**T84 Complications of internal orthopedic**
T848	Other complications of internal orthopaedic prosthetic devices, i	**prosthetic devices, implants and grafts**
T8578	Infection and inflammatory reaction due to other internal prosthe	**T85 Complications of other internal prosthetic**
		devices, implants and grafts

11. Appendix 6: Assessment of diagnoses by Emergency Medicine consultants

In the table below, the diagnoses that the consultants suggested would not lead, almost always, to admission are highlighted. Red indicates all 3 consultants did not think the injuries captured by the diagnosis would invariably lead to admission, yellow indicates 2 consultants and green indicates one.

S020	Fracture of vault of skull Frontal bone Parietal bone Temporal bone (squamous part)
S021	Fracture base of skull Fossa: Anterior Middle Posterior Occtiput Orbital roof Sinus Ethmoid Frontal Sphenoid Temporal bone (excluding squamous part) Excludes orbital NOS, orbital floor
S029	Fracture of skull and facial bones, part unspecified Face NOS
S051	Contusion of eyeball and orbital tissues Traumatic hyphaema Excludes black eye, contusion of eyelid and periocular area
S052	Ocular laceration and rupture with prolapse or loss of intraocular tissue
S054	Penetrating wound of orbit with or without foreign body Excludes retained (old) foreign body following penetrating wound of orbit
S055	Penetrating wound of eyeball with foreign body Excludes retained (old) intraocular foreign body
S057	Avulsion of eye Traumatic enucleation
S0623	Multiple intracerebral and cerebellar haematomas 5mLs of blood Multiple intracerebral haemorrhages
S0628	Other diffuse cerebral and cerebellar injury Multiple lacerations of cerebrum and cerebellum
S0631	Focal cerebral contusion <=5 mLs of blood
S0633	Focal cerebral haematoma >5mLs of blood Intracerebral haematoma/haemorrhage
S064	Epidural haemorrhage Epidural [extradural] haematoma Extradural haemorrhage

S065	Traumatic subdural haemorrhage Subdrual haematoma
S066	Traumatic subarachnoid haemorrhage Subarachnoid haematoma
S068	Other intracranial injuries Traumatic haemorrhage/haematoma/contusion: Brain NOS Intracranial NOS
S080	Avulsion of scalp
S1101	Open wound of larynx
S120	Fracture of first cervical vertebra Atlas
S121	Fracture of second cervical vertebra Axis
S1222	Fracture of fourth cervical vertebra
S1223	Fracture of fifth cervical vertebra
S1224	Fracture of sixth cervical vertebra
S127	Multiple fractures of cervical spine Excludes multiple fractures of specified levels of cervical vertebrae.
S1313	Dislocation of C3/C4 cervical vertebrae
S1315	Dislocation of C5/C6 cervical vertebrae
S140	Concussion and oedema of cervical spinal cord
S1410	Injuries of cervical spinal chord, unspecified
S1411	Complete lesion of cervical spinal chord
S1412	Central cord syndrome (incomplete cord injury) of cervical spinal cord
S1413	Other incomplete cord syndrome of cervical spinal cord Anterior cord syndrome Incomplete cervical spinal cord lesion NOS Posterior cord syndrome
S143	Injury of brachial plexus
S2202	Fracture of thoracic vertebra, T3 and T4 level
S2206	Fracture of thoracic vertebrae T11 and T12 level
S221	Multiple fractures of thoracic spine Excludes multiple fractures of specified levels of thoracic vertebrae.
S222	Fracture of sternum
S2244	Multiple rib fractures, involving four or more ribs Excludes multiple rib fractures involving first rib.
S225	Flail chest
S2410	Injury of thoracic spinal cord, unspecified
S2411	Complete lesion of thoracic spinal cord
S2412	Incomplete cord syndrome of thoracic spinal cord Anterior cord syndrome Central cord syndrome Incomplete thoracic spinal cord lesion NOS Posterior cord syndrome
S2471	Functional spinal cord injury, T1 level
S2474	Functional spinal cord injury, T6/T7 level
S2477	Functional spinal cord injury, T12 level

S250	Injury of thoracic aorta Aorta NOS
S270	Traumatic pneumothorax
S271	Traumatic haemothorax
S272	Traumatic haemopneumothorax
S3201	Fracture of lumbar vertebrae L1 level
S3203	Fracture of lumbar vertebra, L3 level
S3204	Fracture of lumbar vertebra, L4 level
S321	Fracture of sacrum
S323	Fracture of ilium
S324	Fracture of acetabulum
S325	Fracture of pubis Ramus (inferior and superior pubis) Symphysis pubis
S3283	Fracture of pelvis, part unspecified Fracture of pelvis NOS
S341	Other injury of lumbar spinal cord (conus medullaris) Complete/incomplete lumbar cord lesion
S343	Injury of cauda equine
S3472	Functional spinal cord injury, L2 level
S355	Injury of iliac blood vessels Iliac artery or vein
S3600	Injury of spleen, unspecified
S3604	Massive parenchymal disruption of spleen Rupture of spleen
S3615	Major laceration of liver Laceration with significant disruption of hepatic parenchyma [i.e. 10cm long and 3cm deep] Multiple moderate lacerations, with or without haematoma
S3640	Injury of small intestine, unspecified site
S3649	Injury of other and multiple parts of small intestine Injury to ileum Injury to jejunum
S3682	Injury of mesentery
S3683	Injury of retroperitoneum
S3728	Other injury of bladder Laceration of bladder
S396	Injury of intra-abdominal organ(s) with pelvic organ(s)
S447	Injury of multiple nerves at shoulder and upper arm level
S450	Injury of axillary artery
S451	Injury of brachial artery
S551	Injury of radial artery at forearm level
S581	Traumatic amputation at level between elbow and wrist
S650	Injury of ulnar artery at wrist and hand level
S661	Injury of flexor muscle and tendon of other finger at wrist and hand level
S680	Traumatic amputation of thumb (complete)(partial)
S681	Traumatic amputation of other single finger (complete)(partial)
S682	Traumatic amputation of 2 or more fingers (complete)(partial)
S683	Combined traumatic amputation of (part of) finger(s) with other parts of

	wrist and hand
S684	Traumatic amputation of hand at wrist level
S688	Traumatic amputation of other parts of wrist and hand
S7200	Fracture of neck of femur, part unspecified
S7203	Fracture of subcapital section of femur
S7205	Fracture of base of neck of femur Cervicotrochanteric section
S7211	Fracture of intertrochanteric section of femur
S722	Subtrochanteric fracture
S723	Fracture of shaft of femur
S7240	Fracture of lower end of femur, part unspecified
S7241	Fracture of femoral condyle
S7243	Supracondylar fracture of femur
S727	Multiple fractures of femur
S781	Traumatic amputation at level between hip and knee
S789	Traumatic amputation of hip and thigh, level unspecified
S825	Fracture of medial malleolus Tibia including: Ankle Malleolus
S8281	Bimalleolar facture, ankle
S8282	Trimalleolar fracture, ankle
S8288	Fracture of other parts of lower leg Ankle NOS Malleolus NOS
S829	Fracture of lower leg, part unspecified
S851	Injury of (anterior)(posterior) tibial artery
S881	Traumatic amputation at level between knee and ankle
T233	Full thickness burn of wrist and hand
T845	Infection and inflammatory reaction due to internal joint prosthesis
T848	Other complications of internal orthopaedic prosthetic devices, implants and grafts
T8578	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts

FOR FURTHER INFORMATION CONTACT
Injury Prevention Research Unit
Department of Preventive and Social Medicine
Dunedin School of Medicine
PO Box 913, Dunedin 9054, New Zealand
Tel 64 3 479 8342 Fax 64 3 479 8337
Email iprunz@otago.ac.nz
www.otago.ac.nz/ipru