

NZ Spinal Cord Injury Registry
Te Rēhita Whara Aho Tuaiwi ā-Motu

New Zealand Spinal Cord Injury Registry

Five-year Special Report 2020-2024

In partnership with
PRAXIS
Spinal Cord Institute

As Chair of the **New Zealand Spinal Cord Injury Registry (NZSCIR)** Governance Group, I am pleased to introduce this five-year special report. The report brings together national Registry data from 2020 to 2024 to describe who is experiencing spinal cord injury or impairment in Aotearoa New Zealand, how people move through specialist spinal services, and what the data tells us about emerging service, equity, and outcome priorities. It is intended as a technical report rather than a narrative annual review; however, the Registry's purpose is ultimately practical: to support better evidence, better service planning, and better outcomes for people with spinal cord injury and their whānau.

The NZSCIR team would like to thank the 3,677 people with spinal cord injuries who have contributed their time and experiences to the Registry since it's inception. We would also like to acknowledge all the spinal service clinicians for their work, data collection and providing specialist insight into the findings in this report.

Thanks also to the Praxis Spinal Cord Institute for their ongoing Registry support and expertise, statistician Asheel Ramanlal for his specialist knowledge in developing this report, and Jo Kinley from Hullaballoo Design.





Dr. Christine Howard-Brown

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Contents

NZSCIR purpose and scope 4
Impact and use of registry data 5
NZSCIR framework 6
What is a spinal cord injury? 6
NZ spinal cord injury services 6
Governance and data management of the NZSCIR 7
Five-year overview 7
Reader guide 7
Total NZSCIR participants 2020-2024 8
Participants by service and type 9
Admissions to the rehabilitation facilities by service 9
Participants by sex 9
Consent rates: Full dataset vs minimal dataset 10
Participants by SCI type 11
Participants by age 12
Participants by ethnicity 13
Weight and Body Mass Index (BMI) of those attending rehabilitation 14
Pre-existing conditions 15
Traumatic SCI (tSCI) 15
Comparison of tSCI by year 16
Causes of tSCI 17
tSCI causes by age 18
tSCI causes by sex 18
Location of tSCI events 19
Sport and leisure-related injury breakdown 20
Transport breakdown 21
Other tSCI causes 21
Perioperative tSCI 21
Non-traumatic spinal cord impairment (ntSCI) 22
Comparison of ntSCI by year 22
Causes of ntSCI 22
ntSCI causes by age 23
ntSCI causes by sex 23
ntSCI original hospital admission 24
What is the level of and severity of injury? 25
AIS change over stay 26
AIS change over stay, by service 27
What are the length of hospital stays? 28
Length of stay by discharge AIS grade 29
What factors impact LOS? 29
Where do people go after discharge from hospital? 30
How many people have surgery? 31
Time to decompression for tSCI 32
Location of first surgery for those with tSCI 33
Secondary complications 34
Mortality 35
Functional outcomes 36
Spinal Cord Independence Measure (SCIM) distribution 36
SCIM change 37
SCIM change by discharge AIS grade 38
How many people walk on discharge? 38
Registry Evolution 40
Challenges, limitations and future priorities 40
Glossary 41
References 42
Appendix A: Denominators, reporting basis and interpretation 45
Appendix B: Statistical analyses 49
Appendix C: SCIM scoring framework 50
Appendix D: Supplementary mobility analysis 51

NZSCIR purpose and scope

Executive summary

This five-year special report provides a national overview of new traumatic and non-traumatic spinal cord injury or impairment recorded by the New Zealand Spinal Cord Injury Registry between 2020 and 2024. Across the reporting period, 1,187 new participants were admitted to New Zealand's specialist spinal services. The report identifies several important themes: increasing overall admissions, a narrowing gap between traumatic and non-traumatic injuries, marked differences between service catchments, an ageing cohort, over-representation of Māori and Pacific Peoples, high rates of surgical intervention, substantial rehabilitation demand, and meaningful functional gains for most people with complete rehabilitation data. These findings support the Registry's role in monitoring national trends, informing service planning, identifying equity priorities, and guiding future research and quality improvement.

The New Zealand Spinal Cord Injury Registry (NZSCIR) was established in August 2016 to collect, analyse, and disseminate nationally relevant and internationally comparable data on **spinal cord injury and impairment (SCI)** in Aotearoa New Zealand. The Registry supports quality improvement, service planning, benchmarking, and research aligned with the objectives of the New Zealand Spinal Cord Impairment Action Plan, which sought to improve health, wellbeing, participation, and quality-of-life outcomes for people with SCI and their whānau. [1]

Methods and interpretation

This report is primarily descriptive. It summarises Registry data using counts, percentages, medians, ranges, and selected statistical analyses where these provide additional insight into service utilisation or outcomes. Denominators vary between figures because some variables are collected only for consented participants, while others are available through the minimal dataset. Where subgroup counts are fewer than five, raw numbers are withheld to protect privacy. Findings should therefore be interpreted as population-level patterns within the Registry dataset, not as causal conclusions unless specifically stated.

Denominators vary across the report depending on whether the analysis uses the whole Registry cohort, the full consented dataset, a specific injury subgroup, year-by-year data, aggregated five-year data, or complete-case records. Appendix A provides a detailed denominator and reporting-basis table to support accurate comparison between sections.

The Registry collects prospective data from adults with a new **traumatic spinal cord injury (tSCI)** or new **non-traumatic spinal cord impairment (ntSCI)** or **cauda equina syndrome** who are admitted to one of New Zealand's two **supra-regional spinal services (spinal services)**:

Auckland: Middlemore Hospital (MMH) / Auckland Spinal Rehabilitation Unit (ASRU).

Christchurch: Christchurch Hospital (ChCh) / Burwood Spinal Unit (BSU).

The NZSCIR is permitted to collect a non-consented minimal dataset (MDS) for everyone who is admitted to one of the spinal services with a new SCI. Additional data including demographic information, complications, functional outcome measures and community follow-up information is collected from participants who provide informed consent.

Participants are followed across the care pathway, including acute treatment, specialist rehabilitation, and long-term community follow-up. Some participants may only attend either acute or rehabilitation at the spinal services. Individuals who are treated solely in a regional hospital are excluded.

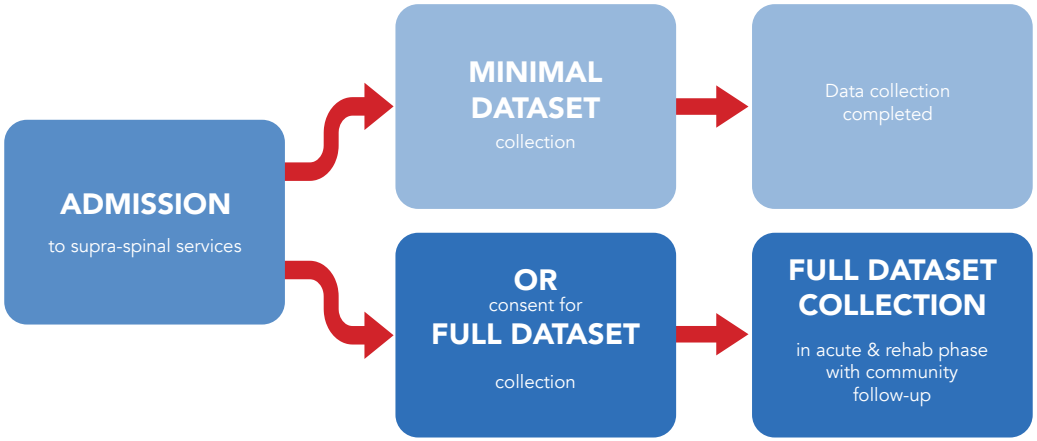


Figure 1: NZSCIR data collection process

The Registry's data collection, reporting, and research activities are guided by five fundamental questions:

- **Demographics and causation:** Who is experiencing SCI in Aotearoa NZ, and from what cause?
- **Longitudinal outcomes:** What are the functional, health, participation and wellbeing outcomes of people with SCI and whānau at specific time points? [Time points: Discharge; 18-months following date of injury (tSCI) or admission (ntSCI); 5-years post-SCI; 10-years post-SCI; 15-years; 20+-years]
- **Service access:** To what extent and how well can people with SCI, and their whānau access healthcare, rehabilitation and support services across the whole of their lives?
- **Secondary complications:** What complications and/or secondary health conditions do people with SCI experience across the whole of their lives?
- **Equity and benchmarking:** Are SCI services provided and health and wellbeing outcomes achieved equitably within Aotearoa NZ, and are they internationally comparable?

These *a priori* questions provide the framework for data collection, reporting and research activities, ensuring that NZSCIR continues to generate meaningful evidence to inform clinical practice, service development, policy and future priorities.

Impact and use of registry data

NZSCIR data is routinely used to support clinical audit, quality improvement, service planning, education, and knowledge sharing across New Zealand's spinal services. Clinicians use Registry data to inform local audits, investigate service trends, compare outcomes with international benchmarks, and support research and conference presentations. A formal data access policy ensures requests are ethical, purposeful, and consistent with the Registry's approved scope.

Research using NZSCIR data has identified important shifts in the epidemiology of tSCI, including an increasing median age at injury and rising incidence among women, older adults and Māori [2]. Registry data has also been used to investigate rehabilitation outcomes, including the impact of pain on function and wellbeing following SCI [3]. These studies demonstrate the value of longitudinal, population-based data in understanding the changing needs of people living with SCI and evaluating outcomes across the continuum of care.

During the reporting period, Registry data informed audits examining bladder management practices and urinary tract infection rates, providing valuable insights into current practice and identifying areas requiring further investigation. Analysis of International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) assessment data also highlighted opportunities to improve documentation, completion and scoring accuracy, leading to targeted education initiatives and significantly improved neurology assessment practices at both sites.

Beyond audit and quality improvement activities, NZSCIR data is used to support patient education and monitor changing population and service characteristics over time. It helps clinicians better understand trends in the ageing SCI population, patterns of service utilisation, length of stay, and discharge outcomes, providing an evidence base for ongoing service development and planning.

With over nine years of accumulated data, NZSCIR represents a unique national resource for SCI research. Ongoing collaborations with academic and clinical partners, including the University of Auckland's multidisciplinary SCI research programme and Canada's Rick Hansen SCI Registry, continue to expand opportunities for knowledge generation, ultimately supporting improvements in care and outcomes for people with SCI.

NZSCIR framework

What is a spinal cord injury?

SCI refers to damage to the spinal cord that results in temporary or permanent changes in strength, movement, sensation and bodily functions [4]. Cauda equina syndrome occurs as a result of the compression of the nerves emerging below the spinal cord and often affects bladder, bowel and sexual functioning [5]. SCI and CES may occur as a result of sudden trauma (tSCI) or develop over time due to illness, structural changes in the spinal column or underlying medical conditions (ntSCI). Although relatively uncommon, SCI and CES are complex conditions with life-altering consequences that can affect people at any stage of life.

NZ spinal cord injury services

An additional recommendation from the SCI Action Plan was the introduction of the Destination Policy in 2015 [1]. Under this policy, emergency services are directed to transport people with a suspected or confirmed SCI directly to one of Aotearoa NZ's two supra-regional specialist spinal acute centres: Middlemore or Christchurch Hospitals. International evidence demonstrates that early transfer of individuals with SCI to specialist centers is associated with improved outcomes [6-11]. Early management within specialised spinal services—particularly for patients experiencing bladder and bowel dysfunction including those with cauda equina syndrome, is linked to better clinical outcomes. The increasing number of such cases in the NZSCIR data may reflect greater awareness of the benefits of early referral and specialist intervention.

The map (Figure 2) illustrates the catchment areas for these two adult spinal services, which provide both acute and rehabilitation care. The catchment boundaries were determined based on population distribution, travel efficiency, and the capacity of each service.

Rehabilitation capacity differs between services, with ASRU having 20 and BSU 30 beds. However, a new 30-bed specialised rehabilitation centre at Manukau Health Park is planned to replace the outdated Auckland Spinal Rehabilitation Unit in Ōtara [12]. The new facility will expand spinal rehabilitation availability and integrate both physical and vocational therapy services, significantly improving access to rehabilitation for the northern region of NZ.

While tSCI is supported by a national destination policy, no equivalent framework exists for those with ntSCI. As a result, clinical capacity constraints limit the routine transfer of all persons with an SCI to supra-regional specialist centres across NZ. Despite this, Christchurch Hospital is seeing increasing volumes of complex surgical procedures, possibly reflecting a reduction in surgical capability or capacity across some regional centers. In contrast, within the Auckland catchment, surgical specialty services are more broadly distributed across major regional hospitals. Consequently, individuals with ntSCI may be more frequently managed within these regional centres, resulting in a lower proportion of cases being centralised. This variation in service configuration may contribute to the observed regional differences.

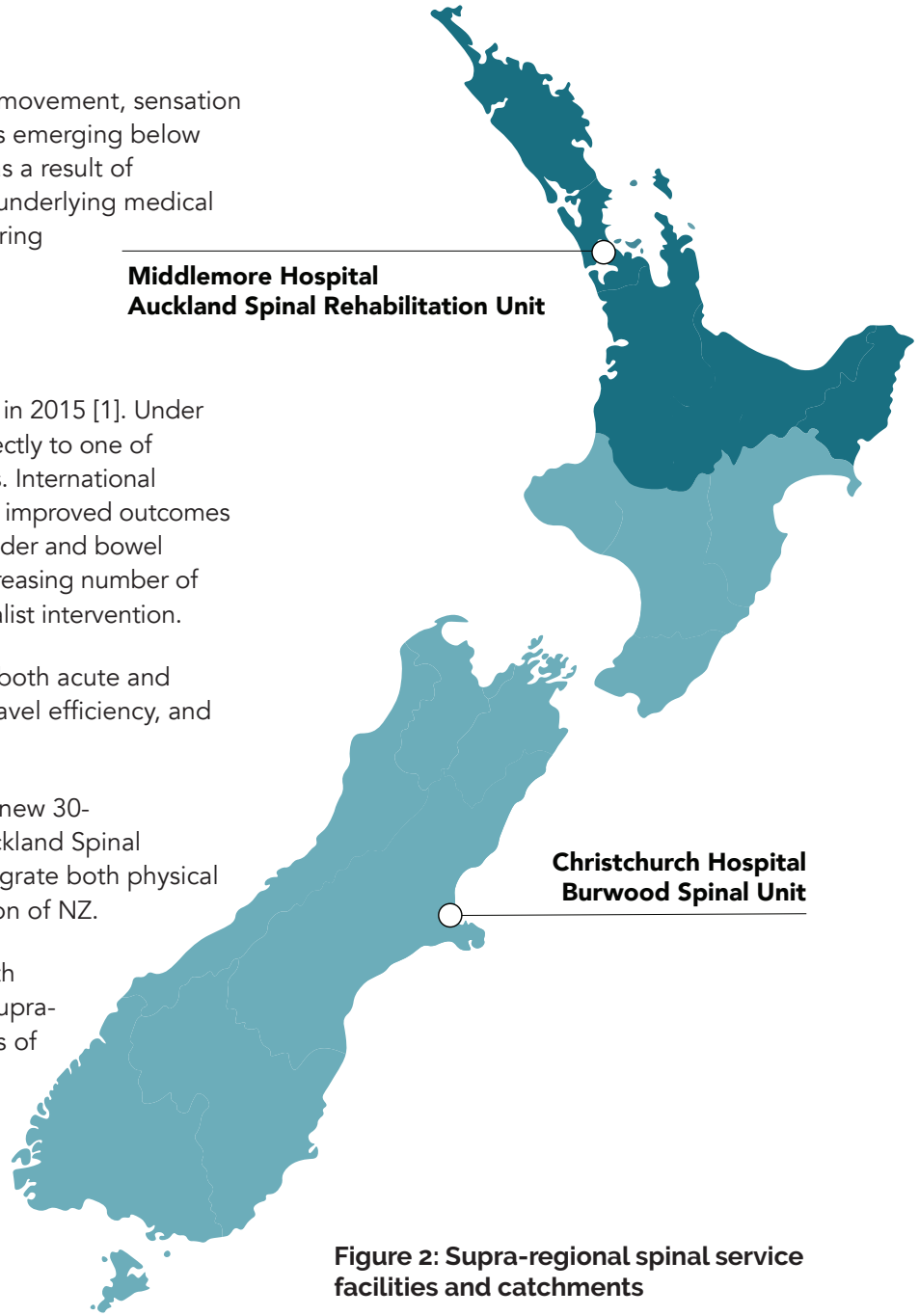


Figure 2: Supra-regional spinal service facilities and catchments

Governance and data management

The NZSCIR operates under strict data stewardship and security guidelines approved by the Health and Disability Ethics Committee (HDEC), ensuring that individual participant identity is protected through de-identified data reporting, heavily restricted staff access, and robust privacy protocols.

The governance of the NZSCIR is overseen by a group of stakeholders including clinicians, service managers, funders, consumers, and researchers. NZSCIR is primarily funded by the Accident Compensation Corporation (ACC) with support from Health New ZealandlTe Whatu Ora (Health NZ). NZSCIR is in partnership with the Praxis Institute, based in Canada, and has administrative support from the NZ Spinal Trust.

On-the-ground coordination and support is provided by the Registry Coordinators—consisting of two part-time employees based at each spinal service. Clinicians (surgeons, doctors, nurses, physiotherapists, occupational therapists) and Coordinators enter designated data for their profession onto the secure, web-based platform, Praxis Connect. Consented participants complete in-person interviews with Coordinators on rehab admission and discharge, as well as community follow-up questionnaires.

Five-year overview

This special report analyses NZSCIR data collected between 1 January 2020 and 31 December 2024. It provides a five-year view of the characteristics, care pathways, service utilisation, and outcomes of 1,187 people who sustained a new tSCI or developed a new ntSCI during the reporting period. Annual statistical snapshots remain useful for monitoring year-to-year activity; however, a five-year view allows the Registry to identify broader patterns, emerging shifts in the population, and service-level trends not visible in single-year reporting. Building on the longitudinal comparison models introduced in 2023 and 2024, this inaugural five-year report evaluates macro-trends, service outcomes, Registry participation, and areas requiring deeper investigation.

This report includes descriptive data on participant demographics, types and causes of SCI, hospital stay durations, functional outcomes, and secondary complications. The latter sections investigate critical areas unseen in annual reporting to date.

To ensure strict privacy and confidentiality, statistical disclosure rules have been applied; where subgroup counts are fewer than five, raw numbers (n) are withheld and only percentages are reported.

For additional context, bolded terms throughout the report are defined in the glossary.

The NZSCIR Governance Group welcomes feedback or questions on this report.

Please contact site Coordinators at cm-NZSCIR@tewhatuora.govt.nz or ct-NZSCIR@tewhatuora.govt.nz. Further information can be accessed at www.nzscir.nz.

Reader guide

The report is structured in four parts. The opening sections describe the Registry's purpose, governance, dataset, and national service context. The main findings then summarise participant characteristics, traumatic and non-traumatic injury patterns, level and severity of injury, length of stay, discharge destination, surgery, complications, mortality, and functional outcomes. The third section describes Registry evolution, current limitations, and future priorities. Technical denominators, statistical methods, and detailed scoring frameworks make up the final section as appendices.

Total NZSCIR participants 2020-2024

- There have been 1,187 new admissions nationally over the five-year period.
- Steady increase in admissions since 2020.
- Increases more consistent in Christchurch.

Figure 3 illustrates a steady increase in admissions over this reporting period. This trend is particularly evident at the Christchurch site, where admissions have risen consistently year by year, where Auckland's numbers are variable but generally stable.

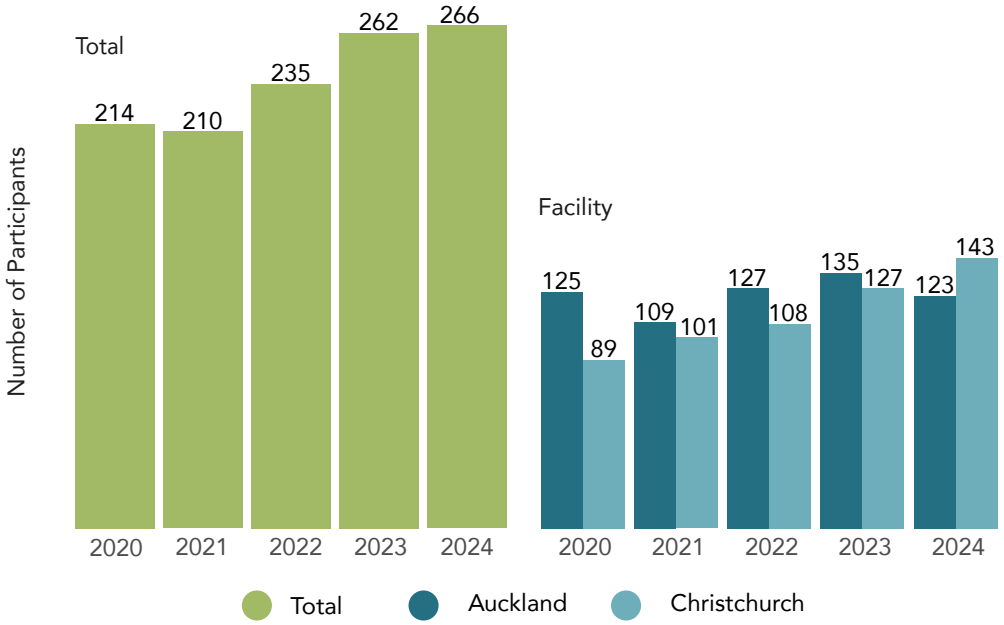


Figure 3: Total participants by calendar year

Figure 4 shows admissions were generally distributed evenly between the two units throughout the reporting period. In 2020, a greater proportion of admissions were observed attending MMH/ASRU, although the number of admissions to ASRU remained relatively stable over all reporting years. In 2024, admissions to Christchurch Hospital/BSU reached their highest level for the reporting period, and for the first time since the Registry's inception, Christchurch Hospital/BSU accounted for the larger share of admissions (54%).

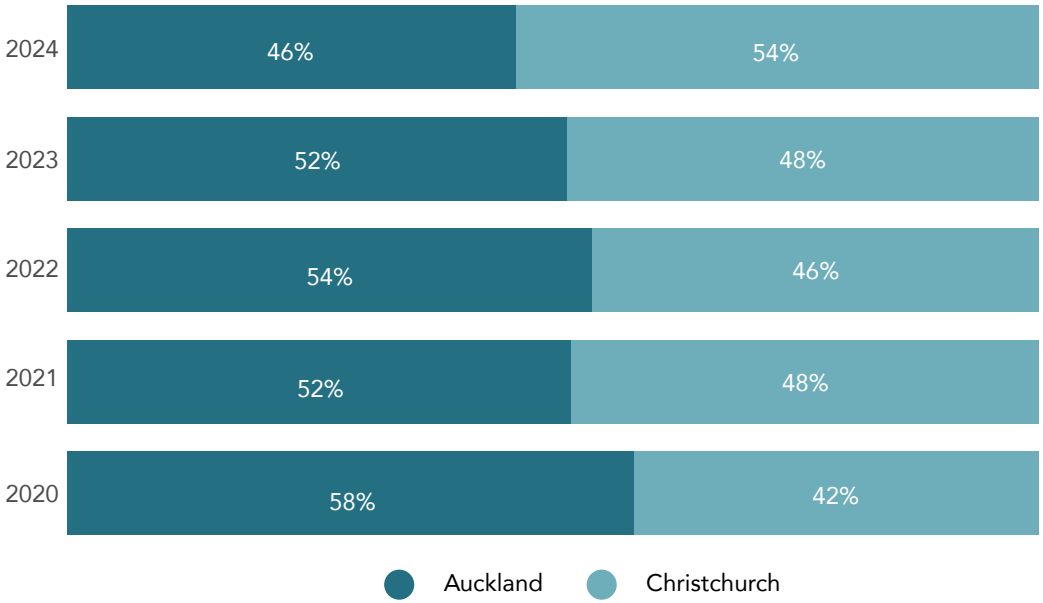


Figure 4: Participants by enrolling service

Participants by service and type

Table 1: tSCI and ntSCI participant numbers across services

	2020	2021	2022	2023	2024
Auckland total	125	109	127	135	123
Christchurch total	89	101	108	127	143
NZ total	**214**	**210**	**235**	**263**	**264**
Auckland tSCI	88	78	96	91	74
Auckland ntSCI	37	31	31	44	49
tSCI:ntSCI ratio	**70:30**	**72:28**	**76:24**	**67:33**	**60:40**
Christchurch tSCI	58	70	76	76	86
Christchurch ntSCI	31	31	32	51	57
tSCI:ntSCI ratio	**65:35**	**69:31**	**70:30**	**60:40**	**60:40**

The total number of participants has grown steadily at the Christchurch service whilst Auckland has remained relatively stable overall. When looking at tSCI and ntSCI service split, numbers of those with tSCI in Auckland ranged from 74 and 96 per year. 2024 saw Auckland's lowest number of tSCI and highest number of ntSCI admissions, resulting in a shift in the tSCI:ntSCI ratio. Christchurch has demonstrated a steady increase in tSCI participants, but a higher rate of ntSCI participant admissions in the past two years has shifted the service's tSCI:ntSCI ratio. 2024 saw both services align with a 60:40 split.

Rehabilitation facility admissions by service

Table 2: Number of participants admitted to rehabilitation facilities

	2020	2021	2022	2023	2024
ARSU total	103	93	95	104	96
BSU total	83	90	95	97	110
Overall total	**186**	**183**	**190**	**201**	**206**

Total ASRU rehabilitation admissions have remained steady over the five-year period, whilst BSU admissions have risen steadily. This has resulted in an overall increase in total rehabilitation numbers.

Participants by sex

- Males are consistently in the majority for those with any type of SCI.

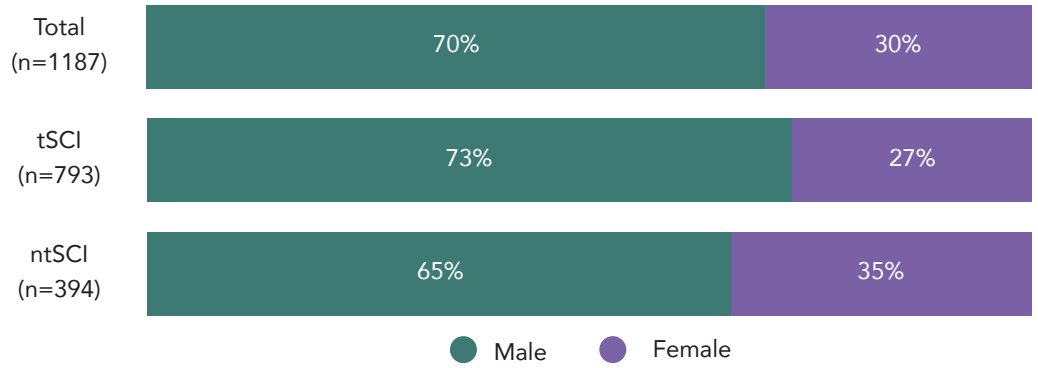


Figure 5: Total participants by sex

Sex of participants has remained one of the most consistent data points collected over the years, with minimal variation. This aligns with other countries internationally [13-15]. Over the five-year period, the tSCI population consisted of 73% males, and the ntSCI population 65%.

Consent rates: Full dataset vs minimal dataset

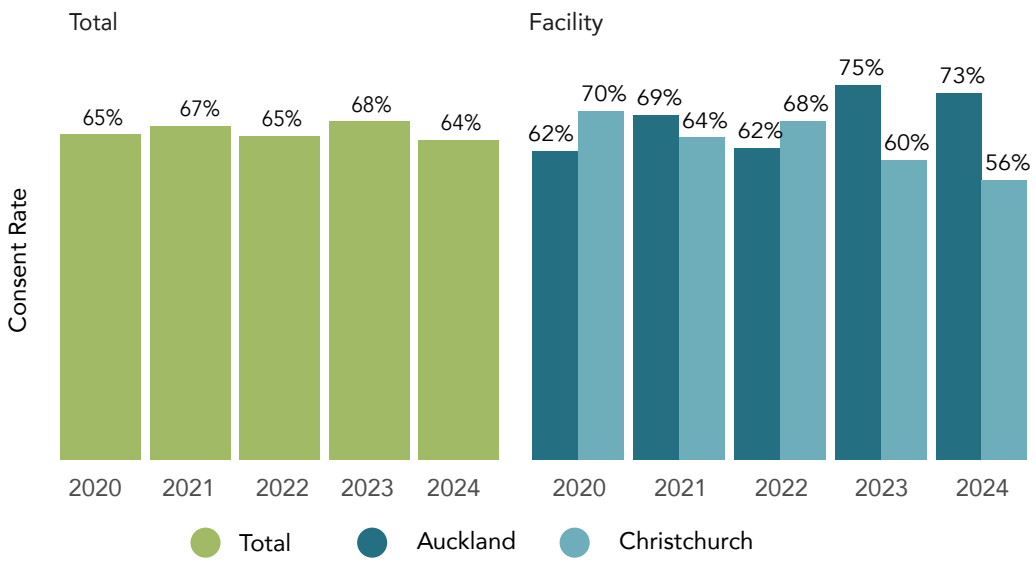


Figure 6: Consent rates by year and service

The NZSCIR is an opt-in Registry for full dataset (FDS) collection but has ethical approval to collect a MDS on those admitted with a new SCI to one of the spinal centres. If participants fit the inclusion criteria and are eligible, they will be approached for consent to collect additional demographic information, as well as functional outcomes, surgical and complication data.

Tourists and those on temporary visas are not eligible for FDS collection but will have a MDS completed. Managing non-resident individuals who sustain a SCI in NZ comes with clinical, financial, and ethical complexities. ACC funds treatment for anyone who sustains an accidental trauma in NZ, including providing equipment and potentially lump sum payments. However, those with ntSCI may encounter funding deficits for ongoing care. Consequently, most non-residents only receive acute stabilisation before returning to their home country for rehabilitation. Annual non-resident and/or tourist numbers averaged 8.4 per year over the reporting period.

Figure 6 illustrates the percentage of eligible participants who have given consent. National consent rates have been consistent across the five-year period, holding at between 64-68%.

There are a variety of reasons why participants have a MDS entered, as illustrated in Figure 7. Of all the reasons a MDS may have been collected, consent declined accounted for the highest number (9% of all participants). Auckland has a slightly higher decline rate than Christchurch which has been investigated, with strategies being put in place to try to improve this. During the COVID-19 pandemic, while the country or region was in Level three or four lockdown, participants were not approached for consent and a MDS was collected. 2021 and 2022 showed the lowest number of full datasets collected for Auckland, which reflects the long regional lock-down periods over this timeframe.

Currently, Christchurch does not consent in the acute phase due to resource availability. Individuals who do not attend BSU only have a MDS collected, resulting in a declining rate of consents in Christchurch visible in Figure 6. This was Christchurch's leading cause for MDS collection over the 2022-2024 period.

There are a variety of reasons why someone has a minimal data set entered. These include:

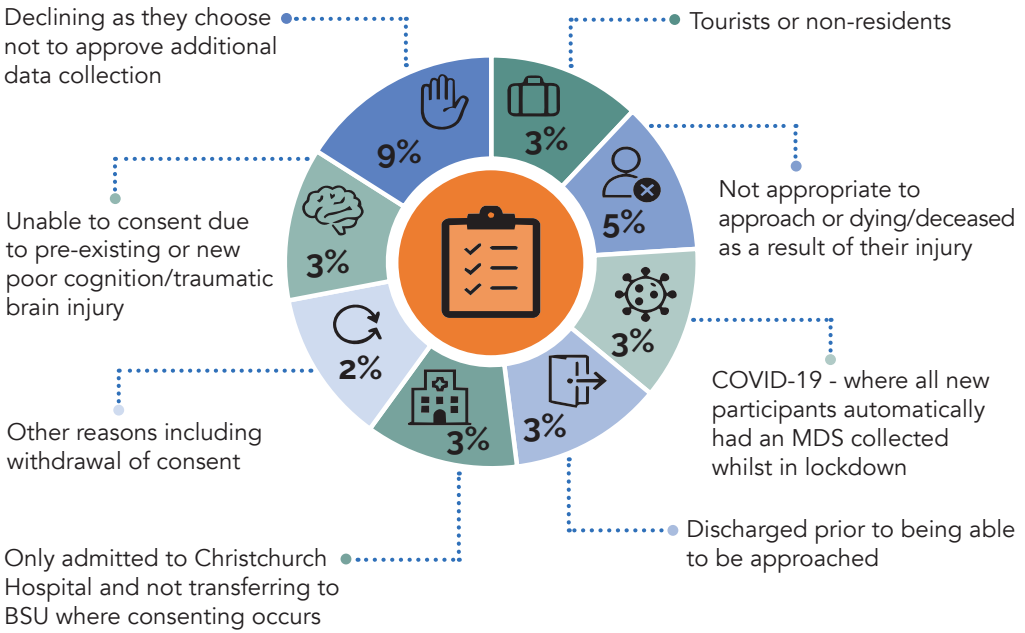


Figure 7: Reasons for NZSCIR Minimal dataset

Participants by SCI type

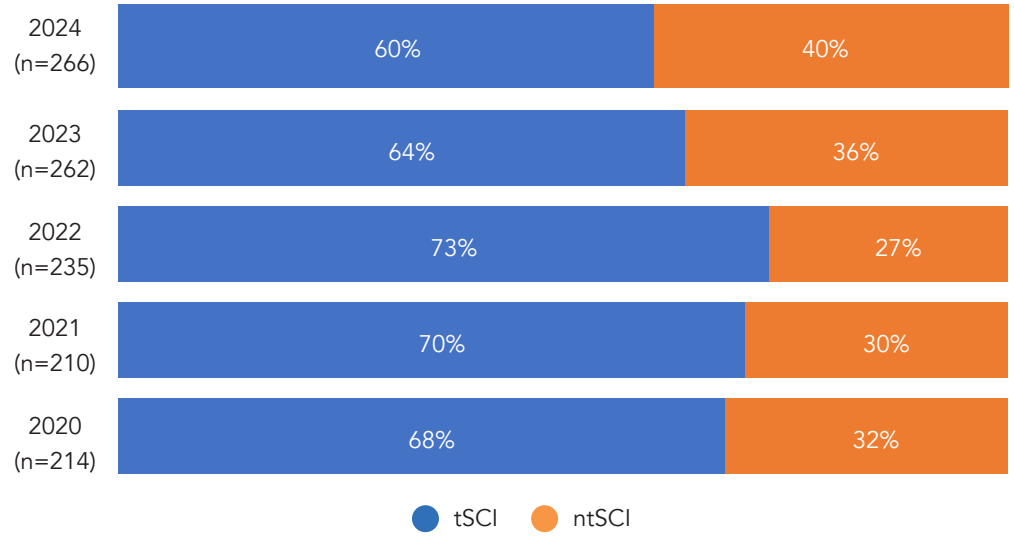


Figure 8: Total participants by SCI type

- Those participants affected by tSCI have always outnumbered those with ntSCI admitted to NZ's spinal services.
- Nationally, 2024 had the lowest proportion of admissions with tSCI over all reporting years due to a lower number of tSCI being admitted to the Auckland service and high numbers of ntSCI participants admitted to the Christchurch service.

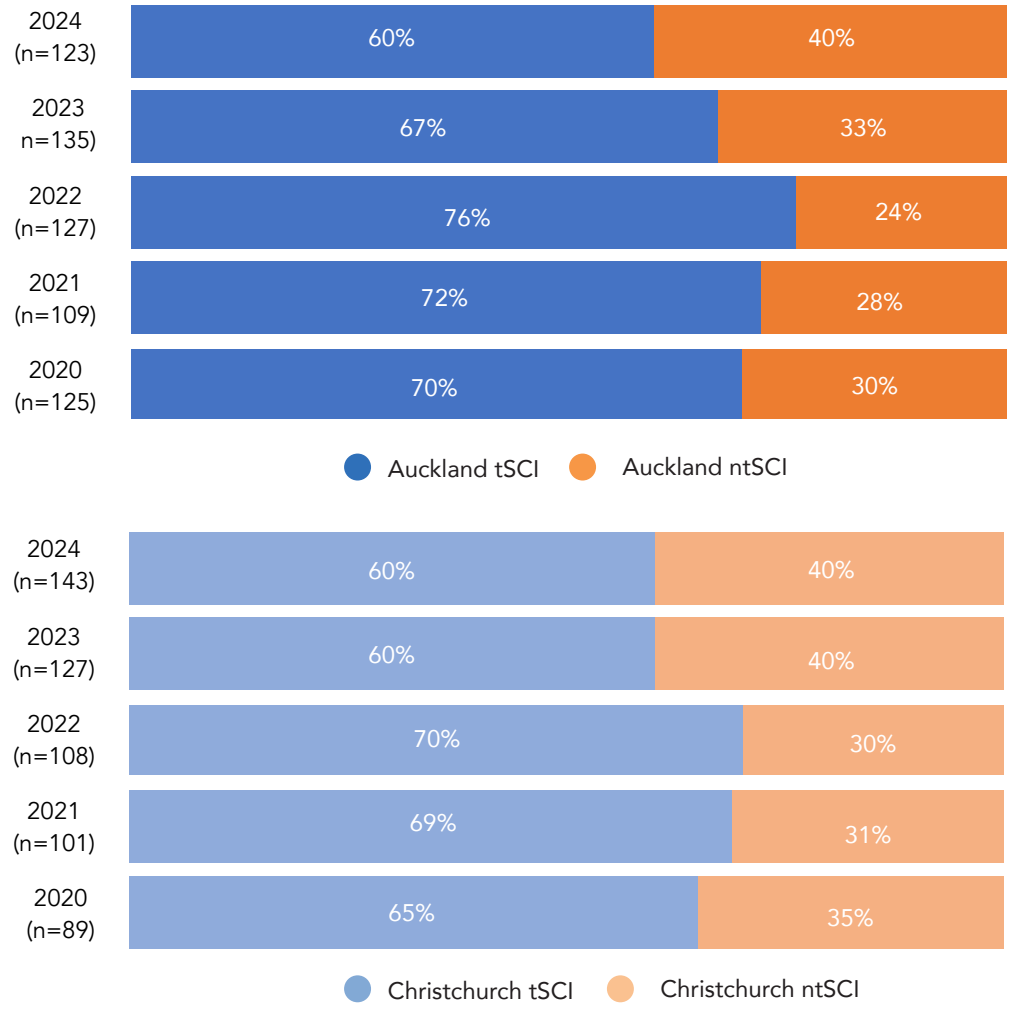


Figure 9: Total participants by SCI type and service

- Both Auckland and Christchurch show a peak in tSCI proportion in 2022.
- Both centres had an increased proportion of those with ntSCI in 2023–2024.

There continues to be a dominance of those with tSCI admitted to NZ's spinal services, consistently accounting for at least 60% of cases. NZ's Destination Policy may contribute to this trend, in addition to less severe ntSCI and CES cases traditionally being treated in their local regional hospital. However, in recent years however, there has been a noticeable shift where the gap between the two SCI types is narrowing. This drift may be due to an aging population, or improved awareness and referral to the specialist spinal services resulting in higher NZSCIR enrolments.

Participants by age

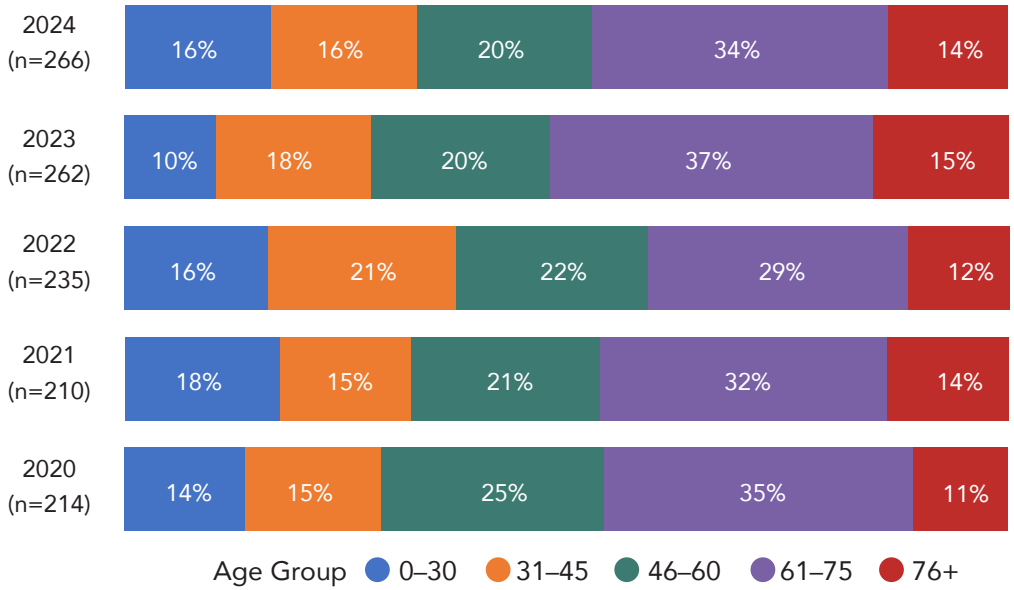


Figure 10: Total participants by age

- Those aged 61-75 years (as seen in purple in Figure 10) have consistently accounted for the largest age group every year.

Whilst SCI can affect people at any age, those aged 61-75 years remain the most common for both those experiencing a tSCI or ntSCI in NZ. NZ's average age of participants experiencing a SCI has ranged from a low of 53.5years (2022) to a high of 56.9 years (2023) over the five-year period. Internationally, the age at which people experience a SCI is increasing [11,16]. Figure 11 demonstrates the range of ages by year. Whilst there is no increasing trend over this reporting timeframe it does show the higher median in the ntSCI population (65 years for ntSCI vs 53 years for tSCI).

NZ has seen a similar ageing shift in recent decades, anecdotally demonstrating a shift from traumatic, younger-aged injuries toward more ntSCI and tSCI, older-aged injuries. As the general population ages, the risk of structural changes within spinal column resulting in myelopathic symptoms increases [17]. Often there are participants admitted with a mixed picture of a new tSCI on top of a myelopathic background. This observation warrants further consideration given similar international trends [16-18].

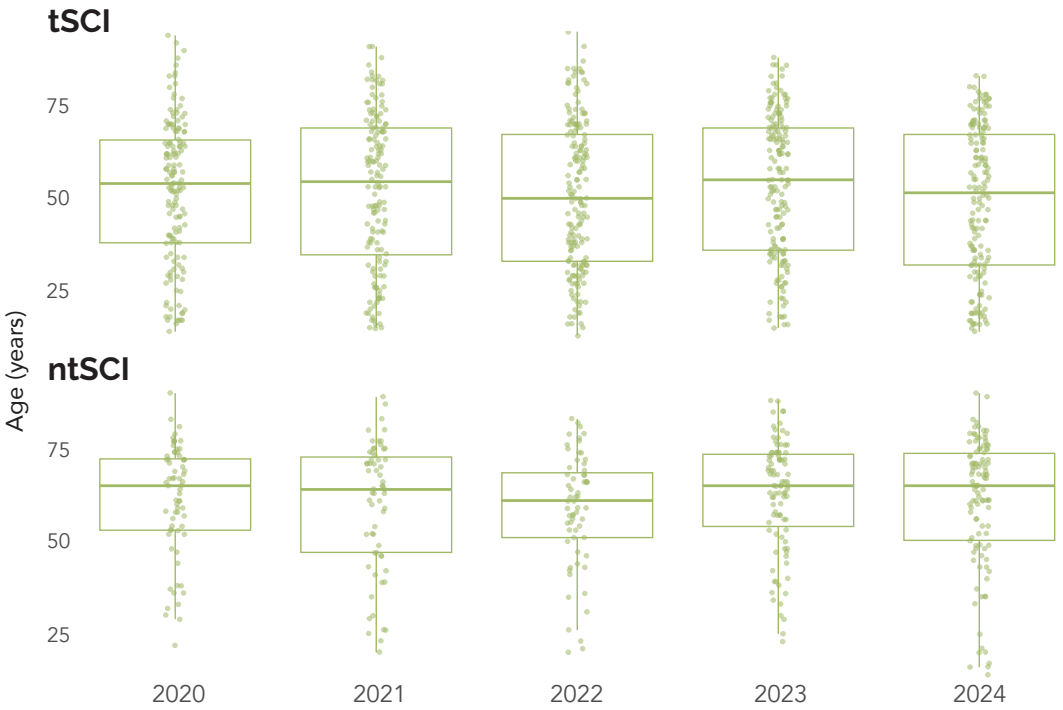


Figure 11: Distribution of age at injury by year

NZSCIR's 10-year retrospective epidemiological paper, published in 2020, demonstrated an increase in average age for those with a tSCI between 2007-2016 [2]. Whilst there is not a clear increase in average age over this special report's timeframe, it does show nearly half of NZ's new SCI population is over the age of 60 years on admission.

Participants by ethnicity

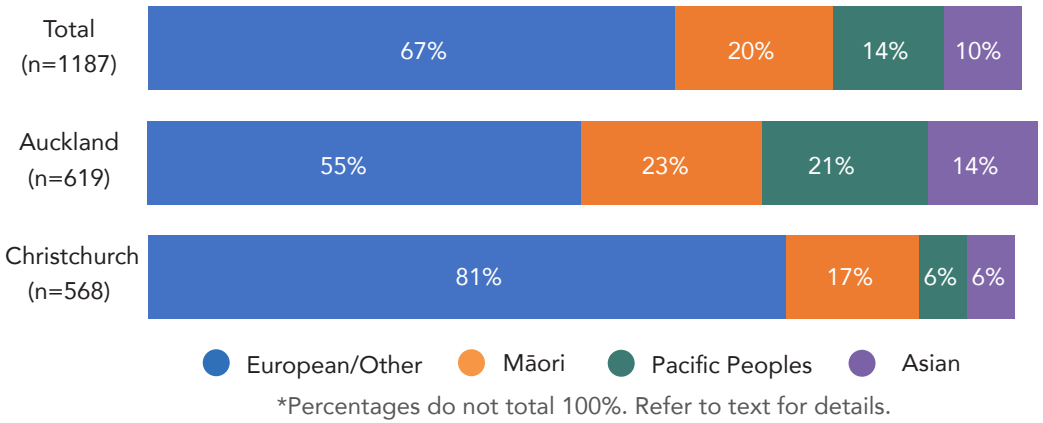


Figure 12: Total response ethnicity by enrolling service

- Ethnicity groupings of each spinal service is vastly different.

Since 2023, in accordance with the Ministry of Health's Ethnicity Data reporting protocols, NZSCIR has reported total response ethnicity [19]. Total response allows participants to select multiple ethnic groups they identify with and this report reflects this for the full five year period. Consequently, individuals may be counted in more than one category, causing the total number of responses to exceed the cohort total number of people and percentages to sum to more than 100%.

There is a clear difference between services regarding ethnicity makeup (Figure 12). The Auckland SCI population is more diverse, reflecting the varied ethnic make-up of this catchment. Māori, Pacific Peoples and Asian make up over 50% of the Auckland catchment spinal population (58%); whilst the majority of Christchurch catchment participants identify as European (81%).

There is a clear pattern of over-representation of both Māori and Pacific Peoples in the SCI population compared with their share of the general population [20]. Māori comprise 20% of the total SCI cohort, compared with 16% of the underlying population, with similar patterns observed in both Auckland (23% SCI vs 17% population) and Christchurch (17% SCI vs 14% population). The disparity is more pronounced for Pacific Peoples, who account for 14% of the SCI cohort overall despite only representing 6% of the combined catchment population. This is particularly marked in Auckland, where Pacific Peoples comprise 21% of the SCI cohort, compared with 9% of the population, and remains evident in Christchurch (6% SCI cohort vs 4% of the population). These findings indicate disproportionate representation that cannot be explained by population distribution alone and suggest a disparity consistent with known inequities in health outcomes [21]. It appears Māori people are overrepresented in the tSCI population, whilst Pacific People have a higher representation in the ntSCI population (see Figure 13) potentially due to known anatomical narrowing in the spinal canal [22,23].

Māori and Pacific Peoples experience lower engagement with some health services due to systemic inequities, including structural racism, barriers to access, and health services that do not consistently meet their cultural and practical needs [21]. It could then be hypothesised the true disparity in the SCI cohort could in fact be larger. This is an important issue affecting New Zealanders and warrants further investigation.

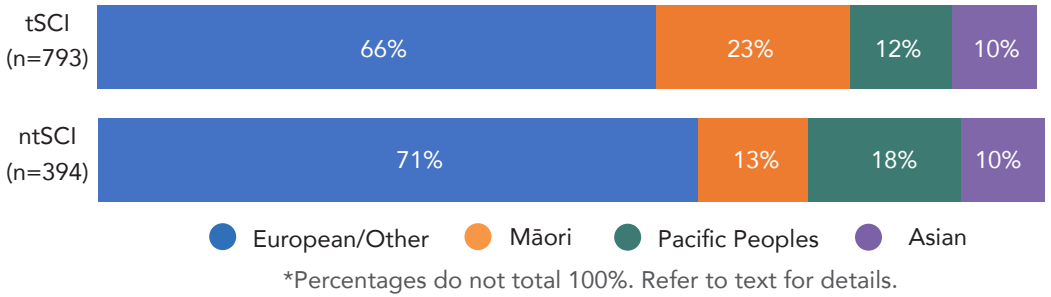


Figure 13: Total response ethnicity by SCI type

The Pacific Peoples population is a diverse group encompassing many Pacific Islands (Figure 14). We would like to acknowledge that each ethnicity is unique but for statistical purposes they are grouped together as per HISO guidelines [19]. Eighty participants (49% of the Pacific Peoples group) between 2020-2024 identify as Samoan which represents the largest group within Pacific Peoples. Cook Island Māori (n=33, 20%) and Tongan (n=20, 12%) are next highest representative groups, followed by Fijian/Fijian Indian at 10% (n=17). Niuean account for 3% (n=5) of the Pacific Peoples population, with other Pacific Island nations accounting for the remaining 5% (n=8).

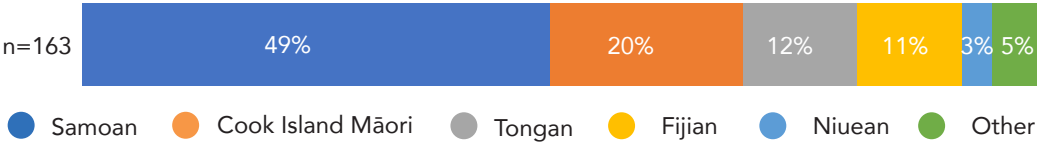


Figure 14: Pacific Peoples category groupings

Weight and Body Mass Index (BMI) of those attending rehabilitation

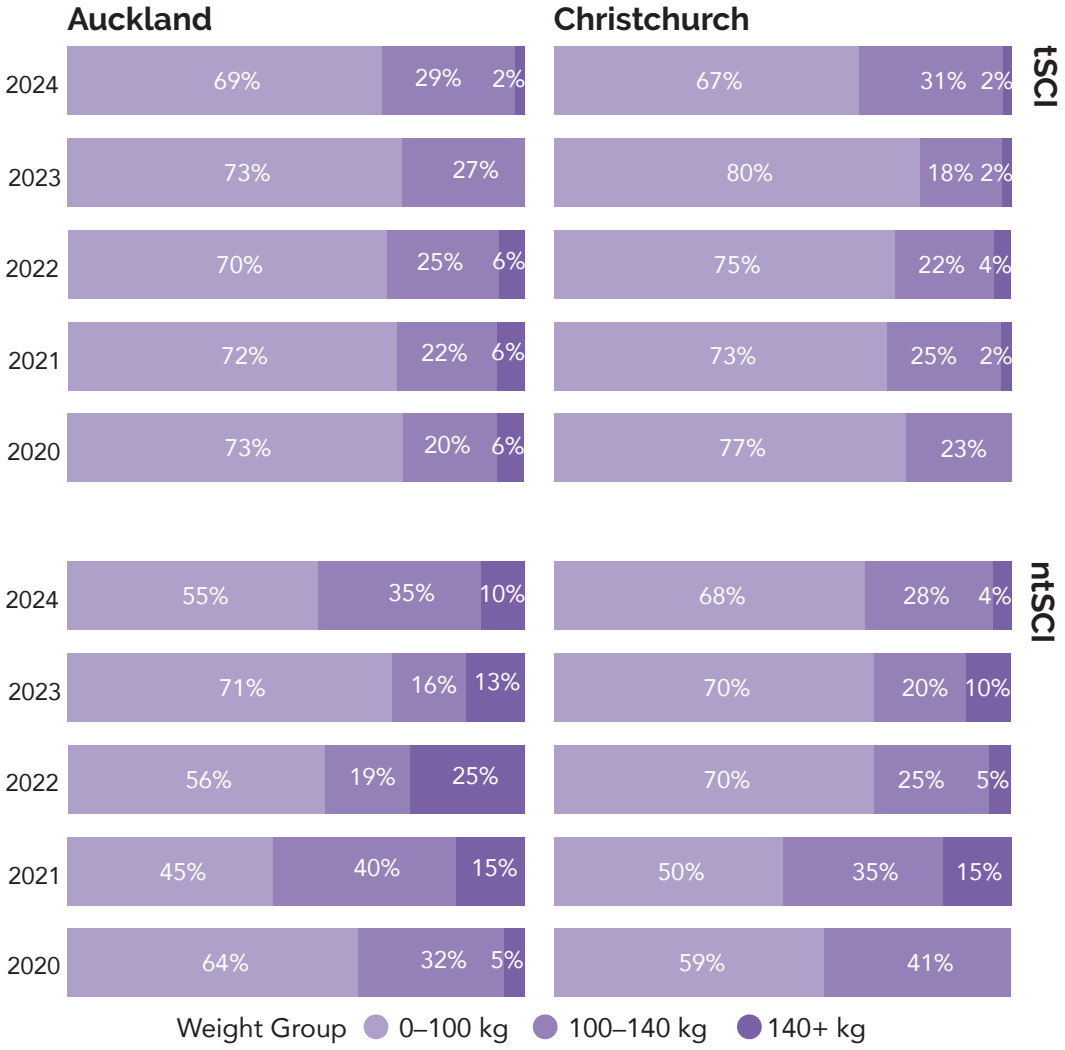


Figure 15: Weight group proportions by SCI type and service

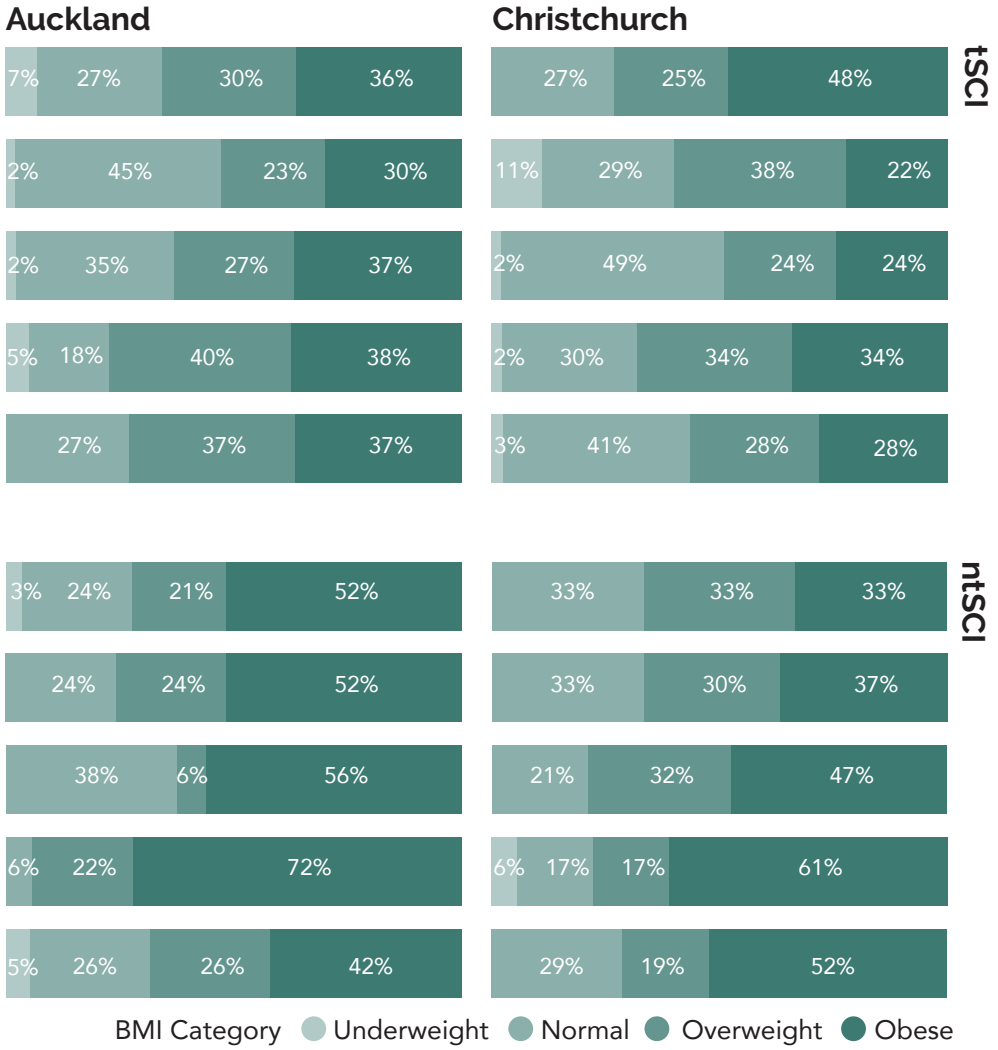


Figure 16: Body Mass Index categories by SCI type and service

- The tSCI cohort shows high proportions of participants who are overweight or obese, however this is significantly more evident in the ntSCI populations at both sites.

- Based on BMI categories, both regions have low proportions of underweight participants.
- Auckland shows higher baseline levels of obesity in ntSCI cases over the last three years compared to Christchurch. Christchurch also demonstrated a more dramatic shift in its tSCI cohort, with obese individuals doubling between 2023 (22%) and 2024 (48%).

Body weight has a multifactorial impact on a participant's clinical journey. NZSCIR collects height and weight data of consented participants at the time of their admission to hospital. Figure 15 demonstrates a higher proportion of participants over 100kg in Auckland's catchment. The ntSCI population also demonstrates a higher proportion of both groups over 100kg and 140kg.

Body Mass Index (BMI) is calculated by dividing weight (in kilograms) by height squared (in metres) (see Figure 16). Participants from different ethnic backgrounds naturally have different body compositions—regarding varying ratios of muscle, bone density, and body fat at the same height and weight [24,25]. Furthermore, the traditional BMI scale was initially developed based primarily on European populations, so we have reported BMI based on ethnicity norms [24,25], using the below categories:

European/Other:
Underweight: <18.5kg/m2; Normal: 18.5-25kg/m2;
Overweight: 25-30kg/m2; Obese >30kg/m2.

Asian:
Underweight: <18.5kg/m2; Normal: 18.5 – 22.9kg/m2;
Overweight: 23.0 – 24.9kg/m2; Obese >25.0kg/m2.

Māori/Pacific:
Underweight: <20.5kg/m2; Normal: 20.5 – 27.5kg/m2;
Overweight: 27.5kg-32kg/m2; Obese: >32kg/m2.

BMI has been known to be a controversial, one-size-fits-all measure of body composition, and it should not be used as the sole measure of health. However, used in conjunction with weight alone, this is our best available tool to help services understand population needs on admission. Specifically, each spinal service uses weight and BMI clinically to help direct many aspects of a participant's rehab journey. Participants with a lower BMI typically lack the adequate subcutaneous fat and muscle mass needed to distribute body weight over bony prominences, leaving them highly vulnerable to tissue breakdown and **pressure injuries.** In contrast, participants with a higher weight and BMI (sarcopenic obesity, characterized by muscle mass reduction and excessive fat accumulation) are also at increased risk of sacral pressure injuries as excess body weight increases pressure and shear force to deep tissue [26].

Rehabilitation can be challenging for the services for those with higher weight and BMI due to the need for specialist hire equipment like beds, mattresses, wheelchairs, commodes and mobility equipment. It also influences staffing levels, room type and discharge planning, where there can be a delay in sourcing appropriate accessible accommodation, care packages and equipment. These issues are all more significant for those with a higher neurological level and severity.

Pre-existing conditions

NZSCIR records pre-existing medical conditions a consented participant presents with on admission using the **Charlson Comorbidity Index.** This helps us understand the population and their needs, as well as the impact it may have on their SCI journey. The most common conditions were high blood pressure, diabetes and depression/mood problems. Table 3 shows the top five conditions participants admitted with by year.

Table 3: Pre-existing medical conditions on admission

2020 (n=139)	2021 (n=141)	2022 (n=151)	2023 (n=177)	2024 (n=170)
Hypertension (32%)	Hypertension (35%)	Hypertension (32%)	Hypertension (52%)	Hypertension (57%)
Diabetes (18%)	Diabetes (20%)	Asthma (19%)	Diabetes (32%)	Diabetes (28%)
Osteoarthritis/ degenerative arthritis (14%)	Osteoarthritis/ degenerative arthritis (20%)	Diabetes (19%)	Depression/ Mood problems (22%)	Depression/ Mood problems (25%)
Any malignancy (11%)	Depression/ Mood problems (16%)	Depression/ mood problems (18%)	Osteoarthritis/ degenerative arthritis (21%)	Any malignancy (12%)
Depression/ Mood problems (9%)	Asthma (10%)	Osteoarthritis/ degenerative arthritis (13%)	Asthma (19%)	Asthma (12%)



Traumatic SCI (tSCI)

Comparison of tSCI by year

- Since 2022, total number of participants admitted nationally with a new tSCI have decreased.
- Auckland catchment numbers have decreased since 2022, whilst Christchurch catchment has increased annually from 2020.
- 2024 saw Auckland with its lowest number of recorded tSCI in five years and Christchurch with their highest.

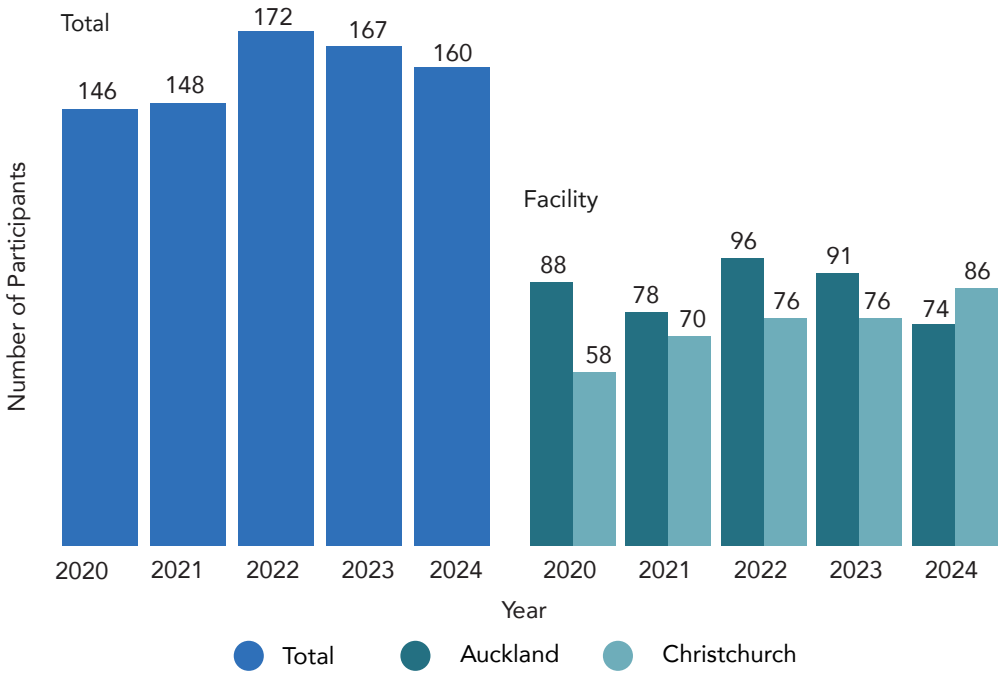


Figure 17: Comparison of tSCI by year

Causes of tSCI

Impairment of spinal cord or cauda equina function through a traumatic cause can result from external force of any magnitude. Traumatic injury causes are categorised according to the International Classification of External Causes of Injuries (ICECI): Fall; Transport; Sports; Assault; Other [27]. A4s it is possible an injury event may be classifiable into more than one of these categories, the following prioritisation has been established: first category priority is given to Sports; followed by Assault; Transport; Fall then Other. In this report, perioperative tSCIs have been extracted from the Other category to be reported on separately.

Table 4 shows the causes of tSCI sustained by those admitted to the spinal services between 2020-2024.

Table 4: tSCI Causes 2020-2024



Fall	Transport	Sports	Perioperative	Other
40%	**27%**	**16%**	**8%**	**9%**
n=321	n=211	n=126	n=67	n=68

Fall – includes anything from a slip on level ground to a fall from a height.

Transport – any injury sustained while using a vehicle for transport (e.g. accident involving a motor vehicle, motor bike, electric scooter or commuter pushbike), including pedestrians.

Sports – any sporting or leisure-related injury e.g. biking (e.g. mountain biking or road cycling), team ball sports (e.g. rugby), aero sports (e.g. paragliding), motor sports (e.g. motocross/dirt biking), water-related activities (e.g. accidents in the surf, pools or rivers), or power sports.

Perioperative - new or deterioration in neurological deficit attributable to a surgical procedure.

Other – includes assault, crushing/lifting injuries, or other non-classified causes.

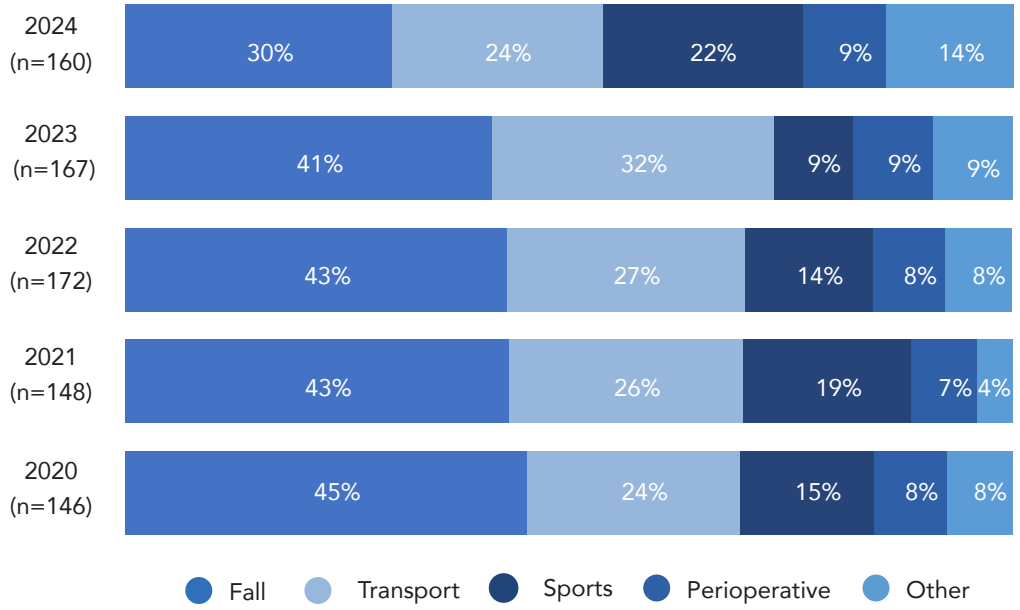


Figure 18: Comparison of tSCI causes by year

- Falls are the leading cause of tSCI in NZ.

Whilst Falls have decreased over the five-year period, it remains the leading cause of tSCI in NZ. Falls have globally overtaken Transport as the leading cause of tSCI in high-income nations, which is also demonstrated here (see Figure 18) [28,29]. Transport is the second most common cause. Transport causes fluctuated between 24% and 32% of all tSCI over the five-year period. Sports and leisure-related injuries, after a significant dip in 2023 (9%), reached a five-year high in 2024 (22%). "Other" causes also reached a five year high in 2024, producing the most even distribution of causes since records began in 2016. The 2024 profile represents a departure from the trend observed across 2020–2023. Early indications from 2025 suggest a reversion toward previous patterns.

tSCI causes by age

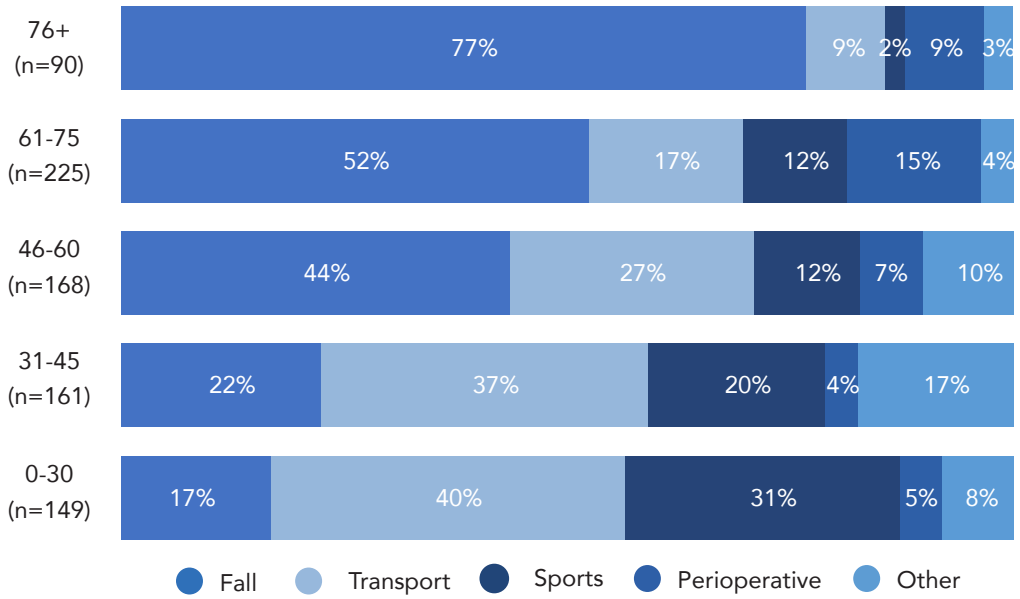


Figure 19: tSCI cause by age

- Falls are the dominant cause of tSCI in older populations, with a direct correlation between increasing age and falls.
- Transport and Sports incidents are significantly more common in younger groups.
- The transition from Transport/Sports to Falls as the primary cause occurs around age 45.

Figure 19 combines all years, then presents causes of injury by age group. Falls show a linear correlation with age, increasing from 17% to 77%. Transport dominates the under 30 range and steadily declines as age increases. Sporting SCIs are highly concentrated in the under 30 age group, still substantial in 31-45, but less prevalent in the older age categories. Historically, tSCI were primarily viewed as a young person's condition caused by high-velocity impacts. Today, our data supports international trends showcasing a bimodal distribution heavily impacted by aging populations in high income, developed countries [28,29]. In these regions, public health measures and vehicle safety standards have steadily driven down youth transport-related tSCI over the last two decades. Concurrently, increasing life expectancy has created a surge in geriatric falls [11].

Younger demographic (under 30 years)
Transport is the leading cause in this age bracket, at 40%. Sports peak here at 31%, their highest across all age groups. NZ's population has a high participation in adventure/contact sports, and outdoor recreational activities. Therefore, the risk for sporting tSCI is higher than other countries globally [30].

Young Adults (31–45)
Transport remains the primary cause (37%). Falls increase slightly to 22%. Sports-related injuries drop significantly to 20%.

Middle Age (46–60)
A major shift occurs here where Falls become the leading cause (44%). Transport injuries continue to decline (27%) while Sports and Other causes remain relatively stable. This matches global patterns where the average age of injury has steadily risen to the mid-50s, with low-velocity falls growing rapidly in this bracket.

Older Adults (61–75)
Falls account for more than half of all injuries (52%). Transport and Sports incidents continue a downward trend (17% and 12% respectively).

Elderly (76+)
Falls are the overwhelming cause at 78%, which is supported by other international reports [11,16,28,29]. Sports-related injuries are nearly non-existent (2%). This group shows the highest concentration of a single cause.

tSCI causes by sex

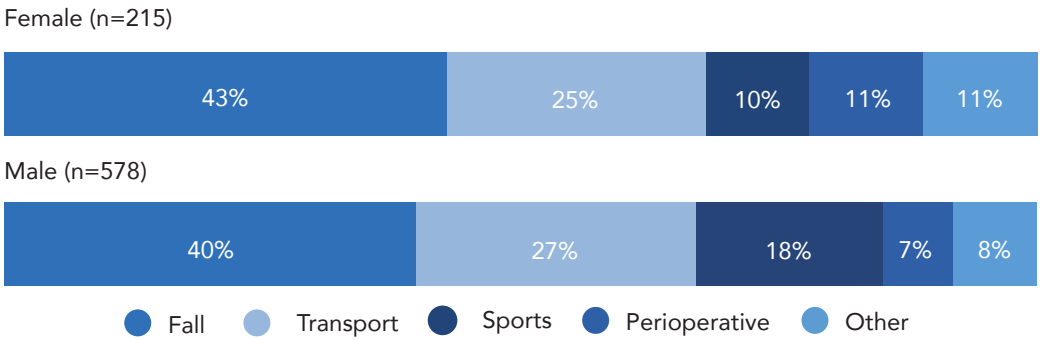


Figure 20: tSCI participants cause by sex

Males experience a notably higher proportion of sports-related traumatic injuries (18% vs 10%), while females have a higher proportional rate of injuries arising from surgical causes (11% vs 7%). It is important to note, males account for a greater number of overall cases, meaning their absolute volume remains higher in almost every category despite internal percentage shifts. However, the overall breakdown of injury types shows distinct differences of proportions between sexes.

Location of tSCI events

The NZSCIR captures the location of a tSCI by using postcode/ regional data from St John Hato Hone Ambulance, Wellington Free Ambulance or admitting medical records for the consented dataset.

Looking at raw numbers of people experiencing a tSCI, the North Island-based injuries are highest in the Auckland City area, whilst Christchurch city has the highest South Island risk. However, if we adjust for population using 2023 Stats NZ estimates, we standardise the risk to the number of injuries per 100,000 residents [31]. Following this framework, the risk in metropolitan hubs reduces, while it rises in smaller provincial regions. So, whilst Auckland has the highest volume of cases (n=127), its large population dilutes its overall risk down to 13th place in NZ (7.13 per 100,000). Using this model; Lakes, West Coast, Hawke's Bay, Whanganui and Northland emerge as the five highest-risk zones per capita for tSCI. Rural Gisborne (Tairāwhiti), the urbanized capital hub of Wellington and South Canterbury sit near the bottom, exhibiting a significantly lower probability of tSCIs relative to their total populations. This is demonstrated on the heat map (see Figure 21).

Fourteen participants were injured overseas and returned home to NZ for treatment, rehabilitation, or discharge planning. These participants are not included in the location heat map. NZ citizens living overseas when they sustain a SCI may choose to return to live in NZ. Participants either complete their inpatient journey overseas and return for discharge planning or return to NZ for acute care and/or rehabilitation. NZ citizens injured whilst travelling overseas will often be repatriated back to NZ, as soon as they are medically stable to do so.

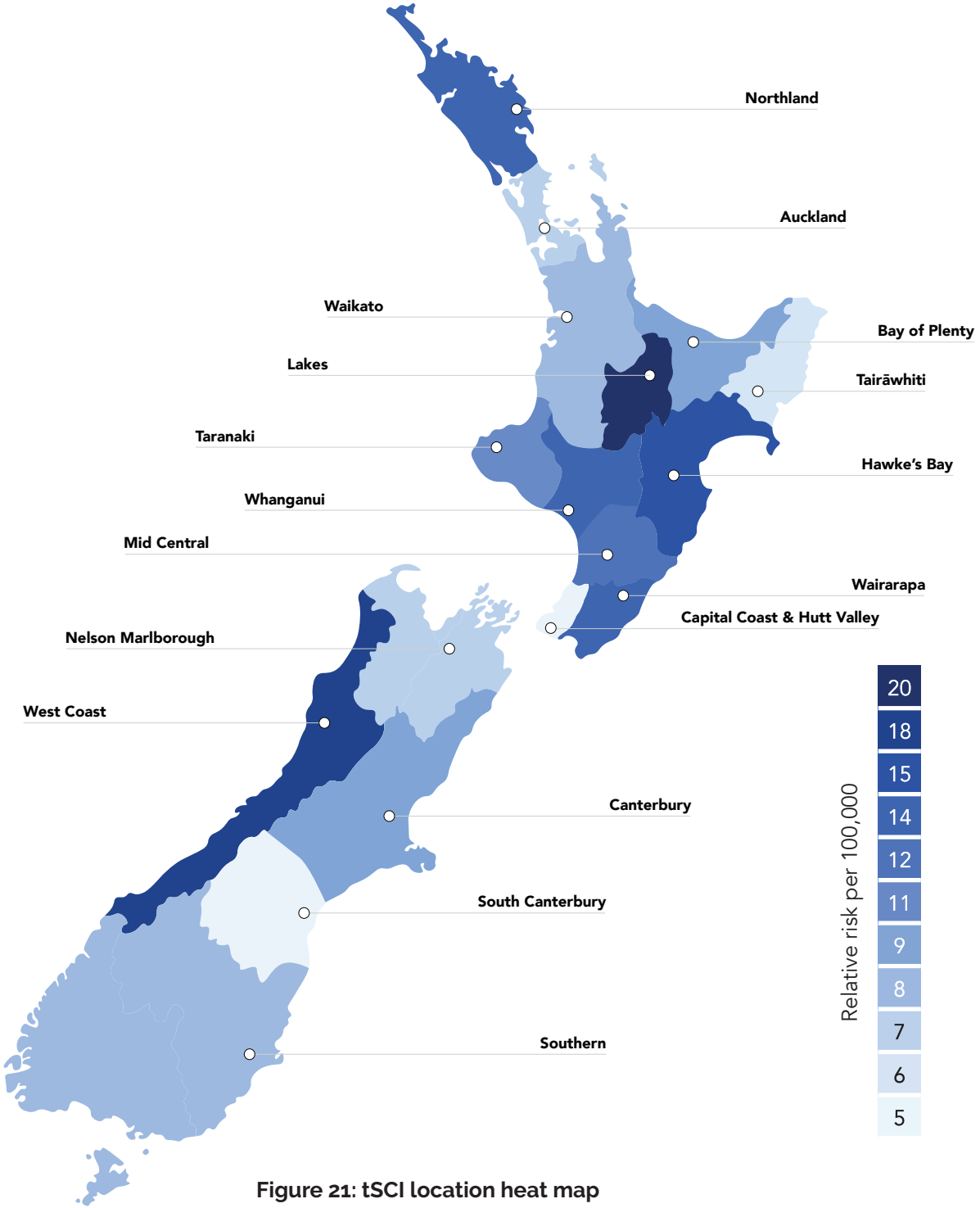


Figure 21: tSCI location heat map

Sport and leisure-related injury breakdown

- Cycling/mountain biking is the leading cause of sporting SCI, followed by water-related injuries and motor sports.

There were 126 sporting injuries over the five-year period. Cycling was the highest represented sporting cause with 35 participants. This includes mountain biking, road cycling, or riding a bicycle for sport or leisure, but not those who were using a bike for transportation. Mountain biking has become one of the leading sporting causes of SCI in Aotearoa NZ and follows similar trends seen in similar geographical locations such as British Columbia, Canada [32]. ACC have some ongoing campaigns trying to address the high number of mountain biking injuries in NZ. There is also communication between NZ and Canada to delve further into this trend and investigate the nature of these injuries, from those with lived experience, to help inform prevention strategies further.

Water-related injuries are the second highest sporting cause, with 28 occurring over the five-years. Injuries can be sustained from diving into a shallow pool, jumping into a river, or diving off a wharf/into the surf. With Aotearoa NZ's extensive coastline and easy access to rivers and beaches, these injuries have consistently featured in our top three sporting causes since 2016 and more work is needed to understand root causes to inform prevention and education strategies.

Motor sports (e.g. motocross/dirt biking/car racing) are the third most common sporting cause with 12 occurring over the five-years. Team ball sports (rugby; basketball), aero sports (paragliding; skydiving) and equestrian are the next most common sporting causes in NZ.

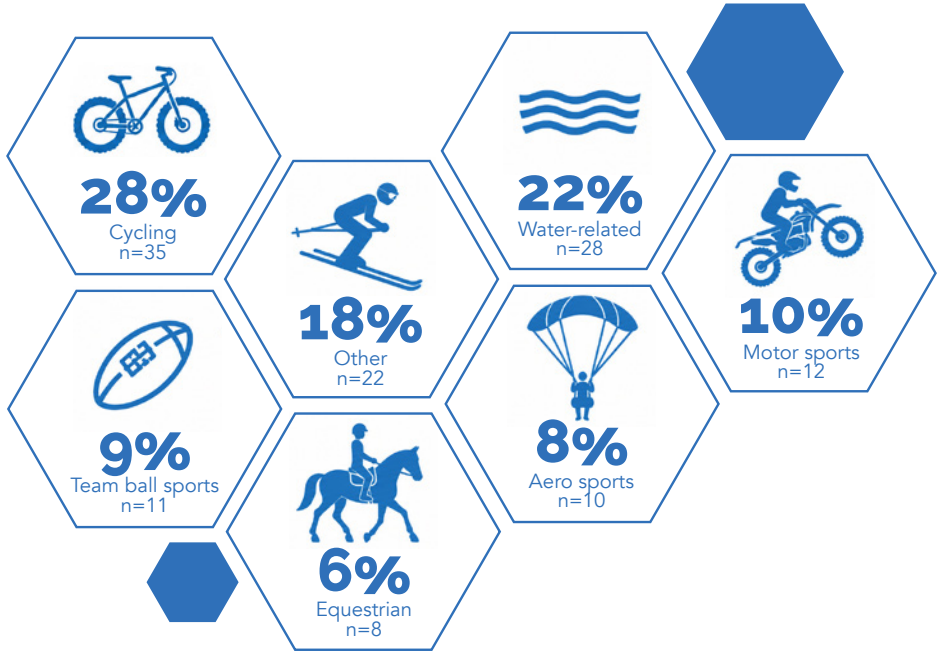


Figure 22: Sporting causes of injury

Transport breakdown

- Transport is the leading cause of tSCI for those aged under 45 years.
- Motorised transport options (cars, motorbikes, all terrain vehicles) are the dominant transport causes, totaling 79% of injuries over the five-year period. The vast majority of transport-related tSCI involve a four-wheeled vehicle, such as a car or van (47%; n=99), followed by motorbike/scooter injuries (21%; n=45) and 23 cases (11%) of special all-terrain or off-road vehicle accidents.
- Pedestrians injured by a vehicle are also listed under Transport (n=16; 8%). Bicycles used as a mode of transport (not sport) are included in this category and accounted for 15 cases (7%).

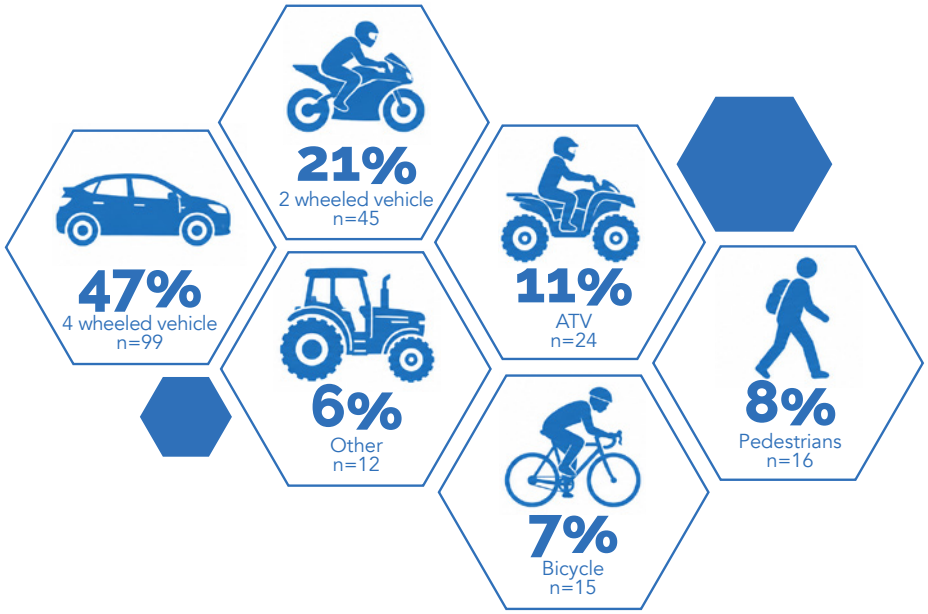


Figure 23: Transport causes of injury

Other tSCI causes

If a traumatic cause of injury does not meet the criteria for Sport, Transport or Fall, the Other category is utilized. In NZ, assault numbers are low (14 participants over the five-year period) so annually these have been added to the Other category due to our inability to report on numbers under five. Nearly half (43%) of those assaulted were between the ages of 31-45 years old.

The remaining Other causes (n=54) include lifting injuries, collision injuries and crush injuries from falling items.

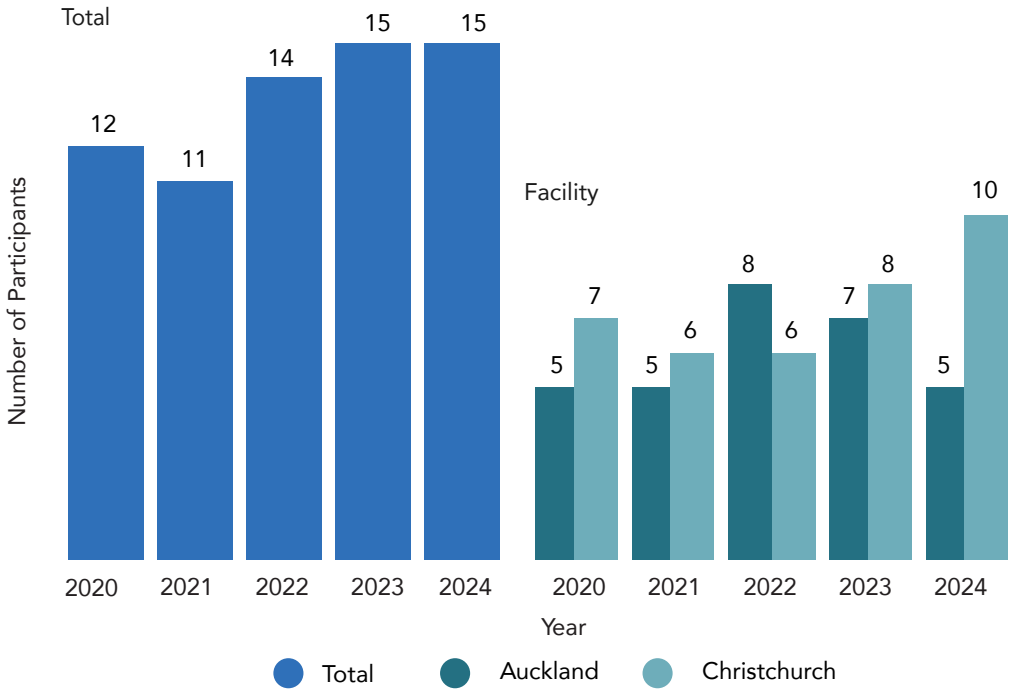


Figure 24: Perioperative tSCI admitted to either service

Perioperative tSCI

A perioperative tSCI occurs as a result of mechanical, ischaemic, or infectious mechanisms either during a surgical procedure or post-operatively. In previous NZSCIR annual reports, perioperative tSCIs have been labelled "surgery-related" and grouped in the Other category.

Figure 24 show those participants treated in that spinal service for their perioperative SCI. These injuries may have occurred either at a spinal service facility or a regional/ private hospital prior to transfer. Cases ranged from 11 to 15 per year nationally.

Non-traumatic spinal cord impairment (ntSCI)

A ntSCI occurs when the spinal cord is affected by an illness or medical cause. This can be through deterioration of the spinal column, infection, tumours, or blood supply issues affecting the spinal cord [33]. Unlike tSCI, ntSCI often develops over time and can present with gradual onset of symptoms. NZSCIR includes conditions that lead to lasting impairment of spinal cord function without an external physical cause. Since 2023, there has been a noticeable increase in those with ntSCI admitted to the Auckland and Christchurch spinal services (Figure 25).

Comparison of ntSCI by year

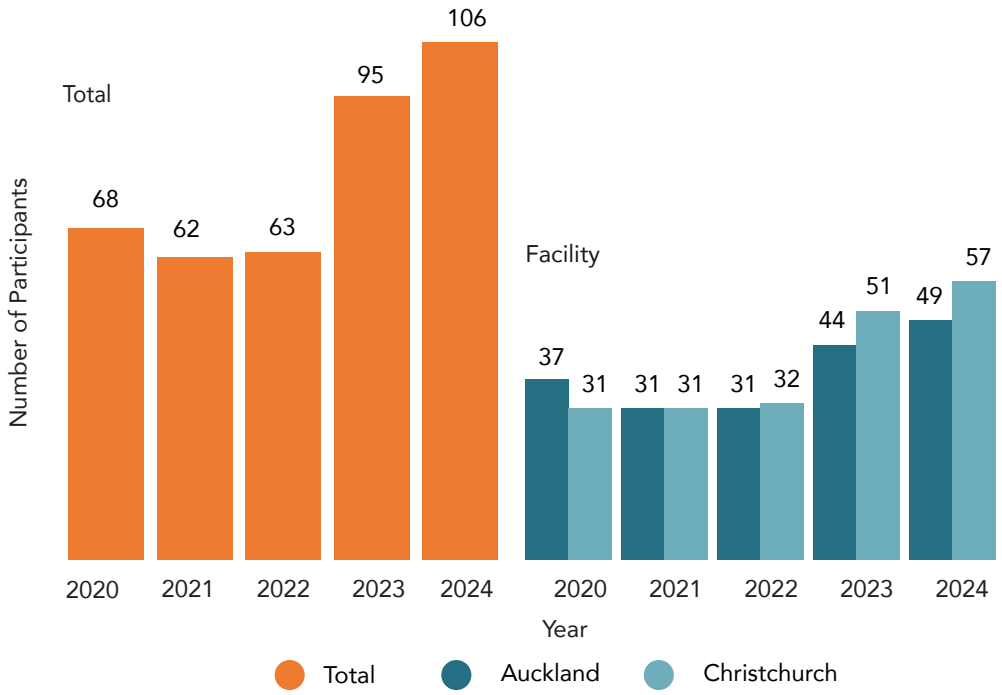


Figure 25: Comparison of total ntSCI participants by year

- 106 participants were admitted with a ntSCI in 2024, the highest number and proportion of ntSCI in any year since Registry records began.
- Numbers in the past two years have increased at both spinal services.

Causes of ntSCI

There was a large increase in ntSCI participants in both services in the last two reporting years, with 2024 recording the highest number (n=106) since records began.

Vascular SCI occur when blood flow is blocked (ischaemia/infarct) or when vessels rupture (haemorrhage causing compression) within or near the spinal cord. In previous NZSCIR annual reports, Vascular was grouped into the Other category. This publication reports this group separately. Note that those who have a vascular event post/intra-operatively (i.e. epidural haematoma) are categorised as a *perioperative traumatic injury* so will *not* be included in the ntSCI dataset.

The Other category primarily consists of inflammatory and autoimmune causes (n=16, 4%), and benign tumours (n=13, 3%) causing neurological compromise.

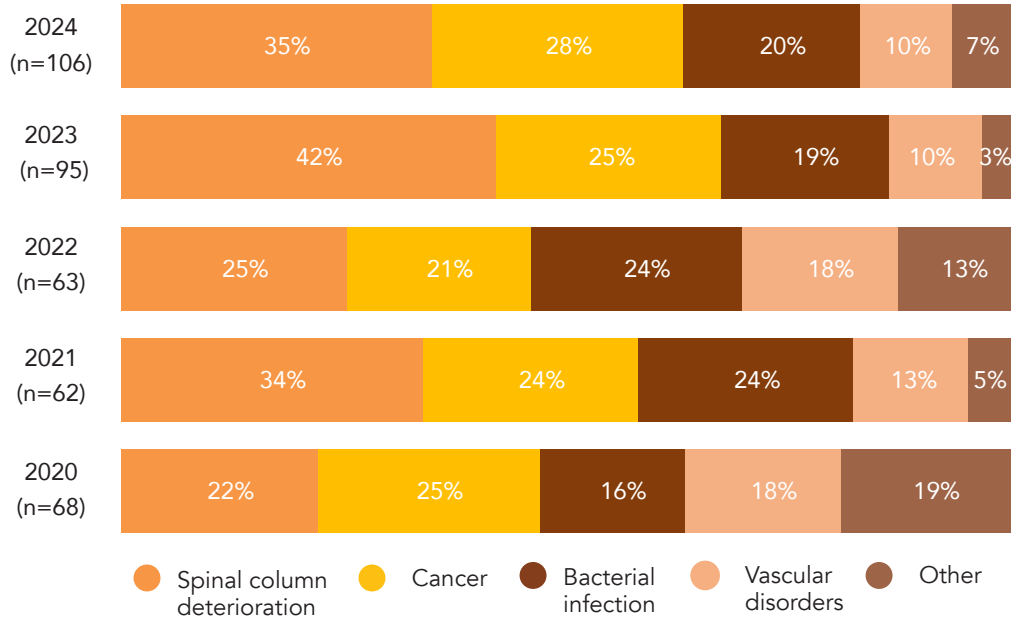


Figure 26: Causes of ntSCI

Table 5: ntSCI causes 2020-2024

Spinal Column Deterioration	Cancer	Bacterial Infection	Vascular Disorders	Other
33%	25%	20%	13%	9%
n=129	n=99	n=80	n=52	n=34

Spinal column deterioration – Any deterioration of the spinal column which protects the spinal cord can lead to spinal cord damage. This can include disc, ligament, joint or bony damage, including stenosis.
Cancer – any cancerous tumours or growths causing spinal cord damage or compression.
Bacterial infection – such as discitis or abscesses.
Vascular disorders – bleeds or lack of blood flow affecting the spinal cord.
Other – e.g. non-cancerous/benign tumours, inflammatory/autoimmune disease, toxic causes.

ntSCI causes by sex

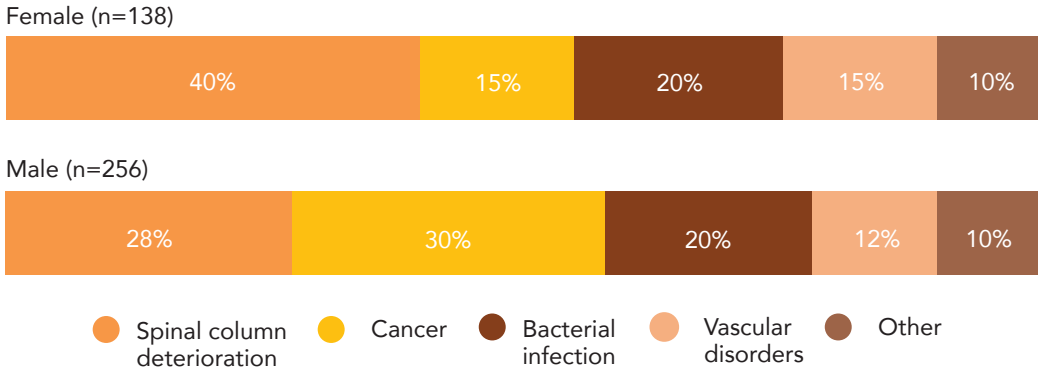


Figure 27: ntSCI causes by sex

As previously highlighted in the tSCI causes by sex section, males account for a greater number of overall cases despite internal percentage shifts. Figure 28 shows primary aetiologies of ntSCI vary significantly by sex. Among males, malignant neoplasms constitute the leading cause at 30%, which is double the proportion observed in females (15%). Vertebral column degeneration is the second most prevalent cause in males at 28%, but it represents the leading aetiology in females, accounting for 40% of cases.

ntSCI causes by age

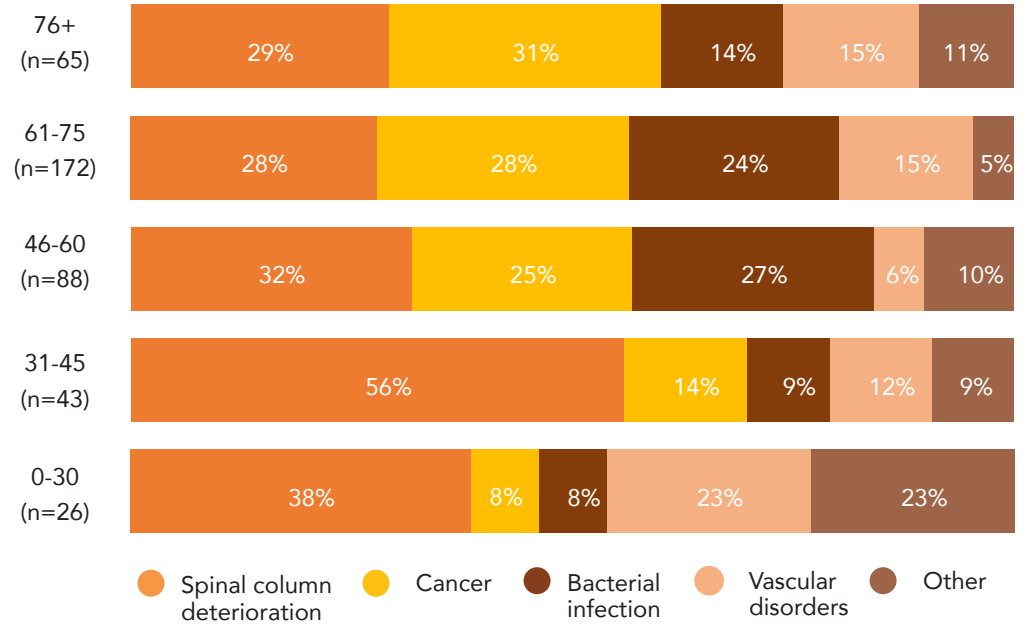


Figure 28: ntSCI causes by age

- Deterioration of the spinal column was the leading cause of ntSCI in people under the age of 45.
- Cancerous tumours were the leading cause in those over the age of 61 years.
- Bacterial infections and deterioration of the spinal column were the predominant causes of ntSCI in 46-60 year olds.
- Vascular disorders represented 12% of total ntSCI and these were predominantly represented in the younger and older age categories.

ntSCI original hospital admission

The map demonstrates where participants with a ntSCI started their hospital journey. Those who came from overseas hospitals are excluded (n=4). The highest number of participants originated where the two spinal services are located (Counties Manukau n=154; Christchurch n=97). The Auckland region encompasses three health districts – Waitematā, Auckland and Counties Manukau, with Northland, Waikato, Lakes, Bay of Plenty and Tairāwhiti making up the remaining Auckland spinal service catchment. The Christchurch service catchment consists of 11 health districts, due to the spinal services being based on population not geography.

- The majority of participants with a ntSCI admitted to the Auckland service are from the Counties Manukau district, followed by Auckland, then Northland and Waitematā.
- The high numbers admitted from the Counties Manukau district may reflect the higher proportion of Pacific People in this region who have anatomically smaller spinal canals, predisposing them to spinal stenosis [22,23].
- Auckland Hospital has the neurosurgical and oncology services for the Auckland region contributing to high admission numbers from this centre.
- Despite having some spinal surgical cover in Northland, Wellington, and Nelson Marlborough districts, service capacity often results in the transfer of people to MMH and ChCh Hospitals for management of their spinal impairment.
- The comparatively low number of Waikato-origin ntSCI admissions are due to these people being managed locally. This warrants further review to understand whether local service configuration, referral pathways, or rehabilitation availability may be influencing transfer patterns.
- The Christchurch spinal service is dominated by Christchurch Hospital, followed by Capital, Coast/Hutt Valley and Nelson Marlborough.

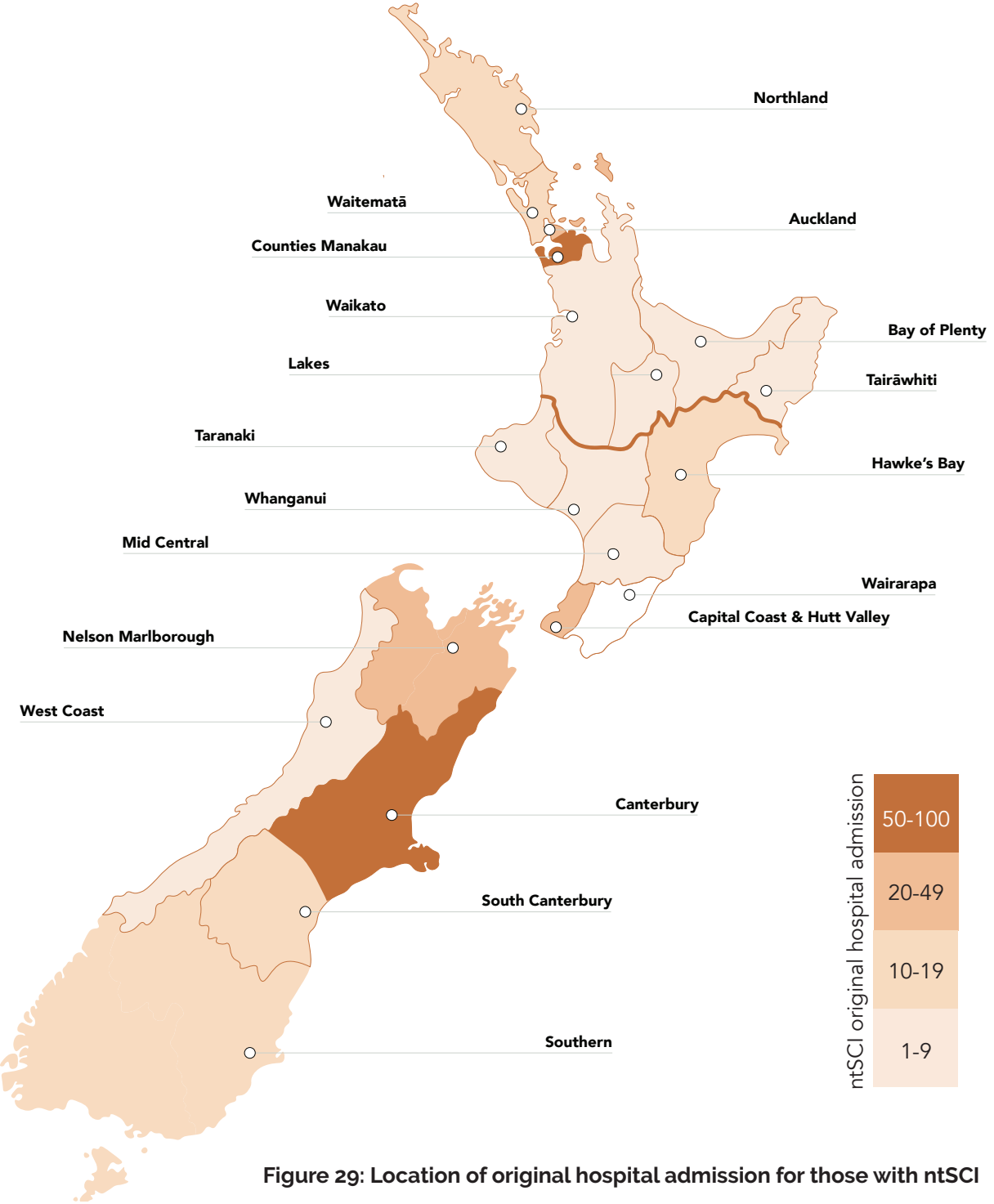


Figure 29: Location of original hospital admission for those with ntSCI

What is the level and severity of injury?

A participant's severity and level of injury are routinely assessed throughout their recovery, using the internationally standardised American Spinal Injury Association (ASIA) Impairment Scale (AIS) [34]. AIS represents the gold standard for the assessment of persons with SCI and enables the interdisciplinary team to share objective, comparable data regarding a patient's neurological status over time.

Although the AIS was historically developed for those with traumatic injuries, globally it is used for tracking neurological deficits across all aetiologies [35,36]. This report includes AIS assessments for the ntSCI population and CES to ensure a unified and comparable measure across our entire dataset.

The **level of injury** refers to the lowest segment of the spinal cord (from the head) where motor function and sensation are normal. The **severity** of injury is classified using a scale from A to E, where Grade A represents a **complete** injury and Grade E indicates normal neurological function (or full recovery). The classification grades are described below:

Grade A: Impairment is complete; no motor or sensory function below injury level.

Grade B: Impairment is **incomplete**; sensory function, but not motor function, is preserved below the neurologic level (the first normal level above the level of injury) and some sensation is preserved in the **sacral** segments S4 and S5.

Grade C: Impairment is incomplete; some motor function is preserved below the neurologic level, but more than half of the key muscles below the neurologic level have a muscle grade less than 3 (i.e. insufficient strength to move against gravity).

Grade D: Impairment is incomplete; motor function is preserved below the neurologic level, and at least half of the key muscles below the neurologic level have a muscle grade of 3 or more (i.e. the joints can be moved against gravity).

Grade E: Participant's functions are normal; all motor and sensory functions are unhindered.

The spinal cord is divided into four regions: **cervical**, **thoracic**, **lumbar**, and **sacral**. **Tetraplegia** results from damage to the cervical spinal cord and is associated with partial or complete loss of movement and sensation in the arms, legs, trunk, and respiratory muscles. **Paraplegia** is any injury in the remaining regions resulting in partial or complete loss of movement and feeling in the legs and lower body due to a SCI in the middle or lower back. Cauda equina syndrome occurs as a result of the compression of the nerves emerging below the spinal cord. People with a SCI or cauda equina injury will likely have bowel, bladder and sexual function affected [4]. People with incomplete injuries at any level may be able to stand or walk, depending on how their spinal cord was affected.

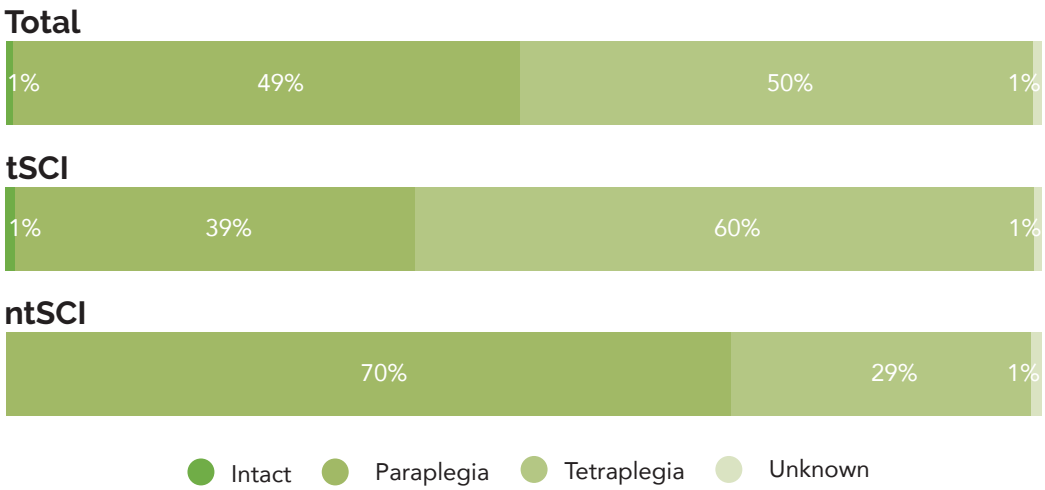


Figure 30: Last known level of SCI by cause

- Across all years, participants with a tSCI are more likely to have tetraplegia.
- Participants with a ntSCI are more likely to have paraplegia.

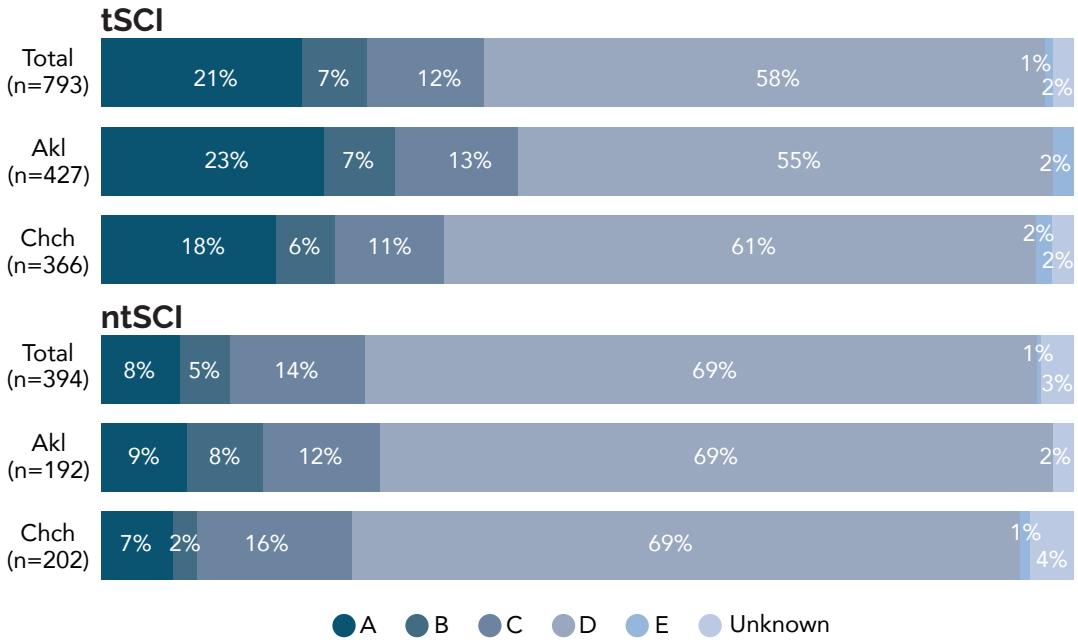


Figure 31: Last known severity of SCI all years combined

Figure 31 provides a detailed breakdown of injury severity across the different categories and services, based on the AIS.

- Complete lesions (AIS A) are more common in those with tSCI (21%), whereas only 8% of ntSCI participants fall into this category.
- Auckland shows a higher percentage of more severe injuries (AIS A and B) for both SCI types.
- Across every category, AIS D (incomplete motor function) is the most common, accounting for 58% to 69% of all participants.

AIS D has the highest predictability for people to achieve independent walking mobility one-year post-SCI [37-40]. 69% of all ntSCI participants are assessed as AIS D. Christchurch shows a slightly higher proportion of AIS D in tSCI compared with Auckland (61% vs 55%). There are a small number of participants who make a full recovery, progressing to AIS E on rehabilitation discharge (n=8).

Some participants may not have an AIS completed. These are categorised as "unknown" in Figures 30 and 31. Impaired cognitive function or severe injury resulting in mortality prior to an assessment being performed may contribute to these unknowns. Whilst not observable on the graphs above, the number of unknown or missing assessments has consistently decreased over the five years due to improved practices at both sites.

AIS change over stay

The following heatmap (Figure 32) illustrates the distribution of AIS grade changes and tracks a participant's neurological status from their initial assessment ("ASIA start") to their final assessment ("ASIA end").

- There is greater neurological stability for those starting at each end of the scale (AIS A and D), whilst more movement is seen in participants presenting with AIS B and C grades.
- The most significant trend is the high proportion of participants ending their rehabilitation journey with an AIS D classification.
  - 94% of participants who were first assessed as AIS D, remained an AIS D.
  - 75% of participants first assessed as AIS C, improved to AIS D.
  - 32% of participants first assessed as AIS B, improved to AIS D.
- For those initially assessed as AIS A, 64% showed no change by the end of their rehabilitation period, however, one-third of this group did demonstrate measurable neurological recovery, advancing to grades B, C, or D.

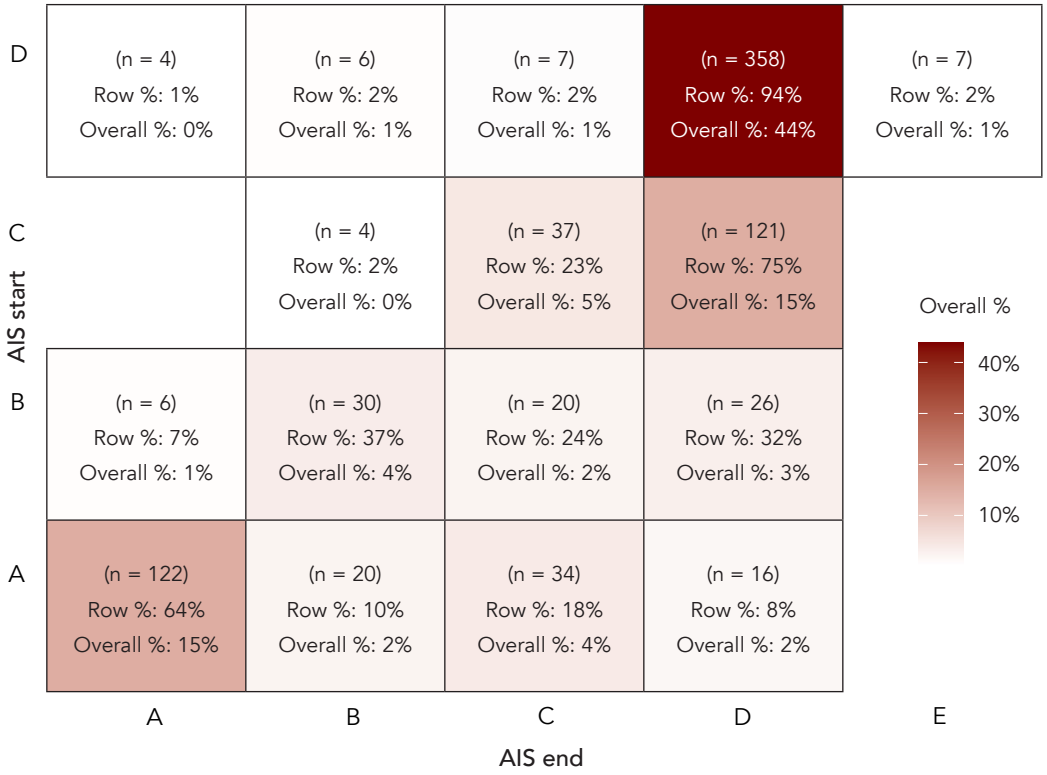


Figure 32: AIS change over stay

- Participants starting at AIS B showed the most distributed outcomes, with large proportions transitioning to AIS C (24%) or AIS D (32%), while 37% remained at AIS B.
- The darkest red cell indicates 44% of all participants in the reporting period (n=358) both started and ended as AIS D.

AIS change over stay, by service

It is important to note in Figures 32 and 33 a small number of participants demonstrated an AIS deterioration by rehabilitation end. These will be explored further in Figure 33 discussion.

Figure 33 illustrates the AIS change by service. As per Figure 32, it tracks neurological initial assessment ("ASIA start") to their final assessment ("ASIA end").

- 44% of patients starting at AIS B in Christchurch improved to AIS D, compared to 21% in Auckland.
- Those with an AIS C, had a high probability of progressing to an AIS D, with a higher rate in Auckland (80%) compared to Christchurch (69%).
- In Christchurch, 15% of those who started as AIS A progressed to AIS D (n=11).
- 4% of participants who started as AIS D in Christchurch progressed to AIS E (n=7).

Both Auckland and Christchurch had a small number of participants with a deterioration in their AIS severity (n=27). Those moving from AIS D to B (n=6) were predominantly participants with incomplete CES which, due to AIS scoring standards, can falsely indicate deterioration in severity when sensory improvement occurs. Other potential reasons include inaccuracy of initial AIS grading due to acute phase challenges such as experience of testers in non-specialist centres, patient alertness or condition in the earliest phase of their recovery, or true deterioration.

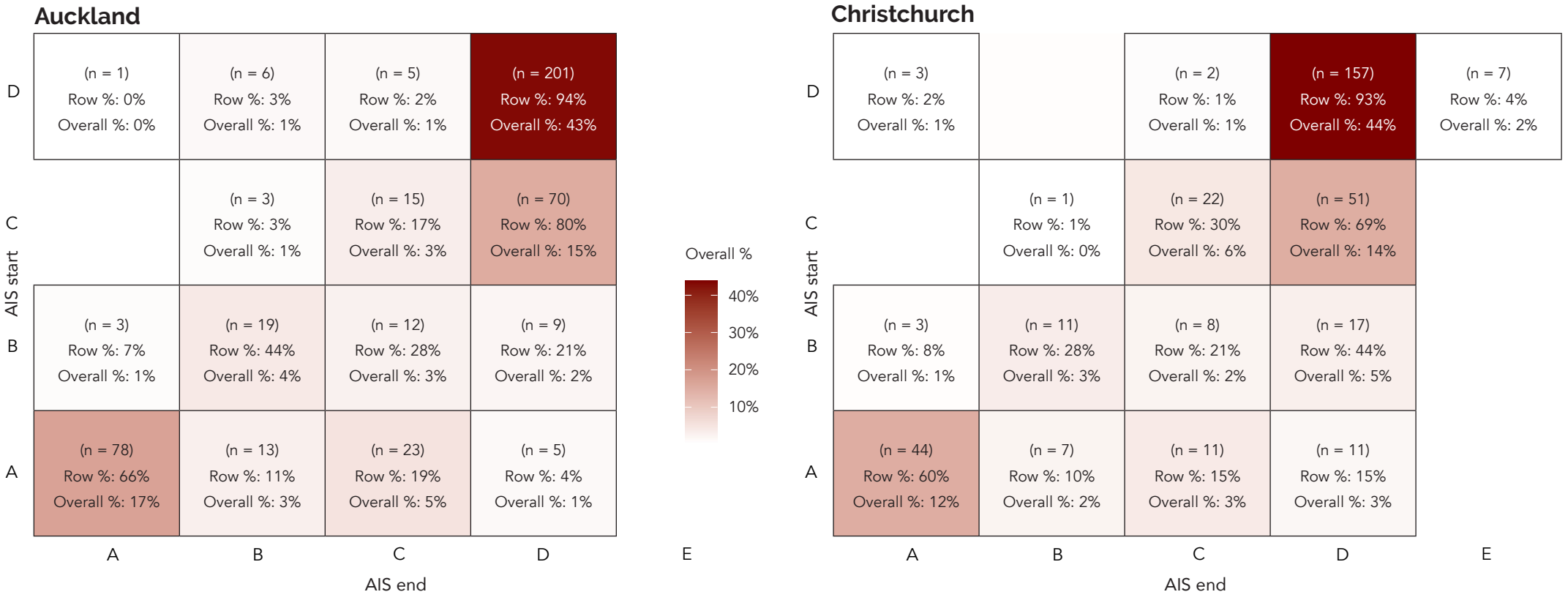


Figure 33: AIS change over stay, by service

What are the length of hospital stays?

Figure 34 plots the length of stay (LOS) data for participants, categorised by injury level and care phase. This is to demonstrate measures of centrality and spread over time.

- Rehabilitation stays are substantially longer and more variable than acute stays across both facilities and all years.

The acute LOS represents the initial hospital stay anywhere (including overseas hospitals) prior to spinal specialist rehabilitation.

- Across both sites and all years, the median acute LOS is consistently low, typically under 25 days.
- There is minimal difference between those with paraplegia/CES and tetraplegia during this phase.
- Auckland shows more frequent high-value outliers (stays exceeding 100 days) compared to Christchurch, suggesting occasional complex cases (multi-trauma or people with significant comorbidities/complications) that require an extended acute stay.

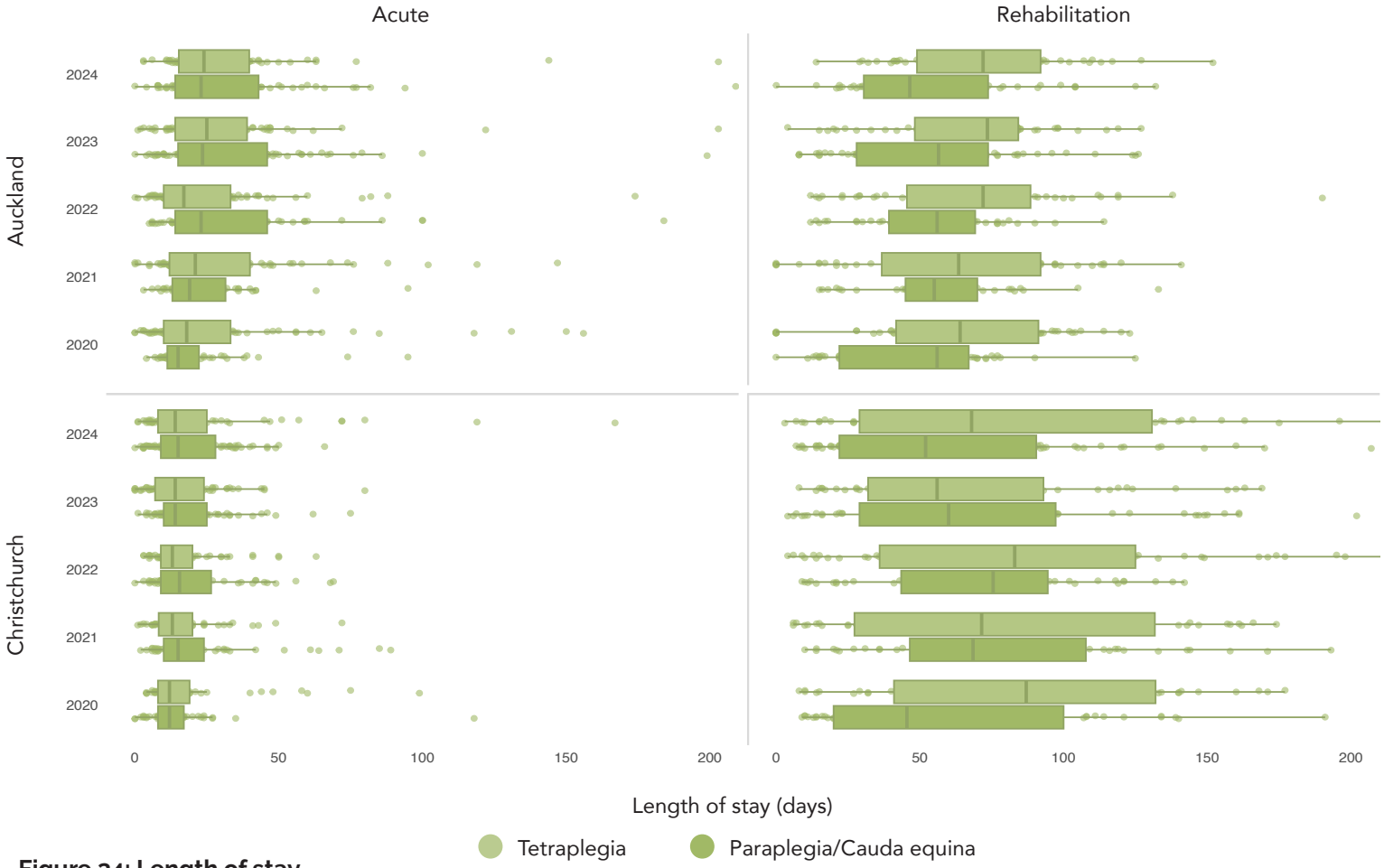


Figure 34: Length of stay

The rehabilitation LOS captures the time spent in either ASRU or BSU.

- As expected, medians for rehabilitation LOS are significantly higher than acute, often ranging between 50 and 100+ days.
- In both facilities, those with tetraplegia (lighter green bars) generally have a longer median LOS and a wider range of stay compared to those with paraplegia/CES. This reflects the typically higher complexity of care and discharge requirements required for those with tetraplegia.
- Rehabilitation LOS at BSU appears generally longer and more widely distributed than ASRU's.
- Rehabilitation LOS at ASRU has remained relatively stable in its median and distribution over the five-year period.

There are no drastic shifts in LOS patterns over the five-year period, indicating a stable clinical pathway in both regions. Being located at Burwood Hospital with its associated services, BSU may have higher acuity capability, enabling participants to be transferred from the acute service sooner. By comparison, ASRU is an offsite facility from MMH and, with lower total volume of rehabilitation beds available, occupancy pressures may contribute to relative differences in acute versus rehabilitation LOS across services.

Length of stay by discharge AIS grade

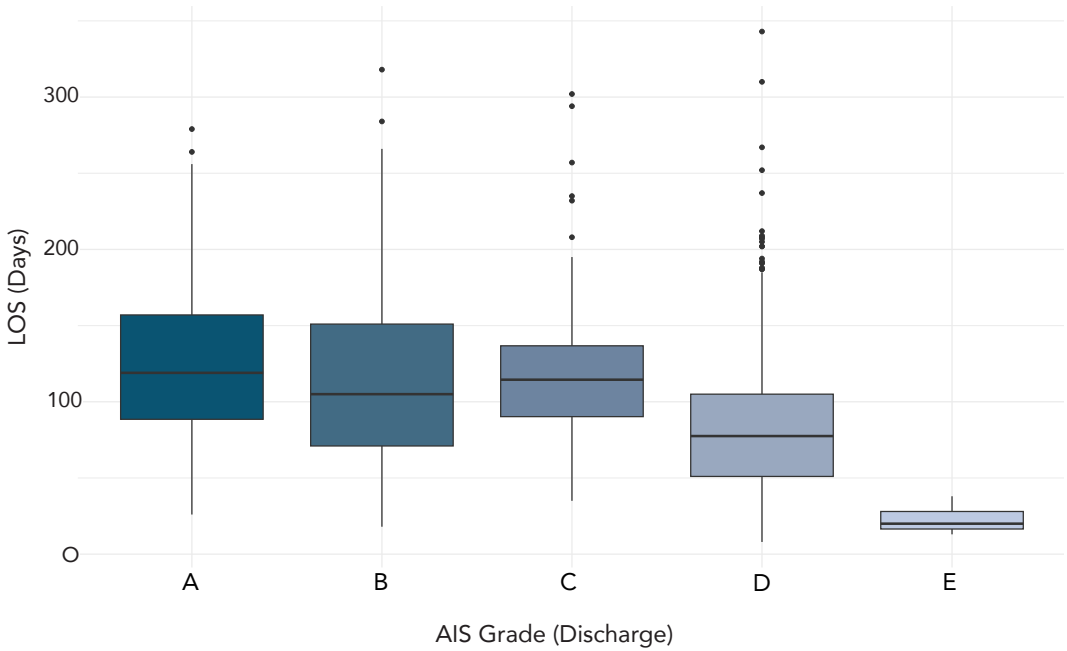


Figure 35: LOS by discharge AIS grade

When reviewed by severity of injury, there is very strong statistical evidence that LOS distributions differ significantly across AIS grade groups. Given LOS is skewed and varies widely, statistical tests were used to focus on median differences. Figure 35 compares LOS against a participant's injury severity on discharge.

Across all comparisons, participants with more severe injuries (AIS A, B, and C) had longer median stays than AIS D and E, with very strong evidence for A–D and C–D differences and moderate evidence for B–D. Complete (AIS A) and incomplete (AIS B/C) injuries do not differ meaningfully in LOS. Overall, LOS is strongly influenced by discharge neurological status; and neurological severity at discharge does predict LOS.

Length of stay was modelled using functional status, complications, discharge destination, and weight as independent predictors. LOS was selected as the outcome because it is a clear operational measure of service utilisation, capturing the combined effect of functional impairment, complications, and discharge complexity.

What factors impact LOS?

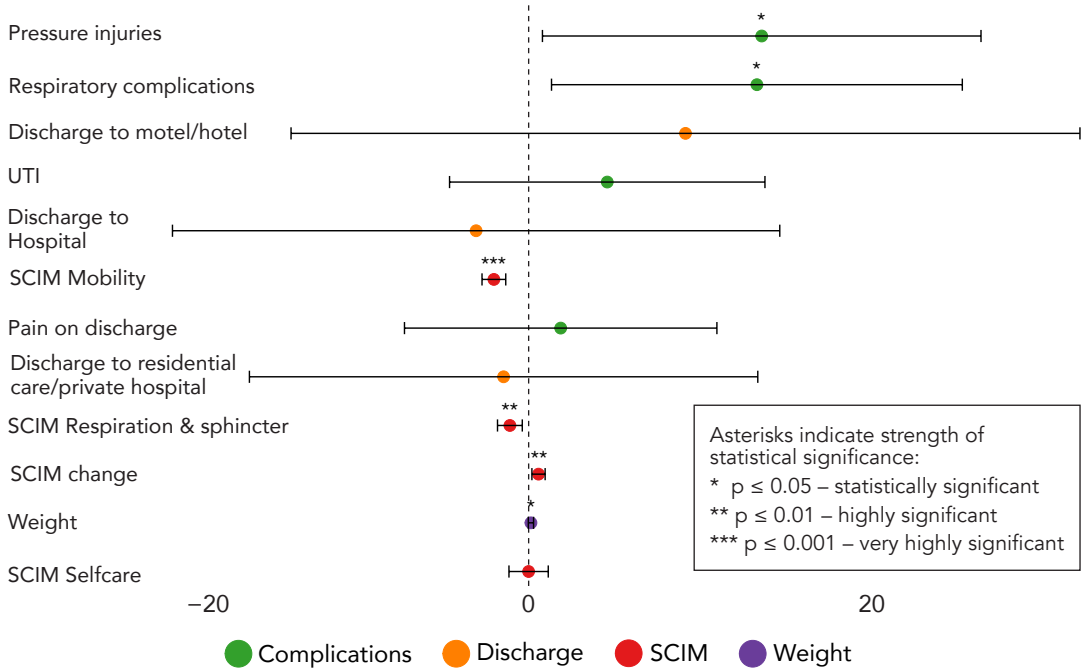


Figure 36: Factors independently driving LOS

SCIM Mobility and SCIM Respiratory domains remained the strongest functional determinants of LOS: each one-point increase in SCIM Mobility was associated with 2.06 fewer days in rehabilitation (95% CI: –2.78 to –1.35), and each one-point increase in SCIM Respiratory was associated with 1.10 fewer days (95% CI: –1.85 to –0.35).

Functional gain (SCIM change) showed the opposite pattern, with each additional point gained during rehabilitation associated with 0.62 more days of LOS (95% CI: 0.23 to 1.02), reflecting the additional time required to achieve improvement. Serious complications continued to have substantial independent effects: pressure injuries added 14.1 days (95% CI: 0.86 to 27.2), and respiratory complications added 13.8 days (95% CI: 1.40 to 26.1).

Discharge to motel/hotel accommodation showed an increased but imprecise association (9.47 days; 95% CI: –14.3 to 33.2), indicating wide uncertainty around its true effect. Weight had a modest increase in LOS (0.17 days per kg; 95% CI: 0.009 to 0.324). Urinary tract infection, pain, self-care scores, and hospital/nursing-home discharge destinations did not demonstrate independent effects.

Where do people go after discharge from hospital?

Figure 37 shows *immediate* discharge destinations of participants following acute care or rehabilitation at the spinal services. For individuals who received acute care only at MMH or ChCh Hospitals and transitioned back to their residential region for ongoing rehabilitation, their immediate destination is categorized as 'Hospital'. Similarly, participants requiring local rehabilitation or discharge planning post-discharge from ASRU/BSU are also classified under 'Hospital', denoting a temporary clinical transition rather than long-term hospitalisation. Long-term care placements are captured separately under Residential care homes (RCH)/ assisted living residence (ALR)/private hospital (PH).

The Christchurch service shows a higher rate of participants discharging to other hospitals, particularly for ntSCI cases, reaching 37% in 2024 compared to Auckland's 16%. Christchurch's geographical catchment covers a larger area than Auckland, resulting in logistical barriers in discharge planning for those individuals living far from Christchurch (e.g., Southland or North Island regions). Generally, those discharging to a hospital would have received the majority of their rehab at the spinal services and return to their local area for discharge planning.

Growing numbers of individuals with SCI and high rehabilitation demand has led to increasing wait times for spinal rehabilitation services. Spinal rehabilitation teams frequently provide consultative liaison support in the acute setting. This allows individuals with less severe impairments or CES to discharge from acute facilities with outpatient follow-up from the spinal services. This liaison model also provides essential support for individuals who cannot participate in intensive rehabilitation (e.g. those with severe cognitive impairments or palliative care needs), ensuring safe transition from acute facilities to an appropriate level of long-term care.

For acute-only patients (data not visible on graph), 43% were discharged home, 28% transferred to another regional hospital, 20% died, and 7% moved to a nursing home.

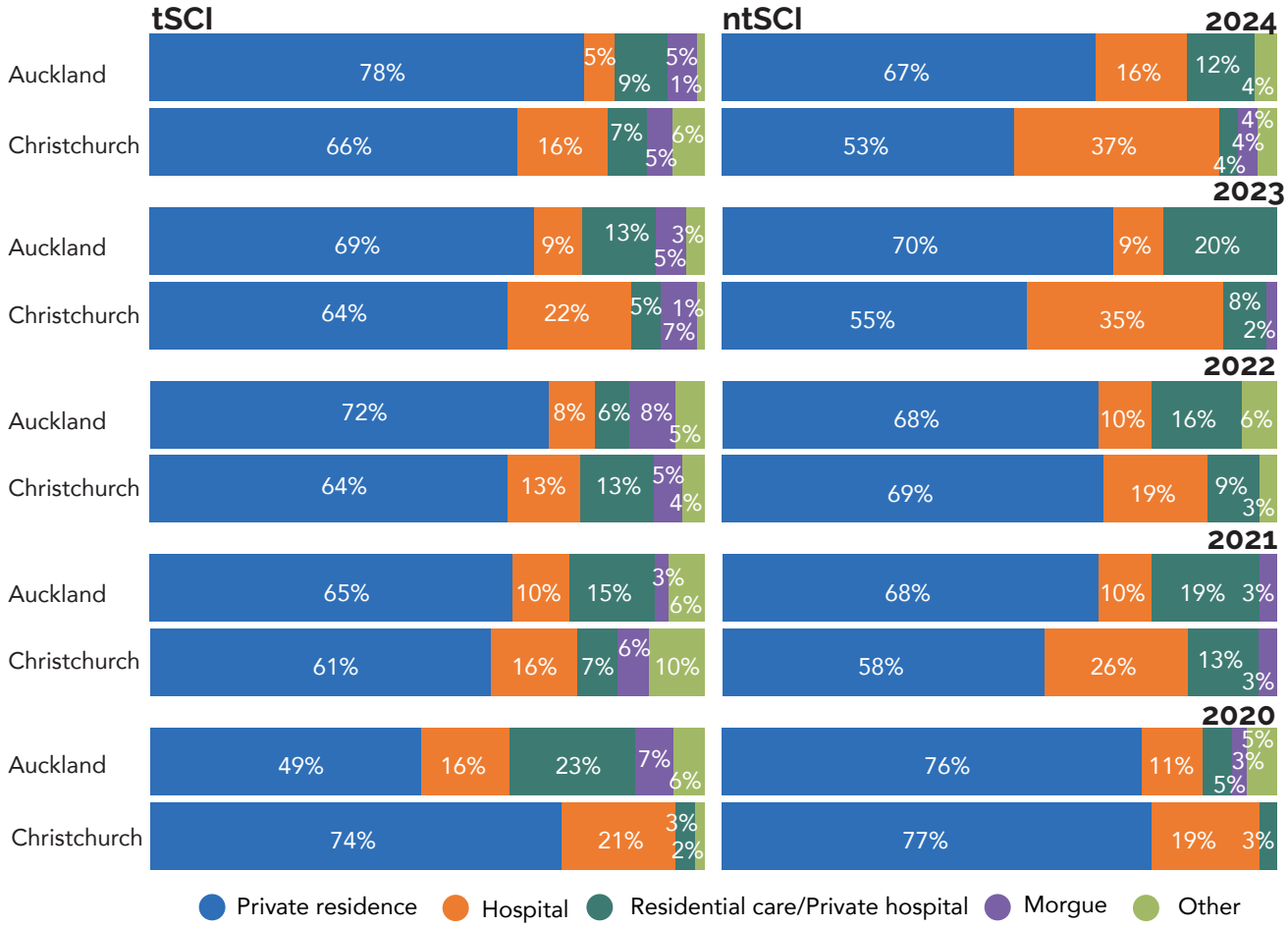


Figure 37: Discharge destinations from spinal services (acute and/or rehabilitation), by type and year

The discharge destination categories are:

Private residence – owned or rented house, flat, apartment, mobile home or houseboat.

Hospital – ongoing input (acute or rehabilitation) or discharge planning at a regional hospital. As data collection stops on discharge from either spinal service, the NZSCIR does not collect the participants' discharge destination post-regional hospital discharge.

Residential care homes (RCH)/assisted living residence (ALR)/private hospital (PH) – includes nursing homes/rest homes (i.e. home where care is provided for those who require it) or private hospitals for long-term hospital level care.

Morgue – those participants who died during spinal service admission (in acute or rehabilitation care).

Other – includes groups with numbers too small to report on, such as those discharged to a hotel/ motel or a correctional institute and those with no permanent discharge destination.

How many people have surgery?

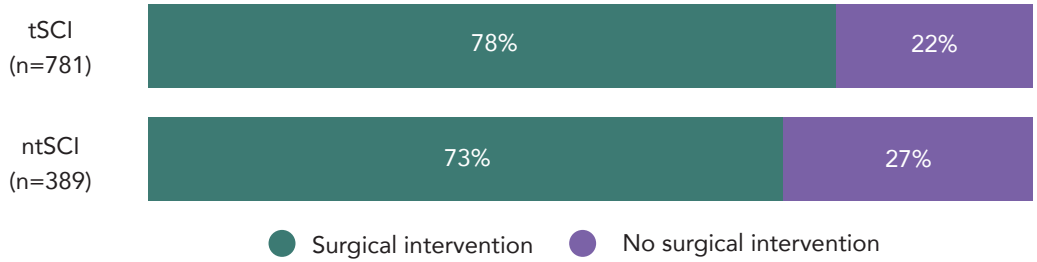


Figure 38: Surgery rates by SCI type

- Every year, treatment via surgical intervention consistently stays above 73% nationally.
- Overall, participants with tSCI receive surgical intervention more frequently than those with ntSCI (78% vs 73%).

There are many considerations for non-operative management. These include spinal stability, improving neurological function (i.e. spontaneous neurological recovery in **central cord syndrome**), poor participant health/multiple comorbidities or advanced age [41-43].

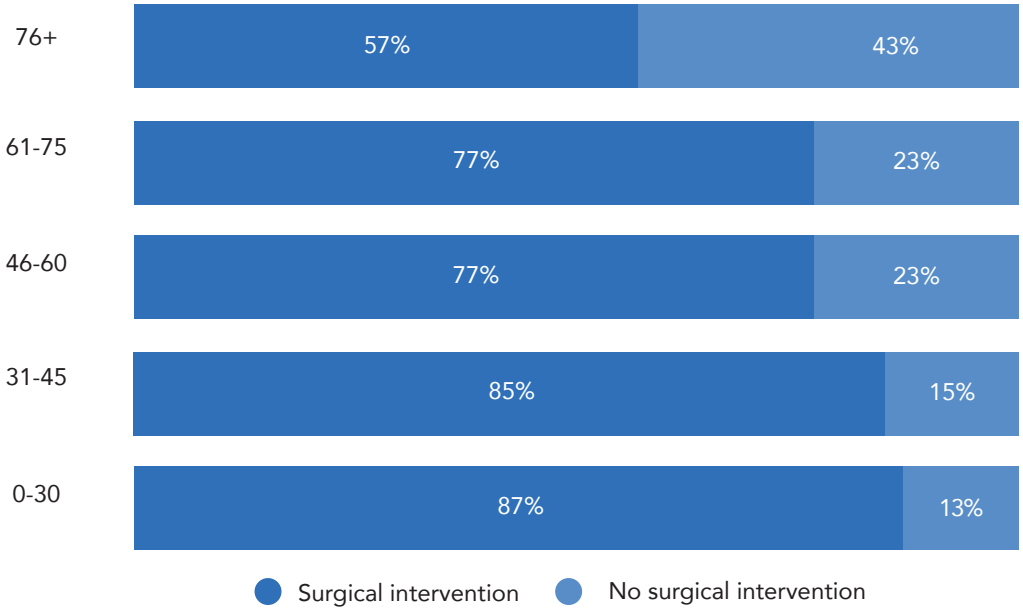


Figure 39: tSCI surgery rates by age

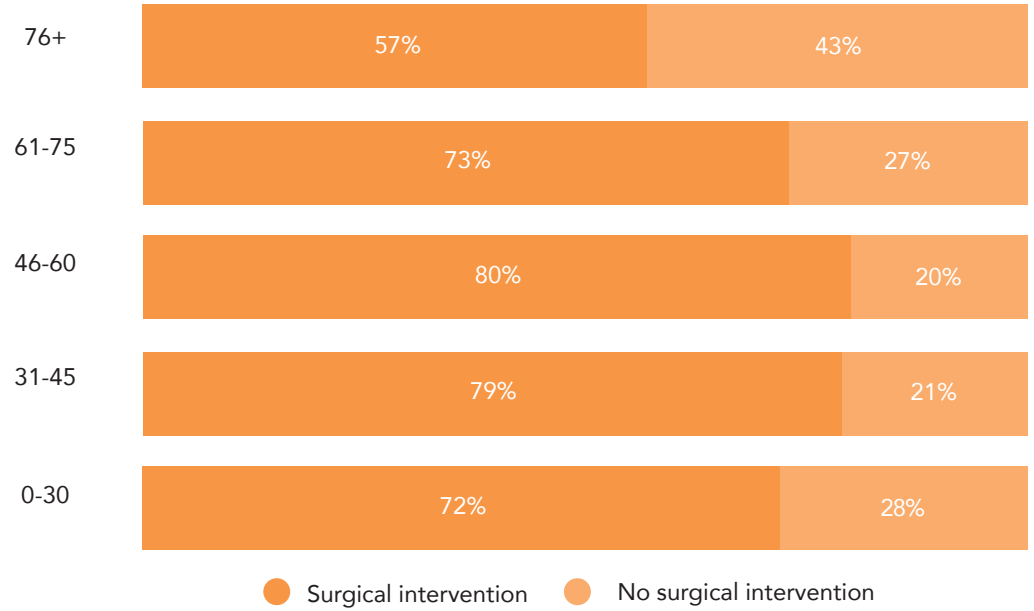


Figure 40: ntSCI surgery rates by age

Figures 39 and 40 provide a comparative look at surgical intervention rates for all participants (tSCI and ntSCI) across different age groups.

- Those aged over 76 have the lowest surgery rates (57% for both tSCI and ntSCI).
- For those with tSCI, the youngest group (under 30 years) sees the highest rate of surgery at 87%.
- Surgery rates decline with age in those with tSCI.
- For those with ntSCI, surgical intervention peaks at 80% in the 46–60 year age.

Lower surgery rates in the older population likely reflects clinical considerations regarding frailty, comorbidities, or the goals of care [43]. Once participants reach 76 years, the cause of injury seems to matter less than age-related factors, as the rates converge at 57%. Younger tSCI participants most often undergo surgery, likely due to high-energy trauma accidents and fewer health co-morbidities.

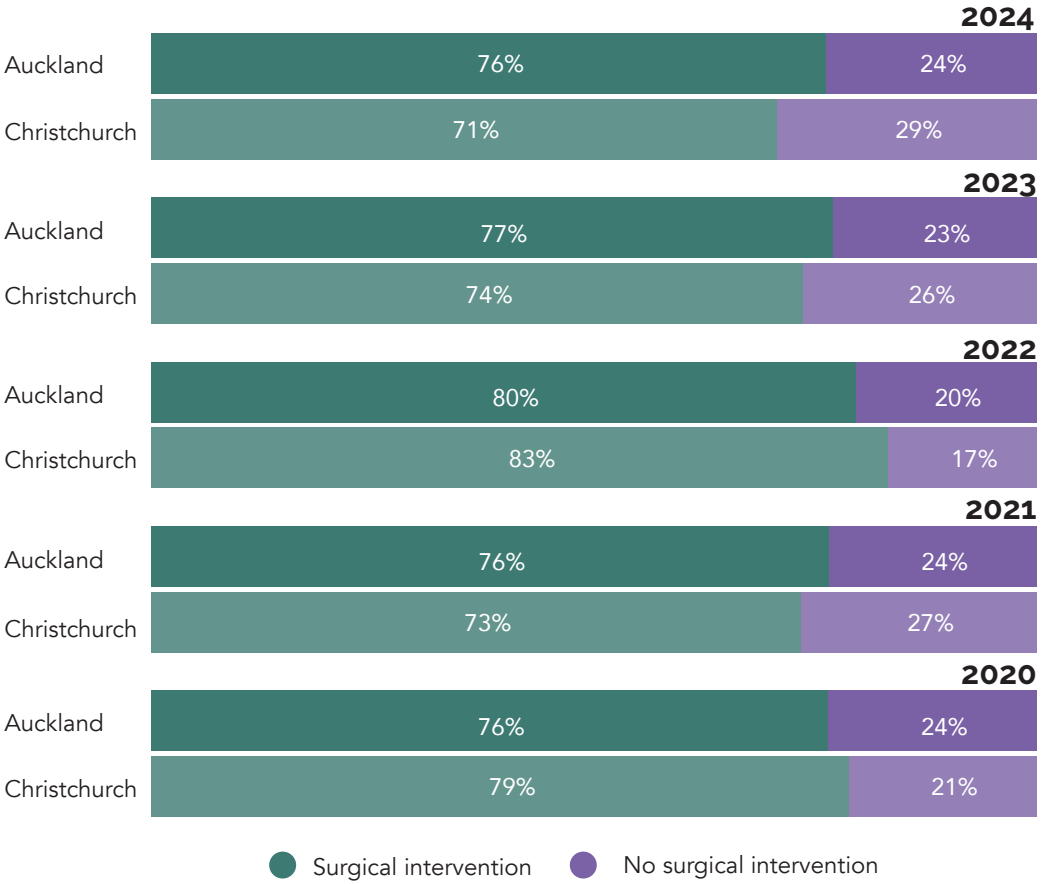


Figure 41: Surgery rates by facility and year (n=1170)

Over the five-year period, surgical intervention remained the primary course of action for those with tSCI and ntSCI across the two services. Auckland service shows relative stability, with surgical rates between 76% and 80%, whilst Christchurch exhibits more range, with a low of 71% (2024) and high of 83% (2022).

Time to decompression for tSCI

Research suggests early cord decompression leads to improved long-term recovery and participant outcomes [44-47]. The objective of the Destination Policy, administered by Hato Hone St John, is for those with a tSCI to have surgical decompression of the spinal cord at either of the two-specialist acute spinal centres - MMH or ChCh Hospitals - as rapidly as possible [48].

Although early decompression is the gold standard, there are multiple reasons why a participant would *not* receive early surgical intervention, including:

- lack of clinical need (i.e. spontaneous neurological recovery in CCS)
- comorbidities or advanced age
- multi-trauma requiring life-saving interventions at tertiary major trauma hospitals first
- poor weather or aircraft availability delaying transportation to spinal services
- delay in diagnosis at the scene/first hospital (i.e. not identified as a person with a SCI)
- not being transported to a specialist spinal service
- or slow development of symptoms over time.

The NZSCIR is yet to report publicly on time to decompression data. This data however has been used clinically in audits and is the subject of current in-depth research being undertaken by University of Auckland, in collaboration with Health NZ.

Figure 42 is a visual representation of the time it takes from the point of injury to spinal surgical decompression. It is important to note these calculations can only be made if all the documented time points (time of injury, surgical start and finish times) are available. Importantly, not all those admitted with a new tSCI are a) transported to the services under the Destination Policy or b) require immediate surgical intervention. However, all surgery data is included in this graphic. Version 2 of the NZSCIR has additional data points regarding the Destination Policy (if participants meet or travel via the policy and, if not, why) so future analysis will be more comprehensive.

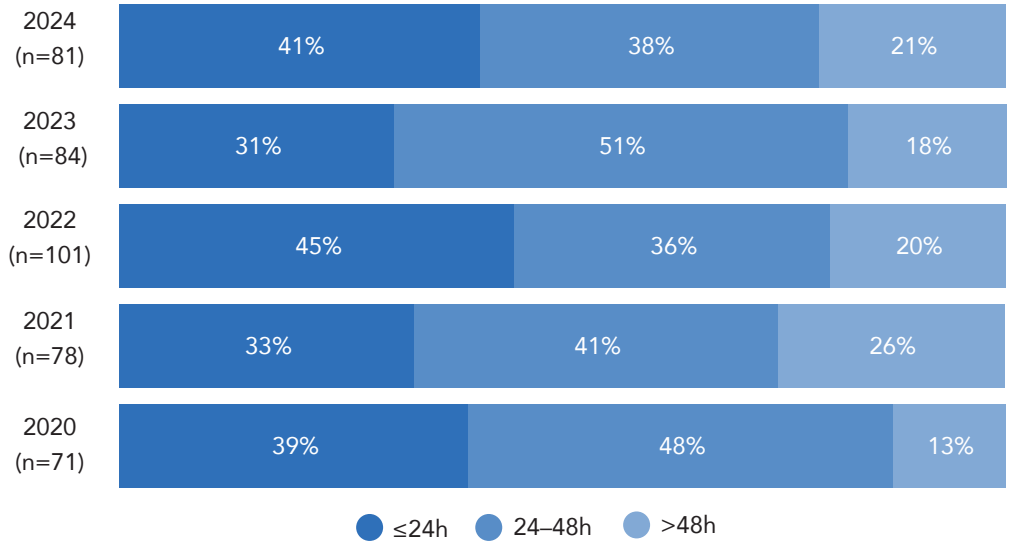


Figure 42: Time to decompression for those with tSCI

Location of first surgery for those with tSCI

Figure 43 indicates the location of first surgical intervention for anyone with a tSCI. Those operated on overseas and recorded in the NZSCIR (n=4) are included in the total section but are excluded from the catchment sections.

- In 81 to 93% of cases, tSCI surgery is performed in specialist centres (MMH/ChCh Hospital), as per the Destination Policy [48].
- In 7 to 19% of tSCI cases over the past five years, surgery was performed in other hospitals.
- 2024 showed a higher percentage of tSCI surgeries being performed outside of the spinal centres. This was evident at both sites and warrants further investigation.

NZ has six tertiary major trauma hospitals, including MMH and ChCh Hospital. Both spinal service catchments have three tertiary major trauma hospitals, but Christchurch catchment has a higher number of additional regional hospitals. Participants may be transported to their regional hospital or closest major trauma centre for a variety of reasons outlined in the previous section. The most common alternative surgical sites were Waikato (n=15), Wellington (n=11); Auckland City (n=8) and Dunedin Hospitals (n=5). These are all designated tertiary major trauma hospitals and likely receive those with multi-trauma or life-threatening injuries.

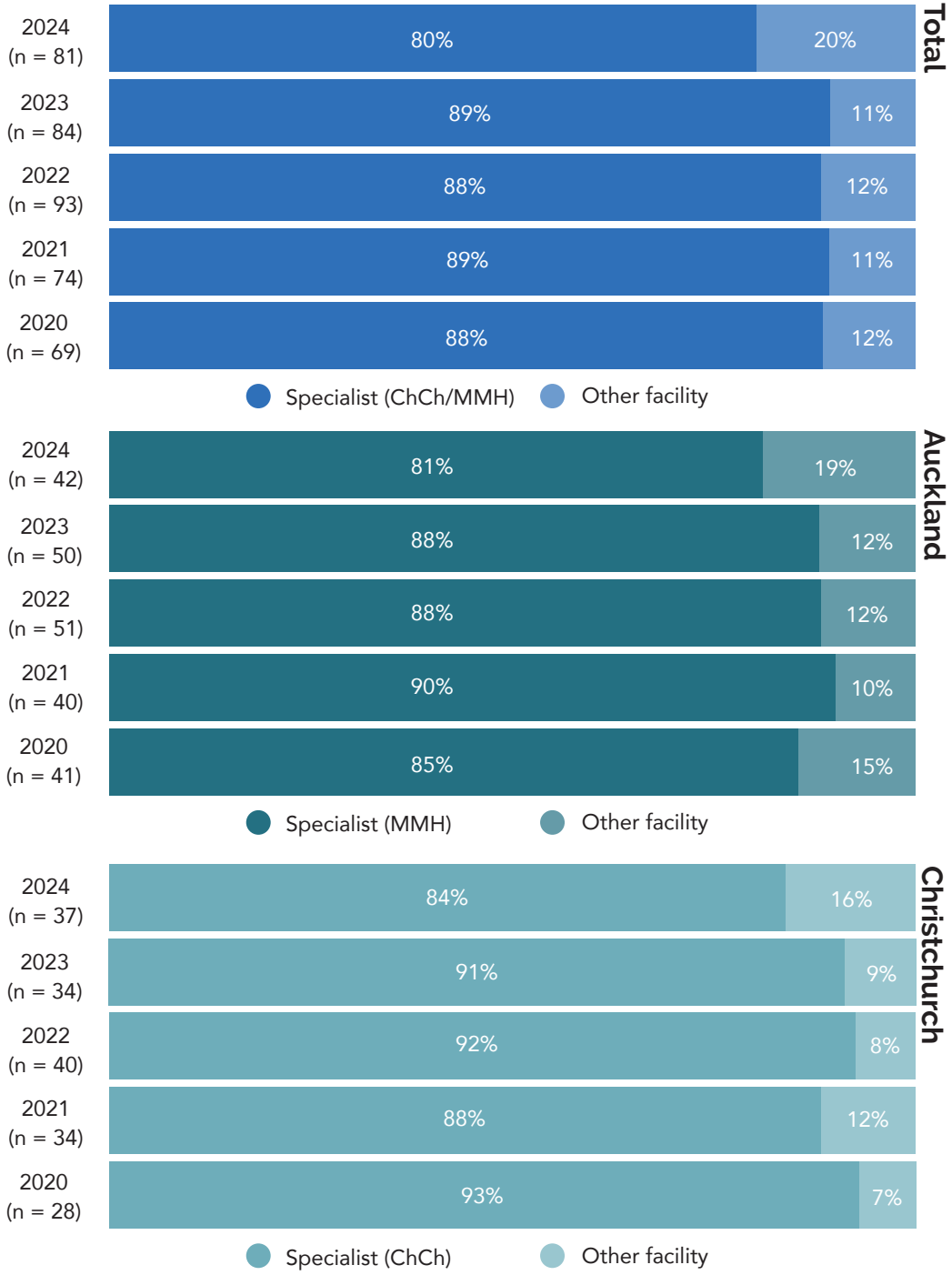


Figure 43: Location of first surgery for those with tSCI by catchment

Secondary complications

The most common secondary medical complications associated with a SCI, in both acute and rehabilitation phases, are captured in the NZSCIR [49].

Pressure injuries are where tissue has been injured by pressure and/or shear forces. These injuries can have a dramatic impact on a participant's ability to engage in rehabilitation, as they often need to be treated through periods of bed rest to resolve. This can significantly increase their length of stay as pressure injuries need to heal before participants can participate fully in rehabilitation.

Pressure injuries are the least frequent complication, consistently staying below 20%.

Rates have remained stable for both tSCI and ntSCI in the rehabilitation phase.

Respiratory complications extend over a wide range of conditions including pneumonia, COVID, pulmonary emboli (PE)/ deep vein thrombosis (DVT), pneumothoraces and obstructive sleep apnoea (OSA). OSA is often present post-SCI in those impacted by higher neurological levels of injury.

Acute respiratory complications are consistently more prevalent in those with tSCI.

Urinary tract infections (UTI) as a complication of SCI are only recorded if they are symptomatic and treated with antibiotics. Prophylactic use of antibiotics for those learning intermittent self-catheterisation are not included in these statistics.

- Rates for those with tSCI and ntSCI are lower in the acute stay, compared to rehabilitation.
- Rehabilitation UTI rates are consistently higher in those with tSCI.

Those with tSCI generally experience higher rates of complications across most categories, particularly acute and rehab respiratory and UTIs in rehabilitation. Bladder management has been investigated in both services through local audits, underscoring the importance of individualised approaches considering both international guidelines and participant characteristics. The 2023 spike in acute UTIs across both cohorts was identified clinically at MMH, with NZSCIR confirming the trend. This led to changes in neurogenic bladder management and catheter practices in the acute phase in Auckland, which may have contributed to decreased rates in 2024.

Although not shown graphically, pressure injury risk increases with higher AIS severity, however, the relatively low rates suggest current skin assessment protocols are performing well. The most common location of pressure injuries is the sacral region/ natal cleft (56%), followed by the heel (13%).

Pain and **Spasticity** - consented participants are asked about their experience with pain and spasticity in the days leading up to rehabilitation discharge. Pain is reported in Figure 45.

Spasticity is a common secondary complication following SCI, with 68% of consented participants (excluding those with CES) self-reporting spasticity at rehabilitation discharge. While mild spasticity can sometimes facilitate functional tasks like transfers or standing, significant or problematic spasticity frequently hinders functional daily activities, sleep, and overall quality of life [49]. The high prevalence of this complication highlights the need for targeted management of spasticity, including oral pharmacology, physiotherapy and/or localised injections. In version 2 of NZSCIR, more detailed spasticity questions capture impacts on participants' daily activities, mood and sleep at rehabilitation end, allowing for future investigation.

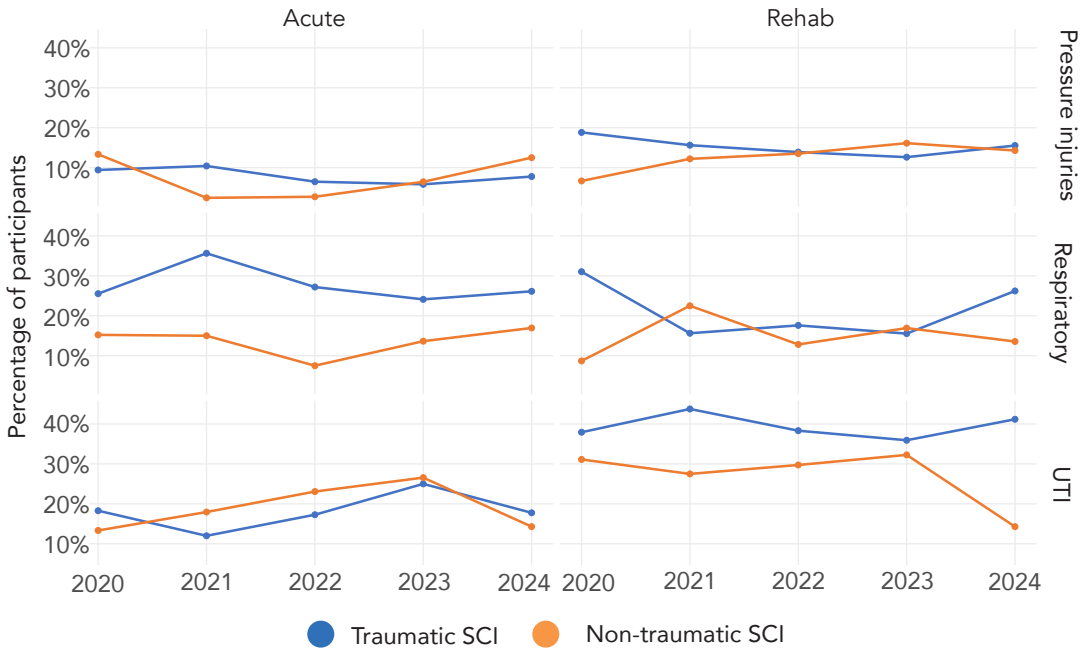


Figure 44: Complications in acute and rehabilitation stays

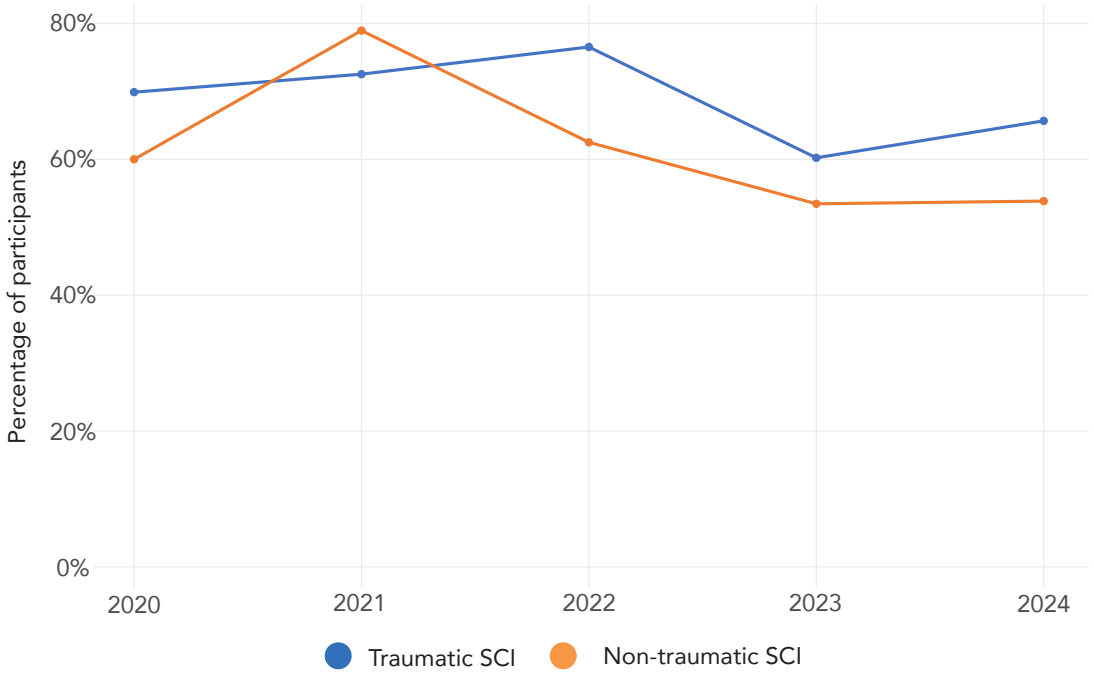


Figure 45: Pain reported on rehabilitation discharge

- Pain is the highest complication recorded in NZSCIR for both SCI cohorts.
- Those with traumatic injuries generally experience pain at higher rates.

Pain following a SCI is common. It is also complex, encompassing both neuropathic and musculoskeletal origins. Of those participants questioned, 46% report daily neuropathic pain, and 72% require prescription medication for pain management on rehabilitation discharge.

Mortality

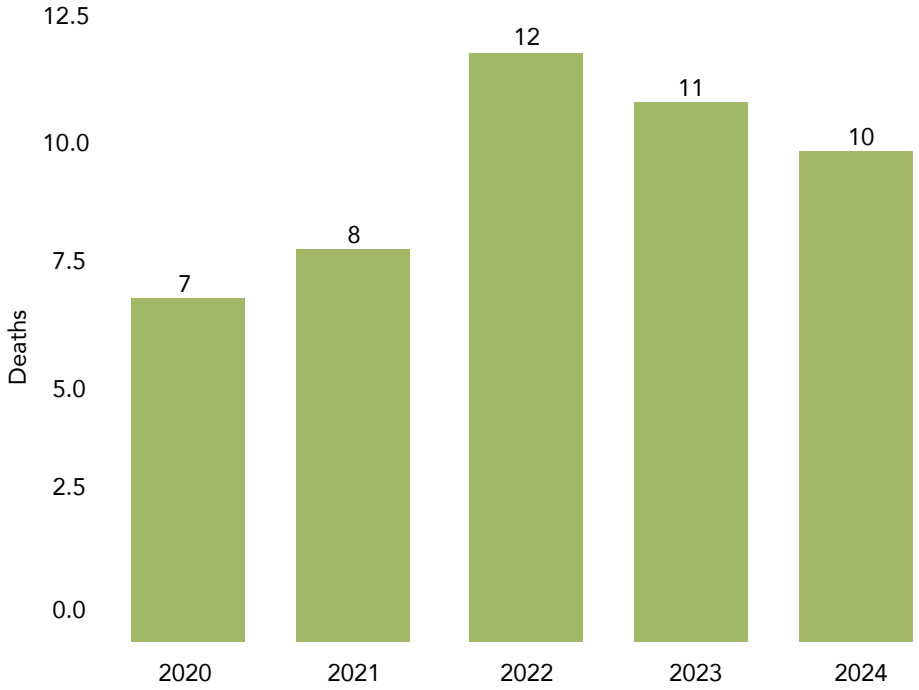


Figure 46: National mortality before discharge

NZSCIR captures those who are admitted to one of the acute spinal specialist services but do not survive their initial SCI. This can be due to SCI-related causes or complications from their injury or illness. The majority of this group are from the older age categories and/or have severe injuries.

61% of this mortality cohort are over 60 years. This compares to 47% of the overall five-year population being aged over 60. If a neurology assessment could be performed, 69% of those who do not survive have the most severe AIS A complete injury. The deceased population are more dominantly affected by tetraplegia than paraplegia/CES (83% tetraplegia vs 17% paraplegia/CES), which demonstrates cervical cord damage carries a higher mortality risk due to impairment of respiratory and autonomic functions. This is a reported trend worldwide [42,43,50,51].

Functional outcomes

Spinal Cord Independence Measure (SCIM) distribution

The SCIM is a specialised tool used by clinicians to evaluate functional independence and daily living skills in individuals with SCI [52]. The SCIM evaluates function on a 0 to 100 scale, where 0 represents total dependence and 100 represents complete independence. It is divided into three key domains:

Self-Care: Scores from 0 to 20 (measures eating, grooming, bathing, and dressing).

Respiration and Sphincter Management: Scores from 0 to 40 (measures breathing, bladder, and bowel management).

Mobility: Scores from 0 to 40 (measures moving around in bed, transferring, and indoor/outdoor mobility).

SCIM is completed by treating clinicians (occupational therapists; physiotherapists; nurses) at the start of the rehabilitation process and on rehabilitation discharge. Compared to other tools, like the Functional Independence Measure (FIM), the SCIM is recognised by healthcare professionals as more sensitive to changes in patients with SCI [53]. It assigns points based on practical tasks, making it highly effective for tracking recovery.

Figures 47 to 49 show the distribution of scores on rehabilitation discharge, grouped into each domain.

Available scores for each functional task can range from one (transferring from floor to chair) to fifteen (bladder sphincter management). Zero is given for those who require total assistance (i.e. requiring an indwelling catheter for bladder management or having a long-term tracheostomy) whilst the top score is for a fully independent participant completing tasks unaided (i.e. washing independently without any adapted equipment or environment). See Appendix C for the full outcome measure.

In previous NZSCIR annual reports, independent walking on discharge was the only SCIM element presented. This is the first time NZSCIR has reported on the full SCIM dataset and aims to investigate functional and mobility trends in further detail.

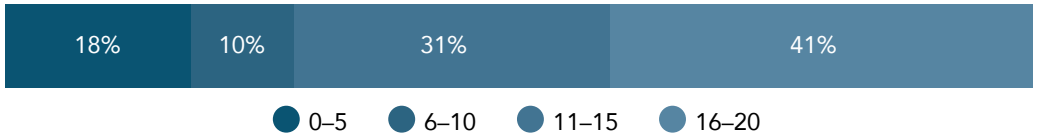


Figure 47: SCIM Self-Care domain on rehabilitation discharge (n=669)

The largest group of individuals (41%) scored in the highest category of independence (16-20 points) for the Self-Care domain. 0-5 indicates high levels of assistance needed with daily self-care tasks. 18% of participants fall in this category, signifying a need for long term nursing care and extensive family or institutional support systems.

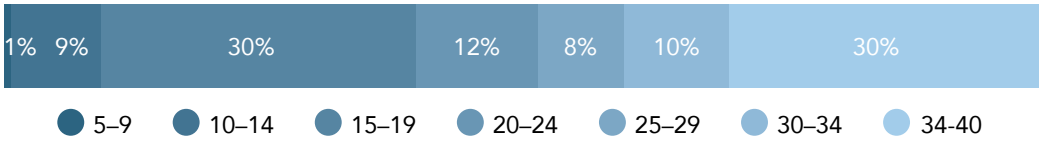


Figure 48: SCIM Respiration and Sphincter Management domain on rehabilitation discharge (n=655)

The two largest categories in the Respiratory and Sphincter domain have scores of 15-19 and 35-40 points. 30% of participants scored 15-19 for respiration and sphincter management. A score in this range typically signifies a participant who breathes independently but requires assistance to manage their bladder dysfunction (i.e. indwelling catheter) and bowel regimen. 30% of participants are independent or require minimal intervention for daily respiration and sphincter management at rehabilitation discharge (35-40 points).

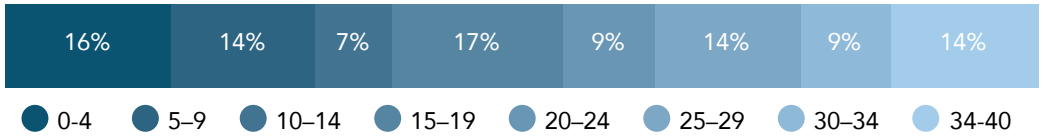


Figure 49: SCIM mobility domain on rehabilitation discharge (n=630)

Mobility data is the most evenly spread of the three SCIM domains, showing that mobility is highly varied on rehabilitation discharge. For context, a fully independent manual wheelchair user would likely have a maximum SCIM score of 19, whilst a participant who is walking independently (indoors and outdoors) would likely score a minimum of 25 in this domain.The largest group (17%) have SCIM mobility scores of 15-19 which represent those who are independent with most aspects of mobility but likely require a wheelchair. 16% of participants have mobility scores in the lowest range (0-4) indicating a high requirement for assistance with all mobility.

SCIM change

Figure 50 shows the change in SCIM scores from rehabilitation admission to rehabilitation discharge. To measure meaningful functional progress over time, a change of at least four points indicates a small significant improvement, while a 10-point change represents a substantial improvement (black dotted lines) [54]. For a participant's data to be included here, they must have provided consent for full dataset collection and all domains at admission and discharge must be completed by nurses, physiotherapists and occupational therapists – to ensure totals out of 100 are recorded for comparison. Those with missing domains are excluded. Both 2020 and 2021 have low numbers of SCIM assessments due to a MDS being collected during COVID-19 lockdowns. This had more of an effect on Auckland due to their extended lockdown periods.

Figure 50 demonstrates the majority of those in rehabilitation make improvements; 94% making a small significant improvement (with at least a four-point change), and 80% making a substantial improvement, being over the 10-point change threshold. Table 6 refers to site-specific SCIM improvements, showing Auckland has a higher number of completed SCIM datasets and Christchurch shows higher percentage of substantial improvements.

Table 6: SCIM change improvements by site

	Total (n=564)	Auckland (n=346)	Christchurch (n=217)
>4 change: at least a small significant change	530 (94%)	322 (93%)	208 (96%)
>10 change: a substantial change	454 (80%)	267 (77%)	187 (86%)

N=564 with complete records

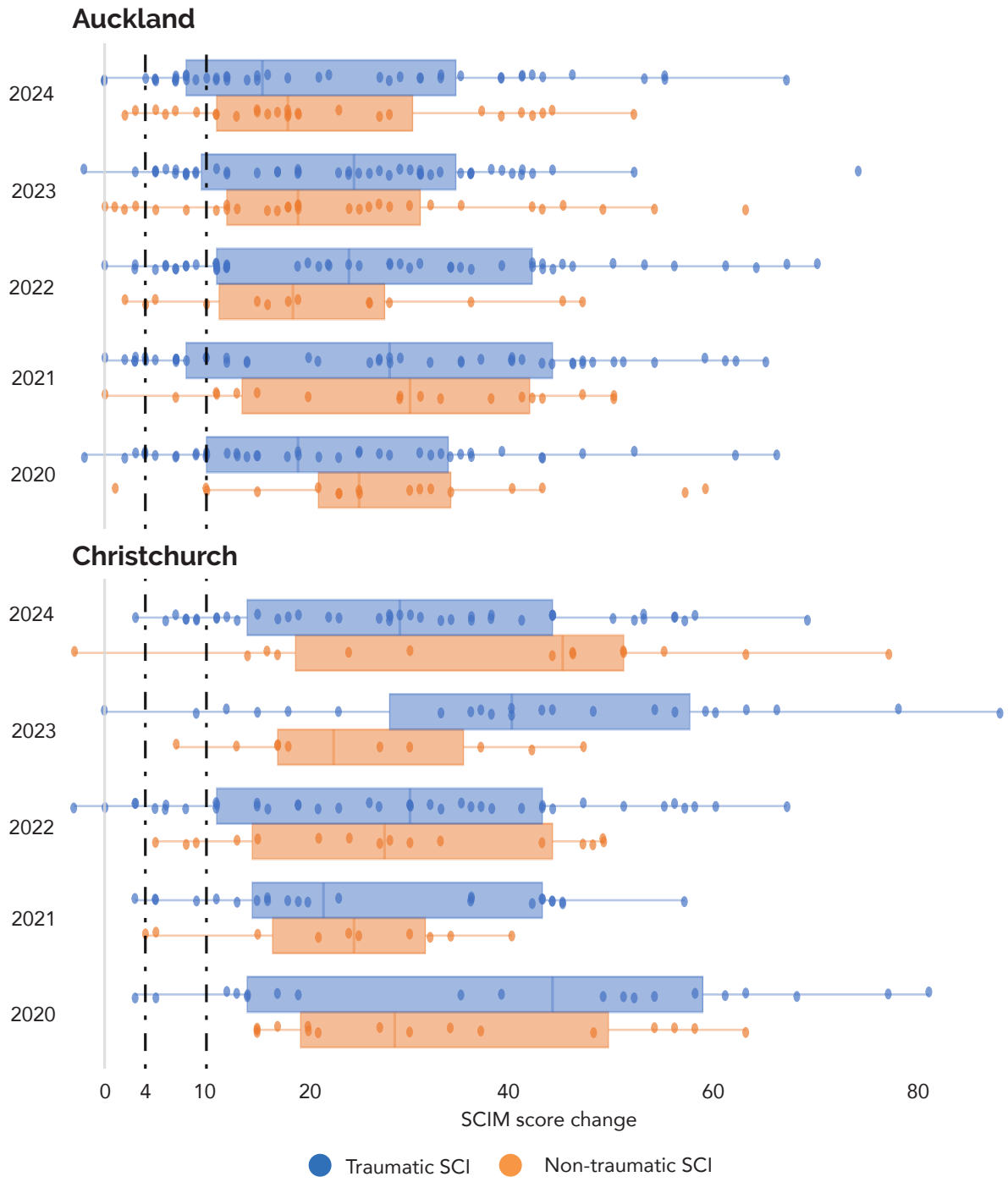


Figure 50: SCIM score change: rehab admission to rehab discharge

SCIM change by discharge AIS grade

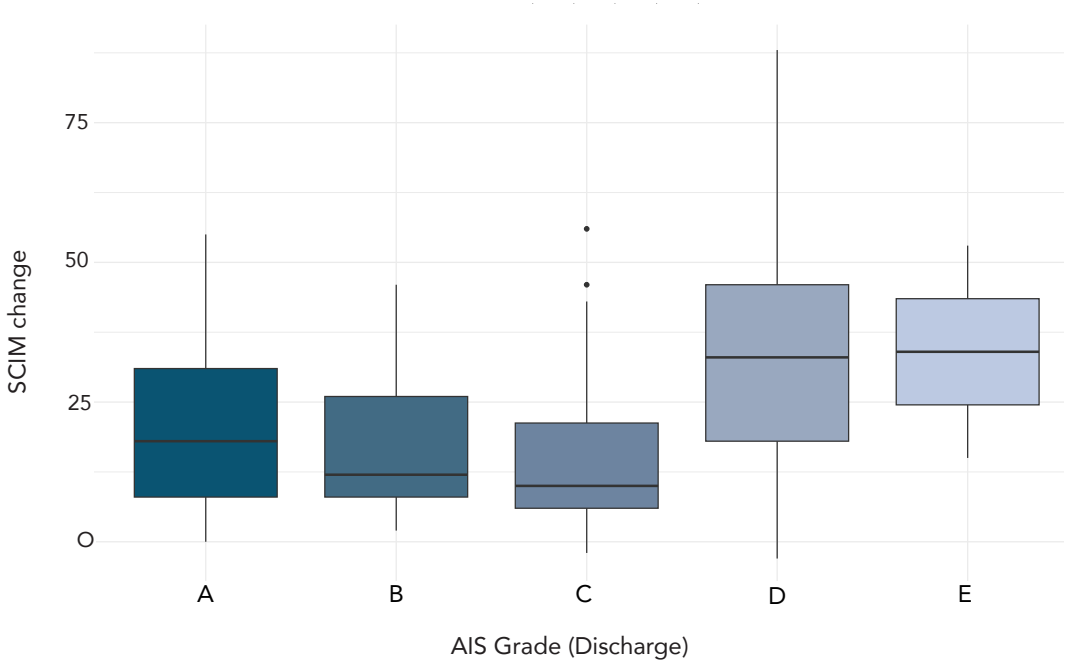


Figure 51: SCIM change by discharge AIS grade

Figure 51 shows the change in SCIM scores from rehabilitation admission to rehabilitation discharge, filtered by the final AIS grade. The median is represented by the line bisecting the boxplot. The interquartile range (IQR)—represented by the height of each box—shows the middle 50% of participant outcomes within each AIS grade. SCIM improvement differed meaningfully across AIS grades, and the pattern strongly highlights the position of AIS D in the functional recovery spectrum. Using median-based tests appropriate for skewed rehabilitation outcomes, we found that AIS D and E participants achieved substantially greater SCIM gains than the more impaired AIS A, B, and C groups, with strong to very strong evidence supporting these differences. Caution is required when interpreting AIS E data due to previously mentioned low numbers.

There is a downward trend in improvement from AIS A to AIS C, with AIS C participants showing the lowest median change. This highlights a known clinical reality that participants with non-functional motor preservation (AIS C) can make less progress due to limited motor function. This group has the shortest boxes indicating they have the most predictable outcomes.

The vertical "whiskers" and box height for Grade D are the longest, showing a large diversity in outcomes. Some participants demonstrate nearly zero improvement, while others achieve large functional gains. This variance is typical of Grade D which encompasses a very broad range of motor functionality and therefore have an unpredictable recovery trajectory.

How many people walk on discharge?

Mobility is assessed by physiotherapists across three distinct distance thresholds: short-distance indoor walking (10m), moderate-distance walking (10–100m), and longer-distance outdoor walking (>100m). Previously NZSCIR used the SCIM outdoor walking data point, those who can walk 100m outdoors (unsupervised/with or without mobility aid), to calculate 'independent walkers.' For this report we are also exploring proportions of those who can walk over shorter distances.

- Short-distance indoor environments showed the highest rate of ambulatory success.
- As the walking distance increases, wheelchair use rises and walking independence declines.
- 22% walk short distances indoors on admission. This increases to 54% on discharge.
- 63% of people use a wheelchair for their outdoor mobility.
- 30% of walkers use a wheelchair for longer distances.
- 11% of all participants walk unaided outdoors on rehab discharge.

Based on those with complete records, 54% (n=391) were walking indoors (up to 10 metres) on discharge. This includes anyone able to walk independently or using an aid and/or with supervision on discharge. Independence drops as distance, energy and environmental demands increase, with 37% of participants walking outdoors over distances exceeding 100 metres. SCIM score captures the preferred mobility mode over three distances, so whilst participants may be able to walk indoors, many require a wheelchair (manual or power) for community mobility. Of the 391 indoor walkers, 9% use a manual or power wheelchair for moderate distances and 30% use a manual or power wheelchair for outdoor distances.

Table 7: Mobility at discharge over different SCIM distance domains

Walking indoors on discharge (≤10m)		n	
0-2	Wheelchair users	330	46%
3-8	Walkers; including needing supervision	391	54%
Moderate walking on discharge (10-100m)		**n**	
0-2	Wheelchair users	365	51%
3-8	Walkers; including needing supervision	355	49%
Walking outdoors on discharge (>100m)		**n**	
0-2	Wheelchair users	451	63%
3-8	Walkers; including needing supervision	268	37%

In keeping with previous NZSCIR annual reports, Figure 52 illustrates the proportion of participants who were mobilising independently outdoors at the time of discharge from rehabilitation. This includes participants who may require a mobility aid, but *not* those who need supervision.

- Christchurch generally reported a higher percentage of independent outdoor walkers compared to Auckland.
- In 2020, Christchurch saw its highest rate of independent walkers at 52%, the only instance where independent walkers outnumbered non-independent walkers.

The data suggests roughly two-thirds of all participants across both facilities still require mobility assistance on discharge. This should be interpreted alongside differences in case mix between services, including Auckland's higher proportion of more severe or complete injuries (AIS A and B). SCIM data completeness has improved over the five-year period, providing a more comprehensive view of consented participants' mobility outcomes.

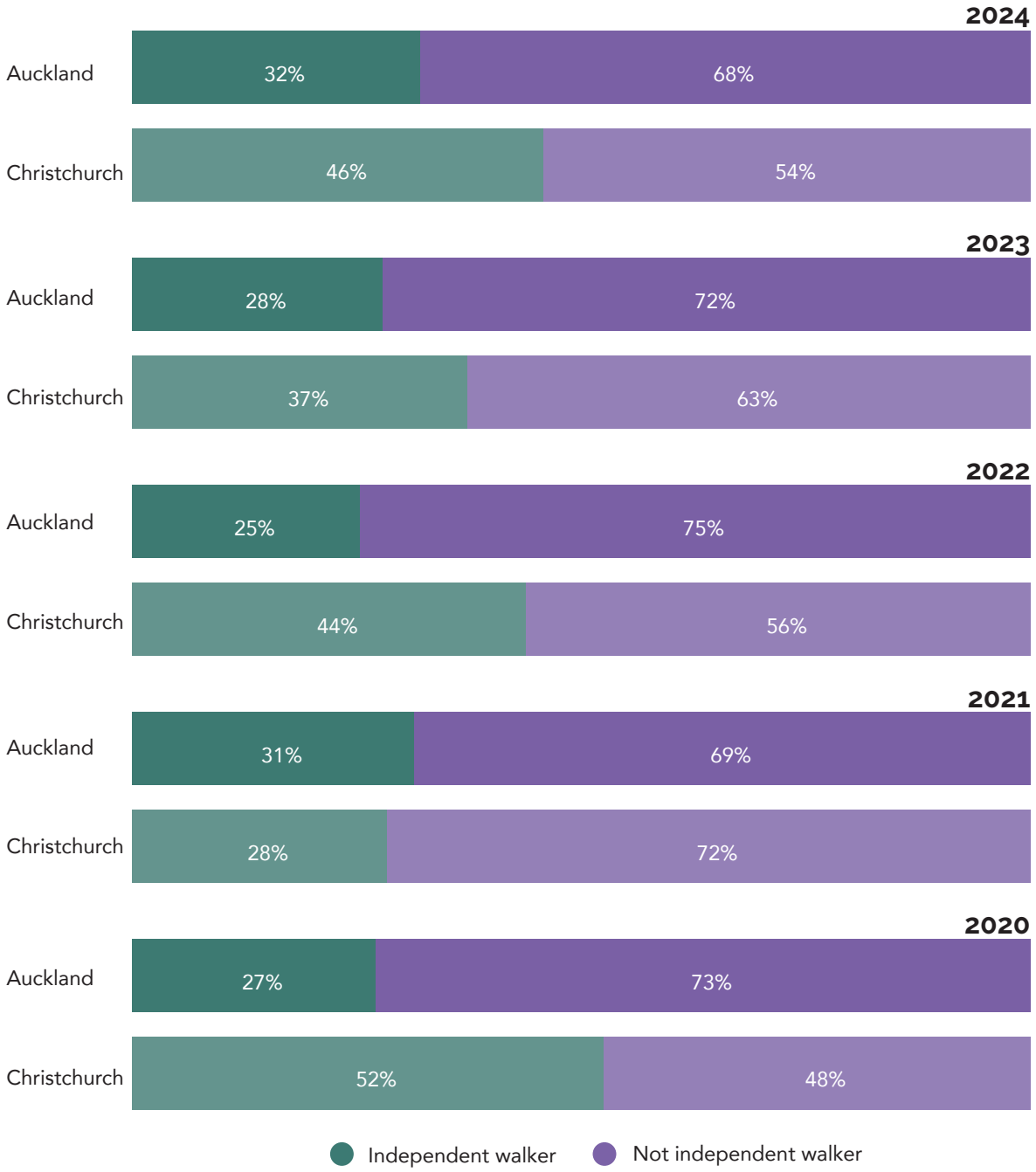


Figure 52: Mobility outdoors on rehab discharge by site

Registry Evolution

A significant milestone was achieved in 2023 through a comprehensive review of Registry data points. Led by Burwood Academy Trust, the review refined and modernised the dataset by removing unused variables, improving standardisation, and ensuring the information collected remained relevant to the Aotearoa New Zealand context. The review also broadened the Registry's focus beyond injury and service delivery measures to include long-term health, participation, wellbeing, access to services, and equity across participants' lifespan. To support these expanded requirements, operational capacity was strengthened in 2023 by increasing Coordinator support to 1.0 FTE at each site, shared between two Coordinators in both Auckland and Christchurch.

Following the review, the NZSCIR redeveloped its platform to Version 2 in partnership with the Praxis Spinal Cord Institute and was released in 2025. Data from Version 1 was successfully migrated and mapped to align with this new format. This structural upgrade has streamlined ongoing data collection while significantly increasing the overall completeness, accuracy and relevance of the Registry's data.

In 2024, the NZSCIR transitioned its technology from the Global Research Platform (GRP) to Praxis Connect, updating the database to enhance data collection and reporting.

Challenges, limitations and future priorities

For consented individuals, NZSCIR continues data collection in the community with follow-up questionnaires at 18-months, 5 years, 10 years^{+} post-discharge. An ongoing challenge is the lack of longitudinal community follow-up (CFU) data resulting from low questionnaire return numbers, despite allocating additional resource to improve this area in recent years. A future priority is to review and simplify the CFU questionnaire to reduce the time burden on participants and focus on more relevant quality-of-life data. Furthermore, a recent ethics amendment has enabled the introduction of a koha voucher initiative. This incentive acknowledges participants' time and effort, serves as a proactive strategy to boost return rates, and ultimately aims to broaden the Registry's long-term outcome data.

Currently, Christchurch's ability to consent in the acute phase is constrained by resource availability. This limitation means individuals who do not transition to rehabilitation have only a minimal dataset (MDS) collected. To mitigate this data gap and improve collection within this cohort, a recent Health and Disability Ethics Committees (HDEC) amendment has been approved. This amendment expands the MDS to include all full dataset (FDS) components, *excluding* Coordinator interviews.

As a potential opportunity we note the Hua Oranga, a Māori health outcome measure, is currently being trialed at ASRU as a goal-setting tool. This initiative builds on existing evidence within other healthcare settings to validate its use as a quality-of-life outcome measure for individuals with SCI. The NZSCIR hopes to incorporate Hua Oranga as an outcome measure of quality of life for Māori participants in the future.

Taken together, these findings demonstrate the value of NZSCIR as a national clinical quality, service planning, and research asset. The five-year view shows a changing SCI population, increasing rehabilitation demand, important equity signals, and opportunities to strengthen pathways for those with tSCI and ntSCI. Continued investment in data completeness, long-term follow-up, culturally meaningful outcome measures, and service benchmarking will be essential if the Registry is to keep informing improvements in care and outcomes for people with SCI and their whānau.

Glossary

Cauda equina syndrome (CES) – an injury or compression of nerve roots exiting the lumbar spine at the bottom of the spinal cord. Whilst not officially a spinal cord injury, this nerve injury does impact on bowel, bladder, sexual function and/or leg sensation and strength.

Cervical spine - The upper seven vertebrae located in the neck (C1 - C7). The nerves from this area control head and neck movement, the diaphragm, deltoids, biceps and muscles controlling the wrist and hands.

Central cord syndrome – A cervical injury affecting the central spinal cord with movement and sensory loss - more in the upper limbs, with relatively less impairment of the lower limbs. May impact bladder and bowel function.

Charlson Comorbidity Index (CCI) – A scale that considers a range of comorbidities to predict the mortality of a person. There are 17 categories which evaluates conditions such as heart disease, cancer and diabetes.

Complete injury - An injury where there is no sensory and motor function (inability to feel or move) preserved in the last nerves leaving the spinal cord (sacral 4th and 5th nerves). This usually results in a total lack of sensory and motor function below the level of the injury.

Incomplete injury - An injury where there is some sensory or motor function (ability to feel, touch or move) below the level of the injury. This must include the last nerves leaving the spinal cord (sacral 4th and 5th nerves).

Lumbar spine - The five vertebrae in the lower back (L1 - L5). Injury to this area damages the very lower-most tip of the spinal cord (known as the conus medullaris) or the cauda equina, which results in decreased control of hips and legs, as well as bladder, bowel and sexual function.

Non-traumatic spinal cord impairment/dysfunction (ntSCI) - A spinal cord injury that occurs as a result of a medical cause or illness such as vertebral degeneration, infection or cancer.

Pain – Includes self-reported generic (nociceptive) pain and neuropathic pain (pain that is often ongoing and intense that occurs spontaneously or by light touching and is characterized by feelings of burning, shooting, tingling, etc.)

Paraplegia - Complete or partial loss of sensation and/or movement in the legs and often in part of, or the entire trunk. Can affect breathing muscles. It is caused by an injury to the spinal cord in the thoracic (trunk) region or below. May have bowel, bladder and sexual function affected.

Pressure injuries - Tissue injured by pressure and/or shear forces.

Respiratory complications - Includes pneumonia, venothromboembolic events (including pulmonary embolus [PE] and deep vein thrombosis [DVT]), obstructive sleep apnea and other respiratory complications.

Sacral spine - The five vertebrae located in the pelvic area (S1 - S5). As with lumbar injuries, damage to the sacral nerves can result in decreased control of hips, legs, bladder, bowel and sexual function.

Sex – NZSCIR reports on a participant's sex assigned at birth in reports. A participant's gender is also collected and refers to a person's social and personal identity. A person's gender may differ from the sex recorded at their birth.

Spasticity – Stiffness or tightness in the muscles often associated with uncontrolled, involuntary movement of the trunk and limbs. Can occur when there is injury to the brain or spinal cord and can make movement difficult and sometimes painful.

Spinal cord injury and impairment (SCI) - Damage to the spinal cord resulting in impairment of muscle function, sensation and/or autonomic function (bowel, bladder and sexual function).

Supra-regional spinal service (spinal service) - NZ has two supra-regional spinal services and four facilities. Waitaha Canterbury District: Christchurch Hospital (acute) and Burwood Spinal Unit (acute/rehabilitation). Counties Manukau District: Middlemore Hospital (acute) and Auckland Spinal Rehabilitation Unit (rehabilitation).

Tetraplegia or Quadriplegia - Complete or partial loss of sensation and/ or movement in the arms, and typically in the trunk and legs. Usually affects breathing muscles. May have bowel bladder and sexual function affected. It is caused by an injury to the spinal cord in the neck.

Thoracic spine - The twelve vertebrae that extend through the chest area (T1 - T12). The nerves from this area control chest and abdominal muscles.

Traumatic spinal cord injury (tSCI) - A spinal cord injury that occurs as a result of trauma such as a fall, a motor vehicle crash, or a sporting accident.

Urinary Tract Infection (UTI) - A bacterial proven infection of the urinary tract in a symptomatic participant, treated with antibiotics.

References

1. ACC and the Ministry of Health. New Zealand Spinal Cord Impairment Action Plan 2014- 2019. Wellington: June 2014.
2. Mitchell, J., Nunnerley, J., Frampton, C., Croot, T., Patel, A., & Schouten, R. (2020). Epidemiology of traumatic spinal cord injury in New Zealand (2007–2016). *New Zealand Medical Journal*, *133*(1509), 47–57.
3. Ryu, J. H., Joyce, H., Coomarasamy, C., Ozumba, J., Semikina, V., & Subramanian, S. (2022). The impact of pain on function after spinal cord injury. *New Zealand Medical Journal*, *135*(1566), 46–55. https://doi.org/10.26635/6965.5910
4. National Institute of Neurological Disorders and Stroke. (2022). *Spinal cord injury.* U.S. Department of Health and Human Services, National Institutes of Health. https://www.ninds.nih.gov/health-information/disorders/spinal-cord-injury
5. Rider, L. S., & Marra, E. M. (2023, August 7). Cauda equina and conus medullaris syndromes. In *StatPearls*. StatPearls Publishing. Retrieved July 7, 2026, from https://www.ncbi.nlm.nih.gov/books/NBK537200/
6. Ahn, H., Singh, J., Nathens, A., MacDonald, R.D., Travers, A., Tallon, J., Fehlings, M.G., & Yee, A. (2011). Pre-hospital care management of a potential spinal cord injured patient: a systematic review of the literature and evidence-based guidelines. *Journal of Neurotrauma, 28,* 1341–1361. https://doi.org/10.1089/neu.2009.1168
7. Bourassa-Moreau, E., Mac-Thiong, J.-M., Ehrmann Feldman, D., Thompson, C., & Parent, S. (2013). Complications in acute phase hospitalization of traumatic spinal cord injury: does surgical timing matter? *Journal of Trauma and Acute Care Surgery*, *74*, 849–854.
8. Parent, S., Barchi, S., LeBreton, M., Casha, S., & Fehlings, M.G. (2011). The impact of specialized centers of care for spinal cord injury on length of stay, complications, and mortality: a systematic review of the literature. *Journal of Neurotrauma, 28*, 1363–1370.
9. Theodore, N., Aarabi, B., Dhall, S.S., Gelb, D.E., Hurlbert, R.J., Rozzelle, C.J., Ryken, T.C., Walters, B.C., & Hadley, M.N. (2013). Transportation of patients with acute traumatic cervical spine injuries. *Neurosurgery, 72*(Suppl. 2), 35–39. https://doi.org/10.1227/NEU.0b013e318276edc5
10. Maharaj, M.M., Hogan, J.A., Phan, K., & Mobbs, R.J. (2016). The role of specialist units to provide focused care and complication avoidance following traumatic spinal cord injury: a systematic review. *European Spine Journal, 25*, 1813–1820. https://doi.org/10.1007/s00586-016-4554-2
11. Alvarez Reyes, A., Bandlamuri, S., Dumont, T. M., Ganapathy, V., & Hurlbert, R. J. (2025). Spinal cord injury in the 21st century part I: A new demographic. *World Neurosurgery*, *197*, Article 123917. https://doi.org/10.1016/j.wneu.2025.123917
12. Brown, S. (2026, April 9). *New Manukau rehab centre for spinal injury patients.* Beehive.govt.nz. https://www.beehive.govt.nz/release/new-manukau-rehab-centre-spinal-injury-patients
13. Alito, A., Filardi, V., Famà, F., Bruschetta, D., Ruggeri, C., Basile, G., Stancanelli, L., D'Amico, C., Bianconi, S., & Tisano, A. (2021). Traumatic and non-traumatic spinal cord injury: Demographic characteristics, neurological and functional outcomes. A 7-year single centre experience. *Journal of Orthopaedics, 28*, 62–66. https://doi.org/10.1016/j.jor.2021.11.007
14. Khadour, F. A., Khadour, Y. A., Meng, L., XinLi, C., & Xu, T. (2024). Epidemiology features of traumatic and non-traumatic spinal cord injury in China, Wuhan. *Scientific Reports, 14*(1), 1640. https://doi.org/10.1038/s41598-024-52210-4
15. Mackiewicz-Milewska, M., Cisowska-Adamiak, M., Głowacka-Mrotek, I., & Mackiewicz-Nartowicz, H. (2025). Traumatic vs. non-traumatic spinal cord injury—Epidemiology, complications, and neurological status during rehabilitation. *Journal of Clinical Medicine, 14*(15), 5209. https://doi.org/10.3390/jcm14155209
16. Liu, H., Liu, J., Shen, M., Yang, X., Du, L., Yang, M., Li, J., Gao, F., & Li, J. (2021). The changing demographics of traumatic spinal cord injury in Beijing, China: A single-centre report of 2448 cases over 7 years. *Spinal Cord*, *59*(3), 298–305. https://doi.org/10.1038/s41393-020-00564-7
17. Milligan, J., Ryan, K., Fehlings, M., & Bauman, C. (2019). Degenerative cervical myelopathy: Diagnosis and management in primary care. *Canadian family physician Medecin de famille canadien*, *65*(9), 619–624.
18. Fengbin, Y., Deyu, C., Xinwei, W., Yu, C., Jinhao, M., Xinyuan, L., & Xiaowei, L. (2013). Trauma-induced spinal cord injury in cervical spondylotic myelopathy with or without lower cervical instability. *Journal of Clinical Neuroscience*, *20*(3), 419–422. https://doi.org/10.1016/j.jocn.2012.02.051
19. Ministry of Health HISO 10001:2017 Ethnicity Data Protocols. September 2017. Ministry of Health. https://www.tewhatuora.govt.nz/assets/Our-health-system/Digital-health/Health-information-standards/HISO-10001-2017-Ethnicity-Data-Protocols.pdf. Retrieved August 2024.
20. Te Pou o te Whakaaro Nui. (2019). DHB population profiles, 2019-2029: Statistics New Zealand projections 2018 update. Auckland: Te Pou o te Whakaaro Nui.

21. Tarena, E., Anderson, A., Shorter, L., Berentson-Shaw, J., & Salole, M. 2022. Ao Mai te Rā: the Anti-Racism Kaupapa Summary Paper – Lessons for the Aotearoa New Zealand Health System. Wellington: Ministry of Health.

22. Goodwin, A. M., & Hsu, W. K. (2023). Congenital cervical stenosis: A review of the current literature. Current Reviews in Musculoskeletal Medicine, 16(9), 438–445. https://doi.org/10.1007/s12178-023-09857-9

23. Coldham, G. J., Doyle, A., Baber, P., & Faraj, S. (2015). Ethnic variation in cervical spine diameter. Orthopaedic Proceedings, 88-B: No.SUPP_II

24. WHO Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet*, *363*(9403), 157–163. https://doi.org/10.1016/S0140-6736(03)15268-3

25. Gray, G. (2003). The voyage to McDonalds - short and long term factors in the etiology of obesity in Māori children in Aotearoa. *Pacific Health Dialog, 10*(2), 141-148.

26. Nam, S., Yun, H. Y., & Kim, O. (2025). Risk factors for pressure injuries in individuals with spinal cord injuries who have sarcopenic obesity: A comparison of time-dependent changes in sacral region pressure between individuals with and without sarcopenic obesity. *The journal of spinal cord medicine*, *48*(3), 438–446. https://doi.org/10.1080/10790268.2024.2379068

27. Ahmadian, L., Salehi, F., & Padidar, S. (2021). International classification of external causes of injury: a study on its content coverage. *BMC medical informatics and decision making*, *21*(1), 155. https://doi.org/10.1186/s12911-021-01515-9

28. Kim, M., Jeong, W., Jang, S., Park, J. H., Bae, Y., & Lee, S. W. (2025). Spinal cord injury epidemiology and causes: A worldwide analysis with 2050 projections. *Healthcare*, *13*(20), 2552. https://doi.org/10.3390/healthcare13202552

29. Liu, W., Xu, Q., Wang, X., Wang, S., Gao, Z., Gu, R., Wu, H., & Zhu, Y. (2025). Global trends and cross-country inequalities in spinal cord injury attributable to falls: A systematic analysis of the Global Burden of Disease Study 2021. *The Spine Journal*, *25*(12), 2280–2290. https://doi.org/10.1016/j.spinee.2025.04.008

30. Chan, C. W., Eng, J. J., Tator, C. H., Krassioukov, A., & Spinal Cord Injury Research Evidence Team (2016). Epidemiology of sport-related spinal cord injuries: A systematic review. *The Journal of Spinal Cord Medicine*, *39*(3), 255–264. https://doi.org/10.1080/10790268.2016.1138601

31. Stats NZ. (2025, October 29). Subnational population estimates: At 30 June 2025. https://www.stats.govt.nz/information-releases/subnational-population-estimates-at-30-june-2025/

32. Kwan, W. C., Laghaei, P., Kahlon, H., Ailon, T., Charest-Morin, R., Dandurand, C., Paquette, S., Dea, N., Street, J., Fisher, C. G., Noonan, V., Dvorak, M. F., & Kwon, B. K. (2024). Spinal cord injuries secondary to mountain biking accidents — A cause for national alarm. *Neurotrauma Reports*, *5*(1).

33. Molinares, D. M., Gater, D. R., Daniel, S., & Pontee, N. L. (2022). Nontraumatic Spinal Cord Injury: Epidemiology, Etiology and Management. *Journal of Personalized Medicine*, *12*(11), 1872. https://doi.org/10.3390/jpm12111872

34. Rupp, R., Biering-Sorensen, F., Burns, S.H. et al (2021). International Standards for Neurological Classification of Spinal Cord Injury: Revised 2019. *Topics in Spinal Cord Injury Rehabilitation, 27*(2), 1-22. https://doi.org/10.46292/sci2702-1

35. Lena, E., Baroncini, I., Pavese, C., Musumeci, G., Volini, S., Masciullo, M., Aiachini, B., Fizzotti, G., Puci, M. V., & Scivoletto, G. (2022). Reliability and validity of the international standards for neurological classification of spinal cord injury in patients with non-traumatic spinal cord lesions. *Spinal cord, 60*(1), 30–36. https://doi.org/10.1038/s41393-021-00675-9

36. Catz, A., Watts, Y., Amir, H., Front, L., Gelernter, I., Michaeli, D., Bluvshtein, V., & Aidinoff, E. (2024). The role of comprehensive rehabilitation in the care of degenerative cervical myelopathy. *Spinal cord, 62*(5), 200–206. https://doi.org/10.1038/s41393-024-00965-y

37. Burns, S. P., Golding, D. G., Rolle, W. A., Graziani, V., & Ditunno, J. F. (1997). Recovery of ambulation in motor-incomplete tetraplegia. *Archives of Physical Medicine and Rehabilitation*, *78*(11), 1169–1172. https://doi.org/10.1016/s0003-9993(97)90326-9-

38. Hicks, K. E., Zhao, Y., Fallah, N., Rivers, C. S., Noonan, V. K., Plashkes, T., Wai, E. K., Roffey, D. M., Tsai, E. C., Paquet, J., Attabib, N., Marion, T., Ahn, H., Phan, P., & RHSCIR Network (2017). A simplified clinical prediction rule for prognosticating independent walking after spinal cord injury: a prospective study from a Canadian multicenter spinal cord injury registry. *The Spine Journal: Official Journal of the North American Spine Society*, *17*(10), 1383–1392. https://doi.org/10.1016/j.spinee.2017.05.031

39. Burns, S. P., Golding, D. G., Rolle, W. A., Graziani, V., & Ditunno, J. F. (1997). Recovery of ambulation in motor-incomplete tetraplegia. *Archives of Physical Medicine and Rehabilitation, 78*(11), 1169–1172. https://doi.org/10.1016/s0003-9993(97)90326-9

40. van Middendorp, J. J., Goss, B., Urquhart, S., Atresh, S., Williams, R. P., & Schuetz, M. (2011). Diagnosis and prognosis of traumatic spinal cord injury. *Global Spine Journal, 1*(1), 1–8. https://doi.org/10.1055/s-0031-1296049

41. Nau, C., Pape, H. C., Jug, M., Wendt, K., Komadina, R., & Bloemers, F. (2024). Thoracolumbar injuries: non operative treatment: indications, management. *European journal of trauma and emergency surgery: official publication of the European Trauma Society, 50*(5), 1951–1957. https://doi.org/10.1007/s00068-024-02619-3

42. Badhiwala, J. H., Witiw, C. D., Wilson, J. R., da Costa, L. B., Nathens, A. B., & Fehlings, M. G. (2024). Treatment of Acute Traumatic Central Cord Syndrome: A Study of North American Trauma Centers. *Neurosurgery, 94*(4), 700–710. https://doi.org/10.1227/neu.0000000000002767

43. Inglis, T., Banaszek, D., Rivers, C. S., Kurban, D., Evaniew, N., Fallah, N., Waheed, Z., Christie, S., Fox, R., Thiong, J. M., Ethans, K., Ho, C., Linassi, A. G., Ahn, H., Attabib, N., Bailey, C. S., Fehlings, M. G., Fourney, D. R., Paquet, J., (…) & the Rick Hansen Spinal Cord Injury Registry Network (2020). In-Hospital Mortality for the Elderly with Acute Traumatic Spinal Cord Injury. *Journal of Neurotrauma, 37*(21), 2332–2342. https://doi.org/10.1089/neu.2019.6912

44. Dvorak, M. F., Noonan, V. K., Fallah, N., Fisher, C. G., Finkelstein, J., Kwon, B. K., Rivers, C. S., Ahn, H., Paquet, J., Tsai, E. C., Townson, A., Attabib, N., Bailey, C. S., Christie, S. D., Drew, B., Fourney, D. R., Fox, R., Hurlbert, R. J., Johnson, M. G., (…), and the RHSCIR Network (2015). The influence of time from injury to surgery on motor recovery and length of hospital stay in acute traumatic spinal cord injury: an observational Canadian cohort study. *Journal of Neurotrauma, 32*(9), 645–654. https://doi.org/10.1089/neu.2014.3632

45. Middleton, J.M., Sharwood, L.N., Cameron, P. Middleton, P., Harrison, J. E., Brown, D., McClure, R., Smith, K., Muecke, S., & Healy, S. (2014). Right care, right time, right place: improving outcomes for people with spinal cord injury through early access to intervention and improved access to specialised care: study protocol. *BMC Health Services Research, 14*(600). https://doi.org/10.1186/s12913-014-0600-7

46. Fehlings, M. G., Vaccaro, A., Wilson, J. R., Singh, A., Cadotte, D. W., Harrop, J. S., Aarabi, B., Shaffrey, C., Dvorak, M., Fisher, C., Arnold, P., Massicotte, E. M., Lewis, S., & Rampersaud, R. (2012). Early versus delayed decompression for traumatic cervical spinal cord injury: Results of the Surgical Timing in Acute Spinal Cord Injury Study (STASCIS). *PLOS ONE, 7*(2), Article e32037. https://doi.org/10.1371/journal.pone.0032037

47. Bourassa-Moreau, E., Mac-Thiong, J. M., Feldman, D. E., Thompson, C., & Parent, S. (2013). Non-neurological outcomes after complete traumatic spinal cord injury: the impact of surgical timing. *Journal of neurotrauma, 30*(18), 1596–1601. https://doi.org/10.1089/neu.2013.2957

48. National Spinal Cord Impairment Governance Committee. (2015, June). *New Zealand Spinal Cord Injury Destination Policy*. Northern Region Trauma System. https://www.northerntrauma.co.nz/wp-content/uploads/2021/03/Spinal-cord-injury-destination-guidelines.pdf

49. Sezer, N., Akkuş, S., & Uğurlu, F. G. (2015). Chronic complications of spinal cord injury. *World Journal of Orthopedics, 6*(1), 24–33. https://doi.org/10.5312/wjo.v6.i1.24

50. Bokhari, A. R., Sivakumar, B., Sefton, A., Lin, J. L., Smith, M. M., Gray, R., & Hartin, N. (2019). Morbidity and mortality in cervical spine injuries in the elderly. *ANZ Journal of Surgery, 89*(4), 412–417. https://doi.org/10.1111/ans.14875

51. Morita, T., Takebayashi, T., Irifune, H., Ohnishi, H., Hirayama, S., & Yamashita, T. (2017). Factors affecting survival of patients in the acute phase of upper cervical spine injuries. *Archives of Orthopaedic and Trauma Surgery, 137*(4), 543–548. https://doi.org/10.1007/s00402-017-2655-5

52. Catz, A., Itzkovich, M., Tesio, L., Biering-Sorensen, F., Weeks, C., Laramee, M. T., Craven, B. C., Tonack, M., Hitzig, S. L., Glaser, E., Zeilig, G., Aito, S., Scivoletto, G., Mecci, M., Chadwick, R. J., El Masry, W. S., Osman, A., Glass, C. A., Silva, P., (…) & Del Popolo, G. (2007). A multicenter international study on the Spinal Cord Independence Measure, version III: Rasch psychometric validation. *Spinal Cord, 45*(4), 275–291. https://doi.org/10.1038/sj.sc.3101960

53. Dawson, J., Shamley, D., & Jamous, M. A. (2008). A structured review of outcome measures used for the assessment of rehabilitation interventions for spinal cord injury. *Spinal Cord, 46*(12), 768–780. https://doi.org/10.1038/sc.2008.50

54. Scivoletto, G., Tamburella, F., Laurenza, L., & Molinari, M. (2013). The Spinal Cord Independence Measure: how much change is clinically significant for spinal cord injury subjects. *Disability and Rehabilitation, 35*(21), 1808–1813. https://doi.org/10.3109/09638288.2012.756942

Appendix A: Denominators, reporting basis and interpretation notes

This appendix summarises the denominators used for key figures, tables and analyses in the report. It should be read alongside the main findings to ensure that percentages and trends are interpreted against the correct population. Some analyses use the full five-year cohort, some use year-by-year denominators, and others are restricted to consented participants, injury subgroups, rehabilitation admissions, or complete-case outcome records. NZSCIR data used for this report was last updated and extracted on 30 August 2025.

When interpreting the report, comparisons should only be made where the reporting basis is consistent. For example, percentages based on all 1,187 Registry participants are not directly comparable with findings based on the 778 consented full dataset participants, the 793 traumatic SCI subgroup, the 394 non-traumatic SCI subgroup, or the smaller complete-case SCIM and length-of-stay modelling samples.

Structured denominator reference table

The table below provides the comparison guide for whole-cohort measures, service and SCI-type comparisons, consented/full dataset versus minimal dataset, tSCI and ntSCI subgroup analyses, year-by-year versus aggregated five-year data, and complete-case analyses for AIS, LOS modelling, SCIM and mobility outcomes.

Figure/Table	Cohort	Measure	Reporting basis	Denominator	Time period	Interpretation notes
Figure 3 & 4	Total NZSCIR participants	All new Registry admissions	Whole cohort	1,187	2020–2024	Used for overall participant, age, sex, ethnicity, SCI type, LOS and discharge destination summaries.
Table 1 & Figure 8	Participants by service and type	Auckland and Christchurch totals; tSCI and ntSCI split	Whole cohort, stratified by service and SCI type	Auckland 619; Christchurch 568; total 1,187	Year-by-year and aggregated five-year	Appropriate for comparing service volumes and shifts in tSCI:ntSCI mix over time.
Figure 5	Consent rates	Full dataset versus minimal dataset	All eligible Registry participants	FDS 778; MDS 409; total 1,187	Year-by-year	Consent status affects availability of demographic, complication, surgical and outcome variables.
Figure 6	Tourist/ non-resident participants	Participants not eligible for full dataset collection	Subset of minimal dataset	42	2020–2024	Reported separately because eligibility and funding pathways differ from resident participants.
Figure 7	Participants by SCI type	Traumatic and non-traumatic SCI	Whole cohort, stratified by injury type	tSCI 793; ntSCI 394	Year-by-year and aggregated five-year	Percentages within tSCI and ntSCI sections should use the relevant subgroup denominator.
Figures 9-13	Sex, Age and Ethnicity	Participant characteristics	Whole cohort	1,187	Mostly aggregated five-year	Ethnicity uses total response ethnicity, so percentages may sum to more than 100%.
Figure 14	Pacific Peoples	Participant characteristics	Pacific Peoples only	163	2020-2024	Should be interpreted as percentage of Pacific Peoples participant data, not whole cohort prevalence.

Figure/Table	Cohort	Measure	Reporting basis	Denominator	Time period	Interpretation notes
Figure 15	Weight	Admission weight	Consented participants with available weight data	726 Auckland 376; Christchurch 350	2020–2024	Not directly comparable with whole cohort demographic percentages.
Figure 16	Body Mass Index	BMI category	Consented participants with height and weight available	679	2020–2024	Uses ethnicity-adjusted BMI categories; denominator is smaller than weight due to missing height or weight data.
Table 3	Pre-existing conditions	Charlson Comorbidity Index and relevant conditions	Full dataset participants	778	2020–2024	Should be interpreted as consented participant data, not whole cohort prevalence.
Figure 17 & 25	Mechanism and cause of SCI	Broad cause categories	Whole cohort	tSCI 793; ntSCI 394	2020–2024	Provides overall distribution across both tSCI and ntSCI populations.
Table 4, Figures 18-20	tSCI causes	Falls, transport, sport, perioperative and other causes	tSCI subgroup only	793	Aggregated five-year, with selected year-by-year trends	Percentages should not be compared with ntSCI cause percentages unless clearly described as separate subgroup distributions.
Figure 21	Location of tSCI events	Regional location and population-adjusted rate	tSCI cases with available injury location data	442	2020–2024	Uses regional population adjustment. Overseas injuries are excluded from the heat map.
Table 5, Figures 26-28	ntSCI causes	Deterioration of spinal column, Cancer, Infection, Vascular and Other causes	ntSCI subgroup only	394	Aggregated five-year, with selected year-by-year trends	Cause distribution should be interpreted within ntSCI only.
Figure 29	ntSCI original hospital admission	Originating hospital or region before specialist rehabilitation	ntSCI participants with available original admission data	385	2020–2024	Overseas hospital admissions are excluded where noted.
Figure 30 & 31	AIS level and severity	Neurological level and AIS grade	Whole cohort, with unknown or missing assessments identified	1,187	2020–2024	Used to describe overall injury distribution. Missing assessments should be interpreted cautiously.

Figure/Table	Cohort	Measure	Reporting basis	Denominator	Time period	Interpretation notes
Figure 32 & 33	AIS change over stay	Change from start to end AIS grade	Participants with both start and end AIS data	818	2020–2024	Complete-pair analysis; denominator is smaller than the whole cohort.
Figure 34	Length of hospital stay	Acute and rehabilitation length of stay	Whole cohort where LOS is available	1,187	Year-by-year and aggregated five-year	LOS distributions are skewed; median and spread are more informative than mean alone.
Figure 35	LOS by discharge AIS grade	LOS stratified by final AIS grade	Participants with discharge AIS data	815	2020–2024	Interpret as a subgroup analysis based on available discharge AIS data.
Figure 36	Factors independently driving LOS	Regression model predictors	Complete-case statistical model	472	2020–2024	Only participants with complete data for included model variables are analysed.
Figure 37	Discharge destination	Immediate discharge destination after spinal service care	Whole cohort	1,187	Year-by-year and aggregated five-year	Represents immediate destination, not necessarily final community destination.
Figures 38 & 41	Surgical intervention rates	Whether surgery occurred	Participants with available surgery data stratified by injury type and facility	1,170	Aggregated five-year and year-by-year	Slightly smaller than whole cohort due to missing surgery data.
Figure 39 & 40	Surgical intervention rates	Whether surgery occurred	Participants with available surgery data stratified by injury type and age	tSCI 781; ntSCI 389	2020-2024	Requires surgical data; not all cases require decompression.
Figure 42	Time to decompression for tSCI	Time from injury to decompression	tSCI participants with required time points	415	2020–2024	Requires injury and surgical time data; not all tSCI cases require decompression.
Figure 43	Location of first surgery for tSCI	First surgical site	tSCI participants with surgery-location data	401	2020–2024	Overseas surgeries are included or excluded as specified in the relevant figure note.

Figure/Table	Cohort	Measure	Reporting basis	Denominator	Time period	Interpretation notes
Figures 44 & 45	Secondary complications	Pressure injury, Respiratory complications, UTI, Pain and Spasticity	Variable-specific denominators	Pressure injury: acute 736, rehab 736; Respiratory: acute 783, rehab 746; UTI: acute 761, rehab 735; Pain 684; Spasticity 577	2020–2024	Complication denominators vary by phase of care and data completeness.
Figure 46	Mortality	Deaths before discharge	Mortality cohort	48	2020–2024	Reported as a specific outcome cohort and should not be confused with community mortality.
Figures 47-49	SCIM distribution	Self-care, respiration and sphincter management, mobility domains	Complete domain data at rehabilitation discharge	Self-care 669; Respiration and sphincter management 655; Mobility 630	2020–2024	Domain denominators differ because each SCIM domain may have different completeness.
Figure 50 & Table 6	SCIM change	Change from rehabilitation admission to discharge	Complete SCIM admission and discharge data; stratified by site.	563	2020–2024	Complete-case outcome measure. Not directly comparable with broader rehabilitation admission counts.
Figure 51	SCIM change by discharge AIS grade	SCIM change stratified by discharge AIS grade	Complete SCIM and discharge AIS data	510	2020–2024	Smaller subgroup due to requiring both complete SCIM and discharge AIS data.
Table 7 & Figure 52	Walking on discharge	Indoor, moderate-distance and outdoor walking status	Participants with available mobility-domain data	723 overall; distance-specific n varies between 719 and 721	2020–2024	Mobility status varies by distance threshold. Indoor walking should not be equated with independent outdoor mobility.

Appendix B: Statistical analyses

The following tables represent statistical calculations and analyses conducted for this report.

Table 8: Figure 32

KW_statistic	p_value	Interpretation	Results
129.601	< 0.001	Very strong evidence	H = 129.6013, p = < 0.001 Effect size η² = 0.155 (95% CI 0.11 to 0.21).

Comparison	p.value	Interpretation	Results
A - B = 0	0.487	Non-significant	Median LOS higher in AIS A than AIS B (adjusted p = 1). Evidence strength: Non-significant.
A - C = 0	0.435	Non-significant	Median LOS higher in AIS A than AIS C (adjusted p = 1). Evidence strength: Non-significant.
B - C = 0	0.6	Non-significant	Median LOS higher in AIS C than AIS B (adjusted p = 1). Evidence strength: Non-significant.
A - D = 0	< 0.01	Very strong evidence	Median LOS higher in AIS A than AIS D (adjusted p = 1.56e-12). Evidence strength: Very strong evidence.
B - D = 0	< 0.01	Moderate evidence	Median LOS higher in AIS B than AIS D (adjusted p = 0.0262). Evidence strength: Moderate evidence.
C - D = 0	< 0.01	Very strong evidence	Median LOS higher in AIS C than AIS D (adjusted p = 5.29e-10). Evidence strength: Very strong evidence.
A - E = 0	< 0.01	Moderate evidence	Median LOS higher in AIS A than AIS E (adjusted p = 0.0416). Evidence strength: Moderate evidence.
B - E = 0	< 0.01	Moderate evidence	Median LOS higher in AIS B than AIS E (adjusted p = 0.0379). Evidence strength: Moderate evidence.
C - E = 0	< 0.01	Moderate evidence	Median LOS higher in AIS C than AIS E (adjusted p = 0.0416). Evidence strength: Moderate evidence.
D - E = 0	< 0.01	Moderate evidence	Median LOS higher in AIS D than AIS E (adjusted p = 0.0416). Evidence strength: Moderate evidence.

Table 9: Figure 48

KW_statistic	p_value	Interpretation	Results
93.853	< 0.001	Very strong evidence of differences	H = 93.8533, p = < 0.001 Effect size η² = 0.178 (95% CI 0.13 to 0.25)

Table 10: Figure 48

Comparison	p.value	Interpretation	Results
A - B = 0	0.358	No significant difference	
A - C = 0	0.0114	No significant difference	
B - C = 0	0.142	No significant difference	
A - D = 0	< 0.01	Strong evidence	Median SCIM Δ higher in AIS D than AIS A (adjusted p = < 0.01). Evidence strength: Strong evidence.
B - D = 0	< 0.01	Strong evidence	Median SCIM Δ higher in AIS D than AIS B (adjusted p = < 0.01). Evidence strength: Strong evidence.
C - D = 0	< 0.01	Very strong evidence	Median SCIM Δ higher in AIS D than AIS C (adjusted p = < 0.01). Evidence strength: Very strong evidence.
A - E = 0	0.974	No significant difference	
B - E = 0	0.122	No significant difference	
C - E = 0	0.154	No significant difference	
D - E = 0	0.968	No significant difference	

Figure 36 methods

A multivariable linear regression model was constructed to identify independent predictors of inpatient rehabilitation length of stay (LOS). Predictors were selected a priori based on clinical relevance and service-delivery considerations. Functional status was represented using SCIM domain scores (mobility, respiratory, self-care) and functional gain (SCIM Δ). Complications were included as binary indicators for respiratory complications, pressure injuries, urinary tract infection, and pain. Discharge destination was modelled as a categorical factor. Weight was included as a continuous covariate. AIS and SNL classifications were excluded from the final model due to mediation through SCIM domains and lack of independent contribution once functional status was accounted for. Robust HC3 standard errors were applied to mitigate heteroskedasticity. Model diagnostics included R^2, adjusted R^2, RMSE, AIC/BIC, Cook's distance, leverage, and variance inflation factors (VIF). No VIF exceeded 5, and residual diagnostics indicated no influential outliers or multicollinearity. All analyses were performed in R using the lm() function with HC3 robust variance estimation.

Appendix C: Spinal Cord Independence Measure scoring framework

Self Care (20 points)

Feeding	0-3
Bathing Upper Body	0-3
Bathing Lower Body	0-3
Dressing Upper Body	0-4
Dressing Lower Body	0-4
Grooming	0-3

Respiration Sphincter Management (40 points)

Respiration	0-10
Sphincter Management - Bladder	0-15
Sphincter Management - Bowel	0-10
Use of Toilet	0-5

Mobility Score (40 points)

Mobility Bed Action Prevent Pressure Injury	0-6
Transfers: bed-wheelchair	0-2
Transfers: wheelchair-toilet-tub	0-2
Transfers: wheelchair-car	0-2
Mobility Indoors	0-8
Mobility Moderate Distances (10-100m)	0-8
Mobility Outdoors (more than 100m)	0-8
Stair Management	0-3
Transfers Ground - Wheelchair	0-1

Selfcare total:	**20**
Respiration Sphincter total:	**40**
Mobility total:	**40**
SCIM total	**100**

שירותי בריאות כללית

LOEWENSTEIN HOSPITAL REHABILITATION CENTER
Affiliated with the Sackler Faculty of Medicine, Tel-Aviv University
Department IV, Medical Director: Dr. Amiram Catz **Tel: 972-9-7709090 Fax: 972-9-7709986** e-mail: amiramc@clalit.org.il
Patient Name: _____**ID:**_____ **Examiner Name:** _____
(Enter the score for each function in the adjacent square, below the date. The form may be used for up to 6 examinations.)

SCIM-SPINAL CORD INDEPENDENCE MEASURE

Version III, Sept 14, 2002

EXam 1 2 3 4 5 6
DATE \ \ \ \ \ \

Self-Care

1. Feeding (cutting, opening containers, pouring, bringing food to mouth, holding cup with fluid)
0. Needs parenteral, gastrostomy, or fully assisted oral feeding
1. Needs partial assistance for eating and/or drinking, or for wearing adaptive devices
2. Eats independently; needs adaptive devices or assistance only for cutting food and/or pouring and/or opening containers
3. Eats and drinks independently; does not require assistance or adaptive devices

2. Bathing (soaping, washing, drying body and head, manipulating water tap). **A-upper body; B-lower body**
A. 0. Requires total assistance
1. Requires partial assistance
2. Washes independently with adaptive devices or in a specific setting (e.g., bars, chair)
3. Washes independently; does not require **a**daptive **d**evices or **s**pecific **s**etting (not customary for healthy people) (adss)
B. 0. Requires total assistance
1. Requires partial assistance
2. Washes independently with **a**daptive **d**evices or in a **s**pecific **s**etting (adss)
3. Washes independently; does not require **a**daptive **d**evices (adss) or **s**pecific **s**etting

3. Dressing (clothes, shoes, permanent orthoses: dressing, wearing, undressing). **A-upper body; B-lower body**
A. 0. Requires total assistance
1. Requires partial assistance with **c**lothes **w**ith**o**ut **b**uttons, **z**ippers or **l**aces (cwobzl)
2. Independent with cwobzl; requires **a**daptive **d**evices and/or **s**pecific **s**ettings (adss)
3. Independent with cwobzl; does not require adss; needs assistance or adss only for bzl
4. Dresses (any cloth) independently; does not require adaptive devices or specific setting
B. 0. Requires total assistance
1. Requires partial assistancewith **c**lothes **w**ith**o**ut **b**uttons, **z**ipps or **l**aces (cwobzl)
2. Independent with cwobzl; requires adaptive devices and/or specific settings (adss)
3. Independent with cwobzl without adss; needs assistance or adss only for bzl
4. Dresses (any cloth) independently; does not require adaptive devices or specific setting

4. Grooming (washing hands and face, brushing teeth, combing hair, shaving, applying makeup)
0. Requires total assistance
1. Requires partial assistance
2. Grooms independently with adaptive devices
3. Grooms independently without adaptive devices

SUBTOTAL (0-20)

Respiration and Sphincter Management

5. Respiration
0. Requires tracheal tube (TT) and permanent or intermittent assisted ventilation (IAV)
2. Breathes independently with TT; requires oxygen, much assistance in coughing or TT management
4. Breathes independently with TT; requires little assistance in coughing or TT management
6. Breathes independently without TT; requires oxygen, much assistance in coughing, a mask (e.g., peep) or IAV (bipap)
8. Breathes independently without TT; requires little assistance or stimulation for coughing
10. Breathes independently without assistance or device

6. Sphincter Management - Bladder
0. Indwelling catheter
3. Residual urine volume (RUV) > 100cc; no regular catheterization or assisted intermittent catheterization
6. RUV < 100cc or intermittent self-catheterization; needs assistance for applying drainage instrument
9. Intermittent self-catheterization; uses external drainage instrument; does not need assistance for applying
11. Intermittent self-catheterization; continent between catheterizations; does not use external drainage instrument
13. RUV <100cc; needs only external urine drainage; no assistance is required for drainage
15. RUV <100cc; continent; does not use external drainage instrument

7. Sphincter Management - Bowel
0. Irregular timing or very low frequency (less than once in 3 days) of bowel movements
5. Regular timing, but requires assistance (e.g., for applying suppository); rare accidents (less than twice a month)
8. Regular bowel movements, without assistance; rare accidents (less than twice a month)
10. Regular bowel movements, without assistance; no accidents

8. Use of Toilet (perineal hygiene, adjustment of clothes before/after, use of napkins or diapers).
0. Requires total assistance
1. Requires partial assistance; does not clean self
2. Requires partial assistance; cleans self independently
4. Uses toilet independently in all tasks but needs adaptive devices or special setting (e.g., bars)
5. Uses toilet independently; does not require adaptive devices or special setting)

SUBTOTAL (0-40)

Mobility (room and toilet) DATE \ \ \ \ \ \ \

9. Mobility in Bed and Action to Prevent Pressure Sores
0. Needs assistance in all activities: turning upper body in bed, turning lower body in bed, sitting up in bed, doing push-ups in wheelchair, with or without adaptive devices, but not with electric aids
2. Performs one of the activities without assistance
4. Performs two or three of the activities without assistance
6. Performs all the bed mobility and pressure release activities independently

10. Transfers: bed-wheelchair (locking wheelchair, lifting footrests, removing and adjusting arm rests, transferring, lifting feet).
0. Requires total assistance
1. Needs partial assistance and/or supervision, and/or adaptive devices (e.g., sliding board)
2. Independent (or does not require wheelchair)

11. Transfers: wheelchair-toilet-tub (if uses toilet wheelchair: transfers to and from; if uses regular wheelchair: locking wheelchair, lifting footrests, removing and adjusting armrests, transferring, lifting feet)
0. Requires total assistance
1. Needs partial assistance and/or supervision, and/or adaptive devices (e.g., grab-bars)
2. Independent (or does not require wheelchair)

Mobility (indoors and outdoors, on even surface)

12. Mobility Indoors
0. Requires total assistance
1. Needs electric wheelchair or partial assistance to operate manual wheelchair
2. Moves independently in manual wheelchair
3. Requires supervision while walking (with or without devices)
4. Walks with a walking frame or crutches (swing)
5. Walks with crutches or two canes (reciprocal walking)
6. Walks with one cane
7. Needs leg orthosis only
8. Walks without walking aids

13. Mobility for Moderate Distances (10-100 meters)
0. Requires total assistance
1. Needs electric wheelchair or partial assistance to operate manual wheelchair
2. Moves independently in manual wheelchair
3. Requires supervision while walking (with or without devices)
4. Walks with a walking frame or crutches (swing)
5. Walks with crutches or two canes (reciprocal walking)
6. Walks with one cane
7. Needs leg orthosis only
8. Walks without walking aids

14. Mobility Outdoors (more than 100 meters)
0. Requires total assistance
1. Needs electric wheelchair or partial assistance to operate manual wheelchair
2. Moves independently in manual wheelchair
3. Requires supervision while walking (with or without devices)
4. Walks with a walking frame or crutches (swing)
5. Walks with crutches or two canes (reciprocal waking)
6. Walks with one cane
7. Needs leg orthosis only
8. Walks without walking aids

15. Stair Management
0. Unable to ascend or descend stairs
1. Ascends and descends at least 3 steps with support or supervision of another person
2. Ascends and descends at least 3 steps with support of handrail and/or crutch or cane
3. Ascends and descends at least 3 steps without any support or supervision

16. Transfers: wheelchair-car (approaching car, locking wheelchair, removing arm- and footrests, transferring to and from car, bringing wheelchair into and out of car)
0. Requires total assistance
1. Needs partial assistance and/or supervision and/or adaptive devices
2. Transfers independent; does not require adaptive devices (or does not require wheelchair)

17. Transfers: ground-wheelchair
0. Requires assistance
1. Transfers independent with or without adaptive devices (or does not require wheelchair)

SUBTOTAL (0-40)

TOTAL SCIM SCORE (0-100)

Appendix D: Supplementary mobility analysis

Number of people walking on discharge:
54% (391/721) are walking short distances (10m)

Comparison of those admitted walking:
22% (150/695) are walking short distances on admission

Number of people using wheelchairs on discharge:
46% (330/721) over short distances; 51% 365/720) over moderate distances; 63% (451/719) outdoors.

Number of people who are dual users:
if indoor walker (n=391), 35 then use wheelchair for moderate, and 118 use wheelchair outdoors (30% of walkers are wheelchair users)

Number who are completely independent without aids:
11% (76/719) walk unaided outdoors on discharge



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NZSCIR Governance Group notes with great sadness the passing of Christine Mangold, in February 2026. Christine was a valued member of the NZSCIR team, serving as a Coordinator from May 2023. With her strong research background and physiotherapy training, she was instrumental in enhancing the format and content of our annual reporting. We are profoundly grateful for her service and dedicate this report to her. Her passionate desire for improvement and kind, caring nature will be missed by all who knew her.

ACC He Kaupare. He Manaaki. He Whakaora. Prevention. Care. Recovery.

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