SKIN CANCER SCREENING: IMPLEMENTATION OF DERMOSCOPY IN RURAL PRIMARY CARE

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ABSTRACT

Skin cancer is the most common cancer in the United States and worldwide, and rates continue to rise (American Academy of Dermatology Association [AAD], 2020; Skin Cancer Foundation [SCF], 2020). Although there is disagreement about the reasons why, rural areas are more dramatically affected by skin cancer morbidity and mortality than their urban counterparts (Cunningham et al., 2019). Early detection of all skin cancers, especially melanoma, can improve morbidity and mortality rates (Hubner et al., 2018; Kricker et al., 2014).

Secondary prevention strategies, such as naked eye skin examinations and dermsocopy, are critical in monitoring and identifying suspicious skin lesions. The results of naked eye examinations are often inconsistent because of varying clinician competence, confidence level, and time. When performed correctly and in adjunct with the naked eye examination, dermoscopy is more sensitive and specific at classifying skin lesions than naked eye examinations alone and use could help lead to the earlier diagnosis of cancerous skin lesions (Chappuis et al., 2016). However, many primary care clinicians do not have the skills or resources to use dermoscopy effectively.

Dermoscopy training programs have increased skin lesion diagnostic accuracy and confidence among primary care clinicians, even in as little as a one-day seminar (Augustsson & Paoli, 2019). Because of this, an education seminar was implemented at a federally funded institution that provides primary care to rural residents of eastern North Dakota, western Minnesota, and northeastern South Dakota. The purpose of this practice improvement project was to improve overall care quality and skin cancer survival rates in rural areas through early and accurate detection by educating primary care clinicians on the use of dermoscopy.

Pre- and post-implementation surveys were used to compare clinician knowledge of skin cancer, dermoscopy algorithms, opinions on the usefulness of dermoscopy, and comfortability with the practice of dermoscopy. Following the educational seminar, a three-month implementation period provided time for providers to implement their knowledge and dermoscopy skills in practice. Results of the surveys showed an increase in clinician comfortability and knowledge regarding dermoscopy use after the education seminar as opposed to before.

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DEDICATION

I dedicate this dissertation to my wife and children.

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LIST OF ABBREVIATIONS

AAD.....American Academy of Dermatology Association

AANP.....American Academy of Nurse Practitioners

ACS.....American Cancer Society

AK.....Actinic Keratosis

BCC.....Basal Cell Carcinoma

BD.....Bowen's Disease

DOI.....Diffusion of Innovation

EBP.....Evidence-Based Practice

IMR.....Iowa Model of Evidence-Based Practice Revised

IRB.....Internal Review Board

NCI.....National Cancer Institute

NDSU.....North Dakota State University

NP.....Nurse Practitioner

PA.....Physician Assistant

SCC.....Squamous Cell Carcinoma

SCF.....Skin Cancer Foundation

SK.....Seborrheic Keratosis

TADA.....Triage Amalgamated Dermoscopic Algorithm

TNM.....Tumor, Node, and Metastases

USPSTF.....United States Preventive Services Task Force

UV.....Ultraviolet

CHAPTER 1: INTRODUCTION

According to both the Skin Cancer Foundation (SCF, 2020) and the American Academy of Dermatology Association (AAD, 2020), skin cancer is the most common cancer in the United States and worldwide. Despite advances in modern medicine and disease prevention, the prevalence of skin cancer continues to grow. Skin cancer incidence rates are estimated at 9,500 new cases every day in the United States alone (AAD, 2020).

Melanoma, squamous cell carcinoma (SCC), and basal cell carcinoma (BCC) are the main types of skin cancer. Every year in the United States, over 4.3 million cases of BCC and 1 million cases of SCC are diagnosed (SCF, 2020). BCC and SCC are not tracked by cancer registries, so death rates are difficult to estimate. However, some approximations have placed the number of SCC deaths in the United States as high as 15,000 every year (SCF, 2020). Melanoma is less prevalent than nonmelanoma skin cancers but has the highest mortality rate of the three. Approximately 100,000 new melanoma diagnoses will be made, and 7,000 people will die from melanoma in the United States annually (American Cancer Society [ACS], 2020). Even though melanoma is most prevalent in people over age 65, this cancer is one of the most common among young adults.

Several factors increase the risk of developing skin cancer. Skin cancer risk factors are classified as non-modifiable and modifiable. Non-modifiable risk factors are those that the individual cannot change. Examples of non-modifiable skin cancer risk factors include having fair skin, increased age, blue eyes, blonde or red hair, numerous nevi, male gender, and family history of skin cancer (Dunphy et al., 2020). Even though patients with lighter skin are more likely to acquire skin cancer, statistics show that people with skin of color are less likely to survive melanoma (AAD, 2020). Modifiable risk factors are usually preventable and include the

number of sunburns and amount of ultraviolet (UV) light exposure received, carcinogen exposure, and lifestyle choices that increase the risk of immunosuppression. Having a weakened immune system is also a risk factor of skin cancer that can either be modifiable or nonmodifiable. Research has consistently shown that the greatest risk factor for acquiring skin cancer is exposure to UV light from the sun and tanning beds (AAD, 2020).

Skin cancer prevention involves different levels of health promotion strategies. Primary prevention strategies involve the use of topical sunscreens while outdoors, wearing protective clothing while in the sun, avoiding tanning beds, and seeking shade during midday hours (ACS, 2020). Secondary prevention strategies include routine skin examinations by either self-administered patient exams or by clinicians at health care visits. The goal of routine skin examinations is to discover new onset skin cancer in the early stages which may improve treatment outcomes. Currently, the United States Preventive Services Task Force (USPSTF, 2016) does not recommend routine gross visual skin examinations by clinicians. The USPSTF (2016) suggests that the costs of routine examinations, which can result in the misdiagnosis of lesions, emotional distress of false positives, and cosmetic disfigurement, does not outweigh the benefits. However, two other organizations recommend that both clinicians and patients perform routine skin examinations, or at least monitor suspicious lesions closely (AAD, 2020; ACS, 2020).

Background and Significance

Evidence shows the benefits of early detection of skin cancer through routine screening. For example, the 5-year survival rate for melanoma is greater than 99% if detected during the initial stages (SCF, 2020). There is also evidence that early detection of SCC and BCC can improve patient outcomes (Hubner et al., 2018; Kricker et al., 2014). Clinicians are essential in

educating patients on proper self-examination. Proper patient education includes teaching them about different warning signs for skin cancer such as changes in lesion sizes, the appearance of new growth or lesion on the skin, sores that do not heal, and changes in shape or color of a current mole or skin lesion (AAD, 2020). However, even more important than self-examinations are skin examinations performed by clinicians. Skin examinations performed by clinicians tend to detect melanoma in earlier stages (thinner lesions) than melanomas discovered by self-examinations, leading to less time to treatment and better outcomes (Geller & Swetter, 2019). Thinner melanoma lesions are associated with more favorable patient outcomes than thicker lesions (Coory et al., 2006; Peters, 2020).

Routine clinician skin examinations are often administered via the naked eye to examine the body for alarming skin lesions. However, the results of gross visual examinations are often inconsistent because of varying clinician competence, confidence level, and time (Hencley, 2017; Lubitz, 2020; Peters, 2020). Many clinicians also note difficulty in distinguishing melanomas from benign lesions (Jones et al., 2019).

One way many clinicians address the difficulties of visual skin examinations is by using an examination technique called dermoscopy. Dermoscopy, when performed correctly and in adjunct with the naked eye examination, is more sensitive and specific at classifying skin lesions than naked eye examinations alone (Holmes et al., 2018; Jones et al., 2019; Wolner et al., 2017). More accurate diagnoses of suspicious skin lesions could lead to discovery of melanoma at earlier stages, thus improving patient outcomes. This could also reduce unnecessary biopsies, excisions, and dermatology referrals by primary care clinicians.

All types of skin cancers have been on the rise in the United States and globally (Cunningham et al., 2019). Although anticipating how quickly, skin cancer rates are predicted to

continue to rise over the next few decades is difficult. Increasing rates of skin cancer appear to be found in both rural and urban areas, with rural areas being affected more dramatically. Chen et al. (2018) state that "compared to urban residents, rural residents have higher all□cause mortality rates, [and] higher rates of premature morbidity and mortality from diseases such as cancer…" (p. 405). Rural residents were also more likely to engage in risky sun exposure behaviors, to have outdoor occupations, and be elderly compared to urban residents, which are all major risk factors for acquiring skin cancer (Cunningham et al., 2019). Gaetano et al. (2009) claimed that rural residents had less access to quality healthcare, were more likely to seek tertiary care as opposed to primary or secondary care, and were more likely to not have health insurance. Other reasons for rural health care disparities include high rates of chronic disease and reduced access to specialty clinicians. Rural areas especially face significant dermatologist shortages, forcing patients to travel long distances and experience long wait times for accurate diagnoses of suspicious skin lesions (Feng et al., 2018).

In order to address the lack of access to specialty clinicians in rural areas, primary care clinicians have had to take on much of the dermatology care burden. However, the accurate diagnoses of skin lesions, avoidance of unnecessary dermatology referrals, and understanding appropriate biopsy criteria has proven challenging to many primary care clinicians (Augustsson & Paoli, 2019). Even though dermoscopy has been proven to assist with these challenges, many primary care clinicians have not been properly trained to use dermoscopy, which significantly affects the rate of use of the method among clinicians.

Chappuis et al. (2016) reported that the use of dermoscopy in primary care helped general clinicians to diagnose skin cancer more accurately and reliably. Dermoscopy also increased clinician confidence when encountering skin lesions, reduced dermatological referrals, and

helped avoid unnecessary biopsies and excisions. Dermoscopy provides patients with suspicious skin lesions that are benign reassurance and those with malignant lesions access to more timely care, which may be crucial for cancer survival (Jones et al., 2019). Research has shown that dermoscopy training programs have increased skin lesion diagnostic accuracy and confidence among primary care clinicians (Augustsson & Paoli, 2019; Fee, 2019). Because of this, Koelink et al. (2014) suggests that instructing primary care clinicians in the use of dermoscopy would be a cost-effective intervention.

Problem Statement

The theme of poor health care inequities resonates in the finding that skin cancer survival rates and primary prevention strategies are worse in rural populations. Due to healthcare inequality many rural residents are unable to obtain the timely care or accurate diagnosis they need. Primary care clinicians can help relieve the strain placed on rural communities related to the lack of access to specialty clinicians by learning and utilizing dermoscopy.

Purpose

The purpose of this practice improvement project (PIP) was to help address the lack of training and utilization of dermoscopy by primary care clinicians. This project was designed with the intent to improve practice by increasing primary care clinician knowledge and confidence in assessing suspicious skin lesions using dermoscopy. Research has shown that primary care clinicians can be taught to use dermoscopy accurately and cost-effectively. Dermoscopy can assist rural primary care clinicians with early detection of skin cancer to provide better survival outcomes for the residents they serve. The methods learned can be used to decrease dermatology referrals while improving overall skin cancer survival rates and care quality in rural areas through early and accurate detection. Therefore, the PIP focused on implementing a dermoscopy

education program for nurse practitioners, physician's assistants, and physicians employed in a rural primary care setting. At the end of the provided training the PIP assessed the degree in which the knowledge and perceived confidence increased regarding the use of dermoscopy among the project participants.

Objectives

1. Develop and implement an in-person educational seminar that includes practical dermoscopy concepts that can be used in a primary care setting by November 2021.
2. Increase primary care provider knowledge and confidence in identifying both benign and malignant skin lesions using dermoscopy by November 2021.
3. Increase the use of dermoscopy in the primary care setting by February 2022.

CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

In this chapter, various terms used throughout the paper will be defined. The theoretical framework used to guide this project will be briefly discussed. This includes both The Iowa Model of Evidence-Based Practice Revised (IMR) and the Diffusion of Innovation (DOI) theory. A review of skin cancer and precancerous lesions characteristics, as well as skin cancer screening recommendations and screening techniques will also be included. Dermoscopy characteristics, techniques, and its relevant use in the primary care setting will also be discussed.

List of Definitions

Clinician: defined as "a health professional whose practice is based on direct observation and treatment of a patient, as distinguished from other types of healthcare workers, such as laboratory technicians or those employed in research" (Mosby's Medical Dictionary, 2009).

Dermoscopy: defined as a "non-invasive technique using a hand-held magnifier and incident light, which may be polarized to reduce reflection, to reveal subsurface structures" (Jones et al., 2019, p. 2). Juraschek et al. (2019) add to this definition by saying this technique eliminates surface reflection at the skin-air interface to allow better visualization of sub-surface structures and colors. Operationally dermoscopy is the intervention being taught during the implementation portion of the project.

Dermatoscope: defined as a handheld instrument which has a transilluminating light source and standard magnifying optics (Marghoob et al., 2013). The magnification and lighting provided by this instrument allows for microscopic visualization of dermoscopic characteristics resulting from the presence of melanin and hemoglobin in the epidermis, dermo-epidermal junction, and the upper dermis (Pluddemann et al., 2011). Operationally, the course will be

taught using the 3Gen Dermlite Carbon and Welch Allyn Episcope Skin Surface Microscope models of dermatoscopes.

In-Situ: defined as "a group of abnormal cells that remain in place where they are formed" (National Cancer Institute [NCI], 2022). In-situ cells have not yet spread, but they may later become cancer and spread to nearby tissue or throughout the body.

Invasive: the term invasive will refer to any "cancer that has spready beyond the layer of tissue in which it developed and is growing into surrounding, healthy tissues" (NCI, 2022). This type of cancer is also called infiltrating cancer and is any cancer above a stage 0.

Primary care provider: defined as "a physician, nurse practitioner, or physician assistant, as allowed under state law, who provides, coordinates or helps a patient access a range of health care services" by the United States department of health and human services (2020). They are often the first point of contact for patients within a health care system (Jones et al., 2019). Operationally, any one of the previously listed providers can participate in the dermoscopy educational seminar. Physicians, nurse practitioners, and physician assistants may be referred to as "primary care clinician" in this paper to remain consistent with the use of the standalone term "clinician."

Rural: The Oxford English Dictionary (2020) defined as "of, relating to, or characteristic of the country as opposed to a town or city; as opposed to urban." The United States Department of Agriculture (2019) more specifically defines rural as a place with open countryside, fewer than 2,500 people, and an urban area with a population ranging from 2,500 to 49,999 that are not part of a large labor market. Operationally, the definition of rural used in this project will pertain to areas that include all three of the previously mentioned precepts.

Rural health: no formal definition of rural health was discovered in the search process of this PIP. Operationally, this project will define rural health as the delivery of health care in any area that can be defined as rural (as previously defined above).

Sensitivity: Melnyk and Fineout-Overholt (2019) defined as "the probability of a diagnostic test finding disease among those who have the disease or the proportion of people with disease who have a positive test result." Operationally, this term will be used by research articles to show how well certain tests can predict if an individual has the disease being tested for.

Specificity: Melnyk and Fineout-Overholt (2019) defined as "the probability of a diagnostic test finding no disease among those who do not have the disease or the proportion of people free of a disease who have a negative test." Operationally, this term will be used by research articles to show how well certain tests can predict if an individual without a disease does not have the disease being tested for.

Theoretical Framework

Different theories and models can help guide the development and implementation of projects. Evidence-based practice (EBP) emphasizes that clinical decisions must be made based on the best evidence from all systematic research available (Kettner et al., 2013). The DOI theory was used to help as many clinicians as possible implement the evidence-based methods presented into their practice. The IMR was also used to guide this project's development and will be discussed more in subsequent chapters.

The Diffusion of Innovation Theory

The concept of how EBP integrates into a clinical setting can be explained by the DOI theory. Developed in 1962 by E. M. Rogers, the DOI theory helps to explain how diffusion of

novel practice spreads through a population and how people adopt the new practice as their own. In this sense, adoption of the practice refers to the members of the population finding the practice innovative and deciding to practice differently than they had before (LaMorte, 2019). Adoption is important because adoption narrows the gap between what is there and what is best (Mohammadi et al., 2018). The use of EBP in clinical decisions assists to reduce the following: effects felt by subjective errors, use of obsolete information, and practice supported by unsubstantiated experiences. This PIP used the DOI theory to diffuse the EBP of dermoscopy through a population of primary care clinicians at a federally funded institution located in an urban city in North Dakota. The health care facility's primary care department offers disease prevention and chronic disease management services to patients living in both urban and rural settings.

Qualities of Innovation

Five qualities of innovation exist that determine the likelihood of diffusion and adoption of a practice through a population of health care providers (LaMonte, 2019; Mohammadi et al., 2018). The qualities include relative advantage, compatibility, observability, complexity, and trialability. The relative advantage of an innovation includes all the benefits that the innovation can provide to practice quality, effectiveness, and cost. Compatibility refers to the innovation's ability to contribute to present values, previous experiences, and future needs of the population. Observability refers to how apparent the effects and outcomes of the innovation are to the population. If complexity of an innovation is too intense, then its diffusion can be inhibited. Finally, trialability, is the extent to which the innovation can be tried out by the population members before implementing it into their own practice. Researchers would benefit from being

aware of how qualities of innovation are present in their innovation and how they might impact a specific population.

Adopter Categories

The idea of adopter categories is based on the idea that adoption of an innovation does not happen simultaneously among individuals of a within a particular social system (Lamonte, 2019). Rather, certain individuals are more likely to adopt an idea than others. The characteristics of a social system's population are important to identify before attempting to diffuse an innovation through the population.

The first two adopter categories, innovators and early adopters, make up approximately 16% of a social system's population. Innovators and early adopters readily recognize innovative opportunities, are often influential within an organization, and encourage others to adopt an innovative practice (Melnyk & Fineout-Overholt, 2019). One goal was to identify a site liaison willing assist with project implementation who can help influence practice change and encourage dermoscopy use within the implementation department's clinic setting.

In the middle of the adopter categories is the early majority which represents approximately 34% of the population. This category will eventually follow the early adopters but are more cautious and spend more time watching the innovation progress. The last two categories, late majority, and laggards are skeptical of change and typically do not adopt a practice until it becomes the standard. Focus and energy are often placed on the last two categories, which is why many change efforts fail (Melnyk & Fineout-Overholt, 2019). Since innovators and early majority members help facilitate change effectively, it is most important to target individuals in those categories in any change efforts.

Diffusion and Adoption

As explained by the DOI theory, the diffusion process of a practice concept throughout a population includes the following four elements: the innovation itself, communication channels, time, and a social system (Lubitz, 2020; Peters, 2020). As stated previously, the evidence-based innovation used in this project was implementing dermoscopy into practice. The communication channels were virtual during the education seminar, survey questions, education resources, and site visits with providers. Approximately one hour was used for the educational seminar, and the addition of three months was given after the education seminar for the providers to decide to adopt the innovation into practice. The social system included the clinic setting which also included the examination and procedure rooms where the participating providers practice.

According to Mohammadi et al. (2018), the process of adoption as explained by the DOI theory involves three key stages. The first stage is knowledge, where an individual is first exposed to an innovation and acquires a basic understanding of its concepts. Stage two is persuasion, which is when the individual forms an opinion of the innovation based on perceived attributes. The final stage is the decision stage. This stage puts the individual in a position that requires either the adoption or rejection of the innovation into their practice.

Summary

The DOI theory helps to explain how new ideas spread through populations. The theory also illustrates the process of how individuals within a population decide whether to adopt a new idea or not. Researchers can use the theory to better understand their target population. By understanding how ideas spread and where to most focus efforts, researchers can more efficiently and predictably influence change that produces better outcomes. This project used the DOI theory to implement dermoscopy more efficiently into a rural health care setting.

The Iowa Model of Evidence-Based Practice Revised

The IMR is the model that was used to guide to further guide the development and implementation of this PIP. This model guides clinicians and health care leaders in practices that affect health care outcomes (Melnyk & Fineout-Overholt, 2019). By assisting clinicians to utilize current practice standards, this framework encourages clinicians to improve practice. Highly recognized for its ease of use and applicability to a variety of health care issues, this model has been used since the 1990s to help health care organizations make effective changes to their facilities. Many EBP methods have been addressed using this model which have been identified as important by clinicians, even before regulatory standards or reimbursement changes came into effect. The IMR can help create a culture of inquiry and ownership regarding EBP amongst clinicians and can help administrators create a supporting system for the use of evidence-based care delivery (Melnyk & Fineout-Overholt, 2019). More content on this model will be included in subsequent chapters. Permission for using the IMR was given on January 7th, 2021 (Appendix B).

Literature Review

In the review of literature, three skin cancer types and two types of precancerous lesions will be discussed. Skin cancer screening recommendations and techniques, including dermoscopy and its background, will also be covered. Information will also be included regarding the dermoscopic examination as well as various algorithms to use with this screening technique.

Skin Cancer Types

Different types of skin lesions, including the different types of skin cancers, have different characteristics. Lesion characteristics are sometimes subtle and can make distinguishing

lesion types difficult. To understand how to use dermoscopy to identify or diagnose suspicious lesions, a clinician must first understand more about the lesions being identified. The following paragraphs will describe two types of precancerous lesions: actinic keratosis (AK) and Bowen's disease (BD). Three of the most common skin cancers: BCC, SCC, and melanoma will also be discussed.

Basal Cell Carcinoma

One type of nonmelanoma skin cancer is BCC. This lesion is the most common skin cancer worldwide (Fania et al., 2020). Although the mortality rates from this cancer are negligible, BCC is associated with significant health care costs and patient morbidity. BCC is not capable of metastasizing through blood vessels or lymphatics but can significantly penetrate and destroy local tissue if left untreated (Habif, 2016). Although BCC lesions can be found on areas with less than maximal UV radiation exposure, they are mostly found on the sun exposed areas of the face and neck region. Risk of acquiring BCC is correlated more with intermittent and intense UV exposure as opposed to cumulative sun exposure during one's lifetime (Fania et al., 2020).

Three main clinical types of BCC exist: nodular, superficial, and morpheaform (Fania et al., 2020). Nodular BCC is the most common subtype and usually manifests as a pearly white or pink lesion with a sharp border. Nodular BCC lesions tend to develop telangiectasis and are prone to ulceration. Superficial BCC occurs mostly on the trunk and extremities which manifests as a circumscribed, round, scaly plaque that retains a pearly white border (Habif, 2016). Morpheaform BCC lesions have border that blend with normal skin and have waxy, firm, and slightly raised characteristics.

Squamous Cell Carcinoma

Another nonmelanoma skin cancer is SCC. This type is the second most common type of skin cancer, and unlike BCC, is associated mostly with cumulative UV exposure over a lifetime and is capable of metastasizing (Alfonso et al., 2016). SCC is most common in sun-exposed areas but has a different distribution than that of BCC (Habif, 2016). SCC lesions are found mostly on the scalp, lips, backs of the hands, and top of the ear, all of which are less likely to host BCC. Where BCC arises from basal keratinocytes, SCC arises from atypical squamous cells that occur in the epidermis. SCC commonly presents as a firm papule with a rough surface and irregular borders (Dunphy et al., 2019). SCC lesions can also present with hyperkeratosis and have an erythematous base. As they progress, SCC lesions often become friable and appear to ulcerate.

AK and BD are precancerous lesions that can progress to invasive SCC. An increased number of AK lesions positively correlates with an increased risk for SCC development (Dunphy et al., 2019). AK lesions are relatively common in light-skinned older individuals. BD is very likely to progress to invasive SCC, so early identification of this type of lesion is important. BD lesions involving the lips, ear, sites of old trauma or wounds, or larger in size are the most likely to metastasize (Dunphy et al., 2019). Both lesions will be discussed in more depth in later paragraphs.

Melanoma

The incidence of melanoma affects mostly people between the ages of 25 and 50, which is significantly younger than the ages of people most often affected by BCC and SCC (Leonardi et al., 2018). As with other cancers previously mentioned, UV exposure is the most significant environmental risk factor for the development of melanoma. However, unlike other cancers, no

other environmental risk factors aside from UV light has been significantly associated with melanoma development. Another significant risk factor for the development of melanoma are total number and type of nevi. Some estimates indicate that nearly 25% of all melanomas develop from a pre-existing nevus (Leonardi et al., 2018). Of the skin cancer types mentioned, melanoma is the most aggressive and causes the highest mortality because of its metastatic nature. Melanoma is highly curable if discovered early but if the lesion extends beyond 4mm in depth, prognosis becomes poor. A lesion greater than 4mm in depth indicates a high probability for metastasis and is associated with a 75% mortality rate at this depth (Dunphy et al., 2019).

Melanoma can be categorized into four different subtypes: superficial spreading, nodular, lentigo maligna, and acral-lentiginous (Habif, 2016). Superficial spreading is the most common of the four types of melanoma and develops anywhere on the body but most often on the legs and upper back. Superficial spreading lesions often involve many colors (although begin as brown), are greater than six cm in diameter, have irregular asymmetric borders, and are flat or elevated. A superficial spreading melanoma lesion also often involves new vessel formation and inflammation. Nodular melanoma lesions are the next most common type and can be found anywhere on the body and are usually a combination of brown, black, or red. They rapidly progress over weeks to months, are dome-shaped, and tend to bleed easily. Lentigo melanoma is a slow growing melanoma lesion that is usually located on the face. Colors of lentigo melanoma tend to be more uniform than other melanomas but may have a complex pattern with highly irregular borders. This melanoma type also tends to bleed easily in more advanced stages. Acral-lentiginous melanoma are the least common type of melanoma and manifest similarly to lentigo types but appear on irregular surfaces such as palms of hands, soles of feet, under fingernails, and mucous membranes.

The Tumor, Node, and Metastases (TNM) staging system developed by the American Joint Committee on Cancer is used to clinically stage melanoma (Gershenwald et al., 2017). This system considers tumor thickness, ulceration, mitotic rate, and level of invasiveness when staging melanoma lesions (Dunphy et al., 2019). The TNM system employs the help of two other methods: Clark's Levels and Breslow's Method. Clark's Levels of classification is based on the level of anatomical invasion of the lesion into the skin and Breslow's Method is based on the vertical thickness in millimeters of the invasive lesion (Leilabadi et al., 2014). Since thickness or depth of the melanoma is critical for determining prognosis and therapy, Clark's Levels and Breslow's Method assist to determine severity of melanoma lesion based on its depth of advancement from the dermis (Dunphy et al., 2019).

Precancerous Lesions

One type of precancerous lesion is actinic keratosis (AK) which is the precursor to most invasive SCC (Fernandez Figueras, 2017). AK lesions are more common in men, lighter skinned individuals, and older adults (Dunphy et al., 2019). The most common cause of AK lesions is cumulative UV exposure, which causes significant damage to the epithelial layers of the skin. Estimates of how often AK lesions progress to SCC vary from 0.1% to 20%, although when they do progression usually occurs within the first two years of onset. AK lesions usually appear on areas of the skin that have been chronically exposed to the sun and begin as an area of increased vascularity with a rough texture (Habif, 2016). The formation of an adherent yellow and sharp scale usually forms which is gradual and sometimes never occurs at all. AK's development into a malignancy or progression into SCC is usually indicated by induration, inflammation, or oozing. Fernandez Figuras (2017) suggests that dermoscopy can be helpful in differentiating AK from SCC and assist in diagnosing malignant lesions at an earlier stage. Because of the inability to

predict which AK lesions will progress into SCC, AK treatment is recommended., However, cost-effectiveness and patient-related factors should be considered before decisions to treat are made (Fernandez Figuras, 2017; Habif, 2016).

Another type of a precancerous lesion is BD, also called intraepidermal SCC, and as this alternative name implies is also a precursor to invasive SCC. Common risk factors for development of BD are cumulative UV exposure, radiotherapy and carcinogen exposure, human papillomavirus infection, and immunosuppression (Nisa Akay et al., 2016). Although the risk of BD progressing to invasive SCC is typically between 3% and 5%, one third of invasive cases metastasize. BD lesions present as red, scaly patches with well-defined borders that are slightly elevated (Habif, 2016). Surface fissures and foci of pigmentation are also often present. BD usually progresses slowly and shifts laterally before invasion of the dermis layer occurs. Dermoscopy is considered a helpful tool in the early diagnosis of BD, helping to establish early diagnosis and initiation of treatment more quickly (Nisa Akay et al., 2016).

Skin Cancer Screening Recommendations

Screening strategies aimed at detecting skin cancer in the early stages are considered secondary disease prevention techniques. Secondary skin cancer prevention strategies include either routine skin examinations by either the patient's self-examination or by clinicians at health care visits. The goal of naked eye examinations is to discover the presence of skin cancer in its early stages which may improve treatment outcomes. Currently, the USPSTF (2016) does not recommend routine skin examinations for skin cancer by clinicians. They claim that the costs of routine examinations do not outweigh the benefits. The costs of routine screening can include misdiagnosis of lesions, emotional distress of false positives, and cosmetic disfigurement related to unnecessary biopsies and excisions.

However, several other organizations suggest routine skin cancer screening examinations be completed based on individual risk factors and as recommended by clinicians. The ADA (2020) recommends that everyone perform routine skin examinations to assess for skin cancer signs. This organization also recommends that clinicians perform examinations based on the patient's individual skin cancer risk factors. According to the ACS (2020), patients are encouraged to know their skin well by completing self-examinations once a month and report any changes noted to their primary care clinician. The SCF (2020) claims that because early detection of skin cancer is so important, full body examinations should be done annually by clinicians. Johnson et al. (2017) also recommended that patients between the ages of 35 and 75 with risk factors for skin cancer, should be professionally screened annually with a total body examination.

Skin Cancer Screening Techniques

Several different examination techniques have been developed to help clinicians identify suspicious lesions. Pinpointing and investigating suspicious lesions is important to determine if they are malignant or benign. Malignant lesions, or skin cancer lesions in this context, are especially important to identify. The early and accurate detection of skin cancer can help decrease morbidity and provide better survival outcomes (Chappuis et al., 2016; Geller & Swetter, 2019; Jones et al., 2019). However, determining whether a lesion is malignant or benign can be challenging. In order to identify malignant lesions, clinicians must know how to identify with their naked eye clinical features that are suggestive of malignancy. Clinicians should consider developing a personalized naked eye skin or lesion routine examinations so that no areas are forgotten and that any suspicious lesions are identified (Ball et al., 2019). Three

techniques clinicians can consider using for naked eye examinations include the ABCDE rule, the "ugly duckling" sign, and the Glasgow seven-point checklist.

ABCDE Rule

One technique many clinicians use during routine naked eye skin examinations is the ABCDE rule. Based on this technique, clinicians should consider investigation lesions further if they contain one or more of the following attributes: asymmetry, irregular borders, multiple or concerning colors, diameter great than 6mm, and evolution over time (King et al., 2015). The evolution aspect of the ABCDE technique was specifically added to help clinician identify progressing melanoma lesions (Abbasi et al., 2005). Suspicious lesion evolutions could involve changes in size, color, shape, or symptoms such as itching, bleeding, or tenderness.

"Ugly-Duckling" Sign

Another technique that clinicians can use to help guide their approach to identifying suspicious lesions is the "ugly duckling" sign. This term is referencing a lesion that is different or stands out from the rest, specifically regarding nevi (King et al., 2015). However, before being able to identify a suspicious lesion, first identifying the nevi located on an individual that share similar clinical features as the suspicious lesion is helpful (Suh et al., 2008). This is called the patient's signature nevi because often most of the nevi on an individual have very similar characteristics. By becoming familiar with the patient's signature nevi, when a more suspicious lesion is present, suspicious lesion are more easily recognizable as abnormal to the naked eye.

Glasgow Seven-Point Checklist

The Glasgow Seven-Point Checklist is actually very similar to the ABCDE method, although there are some differences. Varying levels of emphasis are placed on different features with this technique (Pareda et al., 2013). This method calls for a referral to dermatology, or at

least further investigation, if one major feature or three minor features of suspicious lesions are present (Lubitz, 2018). Major features are changes in size, shape, or color. Minor features include a size of greater than 6mm, bleeding or crusting, redness or inflammation, and changes in sensation such as itching or pain.

Dermoscopy

Dermoscopy is a technique used by clinicians to identify certain patterns and structures within skin lesions that are not detectable with the naked eye (Habif, 2016). This technique helps clinicians differentiate between benign from malignant lesions by confirming the presence or absence of specific dermoscopic structures (Yélamos et al., 2019). Dermoscopic structures to include color, are visualized within the epidermis, dermoepidermal junction, and papillary dermis by an instrument called a dermatoscope (Soyer et al., 2012). The dermatoscope magnifies the image underneath by approximately 10 to 20 times to reveal features that are helpful at differentiating benign and malignant lesions. Compared to a naked eye examination alone, dermoscopy has been shown to significantly increase the diagnosis of melanoma. With the correct training and experience, dermoscopy has also been shown to improve melanocytic and non-melanocytic skin lesion differentiation.

Dermoscopy Background

Since the late 1600s, skin surface microscopy has been used to evaluate capillaries of the nails and lips. Using this technology for pigmented lesions was first described early in the 20th century based on previous observations made during colposcopies of the cervix (Kaliyadan, 2016). Later in the 20th century, oil immersion fluid was used to improve diagnostic accuracy of pigmented skin surface lesions. The oil in skin surface microscopy techniques eliminated light reflection from the skin surface which allowed better visualization of subsurface structures and

colors (Soyer et al., 2012). By the 1980s, handheld dermatoscopes were first being used to assist clinicians who used dermoscopy often in practice, and dermoscopic criteria used for the diagnosis of pigmented skin lesions first appeared in the 1990s. Today, there are many varieties of dermatoscope instruments available for use with dermoscopy techniques. Most of the newer dermatoscope devices use cross-polarized light properties, which do not require a liquid interface or direct contact with the skin making them more practical to use in the clinical setting. Multiple skin lesions can be examined in a short time and a clear view through the skin layers can be made within seconds with dermatoscopes (Habif, 2016). New technology has also allowed skin lesions to be photographed and stored in electronic medical records to be used for sequential analysis.

Clinical Role

Current trends show that dermoscopy use in clinical practice has been increasing both among dermatology and primary care clinicians (Wolner et al., 2017). Significant data exists that shows dermoscopy is more accurate than naked eye examinations alone for the accurate and early diagnosis of cutaneous melanoma and other skin cancers (Dinnes et al., 2018; Hoorens et al., 2019; Lan et al., 2019; Vestergaard et al., 2008). Chappuis et al. (2016) were able to show that the main reason study participants did not use dermoscopy in practice was because of lack of training. Diagnostic accuracy of melanoma with dermoscopy use is often dependent upon experience, with greater accuracy being correlated with more dermoscopy experience. However, several studies have shown that even short dermoscopy training sessions can increase the diagnostic accuracy of melanoma by improving sensitivity without significantly compromising specificity (Augustsson et al., 2019; Vestergaard et al., 2008). In 2006, Argenziano et al. suggested that even after a two-hour dermoscopy course, the ability of primary care clinicians to

triage suspicious lesions without unnecessary referrals improved. The researchers of that study compared the results of two groups identifying suspicious lesions in need of referral: one that used only naked eye examinations, and one that used dermoscopy after only a short instructional course. Specificity for identifying suspicious lesions remained at approximately 71% for each group, however, sensitivity was 79.2% in the dermoscopy trained group as opposed to 54.1% in the naked eye examination group.

The primary purpose of examining a lesion with a dermatoscope accompanied by the knowledge of dermoscopic algorithms is to decide whether the lesion should be biopsied (Marghoob & Jaimes, 2019). Additionally, the primary purpose of skin biopsy is to diagnose skin cancer earlier with an overall goal to start treatment sooner and improve outcomes. Decisions to excise and biopsy a lesion should be based on clinical experience, physical examination data, and individualized patient history. However, lesions excised by those trained in dermoscopy were more likely to be melanoma than those excised by untrained clinicians (Carli et al., 2004). Clinicians are less likely to biopsy a lesion unnecessarily if they continue to use dermoscopy after receiving training. Carli et al. (2004) found that clinicians who continued to use dermoscopy four years after being trained reduced their malignant-to-benign lesion biopsy ratio from 18:1 to 4.3:1. The decrease of unnecessary lesion biopsy rate significantly reduces needless costs and morbidity.

Use in Primary Care

Dermoscopy is used most amongst the dermatology specialty clinician populations. However, many underserved and rural areas experience dermatologist shortages. Thus, dermatological care is delivered mostly by primary care clinicians in areas with dermatologist shortages (Feng et al., 2018). Primary care clinicians must be able to recognize features in skin

lesions consistent with malignancy and understand when urgent specialty referral is required (Beecher et al., 2018).

Regardless of dermatologist availability, the first opportunity to detect and diagnose melanoma is often given to primary care clinicians. Dermatologic episodic visits comprise between 15% and 25% of all primary care visits (Beecher et al., 2018; Seiverling et al., 2019). Despite adequate opportunities, the accurate diagnoses of skin lesions, avoidance of unnecessary dermatology referrals, and understanding appropriate biopsy criteria has proven challenging to many primary care clinicians (Augustsson & Paoli, 2019; Fee et al., 2019). One of the reasons primary care clinicians find dermoscopy difficult is because of lack of access to equipment such as dermatoscopes. Another reason is because most are not properly trained to use dermoscopy. Formal dermoscopy training is recommended for primary care clinicians in order to improve patient care and assist with early diagnoses and treatment of melanoma and other skin cancers. (Holmes et al., 2018; Seiverling et al., 2019; Wolner et al., 2017).

Training in dermoscopy and its continued use has been shown to help clinicians to diagnose skin cancer more accurately and reliably (Chappuis et al., 2016). Dermoscopy increased clinician confidence when encountering skin lesions and reduced dermatological referrals. Primary care clinicians that have dermoscopy skills are better able to provide patients with suspicious skin lesions that are benign with reassurance and those with malignant lesions with access to more timely care, which may be crucial for cancer survival (Jones et al., 2019). Research has shown that dermoscopy training programs have improved skin lesion diagnostic accuracy, overall patient outcomes, and confidence among primary care clinicians (Augustsson & Paoli, 2019; Fee et al., 2019; Robinson et al., 2018). Instructing primary care clinicians in the

use of dermoscopy would be a cost-effective intervention (Holmes et al., 2018; Jones et al., 2019; Koelink et al., 2014.)

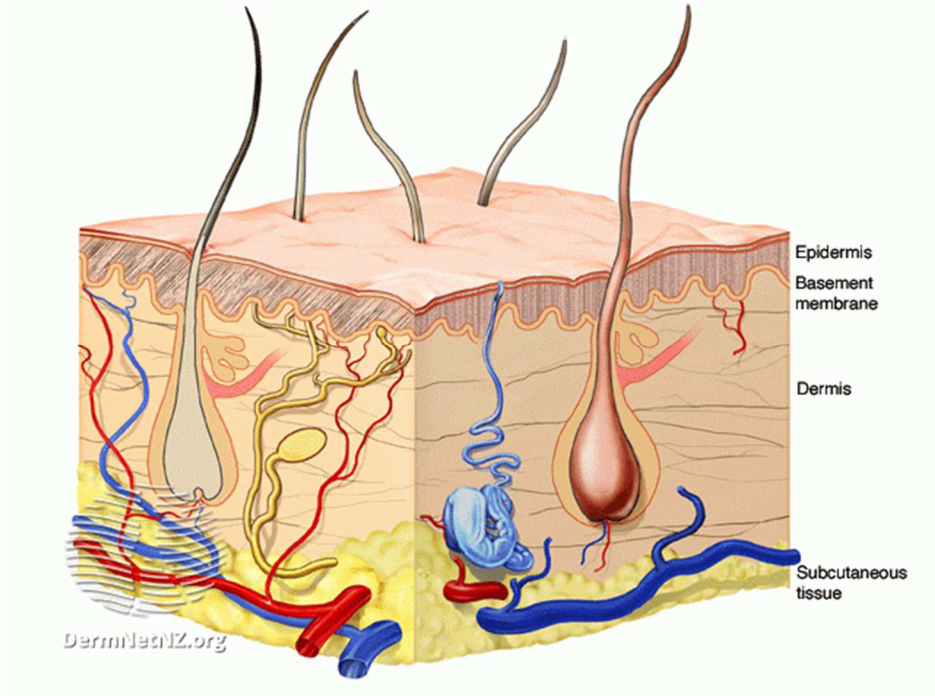
Dermoscopic Examination and Characteristics

Pigmented lesions are what dermoscopy primarily assists to diagnose but can also be used to assess lesions with little to no pigment (Marghoob & Jaimes, 2019). Regardless of dermoscopic instrument used, the overall goal is to eliminate skin surface reflection. Eliminating surface reflection allows for the visualization of deeper structures and colors that are necessary for accurate diagnosis. When an immersion fluid is used as an interface, polarizing filters or a glass plate are affixed directly to the stratum corneum skin layer. This combination eliminates skin surface reflection but is often more cumbersome to use in the clinic setting. Another method utilizes a noncontact dermoscopic instrument that uses polarized light in a process called cross polarization is method used most. In this method, the cross-polarized filter blocks the portion of the light that reflects off the skin surface but allows the light reflecting off deeper structures to pass through.

Colors seen with dermoscopy include red, blue, black, yellow, grey, and white (Marghoob & Jaimes, 2019). Different types of tissue represented by the previously listed colors represent include keratin appearing as yellow, blood appearing red, and white representing collagen and tissue depth (Holmes et al., 2018). The other colors of blue and grey are representative mostly of melanin and suggest pigment and tissue depth. As a rule, black represents melanin in the stratum corneum (superficial layer), brown when in the epidermis, and blue or grey when located deepest in the dermis. Figure 1 provides an illustration of normal skin structure.

Figure 1

The Structure of Normal Skin



Note: Reprinted from DermNet NZ: All about the skin, with permission from DermNet New Zealand.

Structural features will vary slightly depending upon the lesion being observed. BCC usually includes the absence of a pigmented network (Kato et al., 2019). BCC lesions often include bluish gray ovoid nests and globules, spoke wheel areas, leaf-like areas, ulcerations, erosions, and shiny white blotches (Marghoob & Jaimes, 2019). Vascular patterns such as arborizing vessels, short fine telangiectasis, and milky pink backgrounds have been seen (Kato et al., 2019). All the previously listed vascular structures were more commonly seen in superficial BCCs than in nodular BCCs. Figure 2 illustrates an image of basal cell carcinoma as seen through a dermatoscope.

Figure 2

Dermoscopic Image of Basal Cell Carcinoma of the Face

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SCC also has specific dermoscopic structures and vascular features to help distinguish them from other lesions. Usually, SCC lesions contain a combination of white or brown circles, rosettes, white halos, white or yellow scales, and brown dots or globules aligned radially (Marghoob & Jaimes, 2019). They might contain glomerular vessels, hairpin vessels, and linear-irregular vessels (Kato et al., 2019). Ulceration is also common in SCC lesions. Vessels contained in more than half of the visible tumor that are diffusely distributed increase the possibility of SCC that is poorly differentiated. Figure 3 offers an example of SCC dermoscopic characteristics.

Figure 3

Dermoscopic Image of Squamous Cell Carcinoma

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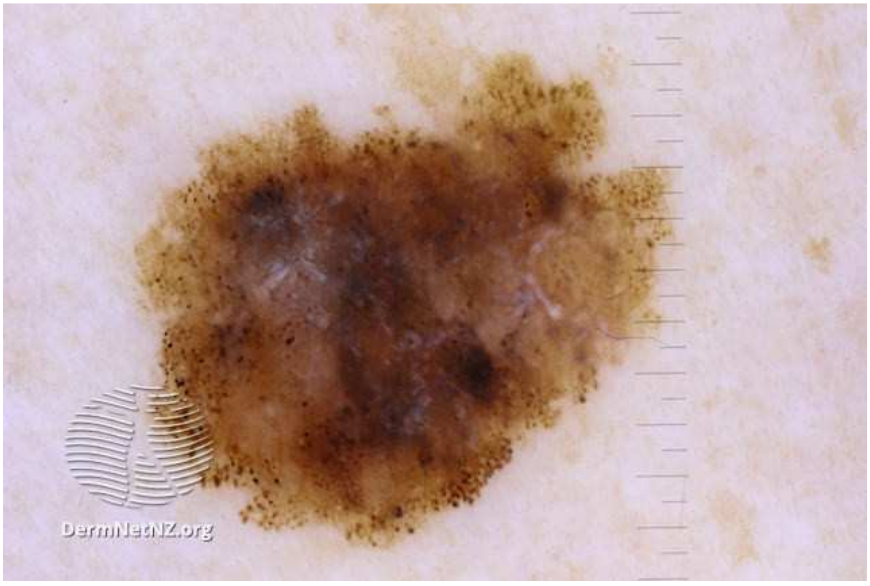
Melanomas are skin cancer lesions that have the most potential for fatal metastasis. Features of melanoma to be especially familiar with include an atypical network of pigment known as the blue, white veil, dots and globules, and atypical vascular pattern (Marghoob & Jaimes, 2019). The previously listed features can be seen in Figure 4. Irregular streaks and angulated lines that create zigzag patterns or polygons are also common. Diffuse polymorphous vasculature including serpentine and glomerular vessels are often present (Wolner et al., 2017). Pseudopod structures and radial streaming that are distributed asymmetrically around the borders of superficial spreading melanoma are a common finding. Regression structures are also common and consist of peppering granularity with scar-like depigmentation.

Figure 4

Dermoscopic Image of Melanoma



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Although skin cancer lesions are most important to identify correctly understanding the dermoscopic characteristics of common precancerous lesions like AK and BD is also helpful. Dermoscopic characteristics of AK lesions are demonstrated in Figure 5 and BD lesions in Figure 6. AK lesions often have a strawberry pattern of fine wavy vessels over an erythematous base surrounded by a white halo (Wolner et al., 2017). Dilated hair follicles of different sizes and white scales are also seen in most AK lesions, as well as brown, curved double lines in pigmented AK lesions (Kato et al., 2019). Common features of BD included glomerular vessels and scaly surfaces with white-yellow pigmentation. The periphery of BD lesions often includes streak-like or leaf-like structures that contain pigmented globules which do not converge toward the center. Other features often found in the periphery of BD lesions include parallel pigmented edges and clusters of brown structureless area.

Figure 5

Dermoscopic Image of Pigmented Actinic Keratosis

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Figure 6

Intraepidermal Carcinoma Dermoscopy

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Clinicians should also be familiar with lesions that have no likelihood of cancer but may present with similar features as either cancerous or precancerous lesions. Seborrheic keratosis

(SK) lesions have an abundance of keratin and epidermal papillomatous overgrowth (Marghoob & Jaimes, 2019). SKs have at least three milia-like cysts, moth-eaten borders, comedo-like openings, and fingerprint-like structures as seen in Figure 7. SK lesions also have fissures and ridges that create a cerebriform pattern with white halos that surround hairpin vessels. Angiomas and hemangiomas are either red, purple or blue-black lagoon like-structures with well demarcated borders (Marghoob & Jaimes, 2019). Dermatofibromas often closely resemble melanoma lesions and often display pigmented networks near the perimeter with shiny white lines, ring-like globules, and a scar-like area near the center (Marghoob & Jaimes, 2019). Dermoscopic characteristics of dermatofibromas can be seen in Figure 8.

Figure 7

Seborrheic Keratosis Dermoscopy

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Figure 8

Dermoscopy of Dermatofibroma

Note: Prominent central white area: dermatofibroma. Reprinted from DermNet NZ: All about the skin, with permission from DermNet New Zealand.

Dermoscopic Algorithms

Algorithms and dermoscopic criteria have been used since the early 1990s to assist with clinical decision-making of whether the lesion should be biopsied or if the patient should be referred to dermatology. Argenziano et al. (2003) first developed a basic 2-step dermoscopic algorithm that can be reliably used by both novice and expert dermoscopy users. The first differentiates nonmelanocytic from melanocytic lesions (Wolner et al., 2017). In this first step, the lesion is examined for structures typical of melanocytic lesions (Marghoob & Jaimes, 2019). If no melanocytic features are found, the presence of BCC, SCC, precancerous lesions (AK and BD) and noncancerous lesions (angiomas/hemangiomas, seborrheic keratosis, dermatofibromas) are ruled out. When the previous types of lesions are confidently ruled out, the lesions are then examined for the presence of blood vessels which can assist in confirming if the lesion is a melanocytic tumor.

The second step of the algorithm is used when the lesion has been classified as melanocytic (Marghoob & Jaimes, 2019). This step helps differentiate a nevus from melanoma or other suspicious lesions. Lesions that are not able to be differentiated as either nonmelanocytic or melanocytic are categorized as featureless or nonspecific and must also be analyzed in this second step. Four additional algorithms are used frequently to assist clinicians to differentiate lesions in this second step: pattern analysis, the ABCD rule, the seven-point checklist, the Menzies method (Kato et al., 2019; Wolner et al., 2017). The first in that list, pattern analysis, contains the highest sensitivity and specificity for diagnosing melanoma with 83.7% and 83.4% respectively (Argenziano et al., 2003). However, pattern analysis is most often used by dermatological experts because of its complexity. Since this project focuses on teaching dermoscopy to clinicians with no or minimal prior experience, this pattern analysis will not be considered in this content.

Newer dermoscopy users tend to favor the other three methods because of their ease of use, so the discussion of their concepts will take place below. The other three algorithms still showed the same level of sensitivity as pattern analysis, but with 10% less specificity than the pattern analysis algorithm (Argenziano et al., 2003; Marghoob & Jaimes, 2019). Other novel methods that were specifically designed for assisting beginners to learn dermoscopic patterns that will be discussed are the triage amalgamated dermoscopic algorithm (TADA) and three-point checklist.

ABCD Rule of Dermoscopy

The ABCD rule is one of several dermoscopy algorithms that uses several features to quantify a lesion's overall structure and organization (Carrera et al., 2016). Based on this method, pigmented lesions are evaluated based on the following four criteria: asymmetry, border

sharpness, lesion color, and dermoscopic features (Marghoob & Jaimes, 2019). Each of the four criteria are assigned a score based on dermoscopic features present. The scores are then individually calculated and multiplied by a specific weighted factor, followed by a totaling of the final criterion numbers. This final number, known as the final dermoscopy score, can range from one to 8.9. Lesions are most likely benign if they contain a score less than 4.75, suspicious if between 4.75 and 5.45, and malignant if greater than 5.45 (Nachbar et al., 1994).

According to this algorithm, asymmetry refers to color distribution or structure contour in either one or two perpendicular axes (Marghoob & Jaimes, 2019). Border sharpness refers to abrupt cutoffs of color between normal skin and the lesion. The presence of white, red, different shades of brown, black, and blue-grey colors are significant with one number being assigned for each color present. Finally, the presence of any of the following structures is also assigned a number: branched streaks, globules, dots, structureless areas that cover greater than 10% of the lesion surface, and pigmented network.

Seven-Point Checklist

Like the ABCD rule, the seven-point checklist algorithm is based on melanoma specific criteria. The ABCD rule contains both major and minor criteria for classifying lesions. The major criteria in this system are blue-white veils, atypical networks, and atypical vascular patterns (Kato et al., 2019). The criteria included the previously listed patterns because they are most indicative of the presence of melanoma (Haenssle et al., 2010). Minor criteria include irregular dots or globules, irregular botches, irregular streaks, and regression patterns. As in the ABCD rule, a score is assigned to the lesion based on the characteristics present, with a final score of three of more suggesting melanomas. Some experts suggest that even a score of one with this algorithm warrants a biopsy. However, the same experts recommend the decision to biopsy

based on a score lower than three should be based on evidence-based reasoning, follow-up availability, and a sequential monitoring approach (Marghoob & Jaimes, 2019).

Menzies Method

As with the previous two methods, the Menzies method was developed to assist a novice user of dermoscopy to differentiate nevi or other suspicious lesions from melanoma (Carrera et al., 2016). The Menzies method include elements of both the previous algorithms. However, some major differences exist between all the methods. The ABCD rule focuses mainly on the overall organization of a lesion and the seven-point checklist concentrates mostly on atypical appearances of structures. The Menzies method focuses on two negative features, which are the presence of only one color and pigmentation pattern symmetry, and multiple positive features (Marghoob & Jaimes, 2019). The positive features in this method include atypical brown dots or globules, regression features, blue-white veil or multiple colors, atypical networks, scar-like depigmentation, pseudopods, and radial streaking. If the two negative features are present, the diagnosis of melanoma can be excluded with high confidence. However, if either one of the negative features is absent and at least one of the positive features is present, then the lesion is considered highly suspicious for melanoma.

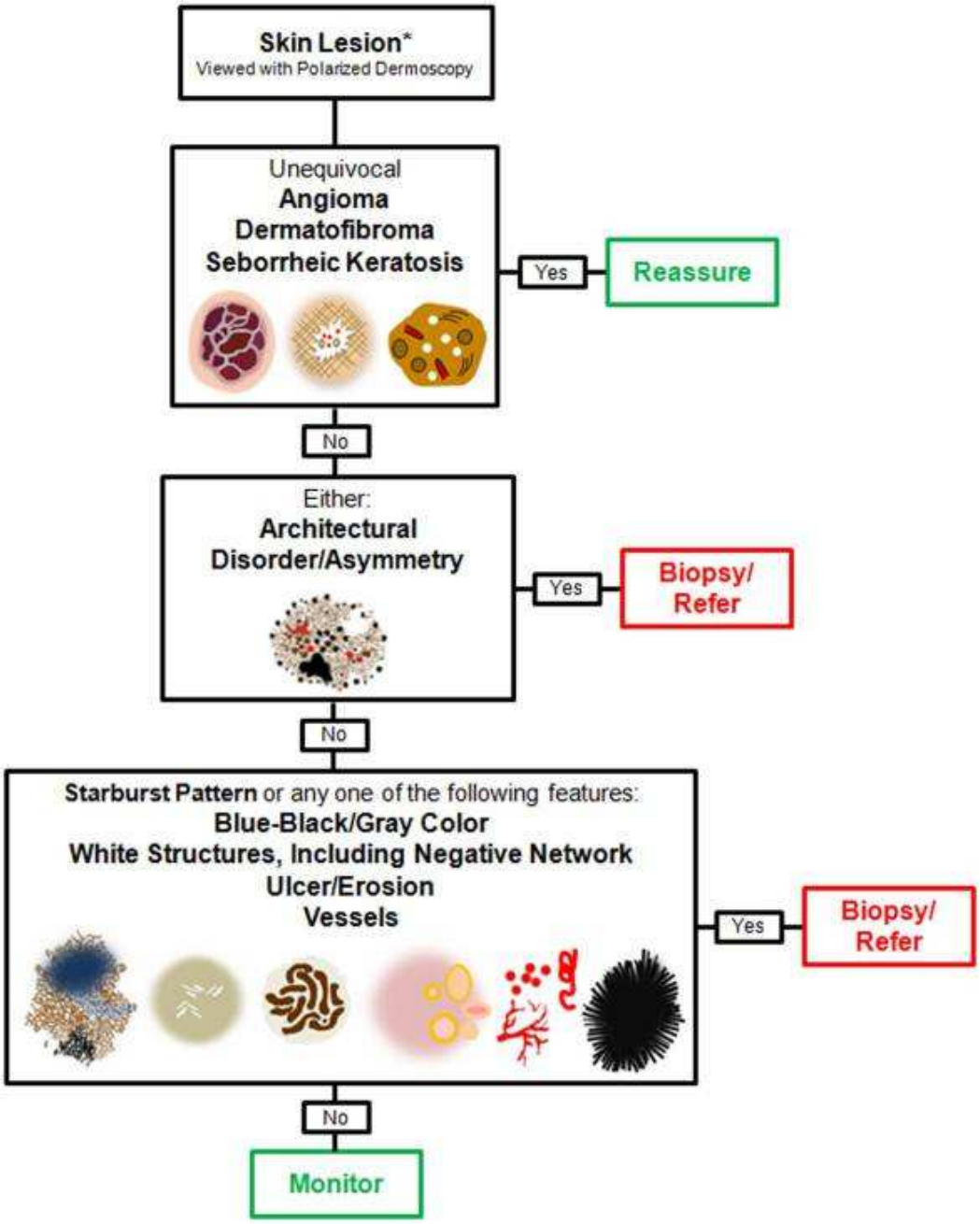
Triage Amalgamated Dermoscopic Algorithm (TADA)

The three-step TADA method was developed specifically to assist beginners to learn dermoscopic patterns and structures. The three-steps are illustrated in Figure 5. Since the task of assigning a diagnosis to suspicious lesions has proven challenging for beginners, the creators of the TADA method have developed a different goal for its use. When performed by non-experts, the end goal of this algorithm will be triage and not diagnosis (Rogers et al., 2017). However, there are some diagnoses that novice dermoscopy users will have to make in the first step of this

algorithm. They must first confirm that the lesion is not an angioma, dermatofibroma, or seborrheic keratosis (Sawyers et al., 2020). Because of that important first step, some recommend focusing attention on teaching the benign lesions during training to improve specificity (Seiverling et al., 2019). Once they have ruled out benign lesions, they must assess for any architectural disorder, which is a strong indicator for malignancy (Rogers et al., 2017). Examples of architectural disorder includes asymmetric or disorganized distribution of colors and structures. The third step involves specifically looking for the following six structures: starburst pattern, blue-black or grey colors, negative networks, ulcerations, or vessels. Studies have found the sensitivity and specificity for this algorithm to be 94.6% and 72.5% respectively (Rogers et al., 2017; Sawyers et al., 2020). The steps are illustrated in Figure 9.

Figure 9

TADA Algorithm



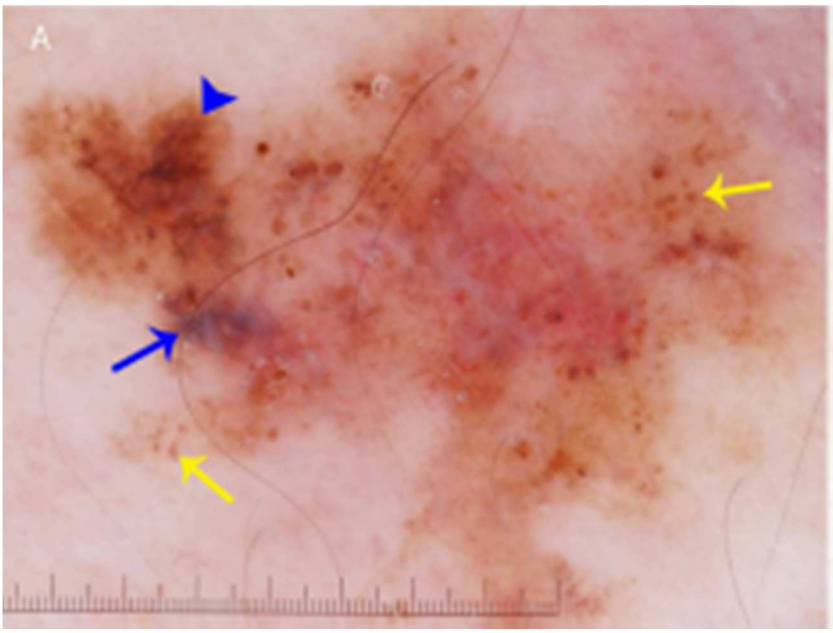
Note: Reprinted from Dermatologic Clinics, 35(4), Wolner et al., 417-437, 2017, with permission from Dr. Ashfaq A. Marghoob.

Three-Point Checklist

This algorithm was specifically designed to encourage novice clinicians to begin using dermoscopy in the primary care setting (Soyer et al., 2012). The primary goal of this algorithm is to assist clinicians to determine whether a lesion needs biopsy, excision, or referral. Three different criteria are evaluated: atypical network, asymmetry of color and structure, and blue-white structures. The presence of two or more of the criteria indicates high likelihood of melanoma and recommends biopsy or excision. Examples of all three criteria can be seen in Figure 10.

Figure 10

Second Dermoscopic Image of Melanoma



Note: Presenting with asymmetry of size and color (yellow arrows), blue-white structures (blue arrow), and atypical network patches (blue arrowhead). Reprinted from Dermatologic Clinics, 35(4), Wolner et al., 417-437, 2017, with permission from Dr. Ashfaq A. Marghoob.

Limitations

Even though dermoscopy enhances a clinician's overall ability to diagnose or triage a suspicious lesion the skill is not without limitations. Some estimates claim between 8% and 10%

of all melanomas have no specific dermoscopic characteristics (Habif, 2016; Holmes et al., 2018). Certain melanomas, such as amelianotic, lentigo maligna, nevoid, or desmoplastic lack established dermoscopic criteria (Habif, 2016). Dermoscopy was not meant to replace clinical examination expertise or experience. To be used effectively, dermoscopy requires at least minimal training to provide an advantage over naked eye examinations (Marghoob & Jaimes, 2019). The necessary training can sometimes be difficult for clinicians to find or difficult to provide by health care facilities. Once clinicians are trained to use dermoscopy, they must continue use in practice to hone and retain their skills. However, if the continued use of dermoscopy is present in practice, then the improvements in diagnostic accuracy remain consistent for approximately six months (Augustsson & Paoli, 2019). If the skills are not used in practice, then much like other skills, the ability to use dermoscopy effectively becomes lost.

CHAPTER 3: METHODS

Overall Project Design

This project was designed with the intent to improve practice by increasing primary care clinician knowledge and confidence in assessing suspicious skin lesions using dermoscopy. The overall goal was to assist primary care clinicians with identifying malignant lesions utilizing dermoscopic techniques and triage suspicious lesions appropriately.

Implementation Plan

The components of the project were showcased using a logic model (Appendix I). The components include inputs, outputs, activities, short-term outcomes, and long-term outcomes. Logic models can be used by the clinic to compare the overall cost of the education program to benefits and determine if the program was worthwhile. A summary of the Iowa Model of Evidence Based Practice (IMR) and how the framework guided this project will be explained in the following paragraphs.

The Iowa Model of Evidence-Based Practice

Despite several revisions since its development in 2001, The IMR (Appendix C) remains a valid practice-oriented guide for the EBP process (Iowa Model Collaborative, 2017).

Step 1: Selection of a Topic

The first key action towards making meaningful change in practice is identifying a problem or an improvement opportunity (Melnyk & Fineout-Overholt, 2019). This step helps guide the exploration of solutions to the problems identified or creative ways to improve practice (Peters, 2020). The review of literature identified that skin cancer mortality rates are increasing, despite many primary or secondary interventions being implemented (Chen et al., 2018; Cunningham et al., 2019; Gaetano et al., 2009). An overarching theme was that rural populations

struggle to obtain access to health care that matches the quality of their urban counterparts. An overall lower quality of health care is consistently delivered globally throughout rural areas as opposed to urban areas. Rural health inequality is often because of limited resources, lagging disease management practices, and lack of access to specialty clinicians (Feng et al., 2018). Due to rural health inequalities skin cancer survival rates and primary prevention strategies have been worse in rural populations. Since rural populations lack access to specialty clinicians, such as dermatologists, calls for changes in primary care settings need to be made.

Early detection of skin cancer can be completed in a cost-effective manner and provide better survival outcomes (Chappuis et al., 2016; Geller & Swetter, 2019; Jones et al., 2019). Primary care clinics can help relieve the strain placed on rural communities related to the lack of access to specialty clinicians by assisting rural primary care clinicians with learning dermoscopy. The methods learned can be used to decrease dermatology referrals and improve skin cancer survival rates and care quality in rural areas through early and accurate detection (Augustsson & Paoli, 2019; Fee et al., 2019; Koelink et al., 2014).

Step 2: Team Selection

With the improvement goal identified, the next step was to choose a team to guide the project as well as assist with intervention development, implementation, and evaluation and dissemination of results. Members may have included practice or facility stakeholders, nurses, physicians, interdisciplinary colleagues, topic experts, and other advanced practice providers. Committee members for this project were selected according to the previous criteria and include professionals proficient in primary care practice and clinical research methods. The committee chair, an assistant professor of the Doctor of Nursing Practice program at North Dakota State University (NDSU) who has previous knowledge of the selected topic and extensive experience

in both rural and urban emergency and critical care settings. Another committee member, a faculty member at NDSU as well as a practicing nurse practitioner (NP) in rural primary care. Another NDSU faculty member was chosen as a committee member due to their knowledge pertaining to the selected topic as well as expertise and experience in nursing research. The graduate appointee also had previous experience in relation to the selected topic, and additional knowledge in research and statistics.

Steps 3 and 4: Locate and Analyze Evidence

Several search terms and electronic databases were used to collect the evidence that supports this project and its intervention. Textbooks and a health librarian also assisted in locating information for the review of literature. The databases used were PubMed, CINAHL, Web of Science, and Cochrane. The search terms used to identify articles within the databases were (“rural health” OR “rural population”) AND (dermoscopy OR "skin cancer"). Other search terms used include melanoma, basal cell carcinoma, squamous cell carcinoma, ABCDE rule, Menzies method, pattern analysis, actinic keratosis, Bowen’s disease. Only articles that were published within the last ten years (unless the studies were landmark studies that stretched back further), written in the English language, and had full text options were evaluated. Abstracts were read for each article retrieved to determine relevance and only the most applicable articles were included in this review. The Cochrane Database was also used to collect evidence for this project. The only search term used while searching the Cochrane Database was “dermoscopy” and there were no exclusion criteria included in this search.

After the data were retrieved, the IMR required that the evidence be evaluated and synthesized. This process involved ensuring that each piece of evidence used is of high quality and appropriate to the topic being investigated. The evidence should also ensure that the

intervention being implemented is feasible in the practice setting used, and that the benefits of the intervention outweigh its risks.

Steps 5 and 6: Design and Implement

An intervention was designed based on the data and information gathered by the team to assist with implementing practice change. Augustsson and Paoli (2019) demonstrated how the use of a one-day dermoscopy training seminar improved the diagnostic accuracy of primary care clinicians and shown to be feasible. An educational seminar was developed to allow providers to review and learn the basics of common skin cancers, skin cancer prevention, screening strategies, and dermatoscope use. The educational seminar allowed the clinicians to practice using a dermatoscope to identify the differences between malignant and non-malignant skin lesions. Participation in the educational seminar was voluntary. Evaluation of the intervention's effectiveness will be completed using a pre- and post-implementation survey via Qualtrics. The data collected from the evaluation tool were statistically analyzed, and a plan was made on how to disseminate the conclusions about the analysis.

Setting and Sample

This PIP was implemented at a federally funded institution located in North Dakota. The health care facility's primary care department offers disease prevention and chronic disease management services to patients living in both urban and rural settings. Rural areas this clinic serves include eastern North Dakota, western Minnesota, and northeastern South Dakota.

The nonrandom purposive sample consisted of all willing providers practicing in the primary care department. The target population included 16 physicians, 12 NPs, and nine physician assistants (PA). The previously listed clinicians were most involved with the diagnosis and treatment of skin lesions compared to providers from other service departments. Inclusion

criteria was limited to primary care clinicians employed in the previously mentioned primary care service department. Exclusion criteria included every clinician not employed by the facilities primary care department as well as children or anyone under the age of 18.

Recruitment

The participants invited to participate were clinicians from the facility's primary care department. Implied consent was assumed of the participants by voluntarily accepting the invitation to attend and by participating in the education seminar. Recruitment took place after internal review board (IRB) approval during the summer of 2021. The recruitment of willing primary care clinicians to participate in the education course was done through verbal explanation of the project, and assistance by the facility's liaison contact. Email recruitment was also be used. All participants were made aware of the purpose, details, and benefits of the education seminar as described in the invitation email (Appendix J).

Protection of Human Subjects

Participation in the pre- and post-seminar survey was voluntary and participants could opt out of completing the surveys without questioning. Participation in the PIP included minimal risk. Precautions were taken to abide by the Center for Disease Control and Prevention guidelines to help ensure safety from COVID-19 exposure during the education seminar. One way this was completed was by presenting the seminar virtually and having clinicians participate by observing the presentation alone in their respective offices. Participants were made aware of pandemic precautions prior to attending, and by voluntarily accepting the invitation to attend, the risk was assumed by the participants.

Confidentiality of participants was secured by not including personal identification such as name and date of birth on the pre- and post-seminar surveys. All data obtained were reported

as cohort data. The pre- and post-seminar surveys were developed in Qualtrics and sent out via email to each of the individual participants. Only the principal and co-investigator had direct access to the online data results, which were and continue to be kept on a password protected computer.

Institutional Review Board Approval

IRB approval (Appendix A) through NDSU for the PIP was obtained after the co-investigator's dissertation proposal meeting and approval by the project committee. The participating facility provided approval for the presentation through their research and primary care departments.

Evidence-based Project Interventions

Written educational resources and an education seminar using evidence-based practice guidelines were developed. A one-hour virtual education seminar was conducted which contained information regarding skin cancer characteristics, application of the ABCD rule and three-point checklist, and dermatoscope demonstration. The dermoscopic algorithms were selected because of their ease of use for novice learners, applicability in the primary care setting, and evidence-based effectiveness (Marghoob & Jaimes, 2019; Nachbar et al., 1994; Soyer et al., 2012). The dermatoscopes used in the training were the 3Gen Dermlite Carbon device and Welch Allyn Episcope Skin Surface Microscope.

Prior to attendance of the seminar, clinician participants read the consent (Appendix K) and consent was implied with the completion of the voluntary pre-implementation survey and attendance of the seminar. Following completion of the seminar, participants completed a voluntary post-implementation survey. The surveys used in this practice improvement project

were previously developed as part of a similar PIP in 2017 and permission for use was obtained prior to project implementation (Appendix F).

Step 7: Clinical Outcomes and Evaluation

The objectives for this project were to enhance primary care clinician knowledge and confidence regarding diagnosis of skin lesions using dermoscopy.

Evaluation of Objective One. Objective one was to develop and implement an in-person educational course that includes practical dermoscopy concepts that can be used in a primary care setting by November 2021. Objective one was achieved by creating an educational handout that includes information regarding skin cancer lesions and dermoscopic image characteristics. During the one-hour seminar, demonstration of evidence-based and practical dermoscopy techniques were provided helping to meet objective one.

Evaluation of Objective Two. Objective two was to increase primary care provider knowledge and confidence in identifying both benign and malignant skin lesions using dermoscopy by November 2021. Objective two was assessed by measuring the change in self-perceived knowledge and confidence using a pre and post seminar survey (Appendix G & H respectively). Analysis of the data included measures of descriptive statistics.

Evaluation of Objective Three. Objective three was to increase the use of dermoscopy in the primary care setting by February 2022. The third objective was met by assessing the use of dermoscopy pre and post implementation via a Qualtrics survey. The post survey was administered immediately and three months after the conclusion of the seminar.

Conclusion

The overall goal of this PIP was to help address the lack of training and utilization of dermoscopy by primary care clinicians. This project was designed with the intent to improve

practice by increasing primary care clinician knowledge and confidence in assessing suspicious skin lesions using dermoscopy. Project participants were given basic dermoscopy education along with written educational resources to support their continued use of techniques in the clinic setting. The interventions, based on evidence-based practice, were implemented with the goal of improving the overall quality and of care delivered by the participating facility's primary care providers and increasing access to dermatology care for the patients they serve.

CHAPTER 4: RESULTS

Adjustments to the Project Design

Due to the COVID-19 pandemic, several adjustments were made to the original project design. The original project design was to conduct two in-person one-hour dermoscopy education seminars. Education sessions included time within the seminar for participants to practice with dermatoscopes in the presence of the co-investigator to allow for questions. However, due to implementation site presentation limitations and current COVID-19 restrictions, one virtual presentation using Microsoft Teams was allowed by the implementation site. The participants were allowed to practice with dermatoscopes that were available in a procedure room within the site's primary care department for three months after the presentation, which was not observed by the co-investigator.

Implementation and Survey Information

The implementation period of the PIP described previously began on September 10, 2021 and concluded on December 14, 2021. The project was conducted at an urban primary care clinic in eastern North Dakota that also serves residents of rural areas. The participants of the project included primary care clinicians employed at the facility. Of the 37 clinicians invited, 30 attended the education seminar. Participation in the project was voluntary. Pre-implementation surveys were sent to all invited participants one week prior to the implementation period. Post-implementation surveys were sent to all invited participants immediately after and three-months after the education seminar. Each survey was allowed to remain open for one week after being sent and participation in the surveys was also voluntary. Surveys were sent from the co-investigator's work email from within the implementation site to avoid surveys being sent to participant's junk email folders.

Sample Demographics

Sixteen physicians, twelve NPs, and nine PAs were invited to participate in this project. Of those invited, twelve physicians, ten NPs, and eight PAs attended the education seminar. The years of practice experience among participants ranged from less than one year to greater than 20 years. Five physicians, one NP, and three PAs responded to the pre-implementation survey. Six physicians, one NP, and two PAs responded to the survey immediately sent after the seminar. Three physicians, zero NPs, and two PAs responded to the survey sent out three months after the seminar.

Data Analysis and Results

The pre- and post-implementation surveys consisted of several Likert scale questions with the response choices of strongly disagree, disagree, neutral, agree, and strongly agree. In addition to the statements asking about different levels of agreement, three other questions were included that assessed participant's prior dermoscopy education, perceived level of dermoscopy expertise, and perceived barriers to using dermoscopy in practice. The first two of the questions were multiple choice, and the last was an open-ended question. Both the pre and post surveys included the same questions except that the post-implementation survey included one additional question asking participants if they attended the dermoscopy education seminar on September 10, 2021. If they had not participated, they were redirected to the end of the survey and not included in the data analysis. Qualtrics was used to perform non-parametric statistics on the data collected and several bar graphs used to visually represent the data are included below. Each graph below shows what percentage of survey responders strongly disagreed, disagreed, remained neutral, agreed, and strongly agreed with each statement.

Figure 11

Dermoscopy Pre-Implementation Survey Results

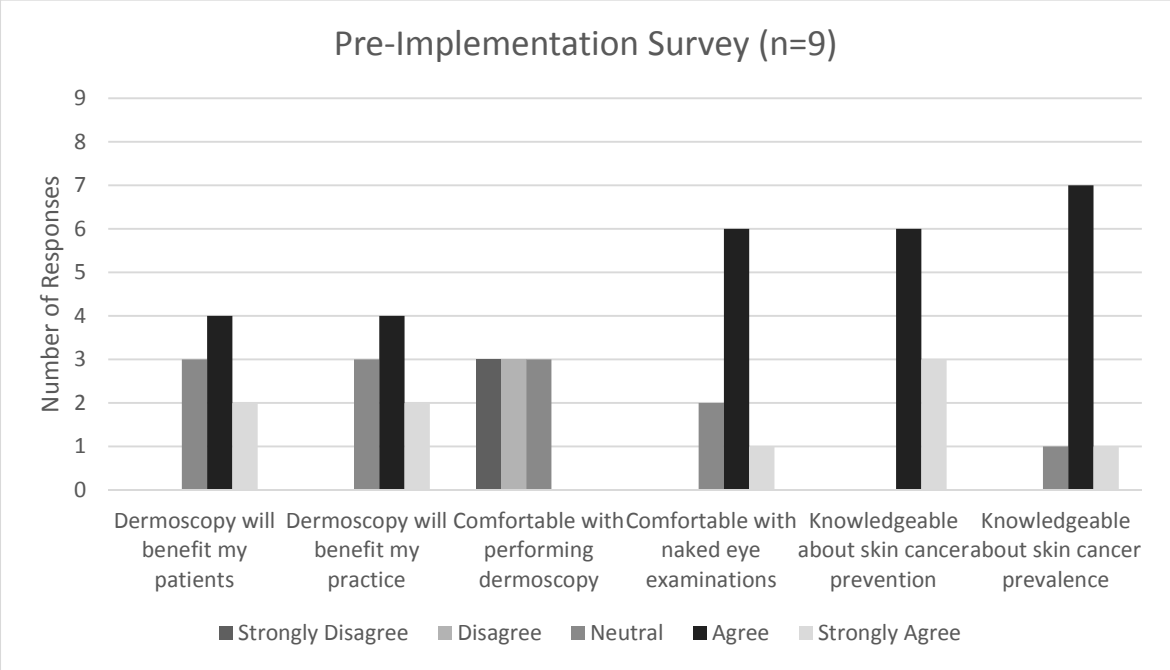


Figure 12

Dermoscopy Post-Implementation Survey Results

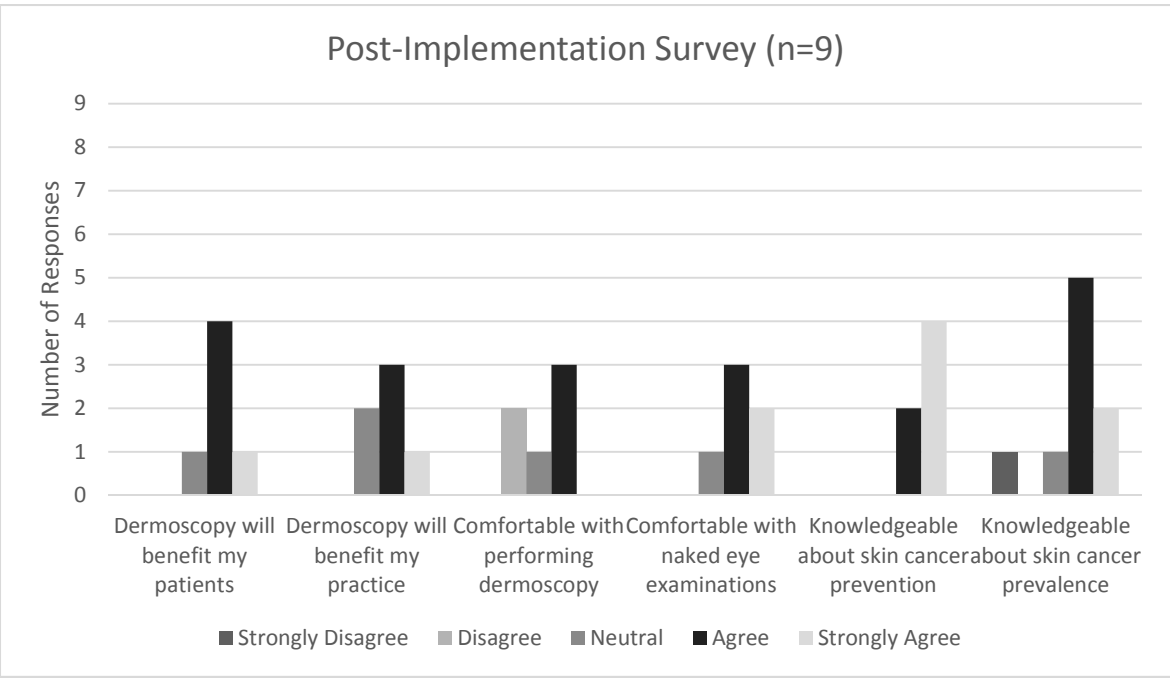
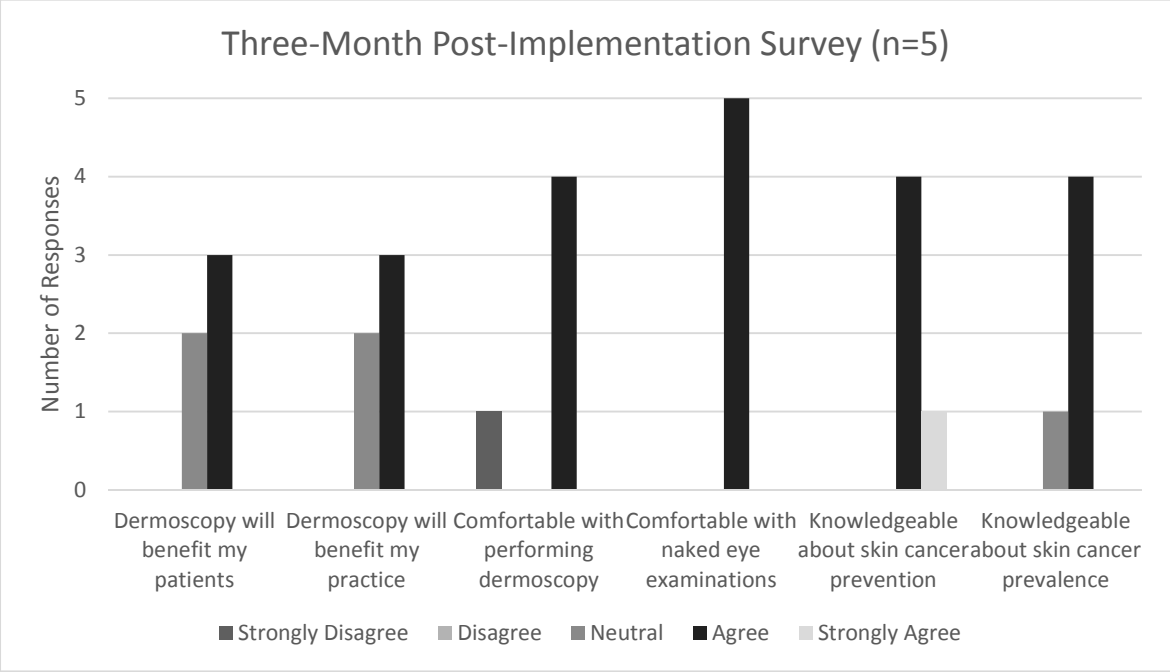


Figure 13

Dermoscopy Three-Month Post-Implementation Survey Results



Statement One

I feel that dermoscopy will benefit my patients. Prior to the dermoscopy education seminar, this statement was used to assess whether clinicians felt that dermoscopy would indeed benefit their patients or not. During the pre-implementation survey, three clinicians felt neutral toward this statement, four agreed, and two strongly agreed. The post-implementation survey showed one clinician feeling neutral, four agreeing, and one strongly agreeing. The three-month post-implementation survey showed two clinicians feeling neutral and three agreeing with this statement.

Statement Two

I feel that using dermoscopy will benefit my practice. This statement was used to assess if clinicians believed that learning and using dermoscopy would positively impact their practice. The pre-implementation survey showed that three clinicians felt neutral to this statement prior to

the education seminar while four clinicians agreed and two strongly agreed. Within one week after the seminar, two clinicians remained neutral, three agreed, and one strongly agreed with this statement. Three months after the seminar, two felt neutral, and three agreed that dermoscopy will benefit their practice.

Statement Three

I feel comfortable while performing dermoscopy. This statement was used to help measure the primary care clinician's comfort level with using dermoscopy before and after a dermoscopy education seminar. Prior to the seminar, no clinicians agreed with this statement, strongly disagree, disagree, and feeling neutral each had three responses from the participants. After the seminar, two clinicians disagreed, one felt neutral, and three agreed that they were comfortable with dermoscopy. Three months after the seminar, one strongly disagreed and four agreed that they felt comfortable performing dermoscopy.

Statement Four

I feel comfortable performing naked eye skin examinations. Naked eye skin examinations are an important aspect of primary care, so the education seminar included information about how to properly perform them. No clinicians disagreed with this statement prior to the seminar, with two feeling neutral, six agreeing, and one strongly agreeing. The post-implementation survey showed one clinician felt neutral toward this statement, three agreed, and two strongly agreed. All five clinicians who responded agreed with this statement three months after the education seminar.

Statement Five

I am knowledgeable about skin cancer prevention strategies. Since skin cancer prevention was discussed in the education seminar, this statement was used to measure the

participant's perceived knowledge level about the strategies. All responders felt knowledgeable prior to the education seminar with six agreeing and three strongly agreeing. Within one week after the education seminar, all responders still felt knowledgeable with two agreeing and four strongly agreeing. Four clinicians agreed and one strongly agreed with this statement three months after the education seminar.

Statement Six

I am knowledgeable about skin cancer prevalence. Skin cancer rates and its many forms were discussed during the education seminar and this statement was used to measure perceived participant knowledge regarding the topics. The pre-implementation survey showed one clinician felt neutral toward this statement, seven agreed, and one strongly agreed. One participant strongly disagreed, one felt neutral, five agreed, and two strongly agreed within one week after the education seminar. One participant remained neutral and four agreed with this statement three months after the education seminar.

Question One

What do you consider to be your current level of knowledge of dermoscopy? This first question was included to assess each participant's perceived level of dermoscopy knowledge. The choices for this multiple-choice question included novice, advanced beginner, proficient, and expert. Novice was defined as someone who performs dermoscopy infrequently or never in practice. An advanced beginner was defined as someone who performs dermoscopy occasionally. Proficient was defined as someone who performs dermoscopy often, and expert clinicians perform dermoscopy nearly every day in practice. Prior to the education seminar, all eight responders to this question considered themselves a novice dermoscopy user. Within one week of attending the seminar, eight clinicians considered themselves novice and one considered

themselves proficient. Three clinicians considered themselves novice and two considered themselves advanced beginner three months after the seminar.

Question Two

If you do not use dermoscopy, please list some of the main barriers to its use below. This question was included to explore reasons why clinicians do not use dermoscopy in practice. Many answers were provided during the pre- and post-surveys and several thematic elements were identified. The themes included lack of access to dermatoscopes, lack of time to complete the screening technique during appointments, and lack of dermoscopy training. These elements correlate well with the findings in the literature (Augustsson & Paoli, 2019; Fee et al., 2019).

Question Three

Have you ever received any prior training in performing dermoscopy and if so, where did your training take place? This question was included to assess if the participants have ever had experience with dermoscopy or opportunities to learn dermoscopy in the past. No clinicians who participated in the pre- or post-implementation surveys responded yes to this question. The three-month post-implementation survey included one response that a clinician had received prior dermoscopy training in the survey. This clinician stated “medical school” in the area designated for clinicians who had respond where their training took place.

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

Summary

Not only is skin cancer the most common cancer in the United States, but skin cancer rates continue to rise (AAD, 2020; SCF, 2020). Increasing rates of skin cancer appear to be found in both rural and urban areas, with rural areas being affected more dramatically (Cunningham et al., 2019). Although primary prevention strategies at controlling skin cancer are ideal, this project focuses on secondary skin cancer prevention strategies. Early detection of SCC, BCC, and melanoma has been shown to improve patient outcomes (Hubner et al, 2018; Kricker et al., 2014). However, many clinicians find distinguishing malignant lesions from benign lesions difficult (Jones et al., 2019).

Dermoscopy is a tool that can be used to classify skin lesions more accurately than naked eye examinations alone when used correctly in conjunction with naked eye examinations (Wolner et al., 2017). This technique has also been shown to increase primary care clinician confidence when encountering skin lesions (Chappuis et al., 2016). Researchers have found that dermoscopy training programs have improved skin lesion diagnostic accuracy and confidence among primary care clinicians (Augustsson & Paoli, 2019; Fee et al., 2019; Robinson et al., 2018). Even when taught in a short one-hour seminar, primary care clinician confidence and knowledge regarding skin lesion diagnosis and dermoscopy has been shown to increase (Hencley, 2017; Lubitz, 2020). However, some of the main reasons primary care clinicians do not use dermoscopy is lack of time, training, and access to dermatoscopes (Chuppuis et al., 2016).

Discussion

The objectives of this PIP will be examined in subsequent paragraphs. Likewise, the framework and methodology of this project will be examined and their effects on project outcomes will be analyzed. Implications of the project on future and current advanced nursing practice will also be discussed.

Objective One

The first objective of this PIP was to develop and implement an in-person educational seminar that included practical dermoscopy concepts that could be used in a primary care setting by November 2021. The seminar would also include an educational hand-out that would be distributed among those who attended. Because the education seminar took place prior to November 2021, this goal was met.

A seminar was developed and implemented in September 2021 that included the necessary practical dermoscopy concepts and included time for questions and practice with dermatoscopes. The educational hand-out included information on skin cancer, naked eye skin examination techniques, as well as the ABCD Method and Three-Point Checklist dermoscopy algorithms. The course was originally meant to be taught in two separate one-hour sessions with a goal of increasing access for the invited clinicians to attend. However, due to the COVID-19 pandemic the seminar was not allowed to be taught in-person at the implementation site. Instead, the seminar was delivered virtually via Microsoft Teams as requested by the site liaison in accordance with site requirements relating to COVID-19 social distancing recommendations. The educational materials were sent to the participants via Microsoft Teams as an attachment the day of the seminar. Participants were allowed to practice with dermatoscopes in a procedure room designated for this purpose by the site liaison one at a time for three months following the

presentation. Also included in the procedure room was the text by Soyer et al. (2012) titled *Dermoscopy: The essentials*, the co-investigator's contact information, the PowerPoint slides used in the education seminar, and the instruction manuals of both dermatoscopes available for practice.

Objective Two

The second objective of this PIP was to increase the primary care provider's knowledge and confidence in identifying both benign and malignant skin lesions using dermoscopy by November 2021. Data used to measure this objective was difficult to interpret. The Likert scale statements one through three were the elements from the surveys used to measure this objective. The statements were the following: I feel that dermoscopy will benefit my patients, I feel that using dermoscopy will benefit my practice, and I feel comfortable while performing dermoscopy. The number of responders to each of the statements were different between each survey used.

Within one week after the seminar, the percentage of survey responders who felt neutral about or agreed that they feel comfortable performing dermoscopy increased to 100% of responders from only 33% prior to the seminar. The three-month post education survey included one responder strongly disagreeing with the statement that they feel comfortable performing dermoscopy, with the other four responders all agreeing they felt comfortable with dermoscopy. The results suggest that there was an increase in those that felt comfortable while performing dermoscopy within one week of the seminar (September 2021), but not necessarily within three-months after the seminar (December 2021). Perhaps the differences in data sets were the result of lack of repetition in practice. Although clinicians were allowed access to dermatoscopes for three months after the seminar, their comfortability with dermoscopy may have been higher

immediately after the seminar, especially if they did not continue using their skills during the three months after their training. Four out of the six responders felt neutral about or agreed with the statement that they felt comfortable performing dermoscopy within one week after the seminar. This is an improvement compared to no responders agreeing and less than half feeling neutral prior to the seminar. In the pre-education, post-education, and three-month post-education surveys, all responders agreed that they felt dermoscopy would benefit both their practice and their patients.

Objective Three

The third objective of this PIP was to increase the use of dermoscopy in a primary care setting by February 2022. The data from the survey that was used to measure the objective came from responses to question one. This question asked what current level of knowledge of dermoscopy each survey responder would categorize themselves. Each answer was given a term with a descriptor that explained how often a clinician of that respective knowledge level might use dermoscopy in day-to-day practice. The responders of the pre-education survey categorized themselves as a novice dermoscopy user, or someone who uses dermoscopy infrequently or never. Most responders of the post-education survey also categorized themselves as a novice user. However, within one week of the seminar, one responder did categorize themselves as an advanced beginner, which was defined as someone who uses dermoscopy occasionally in practice. Three-months after the seminar, three responders categorized themselves as novice dermoscopy users and two categorized themselves as advanced beginner users. This may be attributed to an opportunity for the responders to perform dermoscopy with dermatoscopes during the three months after the education seminar. Another interesting observation is that the co-investigator received an email toward the end of December 2021 from the site's liaison

regarding which dermatoscopes were recommended for primary care clinicians to use in practice. The email was sent because the department's head of purchasing was attempting to purchase at least one dermatoscope for the site's primary care department in response to the requests of multiple primary care clinicians who hoped to start using dermoscopy more in their practice. Information regarding the 3Gen Dermlite Carbon device and Welch Allyn Episcope Skin Surface Microscope were sent to the liaison to be forwarded to those requesting the information. Information on the two dermatoscopes was sent because they were the devices that the clinicians had an opportunity to practice with during the post-implementation period. The primary care population's long-term use of dermoscopy was not evaluated, which is a topic that could be considered for additional or future research.

Project Framework

The framework for this project was guided by the IMR and the DOI theory. The models helped with establishing the project's topic and guiding research, as well as implementation design and evaluation (Iowa Model Collaborative, 2017). The Iowa Model of EBP ensured that specific phases of the project were met before moving onto another phase. This benefitted the project by providing feedback loops that helped with evaluating each phase in order to determine if changes needed to be made before implementation occurred.

Both the IMR and the DOI theory helped to establish dermoscopy as a worthwhile skill to be introduced into a population of primary care providers that serves a rural population. Dermoscopy skill proficiency is worthwhile because the technique has the potential to effectively increase primary care clinician confidence in identifying skin lesions. The DOI theory also calls for the targeting of certain individuals to help diffuse an innovation through a population by showing enthusiasm for the innovation. The individuals who show enthusiasm are known as

innovators or early adopters. Innovators and early adopters are individuals that easily see the established benefits of innovations, encourage others to adopt them, and are usually influential within an organization (Melnyk & Fineout-Overholt, 2019). The implementation site's liaison served this role well as they helped recruit clinician participants, schedule the seminar, and facilitate meetings between the co-investigator and site members which assisted with setting up the virtual presentation. However, site visits and in-person interactions with the primary care clinician population were not allowed because of social distancing restrictions. Additional Microsoft Teams meetings were also not allowed due to scheduling conflicts with other education the primary care department had planned for its clinicians. This made answering questions or giving additional explanations difficult. Only two clinicians reached out to the co-investigator with questions after the seminar. This made establishing additional innovators or early adopters difficult.

The process of adoption as explained by the DOI theory happened in different stages throughout the PIP. None of the pre-education survey responders considered themselves greater than novice dermoscopy users. Because of this, one can assume that most of the knowledge acquisition stage of dermoscopy diffusion, occurred during the education seminar. Stage two, which is persuasion, also occurred during the education seminar. This is because the seminar was the only opportunity for the co-investigator to persuade the participants of the benefits of using dermoscopy. The final stage of the DOI theory is confirmation or adoption. This stage is difficult to determine because data outside of three months post-dermoscopy education is not available for the participants making assumptions about their long-term use of dermoscopy impossible to determine. Should any future projects be used to investigate the long-term use of dermoscopy, both the IMR and DOI theory would work well as project frameworks.

Recommendations

Several recommendations for health care institutions hoping to increase primary care clinician dermoscopy use were developed after the completion of this PIP. One of the questions asked was if a participant did not practice dermoscopy, what were the barriers to use. Much of the data that was gathered from this question was similar to data found in the literature regarding barriers to dermoscopy use in practice. One barrier theme identified was the lack of access to dermatoscopes within the implementation site's primary care department. Based on the findings, the co-investigator recommended that departments who wish to increase this practice amongst primary care clinician purchase a dermatoscope(s). Another barrier theme that was identified was the lack of time in appointments to screen for skin cancer using dermoscopy. Another barrier theme identified was the lack of access to training regarding the proper use of dermatoscopes and dermoscopy algorithms. The barriers identified by the PIP were similar to those found in the literature which also mentioned time, access to dermatoscopes, and lack of training as common barriers (Augustsson & Paoli, 2019, Fee et al., 2019).

The co-investigator recommends that facility administrators support dermoscopy by providing the following: create policies allowing for extra time in appointments for suspicious skin lesion exploration, purchase department dermatoscope, and provide educational opportunities for clinicians to learn dermoscopy. There are many different resources that can be used to learn the dermoscopy techniques and increase dermoscopy knowledge. The co-investigator of this project recommended that clinicians interested in learning dermoscopy purchase a dermoscopy textbook for beginners such as the one by Soyer et al. (2012) titled *Dermoscopy: The Essentials* or attend training conducted at the Annual American Dermoscopy

Meeting. This book was recommended because of its inclusion of step-by-step instructions on one of the algorithms included in the education seminar, the three-point checklist.

Other recommendations were developed that focused on additional dermoscopy research opportunities. Since no assumptions on long-term dermoscopy use among clinicians following a short education seminar could be made, future projects should consider the topic of long-term dermoscopy use to help investigate unknown information. This could include whether or not primary care providers continue using dermoscopy for longer than three months after a one-hour education seminar. Additionally, if others were to perform a similar PIP, the recommendations would include hosting the educational seminar in-person and including site visits, when possible, to stimulate more discussion and hands-on learning among participants. Learners, especially adult learners, often require additional time and the ability to remediate deficiencies before skills can be effectively used (Bienstock et al., 2007). Site visits would have allowed for this additional feedback to occur which may have provided more effective learning. Finally, this PIP also suggests a strong recommendation for primary care clinician training programs to incorporate dermoscopy content in NP, physician, and PA curricula, since most participants in this study had never had formal dermoscopy training in the past.

Dissemination

A peer reviewed poster presentation session was conducted at the North Dakota Nurse Practitioner Association 2021 Pharmacology Conference after implementation of the education seminar but before the data in the project had been gathered or analyzed. The 2021 conference presentation allowed the audience members to learn about the project, educate other health professionals on the evidence behind dermoscopy and how the procedure can benefit clinicians and patients in rural primary care settings.

This project was also included in a health professions student poster session in April 2021 at NDSU and will be included in another of these sessions in May 2022 with an audience of graduate nurse practitioner students, nursing faculty, and undergraduate nursing students. Other future dissemination opportunities include a publication of this PIP. Different publication sources could be a primary care journal or other type of clinical journal that recognizes the benefit of dermoscopy and the benefit of educating clinicians on the procedure. One publication option is *The Nurse Practitioner* journal which offers open access publication through the Wolter Kluwer database. Another publication option is *The Journal for Nurse Practitioners* which offers an open access publishing application process through the Elsevier database. This latter option is particularly attractive because it offers article access to all current members of the American Association of Nurse Practitioners (AANP).

Strengths and Limitations

This project contained aspects that have strengthened the credibility of the project and other aspects that have limited this project's influence.

Strengths

One strength of this project was to help increase access to quality health care for rural patients. As seen from the results of this project and other projects (Hencley, 2017; Lubitz, 2020), dermoscopy has the potential to increase clinician confidence when encountering skin lesions. Dermoscopy also has the potential to reduce dermatological referrals, help avoid unnecessary biopsies and excisions, and expedite the time to treatment if patients do have malignant lesions (Chappuis et al., 2016). Teaching primary care clinicians to use this skin cancer screening technique can help enhance the delivery of increased quality of care to rural patients. Another strength of this project was the amount of interest from the invited clinicians.

Of the 37 clinicians invited to attend, 30 participated in the virtual education seminar. This number of attendees compared to the actual number of invited participants was significant. Although reasons for participating were not provided, one can assume that because participation was voluntary, there was an interest among primary care providers in this topic.

Limitations

One limitation of this project was the number of responders to each survey compared to the actual number of seminar participants. Nine participants (30% response rate) responded to the pre-education survey, nine responded to the post-education survey, and five (16% response rate) responded to the three-month post-education survey. The smaller response rate of the three-month post-education survey may have been related to researcher bias because the co-investigator was not able to be physically present and was unable to complete virtual site visits during the post-education period of the study. Given the small "n" a random sampling of 100% of the target population was used so the survey response rate was the focus rather than sample size. Focusing on the survey response rates rather than the sample size does have drawbacks. One drawback is completed sample size does not correlate directly with statistical power or strength. To go along with this data, each survey contained questions that not all survey responders answered. Although the reasons for this were not given, poor question, statement phrasing, or survey layout may have contributed.

Another limitation was the verbiage used in certain survey questions. As stated previously, question one was included to assess each participant's perceived level of dermoscopy knowledge. Subjective words contained in each answer were used to describe how often the different dermoscopy knowledge levels used dermoscopy in practice, such as infrequently, occasionally, and often. A better strategy may have been to include a range of how many times

the clinicians use dermoscopy monthly. This strategy may have allowed a more objective measurement of how often clinicians were using dermoscopy in practice. This strategy may have also helped assess if the low rates of comfortability with dermoscopy that was seen in the data sets three months after the seminar was due to poor teaching methods or due to the infrequency of dermoscopy use in practice by the individual clinician. Because of this, a recommendation for future research will be to ensure multiple choice survey questions include more objective answers.

A third limitation was because of implementation site email barriers, surveys were not able to be sent to invited participants from the Qualtrics survey program without the risk of getting sent to a participant's junk email inboxes which could have led to poorer survey response rates. Thus, the decision to send the surveys via a direct link from the co-investigator's email address resulted in not being able to send surveys from the Qualtrics program. As a result, individual survey responses were not able to be tracked which would have allowed for clearer assumptions about data. To avoid this issue in future studies, using an individual identifier to track participants responses would be helpful.

Another limitation of this project was the lack of opportunity for site visits by the co-investigator. Although participants were allowed to practice with dermatoscopes for three months following the education seminar, additional virtual site visits did not take place by the co-investigator. This limited the opportunities for questions to be asked by participants or further explanation to take place by the co-investigator.

Conclusion

The significance of this project and application of the project's findings can be applied to the advanced practice nurse's role, especially those in rural areas. Rural residents are more

dramatically affected by cancer, especially skin cancer (Chen et al., 2018; Cunningham et al., 2019). Initial opportunities to detect and diagnose skin cancers are often given to nurse practitioners in primary care settings, with 15% and 25% of all episodic visits comprising of dermatologic visits (Beecher et al., 2018; Seiverling et al., 2019). Dermoscopy is a technique that helps clinicians differentiate benign from malignant lesions by confirming the presence or absence of specific dermoscopic structures (Yélamos et al., 2019). Similar to what this project has suggested, dermoscopy has been shown to improve diagnostic confidence and accuracy among clinicians with minimal training (Augustsson & Paoli, 2019; Marghoob & Jaimes, 2019). Nurse practitioners that have dermoscopy skills are better able to provide patients who have suspicious skin lesions that are benign with reassurance and those with malignant lesions with access to more timely care, which may be crucial for cancer survival (Jones et al., 2019). As a result, rural nurse practitioners equipped with dermoscopy skills can have a major impact on the health outcomes of rural residents.

Advanced practice nurses serve as health care leaders in the communities they serve. Nurse practitioners play a significant role in providing quality healthcare to patients of rural populations, are more likely to practice in rural areas compared to other primary care disciplines and have a responsibility to serve a role in implementing quality improvement principles in the delivery and evaluation of client care (AANP, 2022). They also are trained to use the principle of research in practice. This project has shown how nurse practitioners can use evidence-based practices to increase clinician confidence at identifying skin lesions in both primary care and rural settings. This effect may improve patient outcomes by decreasing time to treatment for those with suspicious lesions and increasing access to care for rural residents.

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APPENDIX A: IRB APPROVAL

NDSU NORTH DAKOTA STATE UNIVERSITY

08/12/2021

Dr. Adam G Hohman
Nursing

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #IRB0003787, "SKIN CANCER SCREENING: IMPLEMENTATION OF DERMOSCOPY IN RURAL PRIMARY CARE"

NDSU Co-investigator(s) and research team:

- Adam G Hohman
- Mitchell Lehn

Approval Date: 08/12/2021
Expiration Date: 08/11/2024
Study site(s): Fargo VA Health Care System
Funding Agency:
The above referenced human subjects research project has been determined exempt (category 1,2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*).

Please also note the following:

- The study must be conducted as described in the approved protocol.
- Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Promptly report adverse events, unanticipated problems involving risks to subjects or others, or protocol deviations related to this project.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

NDSU has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

APPENDIX B. PERMISSION TO USE AND/OR REPRODUCE THE REVISED IOWA MODEL (2015)

Kimberly Jordan – University of Iowa Hospitals and Clinics <survey-

bounce@survey.uiowa.edu>

To: Mitchell Lehn

January 7, 2021 1:30 PM

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* Click the link below to open.

The Iowa Model Revised (2015)

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Citation: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

> In written material, please add the following statement:
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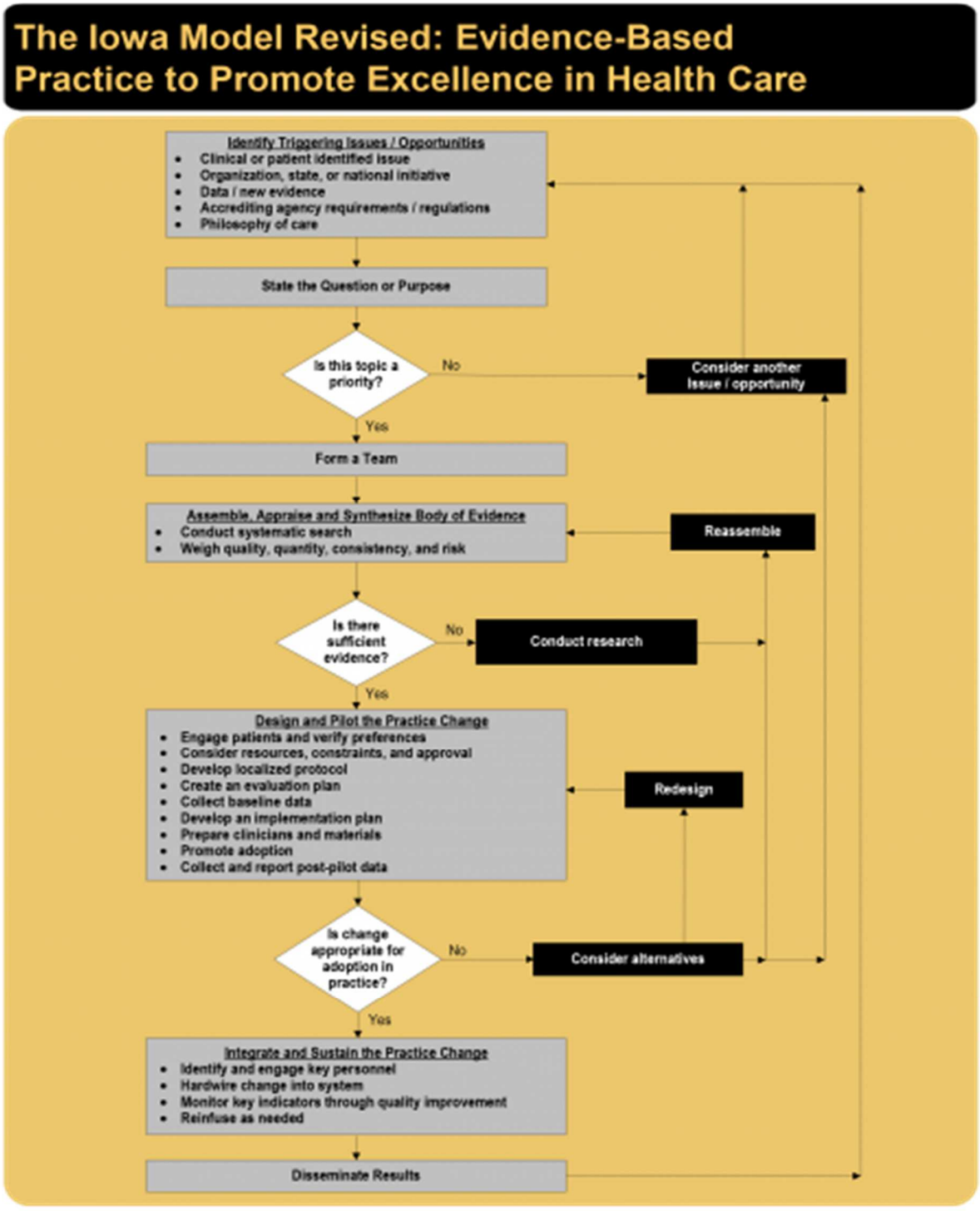
Please contact UIHCNursingResearchandEBP@uiowa.edu or 319-384-9098 with questions.

APPENDIX C: THE IOWA MODEL REVISED: EVIDENCE-BASED PRACTICE TO PROMOTE EXCELLENCE IN HEALTHCARE



(Iowa Model Collaborative, 2017)

APPENDIX D: PERMISSION TO USE DERMNET NZ IMAGES

Contact DermNet <contact@dermnetnz.org>

To: Mitchell Lehn

January 7, 2021 4:20 PM

Thank for your enquiry and interest in DermNet New Zealand images.

You are very welcome to use DermNet NZ's watermarked pictures for personal reasons, for education or for a non-commercial project, providing their source is acknowledged. Please also follow licensing requirements for Creative Commons Attribution - Non-commercial - No derivatives, see more at Creative Commons. For more information please see our image licence.

For commercial, publishing or other purposes we can supply high resolution un-watermarked images for a fee. For details, refer to our image licence where you can download our image application form which shows prices, here's a link to the application form for convenience - https://dermnetnz.org/assets/Image-Application-Form-v8.pdf.

APPENDIX E: PERMISSION TO USE DR. MARGHOOB'S IMAGES

Initial Inquiry:

Mitchell Lehn <Mitchell.lehn@ndsu.edu>

To: Ashfaq A. Marghoob, MD

January 7, 2021

Dr. Marghoob,

I am currently writing my doctoral dissertation on dermoscopy use in primary care. The article you and several other authors wrote in 2017, titled ″Enhancing Skin Cancer Diagnosis with Dermoscopy" that was featured in the journal *Dermatologic Clinics,* contains many images and schematic illustrations that are helpful to those learning to use this technique. May I have your permission to use the images and schematic illustrations from that article in my dissertation?

Thank you for your time and consideration.

Kind regards,

Mitchell Lehn, BSN, RN
Doctor of Nursing Practice Student
North Dakota State University
mitchell.lehn@ndsu.edu

Dr. Marghoob's Response:

Ashfaq A. Marghoob, MD <marghooa@MSKCC.ORG>

To: Mitchell Lehn

January 7, 2021

Good luck. Yes, you have my permission.

Ashfaq A. Marghoob, MD
Attending Physician, Dermatology Service
marghooa@mskcc.org

APPENDIX F: PERMISSION TO USE HENCLEY'S EVALUATION TOOL (2017)

Erin Hencley <email redacted>

To: Mitchell Lehn

January 12, 2021 2:16 PM

Hi Mitchell,

Glad to hear you will be continuing on with my dermoscopy in primary care project! I had a lot of fun completing it, especially the hands on part of teaching techniques to providers in primary care. You of course have my permission to use my evaluation tool in your project. Let me know if anything else is needed!

Erin

APPENDIX G: PRE-IMPLEMENTATION SURVEY

Please fill out the following survey regarding your perceptions and your experience with the use of dermoscopy.

Participation is completely voluntary, yet greatly appreciated.

I am knowledgeable about skin cancer prevalence.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I am knowledgeable about skin cancer prevention strategies.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel comfortable performing naked eye skin examinations.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel comfortable with performing dermoscopy.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel that using dermoscopy will benefit my practice.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel that dermoscopy will benefit my patients.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree

What do you consider to be your current level of knowledge of dermoscopy?

1. Novice (performs dermoscopy infrequently or never)
2. Advanced beginner (performs dermoscopy occasionally)
3. Proficient (performs dermoscopy often)
4. Expert (performs dermoscopy almost every day)

Have your ever received any prior training in performing dermoscopy? Yes or No

If yes, where did your training take place?

What type of primary care clinician are you?

1. Physician
2. Nurse Practitioner
3. Physician's Assistant

How many years have you been practicing?

1. 0 to 5
2. 6 to 10
3. 11 to 15
4. 16 to 20
5. greater than 20

How many years have you been practicing in primary care?

1. 0 to 5
2. 6 to 10
3. 11 to 15
4. 16 to 20
5. greater than 20

If you do not use dermoscopy in practice, please list some of the main barriers to its use below.

APPENDIX H: POST-IMPLEMENTATION SURVEY

Please fill out the following survey regarding your perceptions and your experience with the use of dermoscopy.

Participation is completely voluntary, yet greatly appreciated.

Did you attend the virtual dermoscopy education seminar on Friday, September 10?

I am knowledgeable about skin cancer prevalence.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I am knowledgeable about skin cancer prevention strategies.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel comfortable performing naked eye skin examinations.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel comfortable with performing dermoscopy.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel that using dermoscopy will benefit my practice.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree
I feel that dermoscopy will benefit my patients.	-1- Strongly disagree	-2- Disagree	-3- Neutral	-4- Agree	-5- Strongly agree

What do you consider to be your current level of knowledge of dermoscopy?

1. Novice (performs dermoscopy infrequently or never)
2. Advanced beginner (performs dermoscopy occasionally)
3. Proficient (performs dermoscopy often)
4. Expert (performs dermoscopy almost every day)

Have your ever received any prior training in performing dermoscopy? Yes or No

If yes, where did your training take place?

What type of primary care clinician are you?

1. Physician
2. Nurse Practitioner
3. Physician's Assistant

How many years have you been practicing?

1. 0 to 5
2. 6 to 10
3. 11 to 15
4. 16 to 20
5. greater than 20

How many years have you been practicing in primary care?

1. 0 to 5
2. 6 to 10
3. 11 to 15
4. 16 to 20
5. greater than 20

If you do not use dermoscopy in practice, please list some of the main barriers to its use below.

APPENDIX I: DERMOSCOPY IMPLEMENTATION LOGIC MODEL

Inputs	• Primary care clinician staff • Clinic space to be used as meeting place for dermoscopy teaching • Time for education and practice • Materials (hard copies for all education attendees to be used as references for after the program) • Equipment (dermatoscopes)
Outputs	• Partner with the participating facility leadership • Create rapport/positive relationships with clinicians • Recruitment of clinicians to teach • Develop and conduct educational seminar on the evidence-based practice of dermoscopy • Support clinician success
Outcomes	• Decreased unnecessary dermatology referrals from the participating primary care clinician panel • Increase patient satisfaction with clinic care • Increase clinician confidence with use of dermoscopy • Increase clinician knowledge regarding skin lesion diagnosis and triage
Assumptions	Upon completion of education program, clinicians will: • Integrate dermoscopy into their normal practice • Be supported to continue using dermoscopy by clinic leadership
External Factors	• Space and time limitations • Financial limitations • Clinicians will have different dermatology comfortability and experience at the beginning of the education program

APPENDIX J: RECRUITMENT EMAIL SCRIPT

The following below is the email script that will be sent by Dr. Ottenbacher (facility liason) to the primary care clinician participants prior to my presentation.

Mitchell Lehn will be presenting for our virtual Friday morning education from 0800-0900 on September 10, 2021. The topic will be on dermoscopy and how it relates to primary care. This is also part of a research project he is doing. Although completely voluntary, he asks that you assist with his research by completing a survey prior to attending the Friday morning education session, which will be included in an email he will send prior to presenting. There will also be an attached letter explaining his project and your voluntary participation in more detail in his email.

Thank you,

Dr. Ron Ottenbacher

Assistant Chief of Staff (A/COS) for Primary Care

Fargo VA Health Care System

The following below is the email script that will be sent by me which will also include a link to my pre-implementation survey as well as my consent letter. This email and its contents will only be sent after Dr. Ottenbacher sends his initial email script:

Hello,

As you have probably seen in Dr. Ottenbacher's previous email, I will be presenting for your virtual Friday morning education from 0800-0900 on September 10, 2021. Attached is a PDF that further explains my project. Also, I would appreciate your assistance with this project regarding skin cancer screenings with dermoscopy in primary care.

Before attending the education seminar, I ask that you please complete the survey in the link provided below. All survey responses will be kept confidential. The questionnaire is anonymous and contains no personal identifying items. The survey should take less than five minutes to complete. Completion of the survey will constitute your consent to participate in the survey. Participant information will be used to provide education to healthcare providers.

Thank you so much for your time and assistance with my project.

Regards,

Mitchell Lehn, BSN, RN
Doctor of Nursing Practice Student
North Dakota State University
School email: mitchell.lehn@ndsu.edu
Work email: *email address redacted*

APPENDIX K: PROJECT PARTICIPATION CONSENT

NDSU North Dakota State University
School of Nursing
PO Box 6050
Fargo, ND 58108-6050
701.231.7395

Hello,

My name is Mitchell Lehn. I have been a nurse on 3 Main for seven years and I'm currently in the Doctor of Nursing Practice Program at NDSU. As part of my doctoral degree requirements, I need to complete a project that improves healthcare for patients. During my clinical rotations, I have noted that skin examinations and skin cancer screenings are not routinely performed at annual visits with primary care providers. Because of these observations, I have developed an education seminar meant to inform primary care providers about skin cancer and basic dermoscopy techniques. Studies indicate that skin cancer screenings are performed less often than other routine cancer screenings. Dermoscopy is a technique that along with naked eye examinations can increase skin cancer detection rates and help initiate appropriate interventions for skin lesions. The data gathered from my practice improvement project will help healthcare providers and systems better understand how dermoscopy can improve healthcare outcomes.

I would appreciate your assistance with this project regarding skin cancer screenings with dermoscopy in primary care. Before attending the education seminar, I ask that you please complete the survey in the link provided. All survey responses will be kept confidential. The questionnaire is anonymous and contains no personal identifying items. The survey should take less than five minutes to complete. Completion of the survey will constitute your consent to participate in the survey. Participant information will be used to provide education to healthcare providers. In addition, the survey results may be used in a future publication in a healthcare journal. The project has been reviewed and was approved by the IRB from North Dakota State University on ...

If you have any questions or comments, please feel free to contact: Adam Hohman (**contact information redacted**). If you have questions about the rights of human participants in research, or to report a problem, contact the North Dakota State University IRB Office by telephone at 701.231.8045 or by e-mail at NDSU.IRB@ndsu.edu.

Thank you for your assistance.

Mitchell Lehn, BSN, RN, DNP Graduate Student; North Dakota State University

Adam Hohman, DNP, APRN, FNP-BC; North Dakota State University

APPENDIX L: EXECUTIVE SUMMARY

Background and Significance

New cases of skin cancer and overall skin cancer mortality rates are on the rise in the United States. Rural areas are more dramatically affected by skin cancer morbidity and mortality than urban areas. Many rural areas face significant dermatologist shortages, forcing patients in rural areas to travel long distances and experience long wait times for accurate diagnoses of suspicious skin lesions. However, early detection of skin cancer, especially melanoma, has been shown to improve patient outcomes. Although the USPSTF does not recommend routine skin examinations by clinicians, both the AAD and the ACS recommend either routine skin examinations or the close monitoring of suspicious lesions by primary care clinicians. Dermoscopy is a non-invasive secondary screening technique that has been shown to improve primary care clinician accuracy and confidence in diagnosing skin lesions. This technique can help primary care clinicians help their rural patients to obtain more timely care. Despite the advantages of dermoscopy, most primary care clinicians do not have the skills or resources to use dermoscopy effectively.

Project Design and Results

The purpose of this practice improvement project was to increase primary care clinician comfortability and knowledge regarding dermoscopy use with an overall goal of improving health care quality in rural areas. A one-hour educational seminar that included an informational resource was conducted at a facility that provided primary care services to rural residents. The seminar included information regarding skin cancer rates, dermoscopy algorithms, opinions on the usefulness of dermoscopy, and comfortability with the practice of dermoscopy. Pre- and post-implementation surveys were used to assess the effectiveness of the seminar. Data from the

survey results showed an increase in clinician comfortability and knowledge regarding dermoscopy use after the education seminar as opposed to before.

Recommendations

- The project's results suggest that comfortability and knowledge may have decreased among clinician's three-months after the seminar as opposed to within one week after. Because of this, dermoscopy was recommended to be used consistently in practice in order to maintain and develop the skill.
- Primary care department administrators should support dermoscopy use by providing extra time in appointments for suspicious skin lesion exploration, department dermatoscope purchase, and educational opportunities for clinicians to learn dermoscopy.
- Ensure all future topics include strongly objective answers to any multiple-choice questions used in surveys as well as collecting data for longer than six months after an education seminar.
- Host the education seminar in-person when possible and include dermoscopy content in university curriculums.

Conclusion

When comparing survey results, the data showed an overall increase in skin cancer knowledge, comfort in performing naked eye examinations, comfort level in using dermoscopy, and perceived level of expertise in using dermoscopy after the seminar as opposed to before. Barriers to dermoscopy use, such as time, resources, and training, were identified. Most clinicians surveyed agreed that dermoscopy would benefit both their patients and practice.