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A window into the risks of skin cancer development in unhoused populations and barriers to healthcare access

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A WINDOW INTO THE RISKS OF SKIN CANCER DEVELOPMENT IN UNHOUSED POPULATIONS AND BARRIERS TO HEALTHCARE ACCESS

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ABSTRACT

Unhoused populations in the United States face an elevated risk for the development of skin cancers and suboptimal health outcomes in treatment due to a combination of factors, including increased exposure to solar ultraviolet radiation, limited health literacy, and barriers to access to health services. Limited access to mitigation techniques and inadequate screening and prevention practices, both on the part of the individual and within public insurance frameworks, further exacerbate these risks. An unhoused individual's geographic location within the United States and skin color play a significant role in modulating an increase or decrease in one's risk for cancer development. Additionally, social determinants of health, such as socioeconomic status and societal stigmas, contribute to both the increased vulnerability and diminished treatment opportunities for unhoused individuals. Analysis of existing literature reveals how these aforementioned risk factors interact and compound to increase the vulnerability this population faces. The findings highlight that these cancer types, which are considered preventable for the general population, create a unique challenge for the unhoused, resulting in increased stigma and suboptimal health outcomes. While previous research underscores the complex nature of skin cancer risk and outcomes among the unhoused population, highlighting the interplay of various factors and their contribution to

increasing disparities and treatment, a deeper understanding of the intersection of the factors is essential for addressing the unique challenges faced by this vulnerable group.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS

HUD ..... Department of Housing and Urban Development

ILO ..... International Labor Organization

JAMA ..... Journal of the American Medical Association

UVA ..... Ultraviolet radiation type A

UVB ..... Ultraviolet radiation type B

UVR ..... Ultraviolet Radiation

WHO ..... World Health Organization

INTRODUCTION

Skin cancer is the most commonly diagnosed form of cancer in the United States, though its prevalence is rarely studied within the unhoused community. A 2012 study conducted by Grossberg and associates suggests that skin cancers are more prevalent within this population but are less likely to be diagnosed and treated.[1] Subsequent investigations into skin cancer prevalence and solar ultraviolet radiation (UVR) protection behaviors within this community identified multiple previously undiagnosed skin cancers with little to no preventative measures being taken by the unhoused participants.[2,3] In a study providing free skin cancer screening, Wilde and associates found thirteen cases of skin cancer among their sixty-two unhoused patients, in addition to reports of little to no sunscreen use by their subjects.[2] These aforementioned research trials, in addition to extensive studies investigating cancer risks and attitudes within unhoused populations performed by Williams and colleagues, recognized the increased risk the unhoused community faces for skin cancer development and a need for further investigation.[4] Understanding the demographics of the unhoused within the United States and the factors that contribute to their increased vulnerability is necessary to assist in additional research endeavors and the creation of targeted mitigation techniques for this population.

Within the United States, the Department of Housing and Urban Development estimates there were 770,000 individuals experiencing homelessness on any given January night in 2024, an 18% increase from their estimation of 653,000 individuals the previous year.[5,6] An individual or family is considered unhoused if they are in a situation

without stable, permanent, appropriate housing or are without the immediate prospect, means, or ability to acquire it.[7] These unhoused individuals and families can be further classified as unsheltered or sheltered. Those considered unsheltered do not have temporary housing or forgo shelters; instead, they sleep in locations such as park benches, under bridges, makeshift encampments, or in doorways. An unhoused person classified as sheltered may find temporary housing in places such as a homeless shelter, within a car or other automobile, or move between the houses of friends or family. The sheltered classification also extends to those in unstable housing conditions, meaning they currently have shelter but are at risk of losing their shelter.

Of those experiencing homelessness in the United States, more than a fourth, 27%, are under the age of 24.[8] Children 17 or younger make up 19% of the total unhoused population, and this age demographic makes up the largest percent demographic, 27.6%, of unhoused individuals who are considered sheltered homeless. Those in the 35 to 44-year-old age group consist of 19.9% of the total unhoused population. Half of this age group is unsheltered, and they make up the single largest unsheltered homelessness group, with 25.4% of the total unsheltered population being between 35 and 44 years old. The likelihood of a larger unsheltered status in comparison to sheltered has been found to trend with increases in an unhoused individuals age group; the 45 to 54-year-old group makes up 22.1% of the total unsheltered unhoused classification in comparison to the 11.7% sheltered, despite only containing 13.5% of the total population of people experiencing homelessness. This trend remains consistent with the 55 to 64-year-old and 64 and over populations, accounting for 17.9% and 6.5% of the

total unsheltered population in comparison to 11.1% and 4.6% of the total considered sheltered. Individuals identifying with the male gender contribute to nearly 60% of the unhoused in the United States and contribute to just over two-thirds, 67.4%, of the total unsheltered classification.[8]

As summarized in Table 1, within the nationwide homeless population, the majority of people experiencing homelessness belong to the White-only racial group, 31.7%; ethnically Hispanic/Latino, any Race group, 30.6%; or Black, African American, or African-only racial group,29.5%; three in ten of all people experiencing homelessness belong to each of these groups.[8] Although these groups make up similar portions of the total population of those experiencing homelessness, those who identified as White-only encompass 43.1% of the total unsheltered population, nearly twice that as the ethnically Hispanic/Latino, any Race, and Black, African American, or African-only racial groups which make up 24.5% and 21.7% respectively of that total unsheltered population.

Table 1. Race/Ethnicity of People Experiencing Homelessness in the United States in 2024. The Race of all people experiencing homelessness is subdivided to allow for those of Hispanic/Latino ethnicity to identify themselves within each racial group. The total number of unhoused has been subdivided to specify sheltered and unsheltered status. The total number and percent of the total are expressed for racial and ethnic groups for both the entire unhoused population and the sheltered and unsheltered subclassifications. Adapted from The 2024 Annual Homelessness Assessment Report.[8]

Race	All Unhoused		Sheltered		Unsheltered	
	#	%	#	%	#	%
All People Experiencing Homelessness	**771,480**	**100%**	**497,256**	**100%**	**274,224**	**100%**
Total Native American or Indigenous: any ethnicity	**21,166**	**2.7%**	**10,832**	**2.2%**	**10,334**	**3.8%**
Native American or Indigenous Only	16,894	2.2%	8,074	1.6%	8,820	3.2%
Native American or Indigenous and Hispanic/ Latino	4,272	0.6%	2,758	0.6%	1,514	0.6%
Total Asian or Asian American: any ethnicity	**21,166**	**2.7%**	**10,832**	**2.2%**	**10,334**	**3.8%**
Asian or Asian American Only	10,401	1.3%	6,315	1.3%	4086	1.5%
Asian or Asian American and Hispanic/Latino	794	0.1%	409	0.1%	384	0.1%
Total Black, African American, or African: any ethnicity	**243,736**	**31.6%**	**181,886**	**36.6%**	**61,850**	**22.6%**
Black, African American, or African Only	227,769	29.5%	168,206	33.8%	59,563	21.7%
Black, African American, or African and Hispanic/ Latino	15,967	2.1%	13,680	2.8%	2,287	0.8%
Total Middle Eastern or North African: any ethnicity	**2,012**	**0.3%**	**1,283**	**0.3%**	**729**	**0.3%**
Middle Eastern or North African Only	1,513	0.2%	881	0.2%	632	0.2%
Middle Eastern or North African and Hispanic/ Latino	499	0.1%	402	0.1%	97	<0.1%
Total Native Hawaiian or Pacific Islander: any ethnicity	**11,383**	**1.5%**	**6,568**	**1.3%**	**4,815**	**1.8%**
Native Hawaiian or Pacific Islander Only	10,312	1.3%	5,865	1.2%	4,447	1.6%
Native Hawaiian or Pacific Islander and Hispanic/ Latino	1,071	0.1%	703	0.1%	368	0.1%
Total White: any ethnicity	**295,656**	**38.3%**	**166,458**	**33.5%**	**129,198**	**47.1%**
White Only	244,280	31.7%	125,971	25.3%	118,309	43.1%
White and Hispanic/Latino	51,376	6.7%	40,487	8.1%	10,889	4.0%
Total Multi-Racial: any ethnicity	**31,187**	**4.0%**	**17,079**	**3.4%**	**14,108**	**5.1%**
Multi-Racial All Other	24,346	3.2%	13,088	2.6%	11,258	4.1%
Multi-Racial and Hispanic/Latino	6,841	0.9%	3,991	0.8%	2,850	1.0%
Total Hispanic/Latino: any race	**235,965**	**30.6%**	**168,856**	**34.0%**	**67,109**	**24.5%**
Hispanic/Latino Only	155,146	20.1%	106,426	21.4%	48,720	17.8%

The unhoused population is considered a high-risk patient population with suboptimal health outcomes.[9] In some estimates, an individual experiencing homelessness, regardless of race and gender, is expected to have a life expectancy of 55 years old, more than 20 years lower than the average life expectancy in the United States.[10] The subclassification of homelessness an individual falls within is a major effector for their health and wellness. The unsheltered contribute to over a third of the overall United States homeless population and are more likely to obtain suboptimal health outcomes when compared to those who are considered sheltered. In a Massachusetts-based analysis of all-cause mortality in this population, the unsheltered cohort was found to have a nearly three times, 2.7, greater total mortality rate compared to those who are sheltered unhoused and almost a ten times greater mortality rate, 9.8, than the general population of Massachusetts.

When examining the leading causes of mortality in this population, investigators in Boston, Philadelphia, and Miami noted that cancer ranked as a leading cause of death for the unhoused.[9,11,12] It is well-documented that behaviors such as increased tobacco use, alcohol consumption, and drug abuse contribute to the high cancer profile assigned to the community. Still, most research shows drug abuse is only a behavior representative of 10% to 15% of this population, while alcohol abuse affects roughly 35%, suggesting other risk factors play a significant role in an unhoused individual risk of cancer development and mortality.[13]

The unhoused face a unique combination of social, environmental, and healthcare-related considerations that serve to heighten their risk for developing cancer along with other chronic diseases. While homelessness is linked with a heightened risk of developing many different forms of cancers, one of the most pressing concerns is their perceived increased risk of skin cancers.[1–3] There is currently limited data determining the exact prevalence of skin cancers among the unhoused population, but the unique and distinct social and environmental conditions in which this community lives are thought to expose them to an increased vulnerability and risk for skin cancer development. For the general population, skin cancers are considered one of the most preventable forms of cancer, though for the unhoused, this may not be the case.[9]

There are a multitude of factors that affect one's propensity to develop a form of cancer. Skin cancers are considered unique because they can often be avoided by adopting behaviors such as applying sunscreen before spending extended periods in the sun, avoiding sun exposure during the day, seeking out shade, and wearing protective clothing. Yet the unhoused, especially in states closer to the equator, are at a disadvantage compared to the general population. They, especially the unsheltered, frequently spend long periods of time outdoors and often lack adequate protection from the sun, receiving constant exposure to ultraviolet radiation, the primary environmental cause of skin cancer[14]. When caught early, skin cancers are generally highly treatable, and yet the unhoused are at a disadvantage here as well because skin cancer in this community is far less likely to receive an early diagnosis, and even when this happens, there are significant hurdles in accessing proper care. An individual with homelessness

may not only lack access to care but also face challenges recognizing symptoms and susceptibility, allowing skin cancers to remain undiagnosed and untreated until later stages, when they may potentially become life-threatening.

Thus, while the unhoused population faces an increased risk for generalized cancer, their heightened levels of UVR exposure, as well as individual, societal, and systemic barriers to care, make skin cancer a particularly urgent issue. This review of literature will focus on illuminating the unhoused community's increased risk of skin cancer development by examining the environmental and individual factors, as well as reviewing common barriers this community faces in access to preventive care, health literacy education, timely diagnoses, and treatment. This paper will explore key factors, such as prolonged sun exposure, skin complexion, insufficient health literacy, and barriers to healthcare, while examining how one’s geographic location in the United States serves to help remediate or exacerbate skin cancer risks. By examining the current body of literature, this review aims to provide a comprehensive understanding of why skin cancer is particularly and uniquely harmful to the unhoused population.

UNDERSTANDING SKIN CANCER: DISEASE, RISK FACTORS, AND BARRIERS TO TREATMENT FOR THE UNHOUSED POPULATION

In the United States, skin cancer is among the most common and easily preventable forms of cancer. The three most common dermatological cancer malignancies are the non-melanoma skin cancers, basal cell and cutaneous squamous cell carcinoma, and melanoma.[15,16] In the United States, it is estimated that 9,500 Americans are diagnosed with a form of skin cancer every day and that one out of every five Americans will receive a skin cancer diagnosis in their life.[17–19] Despite being among the most common forms of cancer both in the United States and Worldwide, only forms of melanoma are required to be reported to and tracked by cancer registries. These cancers differ in terms of aggressiveness, diagnosis, treatment options, and outcomes but share risk factors influencing their pathologies, and all pose significant health risks when left undiagnosed or untreated.[15,16] Within the unhoused population, skin cancers represent a widely overlooked but increasingly urgent healthcare challenge. While there are a multitude of factors that can modulate an individual's likelihood of developing one of these malignancies, solar radiation from exposure to high intensities of ultraviolet light or extended periods of sun exposure, referred to as overexposure, is the primary environmental factor, and exposure can be heavily dependent on where a person lives.[20] The color and phenotype of a person's skin can significantly modulate the risk of skin diseases; this is the primary person-specific factor; lighter skin tones are far more susceptible to damage by UVR and may display dermatological abnormalities differently than a person with darker skin complexion. Socioeconomic barriers, such as individual

and practitioner health literacy, restricted access to screening and care, and the ability to acquire mitigation methods, further exacerbate this population's challenges in early detection and effective, timely treatment. This section provides an overview of the major forms of skin cancer and examines common social, systemic, and environmental risk factors that contribute to this population's increased incidence and suboptimal outcomes for skin cancer.

Basal Cell Carcinoma

Basal cell carcinoma is among the most common types of cancer in the United States. It is not required for physicians to report a diagnosis of this cancer, and the exact number of cases remains unknown; however, the American Cancer Society estimates there will be over 5.4 million diagnoses of skin cancer this year, with eight out of ten of the estimated 5.4 million skin cancer diagnoses being basal cell carcinoma.[19,21] This cancer originates from basal cells in the basal layer of the lower epidermis, most often in areas of high sun exposure, specifically the lower arms, neck, face, and head. Non-pathologic basal cells are responsible for producing new skin cells as older ones die off; DNA damage and mutation in these cells can result in basal cell carcinoma. DNA damage resulting from extended exposure or high-intensity solar UVR is the most significant risk factor for developing basal cell carcinoma; additional risk factors such as pale complexion, older age, and a weakened immune system can also contribute to this pathology. There are inherited conditions such as basal cell nevus syndrome that can lead to the appearance of basal cell carcinoma starting in early childhood, but this is very rare.[22]

The presentation and risk of basal cell carcinoma can differ based on the individual's skin tone, phenotype, and race or ethnicity, but all remain susceptible to this pathology with sufficient DNA damage or mutation.[19,21,22] Basal cell carcinoma most commonly appears as open sores, light red growths, dark red patches, shiny bumps, or unexplained scars with elevated or rolled edges on white skin. This pathology may appear the same on darker skin, especially in regard to the characteristic rolled border; however, a shiny brown or a glossy black coloration is far more common. Oozing, itching, bleeding, or crusting over is another common presentation in addition to their typical appearance. Illustration 1 shows examples of the differing presentations of basal cell carcinoma on both lighter and darker skin.

Illustration 1. Visual Examples of the Varied Morphologies of Basal Cell Carcinoma on Patients with Various Skin Types

This figure provides visual examples of the various presentations of basal cell carcinoma. Examples are shown across different locations of the body and between different skin colorations, contributing to this pathology's nonuniform presentation, adapted from the American Cancer Society and Mayo Clinic.[23,24]

Despite being one of the most common cancers diagnosed in the United States, one out of every three cancers diagnosed, the long-term prognosis is considered very favorable when discovered and treated in a timely manner.[25] In the majority of cases, this unaggressive cancer rarely spreads beyond its site of origin due to early-stage diagnosis and treatment with minor surgery, freezing techniques, radiation treatment, or immunotherapy.[19] In cases of late-stage diagnosis, non-diagnosis, or remaining untreated, basal cell carcinoma becomes more dangerous. Loss of life is a very real outcome if this cancer remains untreated for a sufficiently long period of time. Disfigurement is another common outcome for untreated basal cell carcinoma, which can result in a compounding of suboptimal health outcomes and increased stigmatization and social pressures.

Squamous Cell Carcinoma

Squamous cell carcinoma is the second most common form of skin cancer diagnosed in the United States and is often referred to as cutaneous squamous cell carcinoma to differentiate it from cancers originating from squamous cells within the throat or lungs.[26] Like forms of basal cell carcinoma, physicians are not required to report the diagnosis of squamous cell carcinoma, though it is estimated that over 1.8 million cases of squamous cell carcinoma are diagnosed a year, and its incidence, like with all other skin cancers, continues to rise each year. This pathology arises from DNA damage to squamous cells in the outer layer of the epidermis, most commonly on the face, head, neck, and arms, in addition to the mucus membrane of the lips.[27] Of the risk factors that increase the likelihood of developing this cancer, high-intensity and prolonged exposure to ultraviolet light are the primary environmental causes. This pathology shares many of

the same minor risk factors as basal cell carcinoma, with the addition of current or previous cases of basal cell carcinoma and non-cancerous skin pathologies called nevi leading to an increased risk of squamous cell carcinoma incidences. This cancer is also twice as likely to develop in persons assigned to the male sex at birth. This pathology has several variations in presentation based on the skin complexion of those afflicted.[19,26,27] The most common presentations are displayed in Illustration 2 and are as follows: a firm nodule that may be the same color as the skin or pink, red, black, or brown, a flat sore with a flakey, scaly crust, a new sore arising from an old scar, a rough, scaly area on the lip, or an open sore.

Illustration 2. Visual Examples of the Varied Morphologies of Squamous Cell Carcinoma on Patients with Various Skin Types

This figure provides visual examples of the various presentations of cutaneous squamous cell carcinoma. Examples are shown across different locations of the body and between different skin colorations, contributing to this pathology's nonuniform presentation, adapted from the American Cancer Society.[24]

Similar to basal cell carcinoma, this cancer is considered preventable and widely treatable when diagnosed early and treatment starts in a timely manner.[28] Treatments for squamous cell carcinoma largely depend on the size and location of the cancer, in addition to whether the tumor has invaded any subcutaneous tissues. Lesions smaller than two centimeters in diameter are often treated through cautery or electrodesiccation. Different surgical modalities are usually considered for more extensive growths and ones with invasion into subcutaneous tissue, and radiation therapy or radiation therapy in conjunction with surgery is considered in more advanced cases and late-stage diagnosis.[21] Untreated squamous cell carcinoma can lead to significant health and social issues. Squamous cell carcinoma is more aggressive than basal cell carcinoma and more readily destroys and invades surrounding tissues when left untreated.[28] Though rare, this disease has the capacity to metastasize and spread to lymph nodes and underlying organs, which can allow it to rapidly become fatal. The same suboptimal health and societal outcomes exist for squamous cell carcinoma that exists for basal cell carcinoma but at a more expedited timeframe.

Melanoma

Cutaneous malignant melanoma is less common than the discussed nonmelanoma skin cancers but is the most lethal and aggressive variant of skin cancer. Melanoma represents approximately 5% of skin cancer incidences; however, it accounts for seventy-five percent of all skin cancer mortalities.[29] Over the last 50 years, the incidence of melanoma cases worldwide has risen rapidly. According to data from the International Agency for Research on Cancer in a 2018 study, the global incidence rate of melanoma

was 3.1 per 100,000/year with an accompanying mortality rate of 0.63 per 100,000/year; when examining incidences in populations descended from Europe, incidence rates trended upwards with increased amounts or periods of solar UVR exposure.[20,30] In 2024, the American Cancer Society predicted that between 8% and 10% of all melanoma diagnoses in the United States will end with loss of life.[16]

Melanoma arises from melanocytes in the upper layer of skin; under normal conditions, these cells produce the melanin pigments that give skin its color.[31–33] Similarly to other skin cancers, areas commonly exposed to the sun are the most likely regions of incidence, but this pathology can also develop on areas of the body that experience little to no exposure to UVR, such as the soles of feet, under fingernail or toenail beds, genitals, and the eye. Ultraviolet light does not cause all melanomas as they can form within the inner eye and the lungs; however, healthcare professionals and researchers believe DNA mutations resulting from UVR to be the leading cause of this cancer. Unhoused individuals who develop melanoma share the same potential adverse personal and societal stigmas, biases, and outcomes as basal and squamous cell carcinomas, but they face significantly greater adverse health outcomes.[12,19,32]

Early diagnosis and prompt treatment are vital for optimal health outcomes from melanoma. The diameter a melanoma has reached can help interpret a patient's survival rate; when the cancer is caught smaller than one millimeter in diameter, there is a 93% survival rate; as the diameter increases, the survival chances decrease rapidly.[34] Staging melanoma gives an even more reliable five-year survival rate.[19,35] With treatment, patients with localized melanoma staged as zero, one, or two have a 98.4% chance of life

through the next five years. If treatment starts at stage three, regional melanoma, the five-year outlook is 63.6%. Metastatic melanoma, denoted as stage four, is the most aggressive and malignant form of this disease; with treatment, there is only a 22.5% five-year survival rate. The outlook of untreated melanoma appears less favorable; for individuals who are unable to receive or choose to go without medical intervention for regional stage three melanoma, the five-year survival rate decreases to 32%; if the melanoma was malignant, stage four, the five-year survival rate drops to below 15%.[19,36]

Early treatment is crucial for optimal outcomes. To aid in screening efforts, the New York University School of Medicine created a system called the ABCDEs of melanoma, which is displayed in Figure 1.[34] The presentation of melanoma varies to an extreme degree both between and across patients; early stages often resemble a mole or benign nevi and risk being overlooked by those not knowledgeable about melanoma. Knowing the ABCDEs helps identify characteristics in early stages that should cause concern. If the area of interest shows asymmetry between its halves, irregularities in its border, uneven coloring, changes in size/diameter, and evolutions in any of these categories over time, then it would be in a person's best interest to have the area examined. Visual examples of melanoma in various stages across various skin tones and locations are displayed in Illustration 3.

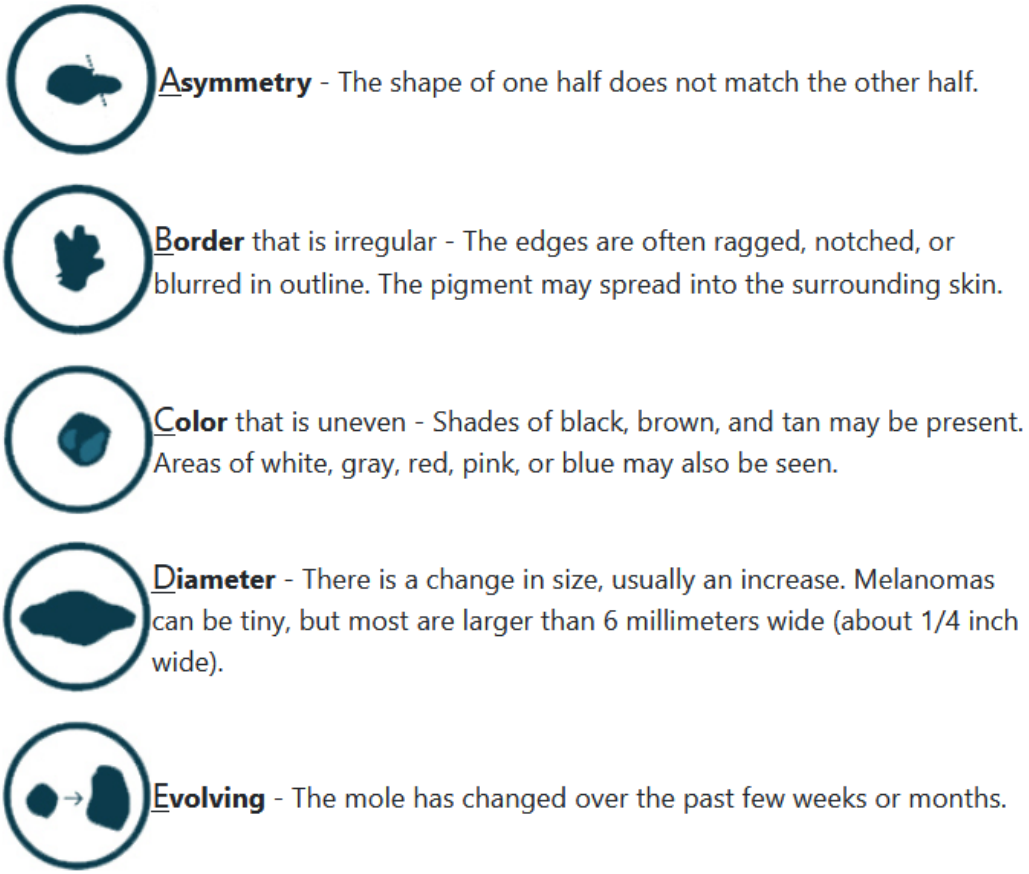

Figure 1. The ABCDEs of Melanoma Screening.
The figure above provides a clear, concise explanation of the ABCDEs used in melanoma screening. It outlines how if a mole or growth demonstrates Asymmetry, irregular Borders, uneven Colors, increasing Diameter, or Evolving shapes, then it's recommended to be checked for skin cancer by a healthcare provider. The figure was taken from the National Cancer Institute, Division of Cancer Epidemiology and Genetics.[37]

Illustration 3. Visual Examples of the Varied Morphologies of Cutaneous Melanoma at Differing Stages on Patients with Various Skin Types

This figure provides visual examples of the various presentations of melanoma in differing stages of progression. Examples are shown across different locations of the body and between different skin colorations, contributing to this pathology's nonuniform presentation, adapted from the American Cancer Society and CA: A Cancer Journal for Clinicians.[24,34]

Ultraviolet Radiation Exposure

UVR is a category of the wavelength spectrum the International Agency for Research on Cancer has classified as "carcinogenic to humans."[30] Research shows exposure greatly increases the change of DNA damage, which can lead to skin cancers. Two subcategories of solar UVR; UVA and UVB, have displayed in animal and human trials to be associated with higher disease incidences through their disruptive effects on multiple critical biological functions. Though UVB is believed to be a more significant contributor, data from numerous animal experiments has shown that both UVA and UVB exposure has the capacity to increase the incidence of DNA mutations, depress immune functions, and disrupt the checkpoints within the cell cycle regulation, experiments on human volunteers have shown the same results in addition to an increased development cancer and other skin pathologies.[30,38] Solar UVR has been classified as the dominant environmental risk factor for developing both nonmelanoma skin cancers, basal cell and cutaneous squamous cell carcinomas, and the primary cause for cutaneous malignant melanoma. High amounts of ultraviolet light exposure are estimated to increase the risk of melanoma by twofold that of individuals who receive moderate to low levels of sun exposure.[20]

To determine the intensity of UVR an individual may exposed to in an area, the World Health Organization and the United States National Weather Service have developed a computing model to relate the strength of solar ultraviolet radiation at ground level to an area of ground elevation, forecasted cloud coverage, ozone concentration in the stratosphere and grade the amount numerically.[39] They measure the

wavelength of UVR at wavelengths between 280 nanometers and 400 nanometers, encompassing the full spectrum of UVR, UVA, encompassing wavelengths from 315 nanometers to 400 nanometers, and UVB, encompassing wavelengths from 280 nanometers to 314 nanometers. A strength value is assigned to each measurement and then weighted using a function called the McKinaly-Diffey erythema action spectrum. A computer model will use point measurements at these wavelengths, the forecasted stratospheric ozone levels, and their corresponding incident angles of sunlight to attenuate the strength and weight of the UVR reaching ground level.

Factoring in forecasted ozone, cloud coverage, and elevation is vital in determining an area's ultraviolet index.[39,40] Ozone more strongly attenuates and absorbs the shorter wavelengths of UVB than longer wavelengths of UVA. The intensity of solar ultraviolet rays increases by 6% per kilometer of elevation above sea level. Clouds, by nature, absorb a portion of the total UVR that passes through them, similar to ozone, clouds are more effective at absorbing UVB than UVA. In a cloudless sky, virtually all UVR will pass through; scattered clouds, on average, will absorb 11% and transmit 89%, broken clouds may absorb 27% and transmit 73%, and an overcast sky can absorb up to 69% of UVR and transmit the remaining 31%. Finally, the computer model will calculate the total ultraviolet effect by multiplying the integrated strength and weight at the recorded wavelength with the elevation above sea level and the percentage of UVR transmitted through cloud coverage. The total ultraviolet effect is then divided by twenty-five and rounded to the nearest whole number, resulting in a numerical value on the

ultraviolet index, which ranges from 0 in total darkness to the mid-teens during extremely strong sunlight, as displayed in Figure 2 and detailed in Table 2.

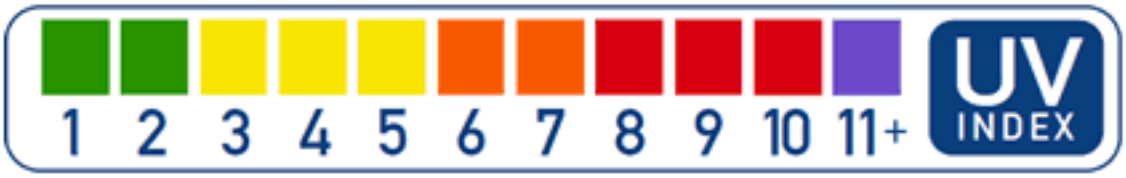

Figure 2. Ultraviolet Radiation Index Scale
The ultraviolet index scale is a numerical scale ranging from 0 to 11+ that is a representation of the intensity of solar ultraviolet radiation reaching the surface of the earth. Higher values indicate a higher risk of potential dermatological damage due to ultraviolet exposure. Higher values indicate stronger ultraviolet radiation. This standardized scale is an important resource for guiding public health recommendations regarding sun exposure. Taken from The United States Environmental Protection Agency[41]

The ultraviolet index, as detailed in Table 2, is set in a range from 0 to 11+. The United States Environmental Protection Agency and the World Health Organization have further classified the ultraviolet index by risk of possible damage due to sun exposure, placing differing index values from low to extreme risk.[41,42] While individual risk does vary by skin type, the ultraviolet index and risk ranking provide a generalized recommendation for determining when the risk of skin damage is high and what protection, if any, should be taken before spending extended periods in the sun. A reading of 2 or below indicates no protection will be needed for the average person; sunscreen is still recommended for an extended time in the sun or if you are fair-skinned, but it is not necessary for the general population. Moderate levels of 3 to 5 indicate a moderate risk of skin damage. It is recommended that the average person seek shade or stay inside from 10 AM to 4 PM while the sun's rays are the strongest if possible, and to wear protective

clothing and sunscreen if staying in the shade is not possible. A high risk of skin damage is denoted by a ultraviolet index of 6 or 7 for unprotected skin; a sunburn can develop in as little as 15 to 25 minutes at this scale. A ultraviolet index reading of 8, 9, or 10 is classified as very high, and it is not recommended to expose unprotected skin to this level of solar UVR. There is a very high risk of dermatological harm. If it is not possible to minimize sun exposure, then it is recommended to apply sunscreen and sun protection chapstick liberally and repeatedly. Any level of UVR that is classified as 11 or above is labeled extreme. Unprotected skin can receive damage in less than 10 minutes. It is best to avoid all sun exposure, even when using sunscreen. A severe sunburn is likely to result from extended exposure to high, very high, and extreme levels of UVR have been shown to triple the risk of melanoma and other skin cancers.

Table 2. The Risk Classification of Ranges on the Ultraviolet Index Scale
This table denotes a classification of dermatological damage risk at corresponding ultraviolet radiation measures on the ultraviolet index scale. The table divided the index into five levels of risk: low, moderate, high, very high, and extreme, corresponding to index ranges of zero to two, three to five, six to seven, eight to ten, and eleven or more. With increasing levels of ultraviolet radiation, the risk of sunburn and of developing other dermatological conditions such as nevi and cancers increases. This table was adapted from the United States Environmental Protection Agency.[41,42]

Risk	Ultraviolet Index Range
Low	0 - 2
Moderate	3 - 5
High	6 - 7
Very High	8 - 10
Extreme	11+

Skin Color/Phenotype

The color, phenotypes, and Fitzpatrick classification of one's skin create variations in the duration and intensity of solar UVR that may become harmful.[43,44] The Fitzpatrick classification system was developed by a professor of dermatology at Harvard Medical School in an effort to create a uniform system for determining skin types, sunburn risk, and tan susceptibility based on constitutive and facultative skin color. Facultative skin color explains the increase in epidermal melanin concentration after hormonal or environmental factors such as sunlight exposure. Constitutive skin color explains the role of genetic phenotypes in determining the distribution of melanin, overall melanin levels, and the type of melanin a person has. Constitutive skin color, unlike facultative skin color, is entirely unaffected by both exogenous and endogenous factors. Skin color is determined by additional factors, including hemoglobin, carotenoids, and bilirubin, but it is the skin's melanin content alone that offers protection from ultraviolet light.

It is an individual's epidermal melanin concentration and typing and not a person's overall skin color that has the most significant effect on skin sun sensitivity.[43,44] There are two broad categories of melanin: eumelanin, which is physically darker, and pheomelanin, which is physically lighter. High eumelanin concentration is characteristic of darker-skinned individuals, forms an effective filter against solar ultraviolet light, and serves the additional function as a free radical scavenger in the epidermis.[45,46] Lighter-skinned individuals typically present with higher levels of pheomelanin, which is a poor

filter against solar ultraviolet light in comparison and has the capacity to act as an endogenous photosensitizer through generating superoxide anions.[29,30]

Since its creation, the Fitzpatrick grading system has been modified to account for variations in race and ethnicity.[44] Initially, it classified all skin colors/phenotypes into 6 categories based on a participant's skin reactions to phototherapy treatment without taking race or ethnicity into account, as denoted in Table 3. Today, more accurate and representative variations of the Fitzpatrick scale are being adopted, such as the Skin Color and Ethnicity Scale and the Colorimetric Scale. These grading systems were created specifically to assist in providing reliable information regarding skin cancer risk for darker-skinned individuals. The Skin Color and Ethnicity scale is based on the Fitzpatrick scale with expanded categories IV and V, which have been further subdivided into IVA, IVB, VA, and VB, as seen in Table 4.[43,44] Type IV and V skin color/phenotypes were expanded to reduce the broad extent the original classifications encompass and better acknowledge the role ethnicity and race have in skin color and melanin contribution. The use of "A" and "B" distinctions, as shown in Figure 3, allows for lighter and darker color variation, distinction, and the addition of both clinical identifiers, such as freckles and pore size, and the geographic race and ethnic origins of subjects; this scale is referred to as the Skin Color and Ethnicity scale.

Table 3. Original Fitzpatrick Skin Phenotype and Skin Reaction Classification
The Fitzpatrick classification of skin phenotypes divides skin color as I, II, III, IV, V, VI based off of skin's reaction to phototherapy treatments. Skin reactions for skin types categorized from I to IV explain the skin's capacity to burn and tan. The skin reaction listed for the two darkest classifications, V and VI, simply states brown and black skin, respectively, and does not outline sunburn or tanning susceptibility, highlighting a major critique of the original classification systems that has since been updated. Table Adapted from Clinics in Dermatology.[43]

Original Fitzpatrick skin phenotype classifiaction	Skin Reaction
I	Always burn, never tan
II	Usually burn, tan with difficulty
III	Sometimes mild burn, average tan
IV	Rarely burn, easily tan
V	Brown Skin
VI	Black Skin

Table 4. Racial/Ethnic, Clinical, and Colorimetry Features of the Skin Color and Ethnicity Scale
This table describes the reactions skin has to ultraviolet light through phototherapy treatment to a rendition of the Fitzpatrick skin typing scale that accounts for race and ethnicity. The relationship between various skin types also corresponds with racial and ethnic geographical origins and the likely effect of age, scarring, and hyperpigmentation in each skin type group. Skin types are categorized as I, II, III, IV (IVA and IVB), V (VA and VB), and VI, ranging from the highest susceptibility for sunburn or other ultraviolet radiation-related dermatological pathology and minimal changes in pigmentation (type 1) to the lowest susceptibility of sunburn or other ultraviolet radiation related dermatological pathologies and possible hyperpigmentation(type VI). Insights into the differing degrees and susceptibility of keratoses, wrinkling, nevi, and additional conditions are all explored across the skin types. Table has been adapted from Dermatologic Surgery49(8):725-731,2023.[44]

Skin Type	Skin Reaction	Racial/Ethnic Homeland	Aging, Scarring, and Hyperpigmentation	Colorimetry (Melanin Index) (Spectrophotometer)
Skin Type I	Always burns, never develops a tan or darkening of the skin (painful burn at 24 h and no tan at 7 d)	Northern Europe England Scotland Ireland Baltic/Nordic Countries	Minimal pigmentary changes Keratoses Coarse and Fine wrinkles Laxity Sallowness Multiple Nevi Increased occurrence of premalignant and malignant skin lesions (including actinic keratoses, basal cell carcinoma, squamous cell carcinoma, and melanoma) Lentigenes and actinic damage	Courage Khazaka Database; Grimes PE VPI Database17 0–100Eilers: 9,000 ± 10
Skin Type II	Easily burns, then develops a light tan or light darkening (painful burn at 24 h and a light tan at 7 d)	Northern Europe Central Europe Eastern Europe Baltic/Nordic Countries	Minimal pigmentary changes Keratoses Coarse and Fine wrinkles Laxity Sallowness Multiple Nevi Increased occurrence of premalignant and malignant skin lesions (including actinic keratoses, basal cell carcinoma, squamous cell carcinoma, and melanoma) Lentigenes and actinic damage	100–150Eilers: 8,500 ± 10
Skin Type III	Mild burning, tenderness, or itching, skin irritation in sun-exposed skin, then develops a medium tan or skin becomes slightly darker in sun-exposed sites	Southern Europe Central Europe Eastern Europe Mediterranean Americas East Asia India	Visible dyschromia Fewer keratoses compared to I and II Laxity Sallowness Fewer Nevi Increased occurrence of premalignant and malignant skin lesions (including actinic keratoses, basal cell carcinoma, squamous cell carcinoma, and melanoma) Some have lentigenes	150–250Eilers: 8,200 ± 10
Skin Type IV A and B	Minimal skin irritation, minimal tenderness, itching, or redness in sun-exposed areas, then develops a deep tan or skin becomes darker in sun-exposed areas (no skin irritation, tenderness, or itching at 24 h and a tan or darker skin at 7 d)	Central America South America North America Philippines Polynesia Vietnam North India East Asia Mediterranean Africa China Korea Japan Thailand North Africa Middle East	No keratoses Mild to Moderate pigmentary changes with aging Minimal wrinkling Few nevi Occasional lentigenes (some palmar and plantar) Propensity for keloid and scarring Jowl formation	50–400Eilers: 6,200 ± 10
Skin Type V A and B	Occasional skin irritation, tenderness, or itching in sun-exposed skin, then develops moderate or significantly darker skin in sun-exposed sites in temperate climates; sunburn uncommon	Afro Caribbean Central Africa East Africa West Africa South Africa South India Polynesia Australia Eritrea Ethiopia North Africa Middle East	Prominent jowls Few rhytides Marionette Lines Moderate hyperpigmentation with aging Propensity for keloid and scarring No keratose	350–475Eilers: 5,000 ± 10
Skin Type VI	No skin irritation, tenderness, or itching in sun-exposed skin, no noticeable change in skin in sun-exposed sites in temperate climates; sunburn uncommon	Afro Caribbean Central Africa East Africa West Africa South Africa South India Polynesia Australia	Jowl formation Few rhytides Marionette Lines Deeply pigmented skin Hyperpigmentation with aging Propensity for keloid and scarring No keratose	450–825 Eilers: 4,000 ± 10

Figure 3 Rating Subjects on the Skin Color Ethnicity Scale
This figure gives examples of what category of the Fitzpatrick-based Skin Color Ethnicity Scale each subject would be classified as. A wide range of skin colors, genders, and age groups are used to demonstrate the variability in subject placement within this skin phenotype classification system. Subjects are matched into their respective categorical classification as I, II, III, IVA, IVB, VA, VB, and VI, ranging from the most susceptible to sunburn or other ultraviolet light-related dermatological pathology to the least. Table has been adapted from Dermatologic Surgery49(8):725-731,2023.[44]

The Colorimetric scale, as seen in Figure 4, in comparison to the Skin Color Ethnicity scale, is not based on race or ethnicity; instead, it provides a skin range from very light beige to very dark brown to better signify an individual's risk for skin cancer development.[47] In colorimetric classification, white-skinned individuals are denoted as 0, and then the range increases from 1, very light beige, to 5, very dark brown. These classifications enable clinicians to better assess the risk of skin cancer and provide color-appropriate treatments for patients. This simplified scale is designed to allow for rapid visual examinations to provide a comprehensive risk assessment and simplify diagnostic procedures for individuals of color.

Figure 4. The Colorimetric Scale for Individuals of Color
This figure demonstrates the range and numeric notation of skin colors on the colorimetric scale. A denotation of 1 indicates light beige skin, and the numerical denotations increase with darkening skin tone to 5, which describes very dark skin. The figure does not demonstrate white skin, which is ranked numerically as zero, and incorporates every skin tone that is lighter than those denoted as 1. This figure was acquired from Cohen P R, DiMarco M A, Geller R L, et al. (November 01, 2023)[47]

Skin color classification is vital when determining the risk of and diagnosis of skin cancers. Skin cancer is more common in patients who are lighter-skinned but is associated with a greater morbidity and mortality rate in darker-skinned patients.[48] The visual presentation of skin cancers varies with skin color and phenotype, which can potentially lead to misdiagnosis and mistreatment if skin coloration differences are not considered at screening, especially when examining individuals suffering from homelessness.

Health Literacy and Barriers to Healthcare

The unhoused community as a whole faces considerable barriers to care throughout the United States; it is a broad and multidimensional issue that contributes significantly to the excess mortality and morbidity the population faces.[49] In a national survey performed within the unhoused community by Health Care for the Homeless, 73% of unhoused respondents reported they had at least one unmet healthcare need. Throughout the last decade, substantial strides have been made in the expansion of healthcare access for this population at local, state, and national levels, though barriers do remain.

Health literacy at both individual and provider levels can significantly impact if or when skin cancer is diagnosed for a person with homelessness and possible treatment measures. A cross-sectional study to evaluate knowledge about skin cancer and sun exposure, as well as attitudes and practices regarding screening and sun exposure mitigation practices, was conducted within the Dallas, Texas, male unhoused population, indicated 49% of unhoused individuals knew that if a mole like growth began to change

appearance and if a sore refused to heal that these were signs of skin cancer, all questions asked are detailed in Table 5.[50] This study found that black men were less likely to believe people with darker skin were at risk for skin cancer development and less likely to apply sunscreen before sun exposure. Of the surveyed population, 52% reported spending extended periods of time in the sun on a frequent basis, but only 21% reported any sunscreen use. The majority of this group, 71%, reported they had never checked themselves for signs of skin cancer, and only about one in ten, 13%, reported a healthcare professional had ever screened them for skin cancer. A Los Angeles-based study investigating general cancer screening behaviors in the unhoused population reported similarly suboptimal skin cancer screening rates, with 23% of the 221 unhoused individuals who participated having ever received screening for skin cancer.[51] Researchers conducting a similar study based in Nebraska found that only one-fifth, 20% of the unhoused individuals that participated in their trial had ever received a skin cancer screening.[52]

Table 5. Knowledge Assessment of Skin Cancer and Sun Exposure in the Dallas, Texas Unhoused Population.
The aforementioned table details the answers to a skin cancer and sun exposure knowledge assessment given to members of the Dallas, Texas, unhoused population. The question asked, as well as the total number of answers per choice and percentage of total for each question, are listed. Figured adapted from the Journal of Cancer Education Volume 35, pages 682-688 (2020).[50]

Knowledge questions	n	%
1. A tan is a sign that the skin is damaged.		
True (correct)	37	49
False	38	51
2. People with dark skin cannot get skin cancer		
True	4	5
False (correct)	71	95
3. Which of the following increases your risk of skin cancer?		
Having had three severe sunburns in your past	8	11
Having a family history of skin cancer	16	21
Both of these options (correct)	42	56
Neither of these options	9	12
4. What type of clothing usually blocks more UV radiation (from the sun)?		
Darker colored clothing (correct)	35	47
Lighter colored clothing	19	25
Both of these options	13	17
Neither of these options	8	11
5. When should sunscreen be applied for best protection?		
Just before you go in the sun	24	36
15–30 min before going in the sun (correct)	44	59
Within 15–30 min after going in the sun	4	5
6. How often should SPF 30 sunscreen be reapplied?		
Every 30 min	24	32
Every 2–3 h and more often if swimming or sweating (correct)	44	59
Neither of these options	7	9
7. What is the most common form of skin cancer?		
Melanoma	47	63
Basal cell carcinoma (correct)	12	16
Squamous cell carcinoma	2	3
None of these options	14	19
8. Which of the following could be a sign of skin cancer?		
A sudden or gradual change in a mole's appearance	21	28
A sore that does not heal	8	11
Both of these options (correct)	37	49
Neither of these options	9	12

An interview-based study with clients of the New York City shelter-based clinic system was conducted to better understand attitudes regarding cancer risk and screening within the unhoused community. It discovered that although only a small percentage of those interviewed had ever received cancer screening in any capacity, those questioned did believe that they were at a higher risk of cancer compared to the general population.[15] This same belief of increased cancer risk has been observed in the unhoused population throughout the country, yet due to individual and system-level barriers, screening rates remain low.[15,50–52]

Education regarding when to get a skin development checked and what factors constitute concern is believed to be a significant individual barrier for cancer screening in the unhoused community. The American Cancer Society recommends that individuals should check themselves or have another check them for signs of skin cancer every month and be screened by a dermatologist or another specially trained medical provider yearly. For monthly self-screening to be effective, individuals need to know what signs they are looking for.[53] In a national survey conducted by the Skin Cancer Foundation and colleagues, it was discovered that a staggering 74% of Americans were unable to identify signs of squamous cell carcinoma skin cancer, and only 28% of Americans were aware that it could become life-threatening when left untreated.[54] Additionally, 40% of Americans living in the South surveyed reported they had never heard of non-melanoma skin cancers, even though southern-based individuals are at a higher risk for skin cancer.

An individual's perceptions toward healthcare providers, and vice versa, are additional potential barriers that may alter the likelihood that an unhoused person seeks

out a professional's opinion on dermatological concerns. Studies regarding the attitudes of the unhoused towards healthcare have revealed people who are unhoused have often reported feeling unwelcomed, unheard, disempowered, or dehumanized during healthcare treatments, reporting these negative encounters negatively influenced their desire to seek healthcare in the future.[55,56] Providers are capable of maintaining a bias towards stigmatized groups like the unhoused, though current research suggests the overall perception of the unhoused community is positive among medical students and residents.[57] Although attitudes towards this community by providers are trending positively, there is no denying stigmatization towards this population does exist at all healthcare levels and can affect their care.[58]

In addition to the possibility of provider-side bias, other notable affecters do exist that may affect the likelihood of a skin cancer screening being performed or of a timely diagnosis. Comorbidities common in the unhoused community, such as hypertension, diabetes, soft tissue injuries, lung disease, mental health, substance abuse, and related maladies, can and will often take priority over skin cancer screening during medical visits.[9,59] Skin cancers may be considered more challenging to diagnose in people of color, who make up the majority of the unhoused population; the Association of American Medical Colleges has acknowledged the majority of historic skin cancer research and physician training focused on lighter-skin subjects in which these cancers present differently than darker-skinned subjects.[60–62] Historic insufficiency in training in regards to skin cancer presentation across different racial and ethnic groups is a major

contributor to the sub-optimal survival rate of skin cancers in Black, African, and African American populations despite being at a lesser risk of these pathologies.

Dr. Krueger and her colleagues conducted a study surveying dermatologists throughout the United States, presenting them with photos of a variety of skin conditions in both lighter and darker skin tones.[62] Their findings suggested the majority of practicing dermatologists are less likely to accurately and confidently diagnose conditions on the skin of color, which they believe significantly contributes to the later-stage diagnosis common in darker-skin-toned patients and the Black community. Significant efforts are being made by the Association of American Medical Colleges to diversify medical school, residency, and institutional curricula to increase confidence and accuracy in diagnosing dermatological pathology on non-white skin.[61]Above the previously discussed barriers in bias and health literacy this population must contend with, insurance status signifies one of the most considerable barriers to cancer treatment and screening. Due to the Affordable Care Act, public insurance programs such as Medicaid and Medicare have been expanded and are able to offer skin cancer screening in certain conditions depending on the state of residence.

GEOGRAPHIC LOCATION IN THE UNITED STATES AND ITS IMPACT ON SKIN CANCER RISK FACTORS FOR THE UNHOUSED

Through exploring the various contributors believed to increase the likelihood of skin cancer development within the unhoused population, it is clear that geographic location within the United States plays a pivotal role in modulating these factors. From the higher intensity UVR exposure in certain states to variations in health care access, insurance coverage, and availability, the availability of assistance programs, the environment a person lives within can serve to intensify or mitigate risks associated with skin cancer development. Understanding how the state or geographic location an individual who is unhoused lives within interacts with these variables is essential in the development of targeted strategies to reduce the risk for skin cancers and timely treatment of skin cancers throughout the unhoused populations in the United States.

Where an unhoused person in the United States lives has a significant effect on the intensity of solar UVR they may be exposed to. Figure 5 gives a detailed estimate of the number of unhoused residents in each state. California and New York are the two states with the highest populations of people experiencing homelessness, 187,084 and 158,019, respectively.[8] For every 10,000 residents in California, 48 are experiencing homelessness. In New York, 81 residents are experiencing homelessness per 10,000. Florida and Massachusetts are two states with a comparable number of residents experiencing homelessness in both total population and number per 10,000 people. There are an estimated 31,362 people experiencing homelessness in Florida and an estimated 29,460 people experiencing homelessness in Massachusetts. In addition to having a

similar total population of unhoused individuals, these are two states of particular interest because of other factors such as their location; Florida in the south and Massachusetts in the northeast, the differing solar UVR intensity the residents of these states are exposed to, displayed in Figure 6, and the difference in the percentage of sheltered vs. unsheltered as outlined in Figure 7.

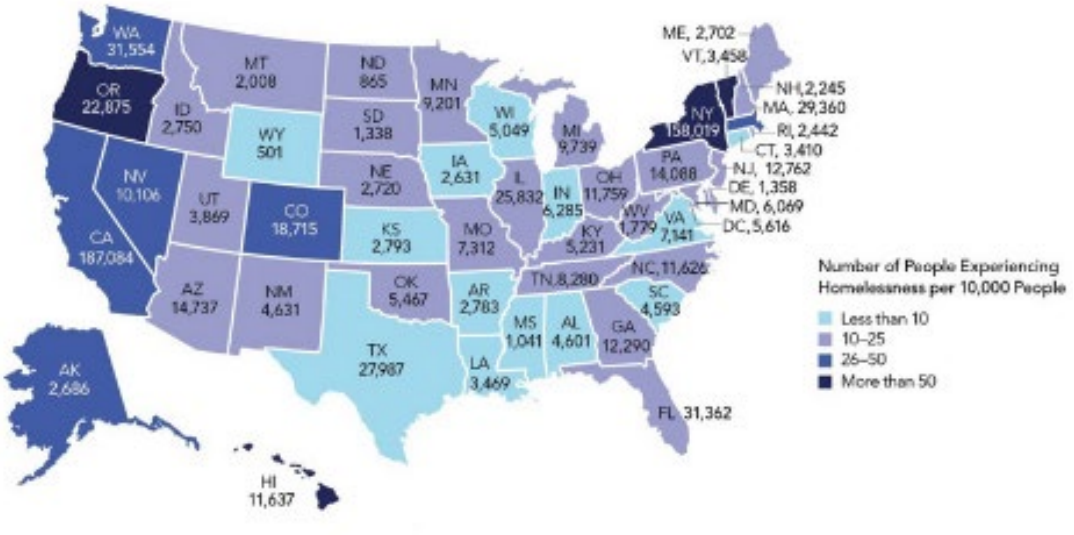

Figure 5. State Level Estimates of People Experiencing Homelessness in the United States, 2024
Per 10,000 residents in the United States, 23 of these people will be experiencing homelessness. States with the highest rates of individuals experiencing homelessness at this January timepoint were Hawaii, Oregon, New York, and Vermont. Taken from The 2024 Annual Homelessness Assessment Report.[8]

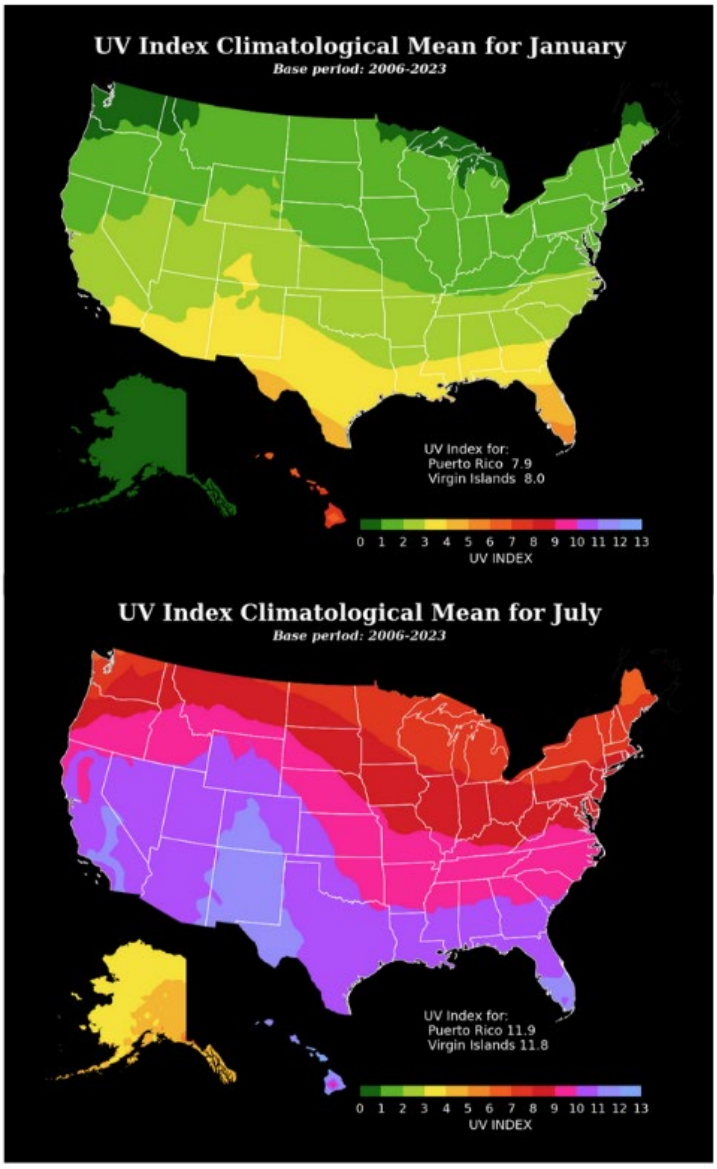

Figure 6. The Monthly Average Ultraviolet Index in the United States of America for January and July from 2006 to 2023

The time points January and July were chosen as they represented the lower average nationwide ultraviolet index and the highest average, respectively. Alaska experienced the lowest average ultraviolet index, and Hawaii experienced the highest for the month of January during this time period. In July, Alaska retained the lowest average ultraviolet index for this same time range, while Hawaii, Florida, and Texas experienced the highest ultraviolet indices. Taken from The United States Environmental Protection Agency[63]

Figure 6 outlines the average intensity of ultraviolet radiation in the months of January and July across the United States from 2006 to 2023. During the month of January, an unhoused individual located in Florida has been exposed to, on average, an ultraviolet index of 4 to 6, while in July of this same timeframe, they have experienced an ultraviolet index as high as 11 to 13.[63] The levels measured in January are considered moderate to high; exposing unprotected skin to the sun at these risk and index levels is not recommended. During July, index ratings are classified as extreme; skin damage can arise in less than ten minutes time. It is recommended that everyone avoid getting exposed to ultraviolet radiation at this level, regardless of skin color. In January, during this same time frame, an unhoused person in Massachusetts would have been exposed to a ultraviolet index of 2 to 3 and an average index of 7 in July. These are classified as low to moderate risk in the winter and high risk in the summer. A person living in Massachusetts with unprotected skin in July would have the same risk of skin damage as an individual in Florida during January.

Sun exposure encompasses both the intensity and duration of the solar UVR one is exposed to; short high-intensity exposures and long low-intensity exposures both exponentially increase the risk of developing dermatological pathologies.[64] The duration and intensity of the UVR the residents are exposed to remains to be the primary environmental cause for skin cancer development, but for the unhoused population, their status as sheltered or unsheltered can drastically affect the duration those experiencing homelessness are exposed to the sun. As demonstrated in Figure 7, states with a higher percentage of their unhoused population also classified as unsheltered may be at higher

risk of skin cancer pathologies in this community because of longer durations of sun exposure regardless of UVR intensity. Someone who is experiencing homelessness and who is sheltered may have more refuge from the sun available to them than an individual who is unhoused and unsheltered.

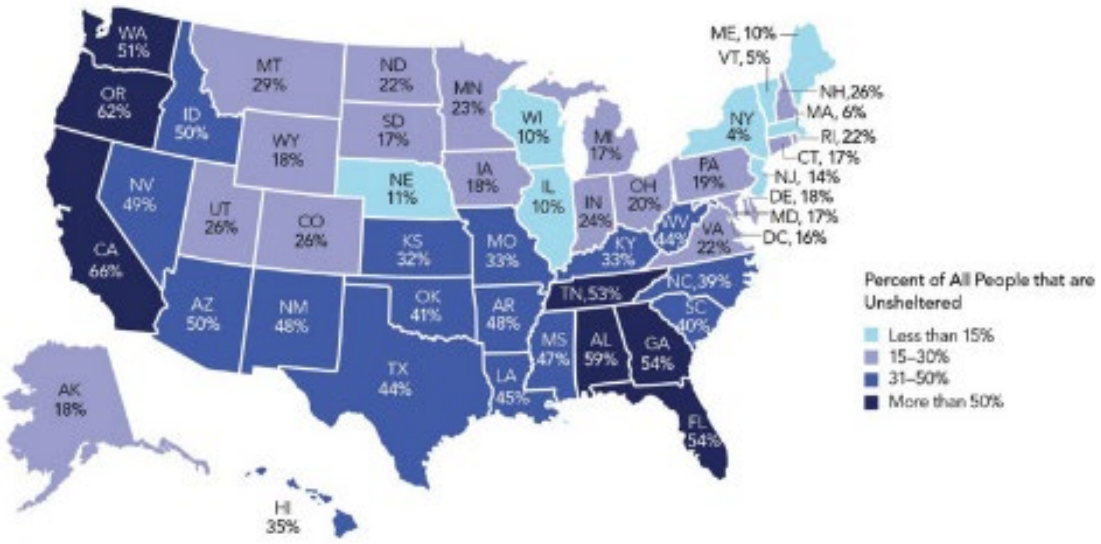

Figure 7. Percentages of People Experiencing Homelessness Who Are Unsheltered by State in January 2024

January was chosen as the point in time to conduct counts because is was deemed the coldest time of that year. States with lower rates of unsheltered unhoused during this point in time tended to be colder climates (e.g., New York, Vermont, Massachusetts). States with the highest rate of unsheltered unhoused at this time point primarily consisted of states in warmer climates (e.g., California, Alabama, and Florida). Washington State and Oregon are no exceptions to these trends. Taken from The 2024 Annual Homelessness Assessment Report.[8]

Considering as a state that Florida ranks among the highest for year-round ultraviolet indices, it is unsurprising that Florida has one of the highest incidences of both nonmelanoma and melanoma skin cancers in the United States, ranking second according

to the American Cancer Society and ranking first by the American Academy of Dermatology.[65,66] In 2018, almost one in ten Florida residents, 9.2%, were told they had a form of skin cancer, while the majority are nonmelanoma skin cancers; cutaneous melanoma accounted for 7,940 of these cases.[67] Nationwide, in 2018, there were an estimated 91,270 melanoma diagnoses; 8.7% were in Florida residents; the year-round high intensity of UVR its residents are exposed to is a major contributor to these pathology incidences. At a glance, the lower year-round UVR in Massachusetts would support the state's lower incidence of melanoma; in the four years from 2016 to 2020, Massachusetts residents were diagnosed with 8,577 cases of melanoma of the skin, taking multiple years to reach a similar number of diagnoses to Florida.[68] However, this lower incidence is only relevant to melanoma-type skin cancer.

For a northeastern state like Massachusetts, with a significantly lower year-round ultraviolet index, it would be expected that the incidence rates of skin cancer would be significantly lower, and for melanoma specifically, it is, but for non-melanoma forms of skin cancer, as displayed in Table 6, skin cancer researchers at the American Academy of Dermatology and Blue Cross Blue Shield of Massachusetts found Massachusetts and other states in the Northeast (e.g. Connecticut, Rhode Island, and Vermont) to rank alongside Florida with above the nation average of skin cancer diagnosis.[66] This research did identify Florida as having the highest rate of skin cancer diagnosis, with a rate of 7.1%, which is higher than Massachusetts' rate of 5% and the national average of 4.3%. At the county level, as displayed in Table 7, Florida contains four of the five counties in the country with the highest skin cancer incidence rate, with Massachusetts retaining the

fifth. Sarasota-Bradenton County, Florida, was found to have the highest skin cancer diagnosis rate of any county in the United States, with 10% of all cancer diagnoses being a form of skin cancer. Barnstable-Yarmouth, Massachusetts, was found to be tied with the Florida county Melbourne-Titusville-Palm Bay for the third highest skin cancer incidence rate, 8.6%, in the United States. It should be noted that the data used to generate these percentages used exclusively data from the privately insured; diagnoses from publicly insured and uninsured, like a majority of those experiencing homelessness, were not accounted for.

Table 6. States with the Highest Skin Cancer Diagnosis Rates
The percent rate of skin cancer diagnosis represents the percent of skin cancer diagnosed in these states out of their all cancers diagnosed in these states, The data examined in the making of this rank was from the 43 million insured by the private insurance company Blue Cross Blue Shield, the American Academy of Dermatology then extrapolated the results to the 216 million privately insured people in the United States. The average skin cancer diagnosis rate was found to be 4.3% within this cohort. It should be noted that only data from privately insured individuals were used to determine the national average and state average for skin cancer diagnosis rates; no data from publicly insured or uninsured persons was collected. Modified from Blue Cross Blue Shield of Massachusetts.[66]

Rank	State	Skin Cancer Diagnosis Rate
1	Florida	7.1%
2	Washington, D.C.	5.8%
3	Connecticut	5.6%
4	Rhode Island	5.3%
4	Vermont	5.3%
4	Maryland	5.3%
5	North Carolina	5.2%
6	Massachusetts	5.0%
6	New York	5.0%

Table 7. Counties with the Highest Skin Cancer Diagnosis Rates in the United States The data examined in the making of this rank was from the 43 million insured by the private insurance company Blue Cross Blue Shield, the American Academy of Dermatology then extrapolated the results to the 216 million privately insured people in the United States. The percent diagnosis rates listed represent what percentage of all cancers diagnosed in these counties were a form of skin cancer. It should be noted that only data from privately insured individuals were used to determine the national average and state average for skin cancer diagnosis rates; no data from publicly insured or uninsured persons was collected. Modified from Blue Cross Blue Shield of Massachusetts.[66]

Rank	County, State	Skin Cancer Diagnosis Rate
1	Sarasota-Bradenton, Fl	10.0%
2	Fort Pierce-Fort St. Lucie, Fl	9.5%
2	West Palm Beach-Boca Raton, Fl	9.5%
3	Melbourne-Titusville-Palm Bay, Fl	8.6%
3	Barnstable-Yarmout, Ma	8.6%

To understand how Massachusetts has a skin cancer diagnosis rate near to that of Florida when it receives significantly lower levels of UVR than Florida, we must consider the skin type, race, ethnicity, and healthcare access of the Massachusetts population. In 2024, the United States Census Bureau reported that 68.8% of Massachusetts residents were white only, not Hispanic or Latino, accounting for roughly 5 million of the state's 7 million residents.[69] As previously discussed, it is well documented that those with lighter skin tones are at higher risk for the development of

skin cancers, even at lower ultraviolet indexes, which is a significant contributor to the higher skin cancer diagnosis rates found in Massachusetts and other northeastern states such as Connecticut, Rhode Island, and Vermont which also share lower average ultraviolet indices and a predominantly white population.[66,70–72] Massachusetts residents are among the highest in the nation in regards to health insurance, with 98.3% of the state's population reporting a health insured status, which could account for higher than average skin cancer screening rates within this state.[73]

For the unhoused community, both the ability to enroll in public insurance programs and the specific coverages and terms the insurance provides will significantly affect their ability to receive screening for skin cancers, and this varies with both the state of residence and the age of the individual. States that elected to expand Medicare and Medicaid access through the Affordable Care Act have seen higher health insurance regulations within their unhoused populations.[74,75] In a 2016 study by Rodriguez and colleagues, it was discovered that 72% of the 134 unhoused participants who participated were enrolled in Medicaid; from the 28% that were not enrolled, 70% reported they were unaware they qualified.[74] In another study conducted in 2014, it was reported that 67% of unhoused individuals who resided in states that elected to expand Medicaid had health insurance, while only 30% of the unhoused population was enrolled in health insurance in states that elected not to expand their Medicaid coverage.[75] Even though unhoused who are located in the states that have expanded Medicaid and Medicare through the Affordable Care Act have higher insurance rates, there are still barriers above those previously discussed to receive a skin cancer screening. For the unhoused over the age of

65 who are enrolled in Medicare, it is possible for them to use Medicare to cover a skin cancer screening, but only when they are symptomatic and have been referred for one.[76,77] Medicare does not cover a yearly screening even though it is recommended by institutions like the American Cancer Society, and the majority of literature discusses its necessity to mitigate the risk of skin cancer.

DISCUSSION

The findings discussed in this review highlight the complex interplay of factors that contribute to a heightened risk of skin cancer pathology and suboptimal health outcomes due to untimely treatment and social stigma in the United States unhoused population. Those affected in the unhoused population are at a severe disadvantage when it pertains to having positive outcomes from a skin cancer diagnosis. Understanding how the state or geographic location an individual who is unhoused lives within interacts with the variables discussed is essential in the development of targeted strategies to reduce the risk for skin cancers and timely treatment of skin cancers throughout the unhoused populations in the United States.

A Boston-based study examining disparities in cancer incidence, stage, and mortality that the unhoused population faces reported that persons suffering from homelessness when diagnosed with cancers are, on average, diagnosed in later stages compared to the general public.[12] Additional research from the Department of Global Health at George Washington University corroborates this research, not only finding that a majority of cancer diagnoses in the unhoused population do not occur till later stages but that people experiencing homelessness have a four times higher prevalence of cancer in comparison to the general population.[78]

A later-stage diagnosis or non-treatment of basal cell carcinoma can lead to suboptimal health outcomes for the unhoused population and additional social bias and stigma. Beyond the irritation and pain that untreated basal cell carcinoma can cause, the

lesions it forms can grow to the point of disfigurement.[19,25] With the primary areas of indecent being the face, head, and neck, the disfigurement may become a point of shame or embarrassment and can contribute to additional social and societal bias above that already faced by the unhoused. It is possible that facial disfigurement could lead to further isolation, whether socially or self-imposed, and contribute to worsening conditions. If this cancer remains untreated for a prolonged period of time, it has the potential to become locally invasive and invade or destroy further skin, soft tissue, and bone surrounding it. Though rare, if left untreated for a significant amount of time, it can become aggressive and spread throughout the body, becoming potentially life-threatening.

The same suboptimal health and societal outcomes exist for squamous cell carcinoma that exist for basal cell carcinoma in the unhoused population but at a more rapid timeframe. Squamous cell carcinomas grow more quickly and are prominent on both commonly visible and covered body areas.[79] In addition to general pain, ulcerated carouse sores can become infected, leading to worsening health conditions. When facially located, patients often experience syncope events, tunnel vision, and lightheadedness, in addition to deteriorating social treatment and bias that may already be present due to an unhoused status. Repeated poor treatment or general embarrassment due to being unable to hide facial skin cancer can exacerbate the disease further and keep individuals from seeking treatment for significantly longer periods in comparison to housed populations.[12]

Untreated melanoma, like the previously discussed non-melanoma skin cancers, can lead to pain, irritation, and disfigurement, among other already identified negative

health outcomes, but with a significantly higher mortality rate. Considerably more data is available in regard to the diagnosis rates of melanoma skin cancer than non-melanoma type skin cancers because the diagnosis of non-melanoma skin cancer is not nationally reported. As discussed, the stage classification of melanoma at the time of treatment has significant impacts on survival rates, which puts the unhoused population at a significant disadvantage for positive outcomes.[78] The unhoused population, on average, is diagnosed with later-stage cancers, such as melanoma, which has a substantial impact on life expectancy. As discussed, a stage three diagnosis of melanoma with timely treatment yields a 63.6% five-year survival rating, and stage four yields a staggering 22.5% five-year survival rating. When not properly treated, which is common for an unhoused individual due to factors such as cost, displacement, and lacking adequate transport, the five-year survival rating drops to 32% for stage three and below 15% for stage four.[19,36] These rates represent the general housed populations; the five-year survival rating is likely lower for the unhoused population due to comorbidities common within this population.

Race, ethnicity, and skin color can have a significant impact on the stage at which skin cancer is diagnosed; over the last decade, the total incidence of melanoma in the United States has increased by an average of 1.4% per year; non-Hispanic white males have had the highest incidence rate of 34.7 per 100,000 per year.[48,80,81] With non-Hispanic white individuals also make up the single highest percentage, 31.7%, of the total unhoused population. Black, African, and African American individuals make up 29.5% of the total unhoused population and account for the lowest annual incidence rate of 0.9

per 100,000, but this population continues to demonstrate poor overall survival rates, in a term coined the “minority melanoma paradox.” Melanoma incident rates are on the rise in the Hispanic population as well, which makes up 30.6% of the total unhoused population, with an annual 7.4% increase in Hispanic Men and 3.4% in Hispanic women. The total morbidity and mortality rate in the Hispanic population trends similarly to the Black, African, and African American population, with lower diagnostic rates in later stage presentations when diagnosed carrying less optimal prognosis. Combined these two racial groups make up the majority of the unhoused population in the United States, further contributing to the increased risk and suboptimal outcomes the unhoused face.

An unhoused individual's designation of sheltered or unsheltered can play a significant role in the amount of UVR that person is exposed to in a day. If the individual is in unstable housing and at direct risk of losing their housing, they retain the ability to stay indoors and out of the sun during the day. Someone staying in a homeless shelter or outreach center may have the same ability to remain within the shelter during the sunniest and most ultraviolet-intensive portions of the day. While it is not uncommon for many shelters to ask their occupants to leave in the afternoon and return in the evening, they often run soup kitchens and other programs designed to assist their clientele during working hours. Sheltered, unhoused individuals who stay within a shelter may have more options available to them within the system that can keep the time they spend in the sun less than that of their unsheltered counterparts. Many sheltered persons experiencing homelessness are individuals who live in their cars or move between the houses of friends

and family; these individuals may also have more opportunities during the day to get out of the sun than another person experiencing homelessness who is unhoused.

In addition to sheltered status leading to more ability to find indoor refuge from the sun, it was found to correlate with higher employment rates in a 2021 study from the University of Chicago, which in turn offers additional indoor relief from the sun's ultraviolet rays.[82] Researchers discovered that 53% of the sheltered, unhoused population that was currently living within a homeless shelter or outreach center was actively employed when compared to just 40% of unsheltered people who experienced homelessness from 2011 to 2018. These findings heavily imply that the majority of unsheltered people experiencing homelessness throughout the country have less opportunity to escape the sun's rays during daytime hours due to both less access to consistent indoor relief and a decreased likelihood of finding daytime employment. Similarly to how sheltered status may offer the greater ability of indoor sun exposure relief, it also correlated with higher employment opportunities. The unhoused can experience difficulty finding employment, which can be intensified by being unsheltered. Throughout the United States, many employers require a permanent address during the hiring process. A sheltered individual may have the option to list their shelter's address on their application to satisfy this requirement. Shelters also may have accommodations such as assistance in creating resumes, applying for positions, and interview preparation. In comparison, those who are unhoused and unsheltered may be unable to list an address on their applications, limiting their employment opportunity. If the unsheltered person

cannot access a computer, they are also severely limited in their opportunity to apply online for employment.

When extended periods of sun exposure are unavoidable, the two most commonly recommended mitigation techniques are wearing clothes that will cover as much skin as possible and the application of and constant reapplication of sunscreen.[30,51,52] These mitigation measures are not realistic for this vulnerable population. The majority of this vulnerable population has an income substantially below the poverty line; higher priority purchases such as food take precedence over the purchase of sunscreen.[83] The ability to keep one's skin covered is highly location-based in areas with higher overall ultraviolet indices, like the South; wearing long clothing in the heat can bring on heat stroke, increase dehydration, and other high temperature-related maladies.[20]

For the unhoused who are able to obtain public insurance, the current skin cancer screening policies require an unhoused person to know when something on their skin warrants a professional's opinion. As previously discussed, only 49% of unhoused individuals surveyed knew what signs signified possible melanoma, and 74% of housed Americans could not identify signs of non-melanoma skin cancers.[50,54] Only covering screenings on referral also shifts the burden onto emergency departments, urgent cares, and other same-day treatment centers, which are often the first, if not only, healthcare centers available to the unhoused. This policy creates a significant amount of variability between whether a cancer screening, a successful diagnosis, or a referral will happen. As previously discussed, comorbidities common for this population often take precedence over skin cancer screenings when an unhoused individual sees a healthcare provider.[9,59]

Challenges in correctly diagnosing skin diseases in people of color, who constitute the majority of the unhoused within the United States, can also decrease the likelihood of an accurate skin cancer diagnosis if a screening is performed.[60–62] For the majority of the unhoused population under the age of 65, the public insurance they would be eligible for or have is Medicaid. Depending on the state they are located in, skin cancer screenings may or may not be covered; for states that have expanded Medicaid through the Affordable Care Act, the policies mirror that of Medicare.[9,59,74]

CONCLUSION

The limitations in obtaining a skin cancer screening from public insurance policies or complete lack of insurance restrict the likelihood of early detection and timely treatment for skin cancer; these barriers are compounded by the additional challenges the unhoused population is facing. Modulating factors such as skin color, perceived increased sun exposure, and deficiency in health literacy further exacerbate the risks, while environmental conditions and social determinants of health present additional obstacles. These barriers to care underscore the urgent need for interventions targeted at the unhoused population that address these unique vulnerabilities. A multifaceted approach focused on tailoring public health initiatives that provide education, skin cancer awareness, and increased access to healthcare services is needed to address these compounding challenges. Further research is essential to better understand the long-term health outcomes for skin cancers in unhoused individuals and to identify effective and efficient prevention strategies. The continued efforts from healthcare providers, policymakers, community organizers, and volunteers are critical for reducing health disparities and ensuring that this vulnerable population is able to receive the care and protection they need.

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