

Shining a light on sunbeds



The attitudes of NZ
youth to sunbed use
and tanning

by

Wellington School of Medicine

Med 4

Public Health Project

Sunbed Tanning and New Zealand Youth 2011

Written by

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ABSTRACT

Introduction

Whether or not sunbeds cause adverse or beneficial health outcomes is a topic for debate. Parties on both sides claim to have superior evidence. In New Zealand, there is a voluntary code which recent research suggests is not being followed by sunbed operators. We looked at the current picture of sunbeds within New Zealand, with a particular emphasis on young people's attitudes towards tanning and sunbed use.

Methods

We carried out a literature search and employed a survey with both qualitative and quantitative components. We also carried out interviews with those involved in the field.

Results

Whilst benefits can be received from sunbeds, we found that the harms far outweighed them. We also found that knowledge of sunbed risk does not inform the choice to use a sunbed and that young people in the Wellington region would most prefer advice about tanning from their doctor.

Conclusions

The level of sunbed regulation needs to be changed in New Zealand to bring it in line with the rest of the world and to keep sunbed users informed and as safe as possible. This includes putting into legislative law that people under the age of 18 should not be allowed to use sunbeds and that sunbed operators be properly trained in the risks of using a sunbed.

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INTRODUCTION

Melanoma and other skin cancers make up a substantial burden of disease in New Zealand [1]. In addition to this being caused by our country's high levels of ambient ultraviolet radiation, studies have shown statistically significant evidence that the use of sunbeds can also increase risk of skin cancers [2, 3]. In spite of this, the sunbed industry for cosmetic purposes continues to grow, attracting the majority of its clientele from the demographic of young, affluent females [4].

As a result, in 2002 the Australian New Zealand Standards Authority issued a voluntary code, later updated in 2008, detailing both behavioural and technical guidelines [5] with which the industry could comply in order to provide their service in the safest manner possible. However an investigation run by the Consumer Institute in 2009 found compliance to be extremely poor amongst the vast majority of sunbed outlets [6]. This gives rise to another deliberation in New Zealand over whether this indicates a necessity to change the voluntary status of the Code and make it legally enforceable. Already the Standard has been made law in Australia [7].

Conflicting opinions on sunbeds abound. Some tout their advantages in combating vitamin D deficiency [8], increasing mental wellbeing and the aesthetics of a tan. Those against the use of sunbeds reiterate their association with risks of skin malignancies [2, 3].

Given that the majority of sunbed users are youth, many studies have investigated the knowledge and attitudes of young people towards the use of sunbeds. The outcomes have suggested, surprisingly, that in spite of the fact that young people are generally well informed on the risks of sunbeds, their behaviours often tend to conflict with their knowledge [9].

Sunbed tanning is thought to be a cause of melanoma and non-melanoma skin cancer. The sunbed industry is growing, yet showing poor compliance to safety measures within the voluntary guidelines. Therefore, it is of concern that little research has been conducted in New Zealand capturing the knowledge, attitudes and behaviours of youth toward this potentially harmful activity.

Overall Aims

In addressing these issues the study has the following overarching objectives:

1. To complete a literature review concerning:
 - a. The potential health impacts of sunbed use
 - b. The attitudes of youth toward sunbeds from international studies
 - c. The regulatory framework surrounding the industry both in New Zealand and overseas, with a particular focus on the system in Australia.
2. To complete a sample based survey of Wellington youth (aged 15-25) in order to yield information about their knowledge of the risks, attitudes toward, and use of sunbeds.
3. To interview people in the field on their views about sunbed practices in New Zealand.
4. To develop recommendations based on the results of our research.

Key Research Questions

The following key research questions will be answered in addressing the objectives stated above:

1. Currently, what are the regulations and laws regarding the sunbed tanning industry both in New Zealand and internationally?
2. What are the attitudes of young people about sunbeds and how does this inform their behaviour?
3. What are the potential harms and benefits of sunbed tanning?
4. Should any changes be made to the sunbed tanning industry in order to ensure the safety of New Zealand youth?

Report Structure

In attempting to answer these key research questions the report is divided into four parts:

Part One: Review of the Literature on Sunbed Tanning

The first part of this report is divided into five sections the first of which attempts to address our first research question by providing a brief overview of current New Zealand sunbed tanning regulations and guidelines before contrasting these with regulations currently in effect internationally. Sections two and three evaluate the current evidence available on the potential harms and benefits to health associated with sunbed use. Section four reviews the literature on attitudes and behaviours related to youth sunbed use before a summary of the main findings in section five.

Part Two: The Sunbed Tanning and Wellington Youth Survey

The second part of the report is an attempt to discover the knowledge, attitudes and use of sunbeds by Wellington youth. There are four sections beginning with a brief introduction to the rationale for completing a survey of Wellington youth. The method of information gathering in section two describes how the survey (electronic and paper) was developed and utilised for the study. Section three presents the findings of the survey on the knowledge, attitudes and sunbed use of study participants before discussing these findings as they relate to key research questions three and four in the final section.

Part Three: Semi-Structured Interviews

Part three reports on the consultation with members of the medical community including two dermatologists and one general practitioner. The rationale for inclusion of members from the medical community to provide feedback on current sunbed regulations is presented before a brief section detailing the method of interview development is given. Findings in relation to their views on the potential harms and benefits of sunbed tanning as well as their recommendations are then presented.

Part Four: Conclusions, Limitations, Recommendations and Implications of Research

The fourth and final part of this report reviews the overall findings of parts one, two and three in relation to the overarching aims and key research questions posed above. Concluding remarks about the current regulations to protect the public and youth in particular, are made followed by a discussion of the limitations of this research. The report closes with a set of recommendations to address some of the risks of sunbed use among New Zealand youth.

PART ONE:

REVIEW OF THE LITERATURE ON SUNBED TANNING

LITERATURE SEARCH STRATEGY

The value of undertaking practical research into the risks associated with a softly regulated sunbed tanning industry in New Zealand was assessed via review of published literature related to sunbed tanning. The review was split into 4 main areas:

1. Currently, what are the regulations and laws regarding the sunbed tanning industry both in New Zealand and in overseas countries?
2. What are the potential harms of sunbed tanning?
3. What are the potential benefits of sunbed tanning?
4. How do the behaviours of youth, in New Zealand and overseas, correlate with their knowledge and attitudes towards sunbeds?

The Literature review is presented in five sections, the first four corresponding to each of the areas above with the final providing a summary of the overall findings. The search strategies used by investigators are below (note: all searches were limited to articles in the English language).

1. Current Legislation Internationally

A grey literature search was completed concerning legislation and regulations of sunbed tanning within New Zealand and internationally. The key search terms used in Google Web were sunbed legislation, sunbed guidelines and WHO sunbeds. Legislative articles were also searched for on the various government health department websites internationally and on the New Zealand Ministry of Health website.

2. Potential Harms of Sunbed Tanning

A literature search was completed using Ovid MEDLINE ® (1948 to present with daily update). In MEDLINE a multi-field search was completed using the key terms ‘sunbed OR sunbeds OR sun-bed OR sun-beds OR "sun bed" OR "sun beds" OR "tanning bed" OR "tanning beds" OR solaria OR solarium; AND harm* OR hazard* OR risk* OR melanoma OR "skin cancer" OR cataract* OR pterygium OR ageing; NOT “Vitamin D”. A total of 208 articles were retrieved and then reviewed for relevance to the topic.

3. Potential Benefits of Sunbed Tanning

The literature search for sunbed tanning health benefits was conducted in two stages; one relating to the benefits of sunbed tanning directly, and the second to the indirect benefits via Vitamin D.

- i. The first was a multi-field search conducted on Ovid MEDLINE ® (1948 to present with daily update) and using the key-terms ‘sunbed OR sunbeds OR sun-bed OR sun-beds OR "sun bed" OR "sun beds" OR "tanning bed" OR "tanning beds" OR solaria OR solarium; AND “Health benefits” OR “Psoriasis” OR “Seasonal Affective Disorder” resulting in the identification of 19 articles for review.
- ii. The second stage was a search to assess the evidence for a beneficial role of vitamin D. A multi-field search was conducted in Ovid Medline (1996) using the key-terms “Vitamin D” OR Vitamin-D AND Neoplasm* OR Malignan* OR “Autoimmune Disease*” OR “Cardiovascular Disease*”. A total of 2034 articles were retrieved before limits were set to systematic reviews including meta-analyses published after the year 2000 with a focus on aetiology. A total of 23 articles met these conditions and were subsequently reviewed.

4. Attitudes and Behaviours

Literature search was completed in Ovid MEDLINE (R) 1996 to Present with Daily Update and Scopus. A multi-field search was conducted using the key-terms ‘Sunbed OR sun-bed OR sunbeds OR sun-beds OR "sun bed" OR "sun beds" OR "tanning bed" OR "tanning beds" OR solarium OR solariums AND youth OR Adolescen* OR young AND attitude OR opinion OR viewpoint. Medline and Scopus produced 17 and 41 articles respectively. Those deemed relevant to our topic were retained.

CURRENT LEGISLATION INTERNATIONALLY

In 2009, the International Agency for Research on Cancer (IARC), a division of the World Health Organisation (WHO) called for governmental regulation of sunbed use [10]. This followed the re-classification of UV-emitting tanning devices as Group 1 carcinogens, that is, there is sufficient evidence of carcinogenicity. The WHO recommendations include: banning people less than 18 years of age from sunbed use, providing better information to the users of sunbeds and requiring sunbed operators to be licensed [11].

Commercial sunbed restrictions are in place in a number of countries. France, Belgium, Germany, Spain, Scotland, Portugal and Australia all have restrictions on sunbed use, for example banning use by those aged under 18 years [12]. Belgium, France and Sweden also have legislation that limits the proportion of UV-B radiation to 1.5% of total radiation emitted [13]. Brazil is the only country to have completely banned commercial sunbed use [12].

The use of sunbeds in Australia and New Zealand is currently governed by the Australia/New Zealand Standard (AS/NZS) 2635:2008 - Solaria for Cosmetic Purposes [5]. This standard will be referred to as “the Standard” for the remainder of the report. The Standard was originally issued in 2002 [5], replacing the outdated AS 2635-1983 “Installation, maintenance and operation of solaria for cosmetic purposes” of 1983. The current standard focuses on fields such as age restrictions, skin type, eyewear, consent forms, supervision and UV intensity [5]. The National Radiation Laboratory, a division of the Ministry of Health, released a supplementary document “Guidelines for operators of ultraviolet tanning lamps” in 2009 [14]. This provides a clear interpretation of the AS/NZS 2635:2008 and outlines practical procedure for sunbed operators.

The amended Standard (2008) was drafted after having reached a three-way consensus between the sunbed industry, the health sector and consumer organisations, giving rise to compromises on each side [15]. The Standard stipulations cover the following behavioural and technical elements [5]:

Behavioural elements of the Standard

- a. *Prohibit the use of solaria by persons under the age of 18;*
- b. *Exclude people with fair skin (skin type 1) from using solaria;*
- c. *Require a signed and dated client consent form for all eligible users (a template is provided in the Standard);*
- d. *Require at least 48 hours between repeat exposures and such exposures*
- e. *Cannot exceed three Minimum Erythelial Doses per week;*
- f. *Require the provision and use of protective goggles at all times;*
- g. *Impose maximum exposure times according to skin type (formulas to calculate these are provided);*
- h. *Require operators to be trained in the:*
 - 1) *Requirements of the Standard,*
 - 2) *Assessment of skin types and exposure times,*
 - 3) *Screening of exposure limiting conditions,*
 - 4) *Emergency procedures in case of over exposure to UVR,*
 - 5) *Types and wavelength of UV light,*
 - 6) *Hygiene protocols;*
- i. *Require operators to supervise users at all times;*
- j. *Require operators to be able to terminate the tanning session at any time at a central control station;*
- k. *Require users to be able to terminate the session at any time through means within easy reach of the unit;*
- l. *Do not allow claims of non-cosmetic health benefits of solaria to be used in their promotion;*
- m. *Require all surfaces of a sun-tanning unit subject to body contact must be disinfected;*
- n. *Require warnings with certain specifications to be clearly displayed*
- o. *Limit one person in the unit or immediate enclosure at any time*

Technical elements of the Standard

- a. *Installation and use timing devices;*
- b. *Protective screening, mechanical (to prevent knocking and/or breaking of the UV lamp) and UVR (to ensure all direct UVR is contained within the space occupied by the user);*
- c. *Lamp emission restrictions to a maximum intensity of 1.5 W/m² of erythemally effective UVR;*
- d. *Lamps must be replaced at the end of their useful life;*
- e. *Each tanning unit to be on a separate circuit breaker;*
- f. *At least one hand grip or other support mechanism to be installed for upright (standing) tanning units;*
- g. *No detectable radiation with wavelengths below 290nm (approximately the UVC upper limit).*

Investigations by Paul et al. [16] in Australia in 2005 found that the majority of sunbed operators were non-compliant to the recommendations specified in the Standard. Problems had also arisen in following the technical guidelines of the Standard. This was due to the fact that many sunbed operators in Australia assume the emission rates are those indicated by the manufacturers, whereas assessment proved the rates to be highly variable [12]. Better compliance was observed in the study for standard elements which gave the impression of a more professional approach as opposed to elements which would have resulted in loss of business e.g. the offering of eye protection, compared to the refusing of service to Skin Type 1 individuals [16].

Several approaches have been considered in order to both curb the use of sunbeds and improve their safety. These include: legislation, taxation and increased education to the public [16]. However given that taxation is unlikely to be a significant deterrent when users are high-income earners [16] and public awareness of the harms of ultraviolet radiation appears quite high [17] the latter two measures would be of little use. An Australian study has projected that greater government regulation, could result in 35 life years gained and \$300,000 saved per 100,000 persons in Australia [4].

In light of the Australian research above, the Standard was made legally enforceable in Australia. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a federal government agency responsible for protecting the health of people and the environment from radiation. Following the publishing of the Standard, ARPANSA wrote the Standard into legislation, and the regulation of sunbed operations became law [7]. Each state is responsible for enforcing the regulations of the Standard under their own jurisdiction. Enforcement of the standard has resulted in a recent drop in sunbed use in Australia [16] and an estimated 45% reduction in those who experienced adverse effects from sunbed use in Victoria [12]. Heavy fines are now in place for those found to be in breach of the new standard [12].

In New Zealand, the Standard is not legally enforceable. Consumer has undertaken four surveys of sunbed operators since 2005, the most recent in September 2010. These surveys have shown consistent non-compliance of the sunbed industry to the voluntary Standard [18]. In the September 2010 study, only 7 of 69 sunbed operators surveyed complied with all the regulations tested by Consumer [18].

In 1997 a Public Health Bill was proposed with the intention of updating public health legislation. At that time the only public health legislation that existed was the Tuberculosis Act 1948 and the Health Act 1956 [19]. The proposed Public Health Bill, henceforth referred to as “the Bill” [19] was identified as a potential vehicle to bring sunbed control into governmental regulation. The proposed Bill related to the public health aspects of both communicable and non-communicable disease. Part 3 of the Bill was aimed at reducing the risks of non-communicable diseases through powers to issue codes of practice, guidelines, and to make regulations [19].

The Cancer Society of New Zealand Submission to the Health Committee on the Public Health Bill [20] outlined the Cancer Society’s support for the Bill, and their recommendations for amendments. The submission was supported by the Australasian College of Dermatologists, the Cancer Council Australia and the Cancer Society of New Zealand. It included a position statement [21] stating the effects of skin cancer in New Zealand, and the failure of the current controls on sunbed use. However, the avenues through which the Cancer Society suggested sunbeds be regulated were recommended to be removed from the Bill by the Health Committee’s advisory on the Bill in 2008 [22]. The Public Health Bill remains on the government’s legislative programme, and could be called for a second reading to the house at any time.

The New Zealand Cancer Control Strategy [23], published by the Ministry of Health and the New Zealand Cancer Control Trust in 2003, states that the first goal is to “reduce the incidence of cancer through primary prevention.” Goal 1, Objective 4 is to “reduce the number of people developing skin cancer due to UV radiation exposure”. However, indoor tanning is not mentioned as an area for action.

The Australian experience showed that in the absence of a legal requirement to adhere to The Standard, poor compliance resulted. However, this was reversed once adherence was made mandatory with a reduction in use as well as a predicted reduction in negative health outcomes. In New Zealand the lack of legislation requiring adherence to the Standard stands as an impediment to gaining the benefits reported in Australia.

POTENTIAL HARMS OF SUNBED TANNING

Melanoma and sunbeds

Skin cancer, including cutaneous melanoma, squamous cell carcinoma (SCC) and basal cell carcinoma (BCC), is the most common form of cancer in New Zealand. As of 2004, approximately 1800 cases of melanoma and 45,000 cases of non-melanoma skin cancer were confirmed annually by laboratory tests, causing a significant health and economic burden [24].

Sunlight can cause melanoma and it is believed that UV light is the carcinogen; it has been hypothesised that tanning beds could also cause melanoma [25, 26].

Early studies were inconclusive on the matter with a case-control study in Denmark (1988) finding “no association between the risk of cutaneous melanoma and exposure to artificial UV-light, fluorescent light, sun lamps, or sunbeds” [27]. Subsequent to the study it was acknowledged that sunbeds had only recently been introduced and very few of the subjects in the study had used them. In the same year, a case-control study in Scotland [28] found that the risk of cutaneous melanoma was significantly increased with the use of sunbeds compared to never use, OR = 2.9; (95% CI 1.3 to 6.4). It also found that risk increased with duration of use and if persons exposed had used sunbeds more than 5 years before presentation. However, it must be noted that this odds ratio was drawn from a population in which only 38 cases and 10 controls had ever used ultraviolet lamps or sunbeds.

A case-control study in 1990, in Southern Ontario, was carried out to assess whether exposure to artificial UV sources was a risk factor for melanoma [26]. The odds ratio for developing melanoma in males who had ever used sunbeds compared to those who had not, was 1.88; (95% CI 1.20-2.98) and 1.45; (95% CI 0.99-2.13) for females. When stratified by first use before and after 30 years, slightly higher values were attained for those started before 30 years of age but these were not significant. Conclusions of these early papers suggested further study was needed and that artificial tanning devices may be harmful.

We found one prospective cohort study published on the association between melanoma and sunbeds [29]. This study recruited 106,379 women from Norway and Sweden. The cohort was followed for an average 8.1 years and 187 cases of invasive melanoma were diagnosed. The relative risk of melanoma for regular exposure to sunbeds (1 or more times a month) versus rare (less than once a month) or never exposure for the whole cohort was 1.55; (95%

CI 1.04-2.32) when adjusted for factors including age, hair colour, and sunburns. In the 20-29 year age group, relative risk for melanoma associated with using a sunbed more than once a month compared with rare/never use was 2.58; (95% CI 1.48-4.50).

In 2006 the International Agency for Research on Cancer (IARC) Working Group conducted a systematic review to identify all of the studies pertaining to cancer and the use of sunbeds up until March 2006 [2]. The meta-analysis included 19 studies published between 1981 and 2005 and included an estimated overall relative risk for cutaneous melanoma associated with exposure to tanning appliances. They found that ever use of sunbeds was associated with an increased risk of melanoma compared to never use, (relative risk 1.15; 95% CI, 1.00-1.31). This result includes the null value of 1 so was not considered statistically significant. However, a statistically significant increase in risk of melanoma was found in those people who were first exposed to sunbeds before the age of 35 (relative risk 1.75; 95% CI, 1.35 – 2.26). This suggests that using a sun before 35 years increases risk of melanoma by 75% compared with those who never use sunbeds.

This study has been widely referenced and was used in 2009 by the International Agency for Research on Cancer (IARC) to raise the carcinogenicity classification of UV-emitting tanning devices from Group 2 “probably/possibly carcinogenic to humans” to group 1 “carcinogenic to humans.” Other substances in the Group 1 category include asbestos, cigarettes and arsenic [10].

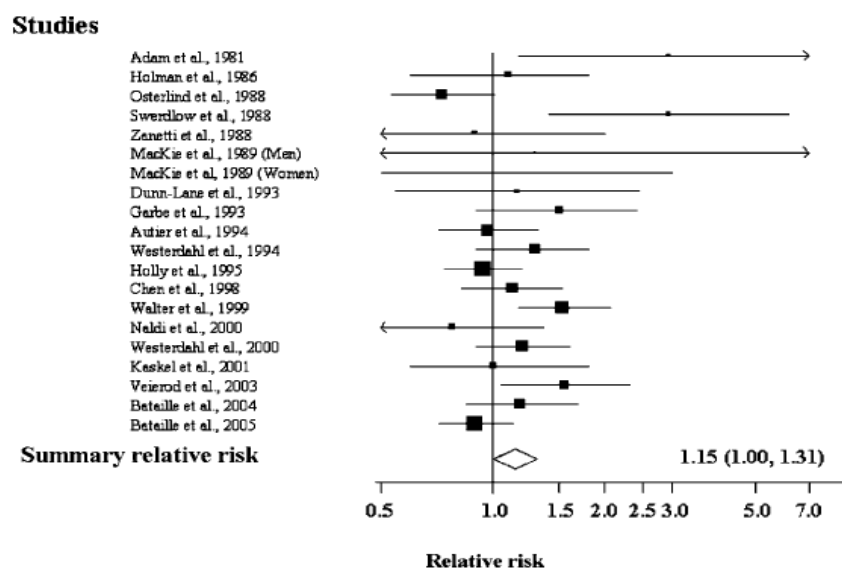


Figure 1: Relative risk for cutaneous melanoma associated with ever use of indoor tanning equipment compared to never use [2]

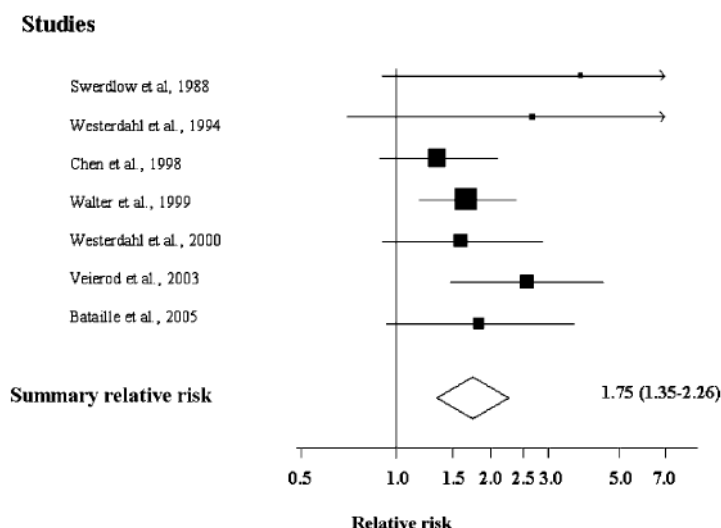


Figure 2: Relative risk for cutaneous melanoma associated with first use of indoor tanning equipment earlier than age 35 versus never use [2].

Some limitations of this meta-analysis have been proposed, such as poor information on sun exposure, lack of a dose response relationship, and the inability to differentiate between the different types of tanning devices [30].

Since the IARC Working Group Systematic Review of 2006, further research has occurred in the field of sunbeds and melanoma to try and conclusively determine the risk of using artificial UV sources. Two population based case-control studies published in 2010 [31, 32]

sought to address IARC study limitations and quantify the risk of melanoma associated with sunbed use.

The Minnesota study [31], which had 1167 cases of malignant melanoma and 1,101 controls found that 62.9% of cases and 51.1% of controls had used artificial tanning methods, yielding an OR = 1.74; (95% CI 1.42-2.14). Importantly, this study controlled for outdoor sun exposure and still found significantly increased risks associated with melanoma for increasing hours of use (p value for trend <0.0001) and increasing risk for increasing number of sessions (p value for trend = 0.0002). They also found that the risk increased for melanoma regardless of what age people started using sunbeds at but that the highest risks were for those who initiated before turning 18 or between 18-24 years (OR = 1.85; 95% CI 1.33-2.57 and OR = 1.91; 95% CI 1.39-2.62, respectively). Melanoma risk increased more if burns occurred, and risk was higher with the more burns present, but risk was still increased significantly if there were no burns from indoor tanning. It was also notable that regardless of the type of tanning device used, the odds ratio for melanoma was still statistically significant; UV-B enhanced tanning units had an OR = 2.86; (95% CI 2.03-4.03) and primarily UV-A tanning devices had an OR = 4.44; (95% CI 2.45-8.02).

The Australian Melanoma Family Study [32] found statistically significant associations with ever use of sunbeds and development of melanoma versus never use (OR = 1.41; 95% CI 1.01-1.96). They found evidence of a dose response with more than 10 lifetime sessions (OR = 2.01 ; 95% CI 1.22-3.31) and that risk was significant if age of first use was earlier than 25 years (OR =1.64; 95% CI 1.07-2.51)

From the research, there is convincing and varied evidence that sunbed use is in fact a risk factor for melanoma, and that earlier age of first use and increasing cumulative exposure are also risk factors for the development of melanoma [2, 31, 32]

As UV exposure to sunlight is a known risk factor for carcinogenesis, it could be difficult to ascertain how many cases of melanoma are attributable to sunbeds as compared to the sun [33]. A British study in 2007 attempted to estimate this [34]. They considered: prevalence of tanning bed use, incidence of melanoma in the British population, and used the combined relative risk from the IARC Working Group of 1.75 for development of melanoma before the age of 35 [2]. Using this method they found that nearly 25% of melanomas in females in the

20-39 year cohort could be attributed to sunbed use, and nearly 12% of melanomas in males in the same age group could be attributed to sunbed use [34].

Table 1: Derivation of the potential number of melanomas preventable in the 20-39 year age cohort by eliminating sunbed use[34]

Gender group	Millions in English population	Prevalence of sunbed use (%)	Incidence per 100 000 in 20-39-year age group	Relative risk	Population proportion of incidence attributable to sunbeds	No. new cases in 2004	Population impact number by eliminating sunbeds
Female	6.9	43	10.7	1.75	0.245	740	182
Male	6.9	18	6.1	1.75	0.116	422	49

Risk of squamous cell carcinomas (SCC) and basal cell carcinomas (BCC) associated with sunbed use

Limited literature exists on an association of other skin cancers and sunbed use in humans. However, a 1988 research paper [35] determined that both UV-A and UV-B radiation could induce SCC in mice and that it was plausible to expect the same mechanism to operate in humans.

A case control study in Alberta, Canada in 1996 looked at males diagnosed with SCC or BCC[36]. They found no statistically significant increased risk of BCC (OR = 1.2; 95% CI 0.7-2.2) or for SCC (OR= 1.4; 95% CI 0.7-2.7) with sunbed use. However, it was acknowledged that only a very small proportion of both cases and controls had used sunlamps which resulted in low statistical power.

A more recent case control study carried out in New Hampshire [3] showed statistically significant associations for the development of both BCC (OR 1.5; 95% CI 1.1-2.1) and SCC (OR 2.5; 95% CI 1.7-3.8) for ever use of sunbeds compared to never use. While not statistically significant, it was interesting to note that: the odds ratios for developing BCC and SCC were highest for those who had used a sunbed before age 20, used a sunbed before 1975 or finished using sunbeds 20 or more years before diagnosis of cancer. These findings may suggest that cumulative exposure and a latent period could be important in the development of non-melanoma skin cancers.

The biological plausibility of an association between sunbeds and the development of BCC and SCC is explained in a 2011 article [33] where it asserts that “exposure of the epidermis to

UV radiation can cause p53 mutations that can lead to the development of clonal tumours and SCC. The total lifetime dose of sunlight is directly related to the development of SCC.” This idea of cumulative exposure being a risk factor for SCC is seen in other studies also [3, 35]. It has been shown that UV mutates key intercellular signalling pathway genes, the mutation of which is associated with the development of BCC[33]. However, this study does not differentiate between UV from the sun and artificial UV from sunbeds.

The IARC Working Group Systematic Review of 2006 [2] also investigated the risks of SCC and BCC associated with sunbed use. They found 9 case-control studies that investigated this, but 4 were excluded because they either did not present a relative risk or did not differentiate between the two types of cancer. The summary relative risk (from 3 studies) of squamous cell carcinoma with ever use of indoor tanning equipment compared to never use was 2.25; (95% CI =1.08-4.70). For basal cell carcinoma, the summary relative risk (from 4 studies) with ever use of indoor tanning equipment compared to never use was 1.03; (95% CI = 0.56-1.90). The summary of this paper in regards to SCC was as follows, “The limited evidence for a positive association between indoor tanning and SCC is consistent with its known dependence on dose of UV radiation to the skin. Thus the biological plausibility of a causal association between indoor tanning and risk for melanoma and SCC is strong [2].” It was also mentioned that from the natural history of BCC, a long latency period may mean that some cases of disease are not detectable yet.

The evidence, though limited, would tend to suggest that there is an association between indoor tanning and SCC, and that a causal relationship between indoor tanning and BCC is plausible though not proven beyond a doubt.

The mechanism of carcinogenesis is different for both UV-A and UV-B rays, but both have been shown to cause damage to DNA and skin cancer [33]. UV-B directly causes DNA damage by causing dimerisation and inhibiting cell replication and transcription[33]. UV-A generates reactive oxygen species and these can then cause mutation in the p53 gene and carcinogenesis [37, 38]. It was shown in a 2007 paper that the process for obtaining a tan and the carcinogenic process are identical [39]. DNA damage is recognized by p53, a tumour suppressor gene, and then production of pro-opiomelanocortin (POMC) is stimulated. POMC drives the release of melanocyte stimulating hormone (MSH) and this produces melanin pigment which leads to tanning. DNA damage is a necessary stimulant for tanning and the “DNA damage intermediate for tanning is identical to the DNA damage intermediate that

transforms a cell to produce cancer [33].” Therefore, tanning is a stress response of the skin to DNA damage, and DNA damage is also the required first step in oncogenesis [40].

Two recent studies refute the idea that there is such a thing as a ‘safe tan’[41, 42]. It was found that human beings exposed to repeat sub-erythral doses of UV light were not protected from DNA damage, i.e. DNA damage occurs even without a visible burn. It was also found that “UV-mediated DNA damage can occur in some individuals in the absence of tanning, but tanning does not apparently occur without antecedent DNA damage [42].”

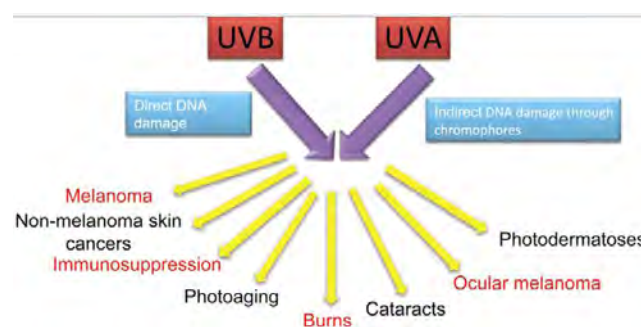


Figure 3: Effects of ultraviolet (UV) radiation on skin[33]

Ocular melanoma and sunbed use

Ocular melanoma is a rare condition, with only about 5-10 cases per million people in the Western World, but it is still the “most common primary intraocular malignancy in adults”[43]. Ocular melanoma has a higher incidence amongst white populations compared to all others [44-46]. A recent meta-analysis [46] found that features of a fair genotype such as light eyes, light skin colour and inability to tan were significantly correlated with increased risks of uveal (ocular) melanoma. These characteristics are also implicated in the development of cutaneous melanoma and so it was hypothesised that they may share more common risk factors, such as ultraviolet light [47].

For ultraviolet light to be a risk factor for ocular melanoma there would have to be some biological plausibility. There is some debate about whether any UV radiation actually reaches the uveal tract, where the majority of ocular melanoma occurs. Debate arises because the lens and cornea absorb these wavelengths in adults, protecting the underlying structures from free radical generation and DNA damage [43, 45]. However, significantly, it has been found that “It is biologically conceivable that ultraviolet light might be implicated in the development of uveal melanoma, as the crystalline lens of children allows transmission of

ultraviolet light to the posterior uvea [47].” It was also found that the lens of the eye in young adults up to the age of 30 does not protect the eye completely. This may increase the susceptibility of the eye to the development of melanoma if exposed to ultraviolet light [48]. Therefore, in theory, there is a potential mechanism for the development or initiation of ocular melanoma with ultraviolet radiation in young adults. Shah et al [26] state that “based on findings with cutaneous melanoma, the melanocyte is believed to undergo malignant transformation from ultraviolet light and melanocytes in the eye might also respond similarly to ultraviolet light.”

As ocular melanoma is a rare condition, it has not been studied extensively. However, three early case control studies [27, 49, 50] investigated the association between sunbed use and ocular melanoma. Two of these studies found statistically significant associations with ocular melanoma and sunbed use. One compared occasional or frequent sun lamp use with never use and found that the relative risk for the development of uveal melanoma was 3.4 (95% CI 1.1-10.3) when compared to population based controls [50]. Holly et al [27] found that for exposure to artificial UV sources, the odds ratio of developing uveal melanoma was 3.69, (95% CI 1.57-8.70), after adjusting for confounding factors. The third study also found a positive association but it was not significant, with the OR for the highest exposure to sunlamps versus never use for the development of uveal melanoma estimated as 1.5 (95% CI 0.9-2.3) [49]. In all of these studies the use of sunbeds was quite low amongst both cases and controls which may have limited power. However, it was noted that “sun lamp use, independent of constitutional factors and other UV exposures, imposed a twofold to threefold elevated risk with consistent direction and magnitude of risk across the control groups, suggesting the association may be real [50].”

A more recent case control study from Australia [51] found that ever-use of sun lamps versus never use gave an odds ratio for ocular melanoma of 1.7 (95% CI 1.00-2.8). When stratified by age at first use less than 20 years old, the OR = 2.4 (95% CI 1.0-6.1). While these results include the null value of 1.00, there were statistically significant trends for age at first use and increasing duration of use of sun lamps increasing risk.

The International Agency for Research on Cancer (IARC) feels that there is sufficient evidence that artificial tanning devices do cause melanoma of the eye, particularly of the choroid and ciliary body [10].

As well as the risks for cutaneous and ocular melanoma and non-melanoma skin cancers, indoor tanning presents many other health risks, both acute and chronic [33, 52]. The most obvious acute harm attributable to UV exposure is a burn, which comes with the classic signs of inflammation – redness, warmth, pain, and swelling. It has also been reported that as well as erythema, human skin is susceptible to immunosuppression, pruritic reactions (itchiness) and xerosis (dryness of the skin and mucous membranes) [33, 53]. Chronically, the eyes can be damaged, with the conjunctivae, lens, and retina all susceptible to photodamage [52, 54, 55]. In the long term, photoaging of the skin occurs with UV exposure [33]. Skin aged by chronic exposure to UV rays is different to intrinsically aged skin; it is more coarse, dry, wrinkled, inelastic, leathery and has uneven pigmentation and spots. Evidence of aging due to UV rays is seen in both mouse and human models [52].

POTENTIAL BENEFITS OF SUNBED TANNING

Despite the claims of harmful effects within the health sector at large, the sunbed tanning industry continues to promote the use of sunbeds as a healthy lifestyle choice. A search of the literature identified several potential health benefits of sunbed use, these including the:

- a) Promotion of vitamin D production in the body
- b) Treatment of psoriasis
- c) Treatment of seasonal affective disorder (SAD)
- d) Prevention of sunburn

In the following section, we review and discuss the state of current evidence in relation to the health benefits proposed above.

Vitamin D and Health

The main health benefit suggested from recent studies is that sunbeds are a reliable source of vitamin D. An American study found that subjects who use sunbeds regularly have 90% higher vitamin D levels in their serum compared to controls [56]. A small amount of UV radiation for a short period of time from a commercial sunbed can result in a large improvement in vitamin D levels [8].

Vitamin D is synthesized in our skin from exposure to sunlight and can also be obtained from the diet by eating foods that are rich in fish fat [57]. In countries that are situated in the upper and lower latitudes people have limited exposure to sunlight in during winter. It has been suggested that using sunbeds or taking vitamin D supplements could correct their vitamin D deficiency [8, 58]. The people of these countries show seasonal variation in their vitamin D level, being higher during the summer months and becoming deficient during the winter [8, 58]. This includes countries such as Norway and New Zealand. In New Zealand, several studies have found that there is high prevalence of vitamin D insufficiency [59-61].

The precursor of vitamin D in the skin is converted, by UV light, into pre-vitamin D₃, before being isomerised to vitamin D₃. After several processes involving the liver and kidneys, vitamin D₃ is then activated into calcitriol. Calcitriol is the active form of vitamin D which interacts with vitamin D receptors in the body [62].

The role of Vitamin D in the prevention of rickets in childhood, and osteomalacia and muscle weakness in the elderly, is well established [63-67]. More recently, studies focusing on the

role of Vitamin D in the pathogenesis of a wide array of other diseases such as cancer, autoimmune and cardiovascular diseases have been underway.

In recent years a number of studies have provided new findings which suggest a role for vitamin D in the prevention and attenuation of malignant processes. The mechanism is believed to be the role Vitamin D plays in preventing proliferation and differentiation of malignant cells [68, 69].

In total, 14 meta-analyses were identified between 2000 and 2011 focusing on the relationship of Vitamin D status and cancer. The most convincing findings indicating an inverse or protective relationship between Vitamin D levels and cancer were related to colorectal cancer [70-74] with five of six meta-analyses reviewed supporting a protective vitamin D effect. The five statistically significant studies comparing incidence of colorectal cancer in the highest quartile of serum vitamin D to rates in the lowest quartile produced summary risk ratios ranging from as low as 0.57 (95% CI = 0.48- 0.68) to as high as 0.85 (95% CI = 0.79-0.87). A single study by Huncharek (2009) found no relationship between vitamin D and colorectal cancer SRR = 0.94 (95% CI = 0.83-1.06) [75]. An important consideration in the Huncharek study is that it used dietary intake of vitamin D as the indicator for participant vitamin D status when in fact it is a poor indicator for this purpose. The findings of six meta-analyses relating to vitamin-D and colorectal cancer reported an inverse relationship between serum Vitamin-D levels and colorectal cancer risk. However, this relationship was not evident in the only large RCT analysis completed to date [76]. This study produced a non-significant difference between the intervention group who received Vitamin D supplements and controls [76]. This inconsistency has been attributed by some to insufficient Vitamin-D doses and poor regime adherence [77]. The findings for studies concerning the role of vitamin-D in prostate and breast cancer are inconclusive, with meta-analyses generally pointing to a minimal role concerning breast cancer [70, 73, 78, 79] and no effect in prostate cancer [70, 80-82].

Clinical cross sectional studies have reported associations between low serum vitamin D [25(OH)D] levels and coronary artery calcification and prevalence of cardiovascular disease. Several ecological studies have reported increasing rates of cardiovascular disease in populations more distant from the equator, a finding credited to lower exposure to sunlight and presumably reduced vitamin D levels [83].

Vitamin D status has attracted growing research attention over recent years in relation to immune related conditions such as multiple sclerosis [84] and diabetes [85]. To date three meta-analyses have been conducted in relation to diabetes. A single analysis based on observational data supported an overall reduction in risk of development of childhood type 1 diabetes with prenatal vitamin D supplementation of pregnant mothers [85]. However, meta-analysis of RCTs did not show any statistically significant association for a relationship between vitamin D status and risk of diabetes [66, 85].

Treatment of Psoriasis

Psoriasis is a chronic skin disease caused by an overactive immune system which results in changes to blood vessels and skin cells. It makes the skin appear red due to abnormal growth of blood vessels, and scaly due to a rapid turnover rate of skin cells [86]. Psoriasis is estimated to affect about 2% of the population [86].

Phototherapy is used to treat patient with moderate psoriasis. UV light helps by slowing down the rapid growth of skin cells. Phototherapy is used in combination of Psoralen which improves skin sensitivity towards sunlight to ensure maximal effect [87].

Phototherapy is usually received in a hospital or clinic setting, however, there are 3 studies that show the use of commercial sunbeds can also be a source of UV light for the treatment of psoriasis [88-90]. Two of the studies measured the effectiveness of sunbed use in treating psoriasis using the Psoriasis Assessment Severity Index (PASI) score and showed a decrease in psoriasis severity from 7.96 to 5.04 with 15 being the most severe and 1 being the least [88, 89]. It was concluded that commercial sunbeds are only recommended for patients who are unable to access the proper phototherapy treatment. These conclusions were drawn due to the lack of medical supervision, suboptimal dose of UV light, and the uncertainty of hygiene in the commercial sunbed setting [90].

Treatment for seasonal affective disorder

There have been suggestions that sunbeds may be a potential treatment for seasonal affective disorder [91]. However, it has been found that the therapeutic effects of light therapy in seasonal affective disorder are mediated not by UV wavelengths but the short wavelengths of the visible spectrum i.e. green and blue light [91].

Prevention of sunburn

Tanning the skin via sunbed use has been suggested to have a protective effect against burns from natural sunlight [92]. Study results suggest that there is no protection against UV-B induced sunburn [92].

YOUNG PEOPLE'S ATTITUDES AND BEHAVIOURS TOWARD SUNBED TANNING

Indoor tanning rates are highest among young [93-96], white females, with a higher education level [97-100]. Sunbed users also tend to live a comparatively unhealthy lifestyle: Users smoke cigarettes and drink alcohol more frequently and eat less healthy food than non-users [98, 99]. Most people do not visit indoor tanning facilities for health benefits [97]. Instead the main motivating factors found seem to be the desire for an attractive tan [101-103] and the belief that tanned skin is beautiful and healthy [104, 105]. Other motivating factors mentioned were warmth, light and relaxation [98, 100, 106, 107], as well as pre-holiday tans and feeling better about themselves. Desire to look like females in movies, magazines or on TV was also mentioned [106].

A previous study [108] on the awareness of young people towards health messages found that youth are well aware of health messages but fail to understand the connections between the broader determinants of health and their own circumstances. This may explain why there is evidence that sunbed users were informed about the risks of sunbed use [109] but continue to use them. It was even found that sunbed users were more informed about some of the risks, such as premature ageing of the skin, when compared to non-users [98]. However, other studies found that there were knowledge gaps about the risks and consequences of being exposed to UV radiation. Studies [99, 101] found that sunbed users were more likely to believe that tanning with sunbeds provides them with a 'healthier' type of tan as compared to those people who never use sunbeds [100]. They stated that obtaining a tan from an artificial tanning device would protect them from the adverse effects of sun exposure or that tanning beds are safer than the sun [100]. This is concerning and seems to indicate that sunbed users may be underestimating the health risks of indoor tanning. However, other studies [93, 103] attributed this to selective learning to minimize fear of disease. They also proposed that the selective learning justifies the risk, for example the feeling of wellbeing from being tanned outweighs the risks.

Also of concern were the findings that 70.5% of the ever users reported that they had never received warning about the health risks of indoor tanning and 45.3% had never undertaken a consultation regarding skin type [100]. This same study found 60.4% of people who had

used a sunbed in the last 5 years believed them to not be dangerous. Although one study did suggest that perhaps these apparent knowledge gaps were actually a factor of cognitive dissonance [101]. It is particularly adolescents and young adults who regard the promised benefits of UVR exposure (e.g. tanned skin, opportunity for socialization, conforming to normative beliefs) as outweighing the hazards of skin cancer [99]. Interestingly one study found that if sunbeds were proven to cause cancer only 10% of respondents would continue using them [94].

As mentioned above, previous studies have found that sunbed use was related to high-risk taking behaviours, for example smoking [95, 96, 110]. It is also thought that dependence may play a significant role, one study found that some users experienced their tanning behaviour as addictive (termed “tannorexia”) [98]. A small RCT trial of opioid antagonism in frequent and infrequent tanners tested whether or not opioid blockade produces withdrawal symptoms in frequent tanners. Results showed that 4/8 frequent tanners exhibited withdrawal symptoms when given an opioid antagonist before UV exposure [97]. No controls exhibited withdrawal symptoms.

Findings that were somewhat concerning were those that showed that a high level of knowledge of the risks did not lead to sun-protective behaviour [93, 94, 105, 111, 112], indicating that knowledge does not appear to influence behaviour. The proportion of adolescents who have experienced burns or other skin injury from indoor tanning ranged from 26-59%, but such experience did not affect the frequency of use nor intentions to continue to tan indoors. Young people were the least knowledgeable about skin cancer and exhibited the most risky behaviour in terms of sun exposure. They also failed to check their skin, and to seek medical advice about new or changing moles [113]. Further research [102, 103] found that a majority of their study participants who had used sunbeds believed their melanoma risk to be lower than that of the general public, despite being warned otherwise. Their interviewees seemed to select and put into practice only the information that supported their beliefs.

SUMMARY OF LITERATURE REVIEW

In conclusion the evidence presented here indicates that with voluntary codes of practice, sunbed operators rarely use the recommended practices to reduce some of the harms to their users. The current evidence suggests that the harms of sunbed tanning are likely to outweigh any potential benefits to be gained by sunbed tanning. Importantly it was shown that knowledge of the harms of sunbed tanning are not an effective means of modifying tanning behaviour in overseas youth. Thus the question must be answered, in the absence of legislation to maximise the safety of young users, can their attitudes and behaviours toward sunbed use be changed instead? This question is investigated in parts two and three of this report.

PART TWO:

NEW ZEALAND YOUTH AND SUNBED TANNING

INTRODUCTION

To our knowledge, no-one has ever looked specifically at the knowledge, attitudes and behaviours of New Zealand youth to sunbed tanning. The research presented in part one leads to several important conclusions which have implications for our research:

1. Sunbed operators rarely use the recommended practices within the voluntary code to reduce some of the harms to their users.
2. The scientific evidence indicates that the harms of sunbed tanning outweigh the potential benefits
3. Knowledge of the harms alone is not sufficient to change sunbed tanning behaviours in some youth.

If the behaviours and attitudes of youth in New Zealand are equivalent to their international counterparts then this suggests that they are at increased risk of adverse sunbed tanning outcomes such as sunburn and most importantly skin cancer. Therefore a sample based survey of Wellington youth (aged 15-25) was completed in order to yield information about their knowledge of the risks, attitudes toward, and use of sunbeds.

METHODOLOGY

Category B Ethical approval for this study was granted by the University of Otago Ethics Committee prior to commencement of the practical research (see Appendix 1)

Survey Development

A survey was developed to collect information from Wellington young people in the relation to skin type, tanning habits including use of artificial tanning devices, and attitudes about tanning and sunbeds as well as base demographics. Questions regarding skin type and reaction to sun exposure were modelled on the Fitzpatrick scale; a widely recognised skin type scoring system which categorised respondents into systematic groups according mainly to skin colour and tendency to burn. Questions related to attitudes were based on studies previously reported elsewhere [28]. The survey contained both qualitative and quantitative components. We used a qualitative approach to measure what the respondents knew about the risks and benefits of sunbeds and their sources of this knowledge. A quantitative approach for attitudes used a Likert scale in which the respondents were asked to rank their level of agreement to statements about likelihood to tan and desirability of a tan. Investigators reviewed the questions and tested early versions of the survey on individuals from within the study population demographic before a final review was completed by the project supervisors. The final survey of 33 short answer and multi-choice questions was submitted for ethical approval.

Study Data Collection

1. Approached organisations for participation. We approached 5 high schools. Paraparaumu College was the only school that chose to participate. Wellington East did not reply to the email sent. Naenae College, Chilton Saint James School and Newlands College chose not to participate due to time restrictions just before the Easter holidays. A Victoria University Hockey team and a Karori Netball Club team, K3, were sent the survey via email. Victoria University Student Health gave out surveys to patients to complete while they waited for appointments. Surveys were handed out to students at the New Zealand School of Dance and were collected the next day. Digital surveys were also emailed to Physiotherapy and Radiation Therapy students at the Wellington School of Medicine.
2. Provided information and consent forms to contact person(s) at sites which expressed an interest in participating for review

3. Surveys (see Appendix 2) were then delivered to organisations which accepted the terms of the project in one of the following ways:
 - a. Investigators delivered the surveys in person to the participating High School and then observed their completion at the site and retrieved them immediately afterward.
 - b. Investigators delivered the surveys to the New Zealand School of Dance and Victoria University Student Health at which point responsibility for their completion was accepted by the contact person at the site. Surveys were then collected by the study investigators when notified of their completion.
 - c. Surveys were sent electronically to several sports teams and the University of Otago Wellington Radiation Therapy and Physiotherapy students to complete in their own time and automatically returned via Google Documents.
4. Data collected from the surveys was entered into Microsoft Excel as they arrived prior to statistical analysis.

Data Analysis

Quantitative analysis of collected data was completed on Microsoft Excel and using the Epi Info program for testing of statistical significance.

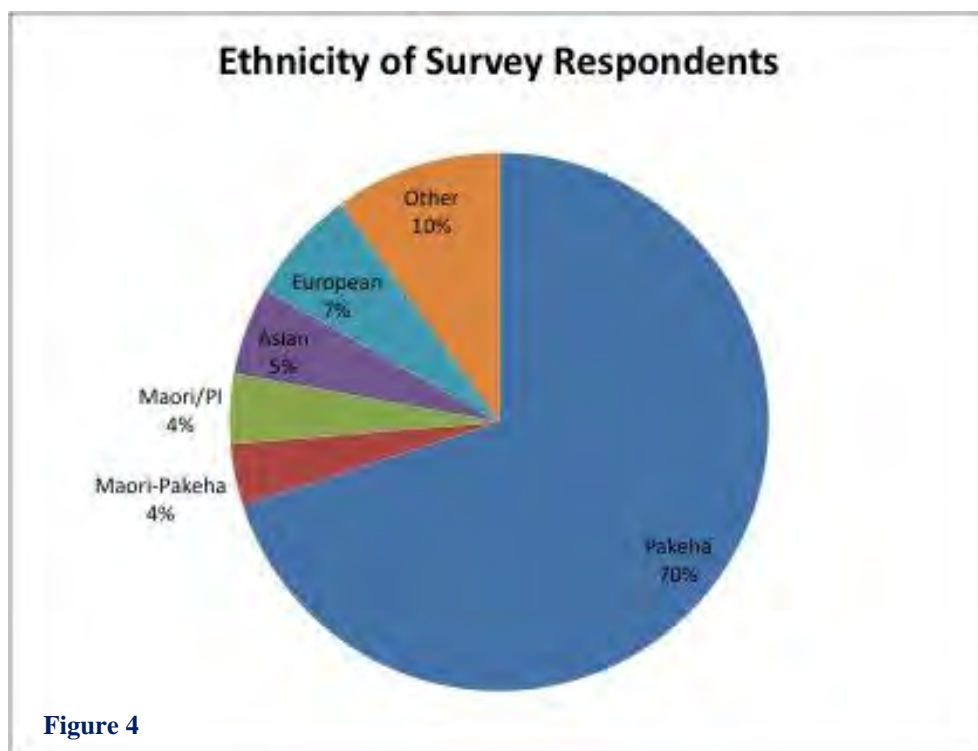
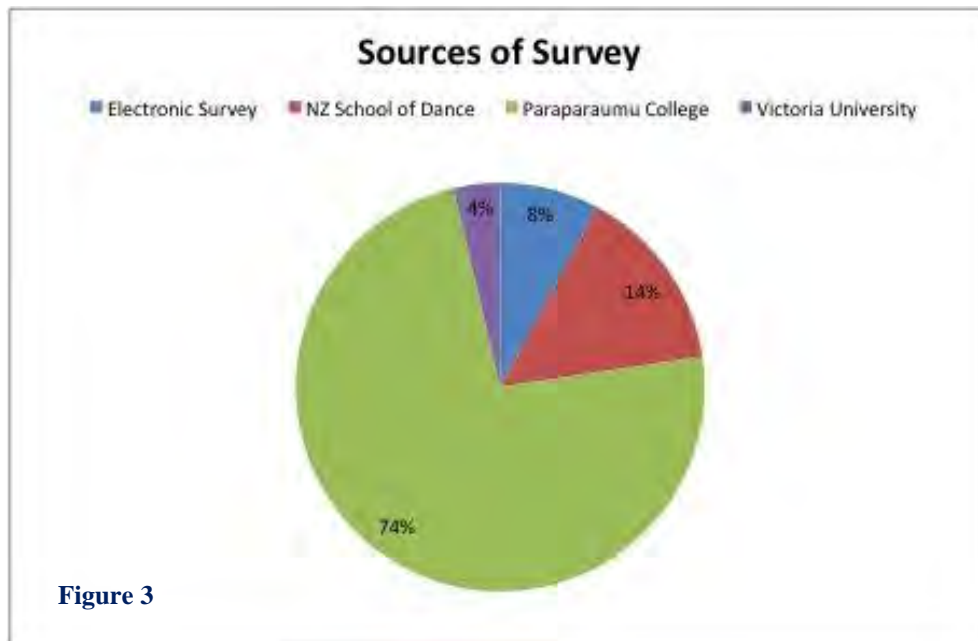
1. The questionnaire data were collated from each survey group into one database
2. It was then stratified by age, gender, use or non-use of sunbeds and Fitzpatrick skin type score.
3. Frequency tables were created with the data and odds ratios, confidence intervals and overall proportions were calculated.
4. The data was then plotted into figures

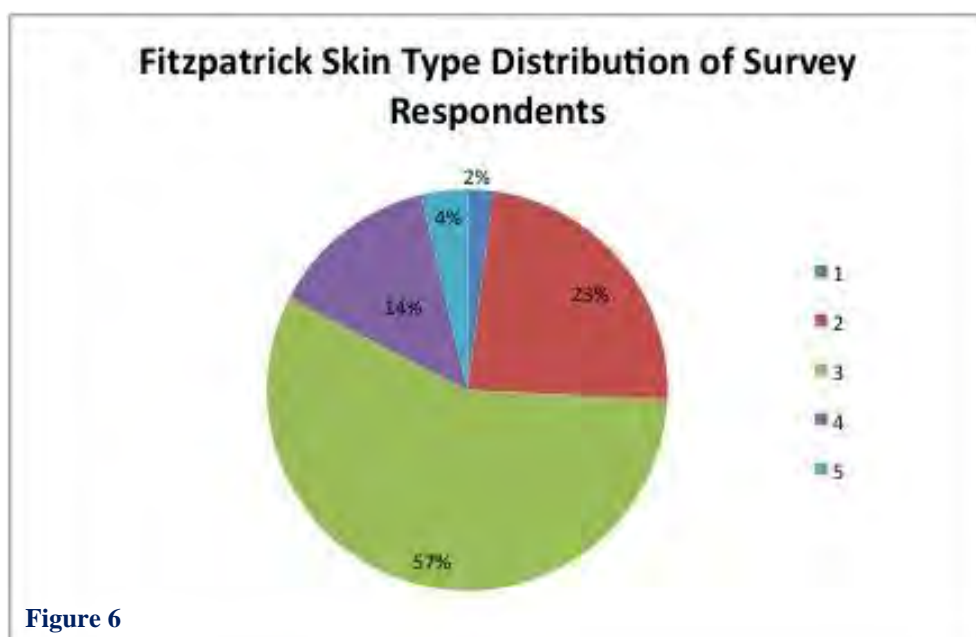
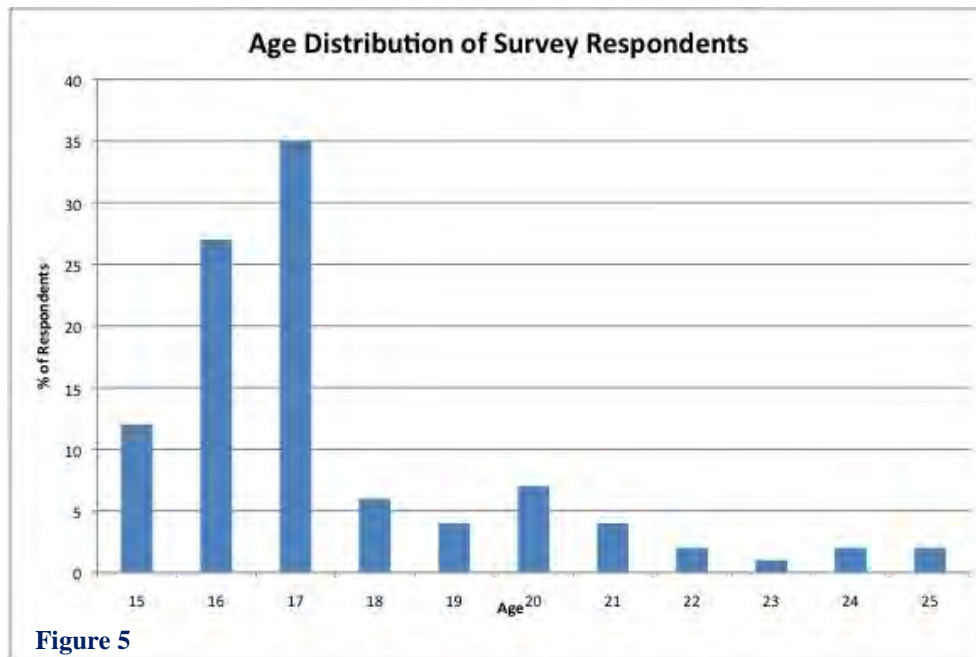
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RESULTS

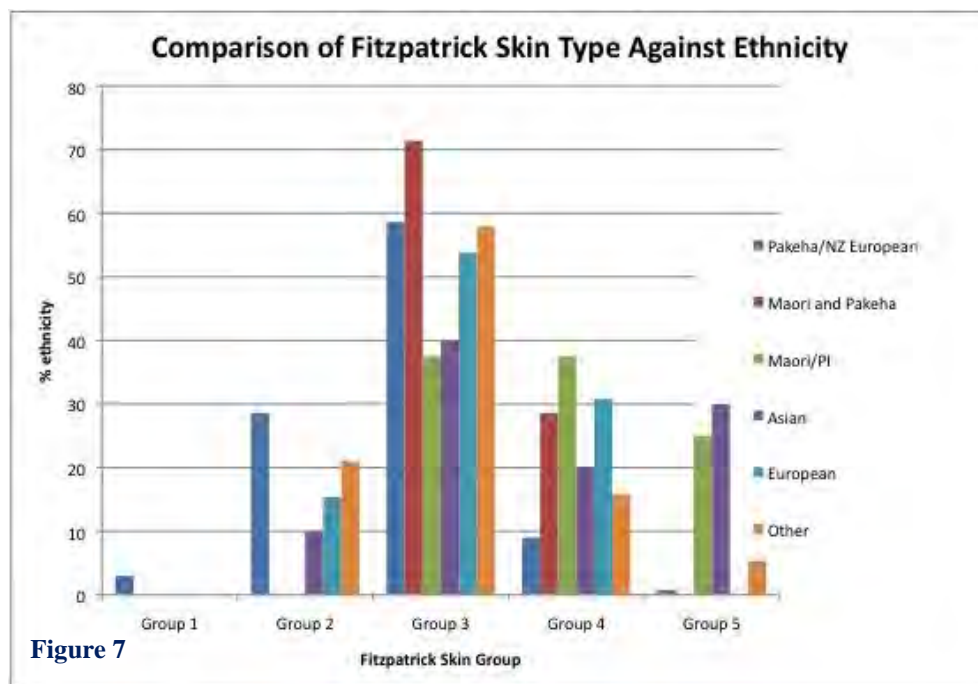
Survey respondent characteristics:

There were 190 respondents to our survey. The respondents were 69.5% female and 30.5% male. The sources of the survey data is shown in Figure 3. The demographics of the respondents are shown in Figures 4-6. The total number of sunbed users in the survey population was 13.



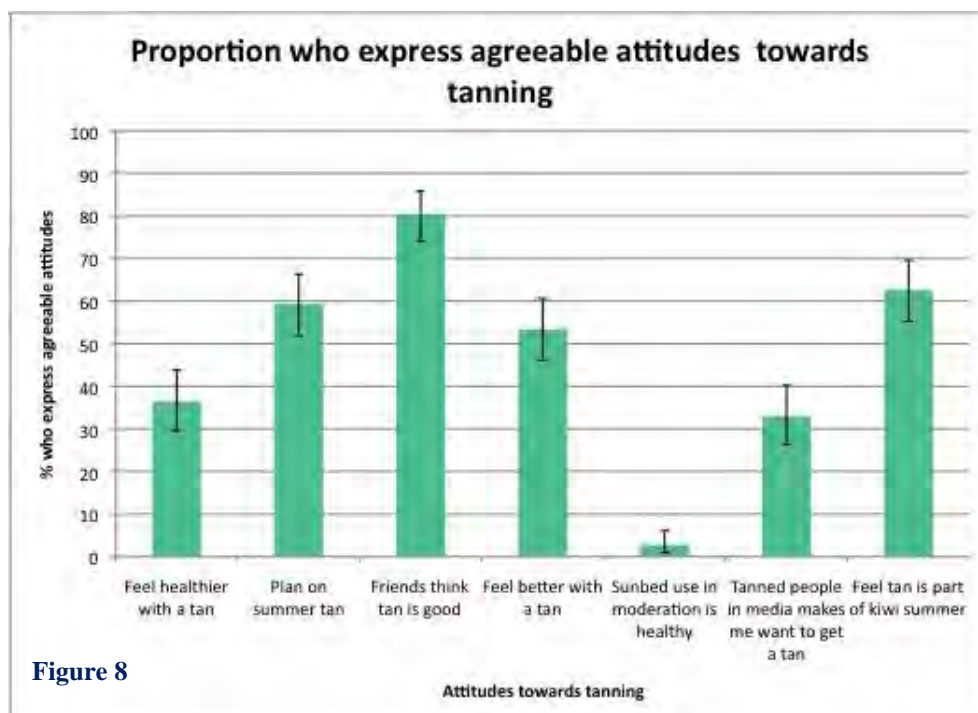


The relationship between Fitzpatrick skin type and ethnicity is shown below in Figure 7. As expected, there is an observable correlation between Maori/Pacific Island and Asian ethnicities and higher Fitzpatrick scores. The Maori/Pacific Island respondents were most strongly skewed toward higher scores. Pakeha/New Zealand Europeans generally have lower Fitzpatrick scores with approximately 90% in groups 1-3.

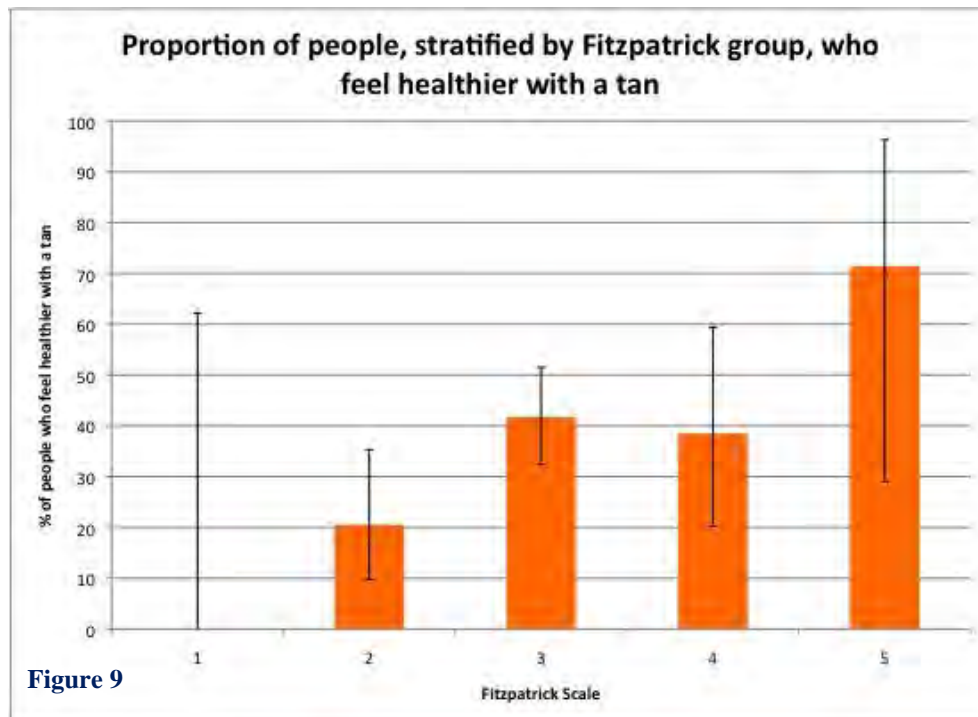


Analysis of Youth Attitudes towards Sunbeds:

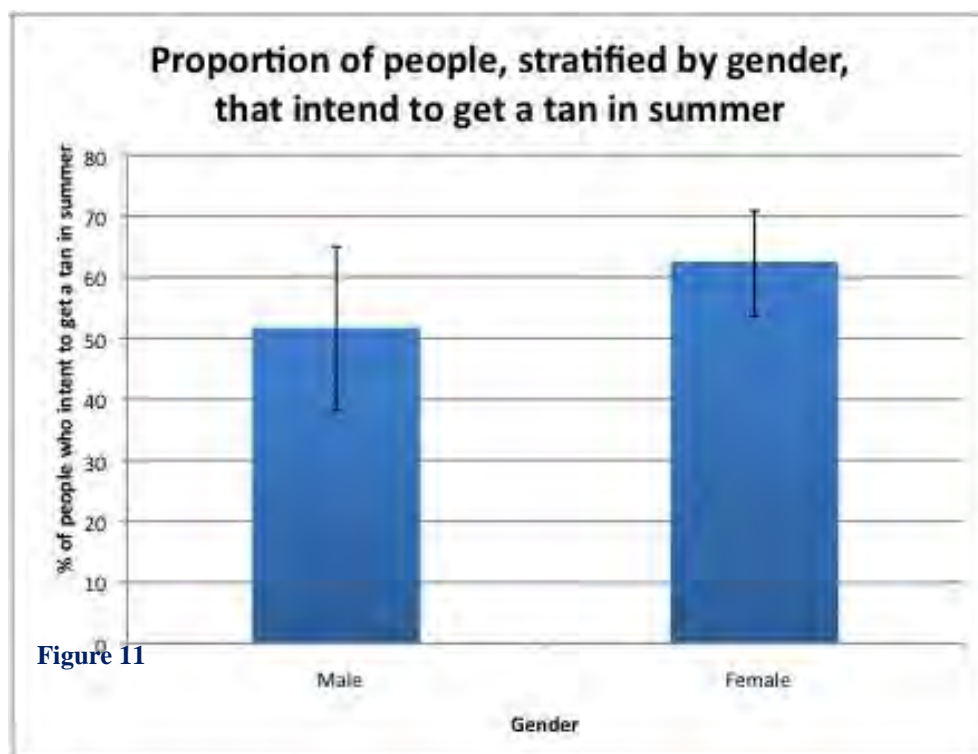
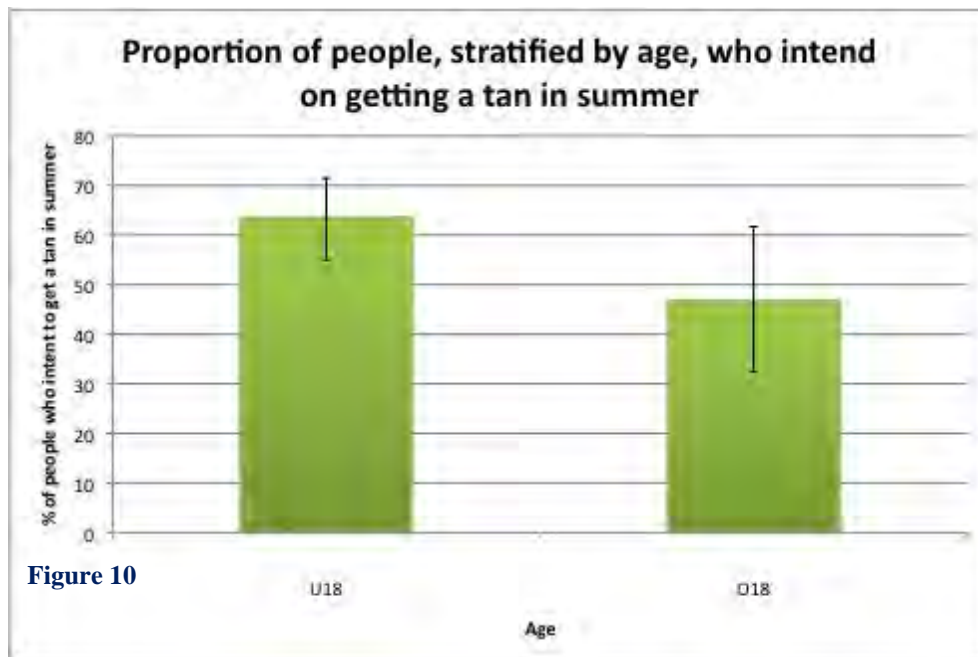
The overall attitudes of respondents to tanning are shown in Figure 8. This graph shows that overall, young people exhibit favourable attitudes towards tanning with particular influences from friends and „kiwi culture’.

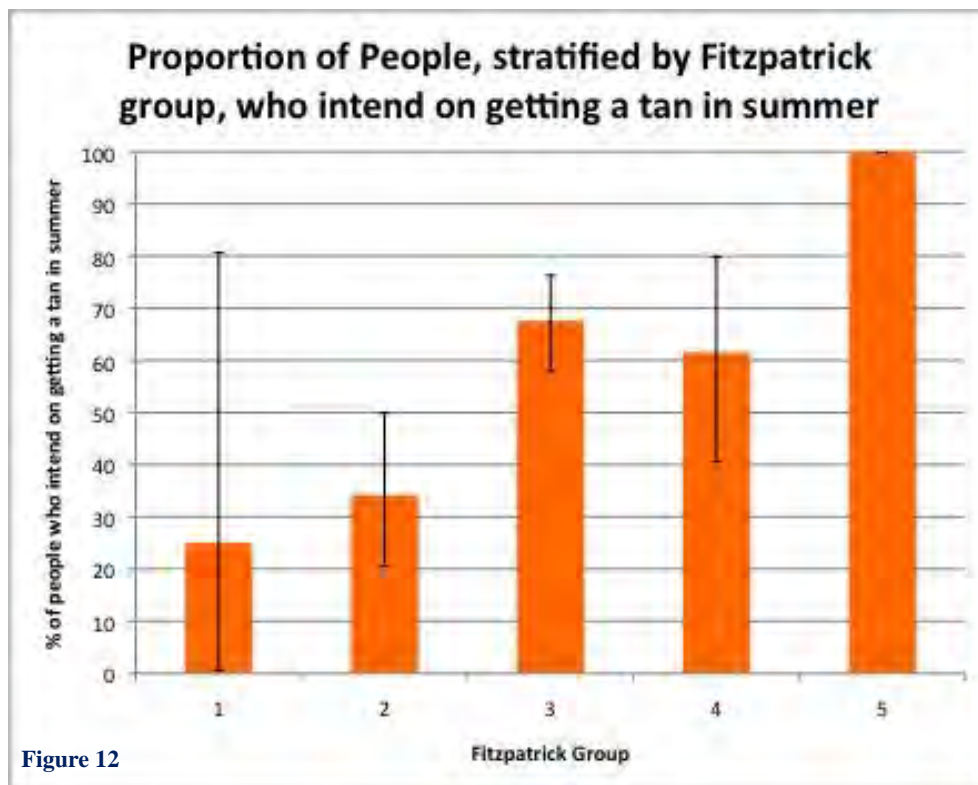


In response to the question „I feel more healthy with a tan’ under-18 year-old respondents and those with higher Fitzpatrick scores showed more support than those 18 years and over and those with lower Fitzpatrick scores. Under-18 year olds were 1.26 (95% CI = 0.63-2.50) times as likely as those 18 and over to feel more healthy with a tan though this finding was not statistically significant. The data displaying the agreeable attitudes in correlation with higher Fitzpatrick scores is shown in Figure 9.



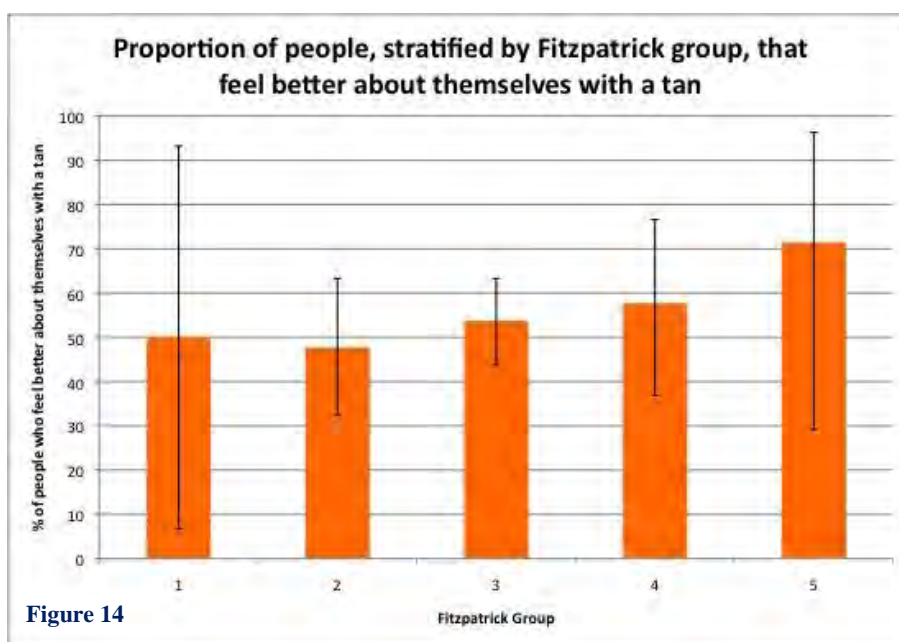
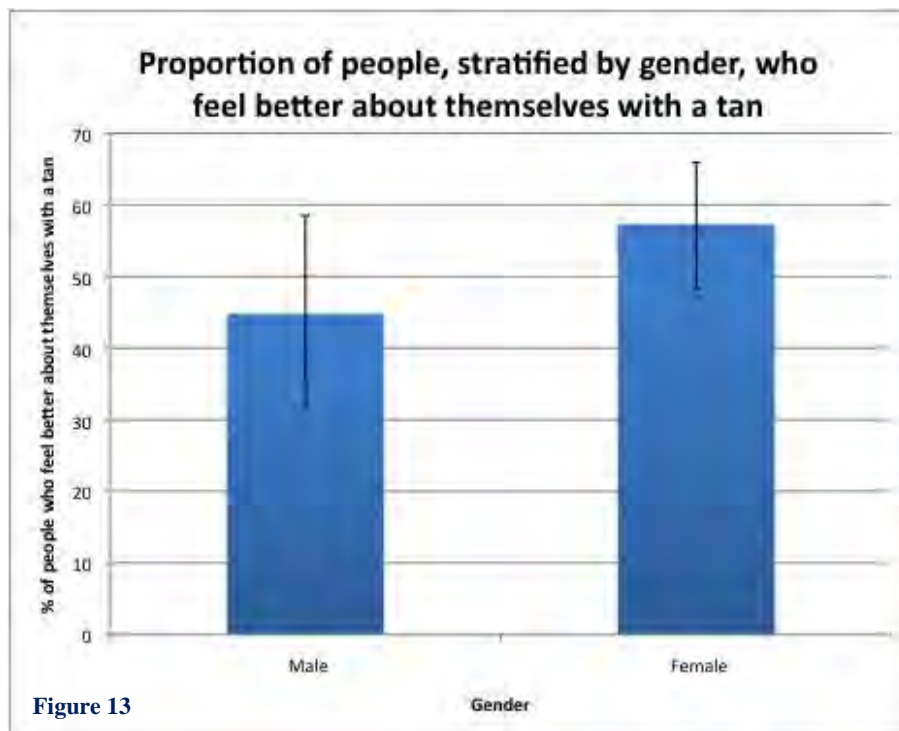
Females, under-18 year olds, and those with higher Fitzpatrick scores were more likely to show agreeable attitudes to the question „In summer I intend to get a tan’. These correlations are observable in Figures 10-12. Sunbed users are 0.66 (95% CI = 0.21-2.16) times as likely to agree with the statement as non-users.





The majority of respondents (80%, not presented here) believed that their friends thought that a tan was a good thing. There were no significant differences in responses when we stratified by age, gender, sunbed use and Fitzpatrick skin type. This question yielded the highest rates of agreement out of any questions assessing attitudes.

The statement „a tan makes me feel better about myself” showed consistent differences between groups. Under-18 year olds were 0.73 (95% CI = 0.38-1.41) times as likely as those 18 years and over to agree with this statement. Sunbed users were 1.81 (95% CI = 0.52-6.22) times as likely as to feel better about themselves with a tan, compared with those who do not use sunbeds. The gender and Fitzpatrick skin type comparisons are shown in Figures 13 and 14.



Males were more likely to believe that sunbed use in moderation is healthy as compared to females as shown in Figure 15. Interestingly, there were no sunbed users who agreed with this statement as compared to 5 non-users. There were no significant variations between age groups and Fitzpatrick skin type.

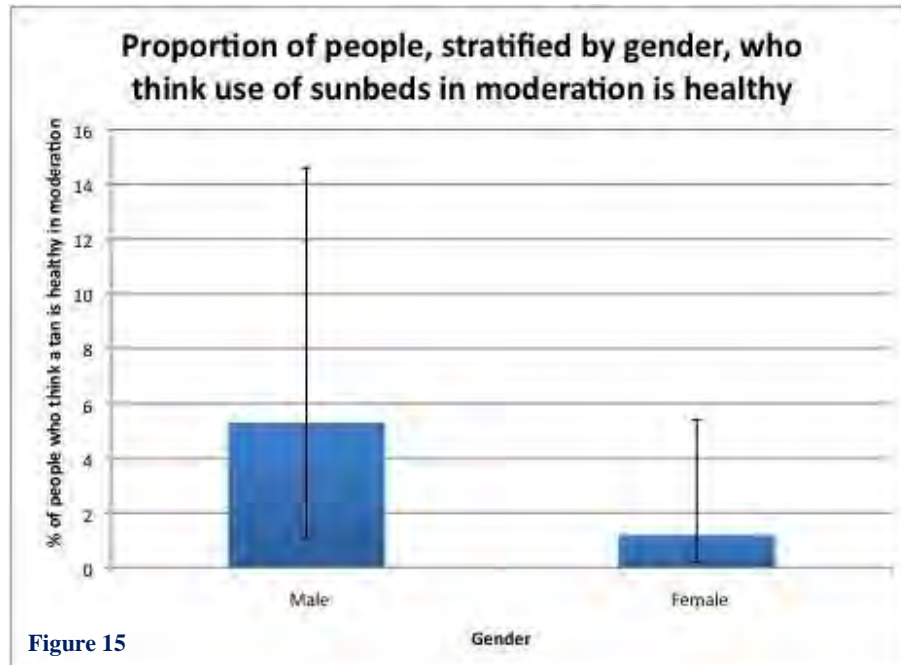


Figure 15

In response to the question „seeing tanned people on TV, in films and in the media makes me want a tan’ there was a difference between groups. Those 18 years and over, sunbeds users, and females showed greater agreement to this statement than under-18 year olds, those who have not used sunbeds and males, see Figures 16-18. A minor positive correlation in agreement with the statement was seen with increasing Fitzpatrick skin type score, as seen in Figure 19.

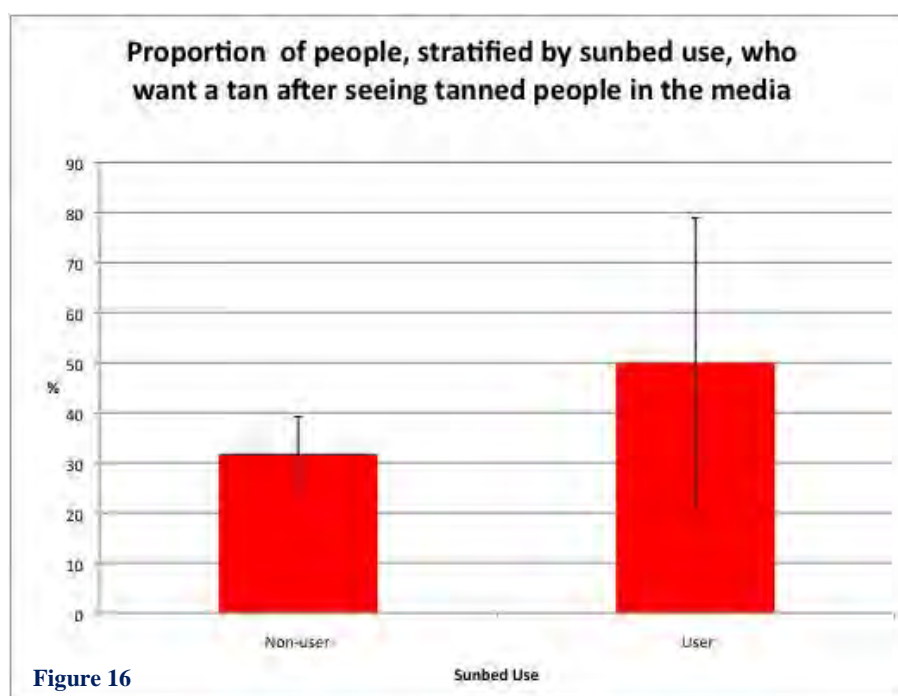


Figure 16

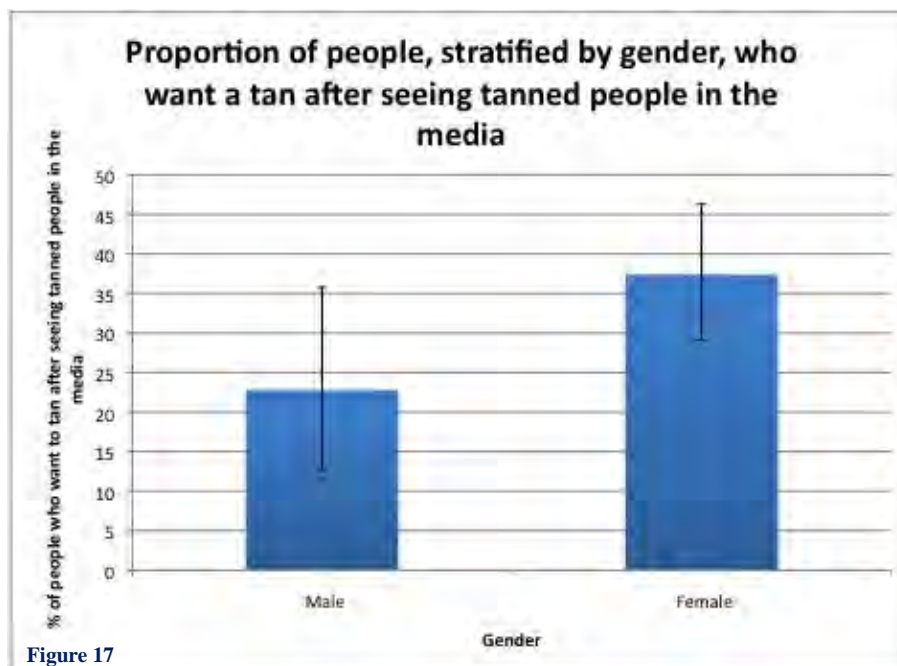


Figure 17

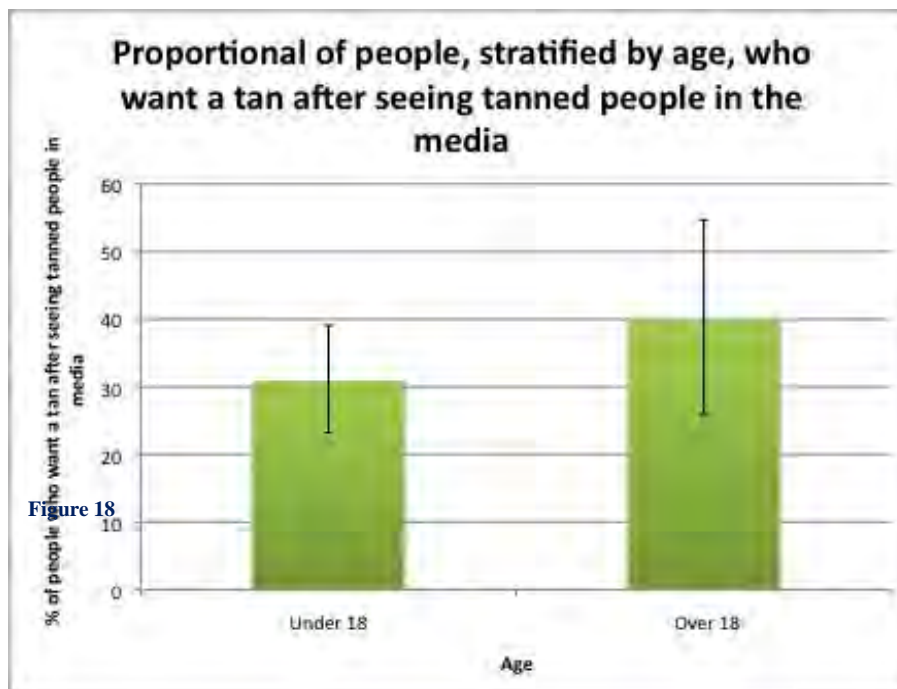


Figure 18

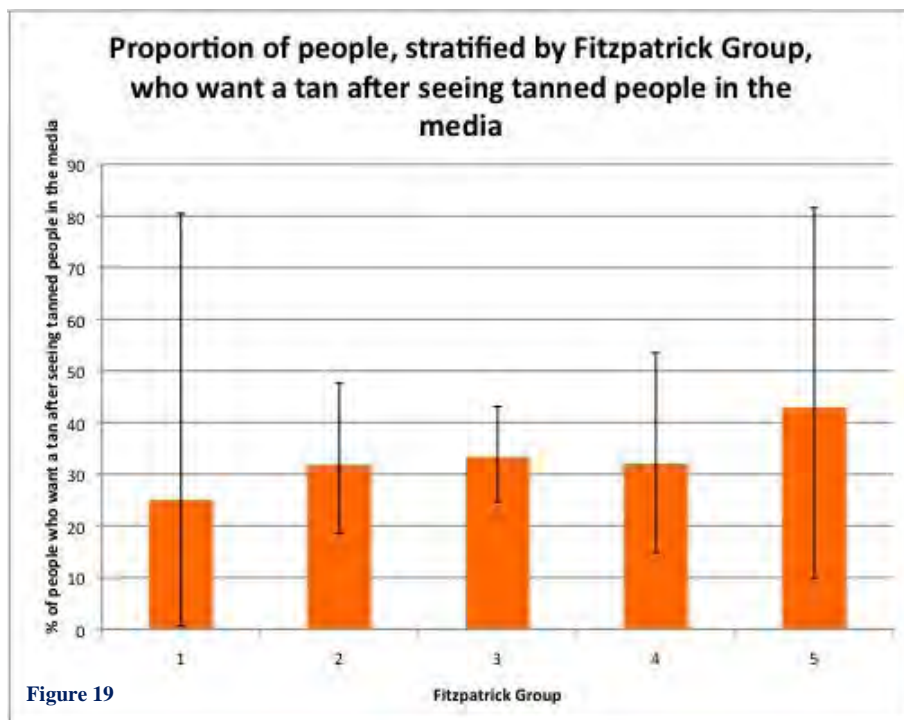


Figure 19

Females were more likely to think that tanning is part of the kiwi summer than males, refer to Figure 20. However, overall 61.6% of respondents agreed with this statement. The difference between age groups, Fitzpatrick skin types, and sunbed use were not significant.

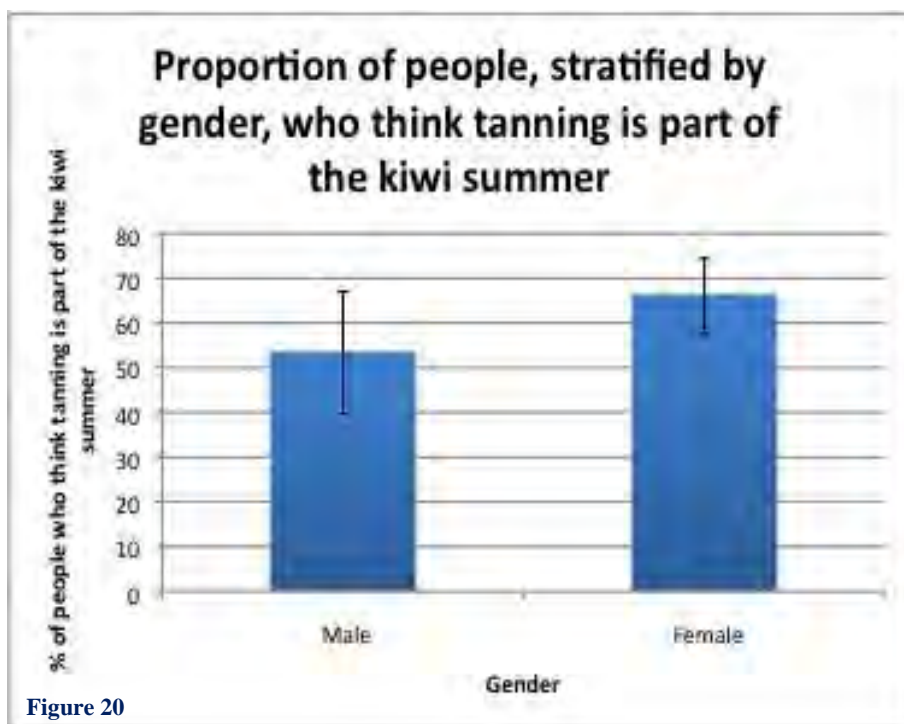
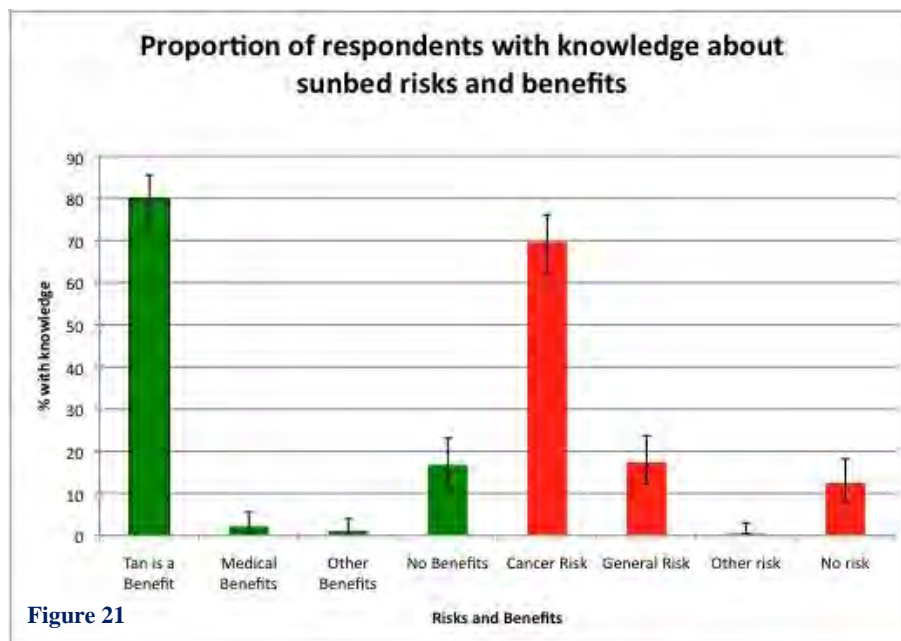


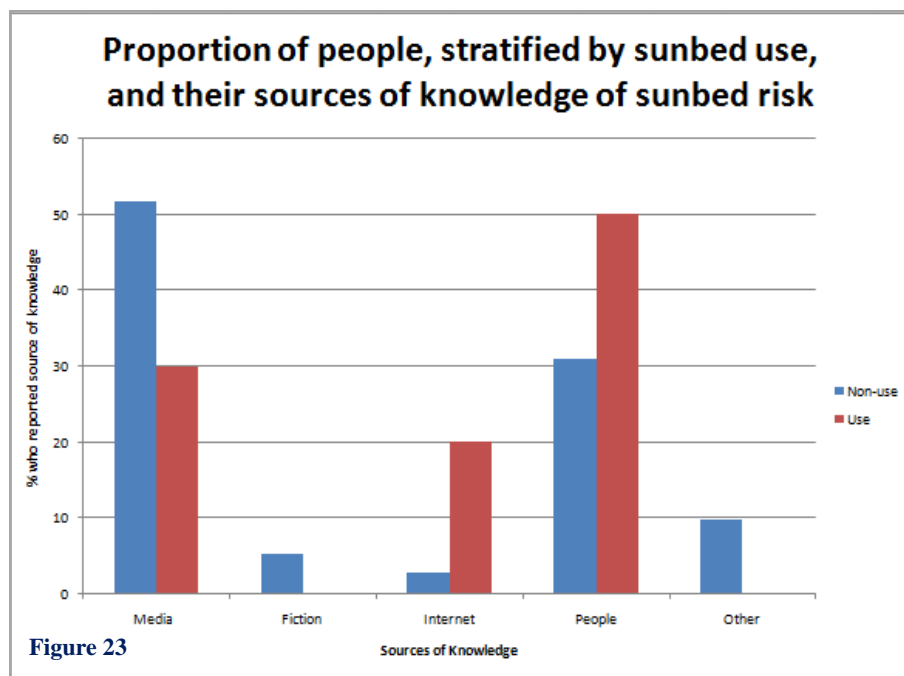
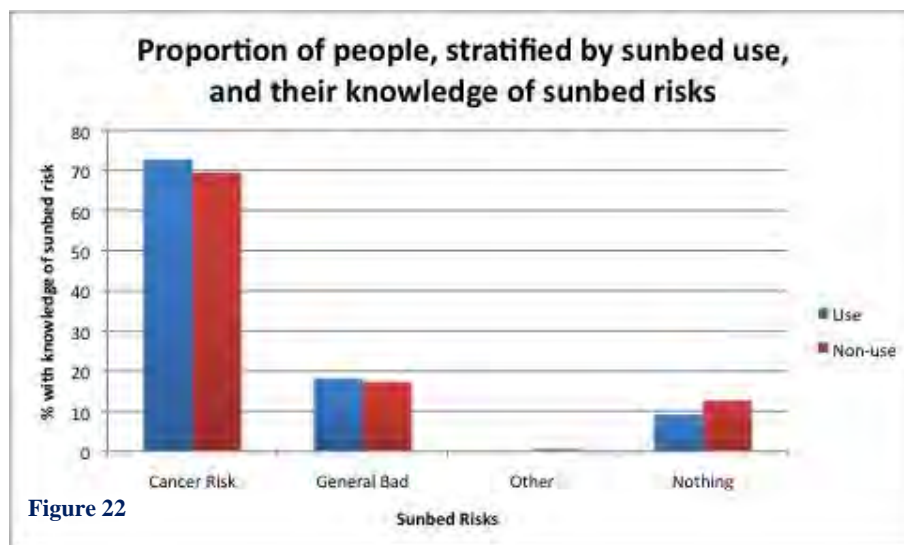
Figure 20

Analysis of Youth Knowledge about Sunbeds:

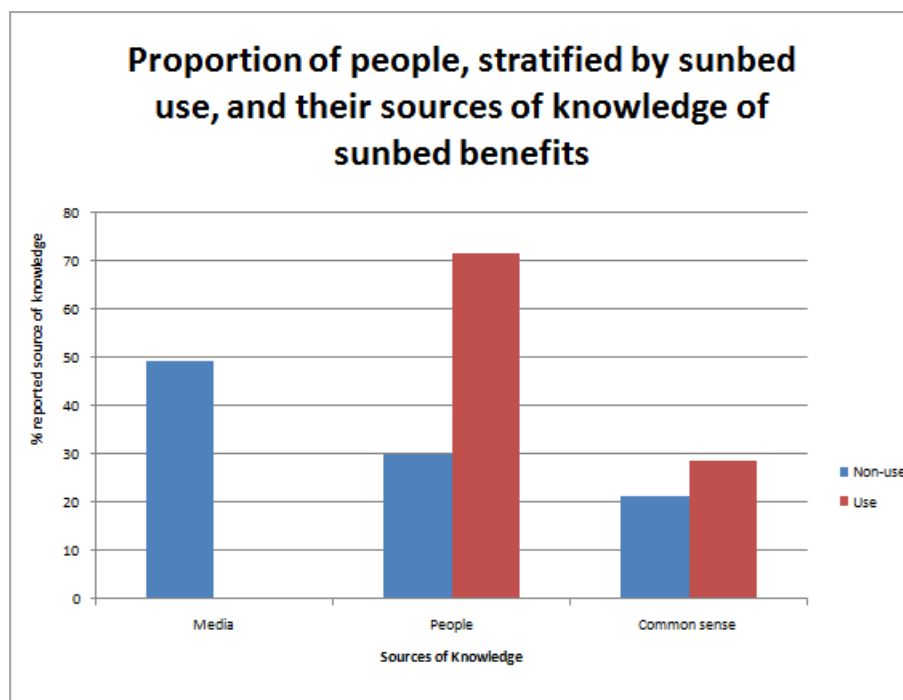
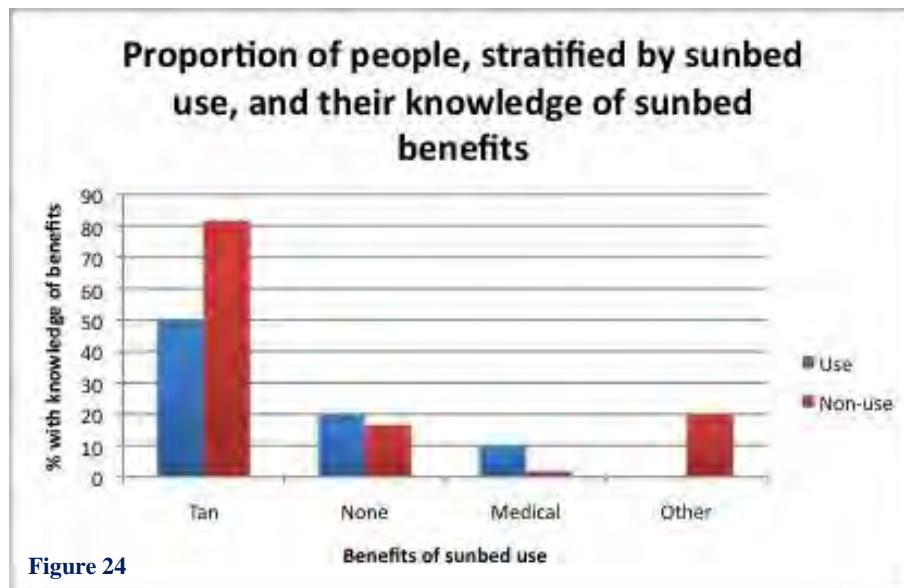
In general, most respondents listed tanning as a benefit and cancer as a risk of sunbed use, see Figure 21. 3.3% of people said that there are medical and other (e.g. „de-stress’ and creation of happy enzymes) benefits to sunbed use. 16.8% of respondents said that there were no benefits of sunbed use. 17.9% of respondents spoke of general and other (e.g. setting on fire, brain damage) risks. 12.5% of respondents were not aware of any risk associated with sunbed use.



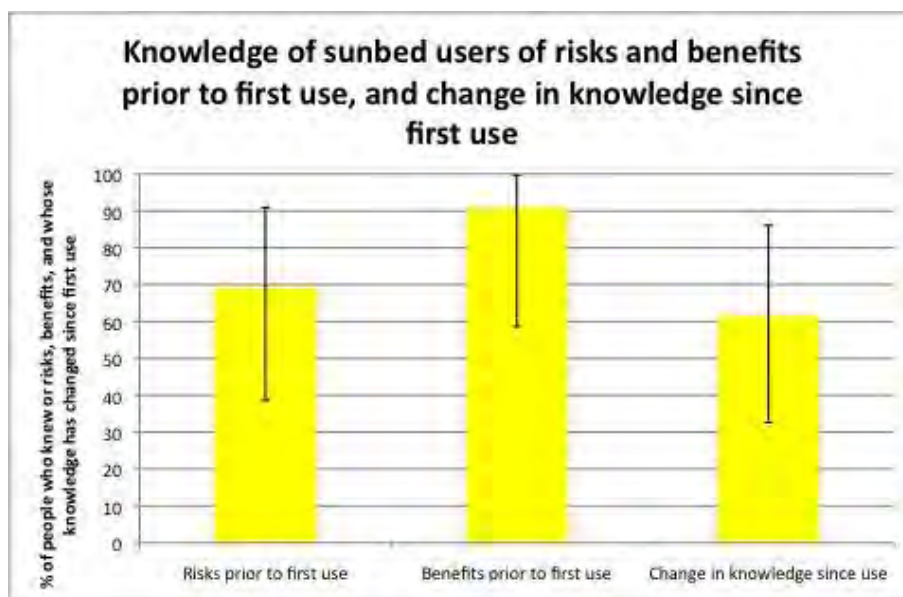
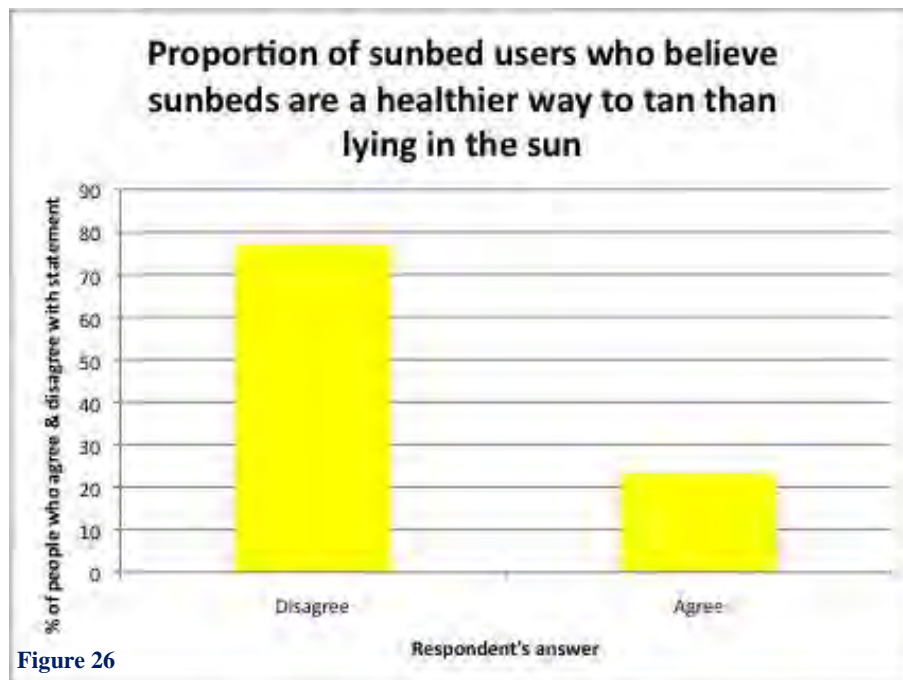
There were no significant differences in knowledge of the risks of sunbed use between users and non-users, see Figure 22. Media and „people’ were the main sources of knowledge of sunbed risk. Those who have not used sunbeds were more likely to have gained their information from the media, whereas, sunbed users stated „people’ as their primary source of knowledge of sunbed risk, see Figure 23.



Most respondents stated tanning as the major benefit of sunbed use, see Figure 24. 81.7% of those who have not used sunbeds and 50% of sunbed users stated this. Many people replied that there were no benefits of sunbed use. A higher proportion of users, 10%, believed that there were medical benefits of sunbed use as compared to those who have not used sunbeds, at 1.8%. Only those respondents who have not used sunbeds stated media as their source of information on the benefits of sunbed use. A higher proportion of sunbed users stated „people’ as their major source of their knowledge of the benefits of sunbed use, see Figure 25.



23% of our sunbed user group believed that sunbeds are a healthier way to tan than lying in the sun, see Figure 26. 69.2% of sunbed users stated they had knowledge about risks of using sunbeds prior to first using sunbeds, see Figure 27. Comparatively, 90.9% of users stated they had knowledge about benefits prior to their first use of sunbeds. 61.5% of users said that their knowledge of the risks and benefits has changed since their first use. No sunbed users thought that benefits of sunbed use outweighed the risks.



Doctors were overwhelmingly regarded as the most preferred source of advice on tanning with 79% preference amongst respondents, see Figure 28. There were no significant difference in responses between sunbeds users and those who have never used sunbeds. For both groups family were listed as the most valuable source of advice on tanning by approximately 20% of respondents. Friends, information from the sunbed providers, media and other sources were also listed as valuable advice providers.

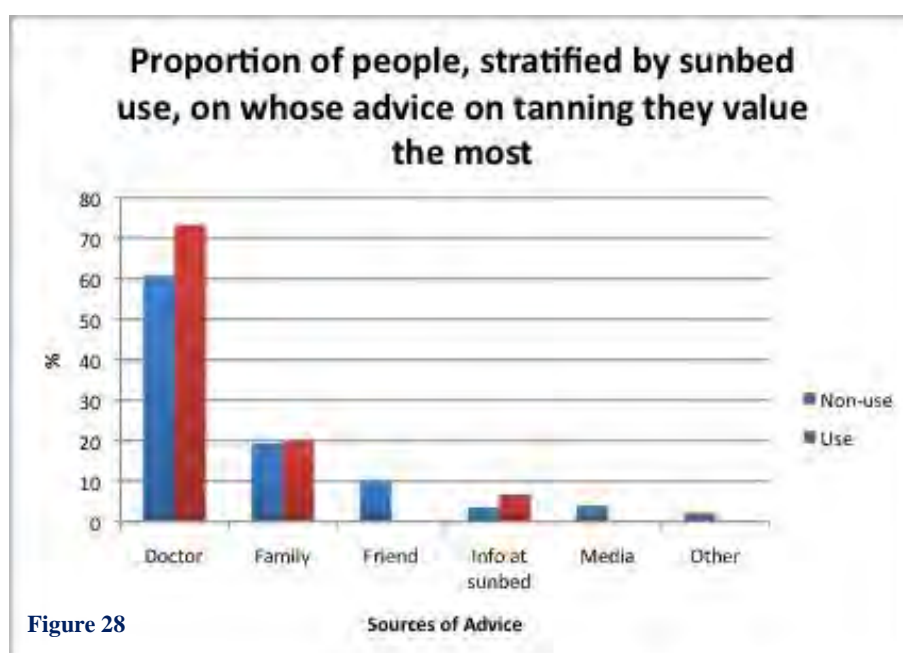


Figure 28

Table 2 shows the age of first use among our sunbed users. It is interesting to note that two thirds of our respondents first used sunbeds before the age of 18 years. Not all sunbed users responded to this question.

Table 2: Age at first sunbed use.

Age of first use	Number of People
8	1
14	1
15	1
16	3
17	2
18	2
23	1

DISCUSSION

The second part of this report aimed to survey Wellington youth (aged 15-25 years) in order to yield information about their knowledge of the risks, attitudes toward, and use of sunbeds in order to illuminate the potential impact on youth of the current voluntary code of practice amongst sunbed operators. A discussion of the results found by this study, as well as its limitations, in relation to achieving these aims is presented below.

Survey Procedure and Respondent Characteristics

The survey questions were phrased to include no leading questions. This was to minimise any bias within our results in either direction. We believe that we were successful to this end, omitting mention of words „cancer’ and „vitamin D’ for example. To gain a greater understanding of youth attitudes and knowledge, we had both quantitative and qualitative aspects in our survey. We gained insight into youth opinions by including open-ended questions and opportunities for further comment. Strong opinions, such as this from a 17-year-old female, “I don’t see why New Zealand has tanning beds because of the high risk it puts your health at. You would think that they would not allow them,” were obtained. Converse opinions were also elicited, such as this statement by a 20-year-old female, “I think using them in moderation is okay.”

There were many obstacles in obtaining survey responses that represented New Zealand youth adequately. We only had 190 respondents in total and a skewed age distribution towards participants under 18 years of age. Five high schools were contacted, however, due to unfortunate timing with school holidays only one school responded to our study. The school we sampled had a decile rating of 8. Decile ratings are determined by the proportion of the students from low socioeconomic communities, a lower number means a higher proportion [114]. This indicates that Paraparaumu College has a moderately low proportion of students from low socioeconomic communities. We aimed to get a mixture of respondents from within this school by sampling various classes at different year levels. In light of the limited scope of our sample, we are unsure as to the generalisability of the results. The sample of respondents between the ages of 18 to 25 was small, at approximately 30%. This is because we had difficulty distributing our survey at the Victoria University student health and at various sports

clubs. Low response rates to our online survey to non-medical Otago University students at the Wellington campus also contributed to our lack of representation of older age groups.

The timeframe of our study limited our respondents over 18 years to those in tertiary education. We note that there may be a difference in attitude and knowledge towards sunbeds among those outside of tertiary institutes. There was a gender bias with 69.5% of our respondents being female. In every sampled group there were far more females than males. We are also aware of potential differences in youth opinion between our sampled Wellington population, as compared to other New Zealand locations. We are unsure as to the extent of this issue. The ethnicity of respondents does not reflect the ethnicity distribution of 15 to 25 year olds in New Zealand. Maori and Pacific Island ethnicities are under-represented in our sample, whilst Pakeha, European and Other (e.g. Australians) ethnicities are over-represented (refer to Figure 4). We are unsure of how this affects the generalisability of our results. Each Fitzpatrick skin type group was represented in our sample population. We had fewer respondents in Fitzpatrick groups 1 and 5; however we believe our results remain relatively generalisable on this issue.

A potential bias in our results could have arisen from the survey information sheet stating that the research was being undertaken by medical students, as well as being sponsored by the cancer society. This could have biased the responses of those answering our survey to include more medically related responses than they may have otherwise considered.

Our sampling method also varied across surveyed groups. At Paraparaumu College we introduced ourselves to the classes as medical students and oversaw their completion of the survey. For over 18 year olds we used online surveys, relied on Student Health administrative staff to distribute surveys, and handed out surveys to NZ School of Dance students for overnight completion. Such varied methods could have possibly biased our results for example, when different age groups are compared.

Youth Attitudes towards Sunbeds

In general, the young people in our survey showed favourable attitudes towards tanning. However, these attitudes did not translate into favourable attitudes towards sunbed use. These favourable attitudes towards tanning are exemplified by the fact that over half of respondents agreed or strongly agreed that „a tan makes me feel better about myself” and „In summer I

intend to get a tan'. However, when asked the question 'I think that using sunbeds in moderation is healthy,' only 3% of respondents agreed or strongly agreed. From this we may draw the conclusion that favourable attitudes towards sun tanning do not translate into similar attitudes towards sunbed use.

Across the range of attitude questions posed, sunbed users consistently showed more favourable attitudes towards tanning than non-users. In five of the seven 'attitude' questions, sunbeds users showed on average about a 10% more favourable response than non-users. This relationship however, is not statistically significant which may be due to our small sample size. We recommend further research be undertaken in understanding this relationship.

Youth Knowledge about Sunbeds

We found that 70% of individuals knew that skin cancer was a risk of sunbed use. There was no statistically significant difference in this result between sunbed users and those who had never used sunbeds. Only those who had not used sunbeds believed that sunbed use in moderation was healthy, compared to sunbed users, of which none answered agreeably to this statement. These observations lead to the conclusion that levels of knowledge about sunbed risk are not correlated with sunbed use. This matches the conclusions of current literature mentioned in Part One of this report.

Although no sunbed users stated that using sunbeds is healthy in moderation, 23% believed that sunbeds were healthier than lying out in the sun. Some went on to justify their reasoning, with examples such as, "Dosage can be regulated in the sunbed but you can't avoid the sun so it [the dosage] ends up doubling up" and "gets vitamins into the skin that the sun would without getting burnt." One even went on to say "you get a tan in less time and you aren't exposed to the harsh UV rays from the sun." This highlights the fact that even though some young people know of the risks of skin cancer, they fail to comprehend the mechanism of sunbed tanning.

Sunbed users reported medical benefits of sunbed use, compared to no medical benefits being listed by those who had not used sunbeds. However, those sunbed users who listed a medical benefit qualified elsewhere in their survey that sunbeds were used in medical conditions, such as psoriasis or seasonal affective disorder. Medical advice was given, in one case, by a

dermatologist, to use sunbeds as a medical treatment. In the case of this dermatologist, the advice was given 15 years ago and medical protocols have changed since then.

Implications

The strongest influences on young peoples' attitudes were messages from the media and opinions of friends. Through our results we found that the majority of New Zealanders intend to tan this summer, especially females and those under 18 years of age. Furthermore, 62% of respondents thought tanning was a part of the „Kiwi summer'. Therefore to change unhealthy tanning behaviours, upstream factors, such as social perceptions of beauty and the „Kiwi-tanning culture,' must be addressed.

As there appears to be no difference in the levels of knowledge regarding sunbed risk between sunbed users and non-users, we may suggest that knowledge of risk does not necessarily influence behaviour. There is already widespread knowledge of the potential cancer risks of using sunbeds. With this in mind, we believe that any intervention aimed at reducing the dangers of sunbeds should include more than just education.

There were differences in sources of information regarding the risks and benefits of sunbeds between users and non-users. Sunbed users were more likely to receive the information from people they knew, whereas those who had not used sunbeds more commonly obtained their information from the media. Examples of media sources that were referenced included the television programmes '60 Minutes' and „20/20'. These results suggest that effective interventions against sunbed use must particularly target social perception, as this was the primary source of information for sunbed users. Preventing current non-users from ever using sunbeds is also important and employing media intervention would be the most effective strategy for achieving this.

Most of our sunbed users had used sunbeds whilst under the age of 18. Although a voluntary standard exists recommending an age restriction, it should be noted that the majority of providers in the sunbed industry, if left to their own devices would accept clients under this age. In light of the increased risk of harms, together with the inability to weigh up risks and benefits as effectively as older age groups, people under the age of 18 should be protected from sunbed use. It has been shown that even with voluntary standards, most sunbed operators still

accept clients under the age of 18. This highlights the fact that there needs to be legislation around the minimum age of sunbed use.

Most people would prefer the advice of doctors when receiving information about tanning. Melanoma is an important cancer in young people and has a high case-fatality rate. Because of this, we believe that doctors should be screening their young patients for “high risk” behaviours linked to developing melanoma. This would be an intervention for attempting to decrease the incidence of this deadly cancer. An education session around melanoma risks could be included in a GP conference or publication, in order to remind GPs that it is an important health issue in young people.

PART THREE:

EXPERT VIEWS ON SUNBED TANNING IN NEW ZEALAND

INTRODUCTION

The second arm of the practical research was the conduct of semi-structured interviews with individuals from the three main areas related to our project. Local representatives from the sunbed industry, medical community and main political parties were contacted to discuss and report their respective positions on the current regulations for the sunbed tanning industry.

METHODOLOGY

We devised questions that we could ask our interviewees as part of the semi-structured interview and requested. We obtained Category B Ethical Approval from the University of Otago Ethics Committee (Appendix 1).

1. Medical Representatives

Representatives from the medical community were found by approaching the Wellington Hospital administrative team who referred investigators onto dermatological specialists.

We contacted six dermatologists were contacted via email four of whom followed up with phone calls. A General Practitioner, previously known to the investigators was also approached for a semi-structured interview (See Appendix 1).

2. Sunbed Operators

We contacted four tanning institutions in the Wellington region via phone and email. The Indoor Tanning Association of New Zealand INTANZ was contacted twice via email. Sunbed operators within the local Wellington region were identified by ringing 4 sunbed operators from the most recent Consumer Survey.

RESULTS

Two dermatologists responded to our request for an interview. They were interviewed together. We were not able to interview a sunbed operator. One place no longer offered sunbeds as a service. Two refused to participate and one did not respond. The Indoor Tanning Association of New Zealand INTANZ also declined to comment. We interviewed one GP.

The themes which rose from the study are as follows:

The main theme was that both dermatologists and the GP saw sunbeds as “highly inappropriate devices” of absolutely no value and that they should be completely banned.

They all thought that the current guidelines regarding sunbed use were “weak, ineffectual and worthless.” They believed the solution to this would be a complete ban, as people would not follow guidelines even if they were made compulsory.

The dermatologists had a number of cases of people with skin cancer at a young age, especially young women, who had a history of sunbed use. The GP noticed an increasing incidence of melanoma, and squamous and basal cell carcinoma. These people were generally unaware of the link between their sunbed use and their skin cancer, and were understandably upset when they were informed about the likely link.

Both dermatologists and the GP thought that the media had a large influence on peoples’ perceptions of beauty. The media portray the idea that having a tan is healthy and attractive. They agreed with our suggestion that some people think gaining a tan from a sunbed will protect them from the sun. The dermatologists however, said in reality it may be equivalent to SPF 2 or 3 at the most.

CONCLUSION

The major themes from the interviews with the three medical professionals are that sunbeds should be banned in New Zealand and that the perceptions of beauty should be changed. Failing that, there should be tighter regulations around their use. We will discuss these concepts under our recommendations in section 4 of our report.

PART FOUR:

OVERALL CONCLUSIONS AND RECOMMENDATIONS

OVERALL CONCLUSIONS

The International Agency for Research on Cancer (IARC) [10], called for governmental regulation of sunbed use in 2009. This followed the upgrading of ultraviolet tanning devices to the status ‘carcinogenic to humans’ by the World Health Organisation. The Government has indicated, through the proposed Public Health Bill and the New Zealand Cancer Control Strategy, its intention to act to reduce the incidence of non-communicable diseases such as cancer in New Zealand. As presented in Part One, the evidence regarding the association of sunbeds and skin cancer is extensive and convincing. The Australia/New Zealand Standard AS/NZS 2635:2008 Solaria for Cosmetic Uses provides a comprehensive set of guidelines to minimise the risks associated with sunbed use.

One of the four main goals of The New Zealand Cancer Control Strategy [23] is to reduce the incidence of cancer through primary prevention. A specific objective under this goal is to “reduce the number of people developing skin cancer due to UV radiation exposure”. The Public Health Bill [19] is aimed at providing powers to issue codes of practice, guidelines, and to make regulations to reduce the risks of non-communicable disease. The Public Health Bill is an important piece of legislation for protecting our population’s health, but has been on the government’s legislative programme since 2008 without progress. The progression of this bill through parliament is required to update our public health legislation to be in line with WHO recommendations.

Results from both our literature review and survey support the idea that despite young people being aware of the risks associated with sunbed use, they still decide to use them. This may indicate that educational campaigns are unlikely to be successful in reducing sunbed use, as knowledge of the risks does not seem to influence behaviour in this situation. Poor compliance by sunbed operators with voluntary codes has been shown in New Zealand and internationally. This leads us to believe that alternative approaches are necessary. From the interviews with dermatologists it is clear that they believe the recreational use of sunbeds should be banned altogether. Brazil is the only country to have imposed a total ban on commercial sunbed use. Due to the differences in demographics between New Zealand and Brazil we believe further research into the feasibility of a total sunbed ban in New Zealand needs to be undertaken. We think that to move directly from a voluntary code to a complete ban on the commercial use of sunbeds is too drastic in the short-term. However, this should be a long term goal for the future.

Interestingly, our survey results showed that young people value advice about sunbeds from their doctors the most. This implies that if General Practitioners (GPs) incorporate some information about the risks of sunbed use in their consultations with young people, this may lead to decreased sunbed use by young people. This would require GPs to be aware of the risks associated with using sunbeds; perhaps a time slot at a general practice conference that addressed the issues of sunbeds would be useful in this respect. Another means for educating GPs is through electronic publications such as the electronic newsletter 'ePulse'. Having an information pamphlet outlining the risks of sunbed use would provide a useful alternative, considering how busy GPs can be. An informative pamphlet also provides patients with a take-home reminder of the advice, and a source of accurate and trustworthy information they can use to inform their decisions on sunbed use.

It is important to consider what society perceives to be beautiful, and how these perceptions are formed. The media, magazines in particular, have been shown to heavily influence beliefs about body image and sexuality and are an important source of information for young people about health and beauty. The beauty industry also heavily influences societal beliefs perceptions of beauty. Images portrayed in magazines and beauty advertisements should include people of all skin types, showing that fair skin is also beautiful. Studies have shown that psychological factors such as cognitive dissonance and the selective application of knowledge of risk played a part in young peoples' decisions to use sunbeds. This suggests that a prevention campaign may require input from psychologists, alongside other experts, in order to change behaviour.

RECOMMENDATIONS

In light of these conclusions we have developed a number of recommendations, as follows.

- We recommend that New Zealand makes the current voluntary standard an enforceable piece of legislation. Passage of the proposed Public Health Bill could allow this to occur. Therefore, we recommend that the Public Health Bill be called for its second reading to parliament.
- We recommend that general practitioners be educated on the risks of ultraviolet tanning devices, and that they pass on the knowledge of the risks to young people in general practice consultations.
- We recommend an information pamphlet on the risks associated with sunbed use be produced for distribution by general practitioners.
- We believe that the perception of beauty within New Zealand needs to be changed, so that sunbeds are not a societal need. Therefore we recommend that a campaign be developed to discourage tanning and the idea that ‘tanned is beautiful’.
- We recommend that more research be undertaken into the feasibility of a total ban of commercial sunbed use in New Zealand.

Many of our recommendations are also recommended by the WHO. Changing these aspects would bring New Zealand into line with the rest of the world. It would make sunbeds safer and ensure sunbed users were more informed of the risks.

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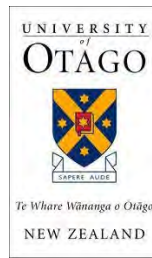
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APPENDICES

APPENDIX ONE

APPENDIX TWO



University of Otago

Wellington School of Medicine & Health Sciences

2011 4th Year Public Health Research Project

Age: _____

Location of survey: _____

Gender: ☐ Female ☐ Male

Occupation: _____

What ethnicity do you identify with?

☐ Maori ☐ Pakeha/NZ European ☐ Pacific Island ☐ Asian-specify: _____
☐ Other European-specify: _____ ☐ Other

Skin type:

1. What is the colour of your eyes?

☐ Light Blue, Light Grey or Light Green ☐ Blue, Grey or Green ☐ Brown ☐ Brownish/Black

2. What is the natural colour of your hair?

☐ Sandy/Red ☐ Blonde ☐ Dark Blonde/Light Brown ☐ Dark Brown ☐ Black

3. What is the colour of your skin (unexposed areas)?

☐ Reddish ☐ Very Pale ☐ Pale with Beige Tint ☐ Light Brown ☐ Dark brown

4. Do you have freckles on unexposed areas?

☐ Many ☐ Several ☐ A small number ☐ 1 or 2 ☐ None

Reaction to Sun Exposure:

5. What happens when you stay in the sun too long?

☐ Severe painful redness, blistering, peeling ☐ Blistering always followed by peeling
☐ Moderate burns sometimes followed by peeling ☐ Rare burns ☐ Never had burns

6. To what degree do you turn brown?

☐ Hardly or not at all ☐ Light colour tan ☐ Reasonable tan over time
☐ Tan very easily ☐ Turn very dark brown very quickly

7. Do you turn brown within several hours after sun exposure?

☐ Never ☐ Seldom ☐ Sometimes ☐ Often ☐ Always

8. How easily does your face get burnt?

☐ Very sensitive ☐ Sensitive ☐ Normal ☐ Very resistant ☐ Never had a problem

Tanning Habits:

9. When did you last expose your body to sun/sunbed?

- ☐ More than 3 months ago ☐ 2 - 3 months ago ☐ 1 – 2 months ago
☐ Less than a month ago ☐ Less than 2 weeks ago

10. Do you use alternatives to sunbeds? (e.g. spray tan, fake tan)

- ☐ Yes ☐ No If yes, what are they?
-

11. Have you ever used a sunbed?

- ☐ Yes ☐ No – Go to question 23

If not, why not?

12. How old were you when you first used a sunbed?

13. How often do you use sunbeds?

- ☐ Less than yearly ☐ Yearly ☐ 6 monthly ☐ Monthly ☐ Fortnightly ☐ Weekly
☐ More than once a week

14. Why do you use sunbeds? (E.g. preparing for a ball or holiday, health, cosmetic reasons)

15. Do you use eye protection?

- ☐ Yes ☐ No Why/ Why not?
-

16. Have you ever signed a consent form before using a sunbed?

- ☐ Yes ☐ No

17. Where do you use sunbeds?

- ☐ Gym ☐ Beauty Salon ☐ Home ☐ Tanning Studio ☐ Other _____
-

18. Were you aware of any risks prior to having your ***first*** sunbed? What are they?

19. Were you aware of any benefits prior to having your ***first*** sunbed? What are they?

20. Has your knowledge of the risks or benefits *changed* since then?

☐Yes ☐No How? _____

21. Do you think the benefits of sunbeds outweigh the risks?

☐Yes ☐No

22. Do you think sunbeds are a healthier way to tan than lying in the sun?

☐Yes ☐No

23. What do you know about the risks of sunbeds?

Where did you learn about them?

24. What do you know about the benefits of sunbeds?

Where did you learn about them?

25. Whose advice on tanning would you value the ***most***?

☐ Doctor ☐ Family ☐ Friends ☐ Information received at sunbed

☐ Media (e.g. TV, Newspaper) ☐ Other _____

Attitudes:

26. I feel more healthy with a tan:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

27. In summer I intend to get a tan:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

28. Most of my friends think a tan is a good thing:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

29. A tan makes me feel better about myself:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

30. I think that using sunbeds in moderation is healthy:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

31. Seeing tanned people on TV, in films and in the media makes me want a tan:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

32. Tanning is part of the kiwi summer:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

Further comments:

APPENDIX THREE

Interview questions:

Sunbed operators:

What do you know of current guidelines?

What is your procedure with new sunbed users?

e.g. How do you screen people?

Do you offer eye protection?

How do you decide length of time and frequency of sunbeds?

Do you think there should be compulsory guidelines?

In your opinion, what changes, if any, should be made to the guidelines?

Who are your clientele? Age, gender, occupation etc.

What do you think of sunbeds? i.e. good thing/bad thing?

What do you think the risks and benefits are of sunbeds?

Do you offer alternatives to sunbeds?

Are sunbeds important to your business?

Dermatologists:

What is your opinion of sunbeds?

What do you think about the current guidelines regarding sunbeds?

Do you think there should be compulsory guidelines?

In your opinion, what changes, if any, should be made to the guidelines?

How do you think we can change attitudes to sunbeds?

What trends have you noticed in skin cancer, especially in young people, over the last decade or so?

What do you think influences young peoples' attitudes towards sunbeds?

Where do you think people get their information about sunbeds from?

What are your thoughts on the benefits of sunbeds? E.g. vitamin D

What about as treatment for skin conditions? E.g. psoriasis

What kind of things do you think should be implemented to curb sunbed use?

Do you think sunbeds should be banned completely?