Incidence, demographics and surgical outcomes of cutaneous squamous cell carcinoma diagnosed in Northland, New Zealand

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ABSTRACT

AIM: Non-melanoma skin cancer (NMSC) is the most commonly diagnosed and most costly cancer in Australasia. Cutaneous squamous cell carcinoma (cSCC) accounts for approximately 25% of NMSC. Despite this, reporting of cSCC is not mandatory in Australasia. This creates difficulties in planning, resourcing and improving outcomes in cSCC. Previous studies in New Zealand have lacked data on ethnicity. The aim of this study was to define the incidence and demographics of cSCC diagnosed in Northland, New Zealand, including data on ethnicity.

METHODS: A 12-month retrospective study was carried out of all primary cSCC histologically diagnosed in Northland for one year. The cohort was identified by searching the Northland District Health Board pathology database. Data on outcomes and ethnicity were obtained from the hospital results system. Primary outcome of interest was the incidence of cSCC in Northland. Secondary outcomes of interest were lesion characteristics and positive margin rate.

RESULTS: 1,040 cSCC were identified in 890 patients. Mean age of patients was 75. Crude incidence of primary cSCC was 668/100,000 patient years. Age standardised incidence was 305/100,000 patient years. An estimate of New Zealand incidence adjusted for age and ethnicity is 580/100,000 patient years. Overall positive margin rate in excised lesions was 9.5%.

CONCLUSION: This study has defined the rate of cSCC in a large, well defined New Zealand population, and estimated age and ethnicity adjusted incidence in New Zealand. It has demonstrated the highest incidence of cSCC in the world outside Australia. Overall positive margin rate of excised lesions was acceptable.

Non-melanoma skin cancer (NMSC) is the most commonly diagnosed malignancy in Australasia, accounting for around 75% of cancers, with Australia having the highest incidence in the world. It consumes significant healthcare resources with an estimated annual cost of $703 million dollars in Australia, and $51 million dollars in New Zealand. This is 9% of total cancer costs, making NMSC the costliest of all cancers.[1–3] It is commonly treated in primary care by general practitioners, as well as secondary care by dermatologists, general and plastic surgeons.

Cutaneous squamous cell carcinoma (cSCC) accounts for approximately 25% of NMSC. Unlike basal cell carcinoma, cSCC frequently metastasises and can be fatal.[4,5] It is however, potentially preventable with relatively simple measures, and is easily treated by excision if detected early.[6,7] Despite this, there is good evidence that the incidence of cSCC continues to increase worldwide.[8–15]

Mandatory reporting for cSCC and other NMSC in New Zealand was discontinued in 1958 due to resource constraints. Therefore, statistics on incidence and outcomes are not

easily available. Previous studies in New Zealand populations have demonstrated some of the highest absolute and age-adjusted incidence rates of cSCC in the world outside Australia, with the most recent published rate of 118/100,00 patient years in 2007.[8,16] The markedly different cSCC rates between Māori and non-Māori mean accurate extrapolation of data to the entire country from local studies where ethnicity is not known is difficult, due to differing ethnic population make-up across the country. All prior studies haven't accounted for ethnicity in this regard. Finally, data addressing surgical outcomes including positive margin rate in cSCC is also inconsistent. Planning, resourcing and improving outcomes in patients with cSCC in New Zealand is therefore difficult using currently available data.

Aim

The aim of this study was to define the incidence, characteristics and surgical outcome of cSCC diagnosed and treated in Northland, including data on ethnicity. This will allow age- and ethnicity-adjusted estimates of New Zealand population incidence.

Methods

Northland is a well-defined region in Northern New Zealand with a population of approximately 151,000 in 2015 (Data obtained from Statistics New Zealand). It is serviced by a single district health board through four hospitals which share the same data management system and pathology service. This includes all primary, secondary and private care pathology. Northland has double the national proportion of Māori, at approximately 30%, and a significantly older population with a higher representation in the over 50 age brackets.

Cohort selection

A 12-month retrospective study was carried out of all primary cSCC diagnosed in Northland for one year commencing 1 January, 2015.

The primary cohort consisted of consecutive diagnoses of primary cSCC diagnosed on punch biopsy or excision. Patients with a final diagnosis of squamous cell carcinoma in situ, even if a previous punch biopsy suggested cSCC, were excluded. Extended resections involving cartilage (excluding ear), bone or periosteum were included in incidence and lesion analysis but not included in margin analysis.

The primary cohort was identified by searching the Northland District Health Board pathology database and a database of outsourced pathological specimens using key terms. Together these databases contain all histological specimens processed in Northland, both public and private from primary and secondary care. The 15,719 pathology reports obtained from this search were manually screened to identify all cSCC. These patients were entered into a Microsoft Excel spread sheet. Demographic data was obtained from the district health board data warehouse, lesion characteristics were extracted from the pathology report and further information on secondary care excisions was obtained from the hospital results reporting system CONCERTO.

Histological specimens were stained with haematoxylin and eosin stain, fixed, and deep and lateral margins inked. Specimens were serially sliced in 2–3mm sections. Positive margins were defined as when tumour was present at the excised margin.

Biopsy was defined as histology obtained by punch biopsy or partial lesion excision before definitive excision. Lesions excised with positive or close margins without further intervention were classified as excisions.

Primary outcome of interest

The primary outcome of interest of the study was the crude and age-adjusted incidence of primary cutaneous squamous cell carcinoma in Northland, New Zealand. Secondary endpoints included positive margin rate at surgical excision.

Incidence analysis

Direct age standardised incidence was compiled using the World Health Organization (WHO) standard population. Estimates of population incidence corrected for age and ethnicity in New Zealand were calculated using direct standardisation of population age and ethnicity data from Statistics New Zealand during the same year. Socioeconomic deprivation was calculated through applying a patient's domicile address to the New Zealand Index of Deprivation (NZDep), which is an area-based

measure of deprivation based on census information. Quintile 1 represents people living in the least deprived 20% of areas; quintile 5 represents people living in the most deprived 20% of areas.

Statistical analysis

Data was analysed using Microsoft Excel and IBM SPSS. Descriptive statistics were used to describe basic demographics. Mann-Whitney U test was used to compare nonparametric data, and chi-square test to ascertain differences between categorical data. A p-value of <0.05 was considered significant.

The data used in this study was collected as part of a service evaluation of patients with suspicions skin lesions referred to Northland District Health Board. Data collection was discussed with the Health and Disability Ethics Committee and an "out of scope letter" obtained on 29 March 2016.

Results

Basic demographics and incidence

1,040 cSCC were identified in 890 unique patients. 819 lesions were surgically excised; 100 lesions contained cSCC on punch biopsy and further excision revealed no further tumour cells and 121 lesions were identified from punch biopsy, but had no recorded further excision. The latter group was included in incidence and demographic calculations, but because no formal excision had been completed they weren't included in surgical outcome or margin analysis.

The mean age of patients was 75 (SD 10.4). 54.9% of patients were aged over 75. There was slight gender preponderance with 60% of lesions diagnosed in males and 40% in females, giving a M/F ratio of 1.52:1 (See Table 1). Very few patients identified as Māori (1.0%).

Table 1: Demographics and tumour characteristics.

Patient demographics of 890 unique patients		
Mean age, years (range)		75 (33–100)
Sex, n (%)	Male	537 (60)
	Female	353 (40)
Ethnicity, n (%)	NZ European	881 (99)
	Māori	9 (1)
Socioeconomic deprivation, n (%)	Quintile 1	19 (2)
	Quintile 2	115 (13)
	Quintile 3	192 (22)
	Quintile 4	253 (29)
	Quintile 5	311 (35)
Multiple lesions	Multiple SCCs Excised, n (%)	107 (12)
	Mean cSCC per patient, n (range)	1.17 (1–6)
Tumour characteristics of the 819 formally excised cSCC		
Tumour size, mm, range	Mean tumour diameter	7.8 (0.65–50)
	Mean tumour thickness	2.77 (0.2–20)
Tumour factors ,n (%)	Perineural invasion	11 (1)
	Lymphovascular invasion	6 (1)
	Metastatic disease	10 (1)
Anatomical region, n (%)	Head and neck	384 (47)
	Trunk	73 (9)
	Upper limb	181 (22)
	Lower limb	178 (22)
	Not stated	3 (0)

Figure 1: Graph of crude incidence rate per 100,000 of cSCCs in Northland, 2015.

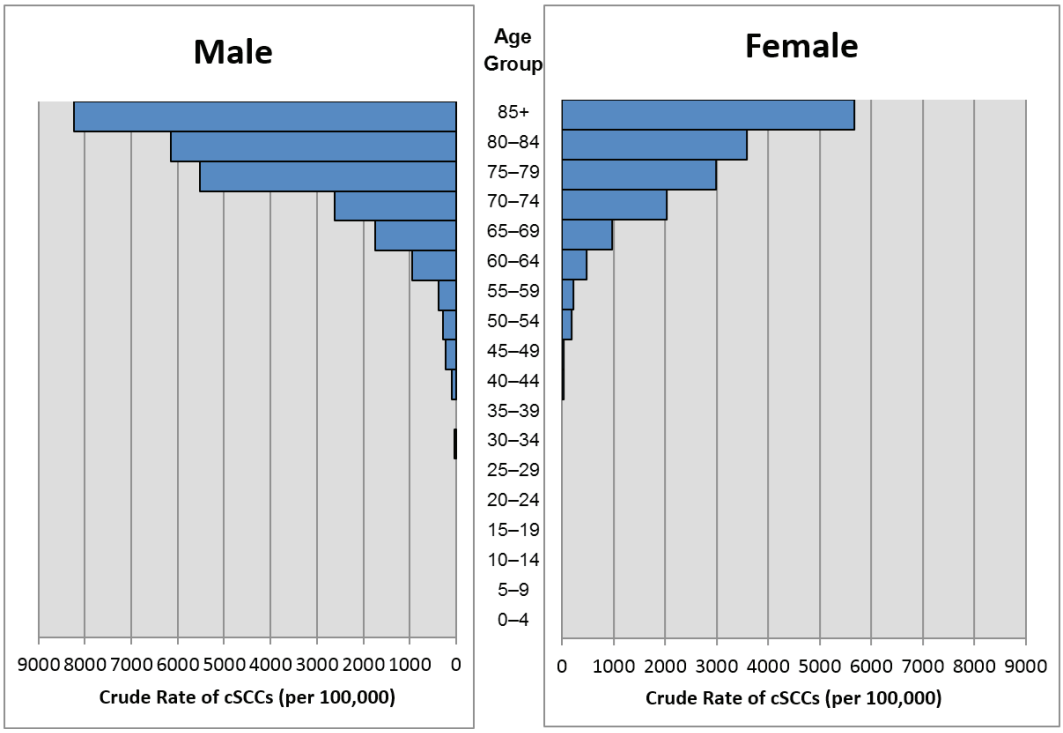


Table 2: Age distribution and incidence of cSCC.

	Number cSCC		
Age group (years)	**Male**	**Female**	**Total**
0–4	0	0	**0**
5–9	0	0	**0**
10–14	0	0	**0**
15–19	0	0	**0**
20–24	0	0	**0**
25–29	0	0	**0**
30–34	1	0	**1**
35–39	0	0	**0**
40–44	4	1	**5**
45–49	11	1	**12**
50–54	16	11	**27**
55–59	21	13	**34**
60–64	51	27	**78**
65–69	87	49	**136**
70–74	100	76	**176**
75–79	135	75	**210**
80–84	100	66	**166**
85 and over	92	104	**196**
Crude incidence (per 100,000)	817.3	527.4	**668**
NZ age standardised incidence (per 100,000)			**544**
WHO age standardised incidence (per 100,000)			**305**
NZ age + ethnicity standardised (per 100,000)			**580**
Expected lesions annually in NZ 2015			**24,605**

Based on a Northland population of 151,000 (2013 New Zealand census) the crude incidence of primary cSCC in this study was 668/100,000 patient-years. The age standardised incidence was 305/100,000 patient-years. Given Northland is a region that has a higher proportion of Māori, we standardised for age and ethnicity and extrapolated this to provide an estimate of national incidence, which was 580/100,000 patient-years. Age standardised rates increased with age, and were higher in males in all age groups (See Figure 1). Based on the New Zealand population, this equates to 24,605 new cSCC diagnosed in New Zealand each year (See Table 2).

Patients in the two least deprived quintiles were proportionally under-represented, forming 2 and 13% respectively of the study population. The three most deprived quintiles were markedly overrepresented; forming 85% of this population compared to the expected 60% of the national population. This follows the trend for the total Northland Regional Population where 82% of people belong to these most deprived quintiles.

Anatomical location and lesion characteristics

Almost half of the lesions were found above the level of the clavicle (47.1%) with the lower limb being the next most common location (24.6%) followed by the upper limb (18.7%) and trunk (8.3%). Anatomical location of the lesion was not stated in 0.3% of cases (Table 1).

There was a marked variation in pathologic reporting of lesions. Tumour size and thickness were recorded on the pathology reports of 581 (70.9%) of excised specimens. Mean size of excised lesions was 7.79mm, with a mean tumour thickness of 2.77mm. Eleven (1.13%) patients diagnosed had perineural invasion and six (0.73%) had evidence of lymphovascular invasion.

Details of surgical excision and outcome

Of the 819 surgically excised lesions, 433 (52.9%) were excised in primary care, 313 (38.2%) in secondary care and 73 (8.9%) by a private specialist. Twenty-two percent of lesions excised in secondary care were excised by a general practitioner with a specialist interest in skin cancer (GPwSI). Lesions in excised in primary care were more likely to have a smaller tumour diameter; 5.0mm vs 6.1mm (P<0.0001), smaller radial margin of excision; 2.2mm vs 3.0mm (P<0.0001) and less likely to be excised from the head and neck; 38.2% vs 57.1% (P<0.0001). There were no significant differences in histologic tumour thickness nor deep margins.

In the 232 lesions excised in hospital, 107 (46.1%) had an elliptical excision, 15% underwent a skin flap, 20% a full thickness skin graft and 11% a partial thickness skin graft. Twenty-five percent of patients had an excision in a formal theatre environment and 67% in a minor procedures room.

The overall positive margin rate of formally excised lesions was 9.5%. Superficial margins were positive in 3.1%, deep margins positive in 4.4% and both margins were positive in 2.1% of lesions.

Discussion

This study has assessed the rate of cutaneous squamous cell carcinoma in a large, well-defined New Zealand population, and provided estimations of age- and ethnicity-adjusted incidence in New Zealand. It has demonstrated the highest incidence of cSCC in the world outside Australia. Overall positive margin rate in excised lesions was acceptable.

A recent systematic review of the incidence of non-melanoma skin cancer has demonstrated wide geographical variance in incidence, with the lowest rates seen in Croatia and the highest rates seen in Australia.[17] It is unfortunate that no New Zealand studies were included in the review. Three previous studies have, however, examined incidence of cSCC in New Zealand. O'Dea in a report to the Cancer Society in 2009 estimated both incidence and total number of New Zealand cSCC diagnosis by applying findings from a 1998 Bay of Plenty to a 2007 population profile.[3] His findings, although not adjusted for ethnicity, were similar to those that we present, with crude rate of 628/100,000, age-adjusted rate of 377/100,000 and national annual estimation of 23,100 lesions.[3] These estimations are significantly higher than both those seen in a study published a year later by Brougham et al examining pathology reports of over 13,000 patients during a 10-year period, as

well as those demonstrated in the Hamilton area in 1982 by Freeman and Fairbrother.[8,16] Both these studies estimated below 8,000 new cSCC in New Zealand per year. The latter study used methodology that likely missed diagnosis of cSCC and is now over 30 years old. The reasons for these differences seen in the former study are unclear, but it is likely that several factors are involved. Firstly, historical data tends to underestimate current incidence.[3] Secondly, as ethnicity was not considered in the study it is likely that the true adjusted rate was underestimated due to the extremely low rate of NMSC in people of Pacific and Māori descent. Finally, it is possible that the methodology did not effectively capture all diagnosed cSCC.

The crude and absolute rates that we present are approaching the rates seen in population studies in Australia, with comparable rates in Caucasian males.[18] As ultraviolet radiation is the commonest environmental cause of cSCC, with areas of similar latitude and high population rate of European descent, this would be expected.[19] The demographics we present are also in keeping with those seen around the world, with an incidence increasing with age, a male predominance in all age groups and a high proportion of lesions seen on the head and neck.[19–20] The majority of patients are Caucasian, with an extremely low rate in other ethnic groups.

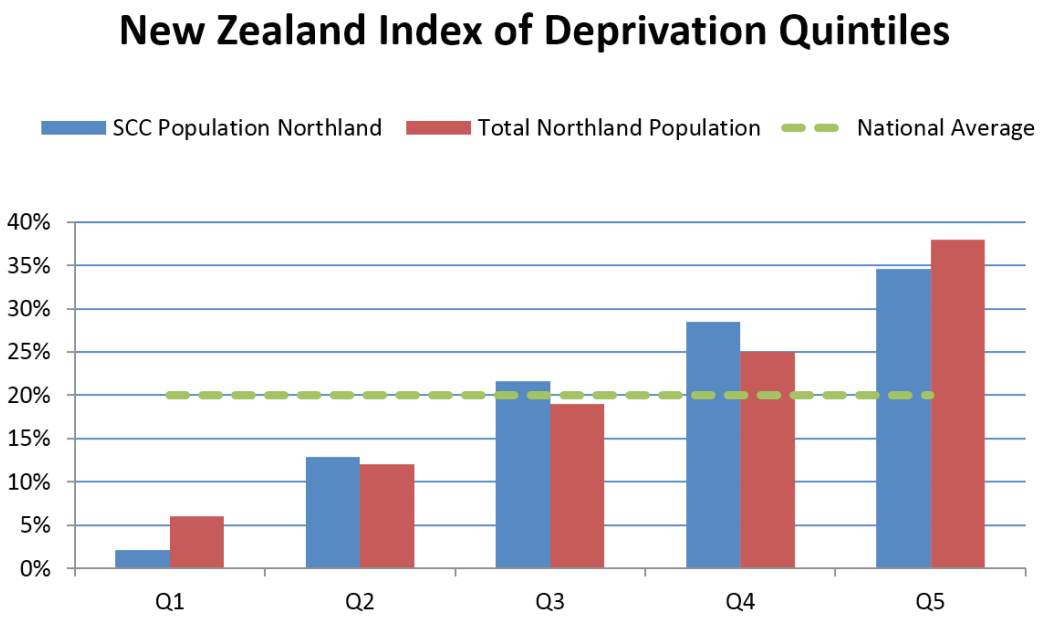
Although retrospective in nature, this study identified a large number of pathology reports using broad search terms. Every diagnosis entered had histological confirmation of cSCC. It is likely therefore that the absolute number of cases identified represents a “minimum” number for the population. It is possible that cases in which a patient travelled out of region for treatment were missed, but it is likely that this number is small. It is also possible that there is a variation in the incidence of cSCC across the country due to regional differences in levels of UV radiation and that this affects our estimations of population incidence. However, this is difficult to control due to lack of regional radiation data as UV index is only consistently measured at five stations across the country with the most northern station located in Leigh.

It is however, the first large study in New Zealand to utilise data on ethnicity. We believe therefore that the data presented allow the most accurate assessment to date of the incidence of cSCC and total lesion count in New Zealand. It is expected that this data will therefore help guide future planning and resource allocation on both a local and national level.

The overall incomplete excision rate at 9.5% was comparable to that in the worldwide literature. There is however, a wide variation in outcomes with a recent review demonstrating positive margin rates of between 6.3% and 17.6%.[21–25] The rate published here is however, significantly lower than that seen in the most recent New Zealand study of 1,100 malignant skin cancer excisions from Bay of Plenty, where the incomplete excision rate in GPs was 23% and specialist surgeons 20%.[26] This discrepancy is most likely due to inclusion of cSCC in situ.

In short, this study has demonstrated a high age and ethnicity adjusted incidence of cSCC in a large New Zealand population with an acceptable positive margin rate.

Supplementary Figure 1: Socioeconomic deprivation of patients undergoing excision of cSCC.



Competing interests:
Nil.

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