Sexual Minority Men and Indoor Tanning: A Qualitative Analysis of Social Media Engagement and Perceptions of Public Health Advertising

By

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Abstract

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Introduction: In the US, sexual-minority men (SMM), defined as gay, bisexual, and other men who have sex with men, are more likely than heterosexual men to report using indoor tanning services; further, lifetime prevalence of melanoma is two times higher among SMM. To date, no indoor tanning interventions directly target SMM. Tanning bed users report high social media use; thus, social media health promotion efforts may reach SMM who indoor tan. This study investigates how social media messages could be designed to discourage tanning bed use among SMM.

Methods: We conducted focus groups with self-identified SMM in San Francisco ages ≥ 18 years who had ever tanned indoors. We audio-recorded, transcribed, and coded discussions to identify themes related to prevention messaging.

Results: 48 men, including white (n=34), Asian (n=8), Hispanic (n=4), black (n=1), and multiracial (n=1) men participated in 10 discussions. Median age was 50 years (range: 21–76 years). Five central themes emerged addressing the importance of the (1) content, (2) spokesperson, (3) source, (4) social media platform, and (5) delivery methods used in anti-indoor tanning health promotion campaigns. Participants' described effective messages to include: graphic images, personal narratives, humorous spokespeople known within the SMM community (i.e., drag queens). Medical professionals were trusted as sources of information, but were generally not well received as spokespeople. Social networking apps (e.g., Facebook) and geosocial networking apps (e.g., Grindr) were both effective platforms for dissemination, but only when the advertisement was well-integrated and targeted in its delivery.

Conclusions: This is the first study to investigate indoor tanning prevention strategies among SMM. A social media campaign designed with attention to the spokesperson, content, and delivery of the message may influence SMM solarium users to decrease or stop use, and, ultimately, reduce the prevalence of melanoma. Future studies can utilize these data to create effective and targeted anti-solarium messages.

Dedication

I’d like to dedicate this thesis to my family, for believing and trusting in me, and supporting me in any way they can.

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I'd like to acknowledge the incredible efforts of my thesis committee.

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Thank you *all* for serving as my firefighters, clearing multiple pathways to save me from the burning buildings in which I trapped myself.

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Figures and Tables

1. Part One: Review of the Literature

I. Introduction

Indoor tanning beds are sources of UV radiation, which is a Group I carcinogen.[1] The association between indoor tanning bed use and the development of skin cancer is well established.[2] Efforts have been made to reduce the use of indoor tanning beds among high-use subgroups (i.e., adolescents, non-Hispanic white women).[3] However, until recently, most epidemiologic research on tanning bed use and prevention has focused on race and binary gender as demographic characteristics of users. In 2015, an epidemiologic study revealed that sexual minority men (SMM; i.e., gay, bisexual) use indoor tanning beds at high rates, and that the incidence of melanoma among SMM is twice that of heterosexual men.[4] This study cast light on how SMM are a high-use, and at-risk subgroup. However, only one study in the literature addresses what motivates indoor tanning behavior within this group.[5] Furthermore, little is understood as to how we can prevent tanning bed use among SMM to reduce their rising rates of melanoma. Additionally, explicit data on non-binary, gender minority men (i.e., transgender men, gender nonconforming men) is absent within the literature on tanning bed use. By exploring what is understood about indoor tanning bed use and online health promotion, I make the case for why there is an increased need for health communication directed towards SGMM against indoor tanning beds, and why social media may be an effective tool to disseminate health promotion messages regarding tanning bed use to the aforementioned groups.

II. Skin Cancer as a Public Health Priority

Cancer. It is a heavy, loaded word. A word that, even for medical professionals, is difficult to carry into a conversation without reservation due to the reactions – anxiety, fear, hopelessness – that may follow its pronouncement. However, with proper framing, knowledge, and preparation, cancer can be a word people rally around to support advances in medicine, to encourage reform in healthcare, and, as this paper hopes to inspire, to promote public health initiatives.

Skin cancer is the most common form of cancer in the United States[6]. The three most common forms of skin cancer include basal cell carcinoma, squamous cell carcinoma, and melanoma. All three of these skin cancers are commonly referred to as epithelial skin cancers[1+,7], since the cells from which the neoplasms are derived all reside within the epidermis of the skin.

Non-melanoma skin cancers (NMSC; i.e., basal and squamous cell carcinomas) are diagnosed in the greatest numbers.[8] In fact, they are diagnosed in such great numbers that national cancer registries in the United States are not able to systematically track the number of cases of these two skin cancers. This is also due, in part, to the relatively low mortality rates associated with NMSC as compared to

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[1+] Non-epithelial skin cancers (i.e. Merkel cell carcinoma and Kaposi's sarcoma) are also cancers of the skin, but occur with such rarity that they are not commonly thought of alongside the three aforementioned common skin cancers.

melanoma. Nonetheless, each year 3.3 million Americans receive a total of 5.4 million new diagnoses of NMSC. Approximately eighty percent of those cases are basal cell carcinoma. Among those millions of cases, approximately 2,000 people in the United States die annually from NMSC. In spite of the wide discrepancy between diagnoses and deaths attributed to those cancers, it is important to note that the rate of diagnosis of these cancers has been increasing significantly over the years.

Melanoma skin cancers are more concerning. In the United States, melanoma is estimated to be the fifth most common cancer diagnosis. When disaggregated by sex, melanoma is the fifth most common cause of cancer in men, and sixth most common in women.[9] In 2018, it is estimated there will be 91,270 new diagnoses of melanoma, with men comprising approximately 60% of all new diagnoses.[10] Furthermore, and in sharp contrast to NMSC, it is estimated 9,320 people will die of melanoma, with men compromising approximately 64% of those deaths. According to the Centers for Diseases Control and Prevention, in 2014 – the year with the most recent complete statistics – 76,655 people (45,402 men; 31,263 women) in the United States were diagnosed with melanoma. During that same year, 9,324 people (6,161 men; 3,163 women) in the United States died from melanoma.[6] These numbers are relatively close to the estimates that had been provided for 2014 – 76,100 new cases (M: 43,890; F: 32,210) and 9.710 deaths (M: 6,470; F: 3,240).[11] The incident cases of melanoma and melanoma-related deaths have not always been this high. Melanoma incidence has steadily risen for the last thirty years.[10] Over the past ten years for which we have complete data on melanoma (2005-2014), the incidence rates of cutaneous melanoma have risen on average by 1.4% annually.[12] When placed in context with the other most common cancers, many of which have negative trends in that same timespan, it becomes clear that melanoma rates should be of concern, and warrant looking at skin cancer (in particular, what places people at risk for developing melanoma) as a public health issue.

Types of Skin Cancer

Why is it important to distinguish between the different types of skin cancer? Well, as the numbers above suggest, different skin cancer types are associated with different mortality rates . In particular, melanoma is associated with the greatest number of deaths. However, basal cell carcinoma and squamous cell carcinoma are also important skin cancers that cause morbidity and mortality. In this section, I go over the basic differences among the cancers, and highlight an important commonality among them – ultraviolet radiation as an etiologic agent. [13,14,15]

Basal Cell Carcinoma (BCC)

In BCC, the epidermal basal cells in the skin become dysregulated. There are five clinical types of BCC: nodular, ulcerating, pigmented, sclerosing, and superficial. Characteristics of a basal cell lesion can include translucency, ulceration, and telangiectasia. These lesions are typically found on sun-exposed areas of the head and neck, although they can appear anywhere on the body. Treatment for BCC can include watch-and-wait, topical chemotherapy, and surgical removal. The image below is an

example of the nodular subtype of BCC. A textbook description of each picture within the image follows.

Source: K. Wolff, R.A. Johnson, A.P. Saavedra, E.K. Roh: Fitzpatrick's Color Atlas and Synopsis of Clinical Dermatology, Eighth Edition: www.accessmedicine.com

Figure 1 Basal Cell Carcinoma: Nodular Type

Description of Figure 1: (A) A glistening, smooth plaque on the lower eyelid with multiple telangiectasias. (B) An oval, pearly nodule on the nose close to the inner canthus. (C) A smooth, pearly tumor with telangiectasia below the lower eyelid. Tumor feels hard, is well defined, and is asymptomatic. (D) A large, firm reddish glistening nodule with small ulcerations on the nose.

Squamous Cell Carcinoma (SCC)

In SCC, the keratinized epidermal cells in the skin are dysregulated. Squamous cell lesions typically appear as “ulcerated erythematous nodules or superficial erosions on sun-exposed skin of the head, neck, trunk, and extremities”. Keratinization – the process of cell differentiation into producing keratin, a fibrous structural protein found in hair and the skin – is a hallmark of SCC that distinguishes SCC from BCC. Treatment for SCC usually includes the removal of pre-cancerous lesions known as actinic keratosis. In addition, topical chemotherapy, and surgical removal are mainstays of treatment.

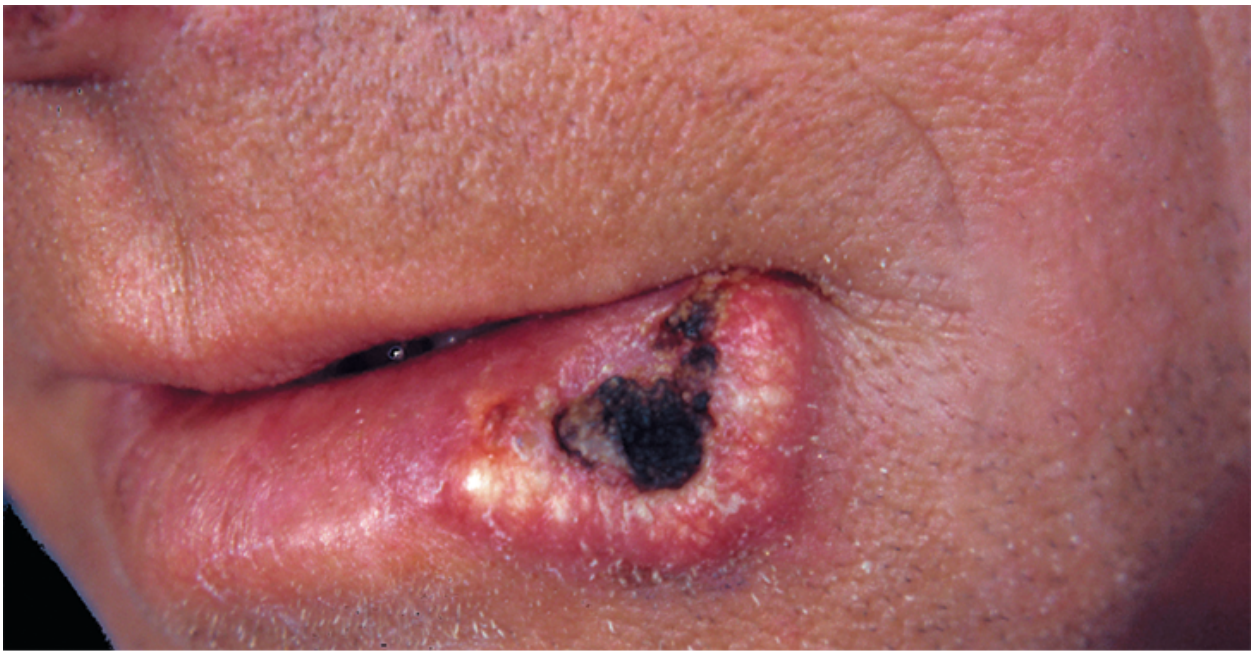

Figure 2 Squamous cell carcinoma (SCC)

Description of Figure 2: A round nodule, firm and indolent with a central black eschar. Note yellowish color in the periphery of the tumor indicating the presence of keratin. The SCC shown here is hard and occurs on the lower lip. SCC hardly occurs on the upper lip because this is shaded from the sun. SCC on the lip is easily distinguished from nodular BCC because BCC does not develop hyperkeratosis or keratinization inside the tumor and does not occur on the vermilion lip.

Malignant Melanoma (MM)

Malignant melanoma of the skin arises from melanocytes, which sit in the basal layer of the epidermis. Melanocytes have a different embryologic origin compared to the skin cells from which BCC and SCC develop. This difference in origin is in part why the associated health outcomes of MM diverge markedly from those of BCC and SCC. There are four major types of melanoma: superficial spreading, nodular, lentigo

maligna, and acral lentiginous melanoma. Superficial spreading melanoma accounts for approximately 70% of melanoma cases. Of all the types of skin cancer, MM carries the highest risk of invasion and metastasis. In order to achieve the best outcomes for those diagnosed with melanoma, swift identification and removal of the melanoma is required. The standard of care for melanoma is surgical removal of the lesion. With early detection and removal, melanoma 5-year survival rates are incredibly high and reassuring. However, upon invasion and metastasis to regional lymph nodes, 5-year survival rates drop significantly, even with adjunctive chemotherapy treatment.

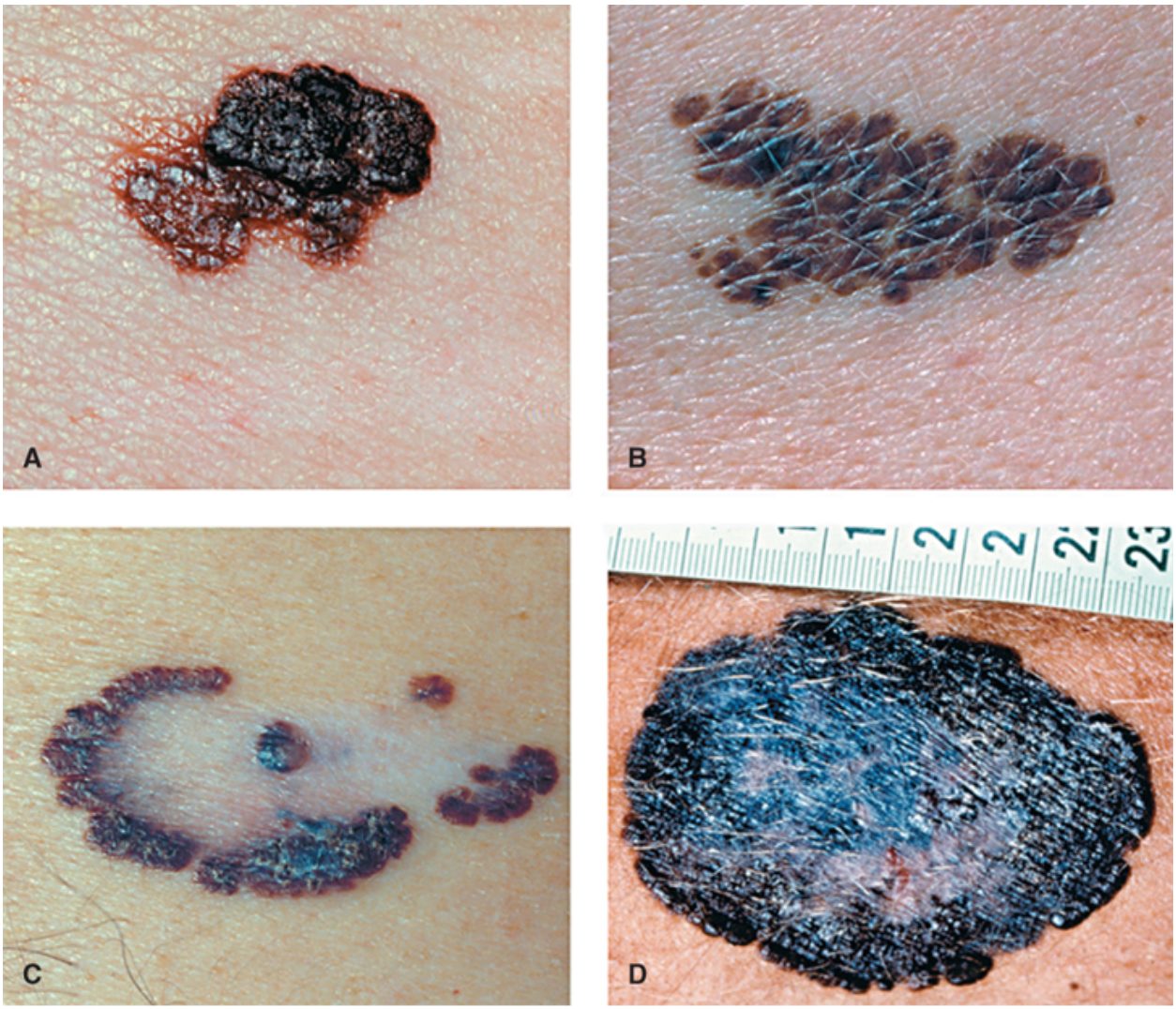

Figure 3 Superficial spreading melanoma, radial growth phase

Description of Figure 3: (A) A flat-topped, elevated, asymmetric, and irregular plaque with variegated color (brown, black) on the trunk with sharply demarcated margins. The surface is also irregular with a cobblestone pattern. (B) An asymmetric, flat plaque with irregular and sharply defined margins and a cobblestone-like surface. The melanin pigmentation ranges from light brown to dark brown, black, and there are lighter areas interspersed. (C) A highly irregular lesion with dark-brown to bluish-black papules forming a ring around a white macular area with a central

brownish to bluish papule. This white area marks spontaneous regression. (D) A relatively symmetric but large (8 cm) plaque with sharply defined and notched border and a considerable variegation of color: black, blue, red, and white.

Skin Cancer Etiology: Ultraviolet Radiation Exposure

The common etiologic thread among the three skin cancers is exposure to ultraviolet radiation (UVR).[1] Epidemiologic and basic science studies provide overwhelming evidence that incidence of skin cancer is associated with the amount of UVR exposure a person has had over their lifetime (i.e., number of sunburns, occupation-related sun exposure). The sources of UVR are either natural (solar) or artificial light (i.e., tanning beds, tanning lamps). Given the connection between UVR exposure and skin cancer, international and national health organizations have recognized UVR as a carcinogen. The World Health Organization classifies UV light as a class I carcinogen. UVR causes damage to cellular DNA in the skin by causing aberrant chemical bonds to form within and between DNA molecules. These aberrant chemical bonds cause: 1) the death of healthy skin cells, due to the cell's inability to either repair the damaged DNA, leading to programmed cell death, or the cell's inability to replicate. Two, the aberrant chemical bonds also cause cell cycle dysregulation leading to unchecked overproduction of dysregulated skin cells. At this point, the cells have developed into a neoplasm. Both NMSC and melanoma have the potential to invade beyond the borders of the epidermis, thus they are considered to be malignant neoplasms; however, NMSC have a very small chance of becoming metastatic, especially compared to melanoma.

There is no agreed upon definition of high-dose UVR; however, UVR exposure is a component of stratifying patients across risk groups (i.e., low-risk, high-risk) for developing skin cancer. Similar to other carcinogens, like cigarettes, any exposure to UVR carries a risk of cell damage and developing cancer. The amount of exposure (dosage) is also important to consider in risk stratification. However, unlike most carcinogens, UVR exposure does provide some health benefits, in particular, UVR exposure aids in the cutaneous synthesis of Vitamin D. The levels of UVR exposure needed to produce this beneficial effect are not standardized and depend on an individual's skin type, but are roughly estimated to be approximately ten minutes a day. Any UVR exposure that generates a perceptible level of erythema is generally viewed as putting a person at greater risk for skin damage and thus considered high-risk exposure.

The quality and quantity of UVR exposure are important to consider in how these skin cancers develop. UVR exposure is often self-reported by patients. Self-reports take the form of asking participants about where they grew up (i.e., country, state, city), the number of severe (i.e., blistering) sunburns they had in childhood, any outdoor occupations (e.g., construction worker, lifeguard) they have, or had in the past, and the types of physical activity in which the person engages regularly (e.g., swimming, hiking). This historical data is meant to capture, in a qualitative manner, lifetime UVR exposure to assess skin cancer risk. Historical data also contributes to assessment of the cumulative UVR exposure over the life course (i.e., amount of UVR exposure over time). While there are no agreed upon values or cut-offs for high- or low-dose UVR exposure, these self-reports of UVR exposure are meant to assist providers in stratifying patients for skin cancer risk from a spectrum of low- to high-risk.

UVR exposure can also be assessed using scaled measures. The three scales used in assessing UVR exposure are the minimal erythema dose (MED), and the standard erythema dose (SED), and UV Index. The minimal erythema dose is a measure of the dose of UVR in Joules (a unit of energy) needed to produce minimally apparent erythema, or redness. For example, one MED is approximately 200 Joules/meter^2 in a person with Fitzpatrick Skin Type 1. Thus, the energy value of one MED is not a standardized quantity (i.e., varies across people and skin types). The standard erythema dose is defined as 100 Joules/meter^2. Thus, the same number of SEDs may result in different levels of skin redness across skin tones. Lastly, the UV index is a globally-used measure of solar UV radiation in a particular locale throughout the course of the day. It is included as part of weather forecasts to assist the public in taking precautions against solar UV radiation.

Studies suggest that discrete exposures to high-dose UVR, such as those experienced during beach holidays, pose a risk for the development of melanoma, and a greater risk for the development of BCC as compared to SCC.[13,16] Excessive chronic exposure to sunlight (cumulative UVR exposure) is seen as a risk factor for melanoma, and a greater risk factor for the development of SCC as compared to BCC.[16,17] Since melanoma is associated with both discrete high-intensity exposures, and excessive cumulative use, melanoma risk stratification tools assess for both qualities of exposure [i.e., UVR exposure activities throughout the life course, and the severity of exposures at any given time (e.g., childhood sunburns)].

III. Skin Cancer as a Health Disparities Issue

As previously stated, skin cancer, is highly prevalent. Since basal cell and squamous cell carcinomas are not tracked through national cancer registries in the United States, the increased prevalence and incidence of these cancers is largely assessed by the numbers of persons being treated for these cancers, and their associated healthcare costs.

Melanoma, on the other hand, is tracked by national registries. In 2014, nearly 77,000 persons were diagnosed with melanoma, and approximately 9,500 people died from melanoma. However, morbidity and mortality data for melanoma only tell a small portion of the story. Those most at risk for developing skin cancers are those with fair skin, usually assessed as those patients with Fitzpatrick Skin Types[2] I and II, those with red hair (given the association with Fitzpatrick Skin Type), and those with a family history of skin cancer. The diagnosis and mortality of melanoma over the life course is a fascinating example of how age, gender, and sexual orientation intersect in facilitating skin cancer risk.

[2] The Fitzpatrick System of classification is a qualitative tool used to determine the relative risk of photo-aging and skin cancer among persons of various skin phenotypes (i.e. skin colors). The scale goes from Type I (the lightest complexion) to Type IV (the darkest complexion). Source: *Fitzpatrick's Dermatology in General Medicine, 8e.*

Age

Skin cancers are one of the most common cancers reported among white, non-Hispanic adolescents and young adults. Over time, as these young adults age, skin cancers, while still reported in great numbers, are generally less concerning in light of other cancers with greater associated morbidity and mortality, such as lung and breast cancers. However, among white persons in the United States, melanoma is still the sixth most common cancer reported overall.

Among young persons, skin cancer is one of the leading causes of cancer-related deaths. In the third decade of life, melanoma is the second highest cause of death among women, and third highest cause of death among men.

Gender

American Cancer Society data from 2012 to 2014 reveals that non-Hispanic white men have a greater probability of developing invasive melanoma between birth and death than non-Hispanic white women (1 in 27 for men vs. 1 in 42 for women).[18] However, aggregating data across the life course only tells part of the story. Between birth and 49 years of age, non-Hispanic white women had a greater probability of developing invasive melanoma than non-Hispanic white men (1 in 152 for women vs 1 in 218 for men). In the sixth decade of life, the greater probability of invasive cancer shifts from women to men (1 in 191 for men vs. 1 in 254 for women). In the seventh decade of life, the gap widens (1 in 106 for men vs. 1 in 202 for women), and by the eighth decade, the disparity between men and women more than doubles (1 in 38 for men vs. 1 in 91 for women). Thus, as the population ages, the demographics of melanoma patients are primarily composed of non-Hispanic white men. Thus, melanoma may be thought of as a cancer affecting younger women and older men. What might explain the differential impact of melanoma on adult women below age 50? As I'll discuss later, women face unique social pressures and participate overwhelming in skin-cancer related risk activities that make them highly susceptible to acquiring cancerous lesions at a young age.

Race

Skin cancers are most prevalent among white, non-Hispanic people in the United States. However, skin cancer does impact people of other races and ethnicities. The prevalence and incidence of skin cancer is low in non-white persons. Unfortunately, as is all too common in most health outcomes assessments, non-white persons who do develop skin cancer tend to fair worse in morbidity and mortality outcomes.[19,20] One suggested explanation for this health disparity is differences in the molecular genetic features of melanomas more commonly acquired by non-white persons (i.e. acral lentiginous melanoma).[21] It is proposed that these features may make those cancers more aggressive and likely to metastasize, explaining the disparity. However, other studies demonstrate that mortality rates among non-white melanoma patients are more strongly attributed to healthcare inequities.[22,23] A 2011 study comparing the melanoma

burden between non-Hispanic white and Hispanic Californians found that melanomas were diagnosed later among Hispanic Californians, particularly among Hispanic men with low socioeconomic status.[23] The authors of the study suggest that low socioeconomic status may contribute to delays in melanoma diagnosis.

Sexual Orientation

Building on a 2014 study that demonstrated sexual minority men (i.e., gay, bisexual, homosexual) engage more in indoor and outdoor tanning, Mansh et al. analyzed sexual orientation as it related to both indoor tanning behavior and skin cancer prevalence.[4,24] In that study, it was reported that both in the state of California, and in U.S. national surveys, sexual minority men (i.e., gay and bisexual men) had higher cases of self-reported non-melanoma and melanoma skin cancers, and higher rates of indoor tanning bed use, as compared to their heterosexual counterparts. These studies, in addition to others confirming their findings, made apparent a previously unrecognized risk factor associated with development of skin cancer – sexual orientation.[25,26]

IV. Skin Cancer and Tanning Beds

As previously mentioned, UV light is a carcinogen that is associated with skin cancer. Both the sun and artificial light sources (i.e., tanning beds, tanning lamps) provide radiation in the ultraviolet spectrum (10 to 400 nanometers). The UV light spectrum is divided further into a few categories, but the two of greatest concern in developing skin cancer are UVA and UVB.[1] UVA light is approximately within 320 to 400 nanometers. UVB light is approximately within 290 to 320 nanometers. Due to properties of ultraviolet radiation and human skin, UVA radiation permits the layers of the skin more deeply than UVB radiation. Generally, UVA irradiation is thought to contribute to photo-aging, and UVB irradiation is thought to contribute to the development of skin cancers, in particular melanoma.

The quality of UV light produced by tanning beds is not necessarily the same as that emitted by the sun.[1] Tanning beds, on average, do not emit as many UVB rays as the sun; however, depending on the device, there is wide variation in the amount of UVB light emitted by artificial light sources. Furthermore, the UVA light emitted by artificial light sources is typically greater than that of the sun. Using a standardized measure, the UV index, Ernst et al. demonstrate that tanning lamps at their peak and average usages exceed the peak UV indices of major cities throughout the United States.[27] Ultimately, it is the severity and frequency of UV exposures that have the greatest predictive value of developing a cancerous skin lesion.

Outdoor tanning prevalence is also of concern when thinking about skin cancer risk. In a U.S. study of outdoor tanning prevalence, it was shown that a significant number of people engage in this activity.[28] However, as previously mentioned, the average UV index of many tanning devices exceeds the peak UV index reached in major cities throughout the United States. Thus, in assessing risk for skin cancer, indoor tanning is generally viewed as a higher risk exposure, given the intensity of exposure, as compared to comparable time spent outdoor tanning. However, it must be noted that outdoor tanning is a more readily accessible activity for those living in perennially warmer climates.

V. Tanning Bed Users

The three demographics reporting high use of indoor tanning beds are adolescents, non-Hispanic white women, and sexual minority men (i.e., homosexual, gay, and bisexual men).[25,26,29,30]

Adolescents

The number of adolescents using indoor tanning beds is well documented by extensive, nationally representative surveys that measure adolescent behavior. These include U.S.-based surveys, such as the National Youth Risk Behavior survey and the National Health Interview Survey (NHIS), as well as international databases. A 2014 meta-analysis of the global prevalence of indoor tanning established that nearly 20% of adolescents have used indoor tanning, with approximately 18% reporting use within the last year.[29]

Within the United States, the 2011 National Youth Risk Behavior survey revealed that 13.3% of high school students had used an indoor tanning bed at least once in the past year.[31] Female students had a greater likelihood of using a tanning bed than male students (20.9% vs. 6.2%). Furthermore, the prevalence of indoor tanning among female students increased with each year (11.7% in 9th grade, 15.7% in 10th grade, 26.5% in 11th grade, and 31.8% in 12th grade). Data from the 2009 Youth Risk Behavior Survey demonstrated that of those who reported using a tanning bed in the last year, nearly 50% reported using the beds 10 or more times.[32] However, promising results of a decline in indoor tanning among teenagers has been recently reported. In a 2017 study analyzing prevalence rates of indoor tanning between 2009 and 2015 from National Youth Risk Behavior cross-sectional survey data, study authors report a decline from 15.6% prevalence in 2009 to 7.3% in 2015.[33] However, the report highlighted that indoor tanning was still prevalent in certain teen subgroups, like non-Hispanic white females (decline from 37.4% in 2009 to 15.2% in 2015). Additionally, among those women, over three-quarters reported experiencing a sunburn in the last year, suggesting high-intensity UV exposure when either using tanning beds or sunbathing.

A 2016 study on the tanning behavior of Canadian adolescents is one of the first studies on tanning bed use among adolescents to include sexual orientation and gender identity in their demographic analysis.[34] They found in male adolescents that indoor tanning was strongly correlated with both non-cis gender identities, and bi- and homo-sexual orientations.

Women

There is an extensive body of research on the epidemiology of indoor tanning among women, particularly non-Hispanic white women, as compared to other racial and gender groups. This is because non-Hispanic white women make up the vast majority of tanning salon customers on an average day. A 2015 review article stated that of the 1 million daily tanning salon customers, white women 16-49 years old comprise 70% of

daily customers.[35] The majority of this tanning occurs among those who are 18-25 years old.[31,36] A 2016 report on the association between melanoma and indoor tanning found that 25% of women 18-34 years of age (compared to less than 5% of men in this age group) used tanning beds annually, with the majority of those women indoor tanning at least 10 or more times in the past year.[37] These findings corroborate those of earlier studies describing the prevalence of indoor tanning among young non-Hispanic white females.[38] Apart from race and age, other demographic features of the female tanning population include living in rural areas, particularly in the Midwest and South, use of tobacco and alcohol, greater amounts of disposable income, and higher education.[31,35]

Sexual Minority Men

As previously stated, sexual orientation was discovered to be a risk factor for skin cancer development several years ago. In 2014, Blashill and Safren, using longitudinal data from the National Longitudinal Study of Adolescent Health (n = 1767), first described that sexual minority men reported more frequent indoor and outdoor tanning compared to heterosexual men.[24] Furthermore, sunscreen use was not found to be significantly different between heterosexual and sexual minority men, either at 16 or 29 years of age. Thus, any differences in skin cancer risk could likely be attributed to differences in tanning behavior as opposed to differences in sunscreen application practices.

In 2015, Mansh et al. corroborated the findings of Blashill and Safren by using a larger set of cross-sectional data (78,487 heterosexual men, 3083 sexual minority men, 107,976 heterosexual women, and 3029 sexual minority women), and went a step further by also analyzing data on self-reported skin cancer.[4] The study included the 2001, 2003, 2005, and 2008 California Health Interview Surveys, and the adult questionnaire of the 2013 National Health Interview Survey. The primary findings of this study were that sexual minority men had approximately two times greater odds of reporting a history of skin cancer (both NMSC and melanoma) compared to heterosexual men. Sexual minority men were also approximately six times more likely to report indoor tanning in the previous year. Additional studies in 2016 and 2017, looking at a population sample and US youth, respectively, found consistent results with the previous studies, reporting greater rates of indoor tanning among sexual minorities.[25,26]

VI. Why Use Indoor Tanning Beds?

In order to reduce the use of tanning beds, it is important to understand the motivations, attitudes and behaviors towards indoor tanning. While the focus of this thesis is on the content and design of interventions targeting indoor tanning, I will briefly review what is understood about what motivates people to indoor tan, so as to give context for how interventions were designed in the past to address these concerns and behaviors.

Adolescents

Adolescents, regardless of gender, are a well-studied group regarding intentional tanning. A systematic review of literature published in 2013 on literature spanning from 2001-2011 presented various individual and contextual factors correlated with increased indoor tanning among adolescents.[39] These correlates provide useful information in understanding potential mechanisms that motivate indoor tanning among adolescents. The themes threading together these correlates were appearance enhancement, and the psychosocial impact of tanning. On an individual level, correlates included positive attitudes about tanning (i.e. liking tanning or tanned skin), engagement in other risky, appearance-altering behaviors (i.e., tobacco, alcohol, and steroid use), and unhealthy eating and eating disorders (i.e., restrictive dieting, improper laxative use, bulimia nervosa). Contextual factors associated with indoor tanning include social norms (i.e., having friends who tan, or thinking your friends tan), and parental approval of tanning.

Women

Given that non-Hispanic white women comprise the largest demographic of indoor tanning consumers, motivations to tan (in particular, indoor tan) have been extensively studied among this population.[40] Tanning, including both indoor and outdoor practices, serves as an important social experience among college age women.[41] In addition to the typical survey methods of understanding indoor tanning behavior among women, an ethnographic study examined the development of regular tanning behavior among young women. The ethnography revealed that salon employees play a role not only in the business of the tanning industry, but also in teaching consumers how tanning works, with a focus on justifying more sessions and purchasing larger packages.[42] Thus, understanding the social experience of tanning cannot be limited to analyzing the relationships a tanner has outside of the tanning salon, but must also consider the relationships an indoor tanner develops as they become a tanner, particularly within the salon itself.

Another social factor that plays a role in indoor tanning among women is social comparison – that is the judgement of oneself based on a comparative group. A study of the impact of social comparison on lifelong habitual (on average 3 times per week) indoor tanning among women identified six emergent themes that encouraged continual indoor tanning: self-esteem, satisfaction with appearance, occupation, desire to curb the aging process[3], and disregard of health risks.[43] Given that social comparison is a factor influencing tanning behavior, it may then seem natural that the desire to attract a partner would also influence participation in risky appearance-oriented behaviors. A study within the field of evolutionary psychology demonstrated that priming young women with inter-sexual courtship and intra-sexual competition enhanced their

[3] It may seem counterintuitive that someone would try to curb the aging process by indoor tanning, because tanning leads to photo-aging. However, in the cited study, it was found that participants indoor tanned to feel less distressed by the fact that they were aging, as opposed to trying to prevent the actual photo-aging of their skin.

willingness to engage in health risk behaviors, such as indoor tanning and taking diet pils.[44]

Multiple studies have sought to identify correlates of indoor tanning in an effort to understand particular mechanisms leading to the behavior, and assist in risk stratification and identification of young women who are more likely to engage in indoor tanning.[39,45–47] Correlates for women who indoor tan include: those who live in states located within the United States Midwest and South; those who score highly on measures of sensation seeking, and warmth sensuousness (i.e., attraction to the specific sensation of warmth); those with darker Fitzpatrick skin types; other appearance-altering practices (i.e., having piercings or tattoos); having interest in cosmetic surgery and enhancements; and smoking cigarettes. Apart from its association with developing skin cancer, tanning has also been associated with other individual health risks, including unhealthy eating habits and psychiatric conditions. A study established a relationship between excessive tanning and body dysmorphic disorder among college age women.[48]

In addition to studies of indoor tanning motivations and correlates among women, there have been efforts to understand why women stop tanning. Some of these reasons include: age greater than 24 years, medium to high level of education, non-smoking, not being bothered by appearing white on the beach, and being unconcerned about friends' sunbed use. However, the most stated primary reason to stop tanning was fear of getting skin cancer.[49]

Sexual Minority Men

Men over the age of 18, as a whole, and their motivations to tan are not as well explored in the tanning literature as compared to women and their motivations to tan; however, there are previous studies reporting results on men.[50–54] In recent years, there has been a focus on analyzing men with an intersectional lens, particularly as it relates to sexual orientation. [4,24,25,30]

A 1997 study on the factors that influence health risk behaviors among tanning salon patrons found that both men and women were motivated to indoor tan for its immediate conveniences (i.e., attractiveness with a tan, relaxation) and medical reasons (i.e., address acne, arthritis, sinus problems, physician-approved treatments). Men were not as motivated as women in the study to visit a tanning salon for long-term considerations (i.e., socializing, price considerations, perceived health benefits or reduction of health risks, or tanning year-round).[50]

Among college students at a large public university in Ohio, those surveyed in 2005 were more likely to believe that they were more attractive with a sun tan, and that men engaged less in sun tanning, compared to those surveyed ten years earlier.[54] This study provides earlier data on outdoor and indoor tanning as a practice among adult men, highlights appearance reasons as a potential motivator among men, and showcases indoor tanning as a behavior that has increased since the 1990s. This study also asked participants about their sexual orientation; however, there was not enough data in that study to support conclusions based on sexual orientation.

A later study in 2013 supported the attractiveness and relaxation motivations in a survey of German residents (both men and women) between 14 and 45.[51] Among the

German participants, pre-tanning for holidays, and to feel warm, were also motivations reported among that group. It should be noted however that the German study, unlike the 1997 and 2005 studies, did not disaggregate motivations between men and women, only between current and ever-use sunbed patrons. The German study was a large, population-based study, though, with 50.9% men; thus, the motivations of male indoor tanners were likely captured well within the study.

Apart from understanding motivations to indoor tan, many studies have sought to identify potential correlates between indoor tanning and gender. A 2010 study on the characteristics of indoor tanning men and women in the United States found that men who live in metropolitan areas and use spray tanning products are also more likely to report indoor tanning use in the past 12 months.[52] Although indoor tanning prevalence is not as high among men as it is among women, certain risk behaviors (i.e., not applying sunscreen, binge drinking) among men who indoor tan were higher than in women.[55] Additionally, in a study examining relationships among indoor tanning frequency, symptoms of various psychiatric conditions, and substance use, indoor tanning was positively associated with symptoms of anxiety and obsessive-compulsive disorder. It should be noted that substance use was not correlated with indoor tanning for men in the study.[53] While modifying non-indoor tanning risk behaviors does not directly protect against indoor tanning and its consequences, these correlated risk behaviors and co-morbidities, and how they differ between men and women who indoor tan, suggest that men who indoor tan have different risk profiles than the indoor tanners who have been given the greatest attention in the field (non-Hispanic white women), and that, given these differences in risk profile, these men may require different intervention methods to influence their indoor tanning behavior.

Since 2014, multiple studies have examined the relationship between sexual orientation and indoor tanning.[4,24,25,30] However, only one study has examined motivations to indoor tan among sexual minority men.[5] In this study, it was found that sexual minority men between 14 and 35 years of age report that their previous indoor tanning behavior, or intentions to indoor tan, were motivated by affect regulation and appearance management. More distal predictors of indoor tanning were reporting elevated sociocultural pressure and skin cancer susceptibility. Elevated sociocultural pressure was positively associated with previous tanning behavior and future intentions. Skin cancer susceptibility was negatively associated with previous behavior and future intentions. Previous work on sexual orientation, body image, and risk behavior from the field of human ecology established a relationship between internalized homophobia and tanning behavior among gay men.[56] This study suggests that indoor tanning among sexual minority men may be motivated by factors related directly to their sexual orientation and gender expression.

Racial Minorities

While racial minorities (i.e., non-white persons) intentionally tan at much lower rates compared to whites, racial minorities still do intentionally tan, both outdoors and indoors.[26,28,57] This issue is of great concern in light of the fact that racial minorities have higher rates of morbidity and mortality associated with melanoma compared to their white counterparts.[19,20] This disparity implores public health authortities to target, or at

least address, racial minorities in efforts to reduce skin cancer rates (i.e., indoor tanning prevention, improved healthcare access, increased skin cancer awareness efforts). Additional evidence in support of addressing racial minorities in indoor tanning prevention efforts comes in the form of recent research showcasing that sexual minority men who also identify as racial minorities report the highest prevalence of indoor tanning, at a rate equivalent to white females, in fact.[26] Another study on sun exposure among Choctaw Nation Youth (Native Americans) shows higher indoor tanning bed use among Choctaw Nation girls compared to national averages for girls, and 10% use among surveyed Choctaw Nation boys.[58]

Given the skin cancer health disparity, and the high prevalence among sexual minority men who are also racial minorities, and Native Youth, it is important to understand racial minorities' motivations to tan. Unfortunately, there is limited research on the tanning practices and motivations among racial minority groups. An example of the lack of research on racial minorities comes from a study done to understand the lifetime history of indoor tanning in young people, which excluded non-whites in their study.[46] Even in studies that include racial minorities, the sample sizes are often too low to reach conclusions.[54] These are recurring problems in the literature on tanning.

Thankfully, there have been a few efforts to understand tanning behavior among racial minorities. In the Choctaw Nation Youth Sun Exposure Survey, over a quarter of Choctaw Nation youth surveyed reported that looking tan makes a person more attractive, implying that appearance reasons may motivate use.[58] One study performed in Australia focused on racial minorities, specifically young adult Asian Australians. It found that Asian Australian young adults engage in intentional tanning (35% reported outdoor tanning, 10% solarium use) in order to achieve a darker skin complexion, and that being acculturated to Australia (measured using the Suinn-Lew Asian Self-Identity Acculturation Scale) was associated with tanning behavior.[57]

VII. Indoor Tanning Interventions

The purpose of this section of my literature review is to provide extensive background on what efforts have been made to restrict or discourage tanning bed use in the past. The first section, which is in two parts, will review the regulatory and legislative efforts made to reduce indoor tanning, particularly among minors. The second section is a review of public health interventions designed to reduce indoor tanning behavior and intentions.

Federal Regulations

Given the compelling evidence that tanning beds cause skin damage and emit UV radiation implicated in the development of skin cancers, attempts have been made to either discourage use of, or restrict access to, tanning beds, through regulatory measures.[35] Groups such as the American Academy of Dermatology, American Academy of Pediatrics, and the American Medical Association have all taken steps to lobby for stricter tanning bed use measures and enforcement policies. Placing restrictions has not only been a domestic issue. Internationally, organizations such as the World Health Organization's International Agency for Research on Cancer have

pushed for stricter enforcement by supporting research to provide evidence for the deleterious health effects of indoor tanning.[27,59] There are reports of a decline in the number of indoor tanning salons in operation in the United States (decline from 18,000 to 9,500 between 2009 and 2016), and greater rates of business loan defaults among tanning salon operators (a proxy for declining sales or challenges in maintaining revenue).[60] Unfortunately, the indoor tanning industry has a long history as a robust business, in spite of fluctuations in popularity over the years, reporting high revenue generation (revenue growth from $2.6 billion in 2010 to $5 billion in 2013), and employing influential stakeholders who actively promote its false benefits and fight hard against restrictions.[27,35,60] Given the wherewithal of the indoor tanning industry, multiple agencies, including the Food and Drug Administration and the Federal Trade Commission have been involved in regulating tanning bed use.

The Food and Drug Administration (FDA) and the Federal Trade Commission (FTC)

The U.S. Food and Drug Administration regulates the use of medical devices. Devices that emit any source of radiation, including ultraviolet radiation, are considered medical devices. Phototherapy is an established treatment for a number of dermatologic conditions, and UV radiation is an aspect of phototherapy. Thus, by extension, tanning beds, although no longer typically prescribed for medical conditions, are still seen as medical devices. The FDA classifies medical devices into three categories – Class I, Class II, and Class III – with each subsequent class requiring greater regulation and monitoring.[36]

When tanning beds initially came into the market in the 1970s, they were classified as a Class I medical device. Class I medical devices are thought of as posing minimal danger to consumers. This means that tanning beds had little oversight, as much as tongue depressors used in the clinician's office, or even bandages you would find over-the-counter at a corner drugstore. Class II medical devices require premarket notification to the FDA, meaning that the manufacturer of the device must notify the FDA of intention to market the device, and "must demonstrate that the device to be marketed is at least as safe and effective" as a legally marketed device that is not subject to premarket notification.[61] Class III medical devices require premarket notification, with submission of clinical trials testing the product.

As greater awareness developed during the 1980s and 1990s among scientists and physicians regarding the dangers of UV radiation, the safety and classification of sunlamps and tanning beds came into question. A first step taken by the FDA in promoting safer use of tanning beds came in the form of recommendations regarding maximum exposure to UV radiation. The FDA developed the following recommendations at that time: A) during the first week of tanning bed use, maximum exposure time equivalent to three sessions at 75% of the minimal erythema dose [MED; minimum amount (of time/UV radiation) needed to produce minimal erythema]; B) for maintenance, exposure time can be gradually increased to four times the MED delivered, at most, weekly or biweekly.[35] The FDA generated these guidelines with the intention of having tanning bed manufacturers create recommended time schedules for clients using their beds.

Although recommend limits were created, the extent to which customers follow these recommendations is unclear, and recommendations around how customers use beds are not typically enforced by tanning salon staff. In a survey of tanning facilities in North Carolina, a state with legislation restricting tanning bed use for minors, 95% of tanning salon customers exceeded recommended exposure limits, with 33% of beginning tanners starting at the maximum recommended maintenance dose rather than the initiation dose.[31] Additionally, in an investigative report released in 2012 by members of the United States House of Representatives, it was found that 74% of tanning salons failed to follow FDA recommendations on tanning frequency.[31] As international organizations and other countries made strides in restricting tanning bed use, particularly among minors, in the 2000s, the United States still lagged behind the rest of the world in both regulation and enforcement of limitations on tanning bed use.[31]

In January 2010, a step was taken to limit the advertising power of the indoor tanning industry. The United States Federal Trade Commission (FTC), which investigates advertising claims, filed a suit against the Indoor Tanning Association (ITA), regarding false health benefits and safety claims made about indoor tanning.[31] In addition, the FTC released a consumer alert about tanning beds to warn customers of the potential risks of using such devices. The ITA suit was eventually settled with the FTC. The ITA was required to include health disclosures on all tanning advertisements, and could no longer make deceptive claims about tanning's health benefits. However, a 2013 study performed in California found that over 70% of tanning salons (338 salons included) still made unlawful claims about the health benefits of indoor tanning.[62]

Shortly after the settlement against the ITA, the FDA took its own course of action against the tanning industry. The formal process of reclassification of tanning beds as a medical device began in March 2010, when the General and Plastic Surgery Devices Panel of the FDA's Medical Devices Advisory Committee met. Various stakeholders contributed to the panel's investigation. The panel eventually concluded that tanning beds needed to be reclassified, age restrictions on tanning needed to be put in place, contraindications to tanning should be stated, and information on the risks of tanning should be offered to customers.[36]

These recommendations were an important step in the FDA moving forward with stricter regulation of UV radiation devices used for cosmetic purposes; however, the reclassification of medical devices occurs slowly, unless there is a catalyst to move the process forward urgently. In February 2012, an investigative report titled "False and Misleading Information Provided to Teens by the Indoor Tanning Industry" was released by the U.S. House of Representatives Energy and Commerce committee.[63] The findings of the report were most concerning for the explicit targeting of young women through advertisements, and the misleading claims made by tanning salons regarding the health benefits (e.g., tanning is a good source of Vitamin D, can prevent cancer, treats depression and lupus) and health risks (e.g., 90% of salons contacted by the committee staff explicitly said tanning presented no health risk) of indoor tanning. In addition to generating the report, the committee sent a letter urging the FDA to reclassify tanning bed devices, and to act on the conclusions they had made in 2010.

The 2012 U.S. HR report, in addition to reporting concerning findings, delivered a sense of urgency to the FDA, and triggered an expedited reclassification process for tanning beds, which took effect in 2014.[64] The expedited reclassification ultimately gives

the FDA more regulatory oversight over which tanning bed devices make it to market. Furthermore, it allows the FDA to enforce the posting of warnings regarding the use of a device.

Between the 1970s and 2014, greater awareness of the dangers of UV radiation exposure and, by extension, indoor tanning, eventually led to the reclassification of the tanning bed as a Class II medical device. However, the process of reclassification was cumbersome, especially considering how overwhelming the evidence was for the harms of tanning beds. And, unfortunately, in spite of the reclassification efforts, regulation of tanning beds has largely been ineffective in enforcing compliance with regulations, or altering tanning behavior among consumers. Thus, legislative efforts by states, which paralleled some of the FDA reclassification efforts, were made as another method of indoor tanning intervention.

Legislative Efforts to Restrict Tanning Bed Use

As with most advocacy efforts, there were multiple arms working to bring about change. In addition to changes made through the FDA and FTC, states have taken steps to restrict access to tanning beds among minors through legislation.

Taxation

On July 1st, 2010, a 10% excise tax on indoor tanning went into effect as part of the Patient Protection and Affordable Care Act (ACA).[36] The 10% excise tax on tanning is colloquially referred to as the "tanning tax", and is estimated to generate 2.7 billion U.S. dollars over the next decade. The intentions behind this tax measure parallel those of taxation for other modifiable health-related risk behaviors, such as cigarette smoking.[29] As defined by the Internal Revenue Service, excise taxes are "taxes paid when purchases are made on a specific good".[65] This means the tax is often paid by customers of indoor tanning bed sessions, either as individual sessions or as a part of membership packages, at establishments where indoor tanning is a primary service. Alternatively, the business itself can choose to absorb the cost of the tax. The idea is that the increased cost may deter customers from using the service, or deter businesses from providing the service. As part of the ACA, businesses that provide indoor tanning services are liable to report tax revenue to the federal government for indoor tanning services, which includes "any electronic product designed to incorporate one or more ultraviolet lamps intended for the irradiation of an individual by ultraviolet radiation, with wavelengths in air between 200 and 400 nanometers, to induce skin tanning".[66] A loophole in this taxation exists for qualified physical fitness facilities where tanning services are not a "substantial part of [their] business". Additionally, the tax does not apply to tanning devices sold directly to customers, or to sunless tanning products, such as spray tan products.

The tanning bed tax has produced mixed results thus far. In a 2012 study reporting participation from over 300 tanning salons in Illinois (a state in a region – the Midwest – with high usage of tanning beds, particularly among adolescent non-Hispanic white females), only 26% of salons reported reduced customer census, and 78% reported that the tax did not deter customers although customers opposed the tax.[31,36] Tanning salons did report that the tax was being paid by customers as opposed to the tax costs being absorbed by the business. This suggests that taxation may not have the

same effect in discouraging indoor tanning as it did for smoking. Furthermore, a 2015 report completed by the Tax Foundation highlighted that, since the inception of the tanning tax, the actual indoor tanning excise tax revenue has fallen short of projections every year.[67] According to the Office of Management and Budget, in 2014 the actual revenue was $92 million less than one-third of the $300 million projected. There are multiple reasons for the stark gap between projected and actual revenue. Part of the issue is that it is difficult to make projections on a new tax. Second, many tanning salons have not been in compliance with paying the excise tax quarterly. In 2011, over 40% of an estimated 25,000 indoor tanning salons did not pay the tax each quarter. Another reason is that the number of tanning salons in business has dropped since the late 2000s, leading to decreases in business. Some cite the onset of the tanning tax as the reason for the decreased number of salons.[60,67] In any case, the decreased actual revenue from the indoor tanning excise tax is a sign of both promising and troubling news about how taxation has impacted the financial state of the indoor tanning industry. While indoor tanning is declining among youth, as previously noted, the behavior is still common, particularly among historically high-using groups, in spite of five years of taxation.[25,29,33] Even if we were to say taxation has had a modest effect on the indoor tanning behavior, could this method of intervention work for sexual minority men? The topic has yet to be explored.

Public Health Interventions

Given the known association and mechanism of UV radiation leading to skin cancer, the link between tanning bed use and the development of skin cancer, and the delayed attention on both federal and state levels in enacting measures to restrict and reduce use of tanning beds, particularly among minors, healthcare providers and public health researchers have made numerous attempts to reduce indoor tanning to decrease the burden of skin cancer through health promotion interventions.

Public health interventions that target indoor tanning can fall into one of three broad categories: 1) skin cancer prevention; 2) sun protection; 3) indoor tanning prevention. Now, while the focus of my study is on the third listed category, the reality is that these interventions are not as clear cut in their distinctions as we might all like to think they are. The reality is that skin cancer prevention and sun protection interventions may include elements of discouraging tanning bed use. However, one major distinction between them and indoor tanning interventions is that the former interventions include a focus on outdoor tanning. As discussed earlier in this paper, outdoor tanning is a popular activity, and accounts for a large number of skin cancer cases; however, the demographics and volume of people who engage in that behavior suggest that different interventions, on a far larger scale than those for indoor tanning, are necessary.

Numerous studies have made attempts at addressing outdoor tanning behavior, including interventions designed to address sun protection (i.e., wearing sunscreen). For example, a common intervention is in-person, school-based programs to encourage sun protective behaviors among teens.[68] Another intervention determined that making death a conscious fear is more effective for sun protection messages.[69] In a study of the effectiveness of sun awareness posters in dermatology clinics, it was found that posters are ineffective in promoting sun protective behavior.[70] In another study, researchers

used an online video contest calling for the production of videos promoting sun safety to study the impact of user-produced videos in promoting knowledge about sun protective behaviors.[71] Although the videos were well-produced and well-received, viewership was a problem after the contest was complete. Even when production value is high, messaging does not always serve its intended purpose. A 2002 study on repeated mass media campaigns to promote sun protection in Australia showed that TV, radio, and print media ads contributed to short-term increases in sun protective behavior, but not long term.[72]

Most tanning behavior interventions have taken the form of educational messaging.[73] Tanning bed interventions take many approaches, but, generally speaking, they either encourage protective behaviors against UV radiation (i.e., promote sunscreen use and wearing sun protective clothing) or discourage risky behaviors (i.e., outdoor sunbathing, or indoor tanning). Some interventions address both. While these two intervention approaches are interrelated, I will focus on interventions that address indoor tanning specifically, since this is the highest risk behavior associated with melanoma. There are also theoretical grounds for distinguishing these two types of interventions.

For the purposes of reviewing what is known about indoor tanning interventions I have chosen to include certain studies that have a broader scope, in order not to miss opportunities in how these interventions may inform tanning bed interventions. However, this literature review is not exhaustive. The purposes are to solidly characterize the interventions targeted towards indoor tanning, elucidate what takeaways they provide us, and highlight gaps in the literature that suggest ways in which we need to develop indoor tanning interventions.

First, I will summarize interventions that have addressed indoor tanning specifically, whether or not they also address sun protective behaviors.

As I analyze the health promotion studies, I will discuss and critique the interventions based on four criteria: 1) target audience; 2) content; 3) delivery; 4) efficacy.

Target Audience

Before going into the details of the content of these interventions, it is of the utmost importance to acknowledge to whom these interventions were targeted. What I mean by target audience is a combination of who the study included in their intervention (i.e., sample), and who the researchers ultimately hope to influence with their intervention. These two things, while often synonymous, may not always be the same.

In 2017, a systematic literature review on behavioral interventions addressing tanning demonstrated that there is a dearth of interventions targeting indoor tanners specifically.[3] Of the twenty-four studies included in the paper's review, only eight explicitly sought to study individuals who had a self-reported history of tanning. Of those eight, only five specifically focused on indoor tanners. Furthermore, and as the systematic review authors wished to highlight, only a small percentage of those studies examined people who meet criteria for tanning addiction (i.e., tanning behavior similar to the addiction behavior seen in people with substance use disorders).

Additionally, and perhaps more alarmingly, the demographics of the study interventions' samples were heavily skewed towards a particular demographic: young Caucasian adolescents and women. Across the twenty-four studies, nine focused exclusively on women. With regard to age, two-thirds (n=16) focused on university students, with ten focusing specifically on a narrow age range of 18 to students in their mid-twenties. Two studies used race or skin type as criteria, only including white students or students who have at-risk phenotypes with regard to skin cancer susceptibility. Consequently, the vast majority of these studies have final sample demographics that are nearly racially homogenous.

Clearly there are gaps in who is being targeted for tanning inventions. First, these studies skew towards a young demographic. This approach makes sense given the data that intentional tanners are overwhelmingly adolescents and university age students. Furthermore, tanning carries the highest risk of skin cancer susceptibility the younger a person starts the behavior. Thus, interventions are largely targeting those who are known to participate in the activity the most, and who are at the greatest risk for the consequences that derive from the behavior. However, as noted in the problem and significance portion earlier in this paper, the age range of sexual minority men reporting high levels of indoor tanning use only overlaps slightly with the age range of intervention study participants. Furthermore, the focus on young study participants is heavily influenced by the motivational models we currently have in the literature that state social norms among young people are what encourage tanning behavior. Since sexual orientation was never asked about in any of the studies included in the 2017 review, it hasn't been included in many studies on behavioral models explaining tanning motivations, it is unclear how sexual orientation influences the age at which people either start or stop tanning. Therefore, it is not clear if these interventions targeted young SGMM, or whether SGMM were even included in the study. It is also unclear whether age facilitates a different type of tanning practice among SGMM (i.e., perhaps they start or end the behavior later in life).

Even if SGMM do start tanning at a similar time as their straight counterparts, the current behavioral interventions that have targeted tanning primarily studied women with a history of tanning. Of the eight studies that focused on people with a history of tanning, only two included men. Unfortunately, neither of those two studies fall into the group of five studies that focused exclusively on indoor tanning. Thus, there has been no behavioral indoor tanning intervention studies that have specifically focused on targeting men with a history of indoor tanning. Any inclusion of men who have used tanning beds has either not used history of tanning as an inclusion criteria for their study, or has captured these men by generally targeting people who outdoor or indoor tan. Any study that uses past indoor tanning as an inclusion criteria has excluded men in their criteria.

Delivery, Content, and Efficacy

The delivery format of any particular intervention depends on a number of factors including the discipline in which the researchers are trained, the financial and logistical (i.e. staffing) limitations of a study, and/or the ultimate goals of the study (i.e. develop a low-cost intervention). Given the various constraints that can go into determining the

method of delivery for an intervention, my purpose is not so much to denigrate the ideas of those who have studied tanning interventions, but rather to draw our attention to the methods that have, and, more importantly, have not, been tried and their effectiveness.

While it is important to repeat aspects of previous studies in order to bolster the validity of methods and respect the scientific process, we do not wish to assume that what previous studies have tried will successfully resolve an old problem in a new group, especially when that method doesn't work that well even for the old problem in a familiar group.

The content of these interventions is primarily dependent on the researcher's chosen theoretical model of tanning behavior. Intervention content, the information delivered to participants to change their tanning behavior outcomes, can be grouped into several categories, which include: educational, …..

The first published tanning intervention that explicitly addressed indoor tanning was delivered in the form of a short informational workbook to 147 female undergraduates, who used indoor tanning beds at least monthly.[74] This study took place in 2002, when the age of the internet and social media were still in their childhood and infancy, respectively. In this study, the purpose of the researchers was to test whether an appearance-focused intervention would be effective in reducing indoor tanning.

The study involved having participants complete a pre-intervention assessment, in which general demographic information was collected, in addition to information on participants' past indoor tanning use, future intentions to indoor tan, and their attitudes and beliefs about indoor tanning and alternative appearance-altering behaviors. Those in the intervention group received a booklet that reviewed the negative impacts of UV exposure on appearance, with a specific focus on tanning beds. The authors developed the booklet to cover nine potential mediators of tanning bed use: "(1) tanning history, (2) current trends in tanning popularity, (3) tanning effects on skin, (4) ultraviolet radiation and the skin, (5) indoor tanning effects on skin, (6) tanning and skin aging), (7) indoor tanning guidelines, (8) sunless tanning alternative, and (9) appearance alternatives to tanning." Follow-up was conducted at two weeks and two months post-intervention. Although it is not clear from reading the study whether participants completed the surveys in-person, over-the-phone, or off-site, given that the study was conducted at one university, and that there were at least three periods during which surveys were administered, I assume that this intervention took place in-person, or at least required a significant amount of completion time from the participants wherever they may have completed the surveys. The study demonstrated the efficacy of a brief, appearance-focused intervention in shifting attitudes, beliefs, behavioral intentions, and, ultimately, behavior of indoor tanners.

The second published tanning intervention addressed tanning bed use exclusively. The sample included 141 Caucasian female undergraduates within the age range of 19-26 years.[75] The purpose of the study was to assess how perceptions of statistical or narrative forms of tanning bed risk messages, and risk self-assessment influence tanning bed use, intention to tan, and perceived susceptibility to UV skin damage. The ultimate goal was to determine which type of message delivery was more effective in changing tanning bed use. Other aspects of the study examined how perceived self-efficacy, perceived threat, and personality factors impacted changes in tanning bed use. This was a survey study. Participants received one of three message

types related to UV skin damage and indoor tanning, and answered a series of questions addressing the message they received, and the other aforementioned topics (i.e., tanning intentions, perceived susceptibility, etc.) After completing the questionnaire, participants were called three to four weeks later for a telephone follow-up survey.

Given that one of the primary foci of the second study was to assess how evidence type (statistical vs. narrative) impacts tanning bed behavior, I will describe the three messages that were used in this study. The first was a statistical message providing information on skin cancer and the risks of tanning beds. The information was not necessarily numeric in its content, but used scientific claims to describe the risks of tanning bed use. One of the examples cited in the study is: “The myth regarding tanning bed use is that the UVA rays they emit are safer than the sun, but this is not true.” The second message put the same or similar content into a narrative format, telling the information through the story of a young woman: “Alicia liked the convenience, and she thought that the UVA rays emitted by the tanning bed were safer than UVB rays from the sun”. The third group of participants received no message, and served as the control group. This study found that statistical messages resulted in decreased tanning bed intentions and behavior, increased susceptibility to skin cancer, and was deemed to be of greater information value. However, narrative messages increased perceptions of realism. Narrative messages also decreased intentions, but did not decrease behavior.

The third study used a unique method of intervention: UV photography.[76] The 204 undergraduates (96 men, 108 women) were recruited from a single university, and randomized to either the intervention or control group. The intervention involved taking a UV photo of the participants. The UV photo is a black-white image that captures non-visible skin damage due to ultraviolet radiation. Both groups had a normal photo taken, and then the intervention group also had a UV photo taken, which they got to see, but not keep. Intervention group participants also received a two-minute informational presentation on UV exposure. All participants then completed a survey to measure their tanning bed use, and their tanning attitudes and perceptions. All participants received brochures about UV exposure at the end of the first session. At the follow-up sessions approximately four weeks later, and participants filled out the same survey, and answered questions about their tanning behavior since the previous session. The content of this intervention was unique up to this point, in that, the intervention content (the UV photograph) was more specific to each participant since the damage revealed on the photo would be unique to the UV skin damage the participant had had up to that point in time. The image-based intervention was successful in demonstrating that UV photos changed tanning attitudes, and perceptions of those who tan. It also decreased tanning bed use by time of follow-up.

The fourth study became the largest indoor tanning-specific intervention to date, with a sample of 430 17-21 year old women recruited from two universities.[77] The study was essentially a revamp of the first, aforementioned tanning bed-specific intervention. However, in this study, instead of an 11-page intervention booklet, a 24-page intervention booklet was used. The focus was still on addressing appearance motivations to indoor tan, but this time the development of the intervention booklet seemed grounded more solidly in “decision-theoretical frameworks”. The 24-page intervention also went through a prototype round in which the researchers conducted

focus groups with indoor tanners to get feedback. The final intervention booklet was divided into six sections. In Section 1, the history of tanning was addressed. In Section 2, current tanning norms were reviewed with emphasis on the social norms established by the media and peers. The third section discussed the impact of UV exposure on the skin, with the intent of increasing perceived susceptibility. Section 4 addressed tanning bed use specifically as a risk factor in developing skin damage. Section 5 discussed how to reduce the harm associated with using tanning beds. Section 6 focused on three appearance-altering alternatives to having tan skin, including exercise, clothing choice, and sunless tanning products. Also, apart from the sample size, and the contents of the intervention booklet, a major difference between the first intervention and this study is that this time the authors measured mediatory processes that could impact the interventions efficacy.

Study four had the longest follow-up interval of any previous study. Participants initially completed a baseline assessment, which captured data on demographics, attitudes towards indoor tanning and appearance alternatives, and cognitive mediators on indoor tanning. Then, participants in the intervention group were given the booklet to keep. A month after the baseline, participants completed the first set of follow-up surveys. Six months after baseline, participants completed a second set of follow-up surveys. This study was also unique in that it had participants complete biweekly diaries of indoor tanning behavior as a method of validating tanning behavior self-reports at follow-up. Much like the first intervention discussed, this fourth study demonstrated that an appearance-based intervention changes tanning attitudes and behaviors in a favorable direction (i.e., less favorable attitudes towards indoor tanning, and decreased bed use). The intervention also increased favorable attitudes towards sunless tanning and alternatives to a tan to enhance appearance. Perceived susceptibility to UV damage was also associated with decreased indoor tanning visits.

The fifth study compared two intervention methods – peer-delivered Motivational Interviews (PMI) and personalized graphic feedback (PGF).[78] The PMI is an in-person, 30-minute intervention in which participants have a discussion one-on-one with a counselor about their indoor tanning behaviors, with the guide of a personalized graphic feedback (PGF) form that has UV damage relevant information tailored to an individual's health profile. The second intervention group – the PGF group – received only a personalized graphic feedback form in the mail, without the personalized counseling session. A third group served as the control (neither intervention). The major finding of the study was that the PMI group markedly reduced indoor tanning behavior compared to the PGF and control groups, suggesting that personalized counseling was critical to the reduction in indoor tanning.

The sixth study was a school-based intervention delivered to 14-18 year old students in Denmark.[79] Thirty-one schools took part in the study, and fourteen received the intervention, which was an educational e-magazine delivered to students. The e-magazine addressed "knowledge and attitudes towards sunbed use" through multimedia delivery – short films, campaign materials, fiction, social media. The contents specifically addressed health risks and appearance-damaging effects of sunbed use. The contents were divided into three sections titled: "Body and Identity"; "Empathy and Responsibility"; "Sickness and Death". The e-magazine contents were delivered to students across three to nine lessons, at the discretion of the teacher. In

total, 996 students participated in the intervention through both baseline and 10-month follow-up (September 2010 to May/June 2011); 1355 participants were in the control group through both baseline and follow-up. The primary finding was that the intervention had an impact on tanning bed use, but not on attitudes or intentions towards tanning bed use. The school students went to, though, did impact attitudes modestly.

The seventh study was delivered by mail to parent-child dyads.[80] The intention of the intervention was to see if parental influence through both parental knowledge of tanning bed risks, and active discussion between parent-child about those risks, could discourage tanning bed use. The intervention consisted of a paper pamphlet and postcard, which included information on health risks associated with tanning, the importance of parental influence in shaping adolescent tanning behavior, the industry tactics to sell indoor tanning to adolescents, and tips for discussing tanning with their teenagers. The adolescent-targeted intervention was three postcards delivered two weeks apart containing similar contents to the parental-intervention, but instead of reviewing parental influence and discussion tactics, adolescents received information about alternatives to tanning. The intervention was delivered to households in Minnesota. Parent-child dyads were identified through HealthPartners members. Households were informed via mail about the potential to receive information on "skin health and behavior". Households were randomized and delivered the intervention. Telephone interviews were then conducted to confirm receipt, and have participants answer questions related to the intervention, as well as their attitudes and intentions towards tanning bed use. The intervention worked well for mothers and female adolescents, in particular perceptions of maternal monitoring (i.e., disapproval of tanning bed use) were found to mediate indoor tanning intentions.

The eighth study is the first of the tanning bed interventions to use the internet as the primary method of intervention delivery.[81] This study included 186 young adult women. The intervention was a website that guided participants through multiple pages on which they reflected on their motivations, attitudes, and beliefs related to indoor tanning. The study intervention was rooted in a cognitive-behavioral approach. Follow-up occurred six weeks after intervention completion. The analysis included 74 women, and the control group had 85 women. This study's findings were interesting in that they demonstrated that the intervention increased the number of intervention-receiving participants who abstained from indoor tanning by follow-up. However, the indoor tanning frequency of participants was not different between intervention and control groups once those who chose to abstain were taken out of the analysis.

The ninth study was also a web-based intervention.[82] Similar to the previous study, the intervention was a website through which participants engaged with content that discouraged tanning bed use and promoted sunless tanning. The website was divided into four sections addressing fashion and beauty, celebrity watch, peer relationships, and resources. These sections could be divided further for a total of 15 subsections. Follow up occurred six months after the intervention was completed. The analysis included 182 women in the intervention group, and 206 women in the control group. The intervention successfully reduced intentions to indoor tan, and increased willingness to try sunless tanning.

The latest known indoor tanning intervention is currently underway. In a 2016 research protocol, Pagoto et al. reported on the first social media-delivered tanning bed

intervention targeting the mothers of adolescent girls.[83] The intervention, delivered through Facebook, teaches mothers about the health risks of indoor tanning. The study will go on for 12-months, and measurements will be taken at baseline, end of intervention, and 6-months post intervention. Enrollment for the study began in 2016 (March 31st, 2016). The study is scheduled for completion at the end of next year (October 2019).

Social Media-Based Health Promotion

Given the efficacy of previous print, in-person, and photographic interventions, and the limited number of online interventions for indoor tanning, why should indoor tanning prevention segue into social media-delivered campaigns?

First, as some of the limitations of previous efficacious studies pointed out, scaling up in-person and photographic interventions is a challenge. While these interventions may be effective, the cost of running these interventions, given the time and resources needed to run them, would be prohibitive for scaling up intervention efforts. Second, reaching indoor tanners, particularly those who do not live on or near university campuses (where most interventions studies took place), would be difficult. Furthermore, reaching tanners at a time when they are contemplating tanning bed use most would be difficult. Apart from delivering interventions in the months preceding the time when indoor tanners use beds most, it is difficult to intervene in the tanning behavior in a more acute, or real-time, timeframe prior to bed use. Lastly, measuring the impact of interventions would only become more difficult to do as these interventions scale up, and loss of follow-up may be of an even greater concern with large numbers or participants.

Social media offers unique benefits that previous interventions, including the previous website-based interventions, do not offer. Social media allows researchers to target persons-of-interest not only based on demographics, but also correlates of behavior. For example, many indoor tanners have tattoos, body dysphoria, and eating disorders. Social media sites, especially Facebook and Instagram, have enormous amounts of data on not only the demographics of their users, but also on their users' behaviors, concerns, and interests. The large social media companies create user profiles geared towards allowing advertisers to seek a particular demographic, or user, to market their products. Social media sites also have mechanisms to gather follow-up data that previous interventions could not, by measuring link clicks, site traffic, and users' online search data.

Not only is social media use ubiquitous these days, but previous studies have also established that indoor tanners are particularly likely to use social media. A study published in 2016 in the Journal of the American Academy of Dermatology reported that among a nationally representative sample of 18 to 25-year-old non-Hispanic white women, the number of indoor tanning sessions in the past 12-month was associated with greater odds of reporting regular Twitter and Instagram use among participants.[84] Number of past 12-month indoor tanning sessions was not associated with frequency of Facebook, and Pinterest, use. While the study's findings suggest that Facebook and Pinterest may not be associated with frequency of indoor tanning over the course of the year, it is important to keep in mind that the study demographic was college-age

women. Given its broad reach, and the sheer number of people on Facebook, the study may be a sign that to reach younger indoor tanners Instagram and Twitter are better choices over Facebook and Pinterest. We do not know if these findings would hold true in an older demographic. Perhaps Facebook and Pinterest may reach indoor tanners as well, but simply an older set of them.

Further evidence of indoor tanners using social media is the sheer number of mentions of indoor tanning on social media. In 2016, two studies were published in Translational Behavioral Medicine related to social media and indoor tanning. In the first published study, Twitter was used as a proxy surveillance tool for tanning bed-related injuries.[85] The researchers found that there were 15,178 tweets describing a tanning bed-caused skin burn. The purpose of the research was to highlight the potential benefit of using social media, particularly Twitter, as a public health surveillance tool. In addition, though, the researchers highlight the sheer magnitude to which tanning bed users are on social media, and posting content associated with their tanning bed use. It is not only tanning bed users posting on Twitter though. In a second study, released approximately a week later, a study of indoor tanning promotions through social media showcased how often indoor tanning salons use social media to reach (potential) clientele.[86] The study, conducted in six cities across the United States, found that salons posted most frequently on Facebook and Twitter, and averaged 2-3 postings a week. On a promising note, sunless tanning was promoted more than tanning beds were; however, this may have to do with the greater profit return on sunless tanning. These studies highlight the critical role social media plays in promoting indoor tanning, whether for promoting the practice or highlighting its dangerous consequences.

Additionally, the desire to share information about indoor tanning's risk is also present on social media. A study published in 2017 reported the quality and quantity of information about skin cancer posted and shared on the social media site Pinterest.com, which permits users to bookmark (or "pin") and share images.[87] Although the purpose of the study was largely to characterize the content of the pinned images relating to skin cancer, and determine the level of factual accuracy, the fact that a total of 708 pins were coded and 82.1% of those were considered highly relevant to skin cancer suggests that there is a considerable amount of virtual conversation happening about skin cancer and its associated risk factors, including indoor tanning.

In addition to social media platform use having an association with higher frequency of indoor tanning, it has been shown that the actual use of social media may in and of itself influence indoor tanning expectations, intentions, and behavior. In 2017, Myrick et al. studied the relationship between adolescents' media use, indoor tanning outcome expectations, and behavioral intentions to indoor tan.[88] The study was conducted among adolescent females at three high schools in the Southeastern United States. The two primary findings related to social media and indoor tanning: (1) a significant and positive association between higher level of social media use and positive outcome expectations for indoor tanning (i.e., mood and health benefits), and (2) a significant and negative association between higher level of social media use and negative outcome expectations for indoor tanning (i.e. health threat, and physical and psychological discomfort). In other words, social media use causes indoor tanners to have higher expectations about the benefits of using a tanning bed, and reduces the negative outcomes they expect from using a tanning bed. Furthermore, the study

established a significant and positive association between positive outcome expectations and indoor tanning intentions, and significant and negative association between negative outcome expectations and indoor tanning intentions. Therefore, the higher positive expectations indoor tanners derive from their social media use translates into them intending to go indoor tanning.

Myrick et al. looked at media using a broad definition of the term, including talking on the phone, texting, mass media, and online social media. Thus, they also studied whether different types of media impacted indoor tanning behavior. In the study, interpersonal and social forms of media had significant and strong correlations with tanning expectations and intentions.

Lastly, social media, apart from being a way of reaching indoor tanners and a tool that shapes expectations of tanning bed use, may attract users who have the characteristics that could predispose them to use indoor tanning beds. Therefore, social media may function as a tool to identify those at-risk for participating in the at-risk behavior of interest (i.e., using a tanning bed). The study that established this idea was a 2017 study of Australian adolescents.[89] The researchers examined the total social media usage, and the nature of that usage among adolescents, and also measured their skin tone dissatisfaction, sun exposure and sun protection. There were strong associations between certain types of social media use (i.e., viewing or posting pictures) and dissatisfaction with skin tone, differences in sun exposure and protection behaviors among adolescents. While the study was examining sun protective behaviors, a previous study has established that poor sun protective behavior is associated with tanning bed use as well. Therefore, social media may be a way of targeting those most likely to use tanning beds.

Perhaps social media could be a tool on which users (who we know are using these platforms) also receive information, or an intervention about tanning bed use. We could use social media metrics to evaluate reach, impact, and follow up. However, questions remain – what type of content would users gravitate towards in the sea of information they receive through social media? Furthermore, how do we target sexual minority men in a way that speaks to them? In addition to Facebook, Instagram, and Twitter, are there social media platforms used by sexual minority men that would be better utilized for the purposes of a social-media delivered tanning bed intervention?

VIII. Health Promotion for Sexual Minority Men

Sexual minority men as a demographic fall within the larger lesbian, gay, bisexual, and transgender (LGBT) community. LGBT populations have historically been marginalized within healthcare settings, leading to widened health disparities between LGBT persons and their heterosexual counterparts.[90] Across the board, LGBT persons typically have greater morbidity and mortality rates for all well-recorded health outcomes. Based on what sexual orientation data has been collected, cancer rates generally are higher among LGBT persons.[4,91] The areas that have the most robust data on sexual orientation as it relates to health outcomes are studies addressing sexual health. These studies typically collect and analyze data on modifiable risk factors, such as cigarette use, substance use, and sexual behaviors, within the context

of their study. Targeting LGBT needs through health-promoting interventions has been a focus in reducing health disparities, but has been met with challenges.

Given that indoor tanning is a modifiable risk factor for developing skin cancer, and that it has been established that sexual minority men engage in indoor tanning more than their heterosexual counterparts, recent interventions that address modifiable risk behaviors among LGBT persons, specifically gay and bisexual men, may serve as examples of how best to reach sexual minority men, and to impact their tanning bed use and rates of skin cancer. In particular, smoking cessation programs and HIV prevention campaigns are important to analyze as they have established precedents in LGBT health promotion.

Cigarette smoking may offer important lessons given the parallels between motivations for starting both smoking and indoor tanning (i.e., relaxation, appearance-alteration or weight loss). Sexual health, particularly HIV prevention efforts among men who have sex with men, may also offer insights. HIV prevention has received a lot of funding, involves a large number of persons studied as compared to anti-smoking interventions among gay and bisexual men, and has had to utilize online intervention methods given the large role online platforms play in facilitating sexual interactions between men who has sex with men. HIV prevention efforts are particularly enlightening in the context of tanning bed use because 1) HIV prevention is an issue for which prevention efforts are designed to target specific communities most affected by the virus (i.e., men who has sex with men, black and African American women and men). This creates a similar parallel to tanning bed prevention efforts focusing on the highest use groups (i.e., non-Hispanic white women and adolescents). Furthermore, given the stigma, and general inconspicuousness, of sex, HIV prevention efforts often struggle in reaching their target demographic, and recruiting participants to openly discuss a potentially uncomfortable, and private, issue. While tanning has not been stigmatized nearly as much as HIV has been historically, there is evidence from prior studies that tanning carries stigma, and the behavior itself can be relatively inconspicuous (i.e., indoor tanners can attribute their tan skin to outdoor tanning practices).[92]

Thus, both SMM-focused cigarette and HIV prevention efforts can shed light on how to develop an effective SMM-focused indoor tanning prevention campaigns.

Examples from Smoking Cessation and Sexual Health

The desire to use social media in health promotion interventions is driven in large part by the challenges in recruiting and retaining hard to reach populations for studies. Given the ubiquity of the internet, social media has become a promising tool to use in this effort, as evidenced by the studies below.

A smoking cessation intervention targeting a hard to reach demographic, young smokers, used Facebook to engage users.[93] The study's target demographic was 18-25 year olds, who used Facebook at least four times a week. The study utilized secret Facebook groups to deliver intervention messages, and measure engagement with those messages. The intervention was delivered entirely through Facebook, but had many dynamic components, including daily posts with cessation messages, live question and answer sessions with smoking cessation experts, and chat-based group cognitive behavioral therapy sessions. Incentives were randomized across the

participants, dividing the participants into three incentive groups. The first group some received a US $50 gift card if they commented an all 90 posts their secret Facebook group by the end of the intervention. The second group had a US $50 gift card donated to a charity of their choice if they commented on all 90 posts. The third group did not receive an incentive for participation. Engagement was measured in two ways. First, post engagement was quantified based on the number of "likes" and comments a post received. Second, the number of participants opting for the cognitive behavioral therapy was measured, in addition to the number of sessions in which they participated. Follow-up was performed at 3 months, 6 months, and 12 months.

The primary findings of the study were that participants found the intervention easy to use, and engaged with it across the course of the intervention. Apart from retention dropping at 12 months for those in the "preparatory" stage of quitting smoking, retention was good throughout the study. Monetary incentive was particularly important for those who were motivated to engage with the intervention.

Sexual health campaigns serve as another example of health promotion campaigns using social media as a recruitment and intervention tool for hard-to reach-populations. A 2014 study sought to reach Spanish-speaking Latino gay couples using social media in an effort to re-purpose a previous English-language based substance use intervention for the aforementioned population.[94] The study used Facebook, in addition to other social media platforms, including Craigslist, Grindr, Twitter, SCRUFF, and Jack'd. The study demonstrated that monolingual Spanish-speaking Latino men who have sex with men readily use social media, and engage meaningfully both socially, and with the intervention-related social media posts and groups.

A study in 2016 targeting a similar population (Latino MSM 18-30 years old) using a multi-media approach to increase HIV testing rates with significant results.[95] The online components of the intervention included social media outreach, a website, and a mobile-technology reminder system. The social media outreach averaged 10% engagement on Facebook, which is higher than the 2% direct engagement typical on Facebook at the time of publication. There was a total of 68,300 impressions from Facebook viewers, meaning the number of times the ad was shown. The Facebook page was shared across people in New York, Los Angeles, Florida, Nevada, and Chicago. There were 324 unique followers and fans of the campaign. The campaign was followed on Twitter 79 times, although no effort was made on the part of the researchers to promote the campaign on that platform.

A third study targeting a different population sought to assess the potential of using social media to recruit adolescent gay, bisexual, and queer men.[96] The study successfully demonstrated that social media is a cost-effective method of not only recruiting a diverse subset of gay, bisexual, and queer-identifying teenage boys, but in showcasing which social media platforms are more effective than others. For example, the study compared the power of Google AdWords to Facebook as a recruitment strategy, and had much more success with Facebook.

IX. Research Question and Hypotheses

A social media-based intervention to combat indoor tanning among sexual minority men would apply advancements in health promotion intervention towards the

goal of addressing a newly recognized health disparity. San Francisco, California, a city and state reporting high rates of skin cancer and technology utilization, and in close proximity to Silicon Valley, is a conducive environment to design this intervention. However, before an intervention study can be conducted, there must be an understanding of tanning behavior and perceptions of public health campaigns among the target population in order to inform the design of the intervention. Hence, I propose a qualitative, focus group study of sexual and gender minority men in San Francisco who have used indoor tanning beds, in order to gain insight into what promotional messages would resonate with them as it relates to indoor tanning prevention.

Part II. Original Research

I. Introduction

Health disparities experienced by LGBT populations have garnered the attention of the Institute of Medicine, the U.S. Surgeon General's Office, and the U.S. Office of Disease Prevention and Health Promotion.[90,97,98] Specifically, sexual minority men (i.e., gay, bisexual, homosexual men; abbreviated SMM) report higher rates of skin cancer and indoor tanning[5] compared to heterosexual men.[4,24–26,30] These disparities in skin cancer, and its associated risk behaviors, have prompted calls to address indoor tanning behavior among this population.[4,99,100]

No data has been published on what percentage of the indoor tanning consumers identify as sexual minority males. In the 2015 National Health Interview Survey, 6.6% of SMM reported indoor tanning within the last 12 months (compared to 1.5% of heterosexual men), and 22.1% of SMM reported ever indoor tanning (compared to 9.1% of heterosexual men).[30] Sexual minority males have at least three times greater odds of reporting ever indoor tanning compared to heterosexual males (OR = 3.17 for male sexual minority high school students, and OR = 3.14 for SMM). Sexual minority men report nearly six times greater odds of use within the last year (OR = 5.85).[26,30] Furthermore, SMM, particularly those between 18-34 years, have greater odds of frequent indoor tanning[6] (crude odds ratios: gay = 4.8, bisexual = 6.5; age-stratified odds ratios: gay = 5.8, bisexual = 7.5).[25]

To date, interventions in the United States addressing indoor tanning have included taxation through the Affordable Care Act, Food and Drug Administration (FDA) regulations, state legislation, and behavioral interventions. In 2010, the Patient Protection and Affordable Care Act included a provision for a 10% federal excise tax (the "tanning tax") on sunlamp services provided in tanning salons.[36] In 2014, the Federal Drug Administration reclassified sunlamps as a medical device requiring warning notifications to consumers of the risks associated with use, including eye damage, premature aging, skin burns and skin cancer.[101] As of March 2018, 44 states regulate indoor tanning for minors, with sixteen states and the District of Columbia banning tanning bed use for adolescents under 18 years.[102] Behavioral interventions to influence indoor tanning take the form of education-based, cognitive-behavioral-based, or brief motivational interventions.[3] These interventions often advocate for alternative appearance-enhancing behaviors (i.e., physical activity, sunless tanning). A 2017 systematic review of twenty-four tanning intervention studies showcased that only five studies focused on indoor tanning, and all of those exclusively recruited female adolescents or undergraduate women. Furthermore, none of the studies in the review explicitly included sexual minorities in the design or study of their intervention, nor examined sexual orientation as a factor in analysis.

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[5] Indoor tanning is defined as use of an indoor tanning device (sunlamp, sunbed, or tanning booth, excluding spray-on tans). The term is meant to capture exposure to an artificial source of ultraviolet radiation, which is a carcinogen.

[6] Frequent indoor tanning is defined as reporting 10 or more uses in a year.

Recent epidemiological studies provide support that indoor tanning in the United States is declining. Based on the National Health Interview Survey in which people are asked about indoor tanning practices over the past 12 months, between 2009 and 2015 indoor tanning prevalence among high school students decreased from 15.6% to 7.3%.[33] Between 2010 and 2015, indoor tanning prevalence among adults declined from 5.5% to 3.5%.[103] While reductions in indoor tanning prevalence are greatest among the largest consumers of indoor tanning services[7] – non-Hispanic white female adolescents and women (female students, 2009 to 2015: 37.4% to 15.2%; women, 2010 to 2015 – 18-21 years: 31.8% to 20.4%; 22-25 years: 29.6% to 13.9%; 26-29 years: 22.1% to 13.8%) – reductions in indoor tanning have occurred across all gender and racial groups, including male adolescents and men (6.7% to 4.0%, and 2.2% to 1.6%, respectively).[33,103,104] However, these studies did not include sexual orientation in their analyses; thus, it is not known whether indoor tanning is declining among sexual minority males.

In spite of recent broad declines in the prevalence of indoor tanning, the disproportionate prevalence of indoor tanning among SMM, and the lack of targeted interventions for this group, suggests further research is needed on indoor tanning and SMM, specifically on how to intervene on this behavior.

In order to address this gap in the literature, we conducted a qualitative focus group study among SMM who have used indoor tanning. The first part of the study (under review) addressed the motivations to indoor tan. The current analysis is focused on characterizing how prevention messages could be designed to be most effective in reducing tanning behaviors among SMM.

II. Methods

Recruitment

Participants were recruited through print and online advertising efforts. Printed flyers advertised a UCSF focus group on indoor tanning. Eligibility criteria were listed as follows: used a tanning bed at least once; men 18+ that identify as gay, bi, trans or queer; use Facebook or other forms of social media. Focus group dates, times, and locations were listed on the flyer as well. Contact information for the study was provided, including a telephone number and an email address. Interested parties could reach out to inquire about enrollment in the study. Although it was not listed explicitly as a criterion of inclusion, participants had to be available for the in-person focus groups to participate in the study. Flyers were posted at two University of California, San Francisco (UCSF) campuses (Parnassus Heights and Mount Zion), and throughout the Castro District of San Francisco, a historically gay neighborhood in San Francisco.

Online advertising included a post in the 'volunteers' section of Craigslist, an ad on the social media site Facebook, and an ad on SCRUFF, a geolocation social networking application for sexual minority men. The Craigslist advertisement was similar

[7] White female adolescents and women between 16 and 29 years comprise 70% of tanning salon customers.

to the printed flyers. Interested parties could contact the study to relay their interest and availability. Social media advertisements consisted of banner ads that read “UCSF Tanning Study: Share your thoughts on tanning and receive $50!” Upon clicking the advertisement on Facebook, people were taken to a Qualtrics survey. Upon clicking the advertisement on SCRUFF, a larger pop-up message was displayed that stated, “The UCSF Tanning Study wants to hear your thoughts about indoor tanning and skin cancer prevention advertisements! You will receive a $50 Amazon gift card for your time. Sign Up!” If interested parties on SCRUFF clicked the “Sign Up!” button, they were taken to the same Qualtrics survey that Facebook users were taken to upon clicking the Facebook banner advertisement.

The Qualtrics survey introduced the study, and led participants through questions to determine if they met eligibility criteria. If participants met all three eligibility criteria, then they were asked for their name, contact information, and which two of the ten scheduled focus groups they were available to attend.

Once a person expressed interest in enrolling into the study by calling, emailing, or completing a survey, one of two research coordinators contacted the person to schedule their focus group date and time, and to answer any questions regarding the study. Research coordinators confirmed study enrollment for members of a particular focus group 48 to 72 hours prior to the start of that scheduled focus group.

Focus Groups

Given the lack of data on tanning bed intentions and behavior among SMM, this study was exploratory. Qualitative methods equip researchers to broadly explore behaviors that have not been studied before. We conducted a qualitative, focus group study in an effort to generate discussion among, and gather multiple perspectives from, sexual minority men who have ever-used indoor tanning beds. Previous literature on tanning bed attitudes, intentions, and behaviors found that social norms play an important role in motivating tanning behavior and beliefs.[41,105] Qualitative methods are used in various fields (i.e., public health, marketing, anthropology) to study social phenomenon and norms. Focus groups, in particular, facilitate these discussions, by allowing individuals to elaborate on their own perspectives, and have others respond to them.[106] Focus groups permit the collection of data from multiple participants at one time. Thus, within the same time frame, focus groups may capture more perspectives on a phenomenon than an individual interview would.

The focus group guide for our study was adapted from that of a previous focus group study on social media use, and perceptions of tanning public service announcements, among women 18 to 30 years old who indoor tan. The goals of that study were to identify a video message that: 1) would resonate with 18 to 30-year-old women who use tanning beds, and 2) could be used for an online intervention discouraging indoor tanning among 18 to 30-year old women. That original interview guide (Appendix A) consisted of four central questions on tanning beds, skin cancer, social media use, and tanning public service advertisements, with a list of probing questions for each central question.

For the purposes of our study, we created a modified version of the previous focus group guide (Appendix B) to reflect our central questions for SMM on motivations

to indoor tan, social media engagement, and general perceptions of public health campaigns and online advertising, among SMM. The first modification to the guide was that we did not focus on skin cancer unless it came up organically in a focus group discussion because we did not know whether it was of concern to, or a tanning bed deterrent among, SMM who use tanning beds. Second, during the focus groups with young women, a series of video advertisements were shown as part of the discussion on tanning public service announcements. These videos were either about sun protection, the dangers of indoor tanning, or skin cancer (see Appendix C for list of videos). The videos were not a focus of our study since our aims were not to identify a previously created advertisement that could be used for an intervention. We wished to investigate generally what types of messages would resonate with SMM by having participants share and discuss their impressions of public health campaigns and advertisements that they have seen in their own lives. However, if it was difficult to sustain conversation for the entire two-hour period of a focus group, we showed the previously created advertisements, and asked participants to comment on the strengths and weaknesses of each. Videos were shown and discussed at the end of a focus group due to concern that participants would shape their perceptions around what we chose to show if the advertisements were introduced earlier in the focus group.

Throughout the two-week study, minor modifications were made to the focus group guide to add more targeted questions. The central topics of discussion remained the same throughout, however. Video advertisements were only shown in two of the focus groups, which each had two participants in them.

We conducted ten, in-person, focus groups at the UCSF Mount Zion campus. The semi-structured study took place over a two-week period at the end of June 2017 (June 15th to June 30th) that overlapped with the San Francisco Gay Pride Festival. Informed consent documentation was reviewed and signed by all participants prior to starting each focus group. Each focus group was audio-recorded, and led by two moderators, one person who served as the primary moderator, and a second person to assist in guiding the conversation. Each focus group started with the primary moderator introducing himself, welcoming the group, and providing an overview of the study. The primary moderator then reviewed the facilitation and discussion rules, and addressed confidentiality. This was followed by the second moderator and participants introducing themselves.

At the end of the interview, all participants completed a survey (Appendix D), asking about their history of indoor tanning bed use, and demographic information, including age, gender, sexual orientation, education level, and yearly household income. All participants were provided with light refreshments, reimbursed for transportation costs to the study site, and received either a $50 Amazon or Safeway gift card for their time participating in the study. This study was approved by the UCSF Institutional Review Board.

Data Analysis

The focus groups were audio-recorded. Audio files were transcribed through an online transcription service (Rev). Transcripts were de-identified, and uploaded to the online mixed-methods software program Dedoose. For the purposes of this paper, the

discussions on social media engagement and perceptions of public health campaigns and advertising were analyzed.

Each moderator performed open coding on two transcripts. The moderators then met to discuss their codes and develop a preliminary codebook. They consolidated their ideas into four larger codes: 1) source/messenger; 2) content; 3) platform/delivery; 4) impact. The focus group transcripts were then divided evenly between the two coders, and coding was completed using the preliminary codebook. Impact was a code that captured the effectiveness of an advertisement, or a specific component of the ad. For example, a participant stating that seeing a celebrity in an advertisement was ineffective warranted the application of the impact code. After preliminary coding, it was agreed that the impact code was applied too often, and, ultimately, what it captured was included in the other codes. The codebook was further refined to distinguish source from messenger, platform from delivery, and to dissolve impact as a code, resulting in five broad codes.

Once coding was complete, the primary moderator printed out code reports and read through them to reflect upon, and analyze the data for subthemes, and emerging insights. Exemplary quotes were incorporated into a large document, along with memos for particular subthemes and insights. Given that the aim of this study to determine which indoor tanning prevention messages would be most effective for sexual minority men, insights that would shape the development of such an advertisement or campaign were the focus of analysis.

III. Results

Ninety-three people responded to our convenience sample recruitment efforts. Of these ninety-three, sixty-six were eligible to participate in our study (eligibility rate 71.0%). Sixteen were ineligible because they could not attend the scheduled focus groups. Six were ineligible because they did not have a history of indoor tanning. Four people inquired about the study, but did not confirm their availability to attend the focus groups. One person was ineligible for not identifying as a man. Of the sixty-six eligible, seventeen were scheduled for, but did not attend, focus groups, and one person ended their enrollment. Forty-eight participants were included in this study.

The median age was 49.5 years [range: 21-76]. Thirty-four participants identified as white, eight as Asian, four as Hispanic, one as Black, and one as mixed race (black/white). Forty-five participants identified as either gay (38) or bisexual (7). Forty-six identified as cis-gender men. Only two people identified as gender minorities (one transgender man, and one queer person). Forty-six participants completed at least high school degree or received a GED. Thirty-one participants reported having a college or graduate degree. Yearly household income for 2016 was as follows: Five below $25,000; eleven between $25,001-$50,000, five between $50,001-$75,000; six between $75,001-$100,000, eight between $100,001-$150,000; six between $150,001-$200,000, and four above $200,001. Three people did not respond to the question on yearly household income. Most participants were residents of the San Francisco Bay Area.

Participants were asked at what age they started going to tanning salons, and how many times they had used an indoor tanning bed in their lifetime. The ages participants started indoor tanning were as follows: 16 years or younger (6 participants);

17-21 years (15 participants); 22-25 years (14 participants); 26-30 years (4 participants); 31-40 years (6 participants); over 40 years (3 participants). For the number of times they've used a tanning bed, the responses were: 1-5 times (6 participants); 6-10 times (5 participants); 11-15 times (5 participants); 16-20 times (3 participants); 21-25 times (3 participants); 26-30 times (8 participants); more than 30 times (18 participants). Among those who had used tanning beds more than 30 times, only four were younger than 40 years old.

The results of the analysis are organized according to the codes from the revised codebook have been used to organize the results. These include message content, information source, type of spokesperson, social media platform, and delivery method.

A. Content

See Table 1 for exemplary quotes addressing content.

The content of an advertisement or message can be analyzed for both the type of evidence it provides, and the format in which that evidence is delivered. Participants described personal narratives and statistical information as two evidence types they enjoy seeing in advertisements and public health campaigns. Participants generally preferred visual depictions of evidence (e.g., an image of a person with a health issue, or a graphical representation of statistical data).

Participants reported that past memorable public health campaigns often featured personal narratives. Personal narratives were appreciated for being relatable and genuine. Participants said they would appreciate personal narratives that dispelled conventional notions about skin cancer and tanning, or depicted the severe consequences of skin cancer and tanning. Examples of personal narratives that counter common beliefs about skin cancer include dispelling the myth that only older people get skin cancer by sharing the story of an affected young person, or dispelling the notion that no one uses indoor tanning beds anymore by featuring the testimonies of members of their community who currently indoor tan. Showcasing severe consequences of indoor tanning could include depicting drastic changes in appearance, life-altering morbidities, or death. The degree to which these personal narratives inspired long-term behavior change, however, was unclear.

Many participants wanted statistical information to understand their own risks of developing skin cancer, and how it related to their past or current use of tanning beds. Participants suggested that statistical information was a tool for people to make an informed choice in their decision to indoor tan. Examples of statistical information people wished to know, included statistics on the association between indoor tanning and skin cancer development, the number of SMM indoor tanning and subsequently developing skin cancer, and the comparative risk of developing skin cancer between indoor tanning and outdoor tanning.

Some participants reported that the most memorable format of previous public health campaigns in their opinion were campaigns that employed graphic images with fear-based appeals. These previous campaigns often inspired both fear and disgust.

Regardless of the evidence type used or the format of the message, advocating for a harm reduction approach was advocated by many participants. Participants felt

that an advertisement that focused solely on abstaining from a behavior would only alienate people. Raising awareness of the issue of skin cancer would be important, and providing multiple alternatives to indoor tanning would get participants interested in the advertisement or campaign. Messages in which the tone was positive were also suggested as it was felt that levity would promote a willingness to engage. Furthermore, not making a moral issue of wanting to tan, but rather simply stating what might happen if you were to tan, would be an important method in framing the message content.

Participants felt the best outcome of a message would be to get them to think twice about their behavior, and seek out more information about indoor tanning and its risks. This strategy would also permit choice, which it was felt is important in engaging adults in behavior change.

However, it is unclear that any particular content would significantly impact indoor tanning behavior. One participant, when asked what he would include in a prevention message to convince his younger self to stop indoor tanning, shared his ambivalence, stating that even with knowledge it is difficult to quit unless one has faced severe consequences from tanning.

B. Spokesperson

See Table 2 for exemplary quotes addressing spokesperson.

We asked participants about the role of spokespeople in campaigns. A common theme throughout the discussions about spokespeople was the importance of being able to trust a spokesperson in a campaign or advertisement. Factors that augmented the perceived trustworthiness of a spokesperson included: connection to the issue; addressing conflicts of interest, a reputation as a trustworthy figure; addressing the issue in a manner consistent with their area of expertise; the time taken by the spokesperson to engage the issue; or coherence of the spokesperson's image, or personal brand, with the message. Factors that weakened trustworthiness included: having conflicts of interest; a disreputable public image; biased reporting; or being a professional actor.

Participants also suggested that the entertainment value of a spokesperson could render them more endearing to the viewer. A common suggestion among participants was to recruit drag queens (a person who dresses in a hyper-feminized or gender non-conforming way, generally for entertainment purposes) to serve as spokespeople. The cautions expressed in using drag performers, however, were that not all sexual minorities enjoy watching drag performers, and that, generally, any entertainer who wears cosmetic products over their skin may be less credible in the context of an advertisement or campaign about indoor tanning.

A related category of suggested spokespeople were beauticians or make-up artists with large online followings. Make-up artists, as distinct from those who simply wear make-up, were noted for their loyal followers, and for the high trust they had built regarding their beauty care regimens. Thus, a make-up artist suggesting the use of sunless tanning products may be an excellent spokesperson given their stature in the beauty industry and because they share the aesthetic goals of viewers.

Considering the target audience of a message was also important with respect to spokesperson. Some participants felt that particular spokespeople spoke more to particular age demographics over others. For example, doctors and health professionals were important spokespeople for older participants compared to younger participants, who felt doctors and health professionals were paternalistic. Younger participants often cited entertainers who are humorous as good spokespeople.

Politicians were another suggestion. However, reactions were fairly strong that politicians were not seen as trustworthy, for apparent bias and potential conflicts of interest in engaging with public health campaigns. The exception to this was politicians who engaged with an issue that significantly affected their constituents, or with a campaign that addressed a social justice issue, or public health crisis, related to indoor tanning. For example, one participant brought up that a politician may be helpful if it was discovered that indoor tanning companies target sexual minority men as a consumer base, similar to how tobacco companies were found to target teenagers in their marketing strategies.

C. Source

See Table 3 for exemplary quotes addressing source.

Participants supported the backing of campaigns by physicians and medical organizations as sources of information, but generally did not feel that medical professionals themselves were the best equipped to relay messages to the public. There were multiple reasons cited for this discrepancy. First, participants felt that medical professionals do not explain or address inconsistencies between popular study findings. These inconsistencies cause participants to discredit what the medical field, and, by extension, medical professionals have to say about an issue.

Second, participants felt that doctors have financial incentives that motivate their efforts and, thus, tarnish them as disingenuous. Participants expressed that a doctor's advice feels paternalistic, and that doctors lack humility, making participants feel dismissed, and shame about their behavior. Lastly, participants voiced mistrust of physicians owing to a history of how SMM have been treated by physicians historically (i.e., experiences related to HIV and sexual health).

Participants also shared ways in which physicians could be better trusted. One such example is when physicians are depicted as being humble and admitting what they don't know. Another is when stories are shared about physicians as researchers, and their motivations for treating patients. These stories humanize physicians and make them more personable. .

When participants were seeking out health information though, as opposed to simply receiving unsolicited advice, their desire to hear from physicians shifted. Doctors were spokespeople that participants were willing to hear from when the participant already had interest in seeking out health information. Some participants suggested using a two-tiered approach to raising awareness, in which detailed sources of information were provided or available once a participant was engaged or wanted to receive more information. Thus, the source of information is important, but may not initially be relevant to getting a person engaged with an advertisement, or campaign.

The information participants sought to receive from physicians or trusted sources of information were statistics that captured: the severity of skin cancer, the prevalence of indoor tanning among sexual minority men, individual risk susceptibility to skin cancer, and the skin cancer risk associated with indoor tanning.

Sources of information that were not seen as reliable included pharmaceutical companies. Pharmaceutical companies were perceived as having conflicts of interest.

D. Social Media Platform

See Table 4 for exemplary quotes addressing social media platform.

Overall, participants were open to the use of social media to receive messages about safe tanning, but had differing opinions on which applications should carry these advertisements.

Participants reported high use of a wide-range of social media applications, both through desktop and mobile devices. The most popular applications used among participants were Facebook, Instagram, Twitter, and YouTube. Instagram use was reported more by younger participants than by older participants. Other possible platforms also emerged. These included LinkedIn, Craigslist, adult entertainment websites and geosocial mobile applications (i.e., dating applications). For many participants, when initially asked about their social media use, engagement with geosocial dating applications for sexual minority men, such as Grindr or Scruff, did not come to mind. Only after further probing did participants share. Of note, many participants from across the age range of our sample engaged with these dating applications.

Of the most popular platforms, participants expressed the greatest comfort with using Facebook and Instagram. Advertisements on those platforms were generally well-received, if they were specifically targeted to the user. However, Facebook was also noted to be “polluted” with undesired content, which caused some participants to generally restrict what they choose to see on their Facebook News Feed. Twitter was described largely as a platform for following news and political figures. YouTube was the website on which participants reported seeing the most advertising, but participants did not watch advertising on YouTube unless they were forced to prior to viewing their content of interest.

For most platforms, participants described dismissing advertising content. Participants across focus groups described either ignoring advertisements, or actively closing them, if closing was an option presented to them. Participants also pointed out that they generally have shorter attention spans on social media platforms. Some participants expressed frustration in seeing advertisements on geosocial networking applications for SMM. They explained that advertisements on these platforms detract from the experience. Participants have gone as far as to pay for application upgrades to avoid ads, if possible.

However, health messages were not dismissed as quickly as general advertisements were. In spite of the frustration expressed in viewing advertisements on dating applications, for example, participants understood the motivations in promoting health messages on these platforms, and felt that these spaces were a reasonable,

and, sometimes, an even better, method of reaching a wide segment of SMM. One participant described how using dating applications would permit reaching a more diverse range of SMM because he felt everyone uses dating applications, especially younger SMM. Other participants stated that given their experience seeing other health messages on these applications, disseminating a message about indoor tanning and skin cancer, would be reasonable, and well received by some.

E. Delivery Method

See Table 5 for exemplary quotes addressing delivery method.

Participants also provided input regarding the manner in which messages regarding safe tanning might be delivered to them.

Upon being asked how and when they see public health campaigns and advertisements, participants initially described the ways in which they encounter online advertisements and public health messages. Online advertisements on social media were encountered either as a participant first engaged with an application (i.e., upon opening the app), or throughout their use of it (i.e., scrolling through the News Feed on Facebook). Participants expressed the opinion that the manner in which an advertisement is encountered can influence its reception. Generally, participants were impressed more by pop-up advertisements, which consume the whole view of the application, than they were by banner ads, which display at the bottom of the screen, or by private messages, which appear in an application's inbox. In spite of being effective as a method of reaching viewers though, forced advertising (i.e., an ad a viewer could not close) was not well received. Some participants described being conditioned to ignore predictable advertisement encounters (i.e., advertisements before videos on YouTube), and others vocalized active disengagement once an advertisement came up.

The degree to which an advertisement targeted their needs, either through relation to previous online searches (i.e., retargeting) or algorithm-based advertisements, promoted engagement with the ad (e.g., viewing or clicking on the advertisement). The timeliness of an advertisement also played a role in engagement. One participant described this in the context of receiving advertisements for upcoming running competitions, at a time of year when races occur and the participant was actively seeking them. Thus, timeliness referred to both the timeliness of the event, and the relevance to the participant's interests. Providing incentives (i.e., free items, or discounts for clicking) positively influences people to engage with an advertisement or campaign. Repetition and ubiquity are also important aspects of delivering an advertisement, in that seeing an advertisement over and over, on multiple platforms, made participants more curious. One participant stated that product placement, although conspicuous and sometimes inelegant, was an effective way of reaching him given that he was already consumed by the content he was watching. .

Although much of the discussion focused on how social media could be used to deliver effective messages to SMM, a few participants voiced the effectiveness of public health campaigns that utilized physical posters to address LGBT health-related issues. The most memorable poster campaigns were those that were located in high traffic, public spaces frequented by gay men. These posters were particularly effective

because they were placed in a historically gay neighborhood and focused on LGBT health needs, both of which contributed to a sense of community.

F. Tables

Table 1 Participants' Quotes on Content

"If you have someone who maybe tanned their entire life, and then they're having a really bad experience, and they communicate to an entire group of people, 'this is what's going on in my life, and here are the actions that led to this.' I feel like that's more discouraging when you actually can see, if they look sick. Because I feel like we sympathize more, and then we can identify." **Participant 18 (30 years old, gay, cis-gender)** **Focus Group 5**
"I wanted to start smoking when I was in my 20s, and I picked it up and did it for a little bit, but then quickly stopped. And it [was] when they started showing ads of half your face gone because of mouth cancer, lung cancer. Graphic pictures did it for me to stop smoking. It killed the desire, just like that." **Participant 9 (49 years old, gay, cis-gender)** **Focus Group 3**
"Really the facts about skin cancer. That's why I got checked because the more times you've been burned, the higher your risk factor goes up. So, those odds are something I think anybody can relate to." **Participant 6 (56 years old, straight, transgender)** **Focus Group 2**
"As a person who's very skeptical of advertising, PrEP (pre-exposure prophylaxis) actually worked well on me because it just presented facts right in some of the advertisements, then that caused me to google it and lookup independent people talking about it. That's what made me then want to talk to my doctor and actually get on PrEP. So, I think it would be something similar for [indoor tanning], if it were to work on people like me." **Participant 32 (23 years old, pansexual, queer)** **Focus Group 7**
"It's hard because I haven't given up tanning yet, so like I'm waiting. I had some stitches a couple of months ago and I've been waiting to go back to tanning, because I'm like 'Oh, no, I want this scar to heal first." I'm struggling with this question because I feel like I haven't had enough negative consequences. Rationally, I know what I would want to tell my younger self, and it would be everything that you guys have said, but, yeah, it's a tough question." **Participant 40 (61 years old, gay, cis-gender)** **Focus Group 9**

Table 2 Participants' Quotes on Spokesperson

"I would be more apt to respond to someone like a celebrity, if they're doing so in a public speaking format, outside of selling something. If you're selling something, I tend to be, like, 'Oh, well, they're just getting paid to do this' versus someone who's speaking at a convention." **Participant 18 (30 years old, gay, cis-gender)** **Focus Group 5**
"[Drag queens] are funny, witty, and engaging." **Participant 48 (49 years old, gay, cis-gender)** **Focus Group 10**
"The thing is [drag queens] are so made up. In terms of their personal story that might not work, but they do have a communication style that might appeal to people." **Participant 14 (64 years old, gay, cis-gender)** **Focus Group 4**
"There's this weird thing about using drag queens as celebrities. I find it incredibly offensive. They're just like clowns." **Participant 24 (34 years old, gay, cis-gender)** **Focus Group 6**
Participant 20: "RuPaul (a drag queen), if she did something, everybody would go, "Okay!'" Participant 19: "I'm thinking for younger gays that would be a better" **Participant 19 (37 years old, gay, cis-gender)** **Participant 20 (51 years old, gay, cis-gender)** **Focus Group 5**
"I follow beauty bloggers, and people who have their own line of skincare products, and there are some people who tell you what they use to get their skin to be whatever way." **Participant 37 (29 years old, gay, cis-gender)** **Focus Group 8**
"It has to be coherent…Like someone health conscious, even socially conscious." **Participant 45 (50 years old, gay, cis-gender)** **Focus Group 10**

Table 3 Participants' Quotes on Source

"I have a healthy skepticism of the medical community, every year I've been alive, there's been two competing studies about, like, 'Oh this is good for you. No, chocolate's not good for you." **Participant 21 (34 years old, gay, cis-gender)** **Focus Group 5**
"Yeah, I think we make a mistake of trusting the medical and scientific community. I don't want to say there should be skepticism around the scientific community, or scientific literature. I think it's probably more about how the messaging of those results are put out…where you're trying to relate deeply scientific information in a general sense that everybody can understand it, where some of the details might get lost in translation." **Participant 19 (37 years old, gay, cis-gender)** **Focus Group 5**
"When a medical professional or scientist [is] saying [do not tan], it almost feels like preaching, like they're talking right down to you…they're wagging their finger at you. It feels a little bit demeaning when they say it even though they're completely right because they're the expert." **Participant 5 (35 years old, gay, cis-gender)** **Focus Group 1**
"Well, I was going to a theater on Van Ness and I noticed on the second floor and the fifth floor, they have this bridge to HIV. And the way they did their promotion even with PrEP is just so believable. It says San Francisco County, and the professionals and doctors are all behind it. That campaign is very convincing." **Participant 28 (34 years old, gay, cis-gender)** **Focus Group 7**
"The University of California, San Francisco ads. They talk about their stories, about what they're researching. And even though what he was doing doesn't pertain to me, it was influential. I mean, I listened to that ad. It just sounds compelling. They have the [principal investigator] and then they have the patient. That interaction. It just seems like a compelling story." **Participant 38 (24 years old, gay, cis-gender)** **Focus Group 8**
"I think just the pharmaceutical [industry] in general has such a bad rap, and track record, that any messaging from them would not be...I mean, I would probably trust my local pharmacist versus a drug rep." **Participant 15 (60 years old, gay, cis-gender)** **Focus Group 5**

Table 4 Participants' Quotes on Social Media Platform

"Facebook, YouTube, and Instagram for me." **Participant 33 (29 years old, gay, cis-gender)** **Focus Group 7**
"If it's super targeted at me, I'll probably click it. And, since they know so much about me, there's the possibility of them serving me a super, super specific ad." **Participant 7 (34 years old, gay, cis-gender)** **Focus Group 2**
"My attention span shortens by an order of magnitude when I'm using my phone." **Participant 46 (51 years old, gay, cis-gender)** **Focus Group 10**
"That is very, very, very irritating. When you're trying to get a connection, or find a person that you want to date at this particular time, and all you get is these pop-up ads." **Participant 11 (40 years old, bisexual, cis-gender)** **Focus Group 3**
"I either paid to upgrade to avoid apps, or I click the little 'x', or I swipe it or any kind of ads off of any application I'm using. I hate ads and I've got a six-inch screen on my phone, and I still don't want any tiny little ad anywhere." **Participant 46 (51 years old, gay, cis-gender)** **Focus Group 10**
"I feel like it'd be strange to see [an indoor tanning prevention message on dating sites]. I mean, it doesn't fit the mood." **Participant 32 (23 years old, pansexual, queer)** **Focus Group 7**
"I've seen [health promotion advertisements on Grindr] and I think if I weren't already on PrEP, I probably would see it and be like, 'Okay, let me learn more'. I think it makes sense. If a motivation to tan is for sexual appearance, it makes [sense]." **Participant 39 (34 years old, gay, cis-gender)** **Focus Group 9**
"I think [health promotion on dating applications] is a good idea, because those platforms are more democratic. They transcend social groups, economic groups. If you have an advertisement in a magazine, you're going to only reach the classification of people that read that particular magazine and that can be very limiting. I think every gay man uses Grindr, or you know I think most 20-something, 30-something year old people use Tinder. And so, you might be able to reach a greater cross-section by advertising in that way." **Participant 41 (30 years old, gay, cis-gender)** **Focus Group 9**
"Grindr would probably be like a really good platform for [health promotion]. You see a lot of health campaigns on it. I think you have a captive audience there, right there on the app." **Participant 22 (40 years old, gay, cis-gender)** **Focus Group 6**

Table 5 Participants' Quotes on Delivery Method

"Only if [the ad] takes over my screen. You know? The little X that you have to find. But if they're easy to get rid of I don't even bother." **Participant 13 (56 years old, gay, cis-gender), Focus Group 4**
Participant 41: "Put them on YouTube, where you can't like scroll. You can't skip the video. You just have to watch it." Participant 43: "I look away, because I, I feel manipulated, you know, forced, so I look away until the 15 seconds are up." **Participant 41 (30 years old, gay, cis-gender) and Participant 43 (71 years old, gay, cis-gender) Focus Group 9**
"I think if you had like an LGBT interest on Facebook, and you did have targeted ads like that. I'm always interested because usually it's something I want to buy on Amazon. It's like, 'Oh, it's right here on Facebook.'" **Participant 22 (40 years old, gay, cisgender)** **Focus Group 6**
Participant 37: "Grindr would be a good one because the ad always comes up. It's inescapable. That's how I signed up for like an, a PrEP study. Moderator 1: But, do you read them? Participant 37: I read them. I don't read the ads at the bottom. Participant 38: They started sending ads now, so like you get messages and it's also an ad. Participant 37: Yeah, I don't read those. But the one that pops up when you log in, and overlays on the grid? I'll read that one. But the, the rest of them, I will not pay attention to." **Participant 37 (29 years old, gay, cis-gender) and Participant 38 (24 years old, gay, cis-gender) Focus Group 8**
"On Grindr, you get several popups, like three in a row. I've never clicked on them, but I am aware of the message that is in that little snap. I register that it's advertising PrEP or mental health services or substance abuse services. I register that there are service providers using this avenue to reach an audience. I'm always generally pleased to see that there. And, I think to myself, if there is one that interests me, I would click on it." **Participant 41 (30 years old, gay, cis-gender)** **Focus Group 9**
Participant 42: "The Castro MUNI station had done a lot of public awareness ads for PrEP because you've got somewhat of a captive audience." Participant 41: "Those always catch my attention. And I appreciate seeing them. They give the sense that the community is trying to take care to itself." Participant 42: "Yeah, especially if you see people that you recognize, from around the community. It doesn't have to be a community leader, just someone you see on the street. Then it's like you have a closer connection to it." **Participant 41 (30 years old, gay, cis-gender) and Participant 42 (61 years old, gay, cis-gender) Focus Group 9**
"I would be more likely to notice something if it were a part of the content that I'm consuming. When American Idol was on, like they always used to have like Cokes on the judges' table. I'd only watched maybe like the first season which is really a long time ago. But, that's stuck with me. Like it was just, it was really blatant and it was a little bit annoying in a way, but, I definitely noticed it." **Participant 7 (34 years old, gay, cis-gender)** **Focus Group 2**
"There's a bunch of really cool podcasts out there. They'll say, "This is sponsored by ... " Then I listen." **Participant 13 (56 years old, gay, cis-gender)**, **Focus Group 4**

IV. Discussion

Our study is the first study we know of that examines how to design effective indoor tanning prevention messages for sexual minority men. We recruited a convenience sample of sexual and gender minority men in San Francisco who have a history of indoor tanning to ask them about their social media engagement, and their perceptions of public health campaigns and advertising. We found that participants prefer public health campaigns that use graphic advertisements to relay personal experiences with health issues and statistical information. However, there was no particular content type or format that consistently influenced behavior change. Participants scrutinize spokespeople in advertisements, with a particular focus on how trustworthy they are. Careful consideration must be taken in selecting a spokesperson for a public health campaign whose public image, and celebrity persona, is consistent with the message of the campaign. Doctors and health professionals are valued as sources of health information, but not necessarily as spokespeople for public health campaigns. We found that social media is broadly defined in this group. Online advertising is ubiquitous throughout the social media experience. While online advertising is generally dismissed, targeted advertisements that integrate well into how viewers are already using a particular social media platform may have a greater impact than advertisements that impose themselves on viewers. Health messages on social media have mixed reception, but are generally well-received by viewers, and social media applications are a successful method of reaching SMM regarding health issues..

This study is not without limitations. Our study largely reflects the experiences of white, cis-gender, college-educated gay men. In addition, the size and location of the sample limit the generalizability of our results. Furthermore, current epidemiological evidence suggests that sexual minority men in the Midwest are the heaviest users of indoor tanning services. Thus, we have not captured the experiences of sunbed users in high-use regions.[25] Since participants only reported ever use of tanning, our results may be heavily prone to recall bias if participants quit tanning many years ago. Although we sought to include gender minority men in our study as well, we only recruited two people who identified as gender minority men.

Past research on effective indoor tanning prevention messages has looked at the impact of evidence type. Greene and Brinn determined that statistical and narrative formats have different impacts in shaping indoor tanning behavior and intentions among white female college students.[75] Statistical messages had a greater impact on tanning behavior than narrative messages; however, both messages types had a greater impact on intentions to tan and perceived susceptibility to skin cancer than no messages. The impact of fear-based appeals has also been analyzed in the literature. In 2013, Cooper et al. noted that messages regarding the efficacy of sun protection were only effective when the viewer was primed to think about death immediately before viewing the message on the importance of sun protection.[69] A message that primed the viewer to think about the appearance consequences of not using sun protection did not impact sun protection behaviors. Our results suggest that sexual minority men have a desire for both narrative and statistical messages. Narrative messages seemed to be more memorable among our participants, based on the greater recall of previous public health campaigns that delivered narrative messages.

There have also been studies in the literature looking at the format of messages. In 2015, Mays and Tercyak demonstrated that loss-framed graphic warnings made a greater impact on the indoor tanning intentions and intentions to quit than gain-framed graphic messages, or text-only message among a sample of 141 non-Hispanic white women between 18 and 30 years old.[107] Our participants reported numerous examples of graphic public health campaigns (most of which were depicting negative consequences of health behaviors), and expressed desire to see both negative- and positively-framed messaging related to indoor tanning prevention. However, we lacked compelling evidence that positive-framed messages influenced our participants tanning behavior. Furthermore, evidence from anti-smoking campaign research suggests that evocative, personal messages that showcase deleterious consequences of smoking influence smoking intentions and behavior.[108] Thus, the evidence does not support the effectiveness of positive-framed messages, for which our participants advocated. Our findings do support the potential of personal narratives as an evidence format though.

Our study supports previous indoor tanning research that suggests Instagram may be a particularly useful social media platform for tanning interventions.[84,88] Our results also descriptively corroborate market research data showcasing how LGBT persons use social media.[109]

V. Conclusion

To our knowledge this is the first published qualitative study regarding indoor tanning prevention for sexual minority men. Our findings suggest that a range of options is available to design effective messages to promote health and reduce indoor tanning among sexual minority men. Advertisers and public health officials may use these findings to develop indoor tanning prevention campaigns targeting SMM.

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VII. Appendices

Appendix A: Focus Group Guide for 18 to 30-Year-Old Women

Discussion Questions

1) When you think of a tanning bed or tanning solon, what images or idea come to mind for you?

- What are the positive associations you have with tanning beds?
- What are the negative associations you have with tanning beds?
- How often do you and/or your friends visit tanning beds?
- (If it doesn't come up spontaneously) What are the reasons you and/or your friends visit tanning beds?
- (If it doesn't come up spontaneously) What are the reasons you and/or your friends stopped using tanning beds?
- (If it doesn't come up spontaneously) Do you generally think that tanning beds are safe? Why or why not?

2) When you think of skin cancer, what ideas or images come to mind?

- What are the negative associations you have with skin cancer?
- What are the positive associations you have with skin cancer?
- (If it doesn't come up spontaneously) Understanding that all cancers are serious, do you think of skin cancer as a particular bad or less bad type of cancer and why?
- (If it doesn't come up spontaneously) Do you think that skin cancer is more or less common than other types of cancer (e.g. prostate cancer, lung cancer). Why do you think this?

3) Which social media platforms do you use the most?

- What platform do you think would be the best way to reach people like you?
- How effective do you think advertising on social media is?
- Do you believe that online advertising could shift opinions about using tanning beds?

4) After showing the advertisements:

- Which ad did you like the most and why?
- Which ad did you like the least and why?
- What did you learn from the ads that you didn't already know?
- Which of these ads (if any) would you share with your friends or family?
- Would any of these ads make you less likely to go tanning? Why or why not?

Appendix B: Modified Focus Group Guide for SMM

Discussion Questions

1) What were your motivations in using a tanning bed?

- What are the positive associations you have with tanning beds?
- What are the negative associations you have with tanning beds?
- How often do you and/or your friends visit tanning beds?
- (If it doesn't come up spontaneously) What are the reasons you and/or your friends visit tanning beds?
- (If it doesn't come up spontaneously) What are the reasons you and/or your friends stopped using tanning beds?
- (If it doesn't come up spontaneously) Do you generally think that tanning beds are safe? Why or why not?

If Skin Cancer Comes Up Spontaneously in Discussion

1A) When you think of skin cancer, what ideas or images come to mind?

- Understanding that all cancers are serious, do you think of skin cancer as a particular bad or less bad type of cancer and why?
- Do you think that skin cancer is more or less common than other types of cancer (e.g. prostate cancer, lung cancer). Why do you think this?

2) Which social media platforms do you use the most?

- What platform do you think would be the best way to reach people like you?
- How effective do you think advertising on social media is?
- Do you believe that online advertising could shift opinions about using tanning beds?

3) How could indoor tanning prevention messages be made to resonant with gay men in particular?

- What types of public figures/spokesmen/organizations do you trust? Distrust?
- What specific messages would be most impactful? Least?
- What style is most shareable? Funny? serious? Personal narratives? Facts?
- What format is most shareable? Short? Long? Meme? Video? Other?
- What platform is most accessible? Which is most likely to reach more people?
- Have you ever seen advertising or messaging targeting gay men that you felt was done really well? What was it and why did you like it?
- Have you ever seen advertising or messaging targeting gay men that you felt was done poorly? What was it and why did you dislike it?

Questions added over the course of the focus group study

Probing Questions for #2 Social Media Use

- Three most used social media apps? (Have them write, then circle)
- On each one, who do you follow on social media?
- What hashtag campaigns have they every used?

Probing Questions for #3 Messages

- What public health campaigns are memorable to you, and why?

ONLY Focus Group 2 and 4

5) After showing the advertisements:

- Which ad did you like the most and why?
- Which ad did you like the least and why?
- What did you learn from the ads that you didn't already know?
- Which of these ads (if any) would you share with your friends or family?
- Would any of these ads make you less likely to go tanning? Why or why not?

Appendix C: Videos Shown in Focus Groups 2 and 4

1. Dear 16-Year-Old Me
    a. https://www.youtube.com/watch?v=_4jgUcxMezM
2. Nivea Sun Safety
    a. https://www.youtube.com/watch?v=NTfmb8LHU18
3. Nothing Healthy about a Tan
    a. https://www.youtube.com/watch?v=EF40KBHFpn4
4. Last Week Tonight with Jon Oliver clip – How is THIS still a thing? – Tanning Beds
    a. https://www.youtube.com/watch?v=FHtdd8NInPU
5. Just Stop | Kesha Tik Tok Tanning Parody | ZDoggMD.com
    a. https://www.youtube.com/watch?v=9IW0HTcSdqQ