



# RACS Trauma Verification

BENCHMARKING TRAUMA CARE

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Australasian Trauma Verification Program

CONSULTATION VERIFICATION REPORT

## New Zealand Trauma System Review

27 November – 1 December 2017



AUSTRALIAN AND NEW ZEALAND  
COLLEGE OF ANAESTHETISTS



AUSTRALASIAN  
TRAUMA  
SOCIETY (Inc)



AUSTRALASIAN COLLEGE  
FOR EMERGENCY MEDICINE



ROYAL AUSTRALASIAN  
COLLEGE OF SURGEONS

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Prof Zsolt Balogh  
Chair  
Trauma Verification Sub Committee  
Royal Australasian College of Surgeons  
ABN 29 004 167 766

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## Site Review Team

- A/Prof Arthas Flabouris, FCICM, FANZCA, Intensivist, Royal Adelaide Hospital, School Of Medicine, University of Adelaide (Team Leader) - arthas.flabouris@sa.gov.au
- Ms Maxine Burrell, RN, State Trauma Programme Manager, Royal Perth Hospital - maxine.burrell@health.wa.gov.au
- A/Prof Mark Elcock. PSM, FACEM, FRCEM, Executive Director, Aeromedical Retrieval and Disaster Management Branch, Queensland Department of Health, College of Public Health, Medical and Vet Sciences, James Cook University - mark\_elcock@health.qld.gov.au
- Dr Ailene Fitzgerald – FRACS Director of Trauma, Canberra Hospital - ailene@bigpond.com
- Prof Mark Fitzgerald - FACEM, AFRACMA, Director of Trauma, Alfred Hospital, Director, National Trauma Research Institute -m.fitzgerald@alfredorg.au
- Dr Anthony Joseph, FACEM, Director of Trauma, Royal North Shore Hospital - tony.joseph@health.nsw.gov.au
- Ros Wendt – Royal Australasian College of Surgeons Trauma Verification Program Coordinator - trauma.verification@surgeons.org

See Appendix 2 for the Review Team Schedule which details sites visited and individuals consulted

## **Purpose of the Review**

The New Zealand Transport Agency (NZTA), in partnership with the Major Trauma National Clinical Network (MTNCN), commissioned the Royal Australasian College of Surgeons (RACS) Trauma Verification Program to undertake a targeted verification of the New Zealand trauma system.

Trauma system verification is a structured and formal review. It is envisaged that the findings of the review will assist the New Zealand trauma system's on-going quality improvement, provide advice as to how the trauma system reflects good practice, and make recommendations that are tailored to the New Zealand trauma system. The scope of the verification review encompassed the trauma patient journey from the time of emergency response in the pre-hospital setting, to acute in-hospital care, and rehabilitation including the New Zealand trauma system's capacity for injury prevention, research, education of the community and the next generation of trauma care providers. The focus of the review was the high level aspects of a trauma system: governance, structure, policy and aspects of quality as they apply to the New Zealand context.

See Appendix 3 for the Research Brief between the New Zealand Transport Authority and Royal Australasian College of Surgeons

## Introduction

In 1998, the New Zealand Ministry of Health (MoH) published the “Roadside to Bedside” document, which set goals for trauma care provision along the lines of the “right patient” to the “right place” within the “right time”. These goals were consistent with accepted principles of trauma care at that time. A framework, to accompany this document, that outlined how these goals were to be applied, achieved, monitored, and their effectiveness measured, was not well established. As a consequence, these goals were applied with variable success across New Zealand.

Since then there have been a number of other reviews, with little progress. In 2009 the then Quality Improvement Committee recommended to the Minister of Health (MoH) that a national trauma system be established in New Zealand. As a result, in 2012, the Major Trauma National Clinical Network (MTNCN), and soon after the NZ Major Trauma Registry (NZMTR), were established to drive trauma care improvement within New Zealand.

During that period, clinicians with a passion for trauma care continued to advocate for a better trauma system, strived at a local level to develop best practice hospital trauma services, developed regional trauma systems and registries to achieve and maintain the best trauma care and better outcomes.

Substantial measurable improvements in trauma outcomes have occurred within some regions. Furthermore, other agencies such as the New Zealand Transport Authority (NZTA) sought to improve road safety and the Accident Compensation Corporation (ACC) engaged in injury prevention. The MoH elevated the profile of trauma via the MTNCN, encouraged District Health Boards (DHBs) to collect data for the NZMTR and implemented national guidelines. Over time, road trauma incidence, deaths, injuries and trauma related mortality has decreased, consistent with international experience. The MTNCN has also driven substantial progress. It has formed robust structural governance, strong leadership and worked collaboratively, in particular with pre-hospital groups, to develop important triage, staging and destination policies with a well-developed plan for trauma in the near future.

Despite these positive steps, there is evidence of vulnerability within the New Zealand Trauma System, and that it is comparatively underperforming at an international level. The historical decreasing trend in incidence of trauma appears to have reached a nadir and appears to be trending upward. The cost of trauma is high and accumulating and will be an increasingly significant national financial and human burden to New Zealand. Furthermore, there is regional variability in trauma incidence and outcomes, in regional trauma service resourcing and capacity, in trauma care provision, contribution of data to the NZMTR and implementation of national trauma policies. There are also tensions amongst key trauma system stakeholders. Combined, these factors are restricting progress, creating uncertainty and inefficiencies for the New Zealand Trauma System, and New Zealand Health and as a consequence the existing New Zealand Trauma System is at risk of not

keeping up with the trauma load.

The RACS Trauma System Verification Team was specifically asked by the NZTA to review and make recommendations on:

- System Leadership and Governance
- Statutory and Resourcing
- System Wide Evaluation and Quality Assurance
- System Coordination
- Funding
- Strategic Planning

In preparation for the review the following methodology was adopted:

A Pre Review Questionnaire (PRQ) was developed and submitted to the MTNCN clinical leads for completion. The PRQ was designed to allow for multiple stakeholders involved within the New Zealand Trauma System to provide input so as to inform the Verification Team and allow for self-reflection.

The PRQ was accompanied by numerous supporting documents, including findings of prior Trauma Verification Consultative and Formal reviews by RACS Verification Teams to Starship, Auckland, Waikato and Midlands Regional Hospitals.

A call for submissions was broadly distributed amongst New Zealand Trauma System stakeholders. (Appendix 1)

A detailed schedule of the visit was developed in consultation with the NZTA and MTNCN clinical leads. An exit presentation to key stakeholders was provided outlining the preliminary key findings and likely recommendations. Present were representatives from NZTA, MoH, ACC and the MTNCN (Appendix 2)

Review of available literature and online contents of supporting evidence and other information relevant to the report contents. (Appendix 4, Documents have been provided to accompany the report)

Preparation of draft Report, for review and input by the RACS Trauma Verification Program Sub Committee

Distribution of the draft Report to the NZTA, MoH and MTNCN representatives for factual corrections. Additional, post factual corrections, response to MoH comments



## Key Findings and Recommendations

### 1. System Leadership and Governance

The MTNCN has a strong governance structure, appropriate representation and has demonstrated admirable progress in a relatively short period of time. However its potential, or actual capacity, to generate real political influence appears to be limited, particularly within New Zealand's highly devolved health system.

A clear example of that is the uncertainty for ongoing funding, and thus "survival" of the NZMTR.

The New Zealand MoH has set an expectation of DHBs to comply with contributing data to the NZMTR, yet it has not funded data collectors. Financially stretched DHBs that are trying to prioritise the distribution of their health budget to best match their community's needs have resourced data collectors at different levels of fractional appointments, partly because of the variability of trauma incidence across New Zealand. Thus trauma, as a health priority, would differ as a priority amongst the DHBs. Furthermore, these data positions have not been complemented by clinical work, thus reducing their appeal, and potentially data quality.

Frustrated clinicians have for a long time and continue to, struggle to attain financial commitment for trauma services, which in turn destabilises the trauma network as a whole. In parallel, certain regions such as the Midland Region have achieved a robust regional trauma system, and remain obligated to maintain the improved trauma outcomes at a local level. High achieving regional trauma systems are not given the incentive, nor sufficient capacity, outside of "goodwill", to support national trauma strategies. Meanwhile the trauma care gap between the regions widens. There is a perception that the MTNCN has the right leadership, governance, structure and will, but lacks the political influence, to assist local clinicians.

Nonetheless, there is evidence that such a system is capable of achieving strategies of national significance, e.g. pre-hospital triaging and destination policies. This has been less so for trauma system resourcing.

Recommendations:

- 1.1. The Ministry of Health, with advice and assistance from MTNCN and the Health Quality and Safety Commission, should nominate trauma as a National Health Priority
- 1.2. The fifth pillar of a safe system, with respect to the United Nations Decade of Action for Road Safety 2011-2020, being the "post-crash response" should be included in all national road safety strategies (e.g. Safer Journey)
- 1.3. MTNCN together with the Health Quality and Safety Commission to use data to:

- Identify variability in incidence of trauma, trauma related mortality, trauma related performance measures with respect to geography and population groups (i.e. ethnicity, age, socio economic, etc.) and trends in trauma incidence and trauma epidemiology
  - Determine data driven trauma related safety and quality gaps (e.g. length of stay, failure to rescue measures, etc.) and initiatives (e.g. triage and destination policies, transfer of traumatic brain injured, etc.)
  - Interpret NZMTR data within the context of National Health System, and recommend to MoH that priority be given to trauma, within the broader health context
- 1.4. MTNCN to continue with existing governance and reporting for the NZMTR, including determining data elements to be collected. In particular to also:
- Align data collection so as to allow for international and national benchmarking (currently in place to do so)
  - Manage funding for the NZMTR (including administrative and IT support)
  - Oversee training for data collectors
  - Support data retention at a local level (i.e. a copy of local data submitted to the NZMTR to be retained locally). This could be achieved by developing nationally distributed data software which allows automatic submission to National Registry, with inbuilt reporting of performance measures that can be monitored locally
  - Add an ACC representative to the NZMTR Governance group
- 1.5. MTNCN to have the authority and responsibility to ensure successful and effective operation of the NZ National Trauma System, including:
- representation of national trauma policy setting within the broader New Zealand Health System
  - designation, or loss of designation, of hospitals with respect to trauma care.
- 1.6. MTNCN to have the authority to assist regions with their responsibilities for implementing New Zealand National Trauma Plan and their responsibilities within the New Zealand National Trauma System. This includes
- Monitoring regional activity
  - Setting minimum expectations for hospital trauma services and supporting regional services to ensure they are delivered
  - Establishing agreed minimum standards with ambulance providers and Retrieval (i.e. aeromedical) services, and monitoring their implementation and effectiveness
  - Supporting regional data collection for the NZMTR with respect to resources, training, quality and reporting
  - Regular reports back to the regions of their submitted data

- Maintenance of local repository of trauma data collected for the NZMTR
- Minimum standards for education of health professionals involved in trauma care delivery, particularly those involved with Emergency Department trauma teams and inpatient care.
- Criteria and job descriptions for major trauma service medical Directors and Nurse Coordinators

## 2. Statutory and Resourcing

New Zealand is divided almost equally into four regional trauma networks, based upon population size. The Southern Region encompasses all of the South Island, although almost three times the size of any one of the three North Island regions. It was not possible on the criteria used to designate hospitals as “Major Trauma Hospitals”. The number of such hospitals varied from two to five in number amongst the North Island regions with road distances of 100 – 310 km (excluding Middlemore Hospital).

The principal trauma hospital(s) for each region is/are designated the “Tertiary Major Trauma Hospital”. Of the six designated Tertiary Major Trauma Hospitals, the nature and capacity of their “trauma services” varied widely. Few have a designated trauma service whose primary overarching responsibility was for major trauma patients, and even fewer have the complete suite of surgical services required for a Level 1 Trauma Hospital, based upon RACS Trauma Verification Model Resource Criteria. This resulted in variability in patient care. For example, the lack of an admitting trauma service and nominated in-patient trauma beds often delayed the flow of trauma patients from ED to the ward.

Only the Northern and Midland Regions, and Starship Paediatric Trauma had demonstrated linkages and collaborative outputs that enabled data to inform system evaluation.

### Recommendations:

- 2.1. Processes, supported by written policy, for designating hospitals that are capable of receiving different levels of trauma are required. Ideally this should be based upon the RACS Trauma Verification Model Resource Criteria. The MTNCN should develop and implement these. Good models to guide policy development exist for Auckland and Waikato Hospitals.
- 2.2. In conjunction with 2.1, reduce the number of hospitals currently designated as “major trauma hospitals”, in particular within the Midland and Central Regions. Operationally, with respect to major trauma, some hospitals should be considered as “staging” hospitals and bypassed particularly with respect to an aeromedical scene response.

- 2.3. Hospitals designated as “tertiary major trauma hospitals”, should be funded by the New Zealand Ministry of Health to have a trauma service, whose primary responsibility is the clinical care of the major trauma patient. The trauma service will also be responsible for trauma related safety, quality, education and performance measures. Within the existing New Zealand health system the tertiary major trauma hospitals are most likely to be:
- Northern Region: Auckland City Hospital (adult) and Starship (paediatric)
  - Midlands: Waikato (Hamilton) Hospital
  - Central: Wellington Regional Hospital
  - South Island: Christchurch Hospital
- 2.4. For all designated “tertiary major trauma hospitals” there should be a:
- Trauma Director
  - Trauma Nursing Clinical Lead
  - Trauma Data Collector
  - Trauma Committee (multidisciplinary, including pre-hospital)
  - Admitting trauma service providing comprehensive trauma care.
- 2.5. All designated tertiary major trauma hospitals should strive to be university affiliated. University affiliation should involve research, under- and postgraduate trauma-related teaching (medical, nursing, allied and paramedical health education) and curriculum development. Participation by senior trauma clinicians from within each region is essential.
- 2.6. All designated “tertiary major trauma hospitals” should appoint a trauma medical and nursing clinical lead
- 2.7. MTNCN to develop national minimum criteria for a trauma service (stipulating resources, structure, fractional appointment of medical, nursing and administrative staff)
- 2.8. National Ambulance Sector Office (NASO), in collaboration with aeromedical providers and the MTNCN, should develop national standards for education, training and safety equipment for medical crew involved in aeromedical retrieval responses (pre-hospital or inter-hospital).
- 2.9. Medical crews assigned to primary (scene) and inter-hospital response should be capable of being tasked on multiple response platforms: road, helicopter and fixed-wing and based, close to those assets, at designated aeromedical bases.
- 2.10. Minimum standards for, and provision of, equipment for PRIME (Primary Response in Medical Emergencies) responders, including the adoption of the recommendations from the recent

review titled “PRIME Service Review 2016 - Steering Group Final Report to the National Ambulance Sector Office” (currently in progress).

2.11. At a regional level:

2.11.1 Tertiary major trauma hospital Trauma Service Director to be the Regional Trauma Clinical lead with authority and responsibility to:

2.11.2 Oversee implementation, monitoring and reporting of national trauma policy implementation across the region

2.11.3 Ensure consistency and equitable distribution of allocated trauma hospital resources (e.g. data collectors, clinical leads, etc.) as would be expected by national policy

2.11.4 Oversee implementation, monitoring and reporting of data and trauma performance measures

2.11.5 Each region to establish a multidisciplinary Regional Trauma Committee, led by the tertiary major trauma hospital Trauma Service Director or major trauma hospital Trauma Clinical Lead.

2.11.6 Regional Trauma Committees should include a DHB and/or Regional Chief Operating Officer (COO)

2.11.7 Regional Trauma Committees should include an Ambulance and Retrieval representative

2.11.8 Regional Trauma Committees to undertake clinical audit of trauma patients who die within the region

- Report on potentially preventable deaths
- Use Trauma Injury Severity Score (TRISS) analysis and Standardised Mortality Ratio (SMR) reporting
- Include an appropriate clinician from another region
- Include medical trainee(s)
- Monitor and report on trauma incident reports
- Mandate ethnicity data reporting and report on health equity with respect to trauma service access and outcomes

2.11.9 Regional Trauma Committees should monitor trauma education across the region, including public education (information to comply with Rauemi Atawhai: A guide to developing health education resources in New Zealand)

2.11.10 Each region to develop, through its Regional Trauma Committee, a Regional Trauma Plan that aligns with the National Trauma System Plan

2.11.11 Each region to develop a regional business case for trauma funding within the region

2.12. MTNCN and Rehabilitation physicians, review, and update, existing “Standards for Inpatient Rehabilitation” and develop a National Rehabilitation strategy, particularly for inpatient rehabilitation.

- 2.13. New Zealand Ministry of Health to review the capacity of Rehabilitation services:
- Bed stock (currently there are delays to discharge from acute hospitals) and accessibility for acute hospital inpatients
  - Specialised rehabilitation services for younger patients, ethnic groups and their needs
  - Nationally coordinated rehabilitation medicine training program
- 2.14. ACC to report on non-inpatient, NGO rehabilitation service providers' outcomes and performance
- 2.15. New Zealand Health system should ensure adequate Māori health and disability workforce to match the needs of the Māori population.

### **3. System-wide evaluation and Quality Assurance**

Evaluation of the New Zealand Trauma System is still in its infancy. There are good examples (e.g. Midland Region) of the potential of how the NZMTR data could be used for system evaluation. Both the Northern and Midland Regions have a good track record of collaborative research, including at an international level. In particular, the Midland Region has set up the Midland Region Research Institute.

The recent 2016/17 Major Trauma Annual Report provided valuable analysis, although it is incomplete with respect to data capture.

The relatively recently implemented pre-hospital policies (including triage, designation guidelines and a National Air Desk for coordination of helicopter aeromedical responses, etc.) have had either an interim evaluation or a plan for a future evaluation. The interim evaluation of the Air Desk suggested it has had a positive impact on helicopter tasking and utilisation, while anecdotally the perception of clinicians has been that the other policies have resulted in system improvement.

Clinical audit from a trauma system level is scant and variable across the regions. When undertaken at a regional level, it often has difficulty overcoming traditional DHB and other boundaries. This impacts the ability to ascertain all necessary information as well as loop closure.

The NZ Blood Service appeared to be an excellent system for managing and monitoring blood stocks, and their consumption across the nation. We would recommend reporting on its effectiveness, if not already done so. There are aspects to this model (web based real time tracking) that could be borrowed and replicated in tracking major trauma and during disaster scenarios.

Recommendations:

- 3.1. Non-major trauma patient data should also be collected as part of the NZMTR. It has a significant impact on health and social costs, provides a more complete view of trauma in New Zealand, can inform on Trauma System quality and performance, and injury prevention measures (e.g. trauma recidivism).
- 3.2. Regional Trauma Committees should be responsible for, undertake and report outcomes from, clinical audits. Reporting should include NZMTR derived performance measures, an assessment of preventable mortality and structured form of clinical incident monitoring.
- 3.3. MTNCN to establish a National Trauma Mortality Review Committee (to which all trauma deaths are reported), to oversee the performance of trauma mortality audit at a national level and reviews trauma mortality and major incidents with national implications. To also include paediatric, isolated spinal and burns patients.
- 3.4. MTNCN to report on OECD and other comparative international data
- 3.5. MTNCN to consider allocating areas upon which each region could focus /develop expertise and contribute to the broader New Zealand trauma system. This will assist in a sense of “ownership and participation” within the New Zealand Trauma System. Examples are, but need not necessarily be the final configuration:
  - Northern Region: trauma education/simulation and leadership
  - Midland Region: trauma epidemiology/trauma profiling/performance measures
  - Central Region: traumatic brain injury/rehabilitation
  - Southern Region: pre-hospital and disaster, teleHealth
- 3.6. MTNCN to further define the purpose and strategic direction of the proposed National Trauma Research Institute. Develop a proposal to align with the New Zealand Health Research Council strategies with the purpose of adding trauma as a strategic research focus
- 3.7. MTNCN to set out a research agenda, which defines priorities and is aligned with other National strategies (e.g. New Zealand Health, NZMRC, Safer Journeys, Māori Health, etc.). Aim for large collaborative research projects, including those that fit within the NZMRC funding criteria. All regional trauma services must come together and work collaboratively if this is to be successful. Consider the possible, more immediate opportunities/aspects.
  - Involve multiple regions as participants/collaborators and contributors
  - Involve university participation/partnerships
  - Immediate consideration of “Big Data” type projects that involve other agencies (e.g.

MoH, NZTA, ACC, Ministry of Transport, etc.)

- Geographical Information Systems and mapping
- Time trend analysis
- Qualitative and cost measurement/efficiency projects

3.8. NZ Blood Service to report on the effectiveness of the NZ Blood monitoring and distribution, if it has not already done so. There are aspects to this model (web-based real-time tracking) that could be borrowed and replicated in tracking major trauma and during disaster scenarios.

3.9. Any consideration of including blood products on medically staffed helicopters responding to the scene of a major trauma, should be preceded by a thorough review of evidence (within the civilian setting) supporting the carriage of blood products, including risk of wastage, and means of reducing that risk and assessment of the measurable patient benefit

## 4. System Coordination

There have been significant improvements in alignment and coordination of pre-hospital ambulance response (including PRIME) and aeromedical assets. There is no central coordination, or oversight, of fixed-wing assets, tasking or response.

The ACC and Starship paediatric trauma service are very active with injury prevention.

Patient flow, particularly inter-hospital transfer, still remains dependent on regional and DHB local practices. Coordination is, on occasion, inefficient and time consuming for referring clinicians.

There are national clinical pathways for burns and spinal cord injury, but not for traumatic brain injury, which is far more frequent, and has variable outcomes based upon local historical practices. Paediatric trauma care pathways seem adequate.

Aeromedical assets should be centrally coordinated and integrated into the overall pre-hospital response to trauma. This will ensure that immediately on entry to the trauma system, patients are provided with consistent specialist level oversight, task specific clinical crewing, targeted critical care, patient centred destination determination and transparent retrieval service governance. Fixed-wing aircraft may, on occasion, be an alternative to helicopters and are more weather tolerant. Often helicopters are used for their convenience (land at departure or arrival site and don't involve secondary road transport from airport), although clinical circumstance may allow for a fixed-wing transfer.

Recommendations:



- 4.1. Central coordination of all aeromedical (to include both helicopter and fixed-wing assets) tasking, including primary trauma and primary medical and all secondary inter-hospital transfers. This would add an extra element of complexity to aeromedical transfers, and is best managed by including an appropriately experienced and trained physician, within the existing National Air Desk central coordination.
- 4.2. NASO, in consultation with the Air Rescue Group, to nominate for each region, a single and centrally based, 24/7 medical staffed aeromedical (retrieval) capacity for scene (primary) response as well as inter-hospital transfers from “stabilising” hospitals. This will ensure a level of consistency across the regions of standards for inter-hospital transfers, and will replace locally based, ad hoc medical crewing arrangements. It will also rationalise and consolidate the number and location of emergency helicopter and fixed-wing air ambulances. In addition, it generates significant efficiencies and concentrates case numbers to specific locations, thus improving exposure, training and quality and safety of retrieval services.
- 4.3. Ideally, regional aeromedical services should be based in close proximity to the regional tertiary trauma hospital, so as to facilitate retrieval service medical and paramedical crew participation in the hospital’s clinical trauma care, education and quality activities.
- 4.4. NASO to oversee that Aeromedical medical crew are trained and equipped to uniform national standards, and co-located with helicopters and crew and available for fixed-wing transfers. Standards related to trauma clinical care to be developed in conjunction with the MTNCN
- 4.5. NASO to establish regional case review forums to allow greater transparency with local helicopter crews for tasks that involve the Air Desk and/or Central Coordination.
- 4.6. MTNCN to undertake a systematic review of traumatic brain injury management at a national level. This review should be external and involve detailed clinical case review. Within the current New Zealand Trauma System, neurosurgical input is variable as is allocation of patients to neurosurgical facilities. Certain hospitals are more inclined to retain patients with traumatic brain injury, often at low volumes (one traumatic brain injury per month, one Intra Cranial Pressure monitor every two months)
- 4.7. If major trauma is to be concentrated at tertiary trauma hospitals, capacity at those hospitals needs to be adequate to meet the demand. There are indications that Inter-hospital transfers are restricted by critical care bed capacity at the tertiary major trauma centres. New Zealand Ministry of Health in conjunction with the College of Intensive Care Medicine and the

Australian and New Zealand Intensive Care Society, should undertake an audit of intensive care bed stock capacity and utilisation.

- 4.8. The New Zealand Health system should establish a process of coordinating critical care bed utilisation within regions, so that there is more efficient and appropriate bed use. This will better inform that the right patient goes to the right level of critical care resource, and specifically for major trauma it will enable prioritising each region's Major Trauma Hospital critical care bed availability for major trauma patients.
- 4.9. Trauma Services within tertiary major trauma hospitals to have
  - single point of contact for inter-hospital referrals
  - clear admission pathway for multiple-injured trauma patients
  - case management of trauma patients, which will facilitate early return to referring hospitals/community
- 4.10. MTNCN, in conjunction with Ambulance Service providers undertake a review of the applicability and use of the Triage and Destination policies. These policies appeared complex and potentially difficult to use by busy road crews.
- 4.11. New Zealand Ministry of Health to facilitate better coordination of specialist services that are spread across multiple sites (e.g. Plastics and Maxillofacial surgery at Middlemore / Auckland, Plastics and Burns services in Wellington). To consider, in the first instance:
  - Credentialing of clinicians across multiple sites
  - Consistency in surgical instruments/operating room procedures
  - Access to emergency lists
  - Consider above points with the view of achieving, over the longer term, the aim of having all essential trauma related surgical services within the one site.
- 4.12. The New Zealand health system to work towards the longer term objective of having one leading major trauma hospital within each region with all subspecialty services, including acute rehabilitation, on the one campus.
- 4.13. New Zealand health system to maintain the current role of the Starship Paediatric Major Trauma Service, as the one national paediatric trauma centre, but monitor regularly the capacity and timeliness of referrals and acceptance of children with major trauma.
  - Capacity and timeliness should be reported to, and monitored as a performance measure for paediatric trauma by, the MTNCN

4.14. The New Zealand health system to evaluate and improve the integration of rehabilitation services within the acute setting.

- Trial of regular conjoint clinical rounds of rehabilitation physicians with neurosurgical units. If successful, this could be expanded to other units.
- Early referral practices to rehabilitation

## 5. Funding

Most health care is funded by bulk grants from the MoH to the DHBs based upon a population-derived calculation. In contrast, injury care is funded by bulk grants to Treasury/MoH by the ACC to cover acute care, and the ACC covers post-acute care (>6 weeks post-discharge). The ACC purchases non acute rehabilitation via the DHBs as well as NGOs on a fee for service basis. The ACC monitors performance and service delivery via contractual arrangements with these rehabilitation service providers. Ambulance services are bulk funded by ACC for road transport, and air ambulances are funded by a combination of fixed and fee for service, but only for trauma related tasks. They also receive bulk grants from the MoH for medical transports.

Funding air transport providers separately for trauma appears inefficient, in particular as the number of tasks for each is almost equivalent. There is also a risk of cost “transference” from medical/trauma tasking from one to the other, to make up shortfalls.

There has been a recent review of road ambulance funding which resulted in enhancements in ambulance crewing. This was a positive step.

The MoH and the ACC fund the MTNCN and the NZMTR. The ACC has funded training for the data collectors. Funding is triennial. There are tensions and uncertainty about who is responsible for which aspects of funding of the MTNCN and the NZMTR. The ACC is a key stakeholder in the NZMTR, but feels it should not be the sole provider.

The MoH requires of the DHB to collect data for the NZMTR, but has not funded the DHBs to do so. Funding across the 20 DHBs for trauma services is highly variable.

The ACC and MoH are involved in governance of the NZMTR.

Recommendations:

5.1. New Zealand Ministry of Health should fund trauma separately, and at a regional level (as compared to the current model of part of global funding to each individual DHB).

5.2. New Zealand Ministry of Health should include trauma incidence as a factor in determining

population-based trauma funding model

- 5.3. With respect to the New Zealand Trauma System, Ministry of Health should fund trauma-related infrastructure and personnel. Funding of trauma clinicians, in particular designated trauma clinical leaders, should be based upon a sustainable and competitive remuneration model.
- 5.4. The ACC should fund trauma programs, the NZMTR and registry-related activities (e.g. training, IT, data management, reporting) as these areas are of most interest to the ACC with respect to injury prevention and improved outcomes.
- 5.5. NZMTR funding to include provision for data collection, data management and analytics. Furthermore, funding for NZMTR should be continually monitored to ensure that as IT developments evolve, productivity improvements can be implemented to reduce reliance on future staffing budget and needs. With the eventual expansion of the Electronic Medical Record (EMR), data acquisition will evolve, and so planning and preparing for integrating NZMTR and other trauma related data into an EMR will be important.
- 5.6. NASO to rationalise funding of air transport providers based upon a standard model for all health related (i.e. trauma and non-trauma) transports.
- 5.7. Ensure adequate funding for transferred patients, so as to not disadvantage receiving hospitals and not discourage transfer to major trauma centres.

## **6. Strategic Planning**

Strategic planning occurs at a number of levels. Strategic planning varied according to each region's needs. These needs differed according to each region's trauma system maturity and resourcing. This variability makes achieving National uniformity a challenge. For example the DHBs we observed had major trauma data collection and contribution to the NZMTR within their plans, but clearly, in terms of achievement there was variation.

Recommendations:

- 6.1. New Zealand Health undertake modelling and simulation of the New Zealand Trauma System, in particular central coordination of pre-hospital and retrieval services, and tertiary major trauma hospitals' ability to receive and distribute trauma patients in the event of a disaster or a major incident involving multiple casualties.
- 6.2. The role of the MTNCN in a disaster/major incident should be incorporated into existing

National Disaster Plans. The MTNCN has clinical expertise, leadership and awareness of New Zealand Trauma System capacity and capabilities.

- 6.3. Incorporate the aeromedical (existing helicopter, and future fixed-wing air ambulance) tasking by the National Air Desk and the three national ambulance coordination centres into existing National Disaster Plans.
- 6.4. Closer alignment of trauma-related strategic planning amongst all regions and DHBs. These can be aligned through an MTNCN-governed unified National Trauma Plan.
- 6.5. New Zealand health system to ensure closer alignment of trauma-related strategic planning with those of other related organisations (e.g. NZTA)
- 6.6. New Zealand health system to ensure closer alignment of trauma-related strategic planning with injury prevention programs, including that of public education and programs that improve health literacy amongst at-risk groups
- 6.7. New Zealand health system to develop a strategy for a national approach for multidisciplinary management of elderly trauma patients and at-risk ethnic groups (e.g. Maori, Pacific Islanders)
  - Trauma service links with geriatric/general medical units
  - Build future capacity into what will be an expanding important service model
  - Trauma linked drug and alcohol services, mental health services
  - Identifying and managing trauma recidivism
- 6.8. To promote discussion and foster stakeholder engagement in future enhancements to the New Zealand Trauma System, the NZTA should disseminate this trauma verification system report to key New Zealand Trauma System stakeholders, including, but not limited to the following:
  - Ministry of Health
  - Accident Compensation Corporation
  - Major Trauma National Clinical Network
  - Regional Trauma Networks (Northern, Midland, Central, Southern)
  - Paediatric Trauma Network
  - St John Ambulance
  - Wellington Free Ambulance
  - National Ambulance Sector Office
  - Health Quality and Safety Commission

- Air Rescue Group
- Royal Australasian College of Surgeons, New Zealand branch
- College of Intensive Care Medicine, New Zealand branch
- Australian and New Zealand College of Anaesthetists, New Zealand branch
- Australasian College for Emergency Medicine, New Zealand branch

The RACS Trauma Verification Sub Committee, and the Trauma Verification team, thank the NZTA for commissioning, and inviting the Australasian Trauma Verification Program to undertake, this review of the New Zealand Trauma System. The Trauma Verification Team would also like to extend our gratitude to the many committed trauma clinicians and other key trauma stakeholders who helped inform our findings and recommendations.



Arthas Flabouris (Team Leader)



Maxine Burrell



Mark Elcock



Ailene Fitzgerald



Mark Fitzgerald



Anthony Joseph



Zsolt Balogh (Trauma Verification Subcommittee Chair)

## New Zealand Demographics

New Zealand is long and narrow (over 1,600 kilometres along its north-north-east axis) and with a maximum width of 400 kilometres for a total land area of 268,000 square kilometres. The South Island is the larger of the two, at 145,836 km<sup>2</sup> and the North Island at 111,583 km<sup>2</sup>. In contrast, Tasmania is 65,022 km<sup>2</sup>, and Victoria 237,629 km<sup>2</sup>.

New Zealand has a population of approximately 4.7 million people distributed unevenly across the North (76% of population, population density of 32.3 /km<sup>2</sup>) and South (24% of population, population density of 7.4 /km<sup>2</sup>) islands. In contrast, the state of Victoria in Australia has a population of 6,290,700 (population density of 26.55/km<sup>2</sup>).

The population is growing, and ageing at a rate above that of the OECD average, and equivalent to that of Australia's population (Fig 1, 2). Life expectancy for New Zealanders is 79.5 years for males and 83.2 years for females, both above the OECD average.



Figure 1 Annual growth rate of OECD countries<sup>1</sup>

Elderly population Total, % of population, 2000 – 2014

Source: Labour Force Statistics: Summary tables

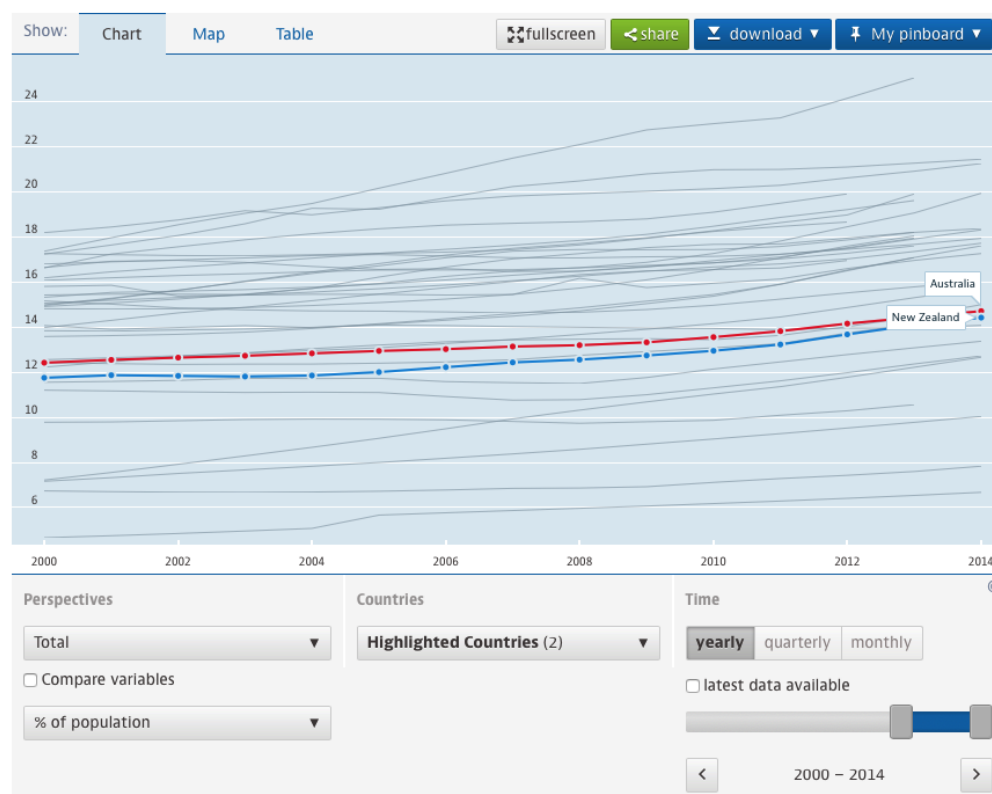


Figure 2 Percentage of population 65 years and over<sup>2</sup>

New Zealand is a predominantly urban country, with 73.0% of the population living in an urban area (population 30,000 or greater) and 53.8% living in the four largest cities of Auckland, Christchurch, Wellington, and Hamilton.

New Zealand is home to a diverse population, with 15% identifying as Māori, 12% as Asian, 7% as Pacific, and the majority 75% as European /other descent.<sup>3</sup> The population has become more diverse over time (Fig 3, 4). In 1961, the population was 92% European and 7% Māori, with Asian and Pacific minorities sharing the remaining 1%. The distribution of the population varies by ethnicity and age. The proportion of elderly amongst the European population is higher than for other ethnic groups.



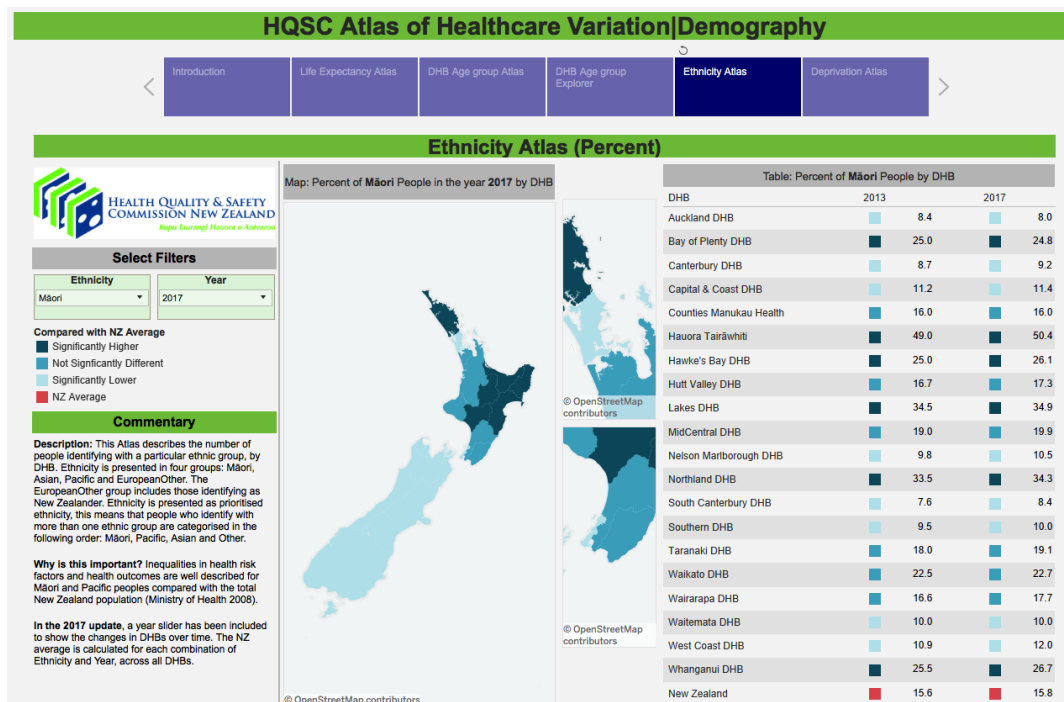


Figure 3 Proportion of District Health Boards identifying as Māori<sup>4</sup>

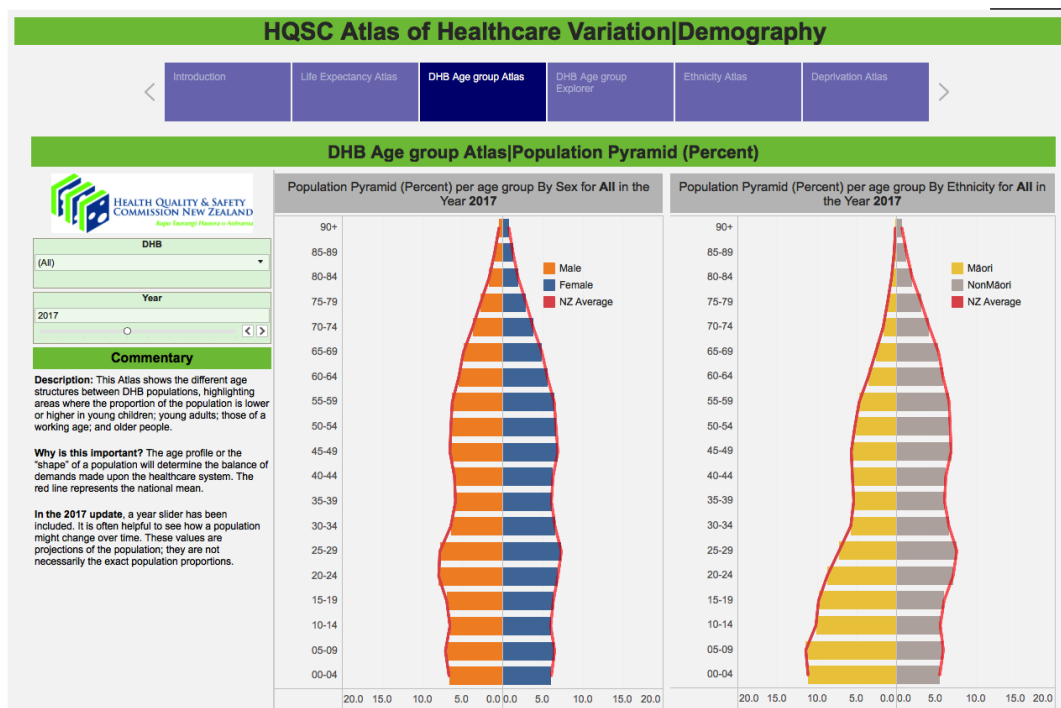


Figure 4 Population pyramid for New Zealand by ethnicity<sup>4</sup>

New Zealand ranks highly amongst other OECD countries, according to the OECD Better Life Index, in particular for Health (Fig 5, 6).

**2016 ranking** [edit]

Legend:

- Explained by: Housing
- Explained by: Community
- Explained by: Civic engagement
- Explained by: Safety
- Explained by: Income
- Explained by: Education
- Explained by: Health
- Explained by: Work-Life Balance
- Explained by: Jobs
- Explained by: Environment
- Explained by: Life Satisfaction

Overall Rank [9][10]	Country	Housing	Income	Jobs	Community	Education	Environment	Civic engagement	Health	Life Satisfaction	Safety	Work-Life Balance
1	Norway											
2	Australia											
3	Denmark											
4	Switzerland											
5	Canada											
6	Sweden											
7	New Zealand											
8	Finland											
9	United States											
10	Iceland											
11	Netherlands											
12	Germany											

Figure 5 OECD Better Life ranking of countries in 2016<sup>5</sup>

**2016 ranking** [edit]

Legend:

- Explained by: Housing
- Explained by: Community
- Explained by: Civic engagement
- Explained by: Safety
- Explained by: Income
- Explained by: Education
- Explained by: Health
- Explained by: Work-Life Balance
- Explained by: Jobs
- Explained by: Environment
- Explained by: Life Satisfaction

Overall Rank [9][10]	Country	Housing	Income	Jobs	Community	Education	Environment	Civic engagement	Health	Life Satisfaction	Safety	Work-Life Balance
5	Canada											
7	New Zealand											
2	Australia											
4	Switzerland											
6	Sweden											

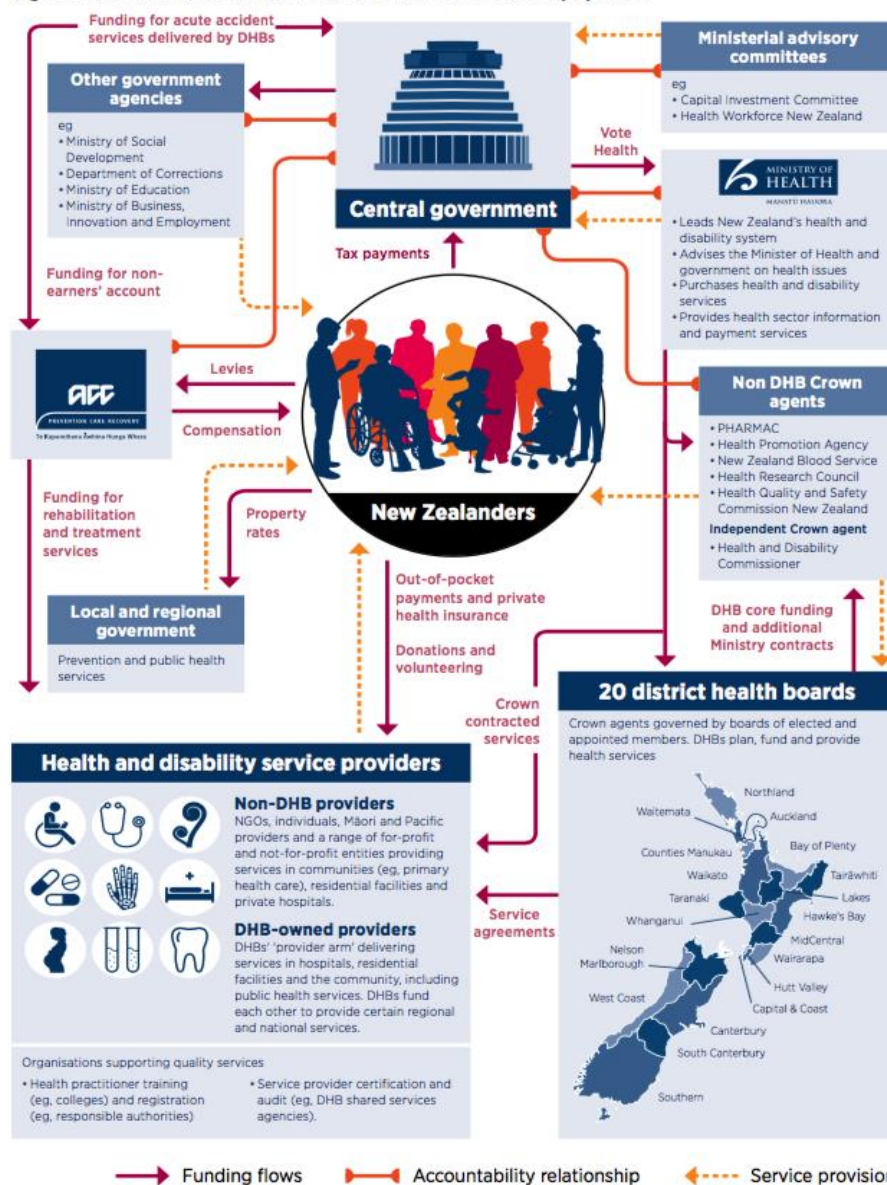
Figure 6 OECD Better Life ranking of countries in 2016 ordered by health<sup>5</sup>

## New Zealand Health and the Ministry of Health

The Ministry of Health (MoH) is the New Zealand Government's principal advisor on health and disability.

The New Zealand Health System is a very devolved system. The central government sets the overall strategic direction, sets the expected standards of service delivery and provides funding. Day-to-day functions and detailed decisions happen at a local level, predominately through the DHBs.

**Figure 3: Overview of the New Zealand health and disability system**



Statement of Strategic Intentions 2017 to 2021 – Ministry of Health

Figure 7 Overview of the New Zealand health and disability system<sup>6</sup>

One of the strengths of this model is the ability for DHBs to determine and plan for meeting their local

community needs. DHBs are also grouped within regions, and so some services are planned and delivered across the region, with all DHBs within that region making a contribution, for example trauma services (Fig 8). The challenges of this model include ensuring national consistency and equity of service delivery, resourcing and ensuring value for money for low volume but resource intense services, and managing geographic boundaries, as that matches population movement and “cross-border” collaboration.



Figure 8 Location boundaries for New Zealand District Health Boards<sup>7</sup>

The basis for the structure, funding and the organisation of health services is legislative within the New Zealand Public Health and Disability Act 2000. The act establishes the District Health Boards (DHB) and the basis for their funding.

The MoH allocates the vast majority of public funds (approx. 75%) to the DHBs, who use this funding to plan, purchase and provide health services, including public hospitals and the majority of public health services, within their areas. Most of the remaining public funds are used to fund national services, such as disability support services, public health services, specific screening programs,

mental health services, elective services, primary child and maternity services, Māori health services and postgraduate clinical education and training.

Funding is distributed based upon the Population-Based Funding Formula (PBFF). The PBFF is a formula that determines the share of funding to be allocated to the DHB, based on the population living in each district. The aim of the PBFF is to equitably distribute funds according to the relative needs of each DHB's population and cost of providing health and disability services. The formula is reviewed regularly. In addition the DHBs also receive funding based upon adjustors for managing complex patients, and payments for patients who are transferred for care.

In New Zealand public funding of health services accounts for around 83% of total expenditure on health, equivalent to \$12b (for 2016/17) and is 6.8% of GDP. Other significant funding sources include the Accident Compensation Corporation (ACC), other government agencies, local government, and private sources such as insurance and out-of-pocket payments. In common with similar high-income countries around the world, the New Zealand health system faces many cost pressures due to changes in population demographics, prices, increased chronic disease and ageing infrastructure. Baseline funding for New Zealand health has increased over the years but DHB deficits are increasing (Fig 9, 10).<sup>8</sup>

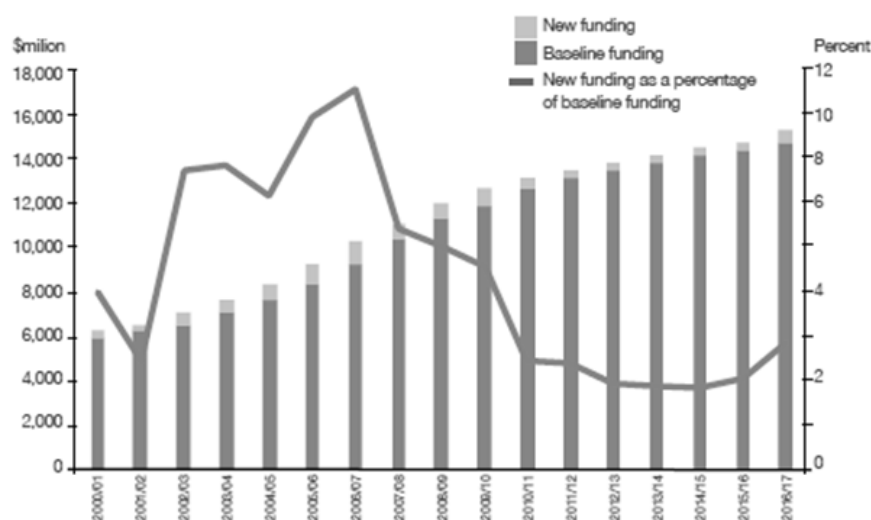


Figure 9 Annual public funding of health services (NZ\$)<sup>8</sup>

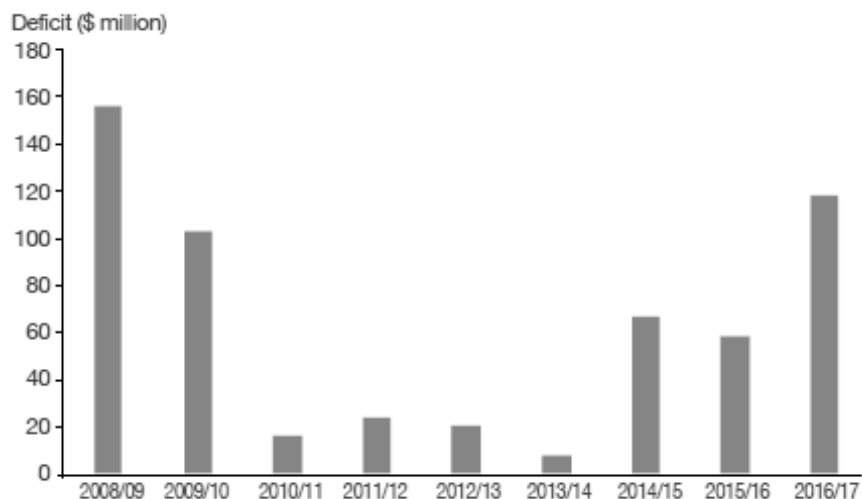
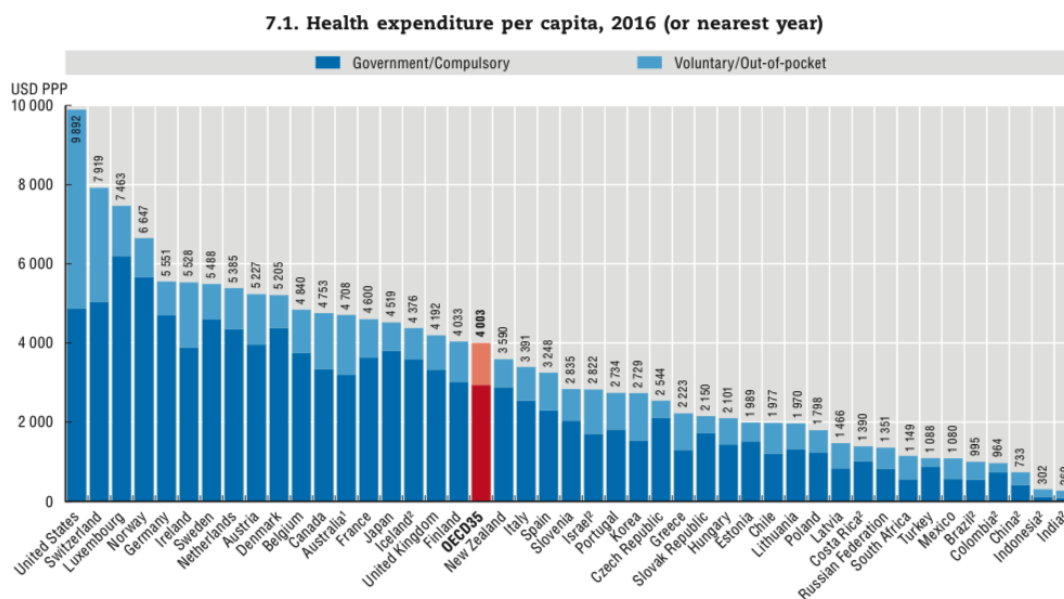


Figure 10 Annual deficit of District Health Boards, 2008-2017, NZ\$<sup>8</sup>

New Zealand's total health and disability spending is, as a percentage of GDP, slightly above OECD and on a per capita spending, and less than Australia's health expenditure which is approximately 10% of GDP (2014-15 financial year). However, New Zealand is unusual in that public funds account for the majority of its health expenditure. (Fig 11-14)



Note: Expenditure excludes investments, unless otherwise stated.

1. Australian expenditure estimates exclude all expenditure for residential aged care facilities in welfare (social) services.

2. Includes investments.

Source: OECD Health Statistics 2017, WHO Global Health Expenditure Database.

Figure 11 Health expenditure per capita (2016, or nearest year)<sup>9</sup>

Report from the Consultation Trauma Verification of the New Zealand Trauma System  
27 Nov – 1 Dec 2017

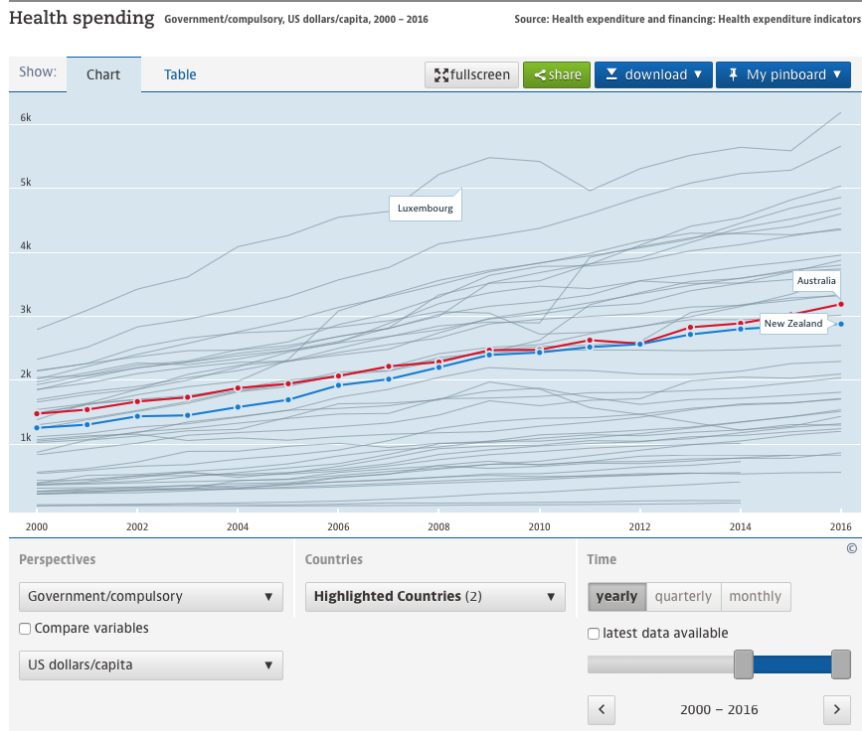


Figure 12 Health spending per capita (US\$, 2000-2016)<sup>10</sup>

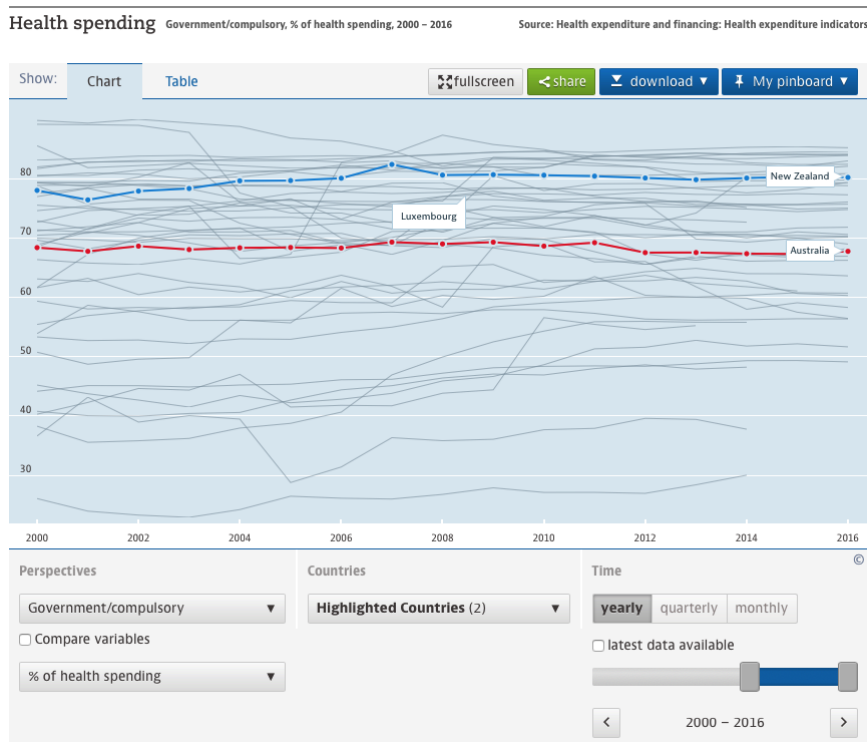


Figure 13 Health spending by government as a percentage of all health expenditure, 2000-2016<sup>10</sup>

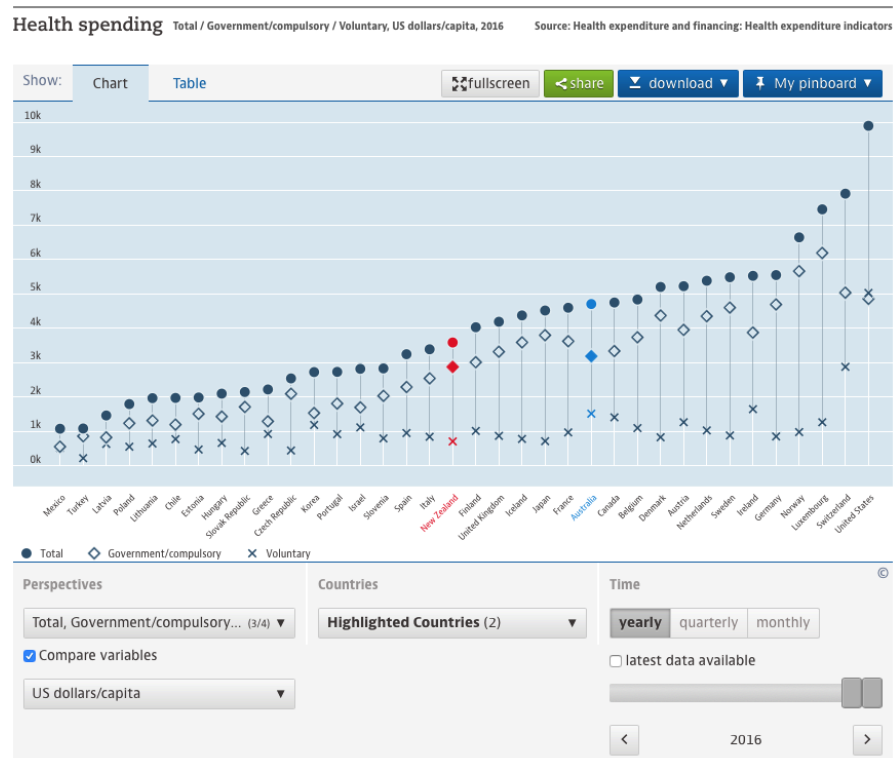


Figure 14 Total/government/private health spending in US\$ per capita by country<sup>10</sup>

### Definition of Health spending

Health spending measures the final consumption of health care goods and services (i.e. current health expenditure) including personal health care (curative care, rehabilitative care, long-term care, ancillary services and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments. Health care is financed through a mix of financing arrangements including government spending and compulsory health insurance (“Government/compulsory”) as well as voluntary health insurance and private funds such as households’ out-of-pocket payments, NGOs and private corporations (“Voluntary”). This indicator is presented as a total and by type of financing (“Government/compulsory”, “Voluntary”, “Out-of-pocket”) and is measured as a share of GDP, as a share of total health spending and in USD per capita (using economy-wide PPPs).

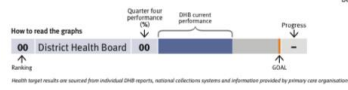
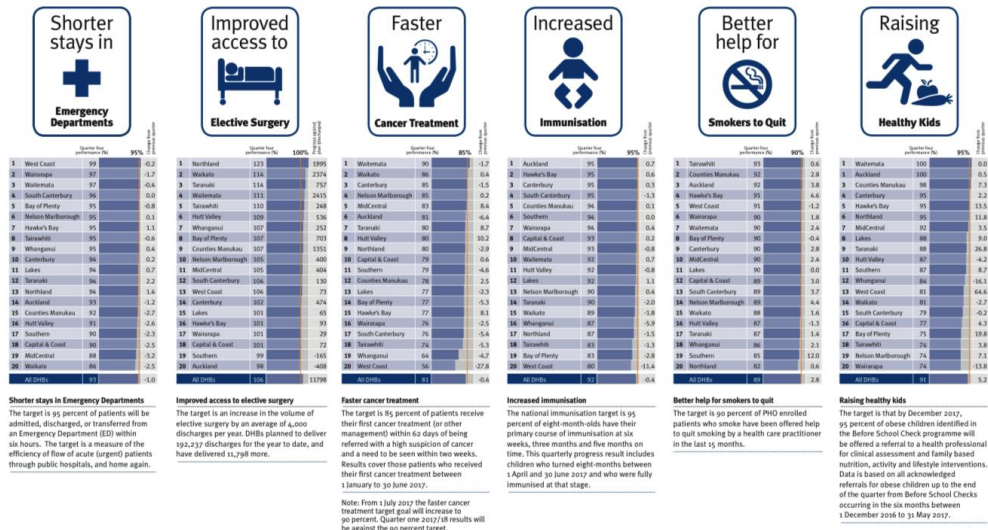
In return the DHBs are required to produce annual plans and regional health plans to the Minister of Health and report upon certain performance measures.<sup>11</sup> A recent example is given below (Fig 15).



# How is My DHB performing?

2016/17 QUARTER FOUR (APRIL-JUNE 2017) RESULTS

www.health.govt.nz/healthtargets



This information should be read in conjunction with the details on the website [www.health.govt.nz/healthtargets](http://www.health.govt.nz/healthtargets) New Zealand Government

Figure 15 Performance of district health boards, April-June 2017<sup>11</sup>

For the past 3 years, major trauma has been included as a priority area, and has been the primary lever to encourage DHBs to implement trauma data collection. DHBs are mandated to undertake data collection on major trauma patients and implementation of pre-hospital destination policies. Major trauma is included within the national non-financial performance measure framework as a regional priority in 2017/18. No commitment has been given for inclusion in performance measures beyond 2017/18. The MTNCN and Governance group have had input into the setting of the non-financial performance measure.

Commonly used population-based outcomes are favourable for New Zealand. Mortality (due to all causes) is below that of the OECD average and comparable, although slightly higher, than Australia's. Life expectancy from birth, and from age 65 years of age, in New Zealand is high, significantly above the OECD average and comparative to Australia's (Fig 16 - 19). Most adult New Zealanders rate their own (88%) and their children's (98%) health as good, very good or excellent, the highest percentage reported by any OECD country. For those aged over 75 years, the figure is 87%. Those living in more socioeconomically deprived areas were 2.5 times as likely to rate themselves as being in fair or poor health. Satisfaction with care in an emergency department is considered as good or very good by 83% of New Zealanders.<sup>12</sup>

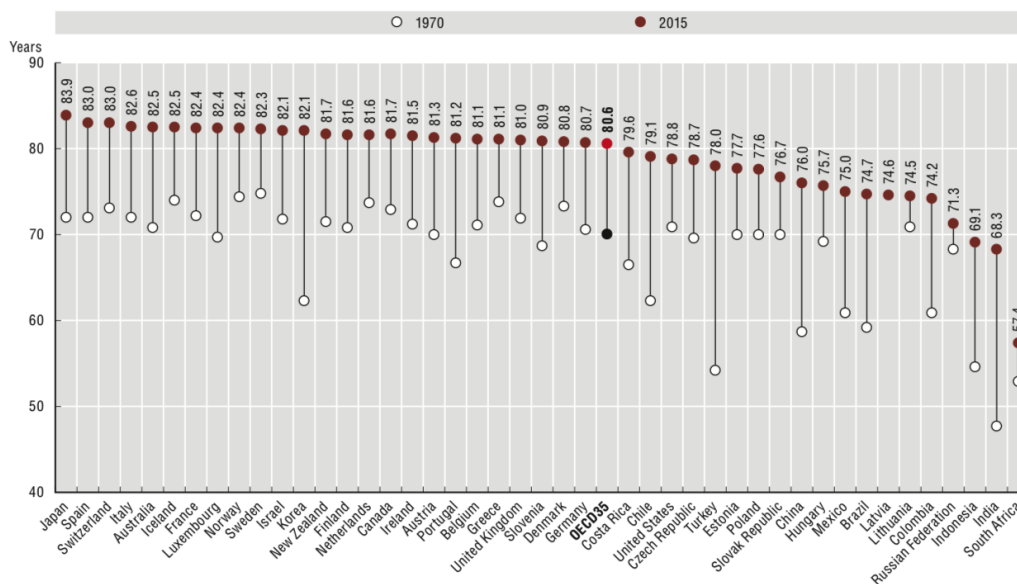
The New Zealand health system has identified the following challenges:<sup>8</sup>

- Population that is growing in numbers and diversity. Life expectancy is improving beyond the average for OECD countries. However, life expectancy is increasing faster than health

expectancy (the time spent in good health), so more people are spending longer in poor health.

- Some New Zealanders, especially Māori, Pacific peoples, people with disabilities, and people living in low socioeconomic areas, have disproportionately poorer health.
- Maintaining funding for services, while cost and demand is increasing.

3.1. Life expectancy at birth, 1970 and 2015 (or nearest year)



Source: OECD Health Statistics 2017.

Figure 16 Life expectancy at birth, 1970 and 2015 (or nearest year) by country<sup>9</sup>

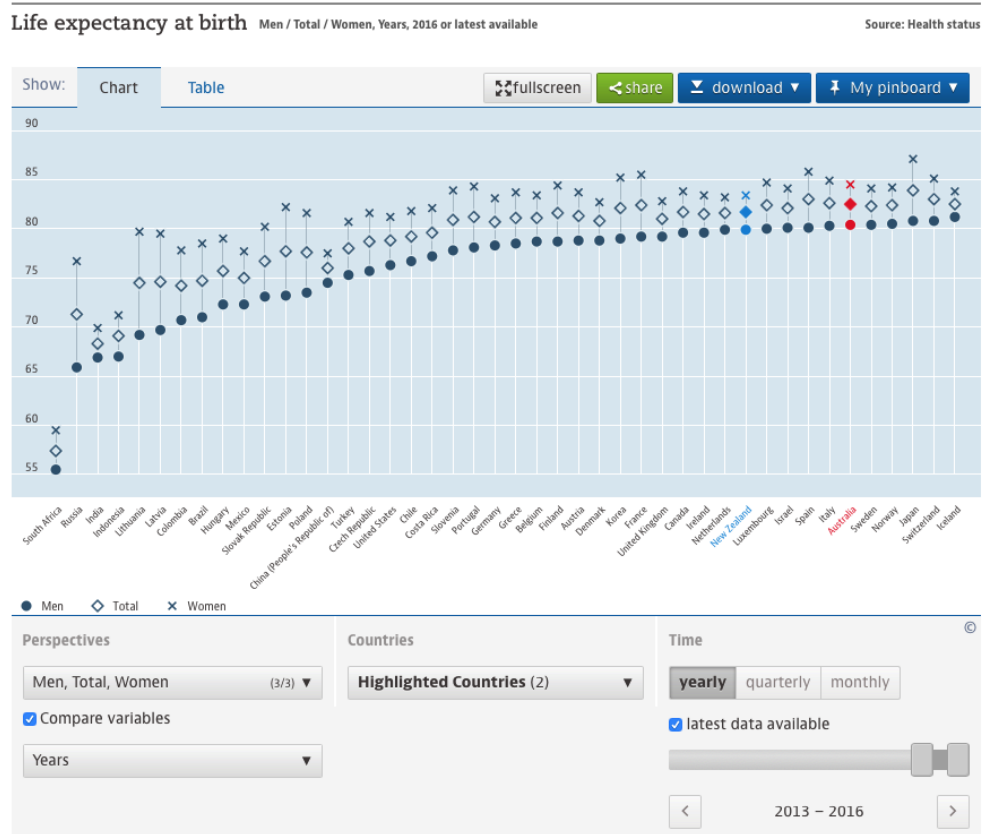


Figure 17 Life expectancy at birth by gender, 2016<sup>13</sup>

*Definition of Life expectancy at birth*

*Life expectancy at birth is defined as how long, on average, a newborn can expect to live, if current death rates do not change. However, the actual age-specific death rate of any particular birth cohort cannot be known in advance. If rates are falling, actual life spans will be higher than life expectancy calculated using current death rates. Life expectancy at birth is one of the most frequently used health status indicators. Gains in life expectancy at birth can be attributed to a number of factors, including rising living standards, improved lifestyle and better education, as well as greater access to quality health services. This indicator is presented as a total and per gender and is measured in years.*

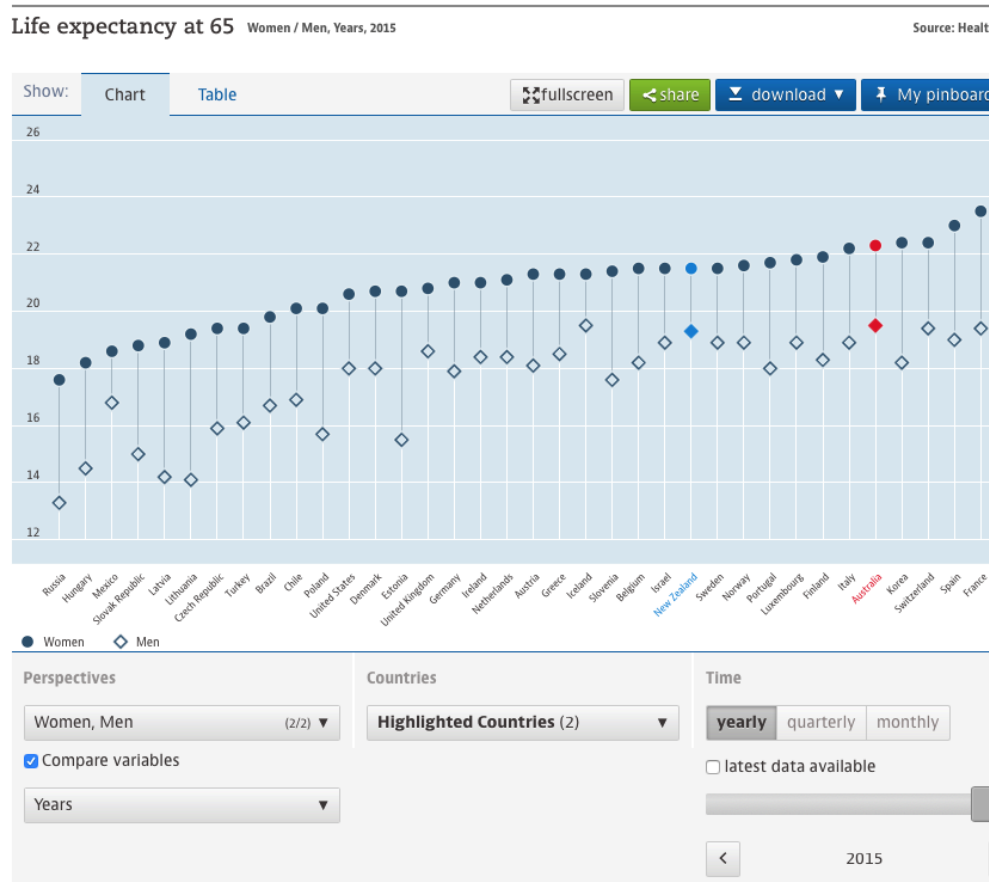


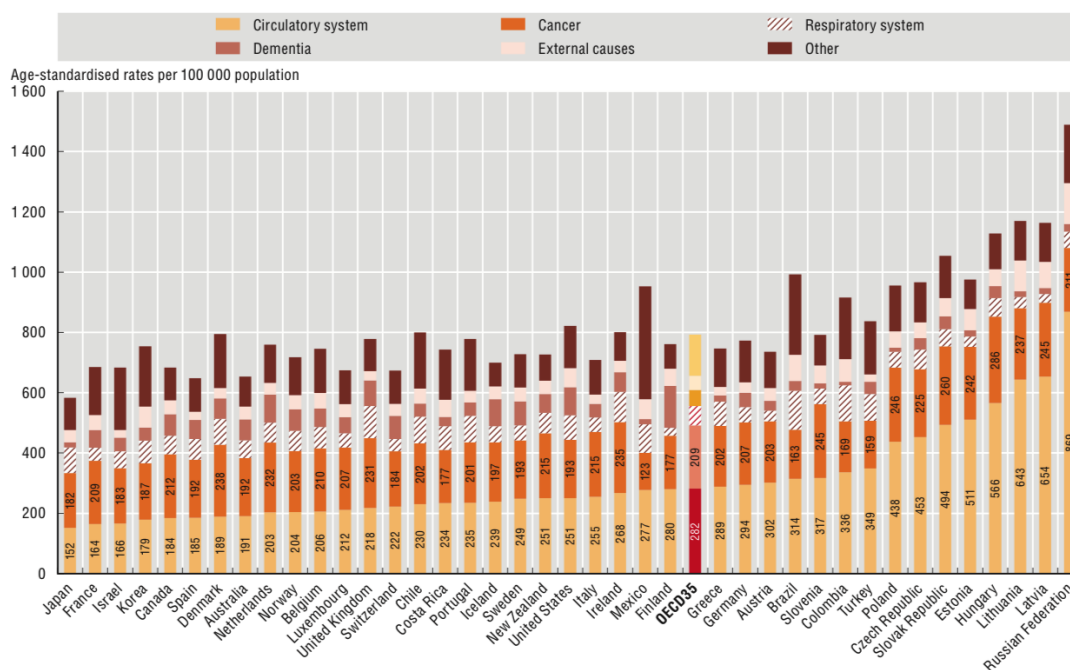
Figure 18 Life expectancy at 65 by country, in 2015<sup>14</sup>

*Definition of Life expectancy at 65*

*Life expectancy at age 65 years old is the average number of years that a person at that age can be expected to live, assuming that age-specific mortality levels remain constant. However, the actual age-specific death rate of any particular birth cohort cannot be known in advance. If rates are falling, as has been the case over the past decades in OECD countries, actual life spans will be higher than life expectancy calculated using current death rates. The methodology used to calculate life expectancy can vary slightly between countries. This can change a country's estimates by a fraction*

of a year. This indicator is presented by gender and is measured in years.

### 3.6. Main causes of mortality per country, 2015 (or nearest year)



Source: OECD Health Statistics 2017.

Figure 19 Main causes of mortality per country, 2015 (or nearest year)<sup>9</sup>

From the observations of the Trauma Verification team, the MoH seemed insufficiently involved with respect to major trauma, despite there being a fairly unanimous impression from other stakeholders that their contribution, and influence, should be greater. There also appeared to be a lack of a clear government priority around trauma, despite the gains made in the past. Trauma is seen as a regional rather than a national planning priority. There is an expectation that there will be an increased “inter-reliance” amongst the regions/DHBs, as has occurred with stroke, and ambulance is seen as an important enabler in that area. The MoH believes that it facilitates the process of achieving excellence in trauma care through setting of trauma expectations for the DHBs. However this approach may limit the impact of the national trauma leadership in influencing changes across the system, and even the regional leadership across the DHBs.

## Mortality

See Figures 20 and 21.<sup>15</sup>

Motor vehicle crashes were the fifth leading cause of death for both Māori and non-Māori males, but not for either Māori or non-Māori females.

Apart from suicide and motor vehicle crashes for males, the major causes of death were all chronic diseases, regardless of gender or ethnicity.

Motor vehicle crashes were the fourth leading cause of premature death for Māori males, but were not in the top five for Māori females, or for non-Māori of either gender.

Injury is the leading cause of death amongst New Zealanders aged 0 – 44 years, with an estimated 1,800 people dying from trauma every year in New Zealand. This is not unique to NZ, as trauma is also a leading cause of death in women and men under the age of 45 years in both Australia and New Zealand.<sup>16</sup>

	Males	Females
<b>Māori</b>	Ischaemic heart disease	Lung cancer
	Lung cancer	Ischaemic heart disease
	Suicide	Chronic obstructive pulmonary disease
	Diabetes	Cerebrovascular disease (stroke)
	Motor vehicle accidents	Diabetes
<b>Non-Māori</b>	Ischaemic heart disease	Ischaemic heart disease
	Suicide	Breast cancer
	Lung cancer	Cerebrovascular disease (stroke)
	Cerebrovascular disease (stroke)	Lung cancer
	Motor vehicle accidents	Colorectal cancer

Figure 20 Major causes of death, ranked by age-standardised mortality rates, by gender, Māori and non-Māori, 2010–12<sup>15</sup>

Males	Females
-------	---------

	Males	Females
<b>Māori</b>	Ischaemic heart disease	Lung cancer
	Suicide	Ischaemic heart disease
	Lung cancer	Breast cancer
	Motor vehicle accidents	Chronic obstructive pulmonary disease
	Diabetes	Cerebrovascular disease (stroke)
<b>Non-Māori</b>	Ischaemic heart disease	Ischaemic heart disease
	Lung cancer	Cerebrovascular disease (stroke)
	Cerebrovascular disease (stroke)	Breast cancer
	Suicide	Lung cancer
	Colorectal cancer	Colorectal cancer

Figure 21 Major causes of death, ranked by YLL, by gender, Māori and non-Māori, 2010–12 <sup>15</sup>

Globally, trends in road fatalities are similar. In New Zealand there has been a 37% decrease in fatalities between 2000 and 2014, compared to a 42% decrease in fatalities in the 32 OECD countries over the same period. New Zealand and 19 other OECD countries experienced a recent increase in fatalities. Between 2014 and 2016, the New Zealand road toll increased by 12%, in comparison, between 2015 and 2016, Australia's road toll increased by 7.9%. Rates for New Zealand remain above that of Australia. (Fig 22-25) (Ref: Deloitte Access Report. Qualitative and Quantitative Analysis of the New Zealand Road Toll: Final Report Ministry of Transport 14 March 2017). This finding has also been highlighted by the recent Deloitte Access report. Although this upward trend has been called into question by a peer review of the Deloitte report (Ref: Peer-Review-on-the-DAE-road-toll-report-redacted-version), on the basis that this same trend is being observed amongst similar other countries, including Australia, and combined with the fact that NZ incidence rate of trauma, and trauma mortality, is above that of some similar countries, then it should not be ignored and considered to be a true representation of an upward trend in injury occurrence and mortality. (Fig 26, 27)

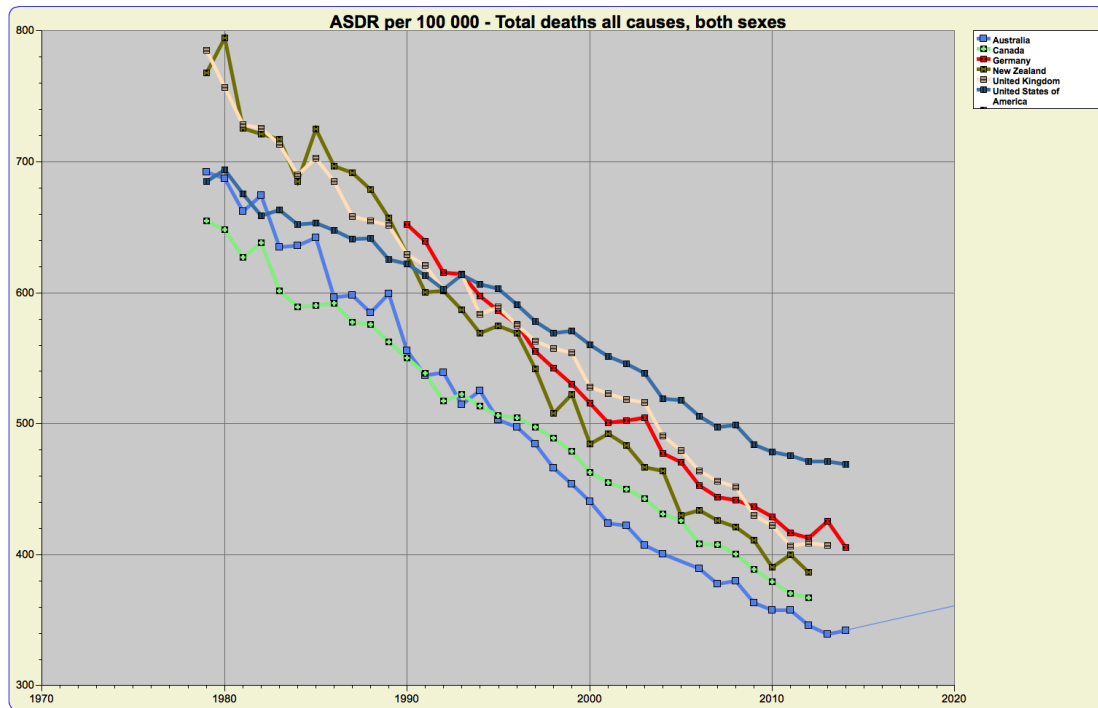


Figure 22 Age-standardised death rates (ASDR per 100 000) for death due to all causes by country<sup>17</sup>

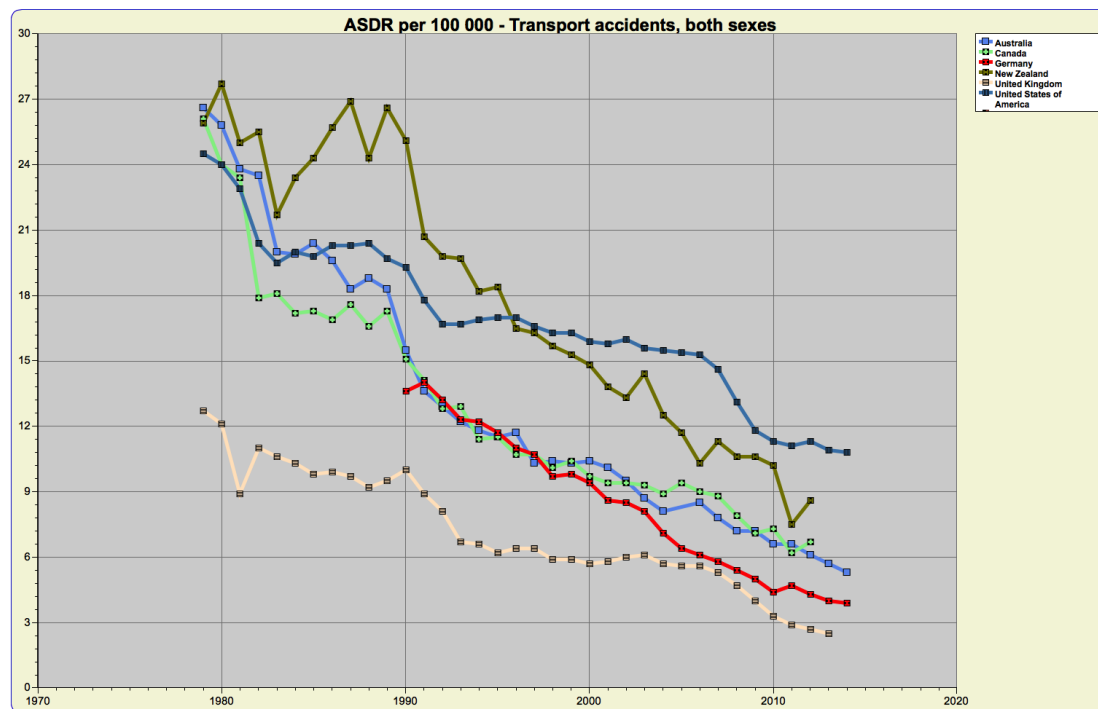


Figure 23 Age-standardised death rates (ASDR per 100 000) for death attributed to transport accidents by country<sup>17</sup>

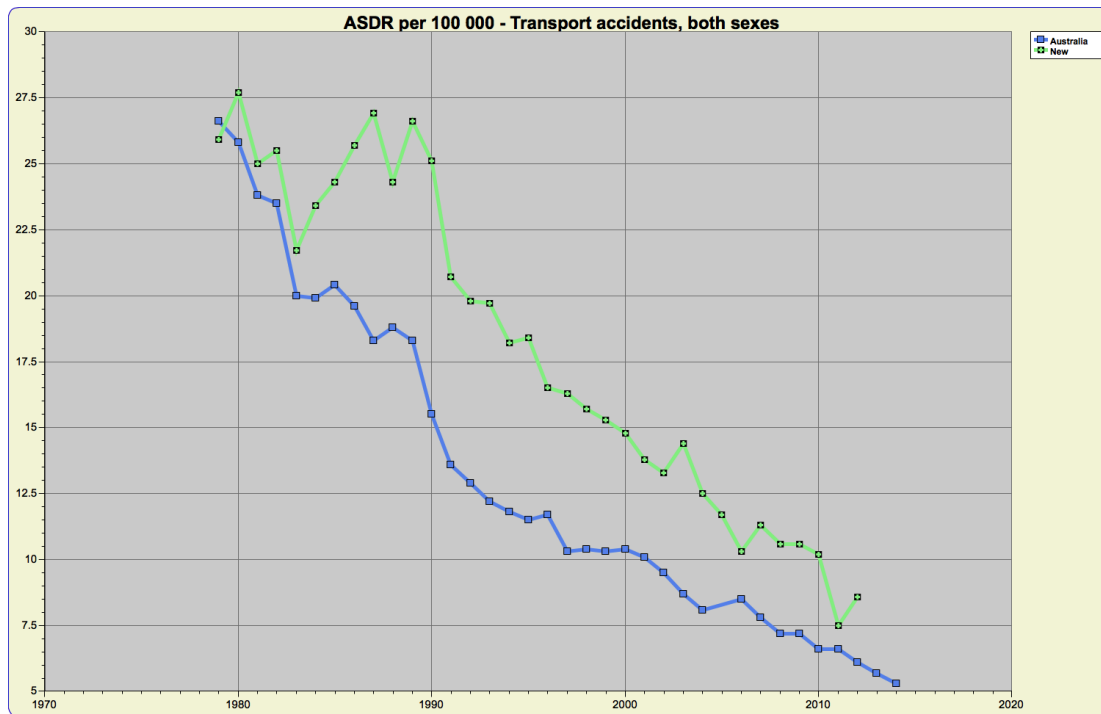


Figure 24 Age-standardised death rates (ASDR per 100 000) for death attributed to transport accidents for Australia and New Zealand<sup>17</sup>

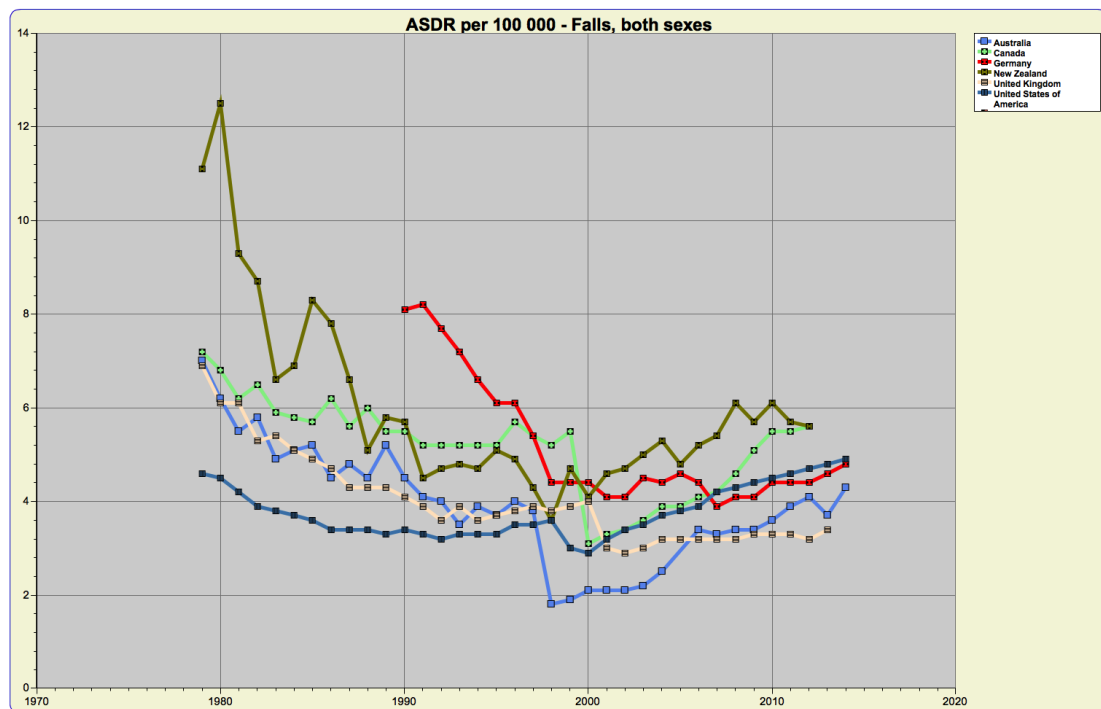


Figure 25 Age-standardised death rates (ASDR per 100 000) for death attributed to falls by country<sup>17</sup>



**Figure 2-5: International 12 month rolling road tolls  
 Percentage change from Jan 2008**

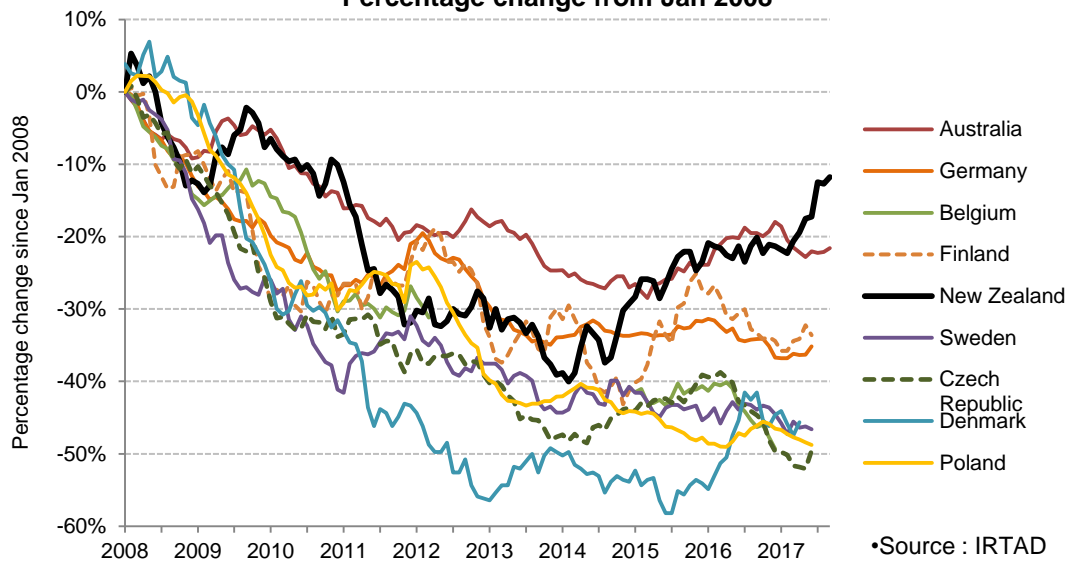


Figure 26 International 12-month rolling road tolls 2008-2017 (percentage change from January 2008)<sup>18</sup>

**Figure 2-4: Fundamental factors  
 Year 2001=100%**

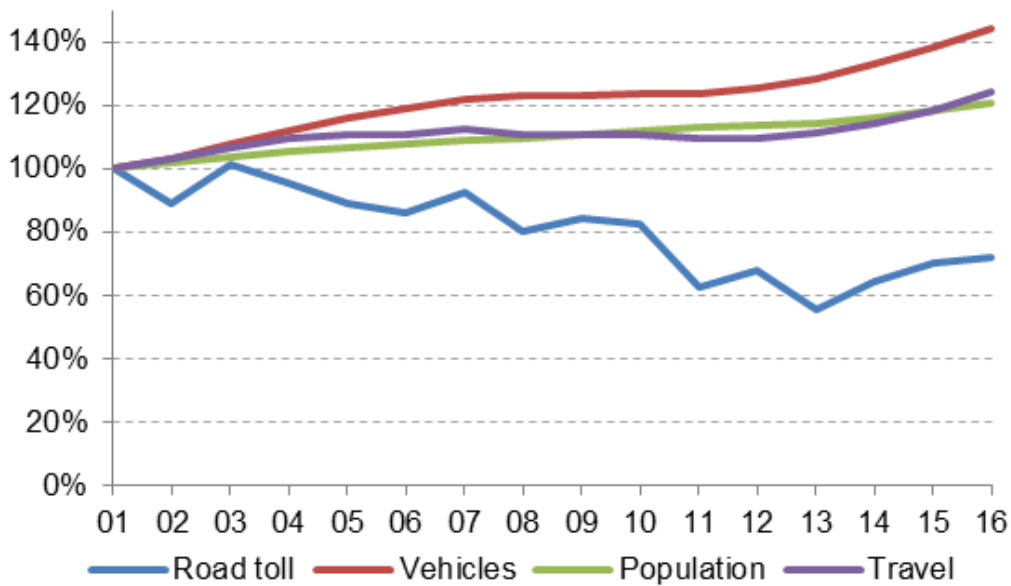


Figure 27 Fundamental factors 2001-2016, year 2001=100%<sup>19</sup>

## **Maori and Major Trauma**

Of the New Zealand population, 15% identify as Māori, with most residing in the North Island. In general the Māori have disproportionately poorer health and are recognized as an at-risk group for trauma. The incidence of major trauma for Maori is 52/100,000 population compared to 31/100,000 for non-Maori.<sup>20</sup> Māori have a 23% greater risk of mild TBIs than New Zealand Europeans.<sup>21</sup>

Māori also account for a disproportionate amount of trauma hospital admissions (28%), in particular paediatric trauma (age less than 15 years), of which 40% of paediatric trauma admissions are Māori.<sup>22</sup>

Thus the Maori group, with poorer health indices, bring an added element of complexity in the setting of major trauma care, and recovery from major trauma. It is likely they would be better served by a multidisciplinary approach during their recovery from major trauma. This approach should incorporate management of pre-existing medical and mental health conditions. Community engagement and meeting the specific health literacy needs are potential strategies to promote injury prevention.

## **Crown Entities and Agencies**

Crown entities form part of New Zealand's state sector and are responsible to the Minister of Health.

### **Health Quality and Safety Commission**

The Health Quality and Safety Commission (HQSC) is tasked with leading and coordinating work across the health and disability sector for the purposes of monitoring and improving the quality and safety of health and disability support services.

The HQSC advises the Minister of Health on health-related safety and quality improvement, mortality, and supports mortality review committees. It reports on safety and quality indicators (such as serious adverse events) for health and disability support services.

It is very data driven and produces an atlas of health care variation. Data includes that of non-major and major trauma. Major trauma statistics are limited.

### **Health and Disability Commissioner**

The main role of the Health and Disability Commissioner (HDC) is to ensure that the rights of consumers are upheld, and health or disability service providers perform as expected.

### **Health Promotion Agency**

The Health Promotion Agency (HPA)'s role is to lead and deliver innovative, high quality and cost-effective programmes that promote health, healthy lifestyles, disease prevention, illness and injury prevention. This includes providing advice and recommendations with respect to alcohol misuse.

### **Health Research Council of New Zealand**

The Health Research Council of New Zealand (HRC) is responsible for the allocation of the government's investment in health research. The majority of the HRC investment is mapped to four Research Investment Streams: Health and Wellbeing; Improving outcomes for acute and chronic conditions; Health delivery; Maori health.<sup>23</sup> These areas align well with respect to considering large collaborative trauma research projects, particularly if trauma becomes a national priority area.

### **New Zealand Blood Service**

The New Zealand Blood Service (NZBS) ensures the safe supply of blood products. NZBS takes responsibility for the development of an integrated national blood transfusion process, from the collection of blood from volunteer donors to provision and monitoring of blood products within the hospitals.

### **The Pharmaceutical Management Agency (PHARMAC)**

PHARMAC decides on which medicines and related products are publicly funded in New Zealand and to what level. It manages medicines across all levels of the health service. PHARMAC is also working towards management of hospital medical devices.

## Health Quality and Safety Commission (HQSC) Atlas of Health Care Variation – Trauma

An important feature of the atlas is that HQSC used two datasets: National Minimum Data Set, data is taken from ICD10AM coding (all New Zealand hospitals), and a major trauma patient subset from the trauma registries, which are currently only operational in Auckland metropolitan region and Midland Regional Trauma System. This appeared to be a useful and feasible exercise, which has not been repeated or updated. It would be even more useful to repeat this data linkage, analysis and mapping using data from the NZMTR, and do so as an ongoing process.

Physical injury data was drawn from the National Minimum Dataset, which is available from public hospitals for all DHBs. Physical injury included all injuries with a first admission to hospital with a principal diagnosis of injury, principal diagnosis in range S00-T35, all deaths from that group including on the first day and excluded the following:

- readmissions for the same injury
- transfers
- LOS < 1 day
- poisoning, drowning and hangings
- fracture neck of femur
- DRG I79A Pathological fracture W Catastrophic CC and I79B
- Pathological fracture W/O Catastrophic CC

Major trauma was defined according to the Abbreviated Injury Scale used at the relevant hospital. At that time, for Auckland DHB and Counties Manukau Health (using AIS 1998), an Injury Severity Score (ISS) greater than 15 was used. For Waikato, Bay of Plenty, Taranaki and Lakes DHBs (using AIS 2008) ISS greater than 12 was used.

Key findings (some of which are illustrated below): (Fig 28-34)

With respect to Physical Injury (data is over a 3 year period, 2012 - 2014):

- on average, 5.9 people/1000 population (586/100,000) were admitted to hospital each year
- admissions for people aged 65 and over (11.3/1000 population) were more than double those for people aged 25–64 years (4.4/1000)
- more males were admitted than females (7.1 vs 4.7/1000 population)
- Māori (6.5/1000 population) and Pacific peoples (6.2/1000) were admitted more often than all other ethnic groups combined (5.6/1000 population)
- DHB admission rates varied from between 1.5-fold to 2-fold.
- approximately 270 people died in hospital each year
- the national mean mortality rate was 1 percent
- death rates in those aged 65 years and over were 8 times those for people under 65 years  
there was little variation in mortality rates between DHBs

With respect to Major Trauma (data is over a 3 year period, 2012 - 2014):

- Major trauma represents about 8 percent of all patients admitted to hospital with physical injury
- 2065 major trauma admissions were recorded on the major trauma registries
- twice as many males were admitted compared with females
- 182 trauma patients died, giving a mean mortality rate of 8.8 percent of major trauma cases registered
- more than twice as many people aged 65 years and older died compared with all other age groups (18.2 percent of cases registered, compared with 6.6 percent of cases for 0–44 year olds)
- there was no significant variation in the mortality rate between the DHBs

Time from injury to first hospital capable of managing major trauma, DHB of service (NZMTR), included data only from the Auckland region.

- 50% of major trauma cases arrived at a hospital capable of managing major trauma in less than an hour after the injury
- 92.8% arrived at a hospital within three hours
- 95.4% arrived at a hospital within six hours.

#### HQSC Atlas of Healthcare Variation | Trauma

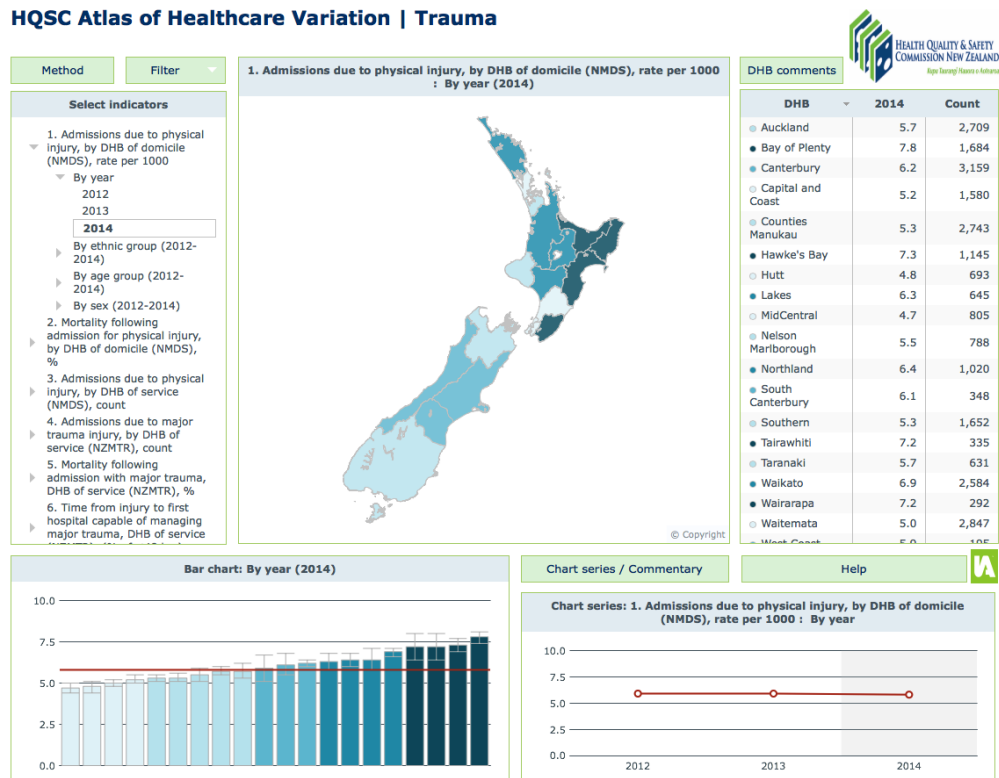


Figure 28 Hospital admissions due to physical injury by DHB of domicile (NHDS) rate per 1000 in 2014<sup>4</sup>

HQSC Atlas of Healthcare Variation | Trauma

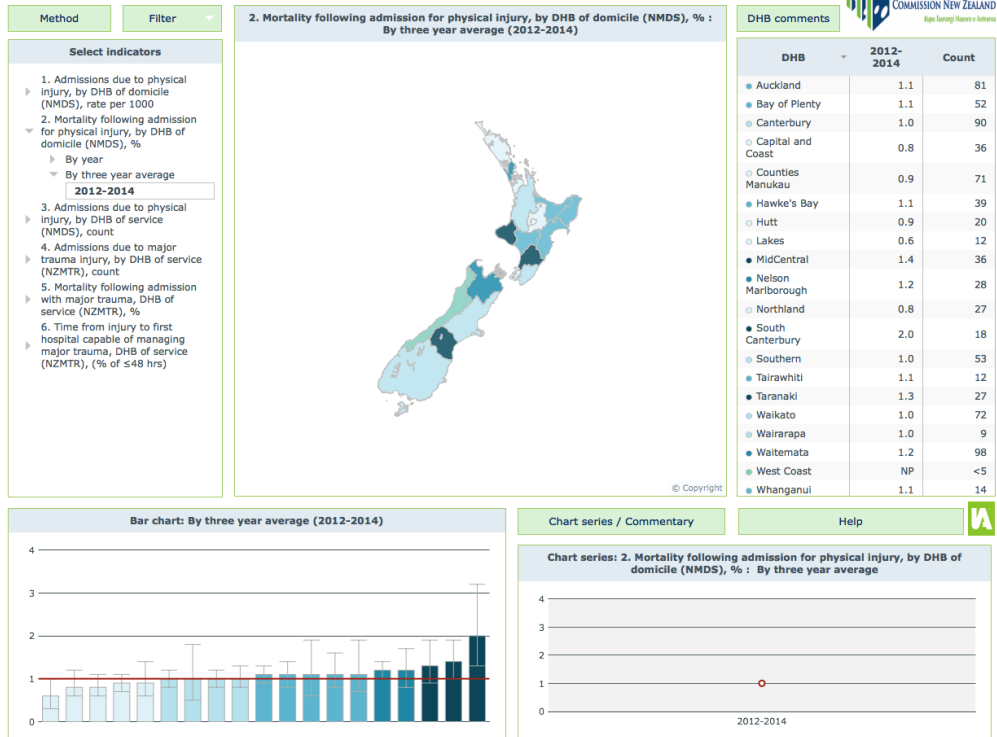


Figure 29 Mortality (percentage) following admission for physical injury by DHB of domicile (NMDS), three-year average (2012-2014) <sup>4</sup>

HQSC Atlas of Healthcare Variation | Trauma

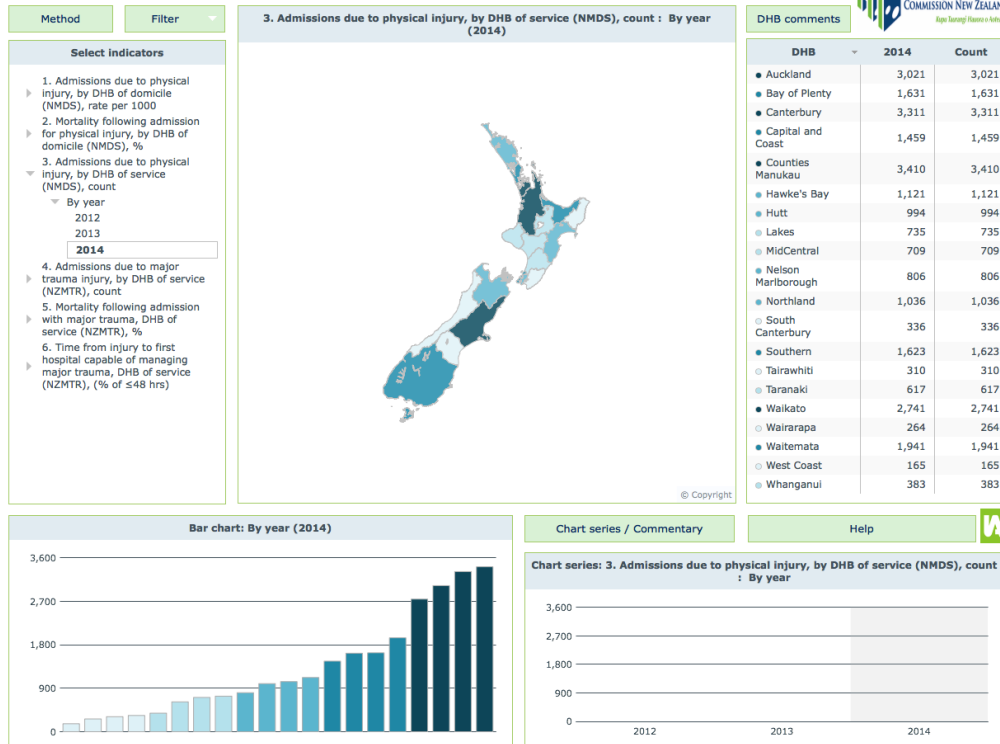


Figure 30 Number of hospital admissions due to physical injury, by DHB of service (NMDS) in 2014 <sup>4</sup>

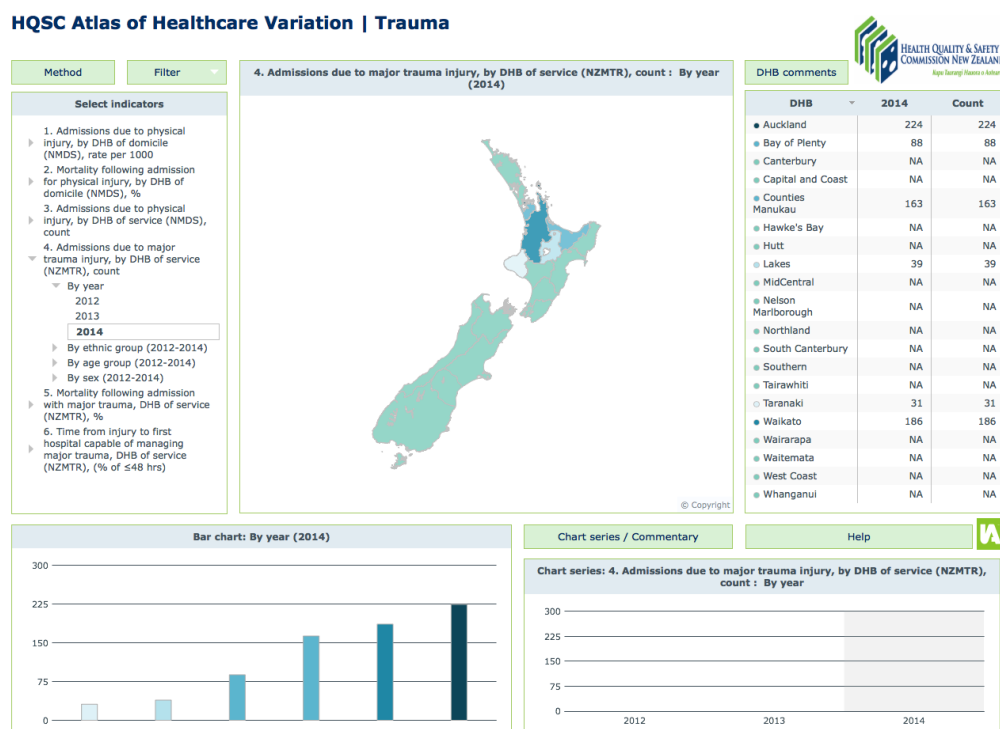


Figure 31 Number of hospital admissions due to major trauma injury, by DHB of service (NZMTR) in 2014<sup>4</sup>

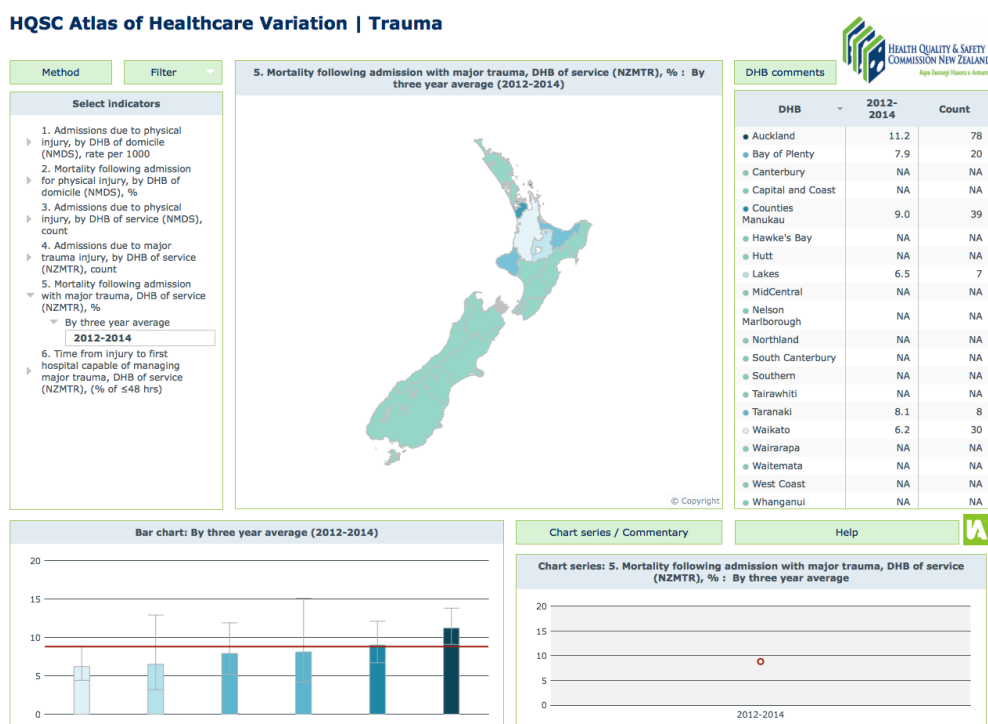


Figure 32 Mortality (percentage) following hospital admission for physical injury by DHB (three year average, 2012-2014)<sup>4</sup>

HQSC Atlas of Healthcare Variation | Trauma

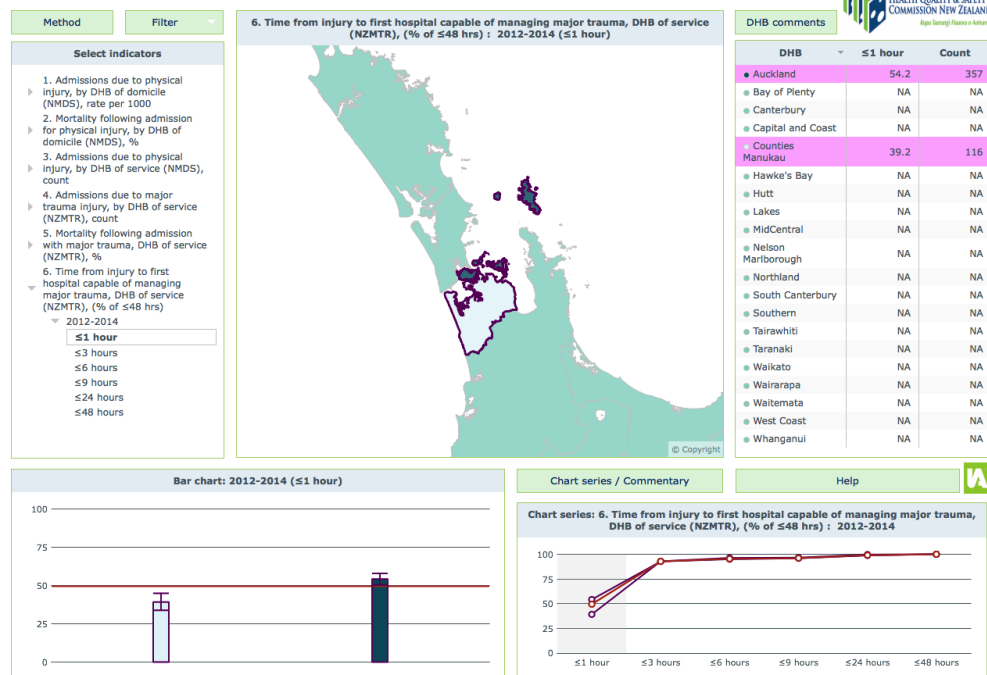


Figure 33 Time to first hospital capable of managing major trauma (Percentage of hospital admissions due to major trauma <48h that are within one hour, 2012-2014)<sup>4</sup>

HQSC Atlas of Healthcare Variation | Trauma

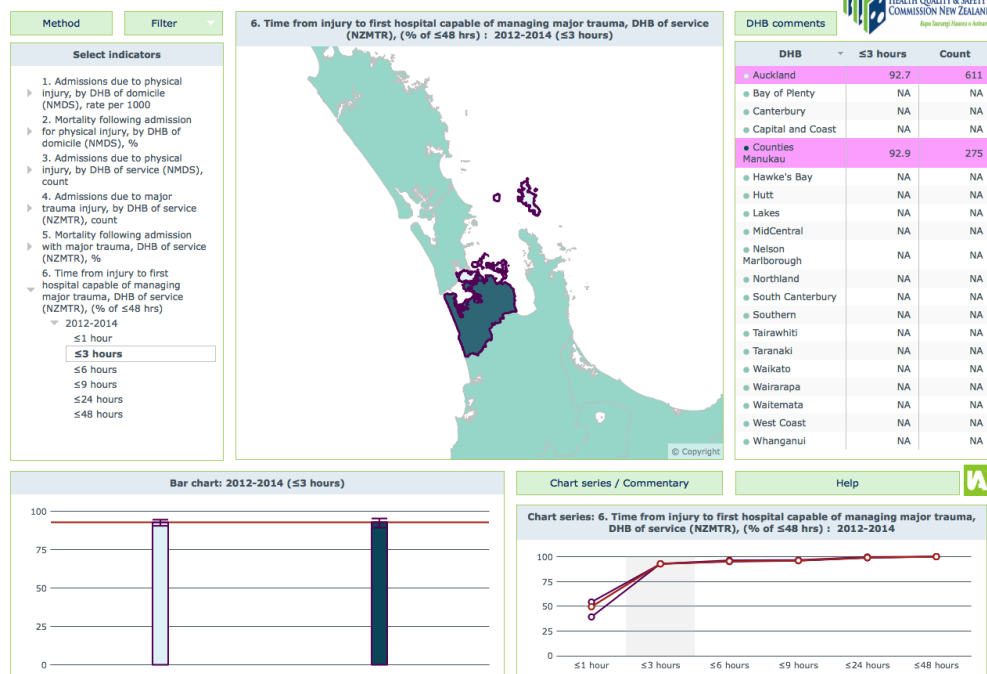


Figure 34 Time to first hospital capable of managing major trauma (Percentage of hospital admissions due to major trauma <48h that are within 3 hours, 2012-2014)<sup>4</sup>



## New Zealand Injury Prevention Strategy

Historically, injury prevention efforts have been fragmented, with various government agencies and non-government organisations addressing a wide range of issues, often without reference to one another. The New Zealand Injury Prevention Strategy (NZIPS) was introduced in 2003 so as to address fragmentation in injury prevention programs by the various agencies throughout NZ.

The definition of serious injury adopted for the official NZIPS indicators is an injury that results in death, or an admission to hospital that is associated with at least a 6.9% chance of death.

A five-year evaluation report for NZIPS in July 2010, compared injury outcomes in 2003 with those in 2006 and concluded that the gains were made in terms of deaths, in particular in areas such as road crashes and workplace, and that those gains were due to sustained activity and investment in injury prevention over time. (Fig 35) The NZIPS was disestablished in 2013, with injury prevention programs to be devolved to relevant organisations.

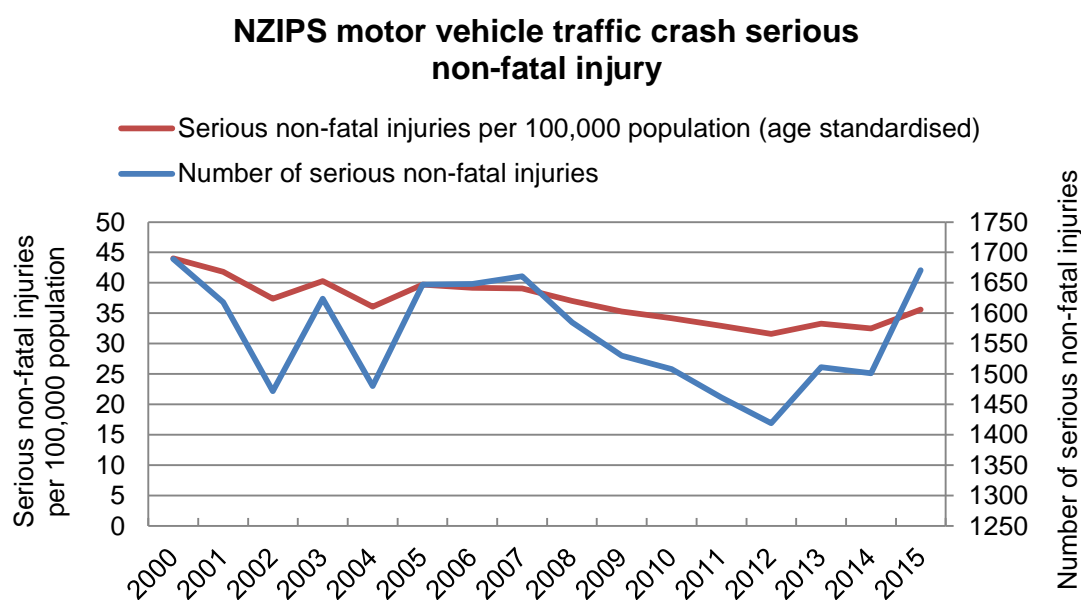


Figure 35 NZIPS motor vehicle traffic cash serious non-fatal injuries, 2000-2015

## **Accident Compensation Corporation**

The Accident Compensation Corporation (ACC) is a New Zealand Crown entity responsible for administering the country's universal no-fault accidental injury scheme. The scheme provides financial compensation and support to citizens, residents, and temporary visitors who have suffered personal injuries. As a Crown entity, the ACC is responsible to its own cabinet minister.

The Accident Compensation Corporation provides comprehensive, no-fault personal injury cover for all New Zealand residents and visitors to New Zealand, regardless of the way in which they incurred an injury. The intent is to support people to get back to work as soon as possible. Another key priority is to prevent injuries occurring, through public education and support. It does so by working closely with other public health and non-health providers, government and non-government agencies. It maintains contractual agreements with public and NGO for provision of community services, and those agreements are underpinned by predetermined performance measures and expectations. The ACC also provides financial compensation to people for losses they incur because of their injuries.

Levies placed on employers, employees and vehicle registrations are used to pay claims for treatment and rehabilitation following injury. The ACC initially collected only sufficient levies to cover the cost of claims for a particular year. In 1999, a fully funded model was adopted whereby sufficient levies were collected to cover the lifetime cost of each injury. Thus the ACC carries a heavy financial burden, whereby injury prevention and minimisation of long term disability has significant financial implications to the ACC and the broader New Zealand community. (Fig 36)

In 2015/16, the ACC's outstanding claims liability (OCL) increased by \$6.4 billion, which lead to a net deficit of \$3.5 billion. The OCL measures the future cost of all existing ACC claims. That year also saw 1.93 million new claims accepted, a 5.2% increase from the previous year.<sup>24</sup>

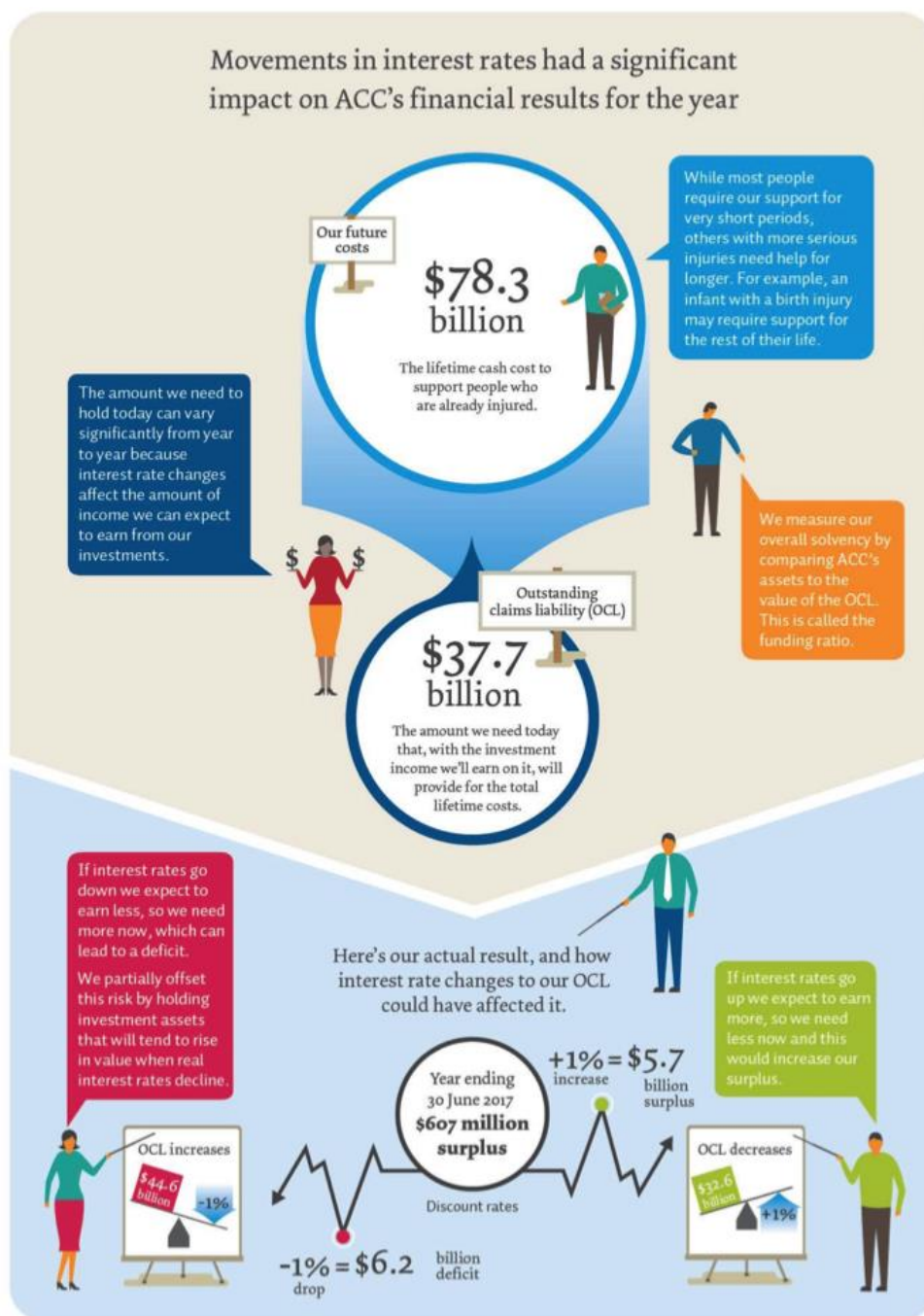


Figure 36 Example of the effect of interest rates on the ACC's outstanding claims liability<sup>8</sup>

The ACC has an agreement with MoH (Public Health Acute Services (PHAS) Annual Service Agreement) for the purchase of acute and other services for ACC personal injury clients. The ACC contributes a block fund to the Crown for acute trauma care (approx. \$500m), however although they do receive an estimation of the cost impact of trauma (based upon NMDS derived data) they don't have visibility of PHAS funding in the DHBs funding allocation. .

In addition, the ACC and MOH jointly govern and fund the National Ambulance Sector Office, which

oversees emergency ambulance services, and both collaborate with regards to injury prevention. The ACC also works together with the NZTA on road safety as part of Safer Journeys, the Drive programme, and the National Road Safety Committee.

A key objective of the ACC is to reduce the number and severity of injuries. It is estimated that for every trauma related death, there are a further 9 people who survive with major injury and disability requiring complex, multidisciplinary care. It does so by investing with partners in a range of programmes and initiatives. These include working together with different communities, across a range of settings such as the sports field and the workplace and environments like the road network.

The success of the ACC's injury prevention program has been its capacity to build relationships with government and community agencies. Significantly, the ACC's injury prevention track record is strong and over time has built a number of partnerships with government and community agencies. The ACC also funds trauma-related research. This includes research into trauma outcomes and elements essential of a high quality trauma system. In addition, the ACC provides funding to specialist spinal and brain injury services, burns (to the National Burns Unit) and paediatric rehabilitation services.

A recent report examined the potential economic and welfare benefits of reducing road traffic injuries in Low and Middle-Income Countries.<sup>25</sup> Reducing road traffic injuries by half would add 15% to 22% of GDP per capita income growth over 24 years. Road safety interventions were assessed as being among the "best buys" in development since they yield measurable results more rapidly than many other investments in human capital and involve modest implementation costs.

The social cost of road crash and injury in New Zealand has been measured and reported.<sup>26</sup> Social cost has been defined as the total cost that occurs as a result of the road crash or injury.

In New Zealand, the social cost of a road crash or a road injury includes the following components:

- loss of life and life quality
- loss of output due to temporary incapacitation
- medical costs
- legal costs
- vehicle damage costs

A willingness-to-pay valuation technique is used to express pain and suffering from loss of life or life quality in dollar terms (that is, the willingness-to-pay based value of statistical life or VOSL).

The VOSL is \$4.14 million per fatality, at June 2016 prices. Adding the other social cost components gives an updated average social cost per fatality of \$4,179,700.

For non-fatal injuries, the updated average social cost is estimated at \$439,100 per serious injury and \$23,400 per minor injury. After scaling up the estimates to account for non-reported cases, the

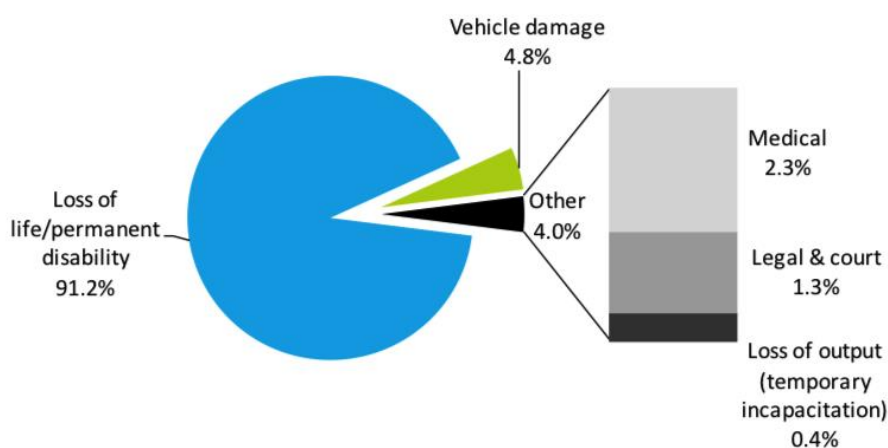
average social cost estimates increase to \$776,000 per reported serious injury and \$77,000 per reported minor injury.

The average social cost is estimated at \$4.73 million per fatal crash, \$504,500 per serious crash and \$28,600 per minor crash. This is adjusted to \$912,000 per reported serious crash and \$99,000 per reported minor crash, after scaling up the estimates to account for non-reported cases.

The total social cost of motor vehicle injury crashes in 2015 was estimated at approximately \$3.79 billion, at June 2016 prices, an increase of \$0.26 billion (or 7.4%) compared to 2014 values (\$3.53 billion in 2014). This increase reflects a 9% increase in the total number of fatalities (from 293 in 2014 to 319 in 2015), a 3% increase in the estimated total number of serious injuries (from 3,668 in 2014 to 3,791 in 2015) and a 10% increase in the estimated total number of minor injuries (from 30,443 in 2014 to 33,497 in 2015).

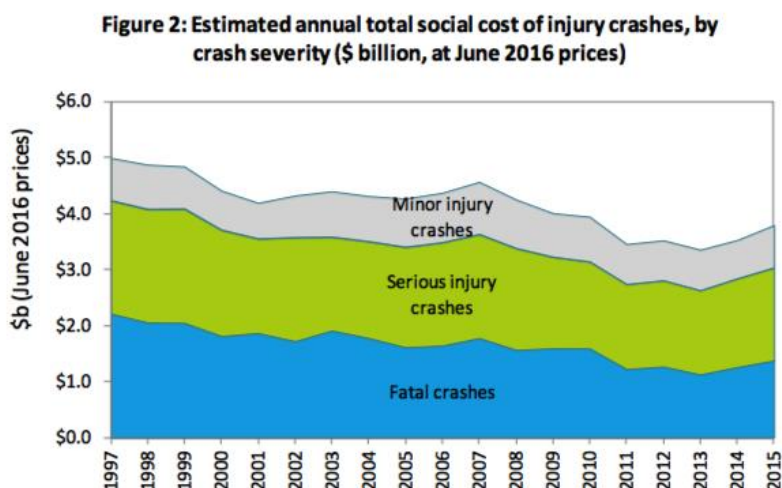
Figure 37 differentiates social costs for fatalities, severe injury and minor injury. Significantly, costs are rising, as stated above, and those due to minor injury, although the smallest proportion of the total, are still substantial. (Fig 38)

**Figure 1: Share of total social cost of injury crashes in 2015, by cost component**



Total social cost of injury crashes in 2015 = \$3.79 billion (June 2016 prices)

Figure 37 Share of total social cost of injury crashes in 2015 by cost component<sup>26</sup>



Note: This chart includes allowances for non-reported cases.

Figure 38 Estimated annual total cost of injury crashes, by crash severity (\$NZ billion, at June 2016 prices)<sup>26</sup>

Figures 39 - 41 are an illustration of the ACC-derived claim data. (They illustrate the estimated magnitude and trends in costs of claims that would represent the spectrum of minor and severe injuries for those body regions. Although claim numbers (active and existing) have been relatively “steady” total costs continue to trend upwards.

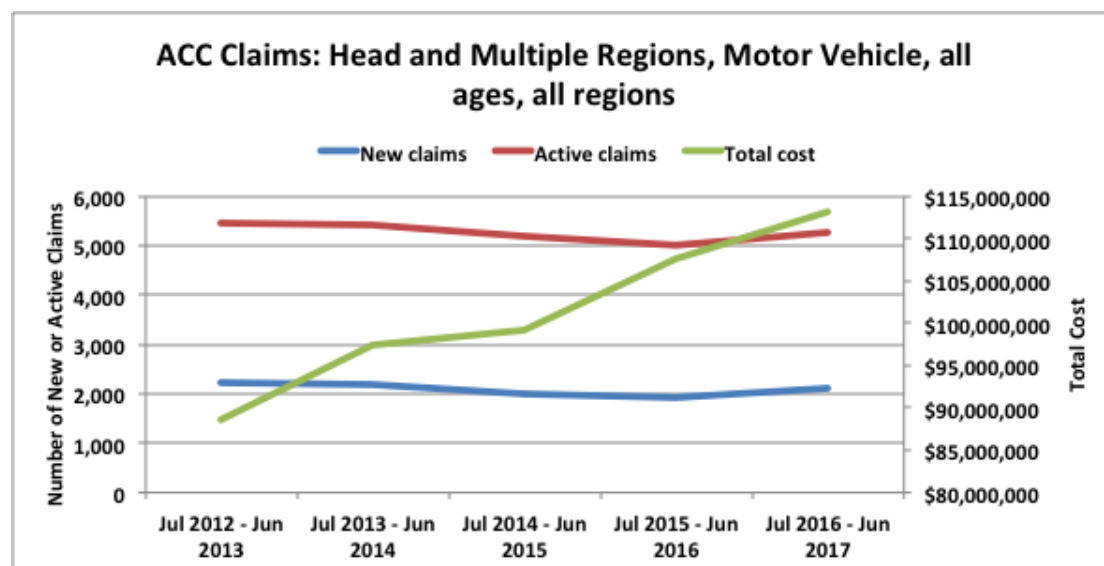


Figure 39 Number and total cost (NZ\$) of ACC motor vehicles claims for head and multiple regions, 2012-2017<sup>27</sup>

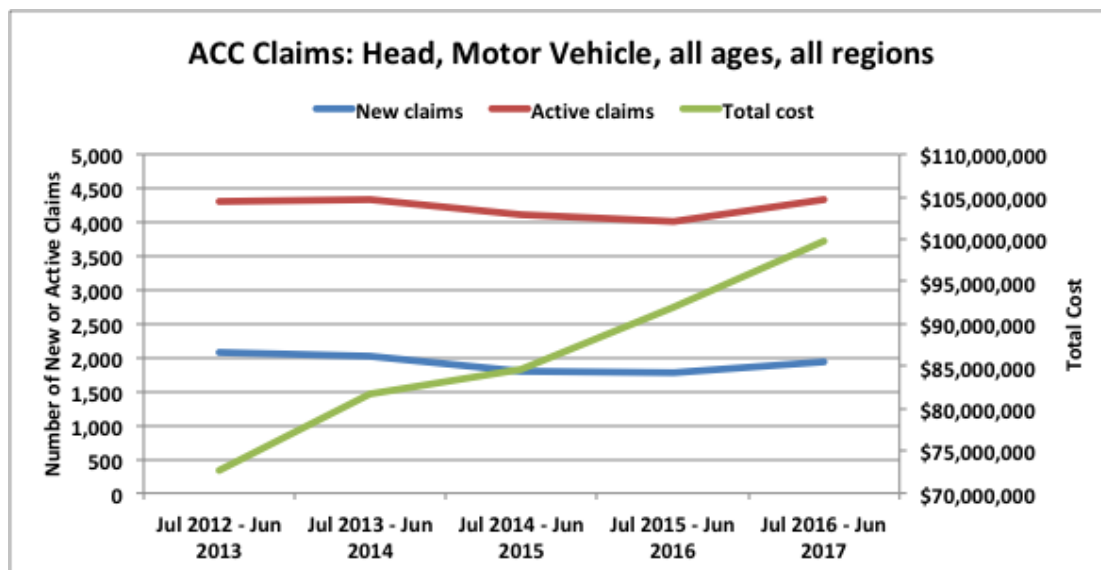


Figure 40 Number and total cost (NZ\$) of ACC motor vehicle claims for head injuries, 2012-2017<sup>27</sup>

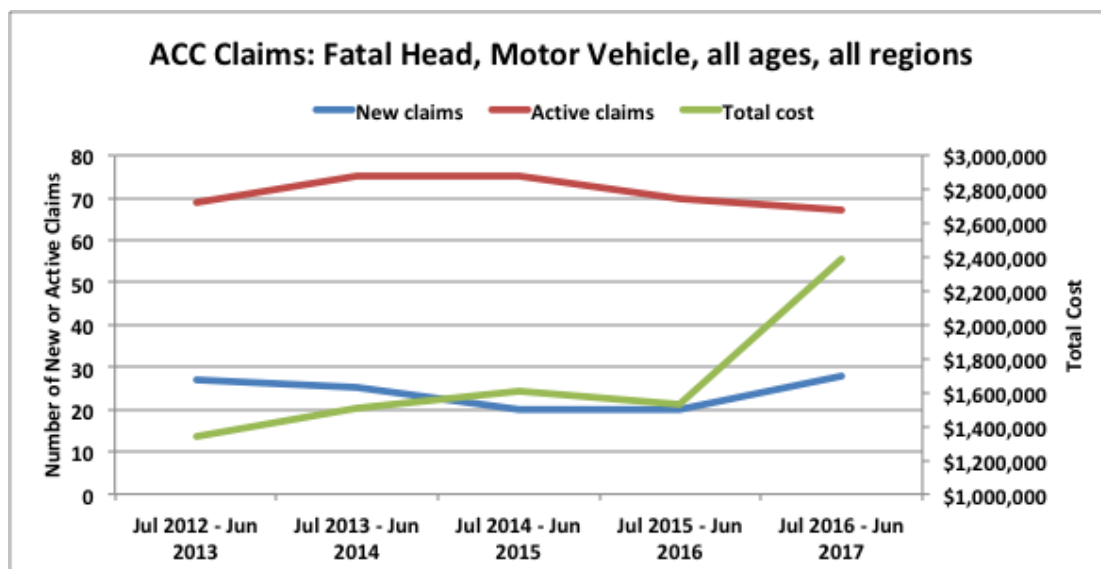


Figure 41 Number and total cost (NZ\$) of ACC motor vehicle claims for fatal head injuries, 2012-2017<sup>27</sup>

## New Zealand Transport Agency

The New Zealand Transport Agency (NZTA) is a New Zealand Crown entity tasked with promoting safe and functional transport by land. The NZTA is responsible for driver and vehicle licensing, analysis of crash data so as to inform where to target road safety interventions, administering the New Zealand state highway network and other related responsibilities.

The United Nations Decade of Action for Road Safety 2011-2020<sup>28</sup> outlines five pillars of activity for a safe system of reducing incidence of road traffic fatalities, especially in low-income and middle-income countries. New Zealand has demonstrated a strong compliance to WHO agreed upon performance measures (Fig 42)

### NEW ZEALAND

Population: 4 505 761 • Income group: High • Gross national income per capita: US\$ 35 550



#### INSTITUTIONAL FRAMEWORK

Lead agency	Land Transport Safety Team, Ministry of Transport
Funded in national budget	Yes
National road safety strategy	Yes
Funding to implement strategy	Fully funded
Fatality reduction target	Multiple <sup>a</sup>

<sup>a</sup> Targets vary for specific groups. See New Zealand Road Safety Strategy 2010-2020, p.13.

#### SAFER ROADS AND MOBILITY

Formal audits required for new road construction projects	Yes
Regular inspections of existing road infrastructure	Yes
Policies to promote walking or cycling	Yes
Policies to encourage investment in public transport	Yes
Policies to separate road users and protect VRUs	Yes

#### SAFER VEHICLES

Total registered vehicles for 2012	3 250 066
Cars and 4-wheeled light vehicles	2 643 624
Motorized 2- and 3-wheelers	114 930
Heavy trucks	112 856
Buses	8 286
Other	370 370

#### Vehicle standards applied<sup>b</sup>

Frontal impact standard	Yes
Electronic stability control	Yes
Pedestrian protection	Yes

<sup>b</sup> UNECE WPIR.

#### POST-CRASH CARE

Emergency room injury surveillance system	No
Emergency access telephone numbers	111
Permanently disabled due to road traffic crash	—

#### DATA

Reported road traffic fatalities (2013)	253 <sup>c</sup> (70% M, 30% F)
WHO estimated road traffic fatalities	272
WHO estimated rate per 100 000 population	6
Estimated GDP lost due to road traffic crashes	1.6% <sup>d</sup>

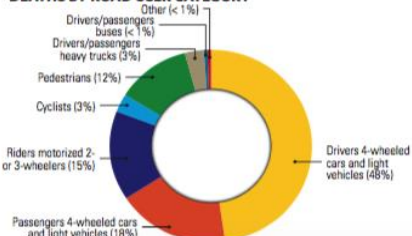
<sup>c</sup> Police reported data. Defined as died within 30 days of crash.  
<sup>d</sup> Calculated from The Social Cost of Road Crashes and Injuries 2013 update.

#### SAFER ROAD USERS

National speed limit law	Yes
Max urban speed limit	50 km/h
Max rural speed limit	100 km/h
Max motorway speed limit	100 km/h
Local authorities can modify limits	Yes
Enforcement	0 1 2 3 4 5 6 7 8 9 10
National drink-driving law	Yes
BAC limit – general population	≤ 0.05 g/dl
BAC limit – young or novice drivers	0.00 g/dl
Random breath testing carried out	Yes
Enforcement	0 1 2 3 4 5 6 7 8 9 10
% road traffic deaths involving alcohol	31% <sup>e</sup>
National motorcycle helmet law	Yes
Applies to drivers and passengers	Yes
Law requires helmet to be fastened	Yes
Law refers to helmet standard	Yes
Enforcement	0 1 2 3 4 5 6 7 8 9 10
Helmet wearing rate	—
National seat-belt law	Yes
Applies to front and rear seat occupants	Yes
Enforcement	0 1 2 3 4 5 6 7 8 9 10
Seat-belt wearing rate	96% Front seats, 90% Rear seats <sup>f</sup>
National child restraint law	Yes
Restrictions on children sitting in front seat	Yes
Child restraint law based on	Age
Enforcement	0 1 2 3 4 5 6 7 8 9 10
% children using child restraints	92% 0–4 years <sup>g</sup> , 96% 5–9 years <sup>h</sup>
National law on mobile phone use while driving	Yes
Law prohibits hand-held mobile phone use	Yes
Law also applies to hands-free phones	No
National drug-driving law	Yes

<sup>e</sup> 2013, police reported data.  
<sup>f</sup> 2012, Annual National Survey of Seatbelts in New Zealand.  
<sup>g</sup> Ministry of Transport, Child restraint use by children under 5 years, 2012.  
<sup>h</sup> Ministry of Transport, Child restraint use by children aged 5-9 years, Results of a national survey 2013.

#### DEATHS BY ROAD USER CATEGORY



#### TRENDS IN REPORTED ROAD TRAFFIC DEATHS

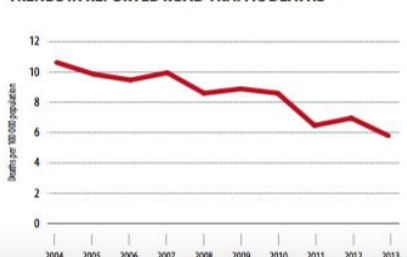


Figure 42 Summary of New Zealand compliance with WHO traffic crash performance measures



The five pillars are:

- road safety management,
- safer roads and mobility,
- safer vehicles,
- safer road users
- post-crash response

The first four pillars have a strong focus on prevention of road traffic crashes and have been the major focus for the NZTA. The fifth pillar is clearly linked to the other four, as potentially sub-optimal post-crash care will mitigate any effort and resources that have been used to generate positive outcomes amongst the other pillars. Of note, New Zealand has not formally adopted the fifth pillar, being post-crash response, in its Safer Journeys 2010-2020 strategy.

The New Zealand Transport Agency is leading national research, considering how well New Zealand delivers post-crash care from location of trauma through to hospitalisation. The research is focused on time and location of impact to hospitalisation, for the prevention of fatalities and increased severity of injury cases. (Fig 43-45) This research has a focus on the transport and transport-related components relating the delivery of post impact care. <sup>29</sup>

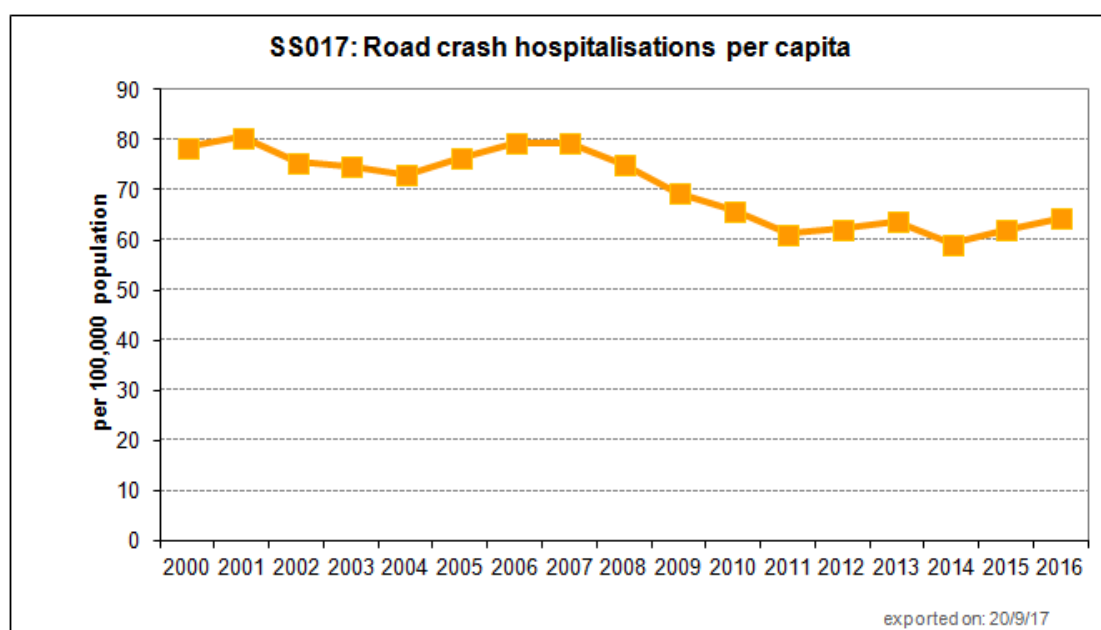


Figure 43 Road crash hospitalisations per 100 000 population, 2000-2016

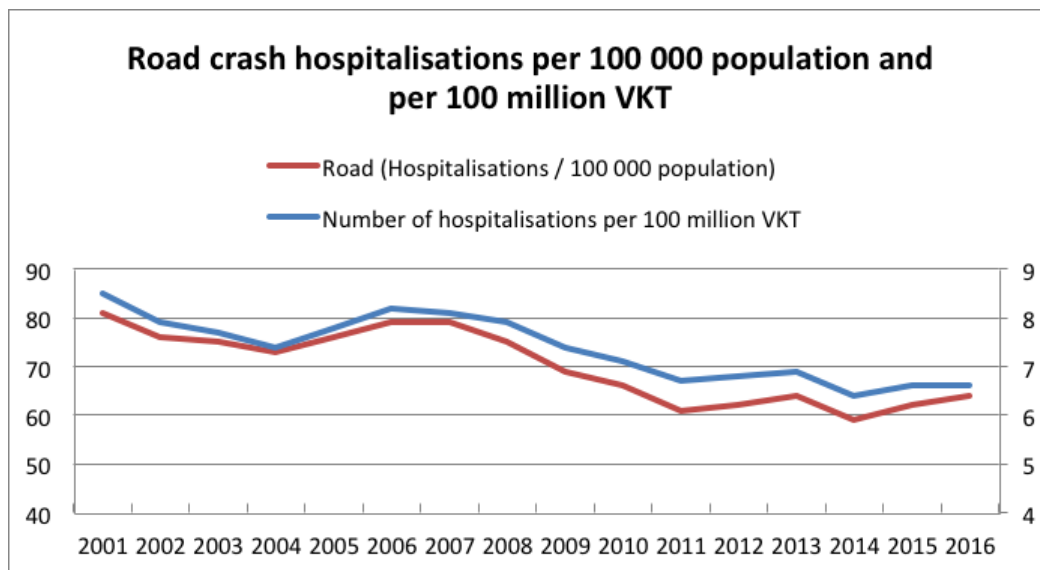


Figure 44 Road crash hospitalisations per capita and kilometres travelled, 2001-2016

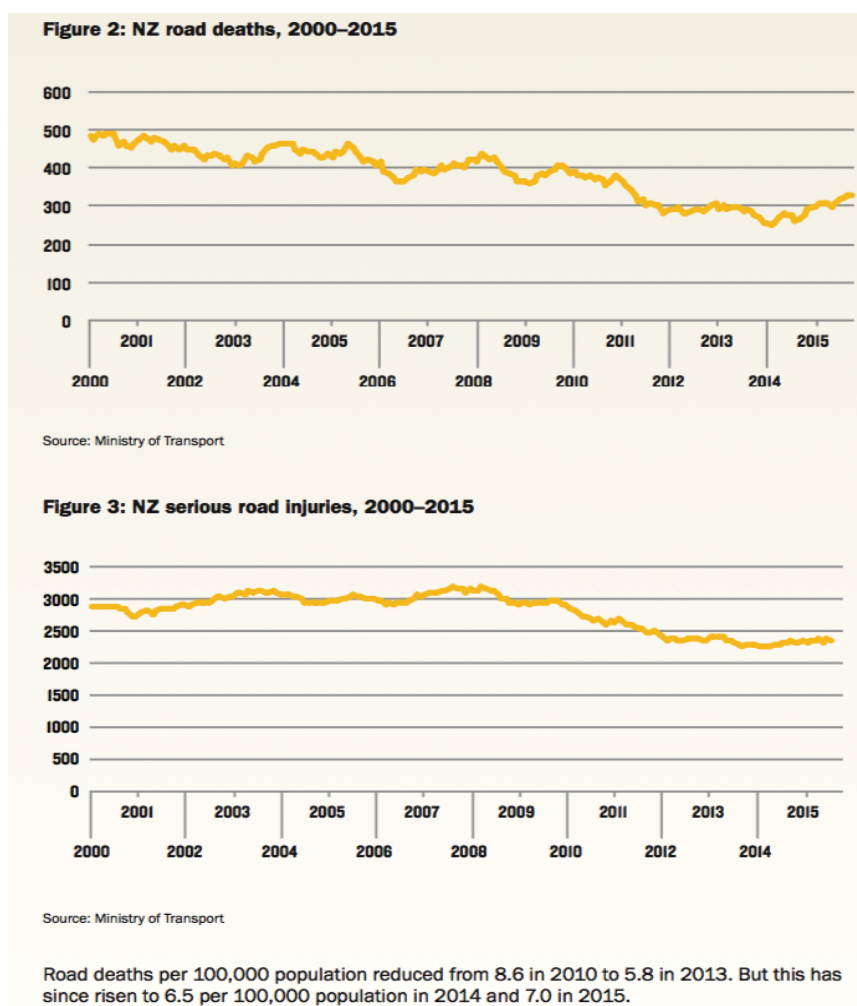


Figure 45 New Zealand road deaths and serious road injuries, 2000-2015

Developed in 2010, The Safer Journeys framework was created with the specific intention of creating

a “more forgiving road system that takes human fallibility and vulnerability into account. Under a Safe System we design the whole transport system to protect people from death and serious injury”.<sup>30</sup> It involves all parts of the road system: roads and roadsides, speed, safe vehicles, and road use. Priority is placed on areas with the most potential to reduce death and serious injury. The premise behind the plan is that road crashes are inevitable because human error will always occur, and road use takes place in a system whose features can be designed or changed to minimize the incidence of human error and the consequences of a crash when it does occur.

The NZTA and the Ministry of Transport have a rich data source, which they utilise to produce informative reports and statistics that underpin current and future initiatives. Relatively “raw” data is freely available and both have worked collaboratively with other organisations. There is also a detailed research strategy, which has implications and opportunities for health, including for trauma.<sup>30</sup>

Based upon Ministry of Transport data:<sup>31</sup>

- Provisional road toll for 2017 is 379 deaths

During the 2016 calendar year there were:

- 328 deaths (compared to 319 in 2015)
- 286 fatal road crashes
- 9,682 injury crashes
- 12,456 people injured

Casualty rates for 2016 were:

- 0.9 deaths per 10,000 vehicles
- 34 injuries per 10,000 vehicles
- 7.0 deaths per 100,000 population
- 265 injuries per 100,000 population

Data is also available by regions. Figures 46 - 49 are of Ministry of Transport tabular data and illustrate the regional variability in road traffic crashes. They also highlight that, despite the variability in incidence, the reduction in road traffic crashes and fatalities overtime has been fairly uniform.

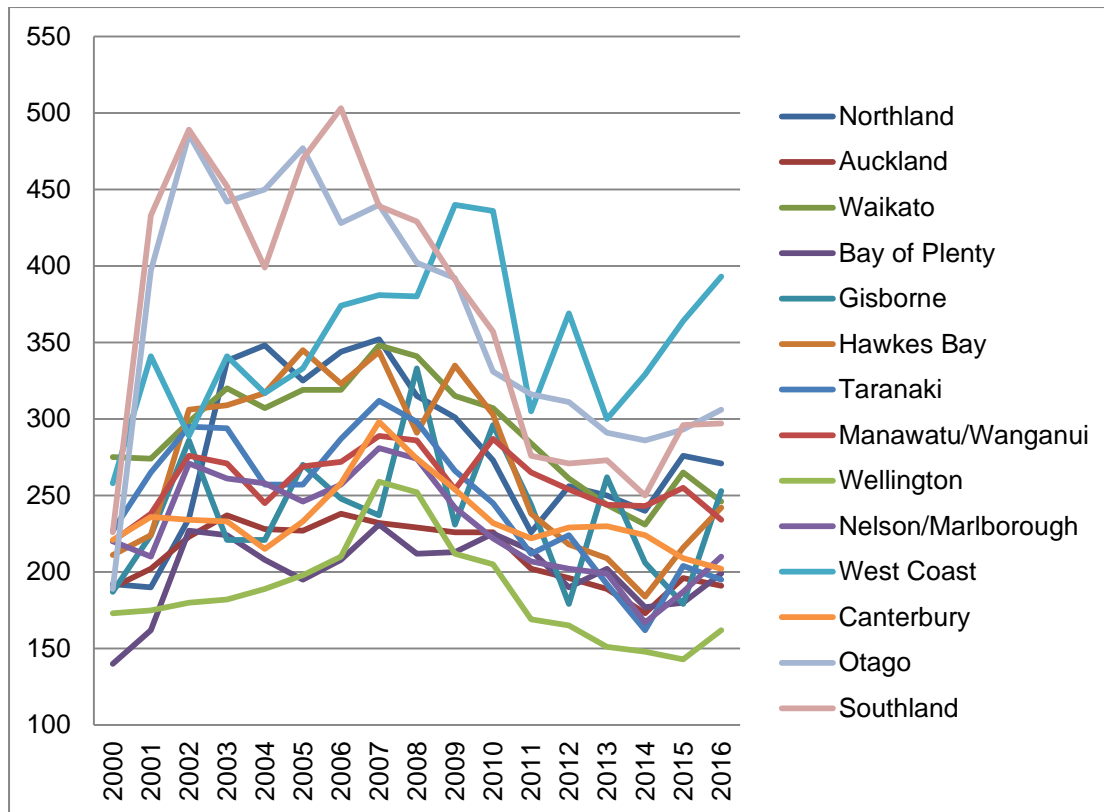


Figure 46 Road traffic crash rates (annual number per 100 000 population) by region, 2000-2016<sup>3</sup>

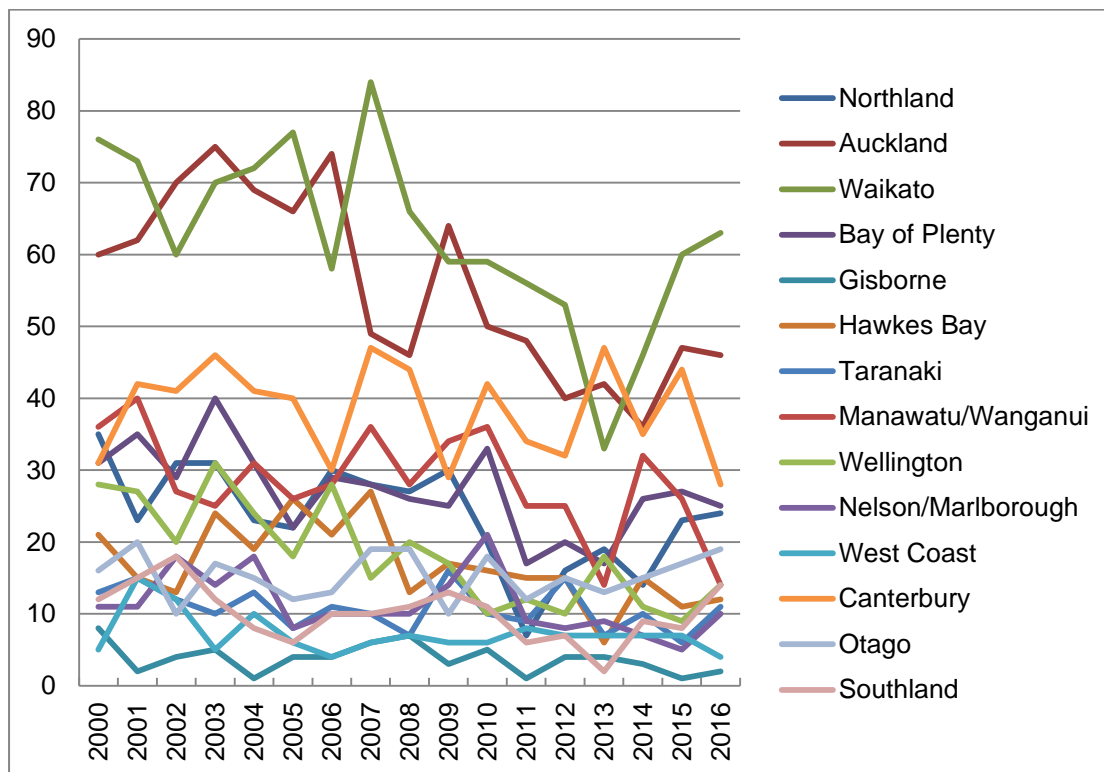


Figure 47 Annual number of fatal crashes by region, 2000-2016.<sup>3</sup>

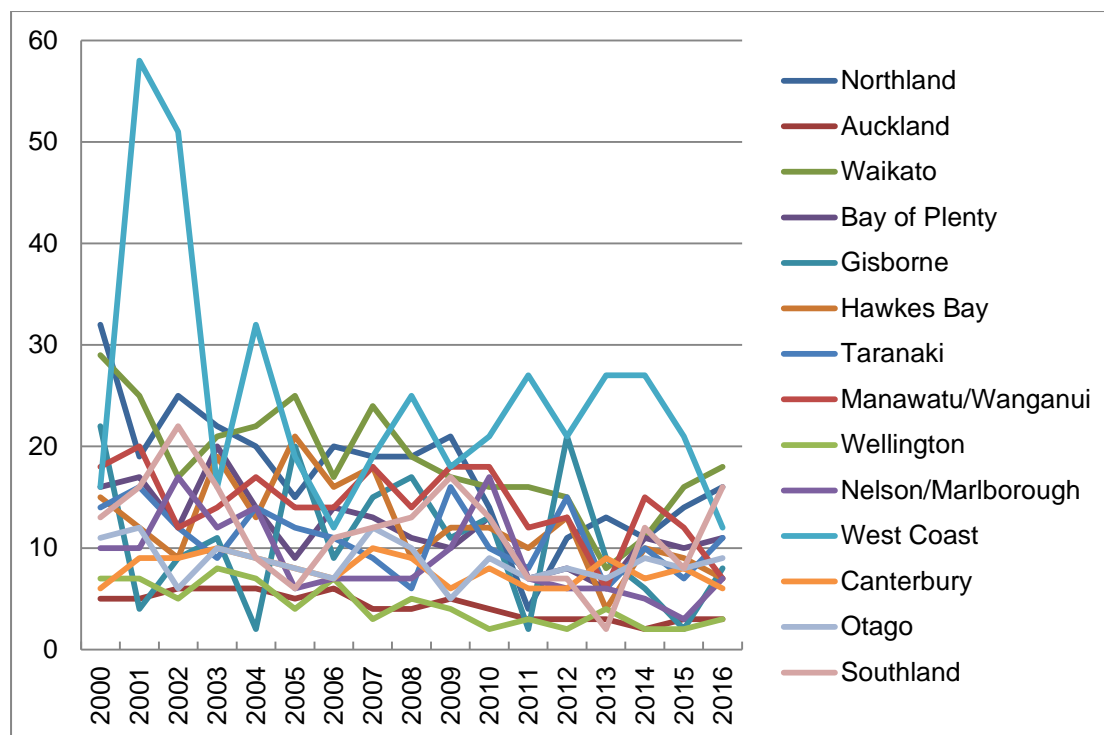


Figure 48 Annual number of deaths on roads per 100 000 population by region, 2000-2016<sup>3</sup>

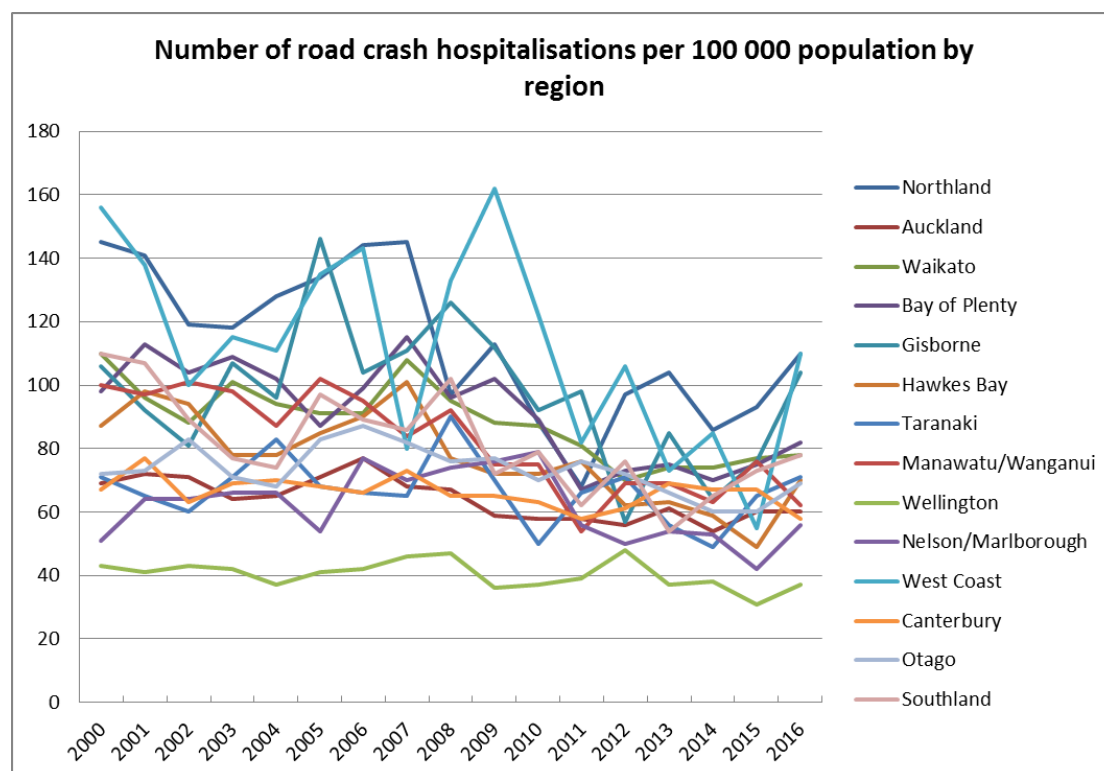


Figure 49 Number of road crash hospitalisations per 100 000 population by region, 2000-2016<sup>3</sup>

The Ministry of Transport commissioned a report “Why people die in road crashes” in 2016.<sup>32</sup> Amongst the factors considered were after crash medical care. Information was limited to that

available on the crash reports. Of potential relevance are the following findings with respect to 70 rural road fatalities:

- In three (4%) of cases it is possible, and in some cases even probable, that the victim would have survived with a more rapid response and no cases where it was considered very probably that the fatality was preventable
- In several of the crashes, the victim or the driver suffered from a medical condition which contributed to the crash. This condition was not the cause of death.
- For two (3%) fatalities, where medical conditions very probably contributed to the crash and three (4%) fatalities where a medical condition possibly contributed to the crash.
- For two (3%) fatalities, frailty due to age was very probably a cause of death and seven (10%) fatalities where this was possibly the case.

Age, frailty and comorbidities are an important consideration with respect to trauma service provision. Trauma is no longer just “a young person’s surgical disease”. An ageing population is seeing an increase in elderly trauma, and with age an increasing incidence of comorbidities amongst injured patients, all of which can impact upon trauma outcomes.<sup>33</sup> This fact is also altering the approach to trauma care, both acute and sub-acute and rehabilitation, as it will require a multidisciplinary specialist team approach to manage what is now a complex multi-dimensional illness.<sup>34-36</sup> Furthermore, it is likely that outcomes of elderly trauma would be better in high trauma volume centres with a broad representation of other health specialities.<sup>37</sup>

## International Road Traffic Crash, Fatality, Injury and Infrastructure Comparative Data

OECD, other country and local comparative data suggest that New Zealand has invested substantially in infrastructure between 2000 and 2015 (Fig 50 and 51). During the same period, there has been a reduction in road traffic crashes, fatalities and injuries. However values remain above those of Australia. (Fig 52-59).

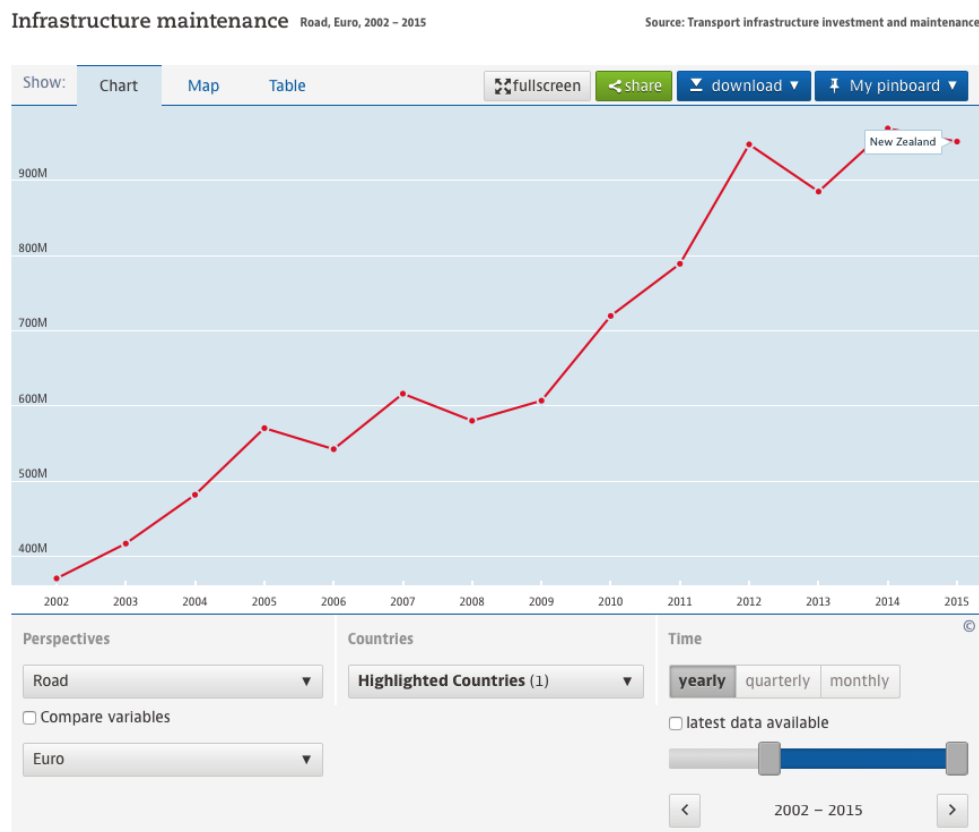


Figure 50 Infrastructure maintenance € spent on roads in New Zealand by year, 2002-2015

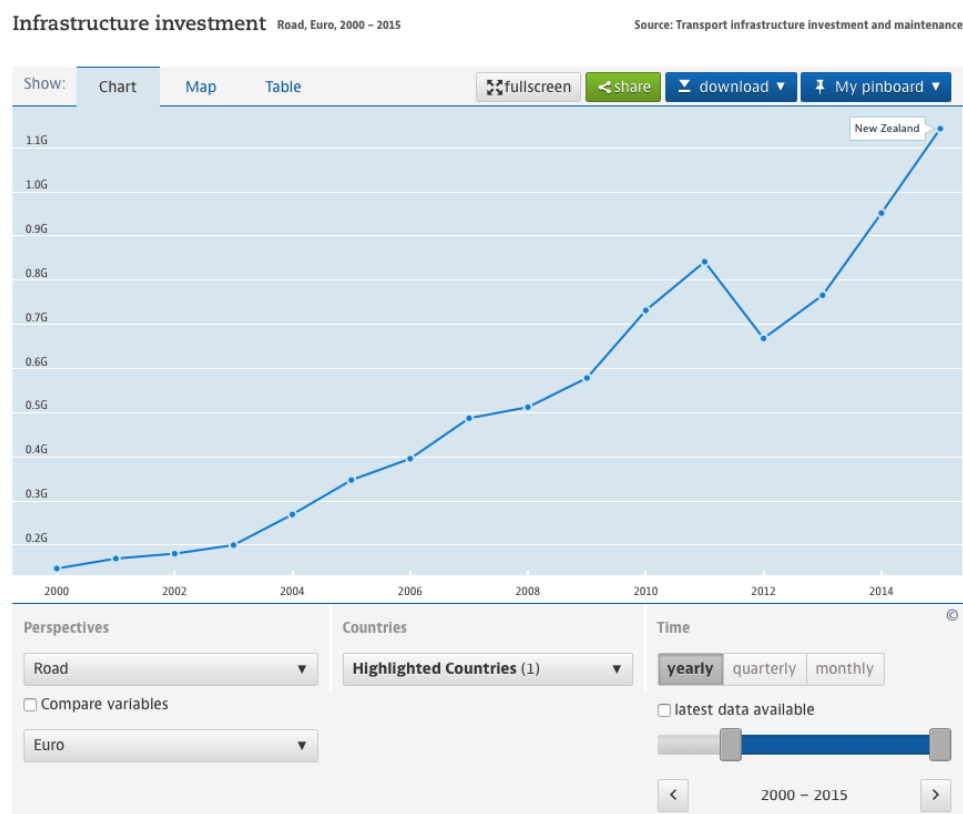


Figure 51 Infrastructure investment, € spent on roads in New Zealand, 2000-2015<sup>38</sup>

*Definition of Infrastructure investment*

*Infrastructure investment covers spending on new transport construction and the improvement of the existing network. Infrastructure investment is a key determinant of performance in the transport sector. Inland infrastructure includes road, rail, inland waterways, maritime ports and airports and takes account of all sources of financing. Efficient transport infrastructure provides economic and social benefits to both advanced and emerging economies by: improving market accessibility and productivity, ensuring balanced regional economic development, creating employment, promoting labour mobility and connecting communities. This indicator is measured as a share of GDP for total inland investment and in euros for the road, rail, air, inland waterways and sea components.*



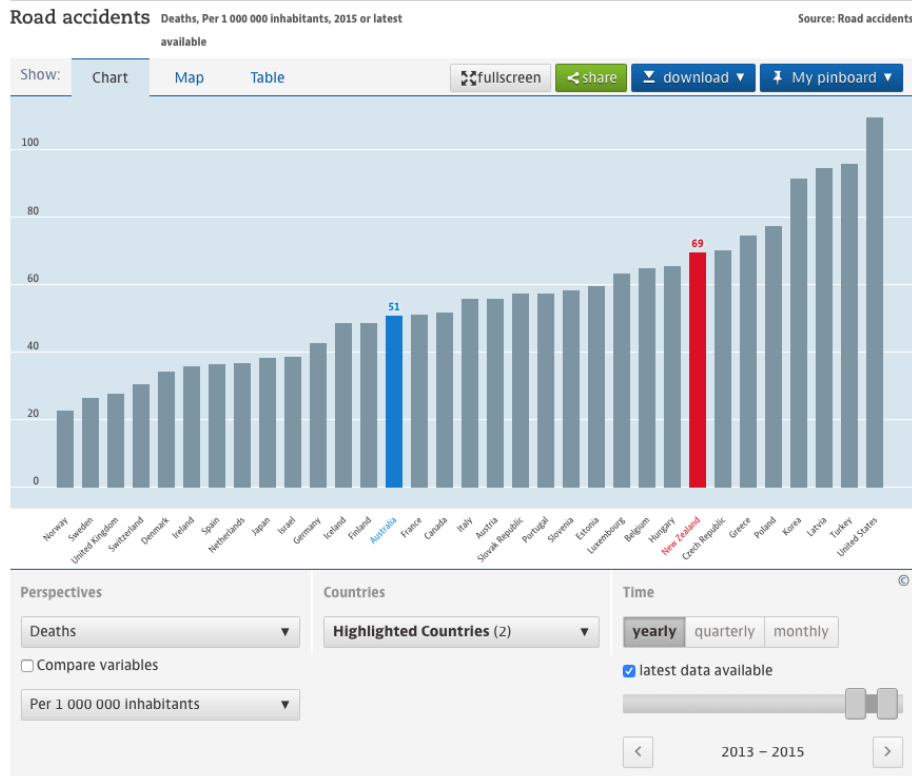


Figure 52 Road deaths (per 1 000 000 inhabitants) in 2015 (or latest) by country<sup>39</sup>

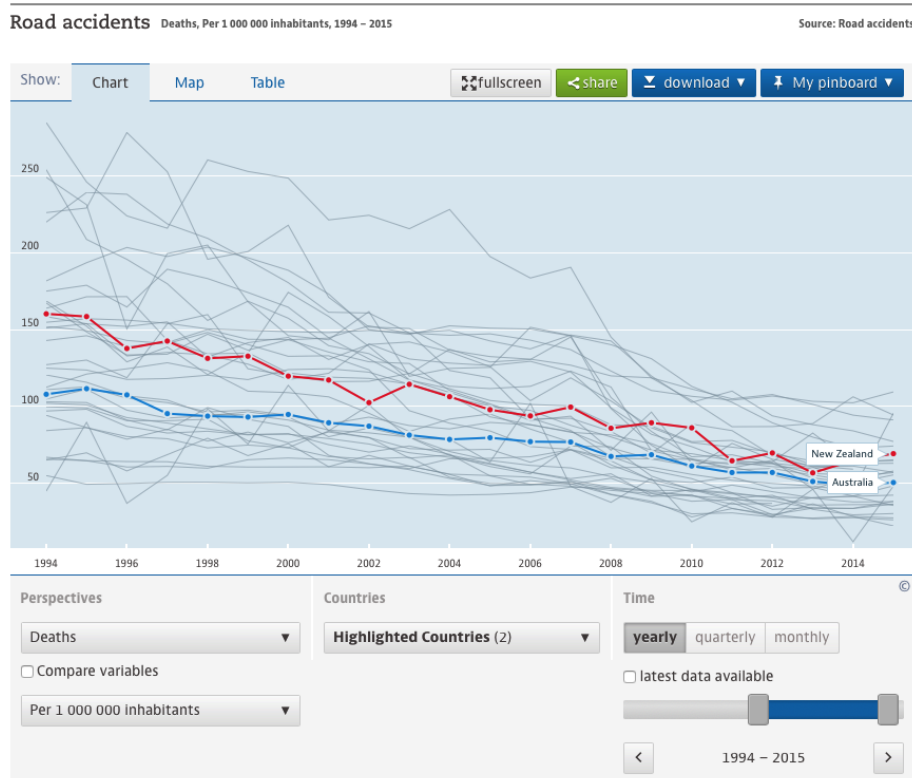


Figure 53 Road deaths (per 1 000 000 inhabitants) 1994-2015 by country<sup>39</sup>

Report from the Consultation Trauma Verification of the New Zealand Trauma System  
27 Nov – 1 Dec 2017

Road accidents Deaths, Per 1 000 000 inhabitants, 1994 – 2015

Source: Road accidents

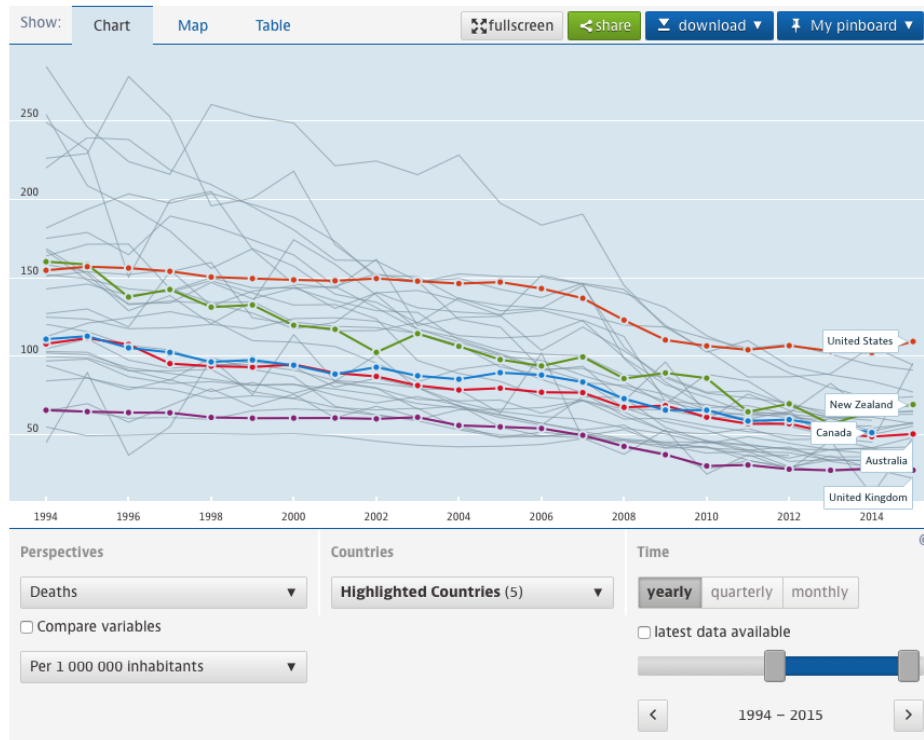


Figure 54 Road deaths per 1 000 000 inhabitants, 1994-2015, per country<sup>39</sup>

Road accidents Deaths, Number, 1994 – 2015

Source: Road accidents

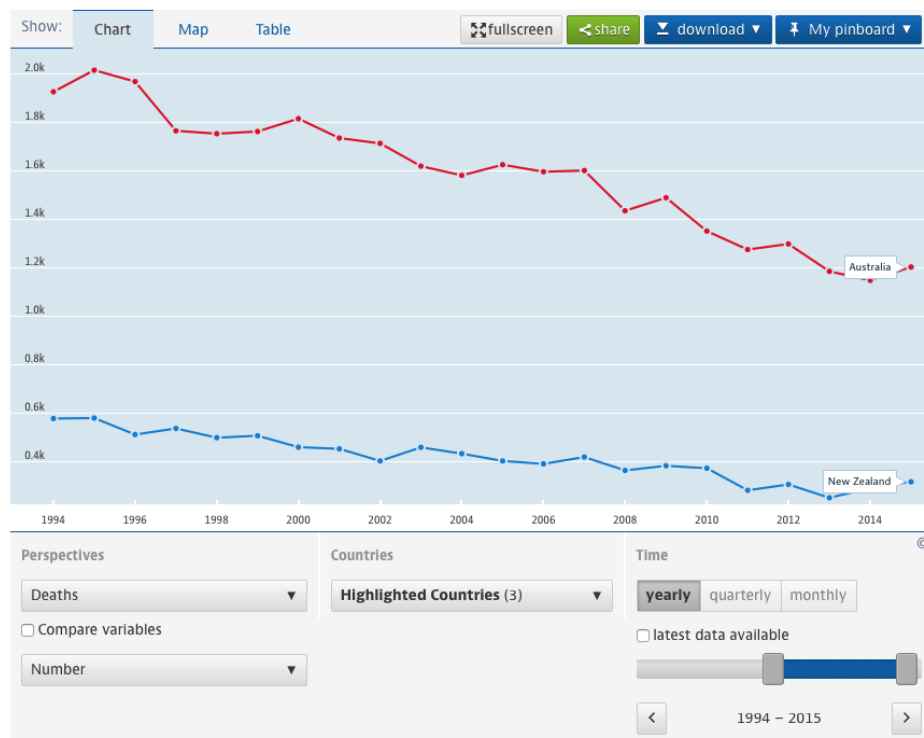


Figure 55 Annual number of road deaths, 1994-2014 for Australia and New Zealand<sup>39</sup>

Report from the Consultation Trauma Verification of the New Zealand Trauma System  
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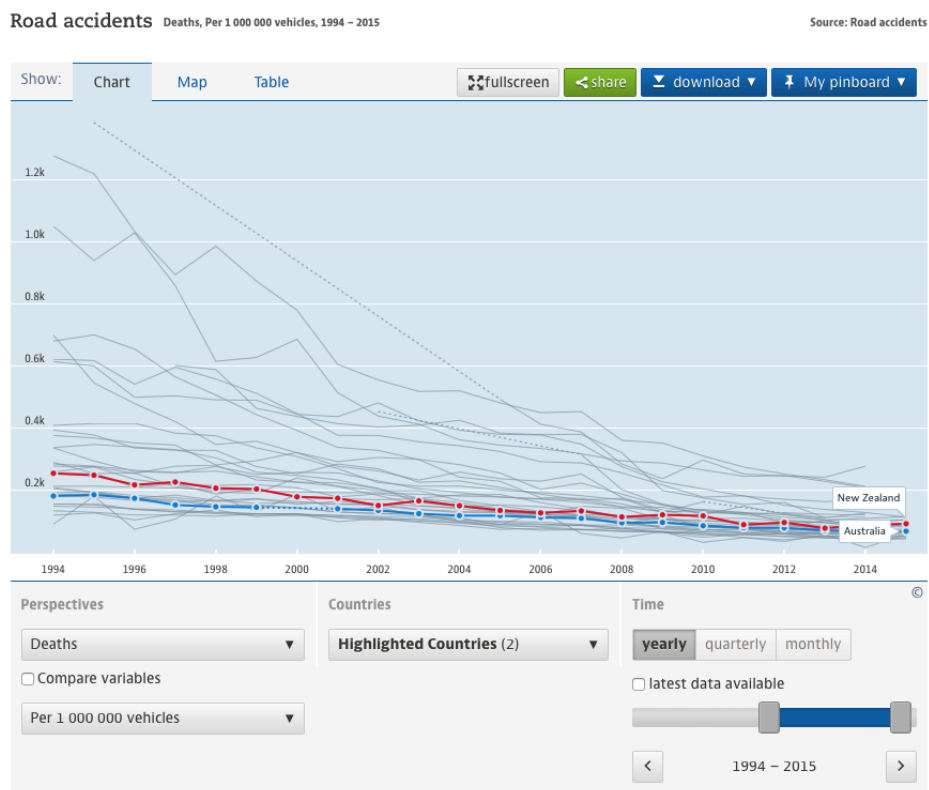


Figure 56 Road deaths per 1000 000 vehicles, 1994-2015, by country<sup>39</sup>



Figure 57 Road deaths per 1 000 000 vehicles, 2015 or latest available, by country<sup>39</sup>

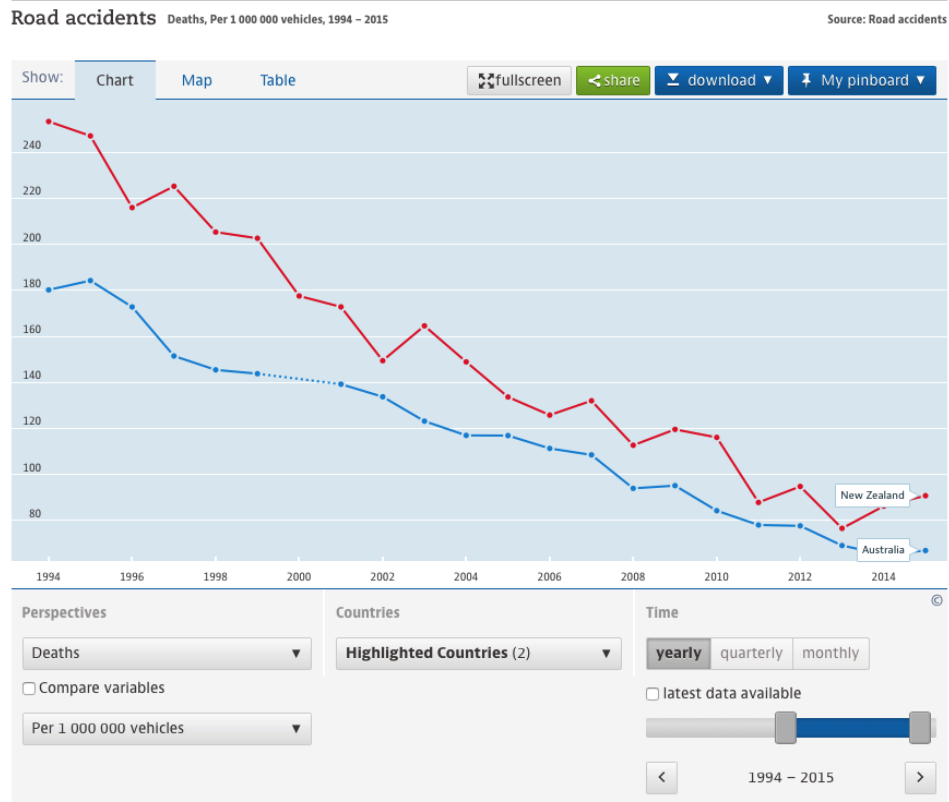


Figure 58 Road deaths per 1 000 000 vehicles, 1994-2015, for New Zealand and Australia<sup>39</sup>

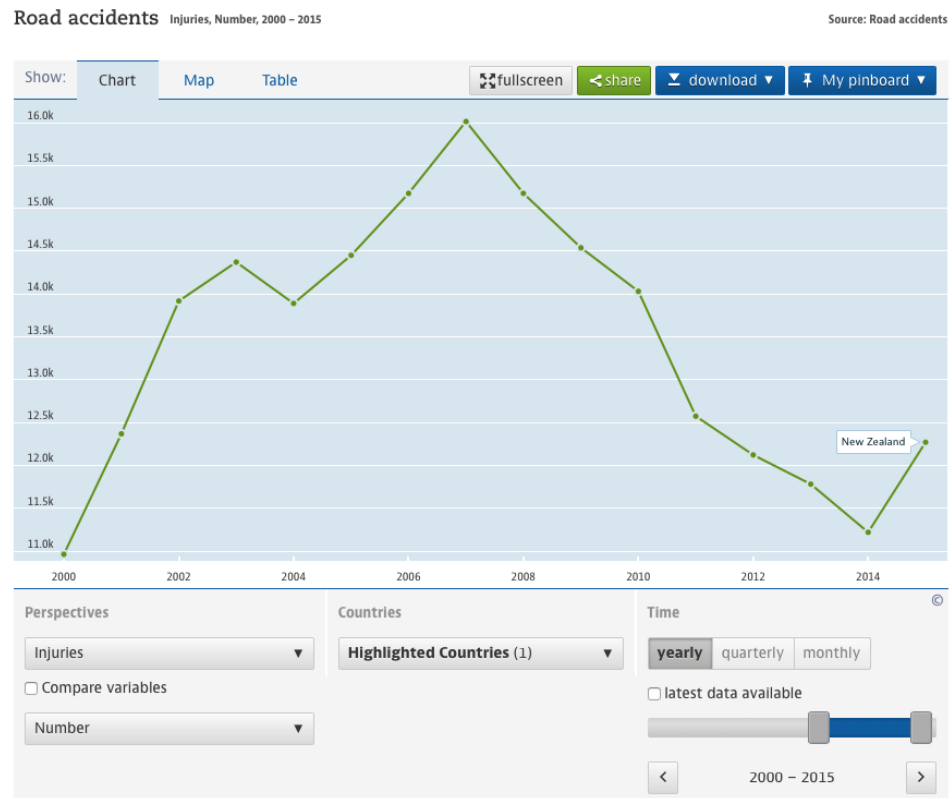


Figure 59 Annual number of road injuries, New Zealand 2000-2015<sup>39</sup>

*Definition of Road accidents*

*Road accidents are measured in terms of the number of persons injured and deaths due to road accidents, whether immediate or within 30 days of the accident, and excluding suicides involving the use of road motor vehicles. A road motor vehicle is a road vehicle fitted with an engine as the sole means of propulsion and one that is normally used to carry people or goods, or for towing, on the road. This includes buses, coaches, trolleys, tramways (streetcars) and road vehicles used to transport goods and to transport passengers. Road motor vehicles are attributed to the countries where they are registered, while deaths are attributed to the countries in which they occur. This indicator is measured in number of accidents, number of persons, per million inhabitants and million vehicles.*

## District Health Boards and Regions

District Health Boards (DHBs) were established in 2001 by the New Zealand Public Health and Disability Act. Although they differ in size, structure and approach, all 20 DHBs have a common goal, being to improve the health of their populations by delivering high quality and accessible health care.

DHB functions include funding, planning and provision of services. DHBs hold contracts and agreements with organisations that provide the health services required to meet the needs of the respective DHB's population.

DHBs are publicly funded. The share of funding they receive is based on:

- the size and demographic mix of their population (age, gender, ethnicity and deprivation)
- their population's past use of health services

The DHBs are not well placed to determine how to best provide for high-cost and low-volume services. To plan for, and support, these services, geographically proximate DHBs are grouped together to form a regional network that encourages collaboration, cooperation and efficiencies. Other challenges with this model of devolved decision making is ensuring national consistency and equity of service delivery, maintaining value for money, and encouraging collaborative system leadership, not just within regions, but at a national level.

It was noted to the Trauma Verification team that quality activities such as multidisciplinary audit across DHBs was difficult and, in particular, loop closure of identifiable patient safety issues difficult to complete and monitor, primarily due to geo-political factors. The less mature the regional network trauma system, the harder it was to precipitate quality improvement and, with that, momentum for quality trauma care.

The 20 DHBs have been organised into four arbitrary geographic regions from north to south. A description of the regions and DHB is given in the table below. (Table 1)

Table 1 Overview of hospital capability and demographics by DHB and regional trauma networks

(based upon 2006 New Zealand census data and 2008 MoH designation)

Overview of hospital capability and demographics by DHB							
Region	DHB	Population	Demographics	Trauma Hospitals	Role Delineation Level		
					ICU	ED	Surgery
Northern Region	Northland	192,487	Large percentage Maori, high deprivation, some concentration in Whangarei otherwise mostly rural	Whangarei - Comprehensive secondary service	4	4	5
	Waitemata	504,165	Large metro population with high and low deprivation. No trauma hospitals		4	5	5
	Auckland	411,454	Large metro population with high and low deprivation	Auckland City Hospital - Comprehensive adult tertiary services (except Burns and Plastics) and some quaternary services Starship Childrens Hospital - Comprehensive paediatric tertiary and quaternary services	6	6	6
	Counties Manukau	491,575	Large metro population with low deprivation and high Pacific and Maori population	Middlemore Hospital - Comprehensive secondary services and National Burns Centre and plastic surgery. Spinal unit	5	5	6
Midland Region	Waikato	388,949	Mixed rural and urban. Urban centre Hamilton.	Waikato (Hamilton)- comprehensive tertiary services	6	6	5
	Taranaki	121,442	Mixed rural and urban. Urban centre New Plymouth.	Taranaki Base Hospital - comprehensive secondary services	4	4	5
	Tairāwhiti	56,269	Mixed urban and rural. Urban centre Gisborne	Gisborne Hospital - limited secondary services	3	3	3
	Bay of Plenty	246,904	Mostly urban, with largest centre in Tauranga	Tauranga Hospital - comprehensive secondary services Whakatane Hospital - limited secondary services	Tauranga - 5 Whakatane - 3	Tauranga - 4 Whakatane - 3	Tauranga - 5 Whakatane - 3
	Lakes	110,720	Mixed rural and urban. Urban centre Rotorua	Lakes Hospital - limited secondary services			
Central Region	Capital & Coast	262,378	Urban population in Wellington	Wellington Regional Hospital - most tertiary services			
	Hutt Valley	142,109	Urban population in Hutt Valley. All trauma goes to Wellington. Hutt Hospital		4	4	5
	Wairarapa	48,849	Mostly rural population. All trauma goes to Wellington		3	3	
	Mid Central	182,668	Mixed rural and urban. Urban centre is Palmerston North	Palmerston North Hospital - comprehensive secondary services	4	5	5
	Whanganui	76,897	Mixed rural and urban. Urban centre is Whanganui	Whanganui Hospital - limited secondary services	3	3	5
	Hawkes Bay	4,296,976	Mixed rural and urban. Urban centres are Napier, Hastings and Wairoa	Hawkes Bay Regional Hospital - comprehensive secondary services	5	4	6
South Island Region	Canterbury	496,734	Large urban centre in Christchurch, some rural areas	Christchurch Hospital - comprehensive tertiary services, spinal unit	6	6	5
	West Coast	40,908	Very small population dispersed over large geographical area. Southern Alps border most of the area, with variable weather.	Greymouth Hospital - limited secondary services	3	3	3
	South Canterbury	65,622	Large rural area. Urban centre Timaru	Timaru Hospital - limited secondary services	4	3	4
	Southern	306,187	Two urban centres in Dunedin and Invercargill, and large rural area	Dunedin - limited tertiary services Southland - comprehensive secondary services	Dunedin - 4 Invercargill - 3	Dunedin - 5 Invercargill - 3	Dunedin - 4 Invercargill - 3
	Nelson Marlborough	150,660	Main centres Nelson and Blenheim, otherwise large rural area	Nelson - comprehensive secondary services			

Table1A DHB demographics based upon 2013 New Zealand census data

District Health	Population	Percent total	Number of Māori and percent of total	Percent of DHB Māori	Number and percent of total, born	Percent DHB born	Median household
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Board		population	Māori population		overseas population	overseas	income
Northland	151,692	3.6	44,928 (7.5%)	29.6	21,597 (2.2%)	14.2	47,000
Waitemata	525,555	12.4	46,302 (7.7%)	8.8	181,791 (18.1%)	34.6	75,800
Auckland	436,341	10.3	31,542 (5.3%)	7.2	171,054 (17.1%)	39.2	80,100
Counties Manukau	469,293	11.1	67,944 (11.4%)	14.5	166,617 (16.6%)	35.5	73,500
<b>Northern Region</b>	<b>1,582,881</b>	<b>37.3</b>	<b>190,716 (31.9%)</b>	<b>12.0</b>	<b>541,059 (54.0%)</b>	<b>34.2</b>	<b>69,100</b>
Waikato	359,310	8.5	74,049 (12.4%)	20.6	60,909 (6.1%)	17.0	58,900
Lakes	98,187	2.3	31,440 (5.3%)	32.0	14,424 (1.4%)	14.7	55,900
Bay of Plenty	205,995	4.9	47,277 (7.9%)	23.0	33,723 (3.4%)	16.4	54,600
Tairāwhiti	43,653	1.0	19,683 (3.3%)	45.0	3,873 (0.4%)	8.9	50,500
Taranaki	109,752	2.6	18,165 (3.0%)	16.6	13,239 (1.3%)	12.0	58,400
<b>Midland Region</b>	<b>816,897</b>	<b>19.3</b>	<b>190,614 (31.8%)</b>	<b>23.3</b>	<b>126,168 (12.6%)</b>	<b>15.4</b>	<b>55,660</b>
Hawke's Bay	151,692	3.6	34,977 (5.8%)	23.1	20,775 (2.1%)	13.7	53,300
Whanganui	60,120	1.4	14,151 (2.4%)	23.5	6,492 (0.7%)	10.8	45,700
Midcentral	162,564	3.8	28,347 (4.7%)	17.4	23,700 (2.4%)	14.6	52,200
Hutt	138,378	3.3	21,213 (3.5%)	15.3	29,739 (3.0%)	21.5	69,200
Capital and Coast	283,704	6.7	28,749 (4.8%)	10.1	76,755 (7.7%)	27.0	83,100
Wairarapa	41,112	1.0	6,360 (1.1%)	15.5	5,331 (0.5%)	13.0	52,000
<b>Central Region</b>	<b>837,570</b>	<b>19.7</b>	<b>133,797 (22.4%)</b>	<b>16.0</b>	<b>162,792 (16.3%)</b>	<b>19.4</b>	<b>59,250</b>
Nelson Marlborough	136,995	3.2	12,384 (2.1%)	9.0	23,976 (2.4%)	17.5	54,300
West Coast	32,148	0.8	3,171 (0.5%)	9.9	3,300 (0.3%)	10.3	55,000
Canterbury	482,178	11.4	37,971 (6.3%)	7.9	93,906 (9.4%)	19.5	66,700
South Canterbury	55,626	1.3	3,843 (0.6%)	6.9	6,402 (0.6%)	11.5	53,000
Southern	297,423	7.0	26,085 (4.4%)	8.8	44,088 (4.4%)	14.8	56,700
<b>South Island Region</b>	<b>1,004,370</b>	<b>23.7</b>	<b>83,454 (13.9%)</b>	<b>8.3</b>	<b>171,672 (17.1%)</b>	<b>17.1</b>	<b>57,140</b>
Area outside DHB	324	0.0	18 (0.0%)	5.6	96 (0.0%)	29.6	44,200
<b>New Zealand</b>	<b>4,242,048</b>	<b>100.0</b>	<b>598,602</b>	<b>14.1</b>	<b>1,001,787 (100.0)</b>	<b>23.6</b>	<b>63,800</b>





Figure 60 Location of the four New Zealand regional trauma networks (red triangles represent tertiary major trauma hospitals and yellow triangles represent trauma hospitals)

## **Northern Region and the Northern Region Trauma Network**

This region comprises 36% of the population, and is mostly concentrated in the metro Auckland area, with large rural areas in the far north. It includes the four DHBs for Northland, Waitemata, Auckland, and Counties Manukau. It is supported by the Northern Regional Alliance for regional coordination and data analysis. The Chair of the Network is Dr Michael Roberts, Chief Medical Officer, Northland DHB. It has a regional trauma network operational for three years with a clinical lead and programme manager. Its priorities are clinical audit, inter-hospital guidelines, hospital guidelines, education and cross sector work. Data collection has been in place in three hospitals for 10 – 20 years.

There is fragmentation of the plastics service delivered at Middlemore Hospital from other tertiary services delivered at Auckland City Hospital. Patients, with hands, plastics and maxillo-facial injuries are transferred from one hospital to another. For certain cohorts of major trauma patients who have injuries to multiple parts of the body, and thus under the care of more than one specialty, this fragmentation of care is significant.

An analysis, over a 6-month period, identified 83 patients transferred for plastics, orthopaedic or maxillofacial referral. This is around three patients per week from inpatients and the Emergency Department and will be substantially more if outpatient volumes were included.

These circumstances are not ideal, and places patients at risk (unnecessary transports, delays in service provision, unnecessary utilisation of important transport services, etc.) and fragments care in multi-injured patients. The following have been suggested by senior clinicians as an alternative to existing practices and inequities:

- Joint service with teams employed by both DHBs with theatre sessions, rounds and clinics in both locations
- Outreach service where the plastics and maxillofacial services are based at CMDHB but has regular theatre sessions, rounds and clinics at Auckland
- Ad hoc visiting where plastics SMOs visit on request to review a patient (i.e. an outreach Consultation service).

The Trauma Verification Team considered, and supports those suggestions as a patient-centred solution.

Middlemore hospital receives major trauma patients, but does not have Neurosurgical or Cardiothoracic services.

Northland hospital is a 250 bed hospital that receives approximately 100 major trauma cases per year. It does not have neurosurgery, and patients with traumatic brain injury (TBI) that do not require neurosurgical intervention will stay at Northland. Inter-hospital transfers are typically performed by

inexperienced ICU registrars, generally not adequately trained, with varied experience, and who are given a half day orientation to helicopter. Transfers are mostly supported by flight nurses.

### **Midland Region and the Midland Trauma System**

This region comprises 20% of the population, and is a mix of urban and rural. The Network covers the five DHBs for Waikato, Taranaki, Lakes, Bay of Plenty, and Tairāwhiti. The Chair is Dr Grant Christey, Clinical Lead Midland Trauma System, Waikato DHB.

The Trauma Network has been operational for the past 10 years, with clinical lead, programme manager, data support, and research. It hosts the New Zealand Major Trauma Registry (NZ-MTR) on behalf of the 20 DHBs and is also responsible for the registry's data quality assurance and reporting functions. Its priorities are data, research, guidelines, and cross sector collaboration.

It is the most advanced of all the regions with respect to trauma. There is a strong governance structure with multi-representative Strategic and Operational Groups that oversees the Major Trauma Service (MTS) and its activities. The Waikato hospital, and subsequently the regional hospitals, have all undergone a RACS Trauma Verification review. The MTS has an extensive trauma registry, which is of high quality, integrated with other systems and geo tagged. This trauma registry has been utilised to drive policy and research, some of which is collaborative, output. It is web-based and therefore contributing DHBs have access to their data. Research and education activities have been supported by the Midland Trauma Research Centre. There is a Midland District Health Plan that outlines a comprehensive approach for trauma care within the region.<sup>40</sup>

### **Central Region and the Central Region Trauma Network**

This region comprises 20% of the population in a mix of rural and urban centres. The Network covers the six DHBs in the lower part of the North Island, being the Capital and Coast, Hutt, Wairarapa, Hawkes Bay, Mid Central, and Whanganui. The Network includes pre-hospital and hospital trauma clinicians across the region and the Chair is Dr James Moore, Anaesthetist & Intensivist Care Specialist.

The trauma Network has been operational for around 12 months, with a clinical lead and support from a trauma coordinator. Its priorities are to embed data collection in all DHBs and improve the capacity and capability of staff.

Outstanding issues are funding for clinical staff, in particular nursing and trauma clinical lead. With respect to nursing, funding only covers data collection. This is not sustainable professionally, nor efficient, as a clinical load would complement both data and clinical efficiency. The Trauma medical lead FTE allocation to trauma is insufficient to manage the role as would be expected.

General and Orthopaedic surgical services are provided at all public hospitals in the region. There is limited vascular surgical service at Palmerston North Hospital and Hawkes Bay Hospital. Interventional Radiology is essentially only available at the Wellington Hospital. Intensive Care services are provided at all major trauma hospitals, although only Wellington and Hawkes Bay Hospitals operate ICUs which are fully staffed by specialist intensivists.

There is a deficiency in the integration of trauma services with not all the essential tertiary trauma surgical services on site at Wellington Hospital. Plastics, Burns and Maxillofacial surgery are provided at Hutt Hospital. There is clinician support, but no administrative intention to move towards providing all services on one site.

Trauma leadership at Wellington Hospital is essential a 0.1FTE Clinical Medical Lead and 1.00FTE Nursing Lead. There are approximately 20 major traumas per month, about 50% being inter-hospital transfers. Regional coordination is perceived to have improved over the years, and this has contributed to increased trauma numbers, however Wellington Hospital has capacity issues with respect to available ICU beds. There is an established trauma committee, and a Regional Plan, which has trauma identified as a key strategy. In the absence of a trauma service, multi-trauma patients are admitted under specialty of most severe injury. Less severely injured often reside in “no-man’s land” with no team taking overall ownership of the patient, resulting in a prolonged stay in ED which presents a risk to the organisation and less than optimal care for patients.

### **Southern Region and the South Island Major Trauma Workstream**

This region comprises 24% of the population scattered across a large area. The Workstream covers the South Island’s five DHBs, Nelson Marlborough, West Coast, Canterbury, South Canterbury and Southern, and includes stakeholders from ambulance, DHB planning and funding, and hospital trauma clinicians. The Chair is Dr Mike Hunter, Intensivist and Surgeon, Dunedin Hospital.

The Southern Alps present a significant transport challenge given the high mountains and weather conditions. The regional trauma network has been operational for 12 months, supported by a programme manager. Trauma Nurse Coordinators have been appointed to roles in all South Island DHBs and have taken on responsibility for collecting and ensuring data is registered nationally.

A proposal for a Southern District Trauma System has been propagated by senior clinicians since 2014. The failure to gain approval of the proposed structure for a Trauma System, personnel and other resources has contributed to their inability to submit data to the NZ-MTR and fulfil other regional requirements as determined by the MTNCN. Based on the positive outcomes (reduction in mortality, hospital LOS, etc.) achieved at the Midland Regional Trauma System, with a similar structure, the estimated potential lives saved within the Southern Districts DHB is 5 – 6 lives per annum.

Christchurch is one of the very few tertiary hospitals with all the essential services on site, including

neurosurgery, cardiothoracic surgery, plastics, maxillary-facial surgery, paediatric surgery and interventional radiology. It has the second busiest ED in NZ, operating at high capacity. Despite its extensive capability, it lacks a Clinical Director of Trauma, a specific trauma service with bed card admission rights or a specific ward for multi-system trauma cases to be admitted to.

A major redevelopment is being planned and this would create an opportunity for infrastructure enhancement of existing trauma services and workflows.

Southland hospital is capable of managing most orthopaedic injuries, abdominal and some chest injuries. Patients with significant vascular, thoracic or traumatic brain injuries require transfer to Dunedin or Christchurch. Dunedin has some interventional radiology.

Dunedin Hospital is restricted by limited ICU capacity, an ICU that would not appear to meet College of Intensive Care Guidelines for an ICU (space, proximity of beds, etc.) and an ageing hospital infrastructure. There is also a lack of sufficient resources to have a functional trauma service e.g. patient journey from one acute area to the other is complex with regard to hospital design and other infrastructure issues such as different monitoring systems in ED and ICU. The Dunedin Hospital is often operating at high capacity and there is limited ability to manage seasonal variations. Nursing FTE in ICU is inadequate, often resulting in double shifts to cover the roster. The current working environment is particularly challenging for on-call retrieval nurses who may be called in overnight for a retrieval and then work the following day as this would appear to be in breach of “safe” hours. ED is also capacity limited with an antiquated design including, out dated resuscitation rooms.

Greymouth Hospital has 45 inpatient beds, receives approximately 40 ED presentations per day and 10 – 12 major trauma patients per year. The hospital covers a very large section of the west coast of the South Island, with a population of 30,000. ED staffing is a mixture of Rural GP and FACEM, who are all Emergency Management of Severe Trauma (EMST) trained. It has good telehealth links with Christchurch Hospital. Aeromedical retrieval is limited (Squirrel helicopter (Air Rescue Trust)) and coordinated via the Air Desk or Retrieval Coordination Centre for inter-hospital transfers. There is ICU consultant-led discussion with respect to need for transfer, and then the on-call retrieval coordinator for South Island organises inter-hospital transfer. The hospital has access to blood products, but in the case of a massive blood transfusion, platelets will be brought by the retrieval team.

## **All Regions**

All DHBs have identified, and almost all have formally appointed, Trauma Clinical Leads. The regional network supports trauma nurse training, data capture and submission to the NZ-MTR. As stated earlier, funding of those positions is through the DHBs.

The trauma networks in the Central and South Island Regions are relatively new and still developing, but over 2016 they have made steady progress and are building strong foundations for the future. Significantly, they have sought, and received, support from the more established Midland and Northern Regional Trauma Networks.

Within the MTNCN, each DHB is represented by their Regional Trauma Clinical Lead (a medical specialist) and Trauma Nurse Specialist. The Clinical Lead and Nursing positions are fractional appointments allocated to an existing specialist role. The current clinical leaders throughout the regions represent a cross-section of specialties, including emergency medicine, surgery, anaesthesia and intensive care. Most regions have a trauma committee representing a cross-section of specialties involved in management of trauma.

Funding for trauma is variable amongst the different regions. The region that has most progressed its funding model is the Midland Regional network. The MTS network is funded entirely by the DHBs on a customised pro-rata model, based on population size that also accounts for high fixed costs in smaller centres. Over a period of seven years, it has assessed its minimum requirement for staffing and other resources and related that figure to actual trauma workload. Recommendations have been submitted in the MTS Business Case 2017-2020 and have been agreed to by the Midland CEOs. The recommendations have been built into the MTS and local strategic plans and will be advocated for, and monitored by, the MTS Operational and Strategic groups, which in turn report to the MoH. In addition, the MTS registry supports the national NZ-MTR and has separate funding. The Midland Trauma Research Centre sits within MTS and is funded by the Midland DHB, augmented by external funding to support projects with external stakeholder groups.

The Midland Region has also undertaken Formal (Waikato Hospital) and Consultative Trauma Verification review, within the RACS Trauma Verification program, so as to benchmark performance and resourcing of those hospitals and inform Trauma System improvement. It is the only region in New Zealand to have done so. Furthermore, in Australia, only the Northern Territory has undertaken a similar extensive review of its trauma system, despite the potential value of Trauma System Verification reviews.<sup>41</sup>

Regional trauma networks, on the whole, appear to be very proactive, but under resourced. There also appears to be a lack of formal conduit for escalation of issues, beyond their own regions. For example, business cases for trauma service establishment just seem to go round and round within regional/DHB systems with, at times, slow to any resolution. The regional networks do not feel supported by the national network.

Similar issues arise when there reattempts at addressing quality issues, particularly if across regional or DHB boundaries. These aspects are slowing down progress and frustrating clinicians as they strive for quality and service delivery improvement. Current means of funding allocations, funding

constraints, and how funds are allocated for trauma and service initiatives is compounding the situation. For example, DHBs are mandated by MoH to provide registry data, and implement pre-hospital and triage and destination guidelines. However, the ACC pays for data collection and training of data collectors, and DHBs are required to provide additional funding for trauma service FTE (medical, nursing and data support) and other trauma service-related resources from existing (Population based block funding) derived resources.

## **Major Trauma National Clinical Network**

In 2009 the then Quality Improvement Committee recommended to the Minister of Health that a national trauma system be established in New Zealand. In 2010 the National Health Board, in close consultation with key stakeholders and clinicians, was tasked to review the potential benefits of such a system.

This review identified that trauma care was at that time variable and highly vulnerable to time-critical clinical response and decision-making, as well as potential system failure. It also noted there was potentially preventable mortality and morbidity, service quality and patient outcomes across New Zealand centres and that information to health services tasked with delivering trauma care was not widely available.

The review also considered information from trauma services in the United States, Australia, Canada, and the United Kingdom. This information highlighted the importance of functional and contemporary trauma systems to achieve improved service. It also highlighted the importance of establishing a national trauma network.

Subsequently, in 2010 the Minister of Health agreed that major trauma should receive targeted assistance. The Minister directed that the Major Trauma National Clinical Network (MTNCN) be formed as the primary mechanism for service improvement. The perceived benefits were considered to include a lower mortality, improved outcomes of survivors of trauma, and cost efficiency across all the regional health services.

In 2012 the ACC and MoH approved funding for a business case for the MTNCN. This support included funding for the program coordinator roles and other areas of major trauma. Funding for the clinical lead preceded this business case. While the MoH and the ACC are joint sponsors of the MTNCN, the ACC took a leading role in promoting and supporting. Funding of the MTNCN is on a 3-year cycle, and includes funding of a clinical lead, programme manager, quality assurance and reporting of data, incentive funding, and general expenses. The ACC also provides incentive funding (\$80K per annum), which is distributed to regional networks pro rata, based on the number of entries to the NZ-MTR.

The MTNCN is made up of senior clinicians and managers from New Zealand's four regional trauma networks, which in turn represent the 20 DHBs. It also includes representatives from ambulance services and other key stakeholders. It is overseen by Governance Group, and from within has a Clinical Network, National Data Governance and Operational Group. At its foundation are the regional trauma hubs. (Fig 61)



The Governance Group oversees the MTNCN work program and budget. Group members include sponsor representatives, the National Clinical Lead for Trauma, and the National Ambulance Sector Office.

The Operational Group is chaired by the National Clinical Lead for Trauma (Dr Ian Civil), and manages the operational aspects of the MTNCN. Members include the national clinical lead and coordinator, the four regional clinical leads and coordinators, representatives from the ambulance sector, and sponsor representatives.

The National Trauma Data Group is chaired by a regional lead who is independent of the national work program and registry (Dr Peter Freeman, Senior Emergency Physician at Lakes DHB). The group governs major trauma data collected in the New Zealand Major Trauma Registry and oversees requests for data for research and other purposes. Members of this group include representatives from each regional network, academics and researchers, and epidemiologists.

The MTNCN provides expert advice on key aspects of the MTNCN's work programme. The group also supports leadership on quality improvement initiatives. Chaired by the National Clinical Leader, members of this group include the Operational Group and other stakeholders such as: academics, clinicians from small and large hospitals, New Zealand Defence Force representatives, rehabilitation service and community representatives.

### HOW THE MAJOR TRAUMA NETWORK IS STRUCTURED

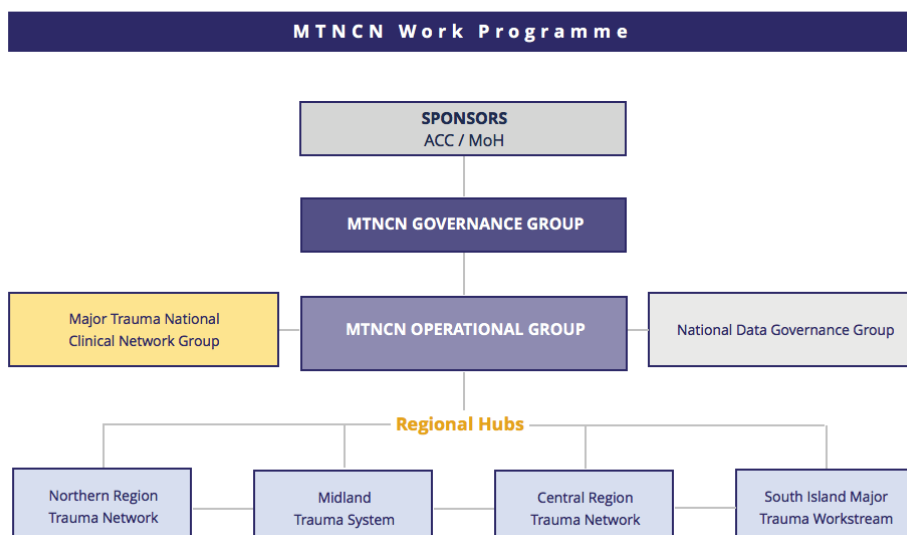


Figure 61 Structure of the Major Trauma National Clinical Network<sup>42</sup>

The relationship between the NZTA and the MTNCN is relatively recent, but strategically important, as both have the same objective of reducing road trauma and its consequences in New Zealand. After all, road crashes contribute to 52% of NZ's major trauma, with proportions ranging from 62% in the Midland Region to 48% in the Central Region.<sup>20</sup>

This relationship also ensures that both entities are functioning in unison, as the resources consumed, and advances made, by the NZTA with respects to improving road safety over the past few years, could potentially be mitigated by trauma care that is not optimal, and care that doesn't provide for those who survive a road crash, the greatest chance of an uncomplicated survival. This relationship is not insignificant, as data from the New Zealand Major Trauma Registry shows that between July 2016 and June 2017, of 344 people who died within 30 days following a road crash,<sup>31</sup> 284 died pre-hospital and 60 in-hospital. Furthermore, 634 people with serious injuries from road traffic crashes were admitted to hospital and survived, some of whom may have the potential for survival with lesser disability.

Considering the very high social costs of trauma (see above), even a small proportion of survival amongst the 60 in-hospital deaths, and improved functional capacity of the survivors, would have substantial immediate cost savings and reduction on pressure of future costs to cover longer term disability.

This relationship is also in keeping with NZ's obligations for delivering a safe system approach<sup>30</sup> and the United Nations Decade of Road Safety Action 2010 – 2020.<sup>43</sup>

Specifically the UN Decade of Action 5<sup>th</sup> Pillar mentions:

Increase responsiveness to emergencies and improve the ability of health systems to provide appropriate emergency treatment and longer term rehabilitation, by

- Developing pre-hospital care systems through the implementation of existing guidelines on pre-hospital care trauma care.
- Developing hospital trauma care systems and evaluating the quality of care through the implementation of guidelines on trauma care systems and quality assurance.
- Implementing appropriate road user insurance systems to finance rehabilitation services for crash victims.

Since its inception, the MTNCN has established a formal trauma system, through the creation of a national network made up of the four regional networks, established a national registry, is developing nationally consistent guidelines (e.g. pre-hospital destination policy), embarking upon quality improvement initiatives and trauma system performance measurement, and is planning for the establishment of a national trauma research centre.

A website has been created as a repository of information about the Network (<http://www.majortrauma.nz>). Education and training symposiums, as well as routine trauma training courses, have been conducted. The ACC Incentive Fund, which pays \$80K per annum to regions pro rata, based on number of entries to the NZ-MTR, has been a significant enabler to increasing the capability of trauma care through the funding of training opportunities for nurses and allied health.

A detailed strategic and implementation plan has also been developed.

## **New Zealand Major Trauma Registry<sup>44</sup>**

At the time of its formation, a key objective of the MTNCN was to lead the development and implementation of a national major trauma database, the New Zealand Major Trauma Registry (NZ-MTR). The journey for the NZ-MTR was not too dissimilar to that of the New Zealand Spinal Cord Registry.<sup>45</sup>

A data subcommittee assisted in developing the specifications and data components of NZ-MTR.<sup>42</sup> Thus, the fields to be included in a New Zealand Major Trauma Minimum Dataset (NZMDS) for data collection and submission to a NZ-MTR were determined. The NZ-MTR began on 1 July 2015, as a single web-based system.

In determining the dataset, consideration was given to the existing Midland Regional Trauma Registry and the Bi-National Trauma Minimum Dataset (BNTMDS) for Australia and New Zealand, used for the Australian Trauma Registry. To ensure alignment and potential for future comparison and collaboration, the NZMDS is identical or similar to the BNTMDS, wherever possible.

The cost of the Registry is considered to be \$220K per annum and an additional \$57K for quality assurance and reporting. Approximate cost per case is \$30.

There is a data dictionary that guides data accuracy and integrity. The data dictionary describes the fields to be collected by all hospitals across New Zealand that care for major trauma patients. Data for each patient is submitted by the final treating hospital to the NZ-MTR at a national level. Hospitals can collect additional trauma data elements based upon local needs. The data is designed to follow the patient journey, from the scene of injury to the referring hospital and/or to the definitive care hospital. The intention is to review the dictionary regularly so as to allow changes and improvements to be made as the need for them arises.

A number of initiatives are in place to assure data quality. This is important as, part of the operationalisation of the registry, around 20 relatively new trauma data collectors, all working in isolation, were established. The challenges of collecting accurate information in elderly patients who have had a fall has been highlighted as being important for future planning, and is likely to add to the existing amount and complexity of workload.

Collection and submission of data to the NZ-MTR is a MoH performance measure required of all DHBs. The DHBs have had to fund the allocated FTE for data collection, and have not received financial support for doing so from the MoH or the ACC.

The overall quality of data is said to be improving in its completeness and accuracy, as data collectors

become more familiar with their work and other quality assurance initiatives outlined. In some analysis, the improved accuracy has been important as it has altered prior trends and interpretations. It has been suggested that it will take 5 - 10 years to reap the full benefits of data collection.

The NZ-MTR collects a NZ-unique patient identifier, the NHI. This allows it to link with other related datasets (e.g. ambulance, and the ACC).

Major trauma and the inclusion criteria for the NZ-MTR, are:

All patients of any age admitted to hospital with either:

- Injury Severity Score (ISS) >12 (based on AIS 2005 Update 2008) or
- Death following injury (including deaths in ED)

Even where patients meet all the inclusion criteria, the following patients will be excluded:

Exclusion criteria

- Patients with delayed admissions more than 7 days after injury
- Poisoning or drug ingestion that do not cause injury
- Foreign bodies that do not cause injury
- Injuries secondary to medical procedures
- Isolated neck of femur fracture
- Pathology directly resulting in isolated injury
- Elderly ( $\geq 65$  years of age) patients who die with superficial injury only (contusions, abrasions, or lacerations) and/or have co-existing disease that precipitates injury or is precipitant to death (e.g. Stroke, Renal Failure, Heart Failure, Malignancy).
- Hangings
- Drowning

In 2016, 1,666 patients had been entered into the NZ-MTR, for a total of 2,967 patients overall since the start of data collection. The regions and DHBs are not all at the same level of readiness and maturity of data contribution to the NZ-MTR. Collectively, data is being submitted from 21 hospitals. Data collection and submission from the South Region DHB and a Northern Region DHB is incomplete. These gaps have limited the capacity to derive population-based results. It is estimated that when all regions are at full data capture, then around 2,000 patients will be entered each year.

The NZ-MTR does not collect data on non-major trauma. Physical injury (see definition under section “Health Quality and Safety Commission”) is captured from the National Minimum Dataset (NMDS), which is available from public hospitals for all DHBs and is to map non-major trauma. The Midland Trauma Registry collects data on non-major trauma.<sup>46</sup> The definitions of non-major trauma differ slightly between the organisations (see Table 2 for a comparison of definitions).

Table 2 Definitions of non-major trauma

<b>Health Quality and Safety Commission</b>	<b>Midlands Trauma Registry</b>
All hospital admissions coded as physical injury	Admission to an in-hospital bed within 7 days of injury
All ages	Age < 80 years
<p>Exclusions</p> <ul style="list-style-type: none"> <li>injuries caused by means other than energy transfer (e.g., poisoning, hanging and drowning)</li> <li>injuries that may have been caused by other disease processes such as osteoporosis or cancer</li> <li>isolated neck of femur fractures</li> </ul>	<p>Exclusions</p> <ul style="list-style-type: none"> <li>Hanging, drowning, asphyxiation, poisoning without evidence of external force</li> <li>Injury as a direct result of pre-existing medical conditions e.g. epilepsy, syncope, Parkinson's, etc.</li> <li>Insufficiency fractures (age ≥ 65 years): osteoporotic, osteopenic, metastatic, pathological, including fractured neck of femur, fractured neck of humerus, Colles' fracture</li> <li>Injury sustained is out of proportion to the force applied because of an underlying medical condition</li> </ul>
<p>Incidence all physical injuries (2012/14): 580/100,000 population (based on data from 7 of 20 DHBs)</p> <p>Incidence of major trauma from NZMTR (2016/17): 35.5/100,000 population</p>	<p>Incidence major and non-major trauma (2015/16): 579/100,000 population</p> <p>Incidence non-major trauma: 543/100,000 population</p> <p>Incidence of major trauma from NZMTR (2016/17): 43/100,000 population</p>

Both the Health Quality and Safety Commission and the Midlands Trauma Registry have used data on non-major trauma to provide a more complete picture of trauma epidemiology, outcomes, costs and regional variation. The inclusion of non-major trauma in large trauma registries has been shown to be useful in Australia.<sup>47</sup>

A common theme from contributing sites was that they are not receiving any data from the registry beyond excel data dumps, which they then find difficult to manage or use productively, either because of resources or lack of data analysis expertise, to utilise. Similarly, the ACC has not received any data

from the NZ-MTR to date.

## **New Zealand Major Trauma Registry 2016/17 Report**

Below is a snapshot of the output of the analysis of the NZ-MTR 2016/17 data. Where possible, Australian comparative values are given.<sup>48</sup>

### **Mechanism of injury**

- 52% Road traffic crash (includes vehicle occupants, motorcyclists, cyclists and pedestrians)
- 26% Falls
- 13% Other
- 9% Assault

Values for road crash, falls and assault are similar to that of Australian values (58%, 31% and 8%, respectively).

### **Cause of injury**

Northern Region as the highest rate of pedestrian injury and assaults; Midland has the highest rate of road crashes; Central and South Island have the highest rates of falls (29% and 31% respectively, compared to Midland (20%))

### **Incidence of major trauma** (see earlier figures for international comparisons) (Fig 62):

- National Incidence – 35.5/100,000
- Northern Region – 28/100,000
- Midland Region – 43/100,000
- Central Region – 46/100,000
- South Island – 52 /100,000 (Canterbury and South Canterbury only)

There was ethnic variation in incidence of trauma with Maori over-represented.

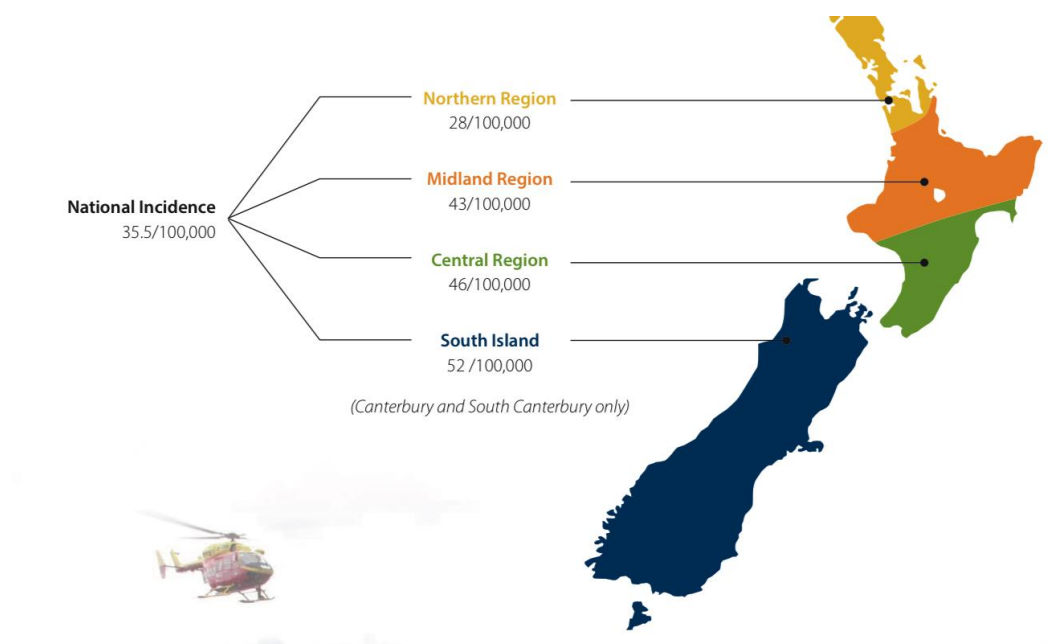


Figure 62 Incidence of major trauma in the four trauma regions of New Zealand

### Age

- 15-29 year and 45-59 year age groups account for nearly half all trauma
- 0-14 year group has the lowest incidence at 7% of all trauma
- Remaining 15 year groups age bands account for around 15% each
- The 85+ age group accounts for 6.6% of all major trauma, and has the highest proportion of injury for its age group.
- Those aged 65+ years accounted for 23% of major trauma

### Major Trauma Mortality

- National 10%
- Northern 9%
- Midland 10%
- Central 10%
- South Island 10% (Canterbury and South Canterbury only)

In comparison, with similar criteria, in-hospital major trauma mortality in Australia is 10% and in NSW it is also 10%.<sup>49</sup> By contrast mortality is 5.3% in Victoria from hospitals that receive major trauma<sup>50</sup> and Western Australia, which uses an ISS >15, reports mortality of 12%.<sup>51</sup>

Three hospitals had higher than the average mortality (ranging from 14% to 21%), and accounted for 17% of all the deaths. In comparison, for the Australian hospital with the highest mortality, the value was 15%.

Falls account for 46% of all deaths, similar to Australian figures<sup>48</sup> followed by road traffic (29%), other (16%), and assault (9%).



### Cause of death

- Central Nervous System 52%
- Other 7%
- Haemorrhage 15%
- Multi organ failure 12%
- Unknown 7%
- Medical 12%

### Traumatic Brain Injury (TBI)

TBI patients were identified if they had an Abbreviated Injury Score (AIS) of three or more.

- TBI occurred in 38% of all New Zealand major trauma patients
- There was wide regional variance in the incidence of TBI (range 29-45%)
- Isolated TBI (isolated TBI reflected those patients with other injuries that were only AIS2 or less) occurred in 26% of all major trauma (or 69% of all TBI), of which 40% were taken to a facility with no onsite neurosurgery, yet 21% were in a coma (GCS  $\leq$  8) at scene.
- Complex TBI occurred in 12% of all major trauma, of whom 26% were taken to a facility with no onsite neurosurgery, yet 36% were in a coma at scene.

### Pre-hospital time

65% of patients were transferred from scene to the first hospital within two hours. This is similar to Australian values, where median pre-hospital time is 1.8 hours. (Fig 63)

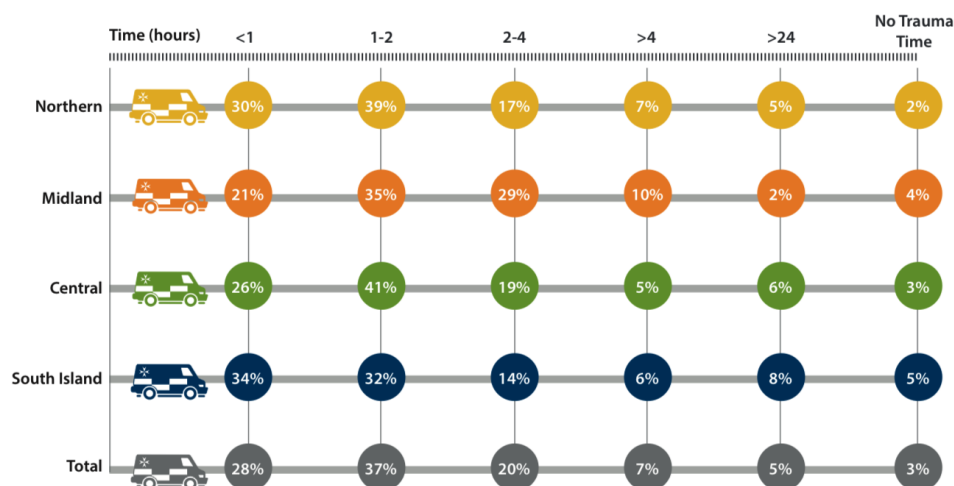


Figure 63 Transportation time from injury scene to first hospital by region

### Patients transferred for definitive care

Approximately 25% patients are inter-hospital transfers for definitive care and approximately 30% reached a hospital that provided definitive care within the “golden hour”. (Fig 64)

In each region, between 16-27% of patients were transferred for definitive care within 72 hours. Comparative value for Australia is 33%.

- 74% of patients received definitive care in a tertiary hospital, with a 9% mortality
- 12% of patients received definitive care in a medium sized hospital, with a 12% mortality
- 7% of patients received definitive care in a small sized hospital, with a 6% mortality

Number of hospitals patient went to before receiving definitive care

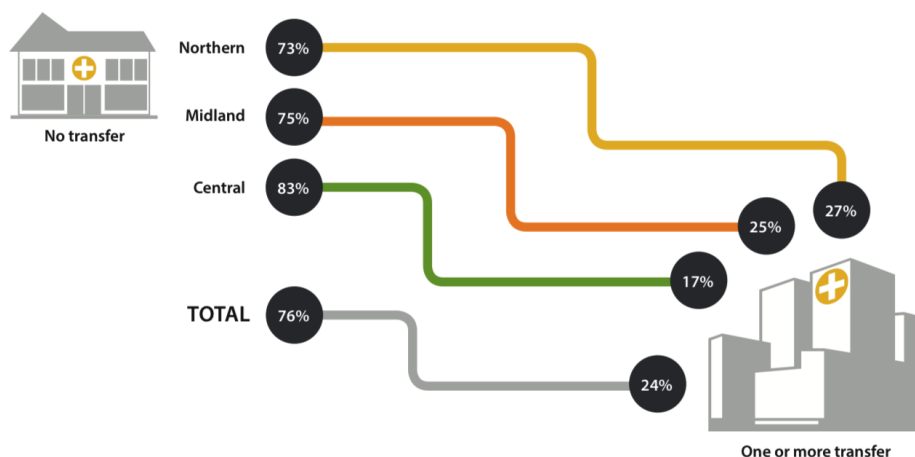


Figure 64 Percentage of patients requiring transfer before receiving definitive care

### Hospital – time to CT (Fig 65)

Proportion of patients receiving a CT scan within two hours is used as a performance measure by the NZ-MTR (previous year's results shown in brackets).

- Northern 68% (82%)
- Midland 76% (72%)
- Central 66% (60%)
- South Island 53%

These results suggest that the guidelines and systems of care are probably different between the regions.

### Hospital – time to diagnostic imaging

Once a patient arrives in hospital, one of the important process of care markers is time to first CT as evidence of effective in-hospital systems. Most major trauma patients need a CT of at least one body region and therefore this indicator is an important marker of the process of care of trauma patients.

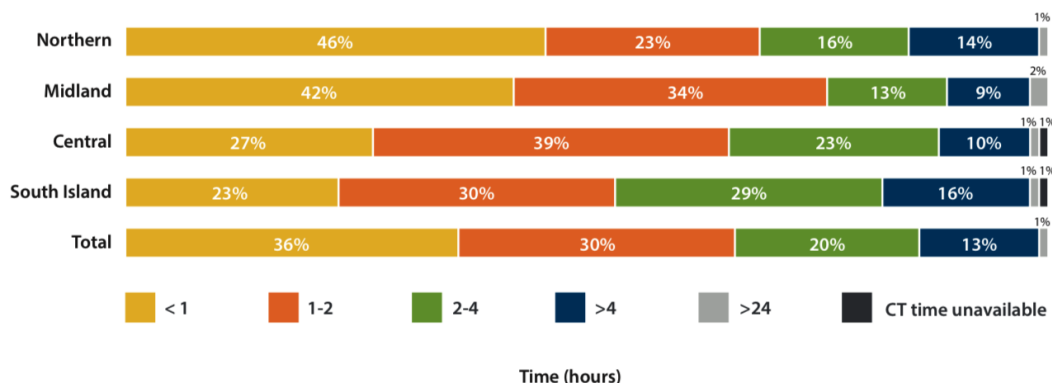


Figure 65 Time to CT scan by trauma region

### Blood alcohol level recorded

Nationally: 44%. Wide variation observed amongst the regions (13% - 68%).

This is despite drivers who drive under the influence of alcohol being considered to be high risk drivers, and high risk drivers contributing to 34% of fatal crashes. Furthermore, more than half of the major trauma follows a road crash.

## Trauma in the Context of Other National Major Health Disease

It is important to place these values for trauma in New Zealand into context. Cancer is a disease of predominately an older age group, and mortality highest among the elderly. Trauma is a disease predominately amongst younger population, and a leading cause of death amongst the young. Early cancer treatment is a national reported upon performance measure (alongside ED LOS, elective surgical targets, etc.). In contrast, there are no national trauma performance measures. Delays in cancer treatment, similar to delays in trauma care increase patient morbidity and mortality.

In 2013, the rate of new cancer diagnosis was 335.5 per 100,000 population.<sup>52</sup> The corresponding figure for major trauma was 35.5 per 100,000 population, and for all injuries requiring hospital admission it was 586 per 100,000 population. Number of deaths due to cancer was 9063, (age standardised rate of 122 per 100,000 population). In comparison, number of deaths due to injury was approximately 1800 (age standardised rate of 36.8 per 100,000).

It would be useful, at this stage to summarise important NZ trauma statistics:

- Trauma is the leading cause of death for New Zealanders under 45
- For every death following injury there are a further 9 people who survive with major injuries requiring complex, multidisciplinary care.
- For survivors, recovery periods and long term disabilities results in loss of productivity and long-term accumulative economic burden upon health and social systems.
- Trauma incidence appears to be increasing
- For the Midland Region alone the total cost of for hospitals alone is approximately \$50 million a year.

During the consultation process, the Trauma Verification team could not get a strong sense of “ownership” with respect to longer term funding of the NZ Major Trauma Registry, a resolution which seems to remain undetermined. The MoH were reluctant to commit to funding the NZMTR, the ACC have a strong interest in such data, but do not see themselves to be the sole funder, whereas the NZTA is interested in sharing its own data, and creating data links with other relevant datasets, but its priorities are within transport.

In this circumstance, it would be useful to briefly outline the known utility of clinical registries in general, and then specifically, Trauma Registries.

Clinical registries systematically monitor the quality (appropriateness and effectiveness), performance and variation of health care delivery, within specific clinical domains, by routinely collecting, analyzing and reporting health-related information. This information is used to improve the provision and quality of the health care systems, and when measured over time, provide important trend data and a measure of the impact of significant health system interventions. They have the capacity to be linked

to other data repositories and thus expand their reporting capabilities.

Clinical quality registries use the data they collect to identify benchmarks and variation in clinical outcomes. They then feed this information back to clinicians to inform clinical practice and decision making. This clinical outcome feedback loop is the defining feature of clinical quality registries. Reports may also be provided to jurisdictions, healthcare providers, funders, clinical colleges and researchers. Clinical quality registries are therefore a fundamental part of continuous quality improvement – improving patient outcomes.

The Australian Commission on Safety and Quality in Health Care evaluated the economic impact of Australian clinical quality registries, one of which was the Victorian State Trauma Registry.<sup>53</sup> This evaluation identified that the Victorian State Trauma Registry delivered significant value for money, influenced clinical practice and improved the value of healthcare delivery. Measurable benefits were improved patient survival, and reduced hospital stay. This is not surprising considering the available evidence to suggest that trauma systems, supported by trauma registries, can reduce mortality, complications and lifelong disability following major trauma.<sup>54-58</sup> Senior NZ Trauma Clinicians have previously used such evidence to advocate for, and subsequently oversee, the foundation of the NZMTR.<sup>44</sup>

The Commission also examined the potential cost benefit of a number of clinical registries. It identified that the benefit to cost ratio for the Victorian State Trauma Registry was 6:1 (i.e., for every dollar spent, the return on that investment was \$6) and this ratio was greater than that of other registries (e.g. prostate cancer and the orthopaedic joint registry). It also identified that low coverage, inadequate reporting and inadequate collection of information about patient outcomes will limit the effect of clinical quality registries, and their benefit to cost ratio. Although incomplete, the NZMTR is already providing valuable data with respect to trauma incidence, variation, performance and outcomes. Similarly the Midlands Trauma Registry has highlighted the utility of geocoded data and improvements in trauma performance over time (i.e. patient outcomes and hospital length of stay reductions)

The Australian Commission on Safety and Quality in Health Care has developed a national framework, endorsed by health ministers in 2014, for Australian clinical quality registries.<sup>59</sup> The framework sets out best practice in registry design and output. Application of the framework to clinical quality registries provides assurances that registry data, and the systems that hold those data, have satisfied minimum security, technical and operating standards.

The NZ MoH currently contributes funding to a number of registries, based on historical arrangements. These registries include, but are not limited to:

- ANZDATA/ANZOD - renal transplant and organ donation registries
- the Joint Registry - major joint replacements

- the Familial Gastrointestinal Cancer registry
- registries supporting national screening programmes (e.g. cervical and bowel cancer)
- cardiac registries - ANZACS QI, ACS, Predict, PCI, Dendrite
- statutory registries such as the New Zealand Cancer Registry

Administrative data, although useful in providing patient, illness, treatment and health facilitate demographics, does not accurately capture specific disease risk based measures and severity scoring, and thus cannot replace disease specific registries.<sup>60</sup> Disease specific scoring (e.g. trauma Abbreviated Injury Score (AIS) and Injury Severity Score (ISS)) allow for more accurate risk adjusted outcomes and benchmarking. The ISS is a coding system unique for trauma and is widely used across the world in trauma outcome evaluation. The AIS injury coding system is not part of routine hospital administrative data and requires extensive training and expertise to record it accurately. Thus trauma registries, such as the NZMTR are unique and valuable repositories of health system quality improvement and worthwhile investments for Ministries of Health. Nonetheless, administrative datasets, when combined/linked to disease specific registries can provide greatly expanded reporting capabilities. The data sets can uniquely complement each other.

The MoH is also actively pursuing the development of a national Electronic Health Record. With time this valuable exercise will be able to provide useful reports and potentially replace certain clinical registries. However the need for a securely funded NZ National Trauma Registry is an acute, and essential one for NZ Trauma System performance.

## Traumatic Brain Injury

The Trauma Verification team were interested in the epidemiology and variation in processes of care and outcomes of traumatic brain injury (TBI). TBI is also an injury that has high ongoing costs for survivors.

It was noted that admission to a tertiary hospital with neurosurgical expertise is not “routine”, even for severe TBI, and transfer rates, as well as remote neurosurgical input, is variable. This happens across a number of hospitals without an onsite neurosurgical service, e.g. Northland and Hawke’s Bay.

Hawke’s Bay is a unique centre, somewhat geographically isolated; it accepts major trauma, has a long history of managing TBI within its Intensivist- staffed ICU, does not have a neurosurgical service and has reported on its outcomes. We are grateful to the Hawke’s Bay Hospital Intensive Care medical staff for their submission, a summary of which is provided below.

Hawke’s Bay Regional Hospital (HBRH) is a 400-bed regional hospital, with an 11-bed level II ICU, and a regional aeromedical service. Hawke’s Bay saw 103 major traumas (ISS over 12) in the 2016-2017 year, versus 114 for Wellington hospital. Retrieval capacity is sufficient and well organised locally, with three fixed-wing aircraft and one helicopter; the airport is 20 minutes’ drive away.

Patients are transferred to a neurosurgical service for ongoing management when the neurosurgeon requests transfer. Most patients are discussed with remote neurosurgeons, who have access to patients’ radiology via a Patient Archiving and Communications (PACS) system.

The Hawke’s Bay ICU operates on a “long corridor” model, with trauma patients often referred back from tertiary intensive care and neurosurgical services for ongoing intensive care in HB for their injuries. This also occurs with, for example, complex pelvic fracture care- Our last major pelvic fracture spent three days in Middlemore Hospital prior to coming back to HB for ongoing care during their month long stay for multi-trauma injuries. This happens for severe TBI less often now that rehabilitation services have been centralised as Auckland Brain Injury takes patients with tracheostomy in place.

Hawke’s Bay ICU runs a busy inter-hospital transport system. All adult patients have inter-hospital transport out by the flight team with an intensive care doctor (when necessary), unless all aircraft are busy, in which case our referral centre would retrieve. Patients can be transported by helicopter with a one hour flight time to Wellington or by fixed-wing, taking 2-3 hours with airport transfers (shorter with the jet), so initial trauma assessment in HB and subsequent transfer, as required, works currently in a

timely fashion.

Neurosurgical patients requiring surgical intervention are referred to either Wellington Hospital (adult services) or Starship Children's Hospital Auckland (paediatric services), which are 300 km & 400 km distant, respectively. Severe TBI is managed within an organised trauma service with consultation from external neurosurgical services. Tele-radiology with shared radiology (PACS) system facilitates this communication. The ICU follows the Brain Trauma Foundation (BTF) guidelines for optimal management of TBI patients. Local general surgeons may perform emergency neurosurgical procedures such as burr holes for drainage of extradural haematoma, if required. Intracranial Pressure (ICP) monitoring, using a parenchymal catheter has been performed in Hawke's Bay by Intensive Care physicians since 1997 to assist in the management of patients with traumatic brain injury and they have previously reported on their safe outcomes.<sup>47,48</sup>

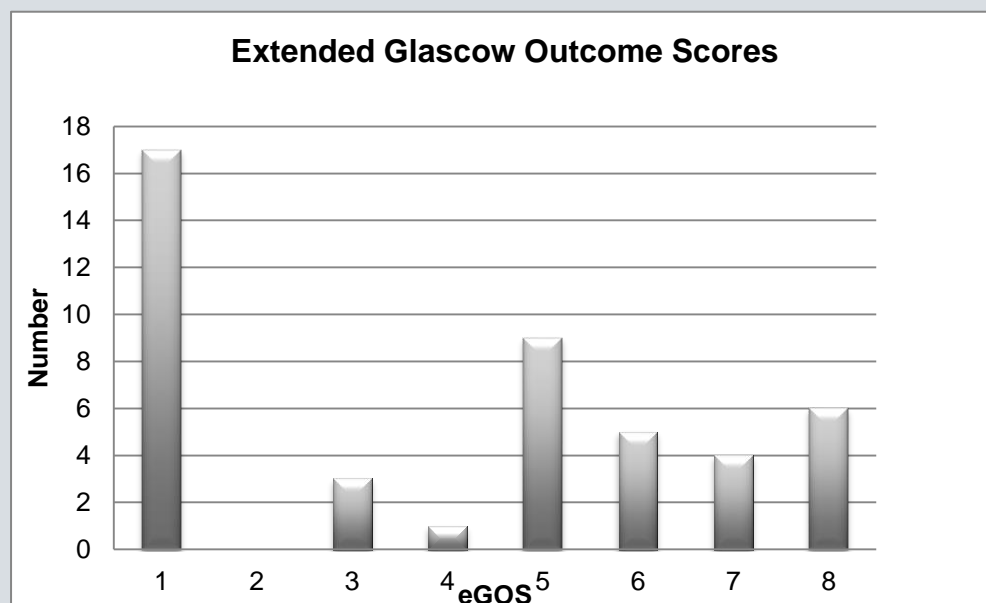
More recently, they also reported on 65 patients (case note review) with traumatic brain injury who had a total of 67 ICP Codman catheters placed over the 10 year period from January 2003.

Of the 65 patients 45 (69%) patients with ICP and severe TBI were managed entirely at HBRH ICU. Neurosurgical consultation was undertaken initially at time of trauma admission in 37/65 (57%). 20 patients (31%) were transferred to Neurosurgical Centres for ongoing management. Reasons for transfer included intracranial haemorrhage (ICH), intracranial hypertension and complex injuries. 10 patients were transferred because of high ICPs not responding to medical treatment and of these, two had no additional neurosurgical intervention, four had Extraventricular drain (EVD) insertion and four had a decompressive craniectomy in the tertiary centre.

ICU mortality	17/65	26%
Hospital mortality	17/65	26%
30 day mortality	16/65	25%
90 day mortality	17/65	26%
1 year mortality	17/65	26%
5 year mortality for 2003-2010 cohort	12/56	21%
10 year mortality for 2003-2006 cohort	11/44	25%

An extended Glasgow outcome score (eGOS) was calculated in 45 patients. 24/45 (53%) of patients had an eGOS 5-8 which is classed as a favourable outcome.





The following complications related to ICP monitor insertion were reported in the clinical record.

**Haemorrhage:** One patient had bleeding from insertion site; Further CT showed no blood accumulation intracranially near insertion site- later transferred to Wellington Neurosurgical Centre for ICH management and craniotomy for drainage of posterior fossa bleed as initial injury. No further bleed at ICP site noted and not deemed significant.

**Cerebrospinal leak:** three reported excessive CSF leak requiring bone wax plug to bony hole at time of procedure. Settled without further intervention

**Scalp bleeding:** one patient needed two scalp incisions. First incision required suture for control of small artery bleed.

**Malfunction:** three loss of waveform - removed and not reinserted

**Dislodgement:** one catheter accidentally cut and not replaced.

**Infection:** No CSF infection identified.

There were two reinsertions for reasons not related to complications. One was removed for Magnetic Resonance Imaging (MRI) and reinserted in a different location. The second had persistent spikes in ICP beyond day five and a 2nd catheter replaced the first at a new insertion site.

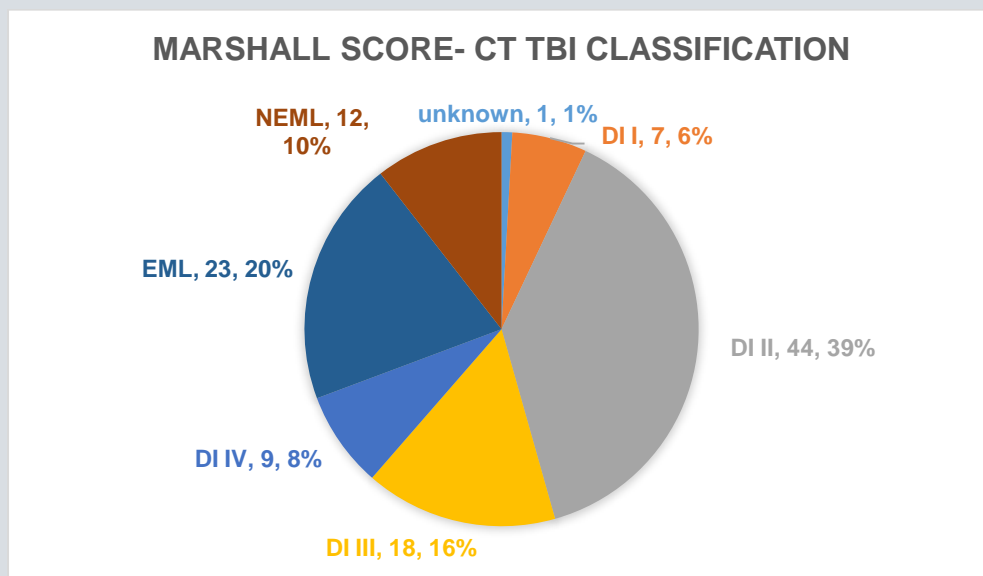
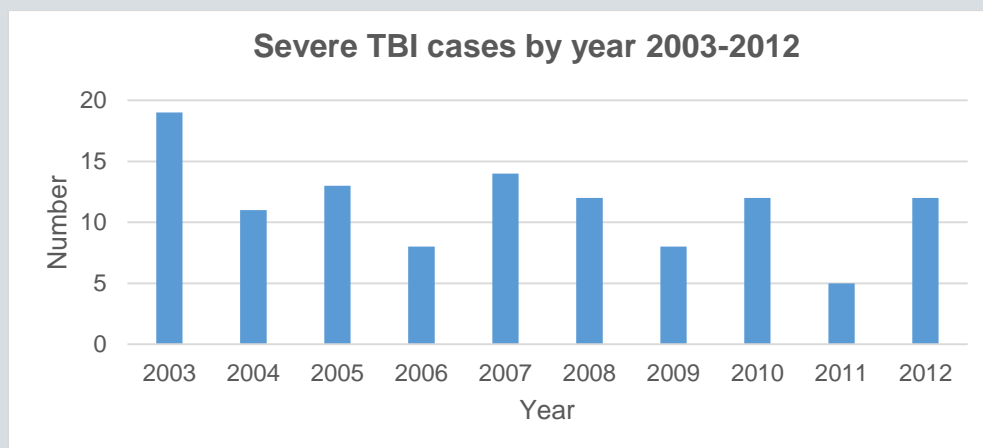
Their conclusion from these findings was:

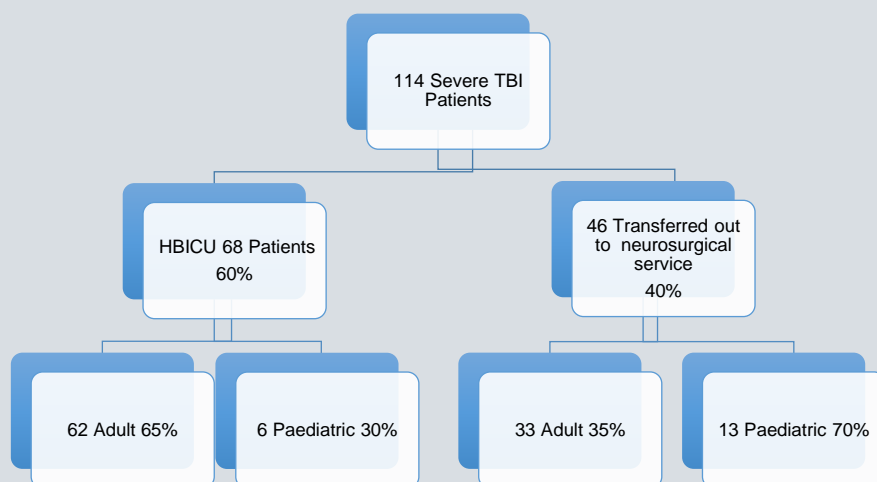
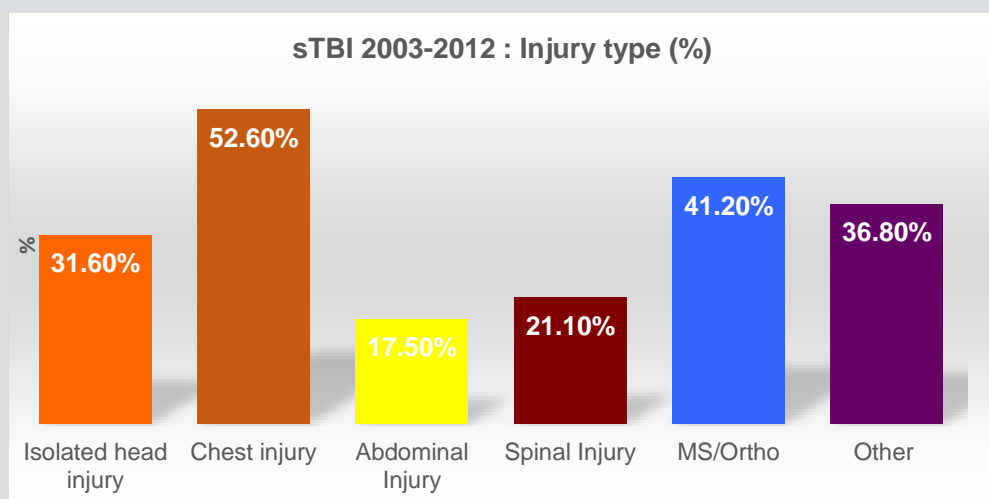
This case series demonstrates simple parenchymal ICP monitors can be safely inserted by Intensive Care Physicians in a regional New Zealand centre without neurosurgeons on site. ICP monitoring is currently the only reliable method for detecting and monitoring raised intracranial pressure in daily practice. ICP monitoring aided in the management of these severely head injured in a regional centre.

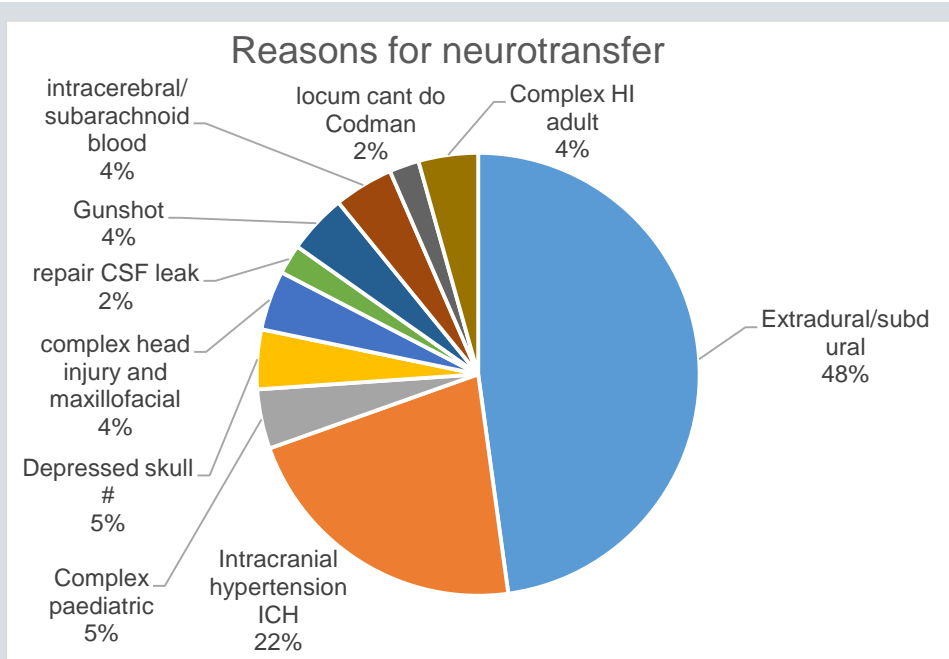
It helped differentiate between those requiring transport to a neurosurgical centre for neurosurgical intervention and those who could be managed locally.

Additional information provided:

Local general surgeons can perform emergency neurosurgical procedures such as burr holes for drainage of extradural haematoma if required. This is a reasonably rare event. Our 10 year TBI audit shows 12 emergency neurosurgical procedures over 10 years in HB (nine burr holes for extradurals/subdurals and three craniotomies). This was 43% of the total severe TBI group with extra and subdural injury. These were performed in a timely manner, and it is arguable/highly likely that the patients would not have had the procedure any quicker had they been transferred directly to Wellington. Eight of these patients were sent to Wellington afterwards. Three died in HB - they had early fixed dilated pupils and were kept in HB for brain death testing and subsequent organ donation. One was not transported due to other injuries and survived. Five out of total group died.







## **National Minimum Dataset**

The National Minimum Dataset (NMDS) is a national collection of public and private hospital discharge and clinical information, for inpatients and day patients. All records must have a valid National Health Identifier number, which is a patient specific unique identifier. The NMDS is used for policy setting, performance monitoring, research, and review. It provides information that informs about the trends in the delivery of hospital inpatient and day patient health services both nationally and on a provider basis. It is also used for funding purposes, quality and research. It is available online. The dataset extends back to 1993, with some variations since then.

Publicly funded hospital events are required to be loaded into the NMDS within 21 days after the date of discharge. Electronic files are received and processed almost every day. The NMDS is accessed by authorised staff, for maintenance, data quality, audit and analytical purposes. Authorised members of the Ministry of Health and DHBs have access to de-identified data from the NMDS for analytical purposes, via the Business Objects reporting tool and the secure Health Information Network.

With respect to trauma, within the NMDS, trauma is coded according to ICD 10 codes, but the NMDS does not provide an accurate measure of organ, and total, injury severity. Of note, the HQSC atlas of Health Care Variation, uses both NMDS data (taken from ICD10AM coding (all New Zealand hospitals)) and a major trauma patient subset from the Auckland and Midland Region Trauma registries (which in the future is likely to be data from the NZMTR)

## Hospital Resourcing and the Trauma System

The Trauma Verification system review did not specifically examine New Zealand hospitals' capacity and resourcing. Ideally this should occur via a planned Trauma Verification Consultative and/or Formal visit for each hospital, particularly those designated as major trauma centres. This has occurred only for the Midland Trauma Network and the Starship Hospitals.

The following is a snapshot of relevant data that helped inform the Trauma Verification team, when making recommendations for the New Zealand Trauma Systems, as well as reinforce written submissions and observations.

The New Zealand MoH has identified a growing and ageing population and an ageing health workforce as a future challenge for New Zealand to have the right health professionals in the right place, at the right time for future needs. Almost 40% of doctors and 45% of nurses are aged over 50 years. In addition, 42% of doctors and 26% of nurses have trained overseas.<sup>12</sup>

Workforce comparative data is illustrated below. (Fig 66 – 71)

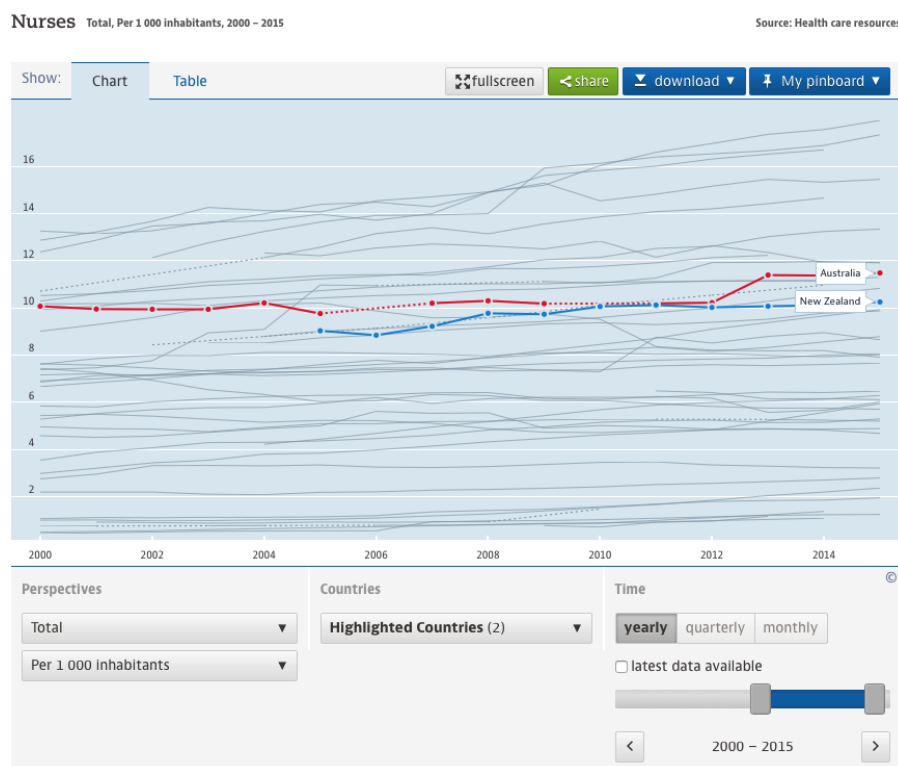
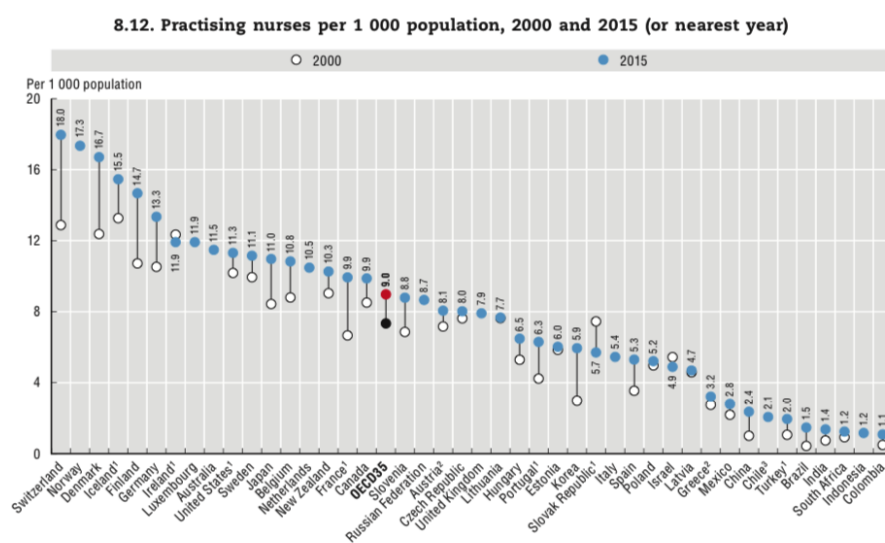


Figure 66 Total number of nurses per 1000 inhabitants of Australia and New Zealand by year, 2000-2015<sup>61</sup>



Figure 67 Total number of nurses per 1000 inhabitants in 2016 (or latest available data) by country<sup>61</sup>



1. Data include not only nurses providing direct care to patients, but also those working in the health sector as managers, educators, researchers, etc.  
2. Austria and Greece report only nurses employed in hospital.  
3. Data in Chile refer to all nurses who are licensed to practice.  
Source: OECD Health Statistics 2017.

Figure 68 Practising nurses per 1000 inhabitants, 2000 and 2015 (or nearest year) by country<sup>61</sup>

### Definition of Nurses

Nurses are defined as all the "practising" nurses providing direct health services to patients, including self-employed nurses. However, for some countries (France, Ireland, Italy, the Netherlands, Portugal,

*Slovakia, Turkey and the United States), due to lack of comparable data, the figures correspond to "professionally active" nurses, including nurses working in the health sector as managers, educators, researchers, etc. For Austria and Greece, the data include only nurses working in hospitals. Midwives and nursing aides (who are not recognised as nurses) are normally excluded although some countries include midwives as they are considered specialist nurses. This indicator is measured per 1 000 inhabitants.*

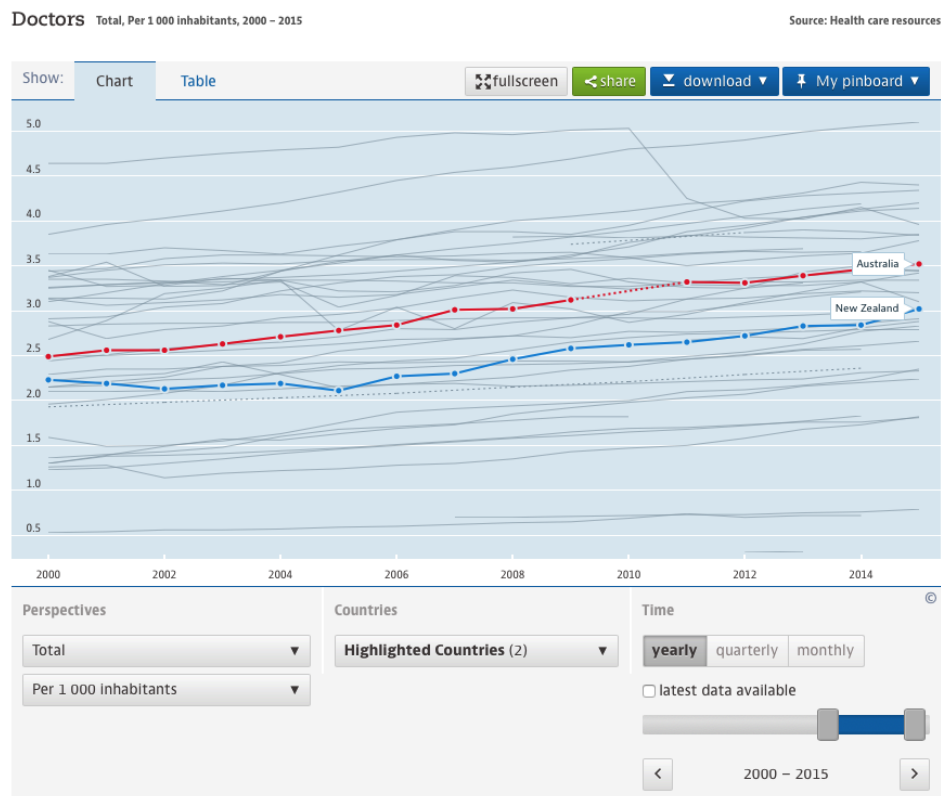


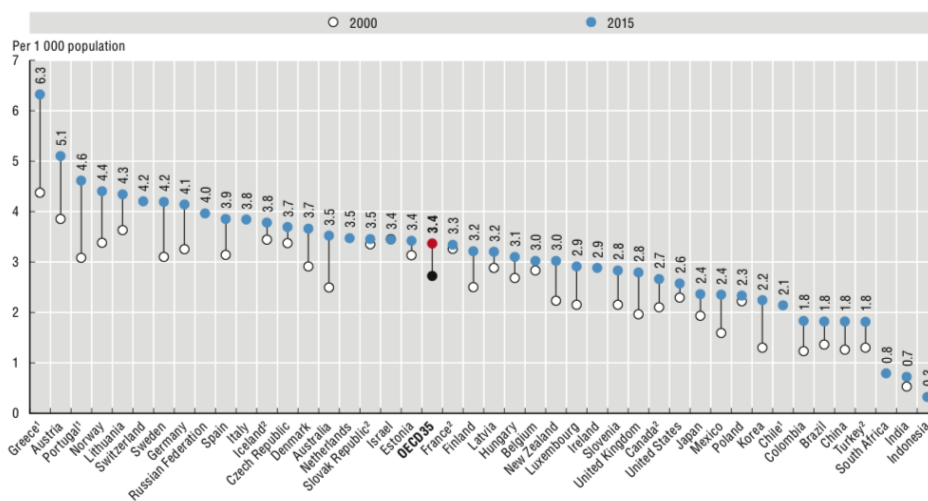
Figure 69 Number of doctors per 1000 inhabitants, 2000-2015 for Australia and New Zealand<sup>62</sup>





Figure 70 Numbers of doctors per 1000 inhabitants, 2015, by country<sup>62</sup>

**8.3. Practising doctors per 1 000 population, 2000 and 2015 (or nearest year)**



1. Data refer to all doctors licensed to practice, resulting in a large over-estimation of the number of practising doctors (e.g. of around 30% in Portugal).  
2. Data include not only doctors providing direct care to patients, but also those working in the health sector as managers, educators, researchers, etc. (adding another 5-10% of doctors).  
Source: OECD Health Statistics 2017.

Figure 71 Number of practicing doctors per 1000 inhabitants, 2000 and 2015 (or nearest year) by country<sup>62</sup>

**Definition of Doctors**

Doctors are defined as "practising" doctors providing direct care to patients. However for some countries (Canada, France, the Netherlands, Slovakia and Turkey), due to lack of comparable data,

*the figures correspond to "professionally active" doctors, including doctors working in the health sector as managers, educators, researchers, etc. (adding another 5-10% of doctors). Doctors are usually generalists who assume responsibility for the provision of continuing care to individuals and families, or specialists such as paediatricians, obstetricians/gynaecologists, psychiatrists, medical specialists and surgical specialists. This indicator is measured per 1 000 inhabitants.*

For the period between 30 November 2008 and 31 March 2017, the Medical Employed FTE increased by 2260 in number. Senior Medical Officers accounted for the majority of the increase (54.2%), with junior doctors (Registrars and House Officers) the second largest component of the overall increase (46.0%). The majority of the 5244 increase in Nursing Employed FTE (including Health Assistants) over the same period was in Registered Nurses (67.0%), with 23.2% of the increase in Senior Nurses.<sup>63</sup>

Over a similar period, hospital beds per thousand population remained lower than those of Australia, and more recently have shown a decline. (Fig 72)

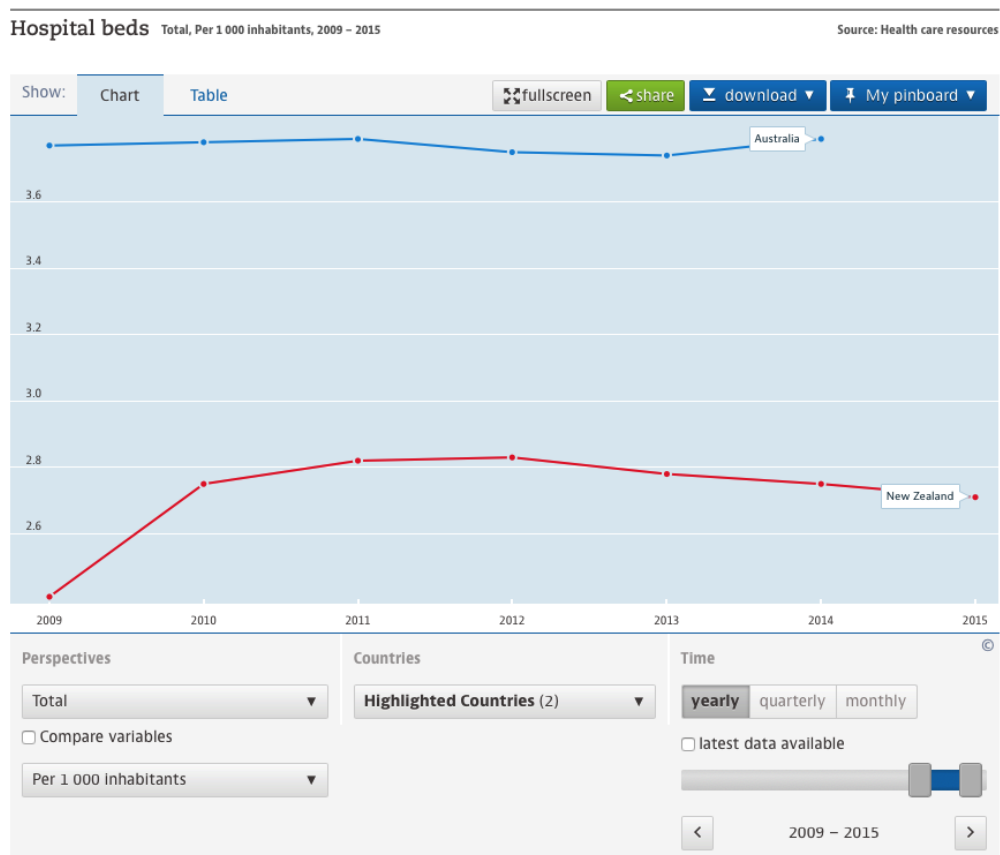


Figure 72 Number of hospital beds per 1000 inhabitants of Australia and New Zealand by year, 2009-2015<sup>64</sup>

#### Definition of Hospital beds

*This indicator provides a measure of the resources available for delivering services to inpatients in hospitals in terms of number of beds that are maintained, staffed and immediately available for use. Total hospital beds include curative care beds, rehabilitative care beds, long-term care beds and other beds in hospitals. The indicator is presented as a total and for curative (acute) care and psychiatric care. It is measured in number of beds per 1 000 inhabitants.*

There are six major trauma hospitals, including one which provides quaternary paediatric services, and two more which provide specialist burns and/or spinal cord injury services.

It was the perception of clinicians that ED access block to inpatient and ICU beds was problematic with patients often having an extended stay in the ED. Similarly, ICU capacity was deemed high and beds limited. It was noted that occasions whereby major trauma patients, seen in the ED, had been formally admitted as an inpatient, but have had an extended stay in the ED (sometimes days) due to lack of an inpatient bed. This not only had implications for ED bed capacity and potential patient safety risks, but it complicated inpatient care as it was not clear who was responsible for delivering that care (ED or inpatient team).

When examining comparative data for ICU beds, ICU bed numbers in New Zealand were 5.3 per 100,000 population (amongst 29 adult ICU and 1 PICU, reporting ICUs to Australian and New Zealand Intensive Care Society (ANZICS) Centre for Outcome and Resource Evaluation (CORE), compared to Australia with 9 per 100,000 population.<sup>65</sup> Refusal to admit was similar for New Zealand and Australia.

When evaluating ED LOS data, a key performance measure for each DHB, the national target for a < 4 hour stay is positive at 94% (Fig 15).

Previous work has found human resources across a number of Australian and New Zealand trauma services did not match those recommended by the Australasian Trauma Verification Program. This can impact a Trauma Service's ability to deliver, coordinate and monitor trauma care delivery.<sup>66</sup>

A Trauma Capacity and Capability Questionnaire Analysis was undertaken and reported upon by the Major Trauma National Clinical Network, by Midland Regional Trauma System, between August 2012 and May 2013.

23 hospitals participated; 10 (43%) were the regional referral centre for trauma patients. The following are extracts from the survey:

When asked what was good about their trauma service; respondents primarily referred to:

- Relationships within the trauma team and across departments.

- Staff commitment and skill level.
- Quality assurance.

When asked what could be improved; respondents answered:

- Increase in FTE or developing the trauma team.
- Regional and national collaboration.
- Increased opportunities for training, research and education.
- Trauma database and data gathering.

When asked to list any major resource or system limitations not otherwise mentioned in the survey; respondents mentioned:

- Lack of dedicated resource or support for trauma.
- Training limitations due to clinical staff support and RMO availability.
- Access to real time trauma data.
- Hospital Emergency and ED Mass Casualty Plans require more work.
- No national or regional trauma system or co-ordination.

Since the survey, the MTNCN has made significant progress in addressing some of those limitations. The allocation of trained staff to collect data has had a positive impact, however in some circumstances this has diverted staff from clinical duties. The fact that additional resourcing for data collection for the NZ-MTR has not involved additional funded clinical time, has reduced the appeal and staff satisfaction with those positions, and may not be sustainable longer term. In addition, there is a significant amount of other important activities, such as patient case management, facilitating discharge planning, and supporting patients and families that specialised trauma nurses could be undertaking, but is going unattended.

The same survey covered aspects of resourcing. Although 10 of 23 hospitals were regional trauma referral hospitals, only six had a dedicated trauma service, nine had 24/7 therapeutic angiography, and quality assurance activities such as multidisciplinary audit and loop closure were undertaken by 43% and 17%, respectively.

In NZ, there is no formal process for designating major trauma centres, or minimum criteria for a major trauma centre. Some hospitals, such as Greymouth and Gisborne are designated as trauma centres (Table 3), despite having very limited surgical and anaesthetic capability, because they are geographically remote and often inaccessible due to poor weather.

Table 3. Hospital receiving major trauma for each region

Region	Northern	Midland	Central	Southern
Tertiary Major	Auckland	Waikato	Wellington	Christchurch

<b>Trauma Hospital</b>	Starship (Paediatric)			Dunedin
<b>Hospital receiving major trauma (Distance to Tertiary Hospital)</b>	Whangarei Hospital (adults and children). (160km)	Tauranga Hospital (103km)	Hawkes Bay Regional Hospital. (310km)	Nelson Hospital. (415km) (212 to Wellington)
<b>Hospital receiving major trauma (Distance to Tertiary Hospital)</b>	Middlemore Hospital (adults and children). (17km)	Whakatane Hospital. (188km)	Whanganui Hospital. (195km)	Greymouth Hospital (238km to Christchurch)
<b>Hospital receiving major trauma (Distance to Tertiary Hospital)</b>		Rotorua Hospital. (131km)	Palmerston North Hospital. (147km)	Southland Hospital (570Km, from Christchurch, 210km from Dunedin)
<b>Hospital receiving major trauma (Distance to Tertiary Hospital)</b>		Gisborne Hospital. (370km)		Timaru Hospital (162km to Christchurch)
<b>Hospital receiving major trauma (Distance to Tertiary Hospital)</b>		Taranaki Base Hospital. (241km)		Dunedin Hospital. (360km from Christchurch)

## Paediatric Trauma Services

The Starship Trauma Service is the major trauma service for children with trauma within New Zealand. It is a long running, multidisciplinary group of clinicians, led by a Trauma Director, who have created a network of services that encompass all aspects of trauma care, including acute in-hospital care, interhospital transfers (operate a 24/7 medical staffed service) and advice, trauma registry, trauma prevention, pre-hospital, outpatient and rehabilitation.

The trauma service collects, reports on and maintains the Starship Trauma Registry. Trauma data is used for reporting purposes, as well as assisting with research, quality improvement, injury prevention and clinical patient management. The registry has been operating since 2006.

Inclusion criteria are paediatric injury that requires hospital admission. Children readmitted following failure of treatment, or those admitted for ongoing management of an existing injury are excluded.

Demographic data, information relating to the trauma event (e.g. when, where and how the individual was injured), description of the injury or injuries, any clinical interventions performed in treating the injury, and outcome data is recorded. For those with major trauma, additional information such type of transport used to get to hospital (e.g. car, ambulance or helicopter), if transferred from another hospital, name of that hospital and use of the Starship retrieval team is recorded. Details of pre-hospital and ED observations and any interventions performed by paramedics are also recorded.

The Starship Trauma Service has approximately 80 major trauma admissions per annum (ISS>15), of which 30 would involve a TBI.

There is a strong track record of injury prevention research and initiatives, often done collaboratively with KidsSafe and the national Health Safety and Quality Commission. Examples of these include:

- Barriers to child car seat use
- Caustic ingestion
- Quad bike injuries
- Motorbike injuries
- Driveway run-overs
- Pedestrian trauma

## Pre-hospital Services

The National Ambulance Sector Office (NASO) is a joint initiative between the MoH and the ACC. NASO's functions include:

- overseeing the New Zealand Ambulance Service Strategy
- provide a single voice for the Crown on Ambulance strategic and operational matters
- manage and monitor funding and contracts from two ambulance service providers in New Zealand

The two ambulance service providers in New Zealand:

- The St John Ambulance Service treats and transports approximately 400,000 people every year. They have more than 600 vehicles and 205 ambulance stations. They attend around 365,000 emergency incidents, annually. St John provides emergency ambulance services to nearly 90% of New Zealanders.
- Wellington Free Ambulance covers the Greater Wellington region (areas of the Capital and Coast, Hutt Valley) and the Wairarapa DHB. It responds to over 74,000 calls annually, with 25 ambulances across 10 stations.
- Both St John and WFA are contracted by the MoH and the ACC for just under 70% of their total operating costs. The shortfall is made up from payment of part charges, community donations, fundraising and revenue from commercial activities.

A 111 call for an ambulance is answered by one of three call centres. St John manages the emergency Ambulance Communication Centres in Auckland and Christchurch and the third, in Wellington, is managed jointly with Wellington Free Ambulance. These centres take calls and dispatch ambulances, emergency vehicles and air ambulance, for all of New Zealand. The three centres are all connected together and are staffed 24 hours a day, 365 days a year by Emergency Medical Dispatchers. The MoH and the ACC fund the Ambulance Communications Centres. The MoH contributes 64% and ACC 36% of the total costs.

In addition, both services provide specialist paramedics to crew emergency helicopters within their areas.

St John also manages the PRIME programme. PRIME is funded by the MoH and ACC to provide a coordinated response and management of emergencies in rural locations, using the skills of specially trained general practitioners and registered nurses. PRIME practitioners support the St John ambulance service in areas where response times may be longer than usual, or where more specialised medical skills would assist the patient's condition. A recent review of the PRIME Service has been undertaken and recommendations made as to how the PRIME Service could be enhanced and better governed.<sup>67</sup> Currently implementation of the recommendations of that review are in progress.

With respect to the emergency Ambulance Communication Centres, calls are prioritised by ProQA™ emergency medical dispatch system and the Medical Priority Dispatch System (MPDS), with calls categorised into life threatening/potentially life threatening/non-emergency. Clinical support staff provide clinical advice to call takers and dispatchers, including need for air vs land transport options. There is a medical clinical director that is on call for consultation.

There have been some significant positive initiatives (guidelines, policies and tasking) within the pre-hospital domain, facilitated by the MTNCN, which have the potential to make a substantial positive effect on patient outcomes and trauma service costs. These initiatives have been developed based upon identified and measurable national needs, are clinician and organisational led, consensus based, and disseminated and adopted across all regions and their DHBs, with planned and staged evaluation points. They represent an example of how and what can be achieved at a national level.

### **Staging Guidelines**

Staging guidelines were developed by a working group of the Major Trauma National Clinical Network, including representatives from ambulance and the Rural Hospitals Clinical Directors Forum. They complement the out-of-hospital major trauma triage policy.

These guidelines are to be used by hospital clinicians when their hospital is being used as a staging point by road ambulance personnel, for a patient with major trauma that is going to be transported by helicopter to a major trauma hospital.

### **New Zealand Out-of-Hospital Major Trauma Triage Policy**

This document is a guide for clinical personnel when triaging patients with trauma in the out-of-hospital setting in New Zealand. It has been developed by the Major Trauma National Clinical Network.

### **New Zealand Out-of-Hospital Major Trauma Destination Policy**

This document is for the use of clinical personnel when determining the destination hospital for patients with major trauma in the out-of-hospital setting. There is one document for each region. It was developed by the Northern Regional Major Trauma Network in conjunction with the Major Trauma National Clinical Network and the Ambulance Sector.

The concept for these policies is a very, very good one, and they have been viewed by clinicians as big step forward. Significantly, they are an important demonstration of what can be achieved, via the MTNCN, from the respect of developing a unifying national policy, which is then disseminated and applied across all the regions/DHBs. They are yet to be evaluated, however anecdotally, the Trauma Verification team have been told that “they seem to be working”. However, on a practical level, these



documents are difficult to read, particularly in the acute out-of-hospital setting. They are better suited to in-house coordinating personnel who can direct/advise scene ambulance staff. Most documents rely on a flow diagram, whilst one uses a look up table. These are all open to a degree of “interpretation” and thus variability in practice. The policies often refer to “seek clinical advice” but how, who and what that advice actually refers to, is not explained.

## **Air Ambulances**

Emergency Air Ambulance Services are an important component of New Zealand’s ambulance service provision. They have predominately evolved from within local communities and regions. The National Ambulance Sector Office (NASO) and the ACC pay each air operator a fixed monthly payment, irrespective of the number of hours flown, and in addition, a fee for service payment for each hour flown, regardless of aircraft type. This NASO-ACC funding model was implemented on the 1 April 2013.

The fixed monthly payments contribute to the fixed costs of providing the service. They are calculated from the number of flying hours each provider completes for the NASO and the ACC.

All air ambulance services also rely on community donations and sponsorships, typically for 30% - 50% of their total costs.

Eight New Zealand Emergency Rescue Helicopter / Fixed-wing Community Trusts and two air operators have joined to form the Air Rescue Group (ARG). The formation of the ARG provides an opportunity to increase coordination, cooperation and sustainability amongst the community providers serving the different regions.

The ARG is working in partnership with the National Ambulance Sector Office (NASO), on all matters concerning the provision and future development of New Zealand Emergency Air Ambulance services. NASO also has a role in setting minimum standards as well as influencing funding.

The ARG is currently comprised of the following service providers:

- Northland Emergency Services Trust
- Auckland Rescue Helicopter Trust (ARHT)
- Philips Search and Rescue Trust
- Taranaki Rescue Helicopter Trust
- Hawkes Bay Rescue Helicopter Trust
- Eastland Helicopter Rescue Trust
- Skyline Aviation
- Life Flight Trust

- Garden City Helicopters
- Otago Rescue Helicopter Trust (ORHT)
- Lakes District Air Rescue Trust

Since 2011, helicopter dispatches are reported to have increased from 3,460, to 5,533 in 2016 (60% increase, or 52% when adjusted for population growth). This increase has been attributed to an increase in actual number of incidents and an increase in incidents where more than one helicopter has been dispatched to an incident. Greatest area of growth has been for medical dispatches, which may fit in with national cardiac and stroke emergency strategies.

There was a clear willingness for pre-hospital providers to work collaboratively. This was made evident by the agreement on uniform paramedic clinical guidelines and training and equipment standards across both Ambulance services, as well as agreement on triage policies and destination hospital policy. The latter was developed following extensive stakeholder engagement across pre-hospital and hospital services, DHB, MoH and ACC, and endorsed by the MTNCN.

There was also a consistent message from Air Ambulance providers that existing remuneration from Government was not sustainable. Service activity and resourcing levels are high. For example, Garden City Helicopters supplies dedicated rescue helicopters out of Christchurch, Greymouth and Nelson, with back up helicopters (certified to the various ambulance standards), supported by dedicated fixed-wing air ambulance planes; two out of Christchurch and one based in Nelson. Total annual medivacs exceed 3500 missions per annum. They have also contributed to supplying database systems, and reporting to assist DHBs and other funders such as NASO. They are supported by in-house paramedical staff, and clinical staff from the Canterbury DHB. Their commitment with respect to service provision is further demonstrated by a planned \$20M new facility in Christchurch.

The Trauma Verification team observed a number of similar air ambulance transport providers and was impressed by facilities, aircraft provision, attention to detail, governance and reporting structures, links with existing health services, community engagement and commitment to longer term support. The constant, and ever increasing, difficulty in filling the financial gap between Government funding and actual running costs was highlighted by all services.

There are no air ambulance providers with medical staff, on base, 24/7. Some services have on-base medical staff for part of the day only, and most can access medical staff by flying to the nearest hospital to pick up staff. For example at HeliOtago, 10 min daytime response time and 30 min night time response time to pick up clinical (medical/nursing) staff. There are no national standards for medical crews, nor standards for equipment they carry or wear.

The Trauma Verification team were supplied with activity data by the Auckland HEMS and HeliOtago.

Both are busy services with > 800 engine hours per annum. Of note, 40% – 60% of their activity is non-ACC (i.e. medical) and interhospital transfers were uncommon (< 5%).

### **National Air Desk (NAD)**

The NAD began operations in the Auckland emergency Ambulance Communication Centre in February 2017, and is funded by NASO. The NAD is currently operating from 0700-2200hrs daily, which corresponds to around 88 per cent of total air ambulance incidents. The NAD works closely with the three Clinical Control Centres and is staffed by experienced paramedic and helicopter staff from St John Ambulance, and existing Air Ambulance Operators. It uses specialised mapping software and Manchester Triage software (also available outside NAD hours). Its scope is restricted to primary helicopter retrievals only. Inter-hospital transfers are organised between the DHBs and fixed-wing assets are arranged via the air service provider.

The centralisation of air ambulance helicopter tasking decision-making has helped overcome a pre-existing lack of understanding, and reluctance to use, the ANTS (Access; Number; Time Dependent; Skill Dependent) criteria, as well as a lack of understanding of the advantages and disadvantages of using a helicopter versus a road ambulance.

Based upon data that was provided to the Trauma Verification team, it appears that medical incidents are becoming more common and are approaching 50% of helicopter activity.

A recent evaluation of the NAD reported the following findings:<sup>68</sup>

- Total number of incidents where at least one helicopter has been dispatched has decreased by 7%, when adjusting for seasonality since the introduction of the NAD. In comparison, prior to NAD, there was an annual 10% growth.
- Total number of helicopters dispatched has also decreased by 4%. In comparison, prior to NAD, there was an annual 11% growth.
- There was a significant increase in the appropriateness of decision-making. A clinical review of a random sample of incidents found that 85% of helicopter dispatches met the ANTS criteria. The remaining 15% did not meet the ANTS criteria – i.e., a helicopter response was inappropriate.
- In 5% of cases, a helicopter was not dispatched, but should have been.

There are a number of circumstances in which ANTS may not be applied, including:

- urgent inter-hospital transfers not picked up by the usual Card35 request, and allocated by the dispatcher on request from the hospital;
- incidents where a helicopter was dispatched due to resourcing constraints (i.e., a road vehicle was unavailable);
- where centre Duty Managers over-rode NAD decisions; and

- some search and rescue incidents.

Feedback from the air service providers has been that the NAD has been a positive initiative. There is an audit mechanism, which they are involved with, however they do not feel they are involved sufficiently, nor receive timely feedback from the NAD with respect to tasking issues. In certain respects, they feel that the NAD is not “proactive” enough and results in delayed tasking. The perception is that not all “111” calls that should go to the NAD, do go to the NAD.

It was often mentioned to the Trauma Verification team, that the number, and distribution, of air ambulance/helicopter networks was driven by the importance of timeliness to trauma outcomes and accessibility to the scene. One of those aspects, commonly mentioned, was the occasional inclement weather encountered in NZ. When pressed however, there was very little data on how often weather and other environmental conditions actually impacted on accessibility to a trauma patient (“not often”, “maybe 5 times a year”, “very infrequent”), and virtually no hard information as to how often a patient is harmed as a result.

The following is an example of the complexities involved, in pre-hospital aeromedical retrieval, provided to the Trauma Verification team in a submission by Hawke’s Bay clinicians.

*“St John Ambulance operates the prehospital trauma service for our region. Patients on the edges of Hawke’s Bay catchment may be transported to other hospitals depending on the injuries, clinical stability, transport logistics and location. This was the case even prior to the major trauma destination policy. For example the Napier-Taupo highway which is a high accident zone often has helicopters and ambulances from Taupo, Waikato and occasionally other services attend especially multi-trauma accidents and patients may be transported north depending on prehospital triage decisions with the ambulance service. This also happens south to the Wellington region. Likewise patients sometimes fly to Hawkes Bay from out of our catchment (e.g. Gisborne, Wairarapa or Palmerston North areas) during prehospital multi-trauma events which may overwhelm local hospital service or sometimes because of weather or capacity issues in tertiary referral centres. Severe trauma that presents to Wairoa hospital (in northern Hawkes Bay) is transported back to Hawkes Bay with our inter-hospital ICU retrieval team which is doctor led. Due to the geography and airport infrastructure no other regional flight service planes can land at Wairoa currently. A recent example highlights many of these issues. On Thursday night last week the helicopter, a plane and an ambulance all staffed with doctors from Hawke’s Bay Hospital brought 8 multi-trauma patients from Wairoa hospital back to Hawkes Bay during a severe national weather event. Reliance on external providers would have resulted in significant delay, and potentially morbidity and mortality for the patients.”*

It does not go into detail as to how the overall coordination occurred, but it is illustrative of the complexities involved in pre-hospital decision-making and the importance of senior clinical involvement, beyond just

written policies, during such occasions.

Our only other available measure was paediatric inter-hospital retrievals. Of the 350 undertaken per annum, 5 have been aborted and resulted in delayed transfer.

## **Blood Transfusion**

The Trauma Verification Team received a presentation from a Transfusion Specialist from the New Zealand Blood Service. The Blood Service was established in 1998 and has a national approach to blood product use. It provides a 24/7 consultation service and has a national computer (web based) system that allows it to manage stocks, monitor and audit use. It appeared to be an excellent system for managing and monitoring blood stocks, and their consumption across the nation. We would recommend reporting on its effectiveness, if not already done so. There are aspects to this model (web based real time tracking) that could be borrowed and replicated in tracking major trauma and during disaster scenarios.

## Rehabilitation

The ACC funds specialist TBI and Spinal Cord Injury (SCI) rehabilitation services in NZ. The ACC will provide access to rehabilitation services until the person has returned to independence, or to the maximum level practicable, dependant on their injuries. The ACC also funds an inpatient rehabilitation facility based in Wellington for patients with traumatic brain injury.

The Trauma Verification team visited an Acquired Brain Injury (ABI) Rehabilitation facility in Wellington. It provides comprehensive services for people with traumatic brain injury and stroke, with specialist centres in Auckland and Wellington (doing about 90% of NZ's inpatient ABI rehabilitation). Others are a unit in Christchurch and one in Dunedin). Founded in 1996, ABI Rehabilitation was the first rehabilitation service in Australasia with Commission on Accreditation of Rehabilitation Facilities (CARF) accreditation. In addition, it is the only ACC-contracted provider of intensive TBI rehabilitation in the North Island and Nelson/ Marlborough areas. It provides both outpatient and inpatient care. Specifically for inpatient care it offers: emergence consciousness and neuro-behavioural assessment and care, psychological assessment services, concussion assessment and a spasticity clinic.

The ABI rehabilitation facility has 18 acute beds. It has a one FTE Rehabilitation physician specialist, when it should have a one FTE for 10 beds. There is occasionally junior medical trainee support.

Reported activity and outcomes are illustrated below. Over 90% of clients that go through the ABI Intensive Rehabilitation Programme return home and receive ongoing home-based or outpatient rehabilitation. (Fig 73, 74) Some have a period of transition in a residential service.

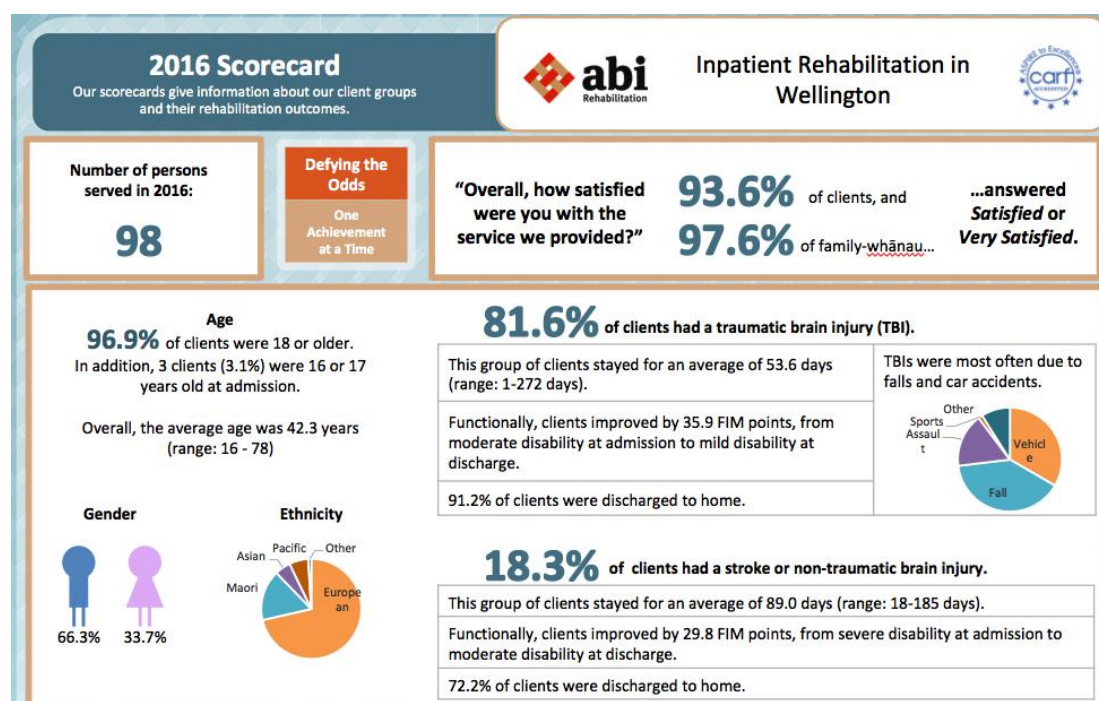


Figure 73 ABI rehabilitation ‘scorecard’ with information about clients and outcomes in Wellington

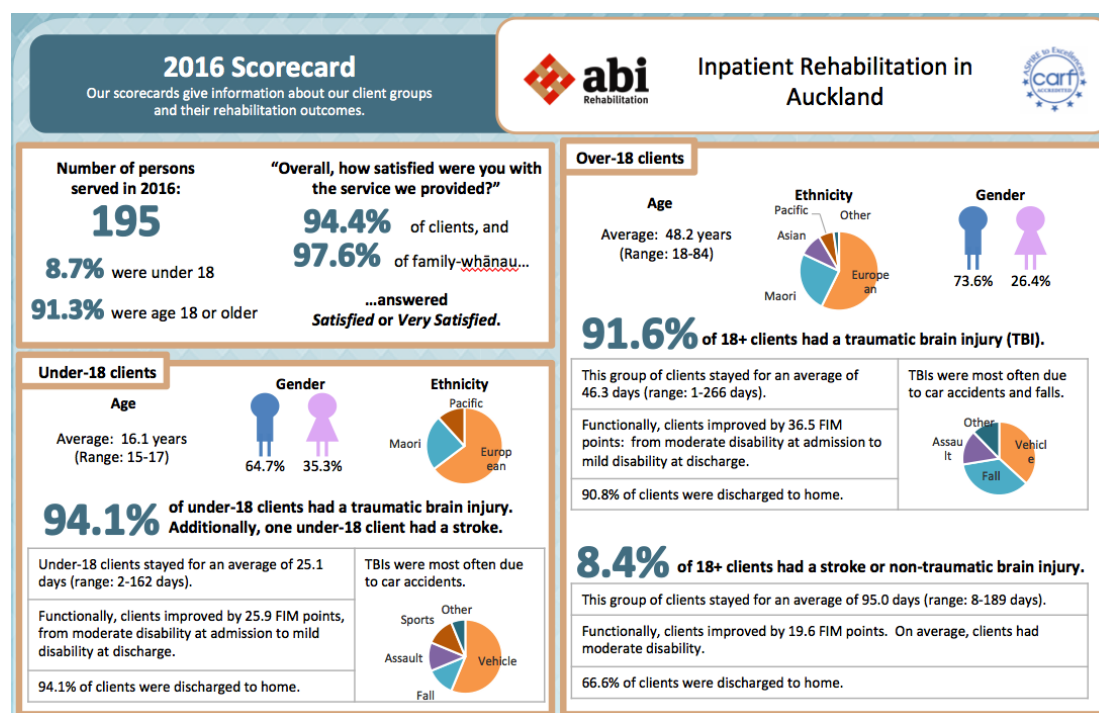


Figure 74 ABI rehabilitation 'scorecard' with information about clients and outcomes in Auckland

Community-based post-injury care and rehabilitation is delivered by the DHBs and private providers. The ACC holds contracts with a range of providers across a range of community rehabilitation providers. These providers provide almost exclusively ACC funded services (although some will provide services for MOH) Contracts are awarded via a tender process and require regular reporting and monitoring for quality.

Inpatient rehabilitation services are provided by DHBs. However the number of trauma patients requiring inpatient rehabilitation services, are small in comparison to that of the elderly inpatient. It has also been stated young people are particularly disadvantaged when inpatient rehabilitation services are predominately focussed at elderly patients, who in turn make up the majority of their clients. This remains a gap in rehabilitation service provision.

The other challenge is having inpatient specialised rehabilitation service within proximity to patient's home environment. There is currently a centralisation of specialised trauma/other rehabilitation services (Wellington and Christchurch), which means for many patients they receive rehabilitation outside of their home region. Thus high-needs patients are unnecessarily dislocated from their families, communities and specialists for both their residential rehabilitation care and return to their community. Once the patient has reached the stage whereby they are fit to go home, community supports and availability of case managers was considered to be strong and well received. In contrast, longer term inpatient rehabilitation was operating at high capacity, with bed blocks creating delays to acute hospital discharge.



Specialist rehabilitation physicians were in short supply, and this limited the amount of consultations they could provide within the acute hospital setting, thus delaying acute hospital inpatient rehabilitation assessment. We saw good examples of rehabilitation services working closely with in-hospital neurosurgical teams, but again, demand for these services exceed available supply, and this is likely to adversely impact on patient outcomes.<sup>69,70</sup> The shortage of rehabilitation physicians was accompanied by a shortage of psychological and counselling services.

This is a particularly difficult challenge for NZ, with its geographical size and distribution of its population. The attention should always be on patient outcomes. As centralised high volume specialised inpatient rehabilitation services are most likely to achieve better outcomes, then this should remain the focus. A shorter acute hospital stay with earlier rehabilitation contact is also important for better outcomes, and this currently remains under resourced. Thus a strategy of increasing the pool of existing acute inpatient rehabilitation specialists, allowing them to spend more sessions in the acute hospital period, closely integrating with admitting teams so that a planned facilitated transfer to an acute rehabilitation facility could be more timely and smooth. If follow up specialist surgical/trauma/medical consultations are required, they could be facilitated as a transfer to an outpatient setting, or for such consultations to occur within the rehabilitation facility.

An example of how some of these challenges are dealt with was given by the Hawke's Bay hospital: Head injury rehabilitation occurred in Hawke's Bay Hospital until 2011, when it was centralised to ABI rehabilitation services in Kenepuru and Auckland. Families are given a choice about which centre to attend. A referral is now made to ABI and an ABI assessor travels to HB to assess the patient, usually within a few days, and a discharge plan is made to either Kenepuru or Auckland. Discharge to the ABI is generally reasonably prompt, depending on bed availability. Patients are taken with tracheostomy if necessary, and most patients have Percutaneous Endoscopic Gastrostomy (PEG) insertion prior to discharge to ABI.

## **Injury Prevention**

Injury prevention activities are many, and actively pursued in the New Zealand context. Injury prevention is a strength of the New Zealand Health system and occurs at many levels of health service delivery.

Injury prevention occurs via a number of stakeholders, many of whom work collaboratively. For example the ACC partners with the NZTA (both of whom have a large interest and significant commitment to injury prevention) to reduce injuries due to road traffic crashes. This includes motorcycle safety programmes and programmes aimed at new/young drivers. Specifically for trauma, the ACC has also focussed injury prevention programmes on reducing falls, sports injuries, traumatic brain injury, assault and family violence.

The ACC undertakes injury prevention activities if it is likely to result in a cost-effective reduction in actual or projected levy rates, or future costs. The ACC takes a balanced portfolio approach to its injury prevention activities, which means it invests in a wide range of injury prevention activities, with a mixture of higher and lower expected returns across the individual activities. Investment in injury prevention has increased from \$30 million in 2014/15 to a budgeted \$70 million in 2017/18. The ACC uses a range of measures to assess whether its investments are having a meaningful impact on reducing the incidence and severity of injury. These include reach (programmes reached over 500,000 people in 2016/17); return on investment (in 2016/17 ACC returned \$1.63 for every dollar spent); injury claims avoided; and the reduction in severity of injury in the population groups targeted.<sup>8</sup>

## Consumer Experience

The Trauma Verification team were fortunate and grateful for the opportunity to speak to two patients who have experienced major trauma, about their experiences within the New Zealand Trauma System.

### Patient 1.

This patient, a middle aged female, was a sales representative for a promotional company, part time singer, married with one child, living in Wellington. She suffered a scooter crash, which resulted in severe facial, chest and traumatic brain injury whilst on holiday on Waiheke Island, requiring intubation and ventilation at the scene and then transferred to Auckland Hospital by helicopter. She spent four days in ICU and four weeks in a general ward, had a number of operations at the Auckland Hospital, and of note, had her definitive facial surgery at the Auckland Hospital. She was subsequently transferred to ABI Rehabilitation in Wellington where an acute missed injury was identified (toe fracture) and she spent six weeks with medical physiotherapy and Occupational Therapy care, before transitioning home. When home, the ACC caregivers continued to provide morning and afternoon assistance in the home (e.g. dinner preparation etc.) and child support. Sarah is very happy with her community Case Manager. She is back to singing, her long term memory has improved, but has on going issues with fatigue management.

In the acute phase the patient and her family received assistance with care of her 6-year-old child and her husband was reimbursed for all out of pocket expenses in relation to visiting her whilst in Auckland. Transfer costs from Auckland to Wellington were covered.

### Patient 2. (Patient's story told to us by her husband).

This patient, an elderly female, was a Professor of Music, of international reputation, who sustained a fall down steps whilst renovating her house, in preparation for planned holiday. Her husband called for an ambulance, which responded promptly and the patient was in the Wellington ED within 15 mins. She was rapidly assessed and subsequently had emergency neurosurgery for an intracranial haemorrhage.

The patient also had other multiple injuries, predominately distal limb fractures. She spent one week in ICU, and then a long stay in the neurosurgical ward. She was reviewed by a rehabilitation specialist when in the neurosurgical ward. While in hospital, she suffered an episode of nosocomial pneumonia requiring readmission to ICU. She spent about a month in hospital. Her husband felt she was prematurely discharged to rehabilitation. She was sent to the ABI Rehabilitation. While there she had an aspiration event (while being enterally fed via a nasogastric tube) on day five, requiring urgent transfer to the Wellington ED for respiratory failure. Her husband describes that experience with the ED to be totally different to the first occasion. Whereas on the first occasion, when admitted as a major trauma pre-hospital she was rapidly assessed, on this occasion, the ED was "very

busy/chaotic” and the patient spent many hours before being medically assessed, subsequently requiring intubation for deteriorating respiratory failure, after five hours in the ED and then a long wait for an ICU admission. She did not return to her pre-discharge levels at the end of this readmission and is currently in the ABI rehabilitation facility (status changed to residential) with minimal improvement after two years. Her husband believes that she suffered a number of medical complications, due to “complex systems errors, despite good people doing good things”.

When asked, he stated that he felt supported with respect to available community supports, and although didn't have a need for them, felt that he could access them if he needed to.

## Appendices

### Appendix 1 Submissions

As part of this review process of the New Zealand Trauma System, a public request for written submissions was sought, by the RACS Trauma Verification Program.



#### Invitation to Submit Information for New Zealand Trauma System Review

The NZ Transport Agency, with the support of the NZ National Major Trauma Clinical Network, has commissioned a project to seek verification of the New Zealand trauma system. A Trauma System Verification process is a multidisciplinary, formal review undertaken by the Royal Australasian College of Surgeons Trauma Verification Program to provide independent and expert review. The scope of verification encompasses emergency response in the pre-hospital setting, hospital care, and rehabilitation. The output of the verification will be consultative guidance on the NZ trauma system and optimisation of resources to ensure patients are treated in the right facility in the right amount of time. The benefit of this project is that it will provide expert advice to ensure that New Zealand's major trauma system and database is representative of international good practice and fit for purpose. This includes but not limited to viewing key processes, data collation, policies and the overall national strategy.

As part of this review, the Trauma Verification team will like to seek broad input. Those interested to contribute are invited to make a submission by writing to Ms Rosalind Wendt, Trauma Program Coordinator, Email: [trauma.verification@surgeons.org](mailto:trauma.verification@surgeons.org) or postal address: Fellowship Services Department, Royal Australasian College of Surgeons, PO Box 7647, East Brisbane, Qld 4169, by Friday, 3<sup>rd</sup> November 2017.



A summary of submissions received is indicated below.

### **College of Intensive Care Medicine, New Zealand:**

Due to NZ's geography, associated logistical challenges and that some of the DHBs are equipped to deal with and manage without transfer to tertiary centres major trauma, a Victorian type model of the management of major trauma does not therefore fully meet the requirements of a New Zealand system.

There is variability in provision of ICU services. Some centres have no capacity, some have limited capacity and some are fully independent and provide the service for others. There is no coordinated national transportation system for critically ill patients within NZ.

Importance of the appropriate planning of transport, utilisation of communications, use of appropriately trained staff with essential equipment, and effective liaison between referring, transporting and receiving staff at a senior level, as is recommended by Bi-National Medical Colleges.

Patient transport requires the use of a dedicated and highly skilled transportation team that is able to care for critically unwell patients.

Timely access to appropriate care may be at a local or regional hospital, or may be some distance away at a tertiary facility.

While there is some need for centralisation of expertise and resources, it is also important to maintain an adequate skillset across the country to ensure that patients are treated appropriately and in a timely manner, and also have access to services, including rehabilitation, close to their own support structures.

A consistent approach to trauma management.

### **Pre-hospital and Retrieval Medicine (Auckland HEMS):**

Emphasized the benefits of a formal medically staffed and/or supported HEMS, being:

- Early, safe, optimal patient care from doctor-paramedic pre-hospital critical care teams can strengthen the chain of survival in the setting of major trauma
- Integration of care provides for seamless transitions within phases of acute care (e.g. pre-hospital activation of massive transfusion protocols and major bleeding pathways)
- Clinical Governance, underpinned by specialist retrieval medicine guidelines and education
- Improved Clinical Leadership and Coordination

### **Australian and New Zealand College of Anaesthetists (ANZCA)**

Strong support for the establishment of the Major Trauma National Clinical Network in New Zealand with respect to facilitation of improvements in trauma care, data collection, an overview of trauma capabilities in smaller centres, and coordination of care.

Expressed a belief that the Network is beginning to gain traction with projects such as spinal cord

impairment policy, pre-hospital destination policy, and the major trauma registry

Strongly supports the New Zealand Major Trauma Registry

Notes and Recommends:

To reduce fragmentation of surgical services within tertiary trauma hospitals. Currently, only Waikato and Christchurch have all major surgical specialties onsite.

There is significant over-demand for intensive care resources currently, with a number of intensive care units operating at or near capacity. How to address this issue will need to be considered.

The success of a national trauma system is based on management of severely injured patients by senior medical staff working in a coordinated manner. ANZCA considers this already exists in New Zealand, and anaesthetists are motivated to develop pathways with colleagues to further improve this.

ANZCA considers that committees reviewing patient care from arrival to completion of acute care should include anaesthesia representation.

The level of trauma care available outside major metropolitan areas needs to be reviewed, to make sure that trauma patients in remote areas have as good a chance of a reasonable outcome as trauma patients in metropolitan areas.

When examining service provision in rural and remote areas, the level of service available and reliance on volunteer-based services needs to be assessed.

It should also be considered whether first responders (such as ambulance services) have access to appropriate resources, staffing and skill levels for trauma care. Regular and ongoing training should be available for first responders.

We are aware that regional trauma networks have already been established. The operation of communication networks and support systems throughout these networks should be considered, including how available technology such as telemedicine can best be utilised, and ensuring clear inter-DHB referral pathways for trauma patients are established, including a single point of entry, to minimise the need for multiple phone calls when arranging patient transfers.

Increased inter-professional collaboration and training for trauma teams would be beneficial, including anaesthesia, emergency medicine, intensive care, and surgery. Operating room simulation training could be established for trauma teams using a model like the University of Auckland's MORSim programme. Inter-professional training is a vital part of improving communication between groups, as demonstrated by the success of the Emergency Management of Severe Trauma course run by RACS.

Further development of the Definitive Anaesthetic Trauma Care (DATC) course would be useful, to educate anaesthetists, surgeons and nurses in coordinated management of severe trauma.

Clinically, anaesthetists are an important part of the trauma team in most hospitals in the early phase of care. Anaesthetists have an essential role in providing airway management, damage-control resuscitations, leadership and decision-making, advanced analgesia, and intraoperative care. Also, a significant number of regional and provincial hospitals do not have full-time intensivists cover, and anaesthetists largely provide that service in those hospitals.

Anaesthetists do and can provide clinical leadership via involvement in local, regional and national trauma committees, and some are involved in trauma education, such as DATC courses.

Anaesthesia's future contribution to New Zealand's trauma system:

Anaesthetists will continue to make an essential contribution to the care of trauma patients in New Zealand, including early management of patients after arrival in hospital, and facilitating early access to surgery.



## Appendix 2 Site Visit Program

### Day 1, Monday 27 November: Wellington

Time	Location	Name, position
07:30 -08:30 Introductory brief/review scope of verification with members of the Major Trauma National Clinical Network	Meeting Room	Ian civil, National Clinical Lead Siobhan Isles, National Programme Coordinator
09:00 – 10:30 Ministry of Health (Staff and documents)	Meeting Room	Stuart Powell, Chief Advisor System Performance Jane Potiki, Principle Advisor, National Services
10:30 – 12:30 ACC staff and documents		Deb Anselm, Manager Health System Design
12:30 NZ Transport Agency		James Newton
13:00 – 14:00 National Ambulance Sector Office		Jon Leach, Team Leader senior ambulance staff,
14:00 – 15:00 Wellington Free Ambulance – Meet ambulance staff		Andrew Bos, Exec Manager Operations Paul Fake, Exec Mgr clinical services
<b>Wellington Hospital:</b>	Main entrance, Level 2	
15:15 – 16:00 Meet CEO and CMO.	Seminar room, Intensive Care Unit, Level 3, main hospital	John Tait Chief Medical Officer CCDHB Debbie Chin, CEO Chris Lowry, COO
16:00-16:45 Tour hospital		Renate Donovan, TNC
16:45-17:15 Meet Clinical Lead for the Central Region and Chair of the NZ-MTR Governance Group		James Moore
<b>Life Flight Trust</b>	17 George Bolt St, Wellington	
17:45-18:45		Speak with stakeholders

### Day 2, Tuesday 28 November: Auckland

<b>Auckland District Health Board</b>		
<b>Auckland City Hospital</b>	2 Graften Rd, Auckland. foyer	
08:00 – 09:00 Visit Starship Hospital trauma service and staff	Centennial Room, Clinical Education Centre Auckland City Hospital	James Hamill, Clinical Lead Paediatric Trauma Julie Chambers, Starship Trauma Coordinator
09:00 – 10:00 Tour Auckland City Hospital		Ian Civil, National Clinical Lead Jon Mathy, Consultant Plastic Surgeon Li Hsee, Service Clinical Director Matt Sawyer, TNC
10:00 – 11:00 Meet CEO and Director of Surgery		Ailsa Claire, CEO Arend Merrie, Director of Surgery
12:00-13:00 meet with Bridget Kool		Bridget Kool, Academic Director, School of Public Health, University of Auckland
13:30 – 15:30 Ambulance sector (Dr Tony Smith) -tour of Ambulance HQ, meet staff (e.g. those involved in retrieval, paramedics)	2 Harrison Rd, Mt Wellington	Tony Smith, Medical Director, St John Ambulance

**Team 1 – Christchurch Hospital (Wednesday)**

Mark Fitzgerald - Tony Joseph - Ailene Fitzgerald – Rosalind Wendt

**Team 2 – Dunedin Hospital (Wednesday)**

Arthas Flabouris- Mark Elcock- Maxine Burrell

**Day 3, Wednesday 29 November: Christchurch or Dunedin and Wellington**

<b>Team 1: Christchurch</b>		
<b>Christchurch Hospital</b>	Main entrance, Riccarton Ave, Christchurch	
08:00-10:00 Meet trauma team + tour of hospital	Level 2 Corporate Building near Hospital need to sign in	Dominic Fleischer, co-lead trauma (FACEM) Gregory Robertson, Chief of Surgery Alan Pithie, Chief of Medicine Mel Evans, TNC
10:00-11:00 Meet CEO and General Manager		Pauline Clark, COO David Meates, CEO Dan Coward, GM, Older Persons Health & Rehabilitation
11:30-12:30 <b>Garden City Helicopter</b>	515 Memorial Avenue, next to Christchurch Airport,	Rick Knight – pilot Stuart Farquhar - COO
<b>Team 2: Dunedin Hospital</b>		
	Dunedin Hospital 201 Great King St	
8:00-10:00 Meet CEO and COO Tour of Hospital Meet Ambulance service staff and retrieval if applicable		Chris Fleming, CEO Pauline Buchanan, District Operations Manager Michael Hunter, Trauma Director Gordon Speed, TNC Martin Watts, Acting Trauma Lead Rebecca Coats, TNC Southland Hospital Fiona Thomas, Trauma Nurse Specialist
10:30-11:30 Otago Rescue Helicopter	Taieri Airfield in Mosgiel	Graeme Gale, Owner and Chief Pilot Doug Fleet, Senior Paramedic
Teleconferences		
16:30-17:30 Northern Region	Teleconference	Mike Roberts, CMO Northland and Clinical Lead Trauma
17:30-18:30 Hawkes Bay	Teleconference	Albert Lo, trauma lead, vascular surgeon Susan Hawken, TNC
18:30-20:30 Midland Region	Teleconference	Grant Christey, Clinical Lead trauma Alaina Campbell, Regional Programme Manager

### Day 4, Thursday 30 November: Wellington

Teleconferences	RACS Office	
09:00 – 10:00 Greymouth trauma	Board Room Teleconference	Andrew Laurenson, hospitalist, trauma lead
11:00 – 12:00 ACC Serious Injury Case Manager		Jennifer de Wringer
13:00 – 14:30 <b>Rehabilitation services in Wellington</b>	ABI inpatient hospital 4 Chapel Rd Porirua Via Lower Main Drive (Lucy Stewart)	Robin Sekerak - rehab specialist
14:30 – 16:00 patients		A few patients, and their carers, with trauma related disability, or recently completed rehabilitation from serious injury
16:30-17:30 Team debrief	Board Room	Site Review Team
17:30-18:30 Exit debrief		Ian Civil Siobhan Isles Jane Potiki James Newton Li Hsee Deb Anselm Kaye Clark

### Day 5, Friday 1 December: Wellington

<b>RACS Office</b>	Lvl 3, 8 Kent Tce, Mt Victoria, Wellington	
9:00-12:00 Report compilation	Meeting Room	Site Review Team

## **Appendix 3 Agreement between New Zealand Transport Authority and Royal Australasian College of Surgeons – Research Brief**

Schedule 1 – NZ Transport Agency representatives on Project Steering Group

# Post impact care – the fifth pillar of road safety

Submitted by James Newton

March 2017

VERSION 3

How well New Zealand delivers post impact care - Verification of the New Zealand Trauma System

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### **PURPOSE OF THE PROJECT**

It is proposed that the NZ Transport Agency, in partnership with the National Major Trauma Clinical Network, commission a project to seek verification of the New Zealand trauma system. This is an important project for New Zealand and for the NZ Transport Agency as the data from the New Zealand Major Trauma Registry suggests that nearly 50% of patients have major injuries associated with road trauma i.e. car, motorbike, cycle and pedestrians.

The Safe System approach to road safety, as adopted by New Zealand through the Safer Journeys Strategy 2010- 2020, consists of four core pillars – safe speed, safer roads and roadsides, safer vehicles, and safer road users. The safe system has a strong focus on prevention of road traffic crashes and mitigation of energy exchange when a crash occurs. The fifth pillar of the safe system, as identified through the United Nations, Decade of Road Safety Action 2010 - 2020 is known as, Post Impact Care, and focusing on crash victims in the event of a safe system failure.

Post Impact Care has been identified as a key strategic priority for the NZ Transport Agency's newly formed Centre of Excellence for Road Safety.

The benefit of this project is that it will provide expert advice to ensure that New Zealand's major trauma system and database is representative of international good practice and fit for purpose. This includes but not limited to viewing key processes, data collation, policies and the overall national strategy.

A Trauma System Verification process is a formal review undertaken by the Royal Australasian College of Surgeons to provide independent and expert review. The output of the verification will be consultative guidance on the NZ trauma system and optimisation of resources to ensure patients are treated in the right facility in the right amount of time. The scope of verification encompasses emergency response in the pre-hospital setting, hospital care, and rehabilitation. The emphasis in this review will be toward ensuring the policy settings and governance are appropriately arranged as these are the most important in the New Zealand context at this time.

The Major Trauma National Clinical Network has three main priorities, which are to:

1. Establish a formal trauma structure and system across New Zealand
2. Establish the New Zealand Major Trauma Registry
3. Develop consistent guidelines and plans for managing trauma in New Zealand.

By focusing on these priorities, the Major Trauma National Clinical Network aims to help shape the future delivery of trauma services in New Zealand. This includes how patients are treated:

- Before they arrive in hospital
- During their time in hospital
- During rehabilitation.

In 2012 the Major Trauma National Clinical Network (the "Network") was established with the intent to establish a contemporary trauma system and realise the benefits seen in other jurisdictions such as the State of Victoria (Australia). The benefits of a robust trauma system, as shown in Victoria, Australia, include lower mortality rate, improved outcomes for those that survive, and cost efficiency across the health system.

Over the last couple of years the Major Trauma National Clinical Network has made significant progress across the Network's three priority areas:

- Establish a formal structure, with a national network and governance structure, four regional hubs, and initiatives ranging from communications to training in place
- Data collection and input to the NZ Major Trauma Registry - there is now data collection in place in 21 of 22 hospitals and we are in the process of preparing the 2015/16 end of year report. It will take 5 - 10 years to reap the full benefits of data collection
- Nationally consistent guidelines and policies, the most important of which is the pre-hospital destination policy which describes which hospital to take patients with major trauma to in each region for definitive care. This is expected to be implemented 27 March, 2017.

The Major Trauma National Clinical Network is now at a point where much of the foundation work has been developed and is looking to the future to inform the strategic direction and ensure the sustainability and optimisation of the national system.

By collectively working in partnership with the Major Trauma National Clinical Network and better understanding the major trauma process and stakeholders will assist the NZ Transport Agency will make more informed decisions in relation to the reduction of road trauma and establishing a robust foundation for future data collaboration and insights.

## WHO WILL LEAD AND MANAGE IT

**Project Steering Group:**

- The proposed project has been sponsored by the NZ Transport Agency, Director of Safety – Harry Wilson
- The strategic relationship holder within the Agency will be managed by the NZ Transport Agency Road Safety Programme Director – Kaye Clarke
- The project delivery will be managed by the NZ Transport Agency, Road Safety Consultant James Newton in partnership with the Major Trauma National Clinical Network, Ian Civil, Clinical Lead, and National Programme Coordinator, Siobhan Isles.

#### **Preferred Supplier:**

The preferred supplier for this project is the consultancy services of the Royal Australasian College of Surgeons.

The Royal Australasian College of Surgeons specialise in leading hospital and trauma systems verification and audits in Australasia and are internationally acknowledged as experts providing independent reviews and consultancy services.

A project management team will be established for the delivery of this work. The project management team will consist of both NZ Transport Agency and Major Trauma National Clinical Network senior staff, through the approval of the NZ Transport Agency Safety Director, Harry Wilson.

## **OTHER PARTIES /STAKEHOLDERS CONTRIBUTING**

### **Major Trauma National Clinical Network**

The Major Trauma National Clinical Network is leading the establishment of a contemporary trauma system in New Zealand. The Network is made up of management and senior clinical leaders from New Zealand's four regional trauma networks which represent the 20 District Health Boards (DHBs). The Network also includes representatives from ambulance services and other key stakeholders.

The Major Trauma National Clinical Network is supported by funding from the Accident Compensation Corporation (ACC) and the Ministry of Health (MoH). The Major Trauma National Clinical Network is a quality improvement initiative to reduce preventable levels of mortality, complications and lifelong disability amongst people who sustain a major trauma.

The relationship between the NZ Transport Agency and the Major Trauma National Clinical Network is strategically important as we work towards a collaborative approach to road trauma reduction in New Zealand and our national alignment with the core delivery of a safe system approach and the United Nations Decade of Road Safety Action 2010 – 2020.

### **NZ Transport Agency's Research Programme**

RFP 2016-716 ART 16/27 - Post impact care – the fifth pillar of road safety - How well New Zealand delivers post impact care through to hospitalisation?

The NZ Transport Agency is leading national research considering how well New Zealand delivers post impact care from location of trauma through to hospitalisation. The research is

focused on time and location (rural and urban) of impact to hospitalisation for the prevention of fatalities and or increased severity of injury. This research has a focus on the transport and transport related components relating the delivery of post impact care.

It is intended that this proposed verification of the Major Trauma National Clinical Network will coincide with the delivery of the RFP 2016-716 Post Impact Care research. It is therefore proposed that this verification be conducted in the fourth quarter of this (2017) calendar year.



## **Appendix 4 List of Documents Viewed During Verification and Supporting Documents (complete documents supplied separately)**

- NZ Trauma Registry Data Governance Group Terms of Reference
- 2017-2018 MTNCN workplan 29 May 2017 Draft
- Listener Code Red article
- 2014-15 MTNCN implementation plan 9 Sept 2014 IC edits
- 2015-16 MTNCN workplan December draft
- Agreement between NZTA and RACS for Trauma System Review
- ACC Treatment Provider Handbook 2017
- Briefing and speech notes for Minister of Health
- Briefing on NZ Health System for the RACS Trauma System Review
- Briefing on NZ Health System for the RACS Trauma System Verification
- Combined PRQ attachments New Zealand System Review
- Does prehospital management by doctors affect outcome in major trauma? Wilson SL et al., 2017
- Dunedin Hospital: Its place in the NZ Trauma System
- Early predictors of functional outcome after trauma. Nemunaitis G et al 2016
- Early Rehabilitation in the Medical and Surgical Intensive Care Units for Patients with and Without Mechanical Ventilation: An Interprofessional Performance Improvement Project. Corcoran JR et al 2017
- Establishment of a trauma service for the Southern District. Mike Hunter, 2016
- ANZCA submission to New Zealand Trauma System Review 2017
- Midland Trauma Regional System Report – Australasian Trauma Verification Program
- Flying hours from Otago Helicopters
- Hawke's Bay Hospital submission to New Zealand Trauma System Review 2018
- Strategic Refresh of the Health Research Council – Report to the Minister of Health and the Minister of Science and Innovation
- Huge gulf of trauma care between North and South Islands
- Major Trauma in Christchurch District Health Board
- Major trauma destination policy – Auckland and Northland areas, Feb 2017
- Major trauma destination policy – Lower North Island area, Feb 2017
- Major trauma destination policy – Midland area, Feb 2017
- Major trauma destination policy – South Island, Feb 2017
- Major Trauma Network out of Hospital Triage Policy and Destination Policy
- Major trauma staging guidelines, Feb 2017
- Major trauma assessment and initial management
- Motorcycle crashes & trauma: merging NZ Transport Agency Crash Analysis System & Midland Trauma System Trauma Registry datasets to gain new insights. Smith A and Morrison C
- New Zealand Major Trauma Minimum Dataset

- New Zealand Major Trauma Network Strategic Plan for RACS 2017-2022
- The New Zealand Major Trauma Registry: the foundation for a data-driven approach in a contemporary trauma system. Isles S et al.2017
- National Institute for Health and Care Excellence Guideline. Major trauma: assessment and initial management.2016
- Notes template for New Zealand System Report 2017
- Garden City Helicopters submission New Zealand Trauma System Review 2018
- Health Research Council of New Zealand: Statement of Intent 2014-2018
- New Zealand Trauma System Review Pre-review Questionnaire
- New Zealand Trauma System Review schedule
- New Zealand Transport Authority update report for New Zealand Trauma System Review
- New Zealand Trauma System Verification indicative scope 24 November 2017
  - Post impact care the fifth pillar – James Newton
- Prehospital and retrieval medicine – Auckland HEMS presentation to the RACS Trauma Verification Visit
- Quality Improvement Committee recommendations re: a National Trauma Network, 25 November 2009
- Quality Improvement Committee letter to Minister of Health 14 October 2009
- RACS Trauma System Review background on stakeholders
- About Safer Journeys strategy. National Road Safety Committee
- Safer pre-hospital anaesthesia 2017. Association of Anaesthetists of Great Britain and Ireland
- St John Clinical Procedures and Guidelines. Comprehensive edition 2016-2018
- St John Clinical Procedures and Guidelines. Pocket edition 2016-2018
- Standards for inpatient adult rehabilitation services 2011 – NZ. Australasian Faculty of Rehabilitation Medicine and RACS
- New Zealand Major Trauma Network Draft Strategic Plan 2017-2022
- Submissions to the New Zealand Trauma System Review
- Major Trauma National Clinical Network Work Programme Terms of Reference 21 April 2016
- Safer Journeys. New Zealand's road safety strategy 2010-2020.
- Implementation of a National Major Trauma Network – Health Report 12 April 2010.

## Glossary

<b>ACC</b>	Accident Compensation Corporation
<b>ACS</b>	Acute coronary syndrome
<b>AIS</b>	Abbreviated Injury Scale
<b>ANTS</b>	Access; Number; Time Dependent; Skill Dependent
<b>ANZACSQI</b>	All New Zealand Acute Coronary Syndrome Quality Improvement
<b>ANZDATA</b>	Australia and New Zealand Dialysis and Transplant Registry
<b>ANZICS</b>	Australian and New Zealand Intensive Care Society
<b>ANZOD</b>	Australia and New Zealand Organ Donation Registry
<b>ARG</b>	Air Rescue Group
<b>ARHT</b>	Auckland Rescue Helicopter Trust
<b>CARF</b>	Commission on Accreditation of Rehabilitation Facilities
<b>CORE</b>	Centre for Outcome and Resource Evaluation
<b>CT</b>	Computed tomography
<b>DATC</b>	Definitive Anaesthetic Trauma Care
<b>DHB</b>	District Health Board
<b>ED</b>	Emergency Department
<b>eGOS</b>	Extended Glasgow outcome score
<b>EVD</b>	Extraventricular Drain
<b>FTE</b>	full time equivalent
<b>HB</b>	Hawkes Bay
<b>HPA</b>	Health Promotion Agency
<b>HQSC</b>	Health Quality and Safety Commission
<b>ICH</b>	intracranial hypertension
<b>ICP</b>	intracranial pressure
<b>ICU</b>	Intensive Care Unit
<b>ISS</b>	Injury Severity Score
<b>LOS</b>	length of stay
<b>MoH</b>	Ministry of Health
<b>MORSim</b>	Multidisciplinary Operating Room Simulation
<b>MPDS</b>	Medical Priority Dispatch System
<b>MTNCN</b>	Major Trauma National Clinical Network

<b>NAD</b>	National Air Desk
<b>NASO</b>	National Ambulance Sector Office
<b>NMDS</b>	National Minimum Dataset
<b>NZIPS</b>	New Zealand Injury Prevention Strategy
<b>NZ-MTR</b>	New Zealand Major Trauma Registry
<b>NZTA</b>	New Zealand Transport Agency
<b>OCC</b>	outstanding claims liability
<b>OCL</b>	outstanding claims liability
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>ORHT</b>	Otago Rescue Helicopter Trust
<b>PACS</b>	picture archiving and communication system
<b>PCI</b>	percutaneous coronary intervention
<b>PEG</b>	Percutaneous Endoscopic Gastrostomy
<b>PICU</b>	Paediatric Intensive Care Unit
<b>PRIME</b>	Primary Response in Medical Emergencies
<b>PRQ</b>	Pre Review Questionnaire
<b>RACS</b>	Royal Australasian College of Surgeons
<b>SCI</b>	spinal cord injury
<b>SMR</b>	Standardised Mortality Ratio
<b>TBI</b>	Traumatic brain injury
<b>TRISS</b>	Trauma Injury Severity Score
<b>VKT</b>	vehicle kilometres travelled
<b>VOSL</b>	value of statistical life
<b>WHO</b>	World Health Organisation

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