Strategies to address the skin cancer crisis in New Zealand due to baby-boomers' outdoor lifestyles. The Future is Here.

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Abstract

Changing demographics mean older people comprise a greater proportion of the New Zealand population in 2018 than in earlier years. Fair skinned, sun-damaged older people are presenting with skin cancer in unprecedented numbers. The dermatology workforce in the public sector has not increased to meet demand. Diagnosis of melanoma is difficult, leading to delayed diagnosis and unnecessary excisions of benign lesions. Implementation of nationwide teledermoscopy services and development of decision support tools using artificial intelligence can mitigate the looming skin cancer crisis.

The skin cancer problem

A baby boomer is a person born in the years following the Second World War, when there was a temporary marked increase in the birth rate. Health care costs are expected to soar as baby boomers reach retirement age. Our baby-boomer generation is predominantly of European origin, with 508,509 claiming this ethnicity and over the age of 65 years according to the 2013 Census (Stats NZ Ethnicity tables). A constrictive New Zealand population pyramid in 1994 has evolved to a stationery pyramid in 2018, common to other developed countries. Just examining a single age-band, we can see an increase of 89% in those aged 65–69 years between 1994 (130,565, 1.8% of the whole population) and 2018 (236,175, 2.5%) (populationpyramid.net). The current life expectancy for a female (male) now aged 65 is 90 years (87 years) (Stats NZ, How long will I live).

Many of the baby boomer generation are fair skinned. Sun bathing and working outdoors was prevalent for young adults in the 1960s and 1970s, who sustained multiple sunburns. Ultraviolet radiation (UV) from sunlight is the major environmental cause of skin cancer, although melanoma, basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) are associated with different patterns of UV exposure (Savoye et al, 2018).

New Zealand's Cancer Register reports first diagnosis with invasive melanoma. Reliable data is available since 1996, when 1,585 melanomas were recorded and the age-standardised rate (ASR) was 38.0 per 100,000 population (Ministry of Health, historical summary). The ASR is reported to be 35.4 in the latest data from 2015, when there were 2,424 melanomas, a 63% increase in total registrations (Ministry of Health, 2015). During the same period, the population of New Zealand rose from 3.62 to 4.60 million, a 27% increase (Stats NZ, population).

One of the main reasons for the increase in absolute numbers of melanoma is the steep rise in the incidence in melanoma with age, particularly over 60 years. In 2015, there were 331 melanomas in those aged 70–74 years, compared to 194 in those aged 50–54 years (Ministry of Health, selected cancers). Skin cancer in older people is due to exposure to UV and immune suppression due to age, diseases and drugs.

The Cancer Register reports first diagnosis of invasive melanoma. Similar numbers of melanoma in situ are diagnosed. About 10–15% of patients are diagnosed with multiple tumours.

We can conservatively estimate somewhere between 20,000 and 100,000 excisions are performed for suspected melanoma, and this year over 5000 will prove to be melanoma or melanoma in situ. We don't actually know how many unnecessary surgeries of benign lesions suspected to be melanomas there are. The benign to malignant ratio varies from two to five-to-one in the best dermatology centres. Approximate 50% of primary melanoma is diagnosed in primary care, where the ratios may be 20-to-1 or greater.

Statistics are not kept for BCC and SCC. It is projected that over 90,400 people will be diagnosed with invasive and in-situ keratinocytic cancer during 2018, with 230,625 diagnoses (Sneyd, 2018). As superficial BCC, SCC in situ and actinic keratoses may be treated topically or by cryotherapy, the actual figures may be much greater. Southern Cross, the country's largest private health-care insurer, paid out on 3.1 million claims for skin-lesion removal in 2015 (Chisholm, 2016).

A typical skin cancer "journey" requires multiple appointments and procedures. Complications are more frequent in older people, adding to morbidity and expense.

Strategies to address the skin cancer problem

In 2012, the Ministry of Health in New Zealand convened Cancer Tumour Stream boards to develop Standards for the care of patients with specific tumours, including melanoma. Published standards remain provisional (Ministry of Health, 2013). They were intended to improve timely access to services and other aspects of cancer care. The regional cancer networks are auditing district health boards (DHBs) against the standard by reviewing the DHB's current service delivery (2018). Prolonged wait times remain usual for melanoma patients to be seen in outpatients and receive surgery (Brian et al, 2017).

Timeliness of access to treatment services is hard to achieve with insufficient numbers of surgeons and operating theatres. Some DHBs have established GP skin cancer surgery services for straightforward procedures.

To date, diagnostic services for early detection of primary melanoma have received scant attention from the Ministry of Health. Although diagnosis of BCC and SCC is relatively straightforward, melanoma is difficult. Dermatologists receive extensive training and are expert in diagnosis of skin cancer, with fewer unnecessary excisions of benign lesions compared to other occupational groups. But a Health Workforce service forecast found that there

was only one dermatologist in the public sector for every 274,000 people (Ministry of Health, 2014). We depend on well-trained GPs to detect and treat skin cancers early. Yet, very little time is devoted to dermatology in medical school (typically, a few hours in 4th year) or in the GP training scheme. There is also a pending workforce crisis in primary care.

Accurate diagnosis of skin lesions depends on dermoscopy, a skill that requires training, practice and experience. Very few GPs are skilled dermoscopists, although many now attend beginner courses. Teledermoscopy is the use of information and communication technology to consult an expert in dermoscopy. Private teledermoscopy services started in 1997 and report low benign to malignant ratios on biopsy, and thinner melanomas compared to Cancer Register data (MoleMap New Zealand, 2014). Virtual lesion clinics using dermoscopy, introduced by Waikato DHB in 2010 and Waitemata DHB in 2012, result in efficiencies and cost savings (Lim et al, 2012; Congalton et al, 2015).

The virtual lesion clinic at Waikato DHB is now supplemented by a direct-from-GP teledermoscopy eTriage service. Enthusiastic uptake by referring GPs resulted in 91 referrals in February 2018. Quality of images and referral data is undergoing evaluation. Benefits include fast response, education, and diagnostic accuracy leading to fewer excisions and referrals to specialist care. Improvements to software and referrer training should lead to gains in efficiency.

Artificial intelligence (AI) offers hope for more reliable diagnosis of skin cancer. Current research efforts with deep machine learning are resulting in impressive skin cancer classification (Esteva et al, 2017). The International Skin Imaging Collaboration (ISIC) is a collaborative effort that hosts a large collection of dermoscopic images and encourages research and competition in machine learning (ISIC, 2017).

Skin cancer AI algorithms are already available to patients, for example the Skin Vision smart device application, whose algorithm based on fractal analysis detects irregularities in images of skin lesions (Skin Vision, 2018). Health professionals may use skin lesion software powered by a reliable image classifier (DermEngine, 2018). MoleMap NZ is collaborating with IBM Watson to reduce error and increase specificity in diagnosis of melanoma (IBM, 2018).

Development requires investment, millions of images of skin lesions, and international collaboration. DermNet, winner of the Ministry of Health's Clinicians' Challenge Active Project 2017, welcomes the new era of machine learning (DermNetNZ.org).

References

Ethnicity tables. Stats NZ. Available at: http://nzdotstat.stats.govt.nz/wbos/Index.aspx.

Populationpyramid. Net, Population Pyramids of the World from 1950 to 2100. Available at: https://www.populationpyramid.net/new-zealand/

How long will I live. Stats NZ. Available at: http://archive.stats.govt.nz/browse_for_stats/health/life_expectancy/how-long-will-I-live.aspx.

Savoye I, Olsen CM, Whiteman DC, et al. Patterns of Ultraviolet Radiation Exposure and Skin Cancer Risk: the E3N-SunExp Study. *Journal of Epidemiology*. 2018;28(1):27-33. doi:10.2188/jea.JE20160166. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5742376/.

Population. Stats NZ. Available at: https://www.stats.govt.nz/topics/population

Cancer: Historical summary 1948–2013. Ministry of Health. Available at: https://www.health.govt.nz/publication/cancer-historical-summary-1948-2013.

New cancer registrations 2015. Ministry of Health. Available at: https://www.health.govt.nz/publication/new-cancer-registrations-2015

Selected cancers 2013, 2014, 2015. Minsitry of Health. Available at: https://www.health.govt.nz/publication/selected-cancers-2013-2014-2015.

Sneyd MJ, Gray A. Expected nonmelanoma skin (keratinocytic) cancer incidence in New Zealand for 2018. Wellington: Health Promotion Agency 2018.

National tumour standards. Ministry of Health. Available at: https://www.health.govt.nz/our-work/diseases-and-conditions/cancer-programme/faster-cancer-treatment-programme/national-tumour-standards.

Brian T, Adams B, Jameson M. Cutaneous melanoma: an audit of management timeliness against New Zealand guidelines. N Z Med J. 2017 Sep 22;130(1462):54-61. PubMed PMID: 28934768.

Chisolm D. Are some doctors cashing in on our melanoma fears by offering unnecessary surgery? Listener, 05 August, 2016. Available at http://www.noted.co.nz/health/health/are-some-doctors-cashing-in-on-our-melanoma-fears-by-offering-unnecessary-surgery/.

Dermatology workforce service forecast. Ministry of Health, 2014. Available at: https://www.health.govt.nz/our-work/health-workforce/workforce-service-forecasts/dermatology-workforce-service-forecast.

The MoleMap Story. MoleMap New Zealand 2014. Available at https://molemap.co.nz/real-story/.

Lim D, Oakley AM, Rademaker M. Better, sooner, more convenient: a successful teledermoscopy service. Australas J Dermatol. 2012 Feb;53(1):22-5. doi: 10.1111/j.1440-0960.2011.00836.x. Epub 2011 Dec 29. PubMed PMID: 22309326.

Congalton AT, Oakley AM, Rademaker M, Bramley D, Martin RC. Successful melanoma triage by a virtual lesion clinic (teledermatoscopy). J Eur Acad Dermatol Venereol. 2015 Dec;29(12):2423-8. doi: 10.1111/jdv.13309. Epub 2015 Sep 15. PubMed PMID: 26370585.

Esteva A, Kuprel B, Novoa RA, Ko J, Swetter SM, Blau HM, Thrun S. Dermatologist-level classification of skin

cancer with deep neural networks. Nature. 2017 Feb 2;542(7639):115-118. doi: 10.1038/nature21056. Epub 2017 Jan 25. Erratum in: Nature. 2017 Jun 28;546(7660):686. PubMed PMID: 28117445.

ISIC, the International Skin Imaging Collaboration. Available at https://isic-archive.com/.

Skin Vision program. Available at: https://www.skinvision.com.

Visual Search, by MetaOptima. Available at: https://www.dermengine.com/en-ca/visual-search.

Outthink melanoma. Watson is learning to help clinicians save more lives. IBM. Available at: https://www.ibm.com/cognitive/au-en/melanoma/.

Clinicians' Challenge 2017. Ministry of Health. Available at: https://www.health.govt.nz/our-work/ehealth/other-ehealth-initiatives/clinicians-challenge-2017.