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Thesis

**ASSESSING THE DERMATOLOGICAL HEALTHCARE NEEDS OF
TODAY'S GERIATRIC POPULATION; A NATION-WIDE
BEHAVIORAL ANALYSIS**

by

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B.S., Boston University, 2016

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requirements for the degree of
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ABSTRACT

The geriatric population (65 years or older) represents a large portion of dermatology patients and is growing rapidly. This population is hypothesized to face several exacerbated barriers to dermatological healthcare, often resulting in the deferral of necessary dermatological healthcare. This avoidance behavior unnecessarily increases morbidity and mortality of this population due to dermatological diseases. The behaviors of this group towards their dermatological healthcare must be assessed for public policy to help fix the disparity seen in their dermatologic care.

A cross-sectional online survey was carried out among a randomly selected sample of 609 registered SurveyMonkey® users aged 65 years or older across the continental United States. Multiple linear regression analysis of the data revealed a negative relationship between perceived barriers to care and self-reported usability of telemedicine ($p=0.01$). This analysis also revealed several gender differences; females were more likely to be concerned with “cosmetic/aging” ($p<0.0001$) and males reported both higher prevalence of skin cancer ($p<0.005$) and higher concern for developing skin cancer ($p=0.05$).

TABLE OF CONTENTS

TITLE.....	i
COPYRIGHT PAGE.....	ii
READER APPROVAL PAGE.....	iii
ABSTRACT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS.....	ix
INTRODUCTION	1
SKIN	1
AMERICA'S AGING POPULATION	3
MECHANISM OF AGING	4
COSMETIC TREATMENTS	7
SKIN CANCER	8
BARRIERS TO CARE	9
TELEDERMATOLOGY	11
PRESENT STUDY	11
SPECIFIC AIMS	13
METHODS.....	13
PROCEDURE	15
DATA ANALYSIS	17
RESULTS.....	18
REGRESSION	19
TELEMEDICINE	19
COSMETIC CONCERN	19

SKIN CANCER	19
RESPONSE DATA	20
DISCUSSION.....	29
RECOMMENDATIONS	35
APPENDIX I: QUESTIONNAIRE	36
LIST OF JOURNAL ABBREVIATIONS	40
REFERENCES	41
VITA	49

LIST OF TABLES

Table	Title	Page
1	Dermatological Disease History	25
2	Dermatological Concerns of Sample	26

LIST OF FIGURES

Figure	Title	Page
1	Sample Size Determination	13
2	Research Information Sheet	15
3	Sample Population Age and Gender	18
4	Response data to question 2	21
5	Response data to question 3	22
6	Response data to question 4	23
7	Response data to question 6	24
8	Response data to question 9	24
9	Response data to question 10	26
10	Response data to question 11	27
11	Response data to question 12	28

LIST OF ABBREVIATIONS

NMSC.....	Non-Melanoma Skin Cancer
PCP.....	Primary Care Physician
SC.....	Stratum Corneum
UV(R).....	Ultraviolet (Radiation)

INTRODUCTION

Dermatological pathologies affect more than 85 million Americans yearly and represent a financial burden comparable with or exceeding other diseases of significant public health concern.^{9,32} Many of these conditions affect people over 65 years of age at a higher rate, often due to accumulated ultraviolet (UV) radiation and a declining immune system. Of those affected, elderly patients also present with significantly more diagnoses than younger individuals (2.2 vs. 1.6 per person). With this obvious increased dermatological disease burden in the elderly, extra attention needs to be paid to the skin of the geriatric patient.

Americans 65+ are currently the fastest-growing cohort, yet no previous research has been done to evaluate the behavior of this group concerning their dermatological health.⁴⁵ This population is believed to perceive elevated barriers to care, specifically in dermatology.⁴⁴ For these, and other reasons, geriatric patients tend to defer care for their dermatological diseases, unnecessarily increasing morbidity of these diseases in the geriatric population. Therefore, the dermatological healthcare needs of the geriatric population must be assessed to improve access to care.

SKIN

As an organ, the skin's primary function is as a barrier separating the outside world from our internal environment. The normal structure of the skin is composed of two functionally distinct layers, the outer epidermis, and the deeper dermis. The epidermis is in direct contact with the outside world. It is avascular and lacks innervation

but does have several features to deter environmental assaults and to contain our internal media. The epidermis is described histologically as a keratinizing epithelium; it is formed and maintained by continual replication and subsequent terminal differentiation of basal keratinocytes. Apoptosis of these cells occurs as they are pushed apically by this proliferative growth. Strong desmosomal connections between keratinocytes contribute to the skin's mechanical integrity and keep cells connected even after death. Specialized intracellular lipids and proteins, collectively known as the cornified cellular envelope (CE), are released upon cellular death, coating the layers of dead keratinocytes (stratum corneum, SC) and conferring water-impermeability to the skin..^{40,52} The dermis is less cellular, exhibits more fibers, usually as collagen bundles, and is innervated and vascularized.

Because of its location, the skin is constantly exposed to both, intrinsic (e.g. reactive oxygen species, ROS, free radicals) and extrinsic factors. Ultraviolet (UV) radiation is among these extrinsic factors and is the leading cause of skin cancer.⁴

Symptoms of many systemic diseases are observable in the skin because of its location at our exterior.⁴⁶ An example of this is a visible yellowing of the skin, known as jaundice; this occurs due to excess levels of circulating bilirubin, a byproduct of erythrocyte metabolism, and is an indicator of several pathologies. Many systemic diseases have characteristic cutaneous symptoms like this and should be monitored for in the geriatric population. Understanding this connection between the skin and systemic health helps comprehend the importance of regular skin exams to the overall health of the geriatric patient.

AMERICA'S AGING POPULATION

America's aging population is a topic consistently at the forefront of modern healthcare debate. The number of Americans aged 65 years or older is expected to more than double the 2016 census' reported population of 46 million to 98 million people by the year 2060, representing a percent population change from 15% to 24%.⁹ This population shift on the horizon is of increased importance to the dermatological field because of the large proportion of their patients that this population represents.

Trichotomization of the geriatric population by age (65-74, 75-85, 85+) is a trend that was noticed throughout the literature and will be carried over into this study. This division helps conceptualize the burden of disease in the elderly.

UNDERREPRESENTATION

The elderly are also substantially underrepresented in public health monitoring surveys due to participant nonresponse.¹⁴ Those that do reply are believed to exhibit high rates of baseline bias, failing to provide a complete medical history, and this is also believed to increase with age. Past studies have found higher rates of nonresponse in elderly patients with poor lifestyle choices and overall poorer health; it is, therefore, likely that this population is largely underrepresented.^{6,25}

MECHANISM OF AGING

The skin's process of aging represents a composite of two entities in itself, intrinsic and extrinsic aging.⁴ Intrinsic aging is thought of as "natural" aging because it is

the same process experienced by other cells in our body.³⁵ Extrinsic aging is a result of the skin's interaction with the external environment; it is associated so strongly with UV-exposure that it is often referred to in the literature and more so in the popular media simply as "photoaging."⁵² Smoking and environmental pollution are two more recently discovered extrinsic factors of skin aging but represent such a minimal part in the process, especially compared to UV-exposure, that they are rarely considered.^{4,8} Results of intrinsic aging alone usually do not appear before 70 years of age, so visible aging can almost entirely be attributed to extrinsic aging.⁴

CONTRIBUTING FACTORS

Chronic UV exposure due to sunlight is the major contributing factor to premature skin aging.³⁰ When this radiation energy enters this skin it can react with DNA or other endogenous photosensitizer molecules. UV photons are directly absorbed by DNA, causing structural changes and eventually mutations if not repaired by intracellular mechanisms. Other photosensitizer chromophores in the skin can absorb these photons and spare DNA damage.²³ These molecules are excited in the process and subsequently react with O₂ to produce reactive oxygen species. These ROS destroy interstitial collagen and also regulate enzyme levels that further contribute to matrix degradation of the skin.³⁰

Atherosclerosis, diabetes mellitus, human immunodeficiency virus (HIV), and congestive heart failure are systemic diseases associated with an increased risk in dermatological disease development.^{41,43} Their contribution to the development of skin diseases is secondary to their effects on reducing blood flow or immune function.⁴¹ These

diseases are all also more prevalent in the elderly population and so, accordingly, they are contributing factors to the age-dependency of skin disease.

Increased use of pharmaceuticals also contributes to the higher prevalence of dermatological diseases seen in the geriatric population. Medications used to treat hypertension (HTN) and cardiovascular disease (CVD) are specifically notorious for causing pruritis and xerosis in the geriatric population.³³ A more general problem is the increased incidence of drug hypersensitivity reactions, adverse drug reactions that range in severity from mild to severe. Symptoms of these reactions are rashes, anaphylaxis, and serum sickness. Significantly increased polypharmacy in this population also makes it difficult to determine which drug or combination of drugs is the causative agent.

Additionally, the lack of effective alternative therapies may hinder changing medication.

HISTOLOGICAL CHANGES

Cross-sectional skin samples from elderly patients are easily distinguishable from those of young patients; samples from elderly patients exhibit visible thinning of both the epidermis and dermis, decrease in basement membrane lipids, and reduced vascularity.²⁴ The thickness of the stratum corneum (SC) is largely maintained throughout life, but the integrity of its barrier function does decline with age.^{16,54} Rete pegs, epithelial extensions that project into the underlying connective tissue, may also be reduced, a process that is believed to be the primary factor in epidermal thinning. Surface lipids decrease with age, thinning the stratum corneum's lipid film.^{5,53}

CLINICAL MANIFESTATIONS

These histological changes are a more recent discovery, and extensive research is necessary for a complete understanding of their development, but the clinical manifestations of these changes have been extensively documented. Regular complaints of the elderly patient are "dry skin," "itching," "wrinkling," "dyspigmentation," "easy bruising," increased susceptibility to insult and reduced healing function.^{3,4} Pruritus, when not secondary to xerosis or cutaneous insult, is often the result of an inappropriate peripheral nervous system response to histamine in the elderly patient.⁵⁷ The increase seen in other complaints is usually attributable to the processes of aging previously described.

Dermatological diagnoses exhibiting increased morbidity in the elderly include psoriasis, alopecia areata, urticaria, fungal infections, decubitus ulcers, skin cancer, and precancerous lesions (actinic keratoses and lentigo maligna).²² These diseases affect patients daily quality of life and can be deadly.

Effects of extrinsic and intrinsic aging are easily studied separately by comparing areas of skin protected from the sun with those usually exposed, such as the face or dorsum of the hand. Photoaged skin is characterized by wrinkles, laxity, increased fragility, easy blistering, a leathery appearance, and decreased wound healing function.³⁰ Intrinsically aged skin is also lax but maintains a smooth texture.

Hair and nail changes also occur with age and are particularly detrimental to patients' psychological wellbeing. Hair loses its pigment, graying with age, as melanin production decrease in the hair follicle.²⁸ Hair also becomes thinner and more diffuse as individual strands become narrower and follicles spend proportionally more time in the

resting phase, telogen. Nails usually become thin and brittle but may thicken in response to repeated trauma. Brittle nails are easily broken and thickened nails are at increased risk of becoming ingrown.² Dystrophic nails are at an increased risk of developing fungal infections like onychomycosis, further complicating care for the geriatric patient's nails. These hair and nail changes are another reminder of patients' age and cause considerable anxiety in those affected.

COSMETIC TREATMENTS

Our society reacts differently to dermatological disorders than to other systemic diseases. Whereas the latter receives understanding sympathy, dermatological conditions often provoke aversive behaviors that lead to feelings of stigmatization in the affected.^{18,37} Aging results in a change of physical appearance which sometimes also leads to aversive reactions

America is a youth-centric society; being young is an ideal and deterring from this causes many people distress. "The Social Skin" is a recent concept proposed by social biologists to help make sense of the differential psychological behavior exhibited by individuals in response to aging. This idea attempts to think of the skin in light of its function in emotional expression and is contrasted with an older idea, "The Biologic Skin."²⁹ Through aging the person staring back in the mirror is transfigured and thereby our psyche is also altered, resulting in distress. This concept will not be discussed further, but its investigation is recommended to those having trouble understanding these psychological effects of aging.

With age, the skin declines in appearance and texture and may cause psychological discomfort in people as a constant reminder of the burden of age. Cosmetic treatments to correct for these changes may alleviate this psychological distress and boost self-esteem.²⁹ The number of cosmetic treatments performed annually has increased in recent years; people like these procedures and the effects they achieve.³⁹ More individuals may be interested in these cosmetic procedures yet they defer treatment due to societal implications. Mood disorders, elevated in the geriatric population, may even be improved by the psychological effect of these treatments. The behavior of the geriatric population regarding cosmetic procedures at the dermatologist office is a topic with no published data, so exploratory research is recommended; societal misconceptions should be addressed if the population at large would benefit.

SKIN CANCER

Skin cancer is the most common malignancy in the United States, affecting more than 3 million Americans yearly.^{20,47} The two most common types of skin cancer are melanoma and non-melanoma skin cancer (NMSC). Melanoma is a malignancy originating in melanocytes of the epidermis. NMSC originates in keratinocytes of the epidermis and comprises two subcategories, basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). These diseases increase in burden throughout the human lifespan, most substantial in those over 75 years of age.¹³ Avoidable UV-radiation is responsible for most skin cancers, directly causing over 90%.¹⁷ Not considering wounds, burns, or cutaneous infection, skin cancer is responsible for almost all skin disease-related deaths,

of which about two-thirds are due to melanoma.³² These malignancies are the frequent targets of public policy in dermatology due to their highly preventable nature.^{21,50}

Several factors have been shown to affect skin cancer prognosis. Interestingly, patients with an established dermatologist have been shown to present with shallower melanomas at time of diagnosis compared with individuals without one.³⁶ This benefit persists despite length since last dermatologist visit, so educational information attained at the patient's first office visit is thought to mediate these differences. With a significant increase in self-diagnostic ability after one office visit, one can only imagine the improvements more substantial preventative care measures in dermatology could make for the geriatric population.

BARRIERS TO CARE

Health insurance source, age, gender, race/ethnicity, and geographic location are all factors that have been shown to correlate with recent dermatologist office visits.³⁸ Dermatological conditions are usually easily diagnosable with minimal invasion, yet the elderly are historically reluctant to consult a medical provider for diagnosis and treatment. Previous studies have found elevated perceived barriers to care in the geriatric population, such as "doctor not responsive to concern" and "fear of discovering serious illness".¹¹ These modifying factors have not been explicitly evaluated in the dermatologic field but may help explain some of this reluctance and the resulting deferral of care.¹¹

Accessibility of dermatological care has emerged as a recent epidemic, mainly due to a simultaneous workforce shortage and an increase in patient load.²⁷ This problem

is seen universally but is significantly more severe in areas exhibiting lower dermatologist density.⁵⁸ This recently increased patient load is primarily due to the growing elderly population, and the recent expansion of healthcare to an additional 16 million people via the Affordable Care Act (ACA).⁴³ Increased demand due to healthcare expansion is transitory and will resolve, but the unproportionate dermatological workforce growth compared to the demand that is posed by the aging American population has no foreseeable resolution and represents a real barrier to care. The outcome of this is generally increased wait times for dermatology appointments.³⁴ This barrier is substantial; reduced density of dermatologists has been shown to affect the outcome of melanoma prognoses negatively.¹⁰

This influx of patients during a dermatological care deficit presents several problems for the reasons described above. The dermatologic healthcare needs of the geriatric population have not been sufficiently assessed, making it difficult to plan for the increased load that this population transition will place on the dermatological workforce. Several options exist to help fortify the field of geriatric dermatology, but further research is needed to decide which is of most potential benefit. Telemedicine is one of these options but not enough is known about technological savviness of the geriatric population to determine whether they could operate the rather involved equipment specific to the dermatologic niche.²⁶ Assessment of these abilities will provide the medical community with information to improve quality of care to this generation and reduce the age-related dermatological health care disparity.

TELEDERMATOLOGY

Telemedicine has emerged as a likely candidate to help reduce dermatological health care disparity. A recent study on teledermatology shows promise in improving access to and price of dermatologic care but emphasizes that this is not always the case.³¹ In comparing the relative success of several teledermatology programs, effective preselection, high-quality images, use of dermatoscopy for pigmented lesions, and having adequate infrastructure and culture in place were factors associated with a successful outcome of teledermatology programs. The absence of any of these factors drastically lowers success. Teledermatology applications have been proven to increase the diagnostic ability for PCPs and thus show great promise in extending care, especially to areas of decreased dermatologist density.^{26,31,49,56}

PRESENT STUDY

Today's aging population necessitates research on the dermatological healthcare needs of the geriatric population. The elderly is believed to face several additional or exacerbated barriers to dermatological health care and often choose to defer treatment in response, unnecessarily increasing morbidity and mortality of dermatological diseases. This study will attempt to assess the dermatologic healthcare behavior of the population over 65 years of age to determine what needs to be done by the dermatological community to help close the current gap in dermatological care.

Specific Aims

In a time of rapidly changing logistics within the medical field, it is important that we consider the needs of all people in order to be able to improve healthcare for all. Little research has been done in inquiry of the dermatological needs of the geriatric population (65+). In order to allow these needs to be accounted for, we will:

1. Identify chief dermatological complaints and previous diagnoses of this group.
2. Identify any barriers to care for this group of people, whether physical or psychological.
3. Identify respondents' location and provider preferences for dermatological care.
4. Use gathered information to update guidelines used in dermatological healthcare of this group if warranted.

METHODS

This study utilized a 15-question survey (Appendix I) as its sole source of data. An online survey platform, SurveyMonkey®, was used to gather completed questionnaire data. The study sample was chosen randomly from the SurveyMonkey® user database. Parameters for inclusion were: United States resident aged 65 years or older. Age balancing was controlled to be representative of USA census data.^{9,42}

In anticipation of data analysis, the sample size needed for sufficient confidence was calculated. The minimum sample size needed was calculated to be 385 people with the equation in Figure 1, using the population size (N) of the USA (327 million), confidence level (Z) of 95%, and margin of error (e) of 5% (Fig. 1).⁴⁸ Actual sample size (611) was determined with the study budget as the limiting factor, to allow for the smallest margin of error and to allow for incomplete responses if necessary.

Figure 1. Sample Size Determination

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N} \right)}$$



N = population size • e = Margin of error (percentage in decimal form) • z = z-score

PROCEDURE

The survey used in this study was created and optimized through a series of steps. An initial literature review of the topic of interest, the dermatologic healthcare behaviors of the population over 65 years old, was performed to determine what information was missing. Searching the popular media helped shed light on which of these topics was currently of most relevance and a proceeding group meeting helped arrive at an initial survey. Two separate and sequential beta tests of 50 respondents each were performed using the SurveyMonkey® platform to assess the usability of the survey and identify any missing popular answers to survey questions. This study values increased reliance on recognition (as opposed to recall) in an attempt to reduce recall bias and streamline analysis.^{7,19} The survey was edited after each beta test to increase comprehension and usability.

This study posed minimal risk to participants and was approved with exempt status by the Boston University Institutional Review Board. Participants of the study self-administered the survey using the SurveyMonkey® online platform. The “Research Information Sheet” (fig.2) was used as a header for the survey, visible throughout the completion, to obtain informal informed consent necessary for exempt research and to inform participants to this risk as well as other aspects of the study deemed essential or beneficial to the participants.

Figure 2. Research Information Sheet

BOSTON MEDICAL CENTER AND THE BOSTON UNIVERSITY SCHOOLS OF MEDICINE, PUBLIC HEALTH AND DENTAL MEDICINE	 EXCEPTIONAL CARE. WITHOUT EXCEPTION.	
RESEARCH INFORMATION SHEET		
<p>You are being asked to voluntarily participate in a research study. We are doing this study to investigate the dermatological health care needs of certain patients in order to improve care in this field. If you agree, we will ask you some questions on this topic as well as your general health care and demographic information. We will not record your name or any information that shows your identity. You will not be signing this form. The only personal identifier we will be recording is participants' zip codes. We will store your information in ways we think are secure. We will store paper files in locked filing cabinets. We will store electronic files in computer systems with password protection and encryption. However, we cannot guarantee complete confidentiality. Compensation will not be provided by our institution but may be provided by the platform you are completing the survey on.</p>		
<p>If you have any questions, please contact the research contact, Ryan Shaw, at rythshaw@bu.edu.</p>		

THE SURVEY

Basic demographic information questions were the first to be formulated; this information included age, gender, geographic location, and dermatologic health history. Behavioral evaluation questions were next; of interest was how respondents find healthcare providers, how they get to medical appointments, their primary source of dermatologic information, where they do or would get care for their skin conditions, and any concerns they have concerning their dermatologic health.

Level of reliance this population has on online reviews in deciding on which healthcare provider to choose emerged early in group discussion as a relevant topic and was included as a question. What barriers to dermatologic care this population faces also came up in discussion and was included.

Recent literature has revealed a trend of better melanoma prognoses in patients with an established dermatologist, and so inquiry of whether the respondent has an established dermatologist was included to assess the impact of these recent findings.^{10,36}

As previously discussed, teledermatology represents a possible answer to improving access to care, but dermatoscopic usability by the geriatric population is unknown. Telemedicine usage ability is simply polled (yes/no) in the survey, as more detailed questions are likely to be misunderstood by the population being studied.

DATA ANALYSIS

Participant demographic information (age, income, gender, and location) and response data collected in the survey will first be coded. The sample population will be trichotomized by age (65-74, 75-64,85+ years old) to allow identification of age-related trends. Two multivariate analyses will be completed, one investigating participant reported teledermatology usability ability by age, gender, household income, region, and perceived barriers to care and another investigating participant complaint of cosmetic concerns by age, gender, income, region, and if their last dermatologist office visit was for cosmetic reasons. Skin cancer prevalence, as well as concern for its development, will be evaluated with two additional multivariate analyses to assess correlation either has with gender, household income, and geographic location.

With sourcing information on the dermatological health care behavior of the population over 65 years old as the primary goal of this study, a portion of the questions

included are simply investigative. Actual results of these questions will be presented to allow for a complete discussion of this population's behaviors and needs.

RESULTS

The survey was completed by 611 respondents. Two data sets were omitted because they did not meet the age parameter (65+); these individuals are believed to have had false age data in their SurveyMonkey® profiles or to be using another person's account. Survey abandonment rate was 20%, and the average completion time was 3 minutes, 56 seconds. The response rate was higher for females as compared to males, but it is only significant for individuals 65-74 years of age (fig.3).

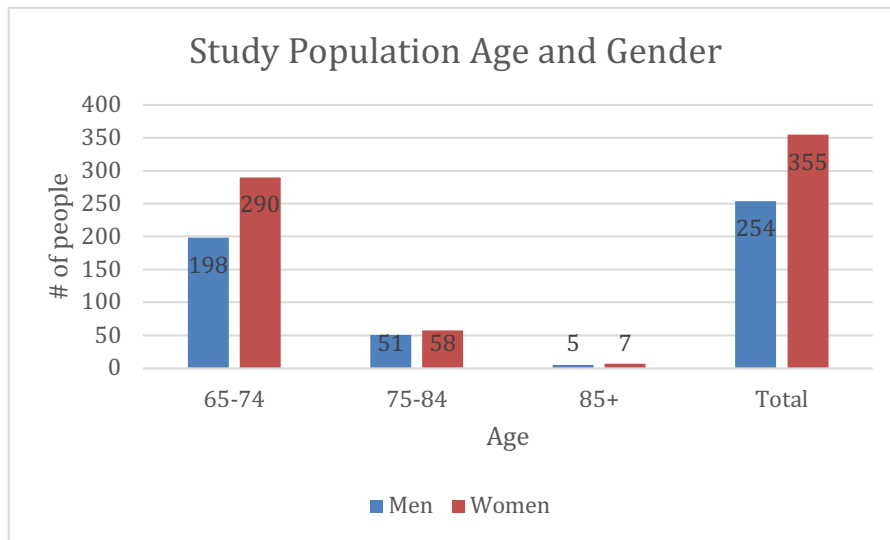


Figure 3: Sample Population Age and Gender

The final sample of 609 was analyzed as described above. In cases where multiple answers were written in for questions asking for the choice most relevant to the respondent, the first answer written was accepted as the complete answer. If, however, a consensus on primary answer could not be definitely made, answer choice of “other” was retained.

TELEMEDICINE

Perceived barriers to care displayed a significant relationship with reported telemedicine usability (linear regression, $p=0.01$, $R^2=0.0267$). People who reported non-usability of telemedicine were more likely to report barriers to dermatological care (36.5%) than people who reported usability (26%). Other factors assessed (age, gender, household income, geographic region) did not display a significant relationship with telemedicine usability.

COSMETIC CONCERN

Linear regression revealed a significant relationship between respondents' gender and concern with "Cosmetic/aging" ($p<0.0001$, $R^2=0.0582$), with significantly more women (70.6%) than men reporting these concerns. Other factors assessed (age, household income, and if their last dermatologist visit was for cosmetic reasons) did not display a significant relationship with concern for "cosmetic/aging."

SKIN CANCER

Concern for developing skin cancer was found to be significantly associated with gender ($p=0.05$, $R^2=0.0202$), with males exhibiting more concern than females (48.9% vs. 31.6%). The other factors assessed (age, geographic area, and household income) did not display a significant relationship with concern for developing skin cancer.

Males in the sample had a significantly higher frequency of being previously diagnosed with skin cancer or related diagnosis than females (linear regression, $p<0.005$, $R^2=0.0315$). Of those studied, 39% of males and 28.9% of females reported a history of

such diagnoses. The other factors assessed (age, geographic location, and household income) did not display a relationship with a history of skin cancer or related diagnosis.

RESPONSE DATA

Of those who responded, 313 (51%) had an established dermatologist, and 296 (49%) did not. No previous data on a population-wide frequency of geriatric patients with an established dermatologist could be found in the literature, but interestingly this statistic is almost the same as the frequency (50.5%) of patients with an established dermatologist reported in a recent study of patients presenting with melanomas in clinic.³⁶

More than half (353; 58%) of respondents reported asking their PCP for a referral when choosing a healthcare provider. Minority answers were asking family or friends (95; 16%), other (60; 9.9%), searching the internet (54; 8.9%), and health insurance website (47; 7.7%).

Most (529) reported driving themselves to medical appointments (fig.4). Other reported methods were riding with friends/family (32), walking or biking (15), non-emergency medical transportation (NEMT, 12), and public transportation (8). 13 people responded “other”, of which the majority were a combination of several above methods; “ride share” and “car service” are two responses worth noting but with only one respondent each.

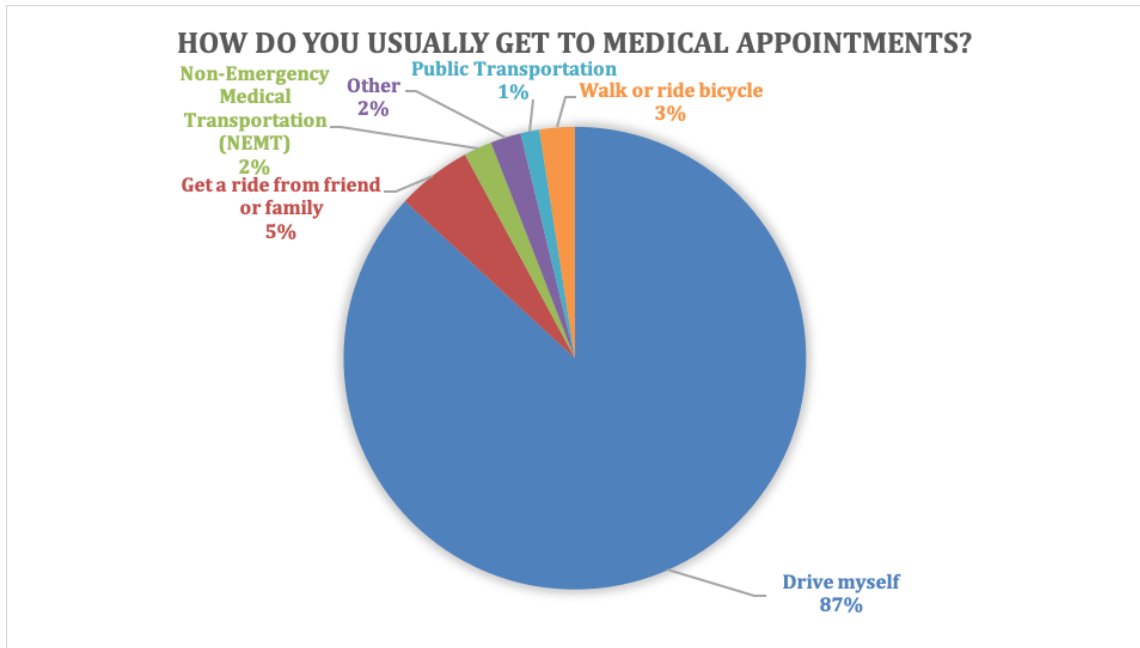


Figure 4: Response data to question 2.

When asked about barriers to dermatological care they face, 405 respondents (67%) reported facing no such barriers (Fig. 5). The most significant barrier was out of pocket expenses, reported by 66 people (10.8%). This was followed by 42 people (6.9%) whom reported deterring care because the issue did not seem serious to them. “Other” was selected by 34 people (5.6%), most of whom seem to have been confused by the question because a nonsensical answer was written in. Long wait time to get an appointment was the next most popular response with 24 people (4%). Twenty-one people (3.4%) reported deferring care due to a previous experience in which their complaint was not taken seriously. Minority answers were “fear of unnecessary tests or treatments” (7 people), “transportation problems” (4 people), “Don’t want to take time

off work” (3 people), “Fear of discovering a serious illness” (2 people), and “Unsafe neighborhood where I live or get medical care” (1 person).

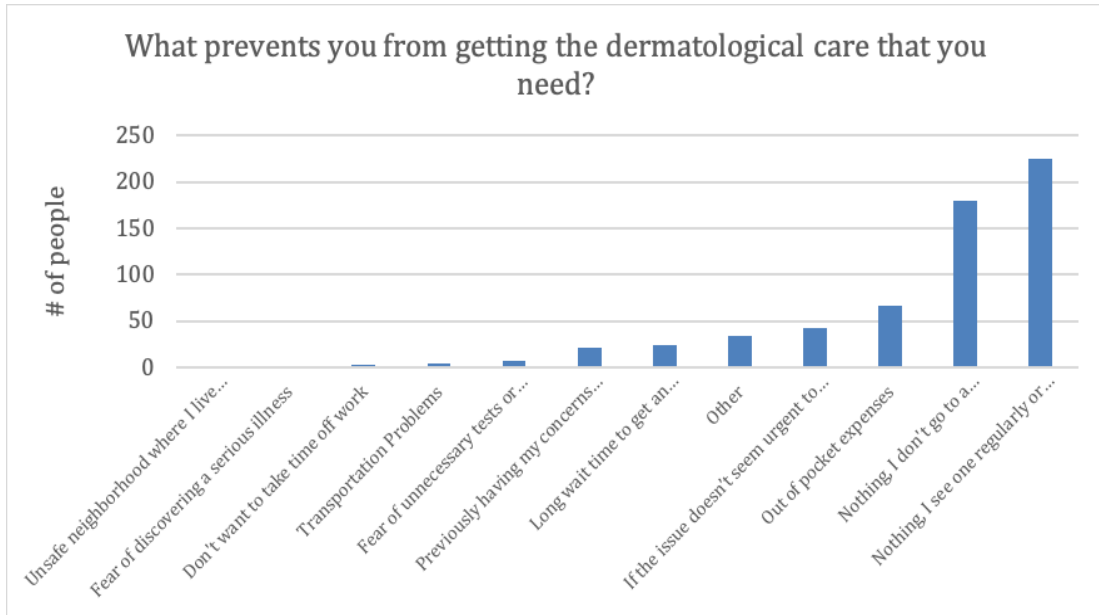


Figure 5: Response data to question 3.

Dermatologists were the most relied on source for medical information on dermatological conditions, with 270 people (44%) citing them as their primary source (Fig. 6). PCPs were the next, used by 216 people (36%). The internet provided this information for 75 respondents (12%). Minority answers were “Other” (45 people; 4%), “Ask Family/Friends” (25 people; 3%), and “Pharmacist” (4 people; 1%).

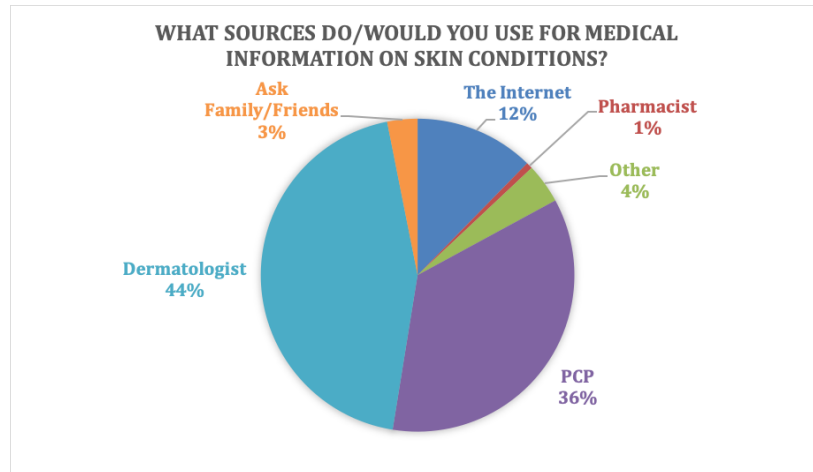


Figure 6: Response data to question 4.

Reason for the last dermatologist office visit for 191 respondents (31.4%) was for a routine skin check (Fig.7). “Suspicious/changing lesion” was the reason for last dermatologist visit for 121 respondents (19.9%). “Other” was the reason for 53 people (8.7%). “Rash” was the reason for 34 people (5.6%). Minority answers were “Cosmetic reasons” (13 people; 2.1%), “Psoriasis” (12 people; 2%), “Hair disorders” (9 people; 1.5%), and “Nail disorders” (4 people; 0.7%). One hundred seventy-one people had never been to a dermatologist.

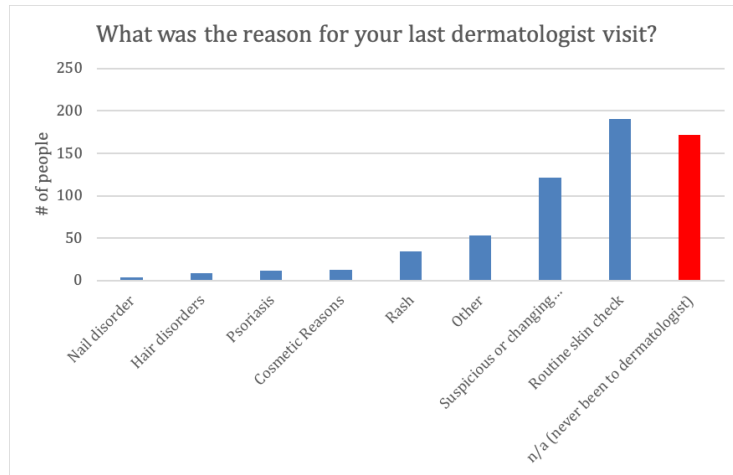


Figure 7: Response data to question 6.

Most respondents were averse to telemedicine (Fig. 8); 389 respondents (63.9%) reported non-usability, of which 371 indicated that they would prefer to go to the doctor and 18 indicated they would not be able to use the technology. People willing to use telemedicine numbered 221 (36.2%).

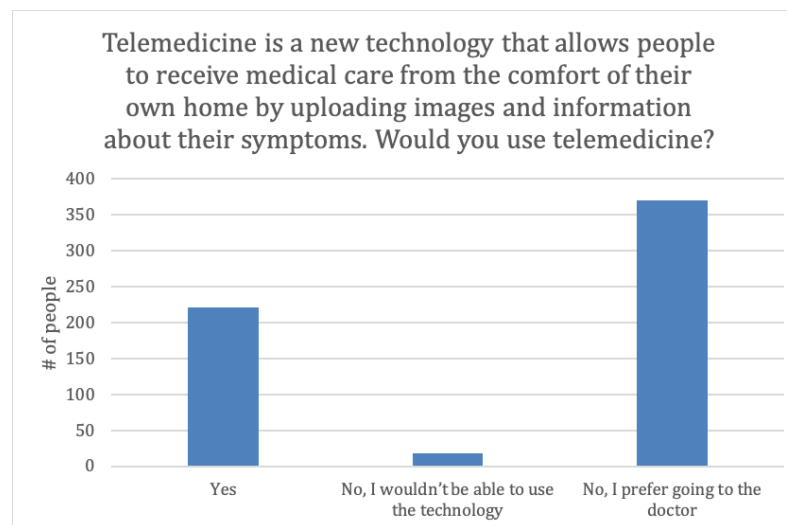


Figure 8: Response data to question 9.

Of the sample chosen, 391 people (64.2%) reported having been previously diagnosed with a dermatological condition. Table 1 summarizes response data and shows the prevalence of each diagnosis. Basal cell carcinoma (BCC) was the most prevalent with 107 people (17.6%) reporting a previous diagnosis. Two hundred eighteen people reported no history of dermatological diagnosis.

Table 1: Dermatological disease history

Disease previously diagnosed with	# people	Prevalence (n=609)
BCC	107	0.175697865
Seborrheic Keratoses	78	0.128078818
Eczema	75	0.123152709
Rosacea	54	0.088669951
SCC	52	0.085385878
Other (specify)	49	0.08045977
Acne	43	0.070607553
Onychomycosis	35	0.057471264
Herpes Zoster	33	0.054187192
Melanoma	34	0.055829228
Skin cancer but unsure which type	32	0.052545156
Pruritus	29	0.047619048
Psoriasis	28	0.045977011
HSV	26	0.042692939
Tinea Pedis	23	0.037766831
Actinic Keratoses	21	0.034482759
Alopecia	19	0.031198686
Ulcer	5	0.008210181
Vitiligo	2	0.003284072
Candidiasis	1	0.001642036
Pemphigus	0	0

Table 2 summarizes response data concerning respondents' dermatological health concerns. A majority of respondents (547 people; 90%) had concerns with their

dermatological health. Most concerned about were "aging/cosmetic" and "developing skin cancer," reported by 297 (48.8%) and 219 (36%) people, respectively.

Table 2: Dermatological concerns of sample

Dermatologic concerns	# people	Prevalence (n=609)
Aging/Cosmetic	297	0.487684729
Developing Skin Cancer	219	0.359605911
Pruritus/itching	139	0.228243021
Hair Loss	134	0.220032841
Suspicious/changing mole	129	0.21182266
Skin Discoloration	62	0.10180624
Viral infection	39	0.064039409
Other (specify)	31	0.05090312
None	31	0.05090312

Respondents' preferred location for dermatological treatment is summarized in Fig. 9. Dermatologist offices are used by 313 respondents (51.4%). Of these people, 289 see a dermatologist in private practice and 24 in a hospital setting. PCP offices are used by 249 people (40.9%). Of the remaining sample, 35 people (5.7%) selected "Other"; 5 people (0.8%), "MedSpa"; 4 people (0.7%), "Telemedicine".

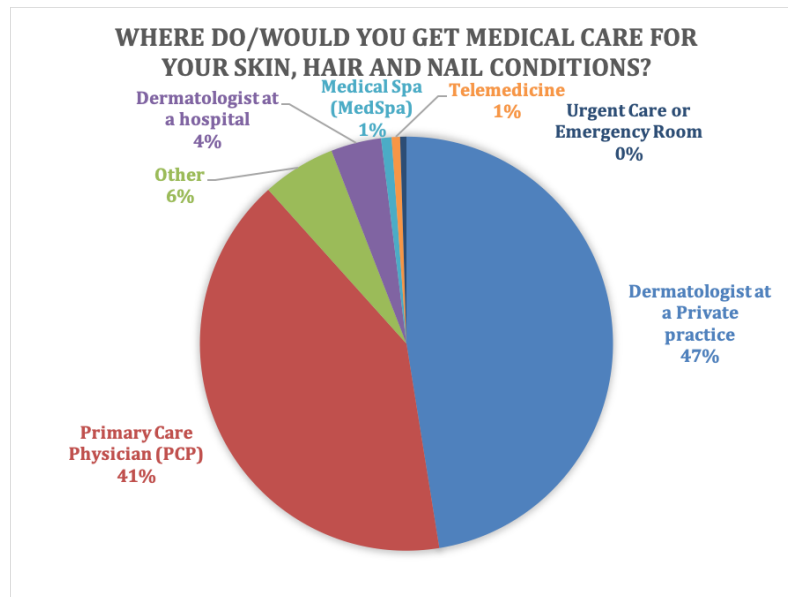


Figure 9: Response data to question 10.

Provider preference for dermatological care of the sample population is summarized in Fig. 10. Dermatologists were preferred by 419 people (68.8%), nurse practitioners by 25 people (4.1%), and physician assistants by 18 people (3%). The remaining 147 people (24.1%) had no preference for provider.

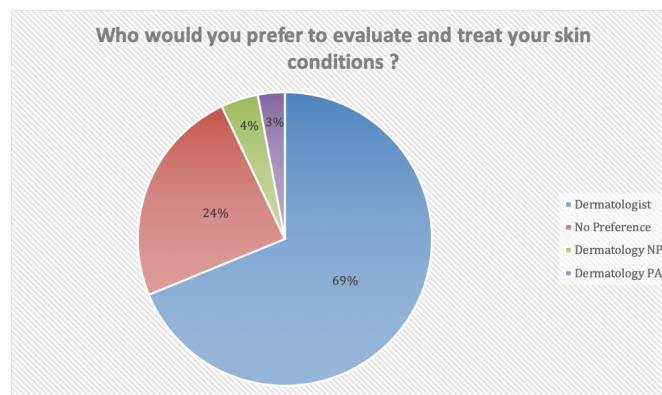


Figure 10: Response data for question 11

Response data regarding the training of respondents last dermatological care provider can be visualized in Fig. 11. Dermatologists (MD/DO) were the provider for 351 (74%) of respondents' previous dermatology visit; Physicians assistants, 42 (6.9%); Nurse practitioners, 31 (5.1%); Both a dermatologist and NP/PA, 20 (3.3%). One hundred sixty-five people (27.1%) did not remember the training of their last dermatology provider.

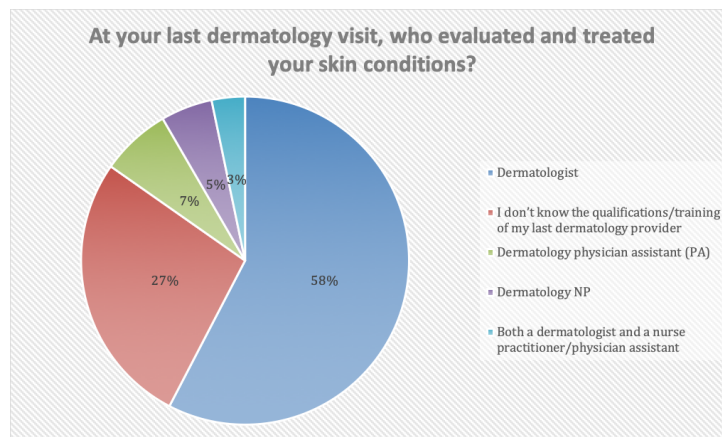


Figure 11: Response data for question 12

DISCUSSION

The purpose of this study was to evaluate the dermatological healthcare needs of the geriatric population. These needs are of significant interest because this population makes up a substantial portion of dermatological patients. These needs were evaluated by analyzing the behavior of this population towards dermatological health and assessing any discrepancies between the behaviors observed and what should be expected.

The data revealed an interesting relationship between telemedicine usability and self-reported barriers to dermatological care in which people reporting they would use telemedicine had a lower prevalence of barriers (26% vs. 36.5%). This is opposite to what was expected; it was theorized that people experiencing barriers to care would be more inclined to use telemedicine to increase access to care. In context, these results can likely be attributed to differences in psychological effect, with those possessing a more central locus of control displaying less perceived barriers and also willing to use new technology, and those with a more external locus of control experiencing more barriers and less likely to embrace new technology. The regression model used to predict telemedicine usability in the geriatric population displayed poor predictability ($R^2=0.0267$), likely because of confounding variables. Further research is needed to reveal stronger predictors.

The expected relationship between cosmetic concern and gender was verified by linear regression; significantly more females reported a concern with “cosmetic/aging.” Gender differences ingrained in American culture are likely responsible for this observed

relationship. This model displayed relatively poor predictability($R^2=0.0582$), accounting for only about 6% of the variance.

Gender was the only tested factor found to be significantly associated with either concern for developing skin cancer or a history of skin cancer or related diagnoses. Males in the sample population are more concerned about developing skin cancer than women (31.6% vs. 48.9%). Prevalence of these malignancies was also found to be higher in males than females (39% vs. 28.9%). Both of these models displayed poor predictability ($R^2<0.04$), most likely because many other factors are at play. Contemplation of these results reveals a possible cause and effect relationship in which men develop more malignant lesions and are therefore more concerned with their development.

Results on how our patients choose new medical providers was different from our expected result. The vast majority reported they would ask their PCP for a referral, with several minor categories trailing far behind. It was theorized that today's geriatric population is more technologically adept than previous generations, so increased reliance on the internet for this process was expected. Internet usage was reported by only 8.9% of respondents, however.

Response data on method of transportation used to get to medical appointments was also not as expected; the majority (87%) reported they drive themselves to appointments. This frequency was predicted to be around 60% based on data from a previous study that found the incidence of elderly patients who drove themselves to medical appointments to be just under 60%.¹² Results of this other study are a more reliable account of patients transportation methods because are based on patients actual

behaviors and not their perceptions of what “usually” happens. The statistic found in this study will be more indicative of the percentage of geriatric patients who can drive themselves to medical appointments if needed.

The infrequency of barriers to dermatological care reported by the sample can be considered an overall positive. Rates may, however, be significantly higher due to response bias (respondents may believe they don’t need to go to the dermatologist or that they see one frequently enough). One may even argue that the response “Nothing, I don’t go to a dermatologist” by an individual over 64 years old is a barrier in itself. Financial problems are the only barrier with previous data in the literature; previous studies have reported prevalence (11%) of this barrier almost identical to that seen in this study (10.8%).^{11,51} This correspondence helps prove the validity of this study and hints at a possible more general set of barriers to care shared by dermatology, primary care, and possibly other specialties. The new variables explored in this study help further elucidate barriers to dermatological care for the elderly.

That only 51% of respondents have an established dermatologist is unfortunate when considering the lack of this relationship is correlated with more invasive melanoma at the time of diagnosis.³⁶ It is unclear how the logistics of this relationship work exactly, but patient education is believed to be the main factor since “time since last dermatologist visit” was not found to be a significant modifying factor. This educational knowledge should be isolated and made available to more patients, perhaps incorporated into geriatric primary care practice.

Unsurprisingly, dermatologists were the most utilized source of information on skin conditions. This was expected due to the preference for dermatologists in the treatment of skin conditions seen in the general public.⁵⁵ The frequency of 36% that reported using their PCP for this information was surprisingly high, especially considering that many of these people will be subsequently referred to a dermatologist for evaluation; perhaps PCPs play a sort of “middle-man” triaging role in this process, helping elderly patients get set up with dermatology appointments. The internet was used by only 12% of the sample population for this information.

Of the respondents who have been to a dermatologist before, “routine skin check” and “suspicious or changing lesion” were the most common reasons for their previous visit. Interestingly, these are the two reasons most pressed by public policy for being evaluated by a dermatologist; preventative health movements in dermatology such as the AAD’s “the ABCDEs of Melanoma” urge people to routinely self-check for changing lesions and visit a dermatologist for evaluation if they do find one.¹ With disproportionately more skin lesions than the youth, the elderly may have increased distress caused by these dermatological preventative health measures. Future studies should assess this distress in proportion to benefit and new preventative health measures should be instituted if the population would benefit.

Self-reported usability of telemedicine was lower (36.2%) than expected (~64%). This discrepancy can be mostly attributed to a preference for in-office doctor visits of this population. These results hint at a current geriatric population with the technological proclivity to use telemedicine but unwilling to change their ways. That few respondents

wouldn't be able to use telemedicine helps maintain it as an option for improving access to care. This geriatric generation may not be open to embracing this new technology but they can be studied to prepare for future, more technologically adept generations.

Survey questions on the dermatological concerns and previous diagnoses of the study population provided dermatological demographic information on the sample. Between these two sets of data, a potential gap in care can be observed as seen in the difference between the number of concerns and diagnoses for the same issue (ex. Pruritus; 139 concerned, 29 diagnosed). Respondents were allowed to choose multiple answers for both of these questions, so the precedence of other answer choices cannot explain this discrepancy. Hair loss is another condition exhibiting this discrepancy. These conditions, as well as concerns about them, are usually treatable and so these geriatric patients should consult the dermatological workforce for counseling or treatment to live a more enjoyable life.

The number of people in the study population reporting a history of NMSC (BCC or SCC) was 135 (22.16%); epidemiological data from recent years estimates the lifetime prevalence of NMSC to be around 20% and on the rise.¹⁵ This correlation with national estimates helps further validate the study data.

Several questions collected data on preference of dermatological treatment location as well as provider. These preferences have recently emerged as popular topics in the literature, likely due to the influx and increased presence of physician extenders. Unsurprisingly dermatologists were preferred and were the last provider for most, but

they were not uncontented. PCPs were also preferred by a large percentage of people, further emphasizing their importance in dermatology.

A general shortcoming of this study is that it was done remotely via the internet. The population selected is possibly part of a smaller, more technologically advanced portion of the geriatric population and therefore not representative of the entire population. This method negates face to face contact and reduces respondent involvement. Respondents would likely have appreciated assistance with the technology used in this survey since technological savviness of today's geriatric population is generally not good; reliability of survey data would likely have significantly increased if this interpersonal interaction could have occurred. This was, however, not possible; several options of delivering surveys in person were explored but eventually abandoned due to lack of foreseen efficacy.

RECOMMENDATION: Establishment of an age-appropriate dermatological healthcare intervention for patients in a primary care setting.

Survey results indicate that relatively few geriatric patients experience real barriers to dermatological care; most people get care if they think it is needed. The main problem causing a perpetual discrepancy in dermatological health care of the geriatric population seems to be a belief that such care is not needed. This way of thinking is likely acquired over the human lifespan as the societal assessment of dermatological diseases as less serious than systemic diseases is continually reaffirmed.

Decreased depth of melanoma at diagnosis in patients having seen an established dermatologist proves the power that preventative health care measures can make in the dermatological field. Being focused on a superficial organ, dermatology stands to benefit largely from more preventative care measures. Informational materials from the dermatologist office with most significance should be selected and incorporated into PCP offices. At patients' first wellness checkup of their 4th decade (roughly 40 years old), these materials, as well as best skincare practices, should be focused on.

APPENDIX I
QUESTIONNAIRE

1. How do you usually find healthcare providers?

Ask friends or family for referral
Web search
Referral by my primary care provider (PCP)
Insurance website
Other (please specify)

****2. How do you usually get to medical appointments?***

I drive
I get a ride from a friend or family member
Public transportation
Walk/bike
Non-Emergency Medical Transportation (NEMT)
Other (please specify)

****3. What prevents you from getting the dermatological care that you need?***

Transportation problems
Out of pocket expenses
Previously having my concerns not addressed or deemed not serious by treating physician
If the issue doesn't seem urgent to you
Long wait time to get an appointment
Unsafe neighborhood where I live or where I get medical care
Fear of discovering a serious illness
Fear of unnecessary tests or treatments
Don't want to take time off work
Nothing, I see one regularly or when needed
Nothing, I don't go to a dermatologist
Other (please specify)

****4. What sources do/would you use for medical information on skin conditions?***

Ask family/friends
The internet
My primary care physician (PCP)
Dermatologist
Pharmacist
Other (please specify)

****5. Do you have an established dermatologist?***

No

Yes

***6. What was the reason for your last dermatologist visit?**

Suspicious or changing lesion/mole/spot
Routine skin check
Rash
Psoriasis
Bruising
Burn
Nail disorder
Hair disorder
Cosmetic reasons
n/a (never been to a dermatologist)
Other (please specify)

***7. Select any dermatological conditions that you have been previously diagnosed**

with? (Please select all)

Basal cell carcinoma
Squamous cell carcinoma
Melanoma
Skin Cancer, but unsure which type
Pruritus (itching)
Tinea Pedis (athletes' foot)
Candidiasis
Alopecia (hair loss)
Psoriasis
Eczema/Dermatitis
Herpes Zoster (Shingles)
Herpes Simplex (Cold sores)
Pemphigus
Seborrheic keratosis (age/liver spots)
Actinic keratosis
Vitiligo
Rosacea
onychomycosis (toenail fungus)
An ulcer
Acne
None
Other (please specify)

***8. What concerns you have about your skin, hair, and/or nails? (select all that apply)**

Aging/cosmetic
Itching

Developing skin cancer
Viral infections (ex- shingles)
Skin Discoloration
Hair loss
Suspicious or changing moles
Other (please specify)

***9. Telemedicine is a new technology that allows people to receive medical care from the comfort of their own home by uploading images and information about their symptoms. Would you use telemedicine?**

Yes
No, I prefer going to the doctor
No, I wouldn't be able to use the technology

***10. Where do/would you get medical care for your skin, hair and nail conditions?**

Medical Spa (MedSpa)
Urgent Care or Emergency Room
Primary Care Physician (PCP)
Dermatologist at a Private practice
Dermatologist at a hospital
Telemedicine (online medical appointment)
Other (please specify)

***11. Who would you prefer to evaluate and treat your skin conditions?**

Board certified dermatologist (Medical Doctor)
Dermatology nurse practitioner (NP)
Dermatology physician assistant (PA)
No preference

***12. At your last dermatology visit, who evaluated and treated your skin conditions?**

Board certified dermatologist (Medical Doctor)
Dermatology nurse practitioner (NP)
Dermatology physician assistant (PA)
Both a dermatologist and a nurse practitioner/physician assistant
I don't know the qualifications/training of my last dermatology provider

***13. What is your age and gender?**

Male aged 65-69
Male aged 70-74
Male aged 75-79
Male aged 80-84
Male aged 85 or older

Female aged 65-69
Female aged 70-74
Female aged 75-79
Female aged 80-84
Female aged 85 or older
Other (please specify)

**14. What is your zip code?*

**15. Are online reviews likely to affect your decision making when choosing a
healthcare provider?*

Yes
No

LIST OF JOURNAL ABBREVIATIONS

Adv Exp Med Biol	Advances in Experimental Medicine and Biology
Aesthetic Surg J	Aesthetic Surgery Journal
Am Community Surv Reports	American Community Survey Reports
Am J Prev Med	American Journal of Preventive Medicine
Am J Public Health	American Journal of Public Health
Ann Intern Med	Annals of Internal Medicine
Arch Clin Neuropsychol	Archives of Clinical Neuropsychology
Arch Dermatol	Archives of Dermatology
BMC Geriatr	BMC Geriatrics
Br J Dermatol	British Journal of Dermatology
Clin Dermatol	Clinics in Dermatology
Curr Popul reports	Current Population Reports
Dermatol Clin	Dermatologic Clinics
Dermatol Ther	Dermatologic Therapy
Eur J Epidemiol	European Journal of Epidemiology
Exp Gerontol	Experimental Gerontology
Exp Mol Med	Experimental & Molecular Medicine
Int J Dermatol	International Journal of Dermatology
J Am Acad Dermatol	Journal of the American Academy of Dermatology
J Clin Gerontol Geriatr	Journal of Clinical Gerontology and Geriatrics
J Dermatol	Journal of Dermatology
J Invest Dermatol	Journal of Investigative Dermatology
J Public Health (Bangkok)	Journal of Public Health
J Tissue Viability	Journal of Tissue Viability
Med Clin North Am	Medical Clinics of North America
MMWR Morb Mortal Wkly Rep	MMWR: Morbidity and Mortality Weekly Report
N Engl J Med	New England Journal of Medicine
Proc Natl Acad Sci U S A	Proceedings of the National Academy of Sciences of the United States of America
Ski Res Technol	Skin Research and Technology

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