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Nailing melanoma on the head: a community screening intervention in the black population

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Thesis

NAILING MELANOMA ON THE HEAD: A COMMUNITY SCREENING INTERVENTION IN THE BLACK POPULATION

by

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ABSTRACT

Acral Lentiginous Melanoma (ALM) is a rare diagnosis that typically appears in places people do not normally check, in the nail beds and on the palms and soles of the hands and feet. This subtype of melanoma is unique in that, unlike most melanomas, it does not arise from sun exposure and it mainly affects the black population. Most diagnoses of ALM are made in late stages, leading to a higher mortality. As evident from community-based surveys, there is a lack of awareness in the black population about melanoma and sun risks and most black individuals do not regularly visit a dermatologist. Thus, there is a need for a community intervention to raise awareness to this problem and to detect these cancers before they reach the late stages of disease progression. In the past, community interventions in the black community have focused on prostate cancer, hypertension, and breast health with good success using the barber shop model. In this study, we utilize the salon model to implement a melanoma training course that educate nail technicians to recognize signs of ALM and detect this cancer on their clients' nails and soles. We also complement this training with a tele-dermatology service so that customers can get timely follow-up from a medical provider. By using a community intervention, we can tackle multiple problems simultaneously; detection of early signs of ALM and improving dermatology access to patients on Medicaid.

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LIST OF ABBREVIATIONS

ABCDE ..... Asymmetry, Border, Color, Diameter, Evolving

ALM ..... Acral Lentiginous Melanoma

BP ..... Blood Pressure

CA ..... Cancer

CMM ..... Cutaneous Malignant Melanoma

HTN ..... Hypertension

NP ..... Nurse Practitioner

PA ..... Physician Assistant

PCP ..... Primary Care Provider

SLN ..... Sentinel Lymph Node

TBSE ..... Total Body Skin Exam

INTRODUCTION

Background

Acral Lentiginous Melanoma (ALM) is the fourth most common subtype of Cutaneous Malignant Melanoma (CMM) an most often presents itself in the black population. [1] Overall, the incidence of ALM is low with an average incidence rate of 2.0 per million person per year from 2006-2015 in the United States. However, this rate increases with advancing age, reaching as high as 14.5 per million person per year in males over 80. [1,2] The mean age for ALM is 62.8 years old and there has been no statistically significant age difference between males and females for ALM, although women typically present with earlier stage melanoma. [1]

The etiology of ALM is mostly unknown, however it has been suggested that the pathophysiology is trauma based. This supports the fact that ALM occurs predominantly on the palms, soles, and in the nail beds. Unlike CMM, Ultra Violet radiation exposure is not a risk factor for ALM and the protective benefits of additional melanin in black skin do not confer an advantage against this type of melanoma. [3]

The black population is highly susceptible to dying from ALM, although it is a rare cancer. After being diagnosed with ALM, blacks have the worst 5-year survival rate (66.9%) of all racial groups due to their presentation at advanced stages. [2] Huang et. al. found that most biopsy diagnosed black patients were elderly males presenting with sentinel lymph node positive advanced stage disease with a greater likelihood of having metastases at presentation when compared to the white population. [2] Social problems that

contribute to this higher mortality include misconceptions about skin cancer in blacks, insurance coverage, and lack of quality health education.

Statement of the Problem

Most melanoma subtypes affect populations with lighter skin, which has led community outreach programs to defocus on the black population. However, since acral lentiginous melanoma has such a high mortality rate, screening and educational interventions should target the black community to decrease the likelihood of advanced stage ALM diagnoses.

Historically, the black population has struggled with medical mistrust, stemming from the days of slavery. Events such as the Tuskegee Syphilis Trial have made the black population hesitant to seek medical care and, when they do, most would prefer to see a black doctor. [4] This is one of the first barriers to care that needs to be overcome. As of 2016, only 3% of dermatologists are black and that highlights the need for increased recruitment of minority racial groups in the dermatology field. [5] The dearth of black dermatologists makes it hard for a patient to find a provider that they are comfortable with if they are interested in seeing a dermatologist. A second barrier is that most black people do not believe that they are at risk for skin cancer. When a group of young black adults were surveyed, sun exposure concerns were formulated around beauty norms rather than skin cancer. [6] Most blacks also had low perceived risk of skin cancer and were more worried about other life threatening conditions, like diabetes. [3]

Hypothesis

There are many issues surrounding the medical management of ALM among the black patients. For this reason, a community-based intervention will improve melanoma screening for the black population. Such an intervention will use community trust to improve a lay person's knowledge of melanoma and reduce the likelihood of finding an advanced stage melanoma.

Objectives and specific aims

By engaging the black community in a screening program for melanoma, we hope to find a solution to several of the systemic issues that inhibit patients from receiving the dermatology care that they need. This solution will engage community members as lay health advisors to complement the expertise of medical professional. With the community as our vehicle, we will be able to build relationships of trust with our patients and provide them with an alternative gateway into medicine. Our specific aims include;

- Achieving better access to dermatology care for the black population
- Educating the community about Acral Lentiginous Melanoma
- Providing melanoma training to lay health advisors

REVIEW OF THE LITERATURE

Overview

Acral Lentiginous Melanoma (ALM) is like more common sub types of melanomas in that it can arise de novo in normal skin or develop from a pre-existing nevus. All subtypes of Cutaneous Malignant Melanoma (CMM) are diagnosed with biopsy and graded with Breslow thickness; a lesion may start in situ (confined to the epidermis) and later invade past the basement membrane entering the dermis. The higher the stage of the Breslow thickness, the more likely to metastasize and the worse prognosis. Treatment methods will differ depending on the extent of invasion. In situ melanomas are surgically excised using a wide excision with margins of 2-3 mm around the lesion, while invasive melanomas may also involve sentinel lymph node (SLN) biopsy or removal. As ALM can be focused on a digit, foot, or hand, amputation may also be part of the surgical plan. If the melanoma is metastatic, the patient will also be treated with immunotherapy, targeted therapy, or chemotherapy. After remission of the melanoma, the patient will be closely monitored with total body skin exams every three months for the next 2-3 years.

ALM is unique in the fact that it predominates on the palms, soles, and nails, areas that are not heavily sun exposed. Additionally, unlike other types of melanomas, ALM is not caused by UV based genetic mutations. Some suggest that the development of ALM is trauma based but the cause is still mostly unknown. Jung et al. found that ALM predominates in sites that may be associated with chronic injury, friction, pressure,

or trauma, such as the plantar locations. [7] Genetic mutations associated with acral melanomas include those in BRAF, NRAS, and KIT. [8]

ALM usually starts as an enlarging patch of discolored skin, most often on the palms, soles, and in the nail beds. This patch is commonly pigmented, however, can be erythematous in the amelanotic version of ALM. Following the ABCDE's of changing moles (Asymmetry, Border irregularity, Color variation, Diameter, Evolving), the melanoma characteristics include a large diameter size of over 6 mm, variable pigmentation and surface texture, and ulceration or bleeding. When it appears in the nail, it may appear as diffuse dark discoloration or pigmented bands that may destroy the nail all together. Warning signs include Hutchinson sign and nail dystrophy (Figure 1).

Images:

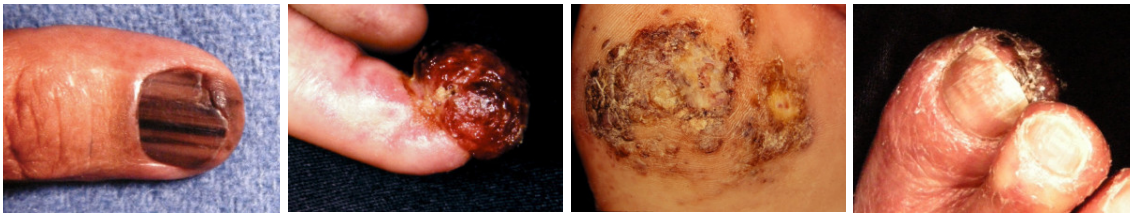


Figure 1: Images from left to right; A. Hutchinson sign of subungual melanoma, B. Nail dystrophy in subungual melanoma C. ALM on the heel of the foot. D. ALM of the R. hallux. All images retrieved from dermnetnz.org.

Because ALM appears in sites that are not often checked, such as the bottom of the feet, the black population suffers unproportionally as they are less prone to go to the dermatologist and get a Total Body Skin Exam (TBSE). Many obstacles affect their access to dermatology; black population is less likely to receive medical care compared

to their white counterparts due to social norms, lack of insurance, poor access, and absence of culturally competent care. [9] Implementing health services in community settings, such as a barbershop or salon, has been a proposed solution to this vast problem. Pilot studies using barbershops have found that barbers are willing and proactive lay health advisors. Nearly all (95.5%) barbers sampled in Chicago felt that they had influence on clients 18-29 years old and 58% of hair stylists in Houston reported recommending that a client see a health professional for an abnormal mole. [10,11] Furthermore, clients are receptive to this idea. The barbershop was rated as the most preferred locale for receiving health services after a doctor's office. [11] As studies have shown, the barbershop model has been proven to work effectively in cities around America.

Existing research

Interventions in the Black Community

Multiple research studies have shown the importance and effectiveness of community interventions in a variety of settings. One such study by Luque et. al.[12] trained barbers to educate about the importance of prostate cancer screening to black clients over the age of forty in Tampa, Florida. They decided to choose prostate cancer because the incidence is 58% higher and the mortality rate 2.4 times higher for a black men compared to white men. The barbershop was selected as the setting, as it is a place of community and trust and somewhere that clients usually frequent every 2 weeks to get a trim. This appointment frequency allowed for follow up education and retention

of information learned. In this pilot study, the barbers underwent 10 hours of training in a variety of didactic instruction, interactive group exercises, and team building provided with by a local urologist. The researchers also developed and adapted a culturally competent brochure with the help of barbershop clients who evaluated the pamphlet for images, color, format, and content. For example, the researchers added a clear anatomical diagram of the prostate gland in the brochure after 33% of clients reported that they did not know the function or location of the gland. Clients were also evaluated prior to seeing their barber with to assess their baseline knowledge of prostate cancer. When they sat in the barber chair, clients would be engaged in a health discussion about prostate cancer and receive a tailored brochure to take home with them. After completion of the study, a follow up questionnaire was given. The primary outcome variables measured were the likelihood of discussing prostate CA with a health care provider after receiving educational materials from their barber and the clients self-reported knowledge scores. Answers were rated on a 4-point Likert type scale ranging from "very unlikely" to "very likely." Most (78%) participants reported that the educational materials increased their knowledge of prostate CA. The intervention increased the willingness to discuss prostate cancer with a provider from 75% to 85% ($p = 0.001$). [12]

This study was a useful model, showing that training a barber to become a lay health advisor for prostate cancer increases participant willingness to discuss prostate CA with a health care provider. This was accomplished in as few as 10 contact hours of training, as well as an educational brochure: two reasonably cost-effective strategies. Limitations of this study include the size and demographics of the sample. Only 8 barbers

and 40 men took part in the study and there was a high rate of private insurance coverage among the men, which makes it easier to make an appointment with a doctor. Additionally, 43% of participants were already somewhat knowledgeable about prostate cancer, possibly making the intervention content less foreign as the material had been presented to them in the past. Finally, the study did not assess long term knowledge retention in their participants, however, since they usually visit the barbershop every 2 weeks, the content would have been reinforced during each visit.

Another study that utilized the twice a month haircut schedule assessed the effectiveness of barbershops for detection of hypertension (HTN), referral, and follow up for black men. [13] HTN is present in 40% of all black people and causes a disproportionate number of heart attacks, strokes, and end stage renal disease in this population. Hess et al.'s[13] study design focused on using black medical students and a black nurse practitioner (NP) to train barbers in Dallas, Texas on how to effectively take and record a blood pressure (BP) reading at each encounter with their clients. This intervention monitored a client's BP every two weeks and was complemented with a BP report card with which to give customers ongoing feedback on their BP readings. Barbers also presented role model stories, explaining successful risk reduction strategies clients could implement to lower their BP. This intervention was contrasted with a comparison group who received only an initial BP screening and got mailed a monthly brochure about hypertension from the American Heart Association for 8 months. Participants in the intervention arm of the study effectively lowered their BP 16/9 mmHg but there was no significant change in the blood pressures of the comparison group. Furthermore, clients

with elevated readings were encouraged to follow up with their primary care provider (PCP) or, if uninsured, the NP would refer them to a community provider. With this encouragement, the number of clients on HTN treatment increased from 47% to 92% and HTN control increased from 19% to 58% in the intervention group. Again, these values remained unchanged in the comparison group.

The study followed 346 hypertensive subjects for a period of 8 months and recorded 8953 blood pressure recordings. The fall in blood pressure seen in the intervention group was equivalent to that produced by the addition of 1-2 antihypertensives. While this fall in BP is significant, the study design may not be very generalizable. Firstly, the intervention was incentivized with discounted haircuts, which may have allowed them to gather more willing participants. If clients were not given 50% off, less people may have been inclined to join. Additionally, four BP readings were taken at each visit with each reading taking 1 minute to complete. This may add up to more than 4 minutes to a standard 10-minute haircut, if the barber does not have additional help, making the process cumbersome. Another limitation of this study is that it did not assess barbers' willingness to educate or screen their clients for HTN. We also were given no data on their knowledge of HTN prior to and after training. Barbers were also incentivized with $50 for each BP report card signed by a medical professional and $3 per BP reading. This may not be economically feasible for a long-term intervention.

The mentioned studies demonstrate two different effective interventions in the black community using the barbers as lay health advisors for prostate cancer and hypertension. The model has also been used with success in the black hair salon to

encourage predominately female customers to engage in breast health behaviors. [14] These studies show that there has been success using models that have targeted health crises, which are not visible to the naked eye. Focusing on skin cancer, something visible to the naked eye, hair stylists are already looking for skin cancers without formal training. Turrisi et. al. found that ¾ of hairstylists randomly surveyed at a white hair salon had ever noticed a suspect lesion on their client and that 100% of those stylists reported recommending having the lesion examined by a physician[15]. Therefore, most stylists are willing to educate their clients in multiple aspects of health literacy and offer screening methods to their clients in house. [16] However, no skin cancer interventions in black hair salons have been implemented to date.

Skin Cancer Community Interventions

Like the black population, Hispanics are also burdened disproportionally with a great number of nonmelanoma skin cancer and melanoma diagnoses, due mainly to misperceptions of skin cancer risk. Hernandez et al.[17] targeted this vulnerable population in west Chicago, a part of the city that is 82% Hispanic, with a video-based intervention to assess for improvements in skin cancer risk perception. Together with a team of a Spanish-speaking dermatologist and medical students, two 3-minute videos in Spanish were developed; one on the effects of UV light and photoaging effects and the other on skin cancer and risk factors. The photoaging video was created because, during an initial survey interview, none of the participants mentioned skin cancer, while 48 of 52 mentioned photoaging as a concern regarding their skin. The video intervention was

picked due to advantages of use in both clinical and non-clinical environments, distribution for viewing at another time, and the minimal burden videos have on practice resources. Hispanics (N=80) in 5 salons in the area were asked to take a pre-survey on skin cancer knowledge, watch both videos, and then take a post-assessment. Prior to the video, 54 out of 80 Hispanics believed that fair skinned Hispanics were at risk for skin cancer. This jumped to 72 out of 80 in the post intervention survey. Additionally, those who planned to use sunscreen rose from 56 pre-education to 76 afterwards. The study also assessed which video was more persuasive and found that 74 clients selected the skin cancer video.

This intervention is unique, as it took a hands-off approach and allowed a video to educate clients. There are pros and cons to this model; the pros include that the videos were in the Spanish language, making them culturally appropriate for the target population. They were also débuted to clients during their hair treatments and they were only 3 minutes long, so they did not require the client to wait any additional time. The pilot study was also conducted in the summer months, making the topic much more relevant and, perhaps, enforcing concepts further. Limitations to this study include the lack of measurement of behavioral change or long-term knowledge gain and the failure to achieve 100% understanding of skin CA risk post-intervention. The lack of full understanding may call for repetitive exposure or refinement of these videos for complete understanding. Finally, unlike other studies, this design did not incorporate the stylists at the salon who have been proven to be trusted advisors in the community. This may make the experience less personable and less relatable to clients. Including the stylists may

boost long term knowledge retention, especially if the educational video is only shown at the initial visit.

A different venue, in which skin cancer education has been delivered, is at a free dermatology clinic, which primarily served uninsured Hispanics (79% of patients).[18] While waiting for a TBSE, participants (n=24) were given a survey to assess their baseline knowledge of skin cancer and their demographics. Then patients were seen for a TBSE by the dermatologist. After their appointment, patients were educated for 15 minutes by medical students using handouts published by the American Academy of Dermatology. Finally, patients were assessed again on their new knowledge of skin cancer risks. The results showed that there were significant increases in knowledge, risk awareness, and confidence for self-screening post intervention. For example, pre-intervention, none of the adults reported knowing how to check their skin for cancer, while, post-intervention, all 24 participants answered "yes" to the question. The same finding was true with knowing the ABCDE's of melanoma; 1 person answered yes before the module and 23 after. However, these answers are limited to the fact that the participants were only given three answer choices of yes, no, or unsure, rather than using a Likert scale to assess level of agreement to the question.

This study is interesting in the fact that the patients were able to obtain a TBSE and skin cancer education at the same time. The combination of tactics makes the information given to participants even more relevant and justifiable. However, the downside of clinics is that they are usually a one-time opportunity; there is little chance for follow up and, in this study's case, there was no assessment of long-term knowledge

gain. This study suggested using medical student led free clinics to alleviate this problem; patients would be able to see a provider free of charge and, in turn, students could also receive more training. More research needs to be performed to determine if student led clinics would be a feasible option in the black population as well.

The last paper analyzed utilized massage therapists as lay health advisors for skin cancer. Massage therapists are unique in the fact that they get full visibility of a customer's skin, making them an ideal for the detection of suspicious skin lesions. When massage therapists (N=114) at a workshop were surveyed, 73% reported having received skin cancer education during their training and 94% felt that they had a professional need to tell a client if they saw a suspicious lesion.[19] Trotter et al. harnessed this willingness and trained massage therapists on detection of skin cancer with a four-hour training session that included a pre- and post-test. The tests included the same images of non-melanoma skin cancer, melanomas, and benign nevi. Participants were asked if the lesion in the image was suspicious for skin cancer and could reply with strongly disagree, disagree, neutral, agree, and strongly agree. Upon completion of the training, 87.7% of participants were correctly able to identify the ABCDE's of melanoma, an improvement from 34.2% pre training.[19] However, there was no improvement in the detection of suspicious lesions, suggesting that a 4-hour workshop may not be adequate to improve skin cancer detection.

This paper highlights the importance of using non-medical providers that are actively looking at the skin but emphasizes that this examination should not replace a skin check done by a board-certified dermatologist. Findings from this study can be used

to build a more effective training protocol for lay health advisors who can not only educate but also detect skin cancer. This training protocol will need to be inclusive of all skin types and have pictures of black skin as well.

In summary, these three papers improve our understanding of community interventions centered around improving skin cancer education. They highlight the importance of utilizing the power of non-medical providers who are in contact with patient's skin and to also connect culturally with the target audience when delivering education. However, there was not 100% understanding after training lay people and, thus, these patients still receive medical follow up. Assessment by a massage therapist, for instance, does not replace a TBSE from a dermatologist.

Training of Lay Health Advisors

All skin cancers need to be verified with biopsy because, even with extensive medical training, health care providers can misdiagnose. Unfortunately, the risk of misdiagnosing a skin cancer is even higher when assessing black skin. One of the reasons behind this is due to clinicians' training. In medical school there is a lack of textbook images showing skin cancer on black skin and also less exposure to black skin in clinic because of the limited amount of black patients who go to see a dermatologist. [20] Less experience means more misdiagnoses. Therefore, without extensive training, attempts to improve the accuracy of lay people's detection of melanoma has also been difficult to achieve. A study by Cornell et al.[21] explored the best method to improve lay people's identification of melanoma, whether it be using the ABCDE's of melanoma or image-based models for training. In a sample of 976 persons and 6 different study conditions,

they found that overall accuracy (a weighted combination of specificity and sensitivity) was greatest when they provided images of both biopsy proven benign and malignant conditions with a sample image to assess. This method did not contain any written ABC criteria; the condition with ABC criteria and melanoma images produced significantly poorer specificity than the control condition. This finding suggests that there is no additive value to providing sample images with ABC information and training programs should focus on exemplar images to educate lay people. Images of both benign and malignant lesions give people concrete examples to which to compare a sample image.

While the study suggests image-based training has superiority over ABCDE criteria, it must be noted that there was only a 9% increase between the control and the best performing strategy. Additionally, the researchers did not assess whether a condition with both a benign image, a malignant image, and ABC criteria would improve accuracy even further. Nevertheless, image-based training would be a feasible option to deploy in community settings to train lay health advisors. Trainees would only need access to the internet and time.

In regard to trainings specific to nail melanoma, only one study was found. Gaghan et al.[22] implemented a community education tool in nail salons to train nail technicians on how to detect signs of melanoma using an educational video. Like the other study designs, Likert scales and images were given to the nail technicians pre- and post-video. Each technician was asked to score their likelihood of referring a client based on the image shown to them. Images included malignant warning signs, such as Hutchinson nail, longitudinal melanonychia, and nail dystrophy, as well as benign

conditions, like pseudo leukonychia, splinter hemorrhage, or habit tic deformity (Figure 2). At baseline, only 8% of nail technicians could identify nail melanoma signs, highlighting the intervention as an important educational opportunity. After watching the 2-minute educational video, which was shown in both English and Vietnamese, twice as many participants responded that they would "definitely refer" a client if they saw a warning sign for melanoma with a "high" or very high" confidence of 80% (compared to 49% pre video). However, top reasons for referral hesitancy included not knowing where or how to refer clients.

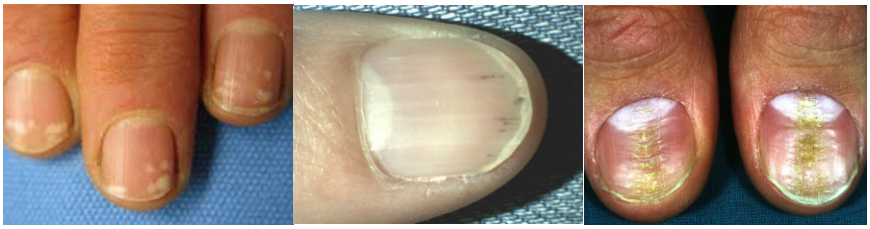


Figure 2: Images from left to right; A. Pseudo leukonychia B. Splinter hemorrhage C. Habit Tic Deformity. All images retrieved from dermnz.org.

Showing a 2-minute training video to nail technicians is a simple, cost-effective method that can be brought to almost any nail salon. A study limitation of note is the lack of baseline knowledge of melanoma, which may cause problems with long term retention since the intervention was only shown once. This underscores the need to bolster cosmetic school curricula with melanoma education or have repetitive interventions to improve knowledge base. Another issue to note is that referral likelihood for splinter hemorrhages, a benign condition, significantly increased after watching the video. If nail technicians begin to refer clients for benign lesions, this may put unnecessary worry on the client and could begin to overwhelm dermatology offices. A way to improve this

intervention would be repetitive intermittent training courses throughout the year to improve memory retention.

A final approach that could be used in the training of lay people is the use of tele-dermatology and E-consults (electronic consults). Naka et al.[23] studied the use of an electronic referral system in the primary care setting to alleviate some of the barriers that prevent people on Medicaid from receiving dermatology care. As of April 2021, 61% of Medicaid's beneficiaries identify as racial minorities. [24] This population struggles with dermatology access because as few as 20% of dermatologists in some states accept new Medicaid patients. Furthermore, Medicaid patients must wait 34% longer than a privately insured patient for an appointment. Implementing a dermatology referral program in a primary care practice was found to efficiently provide a patient's diagnosis, treatments, and a face to face follow up with a dermatologist, if needed. With funding from Medicaid, researchers placed a camera ($200) and dermatoscope ($110) in each site and trained providers on how to acquire images via a PowerPoint presentation. The Econsult contains a clinical image, a dermatoscopic image, and clinical notes, which would then be forwarded to one of 3 tele-dermatologists. They would review the note and either reply with diagnosis and treatment or recommend that the patient be seen in person. PCPs had the option to use the Econsult referral or a standard referral. Most patients on Medicaid were referred via Econsult rather than standard referral with a response rate of 100% for all 499 patients referred through the service. Few (N=78; 16%) of those patients were recommended to come in for a face-to-face visit; the remainder received a diagnosis and

treatment plan in under 24 hours. Of those patients that required an in-person appointment, 70 received an appointment and 46 of them had a confirmed visit.

This intervention is potentially very beneficial for Medicaid patients who are less likely to receive a face-to-face appointment with a dermatologist through a standard referral. However, since only 66% of patients had a confirmed appointment, obstacles to receiving care still exist for minority populations. Utilizing the power of tele-dermatology reduces some of the patient burden on dermatology practices and allows in person providers to assess the most suspicious of lesions. Lesions like seborrheic keratoses may be easily diagnosed as benign with clinical and dermatoscopic images and reduce the need for an unnecessary appointment. Additionally, methods for image acquisition seem simple and could be easily translated to the community setting. By including a dermatoscopic image, the online dermatologist gets a more detailed look at the lesion, which improves their diagnostic accuracy. With this method, minority patients do not have to wait long for their results and can have dermatological care at their fingertips.

In summary, these three studies suggest that training lay people to detect melanoma is a difficult thing to do; it takes medical providers years and years of training to become sufficient at it themselves. While it is a tough endeavor, lay people will get more accurate at detecting images of skin cancer with exemplar image-based training but will need to be able to set aside a couple hours for training. Shorter interventions are helpful for short term memory but repetitive interventions are needed, especially if nail technicians have little to no baseline knowledge of melanoma warning signs. Furthermore, the studies highlighted the fact that, even if warning signs for melanoma

can accurately be detected, minority patients still face barrier to dermatologic care. Econsults can make it fast and effective for minorities to get care but patients need to be also visiting a primary care doctor on a regular basis. To achieve the goal of an increase in treating more earlier stage ALM diagnoses, interventions need to focus on both training lay health advisors and getting minority patients to a dermatologist.

METHODS

Study design

The proposed study is a 2-part community health project based in Boston nail salons over a span of two years. The first goal in this study is to determine the efficacy of a four-hour imaged based training session on a nail technicians' ability to accurately detect signs of melanoma. There will be two groups, control and image training. Both will take a pretest and will be intermittently tested throughout the course of the intervention. A second goal will be to assess the ability of the nail technician to accurately refer a client via the Econsult service. Both study conditions will be encouraged to use Econsults within their nail salon. When nail technicians believe they have detected a warning sign of melanoma in their client's nails, soles, or palms, they will take pictures and send an Econsult with their client's consent. The Econsult will contain information about the patient's insurance status, address, and race for data collection. Clients will receive the results and either get referred directly to a dermatology office or be given a diagnosis and treatment within 48 hours. Together, the study will assess a nail technicians' accuracy to correctly detect melanoma signs on a test and to accurately refer a malignant condition seen in person via the Econsult service.

Study population and sampling

The city of Boston, Massachusetts was selected for its abundance of neighborhoods that are primarily home to many in the black population. The selected neighborhoods are Mattapan and Roxbury, as they have the highest percentage of black

residents, 74% and 53% of the community, respectively, according to the Boston Planning and Development Agency in August of 2017. The study also aims to focus on the Medicaid population, who faces barriers to dermatologic care. In these selected neighborhoods, 44.6% of the community is on Medicaid and 4.36% are uninsured. [25] Further demographics of these communities are found in Table 1.

Neighborhood	**% Black**	**Average Income**	**Average Age**	**# of Nail Salons**
Mattapan	74%	$47,200	35-64	14
Roxbury	53%	$25,937	35-64	8

Table 1: Demographics of the Mattapan and Roxbury Neighborhoods. Information pulled from Neighborhood Profiles produced from the Boston Planning and Development Agency Research Division, August 2017[26]. Nail Salon numbers pulled from a google map search of the areas.

Eligible salons will have nail technicians that are willing to undergo a 4-hour training session outside of work, have access to the Internet, have a smartphone, and are either English, Vietnamese, or Spanish speaking. The most common non-English language spoken in these neighborhoods is Spanish and Vietnamese is common among nail salon workers [25]. Salons will be excluded if they have less than 5 willing employees and are not open more than 4 out of 7 days a week. Employees must work at least 20 hours a week to be included. The estimated sample size is n=110 nail technicians. An alpha level of 0.05 and a beta level of 0.2 will be used for the first part of the study.

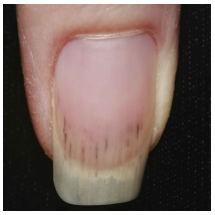
Intervention

Part One

The estimated sample size of 110 nail technicians will be divided equally into two groups, 55 in the control condition and 55 in the training condition. The control condition will receive a 20-question image-based pretest. This test will assess their baseline knowledge of ALM and their willingness to refer a client for a suspicious lesion. Within this test, the technician will see a benign lesion, a malignant lesion, and then a sample lesion, for which they have to decide if it is malignant or not (Figure 3). The test will also assess whether the technician has ever received formal education on melanoma. After taking the test, they will have access to the correct answers for review. The technicians will then be asked to apply what they have learned in the test into their practice.

Those in the training condition will take the same pretest and then will complete a 4-hour course via Zoom, where they will be educated by a Boston University affiliated dermatologist about melanoma. The course is modeled as an interactive live course where the participants will have the opportunity to ask questions and get further clarification on confusing concepts. It will touch on all forms of melanoma but will focus on acral lentiginous melanoma. Power point slides used during the course will be heavily image based and will use a variety of skin tones to teach about the signs and symptoms of ALM. These Powerpoint slides and the entire course will be available for review after the course has completed. Immediately after the course, the technician will take a post course assessment to assess their short-term knowledge retention. This test consists of the same questions as the pretest. Following the course, the trained technician will be encouraged to utilize their new knowledge of melanoma when seeing clients. The training condition

will also undergo a 2-hour education session similar to the first halfway through the study at the 1-year mark. The aim of this additional session is to boost knowledge retention.



1. Melanoma Benign Click one: Melanoma or Benign?

2. **Likelihood of referring? Click one. Unlikely Somewhat unlikely Neutral Likely Very Likely**

Figure 3: Sample question from pre and post test**.** Images obtained from dermz.net.

Part Two

Part two of the study will consist of an additional 30-minute training on how to set up Econsults for use in the salon. Both the control and the training conditions will receive this training. The technicians will be trained using a PowerPoint, which explains how to use the camera and dermatoscope for image acquisition at the salon. They will then be encouraged to combine their knowledge of melanoma signs with the power of the Econsult. If the technician sees a suspicious lesion for which they would like to refer a patient, they can take an image of it and send it to a tele dermatologist via the Econsult feature. This will be done with the customers consent, as they will need to provide their name, insurance information, and contact information into the system to receive a diagnosis or an in-person referral. Together, these two interventions should improve a nail technicians' ability to evaluate for signs of melanoma.

Study variables and measures

The main variable measured is the nail technician's accuracy in detecting signs of melanoma. Monthly questionnaires will assess a technician's accuracy in identifying a malignant lesion via an image. Additionally, if a tech sees a lesion that they would like to refer via Econsult, the accuracy of their reporting will be assessed. We will determine this by seeing what percentage of Econsults result in a recommendation of biopsy.

Recruitment

Nail salons within the borders of Mattapan and Roxbury will be contacted via phone call and/or salon visit to assess willingness to participate. At time of contact, the study will be summarized and the incentives will be explained; technicians will receive $200 initially and $100 for completing the second training course. Nail techs will be consented to the study. Customers will be asked if they want to participate in the Econsult feature only if a nail tech finds a suspicious lesion that they want to refer. Customers will not be able to use the feature for other lesions that they want evaluated. Customers willing to participate will also need to be consented to the study because the result of the Econsult will be tracked and analyzed. Customers may be of any race.

Data collection

The pre and post tests will be administered on the technicians' personal smart phone and the answers will be saved in an online database. The results will then be graded and transferred to a spreadsheet where they will be able to be compared to the previously taken test. Depending on whether the lesion was a melanoma or benign, the response will be graded as a true positive (TP), false positive (FP), true negative (TN), or

false negative (FN). The second question utilizes a 4-point Likert scale to assess the technician's confidence in their answer to question 1. Responses will be stored as digits with a 1 being unlikely and so forth.

Results of the Econsults will also be stored in an online database. The results will tell us if the patient received a diagnosis and treatment options or if they have been referred for an in-person appointment to get a biopsy. Diagnosis and treatment will be referred to as a negative (N) and biopsy will be referred to as a positive (P). The database will not reveal the diagnosis, as this is HIPPA protected patient information. Using this data, it can be determined whether the referral was made with "accuracy" or not. However, a biopsy does not necessarily mean that the lesion is malignant.

Data analysis

Raw data will be de identified and collected into an Excel spreadsheet. For the first question on the test, accuracy was defined as the ability to choose the right answer, if the lesion shown is in fact a true malignant or benign condition. Accuracy is determined using TP/TP+FP+FN for each question. The mean accuracy of the 20 questions is calculated each time the nail technician took the questionnaire. These results will be compared to the control groups scores and looked at longitudinally to determine the amount of change in knowledge over the two years. An example of this data can be found in Table 2. For the second question, which uses the Likert scale, calculating the mode of these answers will tell us about the most frequent response in relation to a particular question. The modes for all questions can then be complied and displayed in a bar graph.

The Econsult data will be assessed in a different manner. We will total the number of consults submitted to the service by both groups, training and control. After the consult is viewed by the tele-dermatologist, they may do one of 2 things, either recommend a biopsy/ in person consultation or provide them diagnosis and treatment immediately. For an Econsult report to be characterized as positive the tele-dermatologist must have recommended a biopsy. Thus, we will determine the percentage of consults that resulted in biopsy and compare the results of both groups.

Condition	**Accuracy Mean March 2024**	**Accuracy Mean April 2024**	**Accuracy Mean Total**	**Total # Consults**	**# of Consults resulting in recommended biopsy (P)**	**% of positive consults**
Control	54%	52%	53%	14	1	7%
Case (Melanoma training)	56%	58%	57%	16	2	12.5%

Table 2: Example of data for March and April 2024 excluding Likert scale data.

Timeline and resources

The course of the study will span over two years (Table 3). This duration was selected as ALM is a rare diagnosis and we want to have a greater odd of encountering signs of melanoma on nail salon customers. Key personnel needed for this study include a principal investigator, preferably someone who has experience in community outreach studies and holds a medical degree. The study will also utilize student workers and a statistician to complete data analysis. Initially, Boston University medical and/or

physician assistant students will reach out and recruit salons and their employees. Notably, the neighborhoods of Roxbury and Dorchester are within walking distance of the Boston University Medical Campus, making recruitment easier to complete. After the maximum number of eligible salons have been contacted, interested employees will undergo melanoma training, which will be taught by a Boston Medical Center board certified dermatologist. This training takes four hours and should be completed within the first 2 weeks of study initiation. The pre- and post-tests will be managed by the students who will monitor response rate and organize results into an Excel spreadsheet for analysis. The second training for Econsults will be taught by students who have already received the training themselves. This training is 30 minutes long and should be completed no later than 1 week after the melanoma training. One year into the study, the training group will receive another 2-hour education session like the first. During the study, follow up tests will be sent out to the tech's phones once a month for 23 months. Special equipment required is access to a computer in each salon so that pictures can be directly uploaded and Econsults can be sent in a timely manner. Additionally, customers may prefer to enter medical information in a private room or space. Temporary rooms may need to be created, however, most salons already have private rooms for waxing, which could be utilized for this purpose. Salons will receive a digital camera and a dermatoscope from the study for use.

Fall 2023	January 2024	February 2024	March 2024-February 2025	February 2025	March 2025-March 2026	April 2026
IRB Submission and Approval	Recruitment of salons and employees	Initial test Melanoma training Econsult training	Questionnaire qmonth Econsults	Second melanoma training	Questionnaire qmonth Econsults	Data Analysis Conclusions

Table 3: Proposed timeline for study

Institutional Review Board

We are applying for an expedited review from the institutional review board. The proposed study surveys and assesses the knowledge of human subjects after training and compares it to the knowledge of board-certified dermatologists. As human subjects are involved, the study must first be approved by the Boston University Medical Center Institutional Review Board. Both the nail technicians and the customers' identities will be confidential and de- identified. No vulnerable populations will be assessed, subjects will be willing participants from recruited salons. Nail technicians are consented to the study and can receive monetary rewards for their involvement. Customers are also consented to the study and will receive medical information. This information is protected under HIPAA Privacy Regulations.

CONCLUSION

Discussion

In this 2-part study, there are several limitations that may affect the study outcome. In general, the sample size will be small, as the number of nail technicians is limited to the number of nail salons in the selected locations. Technicians might also work at more than one salon, which lowers the potential sample size even further. Furthermore, the study only focuses on nail technicians and it tries to teach them what it takes dermatologists years to master. Due to this large education barrier, one might suggest that the focus should be less on the technicians and more on bringing awareness of this cancer to the community.

The number one obstacle that exists in our study is the fact that acral lentiginous melanoma is a rare diagnosis. With an incidence rate of 1.8 per 1,000,000 person years in the black population, it will be hard to increase the odds of finding an ALM in a 2-year study. [1] Thus, the proposed timeline may be too short to catch a diagnosis of melanoma, specifically ALM. However, altering the study to a longer timeline increases the risk of dropout by technicians. We balanced this dropout risk with the risk of not obtaining enough data to analyze. Therefore, we chose to refer to a recommended biopsy as a positive result, rather than the biopsy results. While the patient might not have ALM, the tele-dermatologist was still suspicious of the lesion and recommended further evaluation. Even if we do not catch a ALM diagnosis, patients will be referred into a dermatology office for appropriate medical care and there they could potentially find other less rare cancers during the in person visit. Another obstacle is the small sample size. As the study

will run for 2 years, there might be a large amount of dropout within the nail technician population. Technicians may move jobs or have other conflicts that prevent them from being able to complete tests and work the required 20 hours a week.

In terms of scalability, this intervention can be easily brought to any nail salon around the world; they just need access to a computer. It would be useful to also incorporate this model in the Hispanic population, the second highest population affected by ALM. However, there is not much usefulness for this intervention in salons that individuals of a non-Caucasian community frequent. This is because ALM is the least frequent subtype of melanoma in the Caucasian population [27]. However, this is not to say that the intervention cannot be adapted to focus on other subtypes of melanomas or nonmelanoma skin cancers. Furthermore, the intervention community is selective as it biases the results on one gender. The salon is typically frequented by those who identify as a woman and, even though ALM does not favor one gender over another, the selectivity of the intervention location limits the generalizability of the study. We hope that this initial intervention, while being limited to one gender, is a springboard for further similar studies that can include all genders. In addition, the effect on the women should in turn affect the men, especially those in married relationships. It was found that men are 2.7 times more likely to seek health care when influenced by a person of the opposite sex and members of married couples usually engage in skin exams at similar rates.[28,29]

Despite the limitations and obstacles, this study is unique and advantageous in the fact that the both the intervention and the diagnosis is brought right to the nail salon. Like

a mobile dermatology clinic, patients will get medical care without traveling far, only leaving their home to go get their nails done. They will receive medical advice or a referral within 48 hours and have information right at their fingertips, all thanks to their nail technician.

Summary

Melanin confers no known protective benefit in this subtype of melanoma and most patients are diagnosed in late stages of the ALM. For this reason, there is a need for awareness especially in the group that gets hit the hardest by ALM, the black population. The literature shows that community health interventions have been successful in the black community. Locations like the hair salon are advantageous because the client-stylist relationship is one of trust and people attend the salon with frequency. Studies have also found that tailoring educational materials to the client allows for better understanding and that the best community members to target in such an intervention are those that spend most of their day looking at skin. The more experience with seeing normal skin, the more likely one is to identify something abnormal. However, even with a job like a massage therapist that looks at skin all day, the best skin examination comes from a trained medical provider. It takes years and years with specialized training to be able to identify melanomas so, while training lay people helps bring more suspicious lesions to the forefront, their complete accuracy may still be off. Thus, the best way to improve the accuracy of melanoma detection without years of extensive medical training may be to use exemplar image-based training and to reinforce the information over time.

This proposed study considers these literature findings and develops a creative solution to both identify and treat suspicious lesions in the community with an increased focus on areas specific to ALM. First, the nail salon is a place in the community that fits the criteria for the intervention. Most women go to the nail salon every two to three weeks and spend an average of 45 minutes there, spending valuable time with their technician as they look at their palms, soles, and nails [30]. Additionally, the techs have proven that they are willing lay health advisors but most do not have formal training to detect melanoma. In this setting, the technicians will get the training that they require from a board-certified dermatologist twice along with follow up tests to promote retention of knowledge. Finally, we attempt to solve the problem of access to medical care. In the nail salon, lesions will be both identified and sent to a tele dermatologist via an Econsult. Patients will receive their results within 48 hours, instead of needing to wait to for a provider visit for which they might have to pay out of pocket. This solution increases access to care by screening patients in their community and bringing more people in to the dermatologist for suspicious lesions, even if the lesion is not ALM.

Compared to other interventions, this design educates willing nail technicians on how to identify lesions suspicious for ALM and for their clients to get timely results all under one roof. Positive results of this community intervention will show that this is a reasonable and inexpensive method to improve access to care in vulnerable populations. If successful, the intervention could have widespread effects in other black neighborhoods and within the Hispanic populations in America.

Critics to this design may point out the absence of awareness education for the clients. This is a notable limitation to the study, however we did not want to complicate this two-part design any further in its first iteration. Further improvements to this design include adding another arm to the study that teaches the techs how to educate their clients about ALM during their appointment. Casual discussion or other forms of education about ALM can promote more widespread knowledge gain in the population at large. Additionally, another aspect of the study that has potential for growth is the Econsults. As dermatologists are a valuable resource, this would be a great opportunity to involve physician assistants in the field of dermatology. Being involved in Econsults would give them a wealth of resources and images with which to train and would help decrease the strain on physicians if this intervention is implemented on a wider scale. Both advancements seek to teach and diagnose this rare condition, hoping to make it less rare.

Clinical and/or public health significance

The intervention aims to train lay health advisors and increase the amount of dermatology appointments for suspicious lesions. If successful, this could have major impacts on many aspects of healthcare, including insurance. If insurance companies view the community intervention as a preventative screening method, they may choose to provide monetary support. They may also choose to include more telehealth in the insurance plan so that the individual can continue to participate in these community screening programs. It is known that insurance would rather pay for cost-effective screening than the adverse cost of cancer treatments, which would undoubtedly be high in

a late stage ALM diagnosis. Additionally, widespread awareness of this disease could make dermatology a standard of care for everyone, no matter their race. This could affect Medicaid policies, incentivizing dermatology clinics to see Medicaid patients. Furthermore, interventions like the one proposed could open new jobs for telehealth providers, whether it be physicians or physician assistants. The solution is just one step towards change in a systemically corrupt medical system.

LIST OF JOURNAL ABBREVIATIONS

Acta Dermatol Venereol	Acta Dermato-Venereologica
Am J Mens Health	American Journal of Men's Health
Am J Public Health	American Journal of Public Health
Arch Dermatol	Archives of Dermatology
Asian Pac J Cancer Prev	Asian Pacific Journal of Cancer Prevention: APJCP
Health Educ Behav	Health Education & Behavior
Int J Womens Dermatol	International Journal of Women's Dermatology
J Am Acad Dermatol	Journal of the American Academy of Dermatology
J Cancer Educ	Journal of Cancer Education
J Community Health	Journal of Community Health
J Cult Divers	Journal of Cultural Diversity
J Fam Pract	Journal of Family Practice
J Health Care Poor Underserved	Journal of Health Care for the Poor and Underserved
J Med Educ Curric Dev	Journal of Medical Education and Curricular Development
J Surg Res	Journal of Surgical Research
JAMA Dermatol	JAMA Dermatology
JNCI J Natl Cancer Inst	Journal of the National Cancer Institute: JNCI
Prev Med Rep	Preventive Medicine Reports
Res Soc Work Pract	Research on Social Work Practice

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