Non-resident orthopaedic admissions to Dunedin Hospital 1997 to 2017 and Southland Hospital 2011 to 2017

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ABSTRACT

AIMS: The purpose of this study is to audit the numbers of non-residents requiring orthopaedic admission to Dunedin and Southland Hospitals and determine the effects of increasing tourist numbers on healthcare resources.

METHOD: All non-resident orthopaedic admissions to Dunedin Hospital from January 2005 to December 2017 and Invercargill Hospital from January 2011 to December 2017 were analysed with respect to country of residence, mechanism of injury, primary diagnosis and case weights consumed. The results were combined with figures from 1997–2004 to give a 21-year series for Dunedin Hospital.

RESULTS: There has been a significant increase in the number of admissions and case weights (CW) over the past 21 years at Dunedin Hospital ($p<0.001$). The most common mechanisms of injury were snow sports at Dunedin Hospital and falls for Southland Hospital. Between 2011 and 2017 there were on average 50 non-resident admissions per year (92.9 CW/year) to Dunedin Hospital and 74 admissions (120.7 CW/year) in Southland.

CONCLUSION: Increasing tourist numbers have resulted in an increase number of orthopaedic admissions to Dunedin Hospital over the last two decades although it remains a small proportion of the total workload. Southland Hospital is relatively more affected. These patients represent an annual cost in excess of $1,000,000 to Southern DHB.

Over the past several decades, New Zealand's tourism industry has experienced exceptional growth, and forecasts for the sector indicate this expansion will continue. Statistics New Zealand has recorded that New Zealand attracted 3.5 million international visitors in the year ending December 2016.[1] This has risen from 1.48 million in 1998 and is projected to increase to 4.5 million by 2022.[1,2]

In the Otago and Southland regions, due to the popularity of the tourist resorts of Queenstown and Wanaka, there is a higher ratio of international tourists to local residents and a forecast growth in tourism that is higher than for other regions. This puts relatively higher pressure on the local infrastructure, including healthcare, compared to other regions.[2] In overseas studies the most common reason for admission for overseas residents is trauma.[3,4] In New Zealand in general, and Otago and Southland in particular, adventure tourism, snow sports and motor vehicle accidents involving overseas drivers may all lead to admissions to the orthopaedic service. Concerns over this burden has led to previous studies looking at overseas admissions to Dunedin Hospital from 1997–2004 and snow sports injuries admitted to Invercargill during 2009.[5,6]

Each DHB receives funding according to the population-based funding formula (PBFF). Public Health Acute services (PHAS) are funded from this. Since July 1999, all non-residents with accidental injuries are covered by the Accident Compensation Corporation (ACC) while in New Zealand. Prior to 1999, non-residents were only covered by the ACC if their injury was the result of a motor vehicle accident. The DHB are expected to cover all acute costs through PHAS, from their bulk funding. The Crown recovers these costs from ACC at a national level but not directly to individual DHBs. Therefore the cost of treating patients from overseas comes directly from the base funding of the DHB.

The Otago DHB and Southland DHBs merged in 2010 to form the Southern DHB (SDHB).The Southern DHB has had well-publicised problems with a financial deficit and difficulties with access to elective orthopaedic surgery.[7,8] Any increase in non-resident admissions over and above normal adjustments may have impacts on healthcare costs and directly and indirectly on elective service delivery.

The base hospitals in Dunedin and Invercargill both provide an orthopaedic trauma service. Patients from Queenstown have traditionally been transferred to Invercargill and those from Wanaka and Central Otago to Dunedin. Due to the nature and increased volume of tourism throughout the district it is hypothesised that there will have been an increase in overseas orthopaedic admissions since our original study.

The primary objective of this study is to audit the numbers and details of non-resident orthopaedic admissions to Dunedin Hospital over the 21-year period 1997 to 2017. The secondary outcome is to compare the equivalent figures from 2011 to 2017 for Southland to determine the overall impact on Southern DHB.

Materials and Methods

We used the same methodology as for our previous study.[5] Hospital administration systems were used to identify all non-resident patients that were admitted under orthopaedic surgery from January 2005 to December 2017 for Dunedin Hospital, and January 2011 to December 2017 for Southland Hospital. The search included residency status of all patients and overseas address, which is determined at the time of admission and captured in the electronic record. Patients who were students or people in employment in New Zealand including those on working visas were excluded as in our previous study. All cases identified were individually checked including a review of admission notes if required. The demographics of the patients were recorded, including age, sex, country of residence, mechanism of injury and primary diagnosis. The case weights (CW) consumed were also recorded. The price per CW in 2017 was $4,921 and allowed the cost to the hospital was estimated. The proportion of the total orthopaedic workload was then calculated based on both total discharges and CWs from DHB reporting systems for both hospitals.

The results of this study were then combined with the previous study to create one continuous data set for numbers of patients and case weights consumed from January 1997 to December 2017 for Dunedin Hospital.

Results

Dunedin site 2005–2017

There were a total of 651 patients admitted (mean 50/year). The average length of stay (LOS) was 4.9 days (median three days). There were a total of 3,128 bed nights used over this period (240/year). The total case weights were 1,159 (mean 89.1/year).

The majority of patients in Dunedin come from Australia (201 patients, 31.0%), followed by the UK (115 patients, 17.7%) and Europe (111 patients, 17.1%,). Despite increasing numbers of Asian tourists there were only 88 patients (13.6%) during this time.

Mechanism of injury

The most common cause of injury was skiing and snowboarding with 200 admissions (mean 15.4 admissions per year), comprising 30% of all non-resident admissions. Falls were the second most common cause with 168 admissions (26%) (13/year). Motor vehicle accidents (MVAs) caused 83 admissions (13%) (6/year) with bicycle accidents causing 41 admissions (6%) (3/ year). Commercial tourist activities such as para-

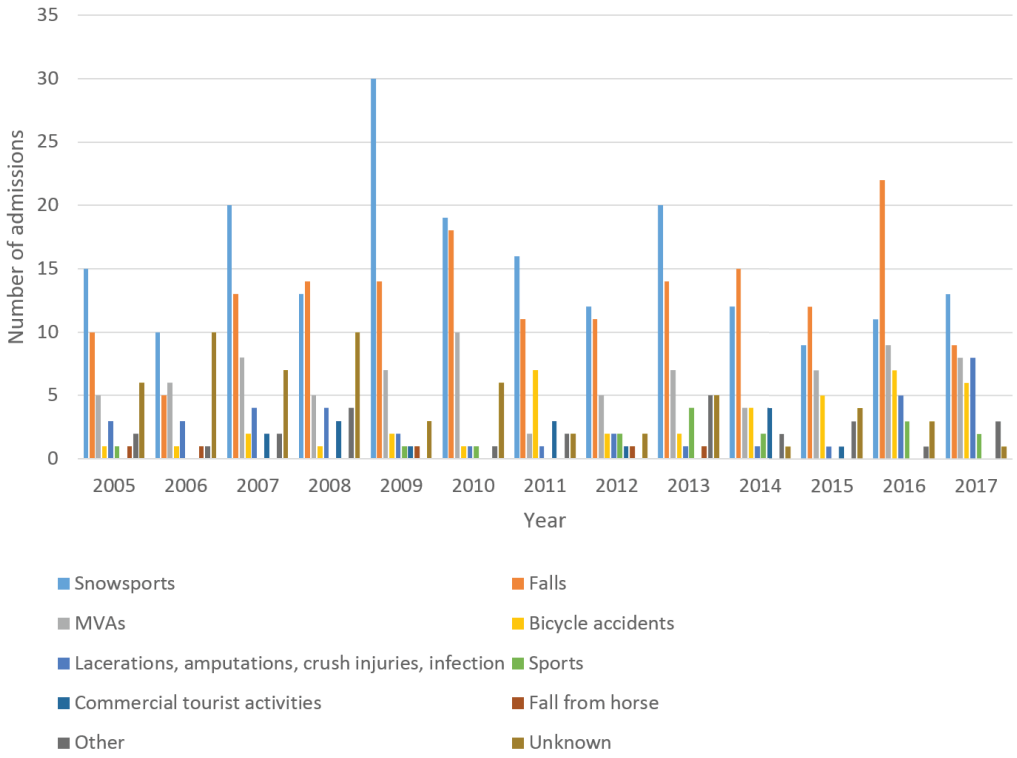
Table 1: Details of mechanism of injury and case weights for non-resident orthopaedic admissions to Dunedin Hospital 2005–2017 and Southland Hospital 2011–17.

	Dunedin 2005–2017				Southland 2011–2017			
Mechanism	**Number**	**%**	**CW**	**CW/D**	**Number**	**%**	**CW**	**CW/D**
Snowsports	200	30	346	1.7	141	27	217	1.5
Falls	168	26	294	1.8	161	31	312	1.9
MVAs	83	13	230	2.8	42	8	76.4	1.8
Fall from bike	41	6	66	1.6	59	11	87	1.5
Lacerations, amputations, crush injuries and infection	36	6	36	1.0	27	5	34	1.3
Sports	16	2	34	2.1	10	2	14.2	1.4
Commercial tourist activities	15	2	36	2.4	30	6	43.7	1.5
Fall from horse	5	1	6	1.2	11	2	23.9	2.2
Other	26	4	43	1.7	12	2	10.9	0.9
Unknown	61	9	68	1.1	24	5	25.6	1.1
Total	651	100	1,159	1.8	517	100	845	1.6

CW; Case Weight, CW/D; Case weight/discharge, MVA; Motor vehicle Accident.

gliding, bungy jumping and canyoning only led to 15 admissions (2%) over the 13-year period (Figure 1). The mean case weight per discharge (CW/D) was 2.8 for patients admitted due to MVAs, 2.4 for commercial tourist activities and 1.6 to 1.8 for snow sports, falls and bicycle accidents (Table 1).

Figure 1: Numbers of non-resident orthopaedic admissions to Dunedin Hospital by mechanism of injury 2005 to 2017.



Commercial tourist activities include: canyoning, parachuting, jetboating, skydiving, hang gliding, scenic flights, go-karting, bungy jumping, fly-by-wire and paragliding.

NZMJ 8 May 2020, Vol 133 No 1514
ISSN 1175-8716
www.nzma.org.nz/journal

Table 2: Details of injury for non-resident orthopaedic admissions to Dunedin Hospital 2005–2017.

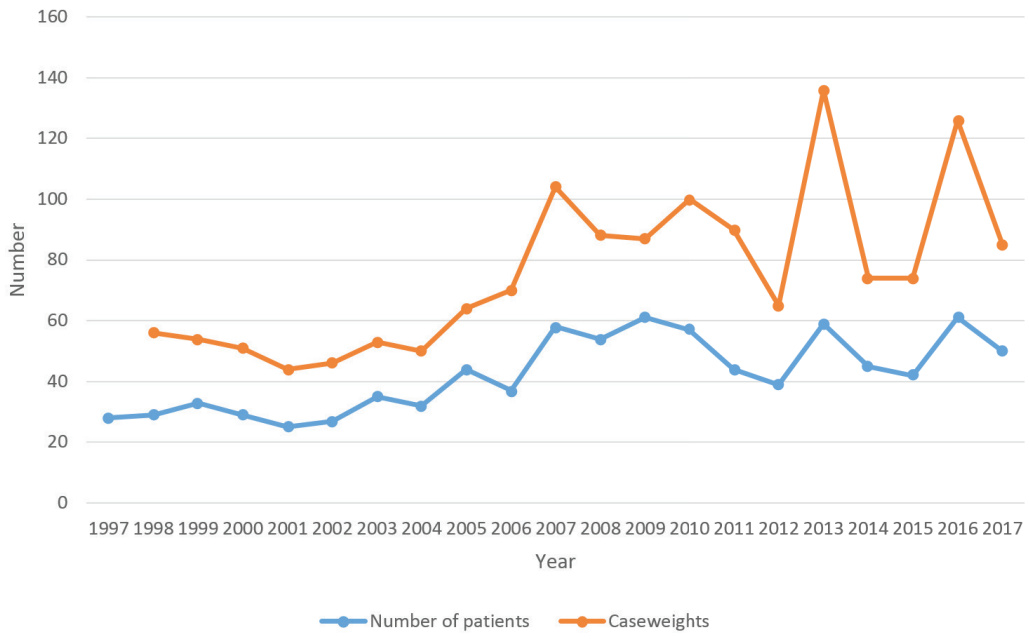
Primary diagnosis	Number of patients	%	CW
Lower limb fractures and dislocations	272	42	557
Upper limb fractures and dislocations	181	28	280
Spinal injuries	47	7	80
Hip and pelvis fractures and dislocations	31	5	55
Laceration, crush injuries and amputations	24	4	24
Tendon and ligament injuries	28	4	36
Infection and soft tissue injuries	24	4	26
Multiple fractures and injuries	8	1	42
Other	18	3	59
Unknown	18	3	
Total	**651**	**100**	**1,159**

The most common injuries seen were lower limb fractures and dislocations, which made up 42% of admissions followed by upper limb fractures (28%) with 47 patients (7%) having spinal injuries (Table 2).

Changes 1997–2017

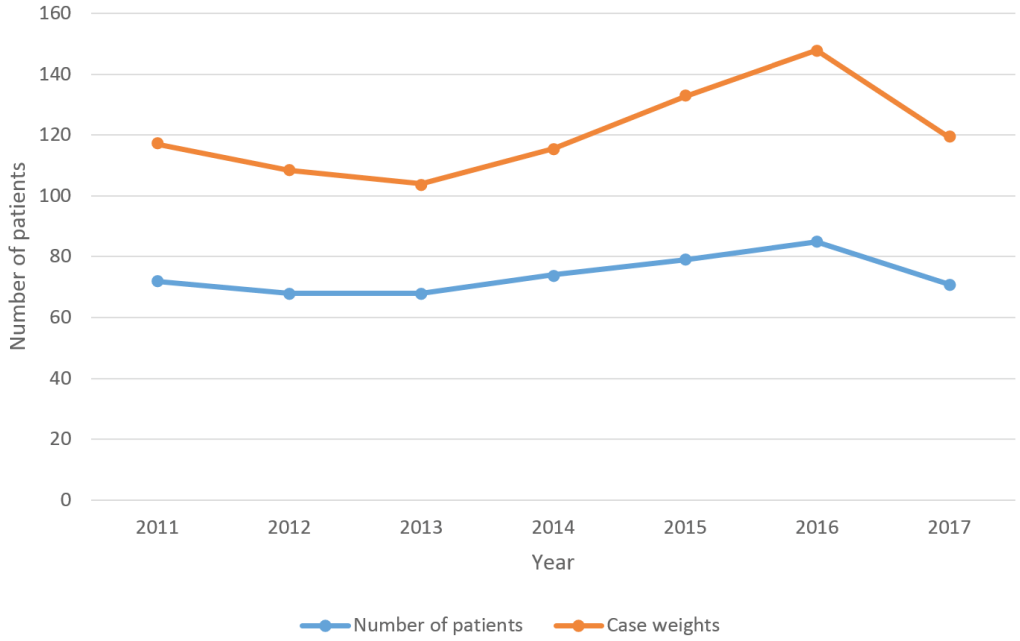
Linear regression analysis shows a significant increase in numbers of non-resident patients (p=0.0002) and case weights (p=0.006) consumed in Dunedin Hospital during the previous 21 years (Figure 2). Numbers have increased from 32 patients per year from 1997–2004 to 50 patients a year (+60%). The case weights ranged between 44 CW (2001) and 133 CW (2016). The mean case weight/year from 1997–2004 was 50, rising to 85.5 CW/year for the period 2005–2010 and 92.9 CW/year between 2011 and 2017. This represents an 86% increase. The mean CW/D has increased from 1.67 (1997–2004) to 1.9 (2011–17) (+14%).

Figure 2: Number and case weights of non-resident orthopaedic admissions to Dunedin Hospital, January 1997 to October 2017.



NZMJ 8 May 2020, Vol 133 No 1514
ISSN 1175-8716
www.nzma.org.nz/journal

Figure 3: Number and case weights of non-resident orthopaedic admissions to Invercargill Hospital 2011–2017.



Southland site 2011 to 2017

At Southland Hospital there were a total of 517 admissions (845CW) over the seven-year period. The average was 74 discharges/year (120.7 CW/year). The numbers also showed a rising trend though there was a dip in 2017 (linear regression p= 0.23, ns) (Figure 3). The case weights consumed for non-resident orthopaedic admissions are also showed an increasing trend year to year with the exception of 2017 (linear regression, p=0.17) (Figure 3). The mean LOS was 3.6 days, (median 3) with an average of 270 bed nights per year.

Patients most commonly were from Australia (226, 43.7%), followed by UK (80, 15.5%), and Europe (77, 14.9%) and Asia. Australians made up a significantly higher proportion of admissions in Southland than in Dunedin (Fisher exact test, p<0.001).

Falls were the most common cause of admission with 161 admissions (23 per year, 31.1% of all non-resident admissions), followed by skiing and snowboarding with 141 admissions (20.1 per year, 27.3% of all non-resident admissions), and bicycle accidents with 59 admissions (8.4 per year, 11.4% of all non-resident admissions). Commercial tourist activities led to 30 admissions (5.8%) (Table 1).

The mean CW/discharge was lower in Southland at 1.6 CW compared to 1.8 CW in Dunedin. The mean CW/discharge was highest for falls from horse (2.2), falls (1.9) and MVAs at 1.8 CW/D and 1.5 CW/D for snow sports, bicycle accidents and commercial tourist activities.

There was a similar mix of injuries to Dunedin with lower limb fractures most common (39%), then upper limb fractures (34%) but a higher proportion of spinal injuries at 72 (13%).

Proportion of workload in Southern DHB

In 2004 the total orthopaedic budget in Dunedin was 4,332 CW. In 2017 this had risen to 6,421 CW. The proportion consumed by overseas patients was 1.1% in the period 1997–2005. Between 2007–17 this had increased to 1.6% of total CW and 1.8% of all discharges. Overseas cases accounted for 3.1% of acute admissions and CWs. In dollar terms, using 2017 CW values, the cost in Dunedin was $620,046 in 2016 and $418,285 in 2017.

In Southland overseas cases accounted for 3.9% of all discharges and 3.8% of total CW for the period 2011–17. They accounted for 6.9% of acute admissions and 7.2%

acute CWs during this period. The cost was $728,000 in 2016 and $585,600 in 2017.

The cost for Southern DHB for the seven-year period 2011–17 has averaged 214 CW or 2.3% of the total orthopaedic budget. Using 2017 values, this represents an average annual cost of $1,051,125 (range $853,795 to $1,348,354).

Discussion

With the increase in tourist numbers in New Zealand, there has been a subsequent increase in the number of non-resident admissions and case weights consumed over the past 21 years for Dunedin hospital, and over the seven-year study period at Southland Hospital. The commonest causes of admission are due to snow sports, MVAs and falls. Australian residents compromise the largest proportion of admissions. Overseas admissions only comprise 3.1% of the acute orthopaedic budget in Dunedin but 7.2% in Southland, which is disproportionately affected.

In the six years (2010–2016) there was a 27.9% increase in annual visitor arrivals to New Zealand (2,525,044–3,499,939).[1] This increase in tourist numbers has occurred throughout New Zealand, including Otago and Southland. In Otago in 2015, the ratio of annual visitor count to resident population was 4.9, which was the second highest ratio in New Zealand, after the West Coast.[2] Therefore, it would be expected that this rise in tourism would lead to an increase in non-resident hospital admissions.

Our previous study showed that while there was a 43% increase in visitor arrival to New Zealand between 1997 and 2004, there was no significant increase in the number of non-resident orthopaedic admissions at Dunedin hospital over that time period.[5] However, over the 21-year period between 1997 and 2017, there is an increasing trend in terms of numbers of non-resident admissions, case weights consumed and the proportion of the total orthopaedic budget at Dunedin Hospital. Between 1997 and 2004 there were on average 32 patients per year, which has increased by 50% to 49 during the last seven years of this study. Southland Hospital carries a higher burden than Dunedin with 74 non-resident orthopaedic patients/year accounting for 3.8% of the total orthopaedic budget. The appointment of a trauma surgeon in Southland has meant that fewer patients are transferred out to larger centres. However, the CW/D ratio is lower for Southland than Dunedin suggesting that it is high numbers of less complex cases that makes up the bulk of their load.

From 2012 to 2016, tourists from Australia made up 40% of our annual visitors, those from Asia made up 23%, and tourists from the US and UK made up 8% and 6% respectively.[1] As expected, patients from Australia make up the largest proportion of orthopaedic admissions (31% at Dunedin hospital, 43.7% at Invercargill Hospital). This may be due to an increase in the number of direct flights into Queenstown Airport from Australia. However, those from Asia only made up 13.5% of admissions at Dunedin Hospital and 12.8% at Invercargill Hospital. This is in contrast to our previous paper covering 1997 to 2004 when patients from Asia made up the largest proportion of orthopaedic admissions (26%), followed by Australia (23%) and the UK (18%).[5]

It is a common perception that snow sport injuries and motor vehicle accidents (MVAs) are a major cause of non-residents' hospital admissions. This study confirmed that snow sports were the most common reason for admission at Dunedin Hospital and the second most common reason for admission at Invercargill Hospital. Burgess and Namazie[6] reported that in 2009, 59 overseas patients (85 CW) were admitted to Southland Hospital following snow sports injuries over a four-month period. This represented two-thirds of admissions for snow sport injuries over the same period. This is much higher than in subsequent years which suggests either that 2009 was a bad year prompting their study or safety measures in the snow sport industry have improved. They recorded country of origin and patients may have been categorised as an overseas patient even if they had a local address and were working or studying. In their study the average CW/D was 1.44 ($7,086, 2017 values) compared with 1.54 CW/D ($7,578) in Southland and 1.72 CW/D ($8,464) in Dunedin in in this study. This suggests that the severity of injury and hence cost is increasing.

There were fewer non-residents admitted after MVAs, however each admission cost an average of 2.8 CW ($13,779) for Dunedin Hospital, and 1.95 ($9,596) for Southland Hospital due to the greater severity of injuries. More seriously injured patients are usually transferred to Dunedin Hospital by rescue helicopter regardless of the location of their accident.

This study found that the average case weights per year from 2011 to 2017 was 92.9 CW for Dunedin Hospital and 120.7 CW for Invercargill, which equates to approximately $457,161 and $590,520 respectively (2017 values). In our previous study non-resident orthopaedic admissions accounted for 1.1% of the total orthopaedic workload.[5] This is now 1.6% in Dunedin and 3.9% in Southland. Consequently the burden of overseas residents on the service has increased in both absolute and relative terms. This is despite significant increases in the orthopaedic elective budget due to the Orthopaedic Joint Initiative and other policies.

There may be both direct and indirect consequences of this work on elective surgery. Bed block and theatre access problems can lead to cancellation of electives. The financial cost per year adds to the budget deficit and could be used to employ more staff. The cost and number of CWs/year across Southern DHB would equate to approximately 65 elective hip replacements.

A weakness of the study is that the inclusion criteria was to have an overseas home address listed on their patient records or in-patient notes. However, some overseas patients report a local address that they are currently staying at and may not have been identified as an overseas resident. However, residency status is routinely checked at the time of admission and was used to help identify non-residents. We excluded students studying in New Zealand and those in employment, for example on working visas, as they were considered to be paying New Zealand taxes. We used the same methodology in our previous study so that trends were more likely to be valid. However, the results are still likely to be an underestimate. Outpatient and fracture clinic costs for patients treated with more minor injuries have not been collected so the true cost to SDHB of injuries to overseas residents will be greater.

This study focused solely on Southern DHB and there is a lack of national data with which to compare these results. However, data presented at the NZOA trauma meeting this year suggests that the total overseas delivery funded through the Population-based funding formula (PBFF) in Southern DHB is the highest in New Zealand and in excess of $2 million.[10] Further work at a national level will help identify the workload caused by overseas tourists. If significant anomalies exist then this should have an impact on future funding decisions such as the mechanism used by ACC to fund acute care for each DHB.

Conclusion

Increasing tourist numbers have resulted in an increased number of orthopaedic admissions to Dunedin Hospital over the last two decades. It remains a small proportion of the total departmental workload while Southland Hospital is relatively more affected. These patients represent a cost in excess of $1,000,000 per annum to Southern DHB, which has to be funded from its share of population-based funding.

Competing interests:
Nil.
Acknowledgements:
Thank you to Jim Robinson from the Southern District Health Board reporting team, and the University of Otago for funding this project.
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www.nzma.org.nz/journal-articles/non-resident-orthopaedic-admissions-to-dunedin-hospital-1997-to-2017-and-southland-hospital-2011-to-2017

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