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Excision pathways for keratinocyte cancers diagnosed by teledermatology: a retrospective review

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ABSTRACT

Introduction. The New Zealand population has one of the highest incidences of skin cancer in the world. Hospital waiting lists for surgical excision of keratinocytic skin cancers (basal cell carcinoma and squamous cell carcinoma) are lengthy, and increasingly, excisions are undertaken in primary care. Teledermatology, in response to general practitioners' electronic referrals (e-referrals), can improve clinical communication between general practitioners and dermatologists. **Aim.** The aim of this study was to evaluate an excision pathway for keratinocytic cancers diagnosed by teledermatology. **Methods.** A retrospective observational descriptive review of a 3-month cohort of primary care e-referrals was undertaken. **Results.** Three hundred and fifty eight suspected keratinocytic cancers (KCs) were diagnosed by teledermatology; histology reports confirmed KC in 201 of 267 excisions (75%). The majority (77.2%) were excised by general practitioners an average of 25 days after the dermatologist's recommendation. The rest were excised by plastic surgeons in private (3.4%) or at a public hospital (19.5%) after an average of 40 or 134 days, respectively. **Discussion.** E-referral pathways are now widely implemented. However, the ideal workflow for skin cancer management is unknown. We have demonstrated in New Zealand that surgery can be undertaken in primary care within a month of a teledermatology diagnosis and excision recommendation. **Conclusion.** This study reports prompt excision of KCs by general practitioners after an e-referral and a teledermatology response.

Keywords: basal cell carcinoma, dermatologists, general practitioners, New Zealand, primary care, referrals, Skin cancer, squamous cell carcinoma, workflow.

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Introduction

The 'nonmelanoma' skin cancers are predominantly keratinocytic cancers (KCs): basal cell carcinoma (BCC) and cutaneous squamous cell carcinoma (SCC). With an increasingly aged and sun-damaged population, excision of these tumours increases the burden on hospital surgical services. In Aotearoa New Zealand (NZ), more than 70 000 individuals were estimated to have been diagnosed with invasive KC in 2013, and 80 000 people were expected to be diagnosed in 2018 when the population was 4.9 million.[1] More than one-third of patients with KC will develop at least one other KC over their lifetime.[2] Diagnosis, treatment, and follow-up of KC are costly to the individual and public and private health services. The healthcare costs for new patients presenting with KCs were estimated to be NZ$ 129.4 in 2021.[3]

Several approaches to publicly funded skin cancer surgery in primary care have been initiated in NZ.[4–7] E-referrals and teledermatology responses showed improved timeliness for melanoma surgery in primary care compared to hospital services in the Waikato.[4] The Canterbury Initiative increased skin cancer surgery in primary care with a coordinated approach, including practical training, HealthPathways guidelines and e-referrals, and funding.[5] A teledermoscopy service supports Waitematā's e-referrals for suspected skin cancers, and many lesions are triaged to specialist-trained GPs for excision.[6,7] Pathways to skin cancer diagnosis and management vary throughout NZ; Te

WHAT GAP THIS FILLS

What is already known: Keratinocytic cancers are increasing worldwide. Teledermatology is a valuable tool for communication between general practitioners, dermatologists, and plastic surgeons.

What this study adds: It describes the teledermatology diagnosis of 358 suspected keratinocytic cancers after e-referral, and pathways to excision by general practitioners, dermatologists, and plastic surgeons.

Whata Ora does not employ dermatologists or plastic surgeons in all districts, and the training and surgical skills in primary care vary.

Teledermatology is also internationally recognised as an important form of healthcare delivery for diagnosing skin cancers.[8,9]

In the Waikato district, general practitioners (GPs) can refer patients with lesions suspicious of skin cancer to Dermatology for advice via a Suspected Skin Cancer pathway.[4] During 2022, an average of 345 e-referrals were received each month for one to five specified lesions. Completing a lesion-specific template and attaching regional, close-up, and dermoscopic images are mandatory. The dermatologist responds with advice and treatment recommendations for each lesion. The main treatment for KC is complete surgical excision. [10] In NZ, GPs may undertake the surgery or refer to a plastic surgeon, dermatologist, or other specialist in a public hospital (where treatment for accepted patients is free) or in a private setting (insurance or self-funded).

This study's primary objective was to determine the local excision pathways for KCs diagnosed by teledermatology after e-referral. The secondary objective was to determine how many suspected KCs were excised after a dermatological recommendation, by whom, and how long patients waited for their initial surgical procedure.

Methods

The study was registered with the local Clinical Audit Support Unit (4382P). It was a retrospective observational descriptive evaluation of primary care e-referrals received in one health district from 1 March 2022 to 31 May 2022 coded C449 (ICD-10 AM) by one of four teledermatologists. For each e-referral, we identified lesions diagnosed as KC and excluded non-KC.

We recorded demographic data (gender, age, ethnicity), the number of KCs per e-referral, clinical data (lesion location, referrer's diagnosis, dermatologist's diagnosis, and treatment recommendation), and the average response time. Using the hospital's and private laboratory's electronic records, we found the date of excision, histological report (histological diagnosis, completeness of excision and distance from the lateral and deep excision border to the tumour), and the identity of the surgeon.

Data were collected using a Microsoft Excel spreadsheet for descriptive statistical analysis. An ethics review is not required in NZ for a clinical audit.

Results

Demographic data (Table 1) were determined from all e-referrals coded as C449, which included 322 patients with an average age of 72.5 years (31–99); 45.03% were female with an average age of 73.7 years and 54.97% were male with an average age of 72.0 years. Ethnicity was most often recorded as NZ European (88.20%), other European (7.14%), or Māori (2.80%). The e-referrals recorded that 44.72% of patients had a history of skin cancer, more commonly in males (45.70% of males) than in females (43.50% of females). The average time for the dermatologist to respond to the referral was 13 days.

Clinical data (Table 2) were determined for 358 lesions in 310 referrals after excluding incorrectly coded clinical diagnoses. Body location was selected using a drop-down menu, most often head and neck (36.59%), arm and hand (20.39%), or lower leg and foot (15.36%) and less often on the torso, back, thigh, and buttock. Lesions on the head and neck were most often on the nose, followed by the neck, mandibular area, forehead, ear, and scalp.

Table 1. Demographic data.

	N (322)	Frequency (%)	Age (mean, median, range)
Sex			
Male	177	54.97	72.0, 74, 31–94
Female	145	45.03	73.7, 74, 34–99
Ethnicity			
European – NZ	284	88.20	
European – Other	23	7.14	
Māori – NZ	9	2.80	
European – not further defined	3	0.93	
Latin American/ Hispanic	1	0.31	
African	1	0.31	
Not stated	1	0.31	
Skin cancer history			
No	178	55.28	
Yes	144	44.72	

NZ, New Zealand.

Table 2. Lesion data.

	N (358)	Frequency (%)
Location of lesion		
Head and neck	131	36.59
Arm and hand	73	20.39
Lower leg foot	55	15.36
Back	43	12.01
Torso	38	10.61
Thigh and buttock	18	5.03
Referrer's diagnosis		
SCC	165	46.09
BCC	145	40.50
Unknown	26	7.26
Seborrhoeic keratosis	6	1.68
Other	6	1.68
Melanocytic naevus	5	1.40
Melanoma	4	1.12
Bowen disease	1	0.28
Dermatologist's diagnosis		
SCC	165	46.09
BCC	158	44.13
Keratinocytic skin cancer	35	9.78
Dermatologist recommendation		
Excision	350	97.8
Topical treatment	3	0.84
Biopsy or monitor	2	0.56
Biopsy	1	0.28
Cryosurgery or topical treatment	1	0.28
Radiotherapy or monitor	1	0.28

SCC, squamous cell carcinoma; BCC, basal cell carcinoma.

The referrer diagnosis was most often SCC (46.09%) or BCC (40.50%). Other suspected diagnoses included seborrhoeic keratosis, melanoma, melanocytic naevus, SCC *in situ*, wart, unknown, or other. The dermatologist diagnosed SCC (46.09%), BCC (44.13%), or keratinocytic skin cancer (9.78%) when either SCC or BCC was likely. Diagnostic concordance between referrer and dermatologist was 73.9% for SCC and 67.0% for BCC.

Excision was recommended for 350 lesions (97.8%) in 302 patients. Other treatment suggestions were to monitor, topical treatment (usually imiquimod), incisional biopsy, radiotherapy, and cryosurgery. The flowchart (Fig. 1) demonstrates the pathway and timeliness of the lesions. A total of 267 excisions were completed, while 83 excisions were not carried out (Supplementary Table S5). Most excisions

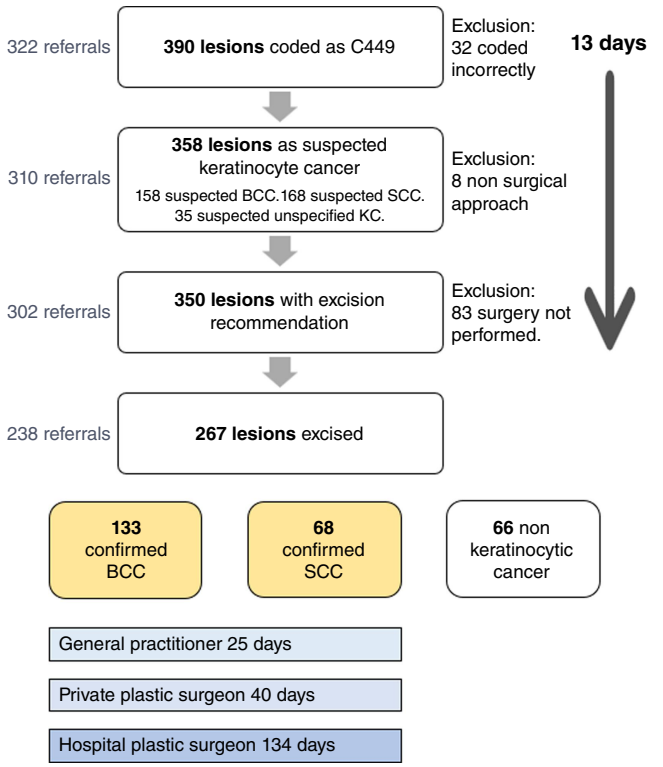

Fig. 1. Flowchart showing keratinocyte cancer excision pathways after teledermoscopy diagnosis. BCC, basal cell carcinoma; SCC, squamous cell carcinoma; KC, keratinocytic cancer.

Table 3. Excision performance.

	N (267)	Frequency (%)	Days to excision
Type of practice			
Primary care	206	77.15	25.2
Hospital Department of Plastic Surgery	52	19.48	133.8
Private plastic surgeon	9	3.37	39.6
Laboratory			
Private	215	80.52	
Hospital	52	19.48	

N, number of lesions.

were performed by GPs (77.15%) after an average of 25.2 days, excluding 20 excisions in primary care before receiving the dermatological recommendation. The rest were performed by the plastic surgical department (22.85%) in a public hospital (19.48%) or plastic surgeons in a private clinic (3.37%) after an average of 133.8 and 39.6 days, respectively. Excision specimens were analysed by a private laboratory (80.52%) or by the public hospital laboratory (19.48%) (Table 3).

Table 4. Dermatological and histological diagnosis, and concordance.

Dermatological and histological diagnosis	*N* (267)	Frequency (%)	Concordance (%)
Dermatologist diagnosed SCC	129	48.31	
SCC	63	23.60	48.8
BCC	17	6.37	
Solar keratosis	15	5.62	
Seborrhoeic keratosis	7	2.62	
In situ SCC	7	2.62	
Epidermal inclusion cyst	4	1.50	
Wart	3	1.12	
Scar	3	1.12	
Lichen planus-like keratosis	2	0.75	
Dermatofibroma	1	0.37	
Hyperkeratosis, chronic folliculitis	1	0.37	
Hyperkeratosis, possible porokeratosis	1	0.37	
Melanoma	1	0.37	
Prurigo nodularis	1	0.37	
Solar elastosis	1	0.37	
Solar keratosis with lichen planus-like inflammation	1	0.37	
Vascular malformation	1	0.37	
Dermatologist diagnosed BCC	116	43.45	
BCC	102	38.20	87.9
SCC	3	1.12	
Dermatofibroma	2	0.75	
No evidence of malignancy	2	0.75	
Dermal fibrosis	1	0.37	
In situ SCC	1	0.37	
In situ SCC and seborrhoeic keratosis	1	0.37	
Scar	1	0.37	
Seborrhoeic keratosis	1	0.37	
Solar keratosis	1	0.37	
Superficial leiomyosarcoma	1	0.37	
Dermatologist diagnosed keratinocytic skin cancer	22	8.24	
BCC	14	5.24	72.7
Solar keratosis	4	1.50	
SCC	2	0.75	72.7
In situ SCC	2	0.75	

N, number of lesions; SCC, squamous cell carcinoma; BCC, basal cell carcinoma.

Histology reports of the 267 excisional biopsies included 201 KCs (75.3%): 68 SCCs and 133 BCCs (Table 4). The teledermatologist diagnosis was concordant with histology in 181 lesions (67.8%), being higher for BCC (87.9%) than SCC (48.8%) (Table 4). The distance of the tumour from the nearest resection lateral and deep border in millimetres (mm) was recorded for confirmed KCs. Details of excision margins have been previously reported.[11]

Discussion

We have described a successful e-referral pathway in one health district between GPs and teledermatologists for managing KCs. There was diagnostic concordance between the referrer and responding dermatologist in more than two-thirds of lesions, reflecting good knowledge and skills in primary care. GPs performed most of the excisions within a month of referral. In 20 cases, this was before the response had been received, which may have been due to perceived urgency or convenience.

There is growing interest in implementing teledermatology for the diagnosis of skin cancer.[12] In many reports, teledermatology has shown a higher sensitivity for cancer detection than face-to-face examination, providing high-resolution images are received, including dermoscopy images.[12] Our teledermatologists' diagnostic uncertainty was mainly due to referrer nonadherence to the e-referral requirements for regional, close-up, and dermoscopy images of high resolution ($>2000 \times 1500$ pixels), in focus, well-lit, and with a plain background.

Three-quarters of the lesions were excised in primary care, including some high-risk lesions on the head and neck. Patients waited an average of 108 days longer to have an excision undertaken at the public hospital than in primary care. Using GP skin surgeons to excise KCs mitigates the long waitlists for hospital surgical excision. Treatment in primary care may incur costs to the patient and a higher risk of the surgery being incomplete, with our study finding that 15 of 201 KCs were incompletely excised in primary care, necessitating further treatment.[11] We recommend following the minimal clinical margin guidelines of 4 mm for SCC and 3 mm for BCC.[13–15]

An analysis of why surgery was not performed in 23.71% of lesions when recommended is out of scope for this study as we did not have access to the primary care records. Eight lesions were treated non-surgically in primary care despite the dermatologist recommending excision, and 20 lesions were excised before the recommendation was received.

Conclusion

We have described a collaborative skin cancer workflow in one health district in New Zealand using teledermatology responses to e-referrals made by general practitioners. Teledermatology is unavailable in many districts of NZ where there is no dermatologist or other expert in skin cancer diagnosis. Referrers to a teledermatology service should be provided with a template to remind them to include relevant patient risk factors and lesion characteristics. To optimise diagnostic quality, they should attach high-resolution, regional, close-up, and dermoscopy images. Excision is usually recommended for suspected KC. General practitioners play an essential role in carrying out most surgeries within a month of the recommendation. They should be trained, credentialed according to their skills, and follow surgical guidelines.

Supplementary material

Supplementary material is available online.

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Data availability. Anonymised data used to generate the results in the paper are available and can be provided upon request.

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