DERMOSCOPY EDUCATION TO IMPROVE PROVIDER CONFIDENCE IN SKIN CANCER IDENTIFICATION

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF NURSING PRACTICE

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ABSTRACT

Skin cancer is the most common form of cancer in the United States and is becoming more prevalent each year. Patients often consult their primary care provider (PCP) for initial evaluation of skin lesions, and PCPs typically use naked-eye examination (NEE) to evaluate the lesion. Using NEE alone can yield varying results of accuracy and differential diagnosis. PCPs can utilize a dermatoscope to aid their visual inspection of suspicious lesions.

Dermoscopy, a non-invasive technique for examining skin lesions, has been recognized as an invaluable tool in the early detection of skin cancer. While traditionally used by dermatologists, the need for early identification of skin cancer demands that PCPs utilize dermoscopy to improve patient outcomes. This practice improvement project aimed to increase PCPs accuracy in dermoscopic analysis while improving confidence in performing skin cancer screening and dermatoscope use.

The practice improvement project utilized a pre-training assessment and dermoscopy training that was presented in-person at a primary care clinic in the Midwest and was available online to providers unable to attend in-person. The training was created to equip providers with knowledge of dermoscopy principles, the PASS algorithm, and the ability to differentiate between benign and malignant lesions. Following the training, the clinic was provided with two dermatoscopes, as well as a binder containing PASS algorithm and training references. Providers then had three months to utilize dermoscopy in their clinical practice prior to taking the post-implementation assessment. Pre- and post-assessments were used to gauge the participants' knowledge and confidence levels throughout the project. Project results support literature findings, including actual and perceived improvement in knowledge and confidence of skin lesion identification and triaging.

Continued rise in skin cancer prevalence necessitates PCPs to become more proficient in secondary prevention strategies. The project concluded with the need to advocate for the integration of dermatoscope access and training aimed to equip PCPs with the necessary skills to effectively identify and prioritize skin lesions. By empowering PCPs with the skills to use dermatoscopes in combination with the PASS algorithm, communities can benefit from early detection of skin cancer, fewer unnecessary referrals, and better healthcare outcomes.

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DEDICATION

Mitchell,

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With all my love and gratitude, this work is dedicated to you.

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LIST OF ABBREVIATIONS

AAD.....American Academy of Dermatology Association.

ACS.....American Cancer Society.

AK.....Actinic Keratosis.

APRN.....Advanced Practice Registered Nurses.

BCC.....Basal Cell Carcinoma.

BD.....Bowen Disease.

CDC.....Centers for Disease Control and Prevention.

CPT.....Current Procedural Terminology.

DOI.....Diffusion of Innovation.

EBP.....Evidence-Based Practice.

ED&C.....Excision Electrodesiccation and Curettage.

HPV.....Human Papillomavirus.

MMS.....Mohs Micrographic Surgery.

NDNPA.....North Dakota Nurse Practitioner Association.

NDSU.....North Dakota State University.

NEE.....Naked-Eye Examination.

PCP.....Primary Care Provider.

PWP.....Prediction Without Pigment.

QR.....Quick Response.

SCC.....Squamous Cell Carcinoma.

SCF.....Skin Cancer Foundation.

SK.....Seborrheic Keratosis.

SLNB.....Sentinel Lymph Node Biopsy.

SPFM.....Southpointe Family Medicine.

UV.....Ultraviolet.

USPTF.....United States Preventative Task Force.

W7PCL .....Weighted Seven-Point Checklist.

INTRODUCTION

Background and Significance

Skin cancer is the most common form of cancer in the United States and is becoming more prevalent each year (Centers for Disease Control and Prevention [CDC], 2022). Skin cancers are categorized as being either melanoma or non-melanoma. While non-melanoma skin cancers are more common, melanoma skin cancers are far more life-threatening. Long wait-times and insurance requiring a referral to see a dermatologist, suggests patients are likely to present to their PCP first when they have a lesion of concern. Challenges in patients' access to dermatology services underscore the importance for PCPs to develop proficiency in identifying skin cancer and prioritizing cases for timely treatment, aiming to reduce morbidity and mortality.

Naked eye examinations (NEE) techniques, such as ABCDE rule and "ugly duckling" sign are helpful in lesion identification (Swetter & Geller, 2021). However, with the addition of dermoscopy use, both sensitivity and specificity of skin cancer identification increases. For example, melanoma identification with NEE techniques showed 71% sensitivity and 81% specificity. When NEE is combined with dermoscopy, both sensitivity and specificity increased to 90% (Marghoob & Jaimes, 2022a; Yélamos et al., 2019). Many PCPs are not trained in dermoscopy use and are not confident in their ability to use the tool (Fee et al., 2022; Williams et al., 2020). However, when providers receive dermoscopy training, evidence shows dermoscopy use is beneficial for accurately identifying and triaging lesions of concern (Jones et al., 2020; Marghoob & Jaimes, 2022a).

Problem Statement

Every day, at least 9,500 individuals in the United States are diagnosed with skin cancer. On average, 1 in 5 Americans will develop skin cancer in their lifetime. The increase in skin

cancer rates should prompt providers to focus on primary and secondary prevention of skin cancer by encouraging sun protective measures and assisting in early detection of cancerous lesions (American Academy of Dermatology Association [AAD], 2022). The best way to decrease morbidity and mortality of these cancers is by early detection and treatment (Davis et al., 2019). Early detection can be aided with the use of a handheld tool called a dermatoscope. Unfortunately, many PCPs do not have access to these tools and lack training in the use of a dermatoscope (Williams et al., 2020). If more PCPs are educated on how to use a dermatoscope they would have the potential to properly use this device to contribute to early skin cancer detection.

Purpose

The purpose of this project is to educate PCPs on the use of dermoscopy to increase provider confidence and knowledge when identifying and triaging skin lesions.

Objectives

The objectives for this practice improvement project include:

Objective 1: Develop and implement an educational module on dermoscopy and skin lesion triaging for PCPs at Southpointe Family Medicine Clinic by July 2023.

Objective 2: Increase PCP knowledge in use of PASS algorithm, dermoscopy and identifying and triaging skin lesions over the implementation period.

Objective 3: Improve PCPs confidence in skin lesion identification over the implementation period.

Objective 4: Increase Southpointe Family Medicine Clinic PCPs interest in utilizing dermoscopy following the implementation period.

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Skin cancer stands as the most prevalent form of cancer in the United States, with over 9,500 new diagnoses reported daily (American Academy of Dermatology Association [AAD], 2022). Typically, individuals with concerning skin lesions initially consult their PCP. PCPs commonly conduct skin assessments using NEE alone, leading to potential differential diagnosis inconsistencies due to varying levels of knowledge about skin lesions and differing assessment methods. Implementation of dermoscopy, a technique utilizing light and magnification to improve the assessment of skin lesions, within primary care settings has proven advantageous (Marghoob & Jaimes, 2020). Dermoscopy assists healthcare providers in detecting skin cancer at earlier stages, thereby reducing unnecessary referrals for further examination and biopsies (Fee et al., 2019). Although dermoscopy offers benefits, implementation in primary care faces barriers such as insufficient training, time needed for training and developing proficiency, and expense of dermatoscopes. These barriers, research endorsing the training of PCPs in dermoscopy use, and Diffusion of Innovations theory were considered during the design of this Evidence-Based Practice (EBP) project.

Skin Cancer

Skin cancer typically develops because of exposure to ultraviolet (UV) radiation from the sun. UV exposure changes DNA strands within the skin cells causing abnormal cellular growth. The abnormal cell growth eventually becomes skin cancer (American Academy of Dermatology Association [AAD], n.d.-d). The cell from which the cancer originates determines the type of skin cancer. There are three main types of skin cancer; basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and melanoma, as well as four types of precancerous skin lesions that may develop into skin cancer over time.

Precancerous Lesions

Precancerous lesions develop from long-term damage to the keratinocytes of the epidermis, from UV radiation from either sun exposure or tanning bed use (The Skin Cancer Foundation [SCF], 2022a). Other risk factors for precancers include male gender, fair skin, light eye and hair color, living in geographic locations with higher UV index, and immunosuppression (Padilla, 2022). Precancerous lesions are limited to the epidermis of the skin and may progress to become SCC. An estimated 40 million people in the US will develop precancerous lesions each year (American Academy of Dermatology Association [AAD], n.d.-a).

The four types of precancerous lesions include actinic keratosis (AK), Bowen disease (BD), actinic cheilitis, and leukoplakia (precancerous skin). AKs are the most common precancerous lesions, and because these lesions are caused by exposure to UV rays, they are often found on highly sun exposed areas. AKs are small, have a rough texture, and may vary in color (Habif & McNeill, 2016). Actinic cheilitis are a rough, scaly, or continually dry spot on the lip (Padilla, 2022). BD looks and feels much like an AK, except the lesion is larger in size. Leukoplakia appears as a white spot inside of the mouth, the borders will be raised, and the lesion will have an irregular shape (Natalia, 2022). Leukoplakia may progress to SCC of the mouth, a site of high-risk metastasis for SCC (Caudill et al., 2022).

The human body tries to heal the damage caused by UV exposure and because of this, AKs may regress. However, a lifetime of skin damage is difficult for the body to heal and this may cause AKs to regress and reappear or progress into SCC (American Academy of Dermatology Association [AAD], n.d.-a). Approximately five to ten percent of precancerous skin lesions will continue to develop into SCC. While this is a relatively low risk, more invasive treatment is necessary for treatment of SCC (Berman, 2022).

Basal Cell Carcinoma

BCC originates in the basal layer of the epidermis (American Academy of Dermatology Association [AAD], n.d.-d). Each year in the US 3.6 million BCCs are diagnosed, making BCC the most common type of skin cancer (The Skin Cancer Foundation [SCF], 2021b). While BCCs rarely metastasize, they can be invasive within the dermis at the original site, and destructive of the surrounding skin, soft tissues, and bone. Risk factors for developing BCC include UV exposure, fair skin, light eye and hair color, immunosuppression, radiation therapy, and certain genetic disorders (Wu, 2021).

BCC has many different growth patterns, the most common histological patterns include nodular, superficial, and morpheaform. Nodular BCCs make up 80% of all BCCs. Nodular BCCs may have raised edges with central indentation, or they may appear as a pink or flesh-colored papule. The lesions typically have a shiny or pearly appearance and may have surrounding superficial blood vessels (Wu, 2021). Sometimes lesions will look like a pimple, or a sore that does not heal (Habif & McNeill, 2016). Superficial BCCs account for 15% of all BCCs. Superficial BCCs typically appear on the trunk and appear as a pink or red scaly macule or plaque. When illuminated they may have a pearly appearance like a nodular BCC. Approximately five to ten percent of BCCs are morpheaform. Morpheaform BCCs often have poorly defined borders, with a smooth texture and can be light pink or the same color as the patient's skin (Wu, 2021).

BCCs are typically very slow growing, making them easily treatable when found early. Depending on type, site, and size of the cancer BCCs are treated with surgical intervention such as, Mohs micrographic surgery (MMS), excision, electrodesiccation and curettage (ED&C), or cryotherapy (McDaniel, 2022).

Squamous Cell Carcinoma

SCC originates in the flat cells of the epidermis called squamous cells (Lim & Asgari, 2022b). SCC is the second most common skin cancer type, and accounts for about 20% of all non-melanoma skin cancers (The Skin Cancer Foundation [SCF], 2021b) SCC also accounts for 20% of all skin cancer deaths. After metastasis has occurred, SCC is estimated to have a 70% mortality rate (Caudill et al., 2022). Risk factors for developing SCC are similar to that of BCC including UV exposure, age, genetic disorders, and immunosuppression (Lim & Asgari, 2022a).

In light skinned individuals, SCC is usually thickened or scaly, red patch; may appear as a crusted bleeding lesion or warty protrusion, and are most often found in sun-exposed areas such as the head, neck, and hands (Lim & Asgari, 2022a; The Skin Cancer Foundation [SCF], 2019). In darker skinned individuals SCC is more likely to develop in non-sun exposed areas such as inside the mouth, or around the genitals and anus (Lim & Asgari, 2022b). Genital and SCC lesions are rare but are often related to high-risk human papillomavirus (HPV) infection. High-risk HPV types include, 5, 8, 15, 17, 20, 24, 36, and 38 (Lim & Asgari, 2022a, The Skin Cancer Foundation [SCF], 2022).

SCC is less common than BCC, but is more likely to metastasize to lymph nodes, lungs, liver, brain, and bones. SCC is divided further into high-risk and low risk, based on likelihood of recurrence and metastasis. Risk of metastasis is dependent upon where the cancer is located on the body, cellular differentiation, and tumor depth and size (Caudill et al., 2022; DeSimone et al., 2022). High-risk SCC typically occur on the ear, lip, face, hands, feet, or genitals, are at least two centimeters in diameter, 2 millimeters thick, and histopathology will show poorly differentiated cells (DeSimone et al., 2022). Treatment of early-stage SCC includes excision, MMS, ED&C, cryotherapy, and radiation. After metastasis a combination of surgery, radiation, sentinel lymph

node biopsy (SLNB) and chemotherapy may be indicated, as well as more frequent follow up with dermatology and oncology (Shreve et al., 2020). Therefore, early detection is crucial to improving patient outcomes, and decreasing associated healthcare costs of metastasis.

Melanoma

Melanoma is a skin cancer that originates within melanocytes in the basal layer of the epidermis, which are responsible for adding pigment, or darkening the skin. About four percent of all skin cancers are melanoma which is extremely lethal, causing about 75% of all skin cancer deaths (Davis et al., 2019).

Certain risk factors can increase a person's risk of developing melanoma. The only modifiable risk factor for developing melanoma is reducing skin damage, blistering sunburns from UV exposure via sun or tanning beds, and other forms of skin cancer. Risk factors contributing to melanoma that cannot be avoided include having lighter skin color, blond or red hair, having many moles, irregularly shaped, sized, or colored moles, having a weakened immune system, or an inherited genetic predisposition to develop melanoma (American Academy of Dermatology Association [AAD], n.d.-c). Hereditary melanoma is relatively uncommon; however, it is important to assess patients for a family history of melanoma which may indicate a genetic inheritance and make a patient more likely to develop more than one primary melanoma lesion (Davis et al., 2019)

Types of melanomas include superficial spreading type, nodular melanoma, lentigo maligna melanoma, and acral melanoma. Superficial spreading type is the most common and develops within an existing mole or freckle, presenting as a previously stable lesion that is growing; typically, larger than six millimeters in diameter, changing color and borders, or ulcerating. Nodular melanoma will look dome-shaped and may be dark brown, tan, red, flesh

colored, or a combination of colors (Jerant et al., 2000). Lentigo maligna melanoma develops in untreated lentigo maligna which are flat, irregularly shaped lesions with poorly defined borders on sun-exposed skin that have patchy coloring in multiple shades of brown (Xiong et al., 2022). Acral lentiginous melanoma is the least common type of melanoma and appears as a discoloration on palms of the hands, soles of the feet, or a dark line or spot under nails (Jerant et al., 2000). Identifying and screening for melanoma will be discussed further in the following section.

Treatment of melanoma varies based on tumor, node, metastasis (TNM) staging. The eighth edition American Joint Committee on Cancer describes melanoma stages I-IV. Melanoma in situ is commonly referred to as stage 0, is contained within the epidermis. Stage I melanoma is thicker, measuring less than 2mm in thickness, there is no lymph node involvement or metastasis. Stage II melanoma is at least 2mm thick without ulceration present, or at least 1mm thick with lesion ulceration, and still has no lymph node involvement or metastasis (Davis et al., 2019). Melanomas stage 0, I, and II may be treated first with radiation to decrease the size of the lesion, then are treated surgically with excision or Mohs and require the patient to follow more regularly with a dermatologist (American Cancer Society [ACS], 2022). Stage III melanoma has spread to at least one nearby lymph node or has cutaneous satellite melanoma lesions. Stage IV melanoma has spread to at least one internal organ, or distant lymph node (Davis et al., 2019). Most common sites of metastasis of melanoma include muscle, lymph nodes, lungs, liver, brain, and bones (National Cancer Institute, 2020). Treatment of metastatic melanoma varies based on location of metastasis and size of tumors, but may be managed with surgeries as previously discussed, in combination with, SLNB and dissection, radiation, chemotherapy, and/or immunotherapy (American Cancer Society [ACS], 2022).

When detected in stages 0-2 the 5-year survival rate for melanoma is 99%, decreasing to 66% with regional metastasis, and only 27% with distant metastasis (The Skin Cancer Foundation [SCF], 2021a). The significant decrease in survival rate demonstrates how important early detection is in decreasing mortality.

Screening Recommendations

Screening for presence of skin cancer is a secondary prevention method. The first step of screening is regular full-body skin examination and can be performed by the patient or a healthcare provider. The United States Preventative Task Forces (USPTF) last update on this matter was in 2023 and concluded that in asymptomatic patients there was insufficient evidence that the benefits of skin cancer detection outweigh the risk of unnecessary biopsy, which include poor cosmetic outcomes, overdiagnosis, and overtreatment (US Preventive Services Task Force, 2023). However, AAD encourages patients to be familiar with their skin, enabling them to recognize if they have a new mole, changing mole, or mole that does not look like the others, itches, or bleeds, and to report this to their healthcare provider (American Academy of Dermatology Association [AAD], n.d.-b). The American Cancer Society recommends everyone perform self-skin examinations, which assist in the early detection of skin cancer, as well as routine skin examinations by a clinician for high-risk individuals (American Cancer Society [ACS], 2019)

Though USPTF does not currently have recommendations for regular skin examination, some providers do perform a quick examination of patients' skin during their annual exam. Naked eye examination (NEE) is when a clinician does a skin examination without instrumentation.

Screening Methods

Several screening methods have been developed to differentiate between benign and malignant lesions and can be used by patients during a self-skin examination or a provider during NEE. Screening methods do not diagnose the patient with skin cancer but can be used to determine if a lesion is suspicious and should be evaluated further, or biopsied for definitive diagnosis (Swetter & Geller, 2022). ABCDE Criteria, Ugly Duckling Sign, or Glasgow Seven-Point Checklist are methods used while performing NEE; these methods will be discussed in greater detail in the following sections.

ABCDE Criteria

ABCD criteria was developed in the 1980s to aid in the detection of melanoma with the naked eye. This criterion was updated in the early 2000s and is now called the ABCDE criteria. According to this checklist, lesions that are suspicious for melanoma will have features that include (A)symmetry, (B)order irregularity, (C)olor variation, (D)iameter larger than 6 mm, and (E)volution in size, shape or colors (Ward et al., 2017). Evolution also considers the timing of a lesion's onset; new moles or lesions appearing after the age of 40 are suspicious for melanoma. This tool is less reliable when diagnosing nodular melanoma, or melanoma in children and adolescents (Swetter & Geller, 2022).

The more criteria a lesion meets, the more specific the tool is to suggesting melanoma. A retrospective study conducted in France showed 100% sensitivity and 43% specificity when all five criteria of ABCDEs were present. In contrast, when using a single criterion specificity was low and sensitivity was high (Thomas et al., 1998). Biopsy after a single criterion is met would lead to many unnecessary biopsies, while requiring use of all criteria would cause a clinician to miss malignant lesions. When utilizing this screening method, clinician-patient collaboration is

crucial, relying on the clinician's best judgment to decide between actions such as biopsy or referral to a specialist.

Ugly Duckling Sign

The ugly duckling sign is a clinical approach to inspecting the skin that speculates and individual's moles will resemble one another, and a malignant lesion will look different than the rest (Herschorn, 2012). Even though a lesion appearing different from others is very subjective, the ugly duckling sign has shown to have an 85% sensitivity for melanoma when used by clinicians. With a high sensitivity, lesions appearing to be an outlier should be considered suspicious for malignancy even if the lesion does not meet any ABCDE criteria (Swetter & Geller, 2022). However, providers may choose to use a combination of ugly duckling and ABCDE screening methods to determine their course of action, and patients should always contact their provider if an ugly duckling mole also exhibits ABCDE criteria (Ngan, 2021).

Glasgow Seven-Point Checklist

The Glasgow seven-point checklist was developed in the United Kingdom in the 1980s as another set of criteria that clinicians can use to determine if a lesion has features of melanoma. After revisions in 1989 the criteria was renamed the weighted seven-point checklist (W7PCL). W7PCL has three major criteria; changes in size, shape, or color, and four minor criteria; diameter ≥7 mm, inflammation, crusting or bleeding, or sensory changes such as itch. W7PCL is scored zero to ten, a lesion gets a score of two for each major feature, and a score of one for each minor feature exhibited (Swetter & Geller, 2022).

In a randomized trial W7PCL demonstrated a sensitivity of 92% and a specificity of 33% for melanoma when a lesion exhibited at least one major and one minor feature for a total score greater than three, in the same trial a score greater than four showed the same sensitivity with

increased specificity of 53% (Walter et al., 2013). The study suggests referring patients with a lesion scoring of four or higher.

While these screening methods are great tools, they all have their limitations. Visual assessment methods are not as specific to detecting the less common, but more aggressive subtypes of melanoma. These melanoma subtypes include nodular melanoma, amelanotic melanoma, melanoma of the nail, and melanoma in children. The addition of dermoscopy to NEE can improve the sensitivity and specificity for diagnosing melanoma, including these difficult melanoma subtypes.

Dermoscopy

Dermatoscopes are a hand-held, non-invasive tools that provides light and magnification and reduces light refraction, allowing the user to see skin structures of the epidermis, dermoepidermal junction and papillary dermis (Buch & Criton, 2021; Hayes, 2018). The ability to visualize these structures allows the user to find features that are characteristic to different types of skin lesions, benign and malignant.

Background

Dermoscopy originated in the use of microscopes to view nailbed capillaries in the 1650s, by 1893 dermoscopy was being used to evaluate skin structures (Hayes, 2018). Over a period of 60 years, dermoscopy was utilized in various arenas of medicine to help differentiate and diagnose common diseases of the time. In 1950, Lean Goldman started using the tool to assess pigmented skin lesions and melanoma. In 1989, a conference was held in Germany to standardize terminology used in dermoscopy as well as in naming structures found in various skin lesions (Buch & Criton, 2021). The tool has made many advances over the years, and

clinicians have created multiple methods and algorithms to be used alongside dermoscopy to diagnose skin lesions.

Types of Dermatoscopes

Different types of dermatoscopes include; contact polarized light, noncontact polarized light, and contact nonpolarized light (Marghoob & Jaimes, 2022a). Each of these dermatoscopes magnify lesions ten-fold. Polarized light dermoscopy allows for clearer visualization of the deeper structures of the epidermis and nonpolarized dermatoscopes allow for better visualization of superficial structures (Thompson, 2020). One perceived drawback to nonpolarized dermoscopy is the requirement of direct contact of the dermatoscope to the skin surface as well as a liquid buffer such as 70% alcohol. Polarized dermoscopy can be used with or without contact, however, using direct contact along with the liquid interface increases the clarity of the image (Marghoob & Jaimes, 2022; Thompson, 2020).

Early Detection

Patients with concerning skin lesions will often go to their PCPs office first. The PCPs ability to utilize dermoscopy increases diagnostic accuracy, and earlier detection and treatment of skin cancer, therefore reducing morbidity, mortality, and associated costs (Fee et al., 2019; Matsumoto et al., 2022). Metastatic melanoma is associated with the need for systemic treatments such as SLNB, chemotherapy, immunotherapy, and radiation; costly treatments that could potentially be avoided with early detection. Recently, there has been concern about overdiagnosis of melanoma in situ, melanomas that may never cause harm to a patient in their lifetime (Whiteman et al., 2022). However, if left untreated melanoma in situ can grow, and some may develop foci, becoming a more invasive type of melanoma. Superficial spreading and acral melanomas are most likely to become invasive, however, quantification of the exact risk of

growth and metastasis of a lesion is impossible (Oakley, 2018). Due to the high risk that melanoma carries, biopsy threshold must be lowered, allowing for early diagnosis and treatment (Matsumoto et al., 2022).

Dermoscopy in Primary Care

Dermoscopy is primarily used by dermatologists, however, there is growing interest in dermoscopy and use of the tool by PCPs. While this is an excellent tool for identifying skin cancer, there are other practical uses for this handheld device. Dermatoscopes can be used to identify disorders of the hair and nails such as alopecia and lichen planopilaris, nail disorders such as psoriasis and onychomycosis, as well as inflammatory and infectious diseases (Marghoob & Jaimes, 2022a). The large number of applications this tool can be used for makes dermatoscopes a valuable tool for not only dermatologists, but PCPs as well. In Australia, about 40% of PCPs use dermoscopy, however in the United States, dermoscopy use by PCPs is about seven percent (Fee et al., 2019).

While dermoscopy has proven to be a valuable tool for hair, skin, and nail concerns, and more specifically, cancer identification, many providers have not incorporated dermoscopy use into their practice. Research shows a few common reasons for the low uptake of dermoscopy and what hinders use of this tool by PCPs. A study by Williams et al. (2020), shows most PCPs utilize NEE on their patients, but 87% of those surveyed would like to use dermoscopy to further evaluate lesions that they deem clinically atypical on NEE. Reasons practitioners did not utilize dermoscopy included lack of training, 76%, and cost of dermatoscopes, 85% (2020). Another study had similar results, concluding that PCPs felt incapable of using dermoscopy because they lacked training, experience with use of a dermatoscope, support from a knowledgeable colleague while using the tool, and access to a dermatoscope (Fee et al., 2022). These studies highlight the

importance of providing educational opportunities for PCPs to gain experience with the use of dermoscopy, as well as advocating for clinics to have dermatoscopes available for providers.

Once providers have training and access to dermatoscopes they can use them to increase early detection of skin cancer. While dermoscopy simply uses light and magnification, the tool has been found to improve the diagnostic accuracy of skin cancer over NEE. A systematic review by Dinnes et al., found that dermoscopy use is more accurate in diagnosing melanoma and excluding lesions that are not melanoma than visual examination alone (2018). While knowing how to use the tool is important, practitioners have voiced concern about knowing what skin structures to look for when evaluating a lesion. A study conducted on the use of dermoscopy training using the triage amalgamated dermoscopic algorithm shows further improvement in diagnostic accuracy when education includes skin structure identification. In this study, diagnostic accuracy of all lesions improved from 76.4% to 90% and accuracy of melanoma lesions improved from 76.9% to 95.0% (Sawyers et al., 2020). Improvement in diagnostic accuracy leaves providers with a feeling of confidence in their lesion identification and improves likelihood of continued use of dermoscopy.

Provider Confidence

Increasing provider use of dermoscopy is dependent upon providers being confident in their knowledge and use of the tool. First, PCPs must receive training on dermoscopy to be able to use the tool properly. Fee et al. found that providers did not feel confident in their ability to utilize dermoscopy due to a lack of training (2022). Studies showed that a one- or two-day training course increased PCPs diagnostic accuracy of both benign and malignant skin lesions (Augustsson & Paoli, 2019; De Bedout et al., 2021). However, many providers cite access to training to be a barrier to dermoscopy use, and shortening the training could increase provider

attendance to such training courses. Studies where PCPs were provided a single one to two hour training session that was followed by a three month period to implement use of dermoscopy showed increased confidence in lesion identification and diagnosis (Hencley, 2017; Lubitz, 2020; Peters, 2020; Wolden, 2023). Evidence shows that even with a short training in dermoscopy along with a trial period of implementation providers can feel more confident in their ability to use a dermatoscope accurately.

A 2019 studied observed Australian PCPs to determine how often lesion checks were completed, how often dermoscopy was used, and how often the use of dermoscopy changed original diagnosis, or increased confidence in original diagnosis. Whiting et al. showed that dermoscopy changed original diagnosis nearly one fourth of the time, and increased providers confidence in their final diagnosis more than half the time (Whiting et al., 2019). Similarly, Herschorn surmised that dermoscopy can increase PCPs confidence in their referral accuracy and ability to provide reassurance about benign lesions decreasing unnecessary biopsies. Dermoscopy has been shown to increase confidence in the tool and the provider's ability to accurately identify lesions and may even increase providers ability to assess lesions using NEE.

Examination with Dermatoscope

A dermatoscope is a tool that is used to examine the structures within a skin lesion, however, if a provider does not know what those structures represent, dermoscopy is a less accurate and effective tool in skin cancer diagnosis. Dermoscopic algorithms assist clinicians in evaluating skin structures and triaging skin lesions. According to Marghoob and Jaimes (2020) dermoscopic evaluation starts with determining if a lesion is melanocytic or non-melanocytic; if the lesion contains melanocytes, or pigment containing cells. Once pigment is determined, a dermoscopic algorithm can be chosen, and the presence of colors and skin structures can be

assessed. The presence or absence of color and structures are integral information for using a dermoscopic algorithm to confirm or rule out a diagnosis.

Colors found within skin lesions include white, red, light brown, dark brown, blue-gray, and black. These colors correspond to where in the dermis the pigment is found and how concentrated the pigment is in that area. Lesions in the stratum corneum or the upper epidermis will appear black, light brown when located in the mid epidermis, brown in the low epidermis, and blue-gray in the dermis, or deepest layer of skin. Yellow lesions are associated with sebum or keratin, white lesions indicate presence of collagen fibers, and red indicates a vascular component (Dermoscopedia, 2021; Marghoob & Jaimes, 2022a). While the colors of lesion may be seen on NEE, these colors may become more apparent, or more colors may be visualized with use of a dermatoscope.

Structures that are observed on dermoscopy within a lesion help differentiate skin lesions depending on the amount of melanin, collagen, keratin, vascularity, and the distribution throughout the lesion. Melanocytic lesions may have structures such as a pigment network, angulated lines, negative network, aggregated or peripheral rim of globules, streaks, and homogenous blue pigmentation. Lesions with any one of these features must be triaged using an algorithm sensitive to melanocytic lesions (Marghoob & Jaimes, 2020).

Common non-melanocytic lesions include BCC, SCC, seborrheic keratosis (SK), cherry angiomas, and angiokeratomas. Structures such as arborizing vessels, with spoke wheel-like and leaf-like structures, blue/gray ovoid nests and non-aggregated globules, white shiny blotches, ulceration, and erosions are seen in BCC (Marghoob & Jaimes, 2022a). While SCCs will have structures such as glomerular vessels, rosettes, brown circles and dots/globules, white circles, and white/yellow scales. Typically, SKs will have milia-like cysts, with fingerprint-like

structures, sharp demarcations, comedo-like openings, gyri and sulci, and moth-eaten borders. Lesions with red or deep blue, purple, or black lagoons are characteristic of angiomas or angiokeratomas (Marghoob & Jaimes, 2020).

Amelanotic lesions should also be assessed for vascular structures, which may help further distinguish the type of lesion. Non-contact, polarized dermatoscopes, or a contact dermatoscope with a gel used as a liquid interface is preferred for examining vascular structures which prevents blanching or obstruction of the vessels. Vessels are categorized based on their morphology, distribution, arrangement, and presence of a pink or white halo (Marghoob & Jaimes, 2022a). Morphology of a vessel may be described as comma, dotted, serpentine, milky-red globules, vascular blush, polymorphous, and corkscrew. The distribution of the vessels within the lesion may be focal, diffuse, central, peripheral, or random. The vessels may also come in different arrangements within the lesion such as crown, string of pearls, clustered, or radial. While vascular structures can be an important aspect of identifying a lesion, there are a lot of different types of lesions that have similar vessel patterns. Therefore, dermoscopic algorithms as well as clinical background of the lesion should be used when determining initial diagnosis.

Dermoscopy Algorithms

Using a top-down approach the provider should assess a lesion using NEE, generate a hypothesis of differential diagnosis then further assess the lesion using dermoscopy to either confirm or deny the initial hypothesized diagnosis. As previously discussed, the first step is to determine whether a lesion is melanocytic or nonmelanocytic. If the lesion has pigment the next involves distinguishing between a benign nevus, suspicious lesion, or melanoma (Marghoob & Jaimes, 2020). While using dermoscopy, providers should choose an algorithm that has been specifically curated for assessment of pigmented or non-pigmented lesions. Many algorithms can

be used, though some are less reliable, difficult to teach, or are more specific when used by clinicians that have had extensive training in dermoscopy. The following algorithms that are discussed were chosen due to their high sensitivity and specificity, as well as their ease of use. Algorithms for pigmented lesions include ABCD rule, Menzies method, seven-point checklist, three-point checklist, CASH algorithm, PASS, and triage amalgamated dermoscopic algorithm (TADA). Non-pigmented lesions may be assessed using prediction without pigment algorithm (PWP), or TADA.

Pigmented Lesion Algorithms

ABCD of Dermoscopy

The ABCD rule of dermoscopy is a semi-quantitative scoring system based on asymmetry, border, color, and differential structure (Marghoob & Jaimes, 2020; Nachbar et al., 1994). ABCD scoring system has been used for a very long time, and has shown to be easy to learn, quick to use, and reliable.

In this algorithm, asymmetry is assessed first and may be given a score of zero to two points. Asymmetry refers to the distribution of colors and structures within the lesion in one or two perpendicular axes, rather than on the contour of the lesion (Marghoob & Jaimes, 2020). Zero points are scored if there is no asymmetry, one point for mono-axial asymmetry, and two points scored for bi-axial asymmetry. The sensitivity and specificity for experts and non-experts using this algorithm ranges from 78 to 90% and 45 to 90%, respectively.

Following asymmetry, border sharpness is determined, and is given a score of zero to eight points. The examiner imagines the lesion to be cut into eight pieces, similar to a pie. The individual pieces of the pie are assessed separately for any abrupt cutoffs between the lesion and

the normal skin. Every piece of the pie with an abrupt cut off is given one point, correlating with the zero to eight scoring system.

Next color within the lesion is examined and scored on a scale of one to six. Colors that may be seen in a lesion include white, red, light brown, dark brown, blue-gray, and black. Each of these colors found within a lesion will score one point.

Next, structures within the lesion are assessed, and will score zero to five points. Structures that are assessed include pigment network, homogeneous or structureless areas greater than ten percent of the lesion, branched streaks, dots, and globules. One point is scored for each structure found within the lesion.

Finally, the dermoscopy score of a lesion is determined. The scores assigned to the ABCD features are multiplied by a weighted factor. Asymmetry score is multiplied by 1.3, while border, color and differential structure are each multiplied by 0.5. These weighted scores are summed up and are used to categorize the lesion as benign, <4.75; suspicious, 4.75 to 5.45; or malignant,>5.45 (Nachbar et al., 1994).

Menzies Method

The Menzies method was created to distinguish between benign pigmented lesions and invasive melanoma (Marghoob & Jaimes, 2020). Menzies is easy to use, as the examiner needs to determine if a feature is present or absent to score a lesion. Furthermore, the algorithm has been shown to increase PCPs melanoma diagnosis sensitivity by 38% compared to NEE (Dermoscopedia, n.d.).

Menzies method compares what are considered negative features, which are suggestive of benign lesions, and positive features, which are suggestive of melanoma. There are two negative features, symmetric pigment pattern across all axes, and presences of only one of the six colors

seen in lesions on dermoscopy. When these two features are seen in a lesion, diagnosis of melanoma is essentially excluded (Marghoob & Jaimes, 2020). Nine positive features that are assessed include blue-white veil, multiple brown dots, pseudopods, radial streaming, scar-like depigmentation, peripheral black dots or globules, multiple colors, multiple blue-gray dots, and a broadened network (Dermoscopedia, n.d.; Marghoob & Jaimes, 2020). Each positive feature has a specificity for melanoma of at least 85%, and the presence of just one positive feature should put melanoma on the examiners differential list. The sensitivity of Menzies Method varies from 85 to 92%, and specificity is between 38 and 78%.

Seven-Point Checklist

The seven-point checklist looks at a combination of seven major and minor features seen on dermoscopy that are typically associated with melanoma. The three major criteria are blue-whitish veil, atypical pigment network, and atypical vascular pattern. Minor criteria include irregular blotches, streaks, dots, globules, and regression structures (Marghoob & Jaimes, 2020). Each major criteria found in a lesion is allotted two points, while each minor criteria scores one point. A total score of three or higher is suggestive of melanoma, however, the revised checklist recommends lowering the threshold for biopsy, and determining histopathology of every lesion with a score of one or more. Sensitivity among all practitioners prior to revisions of the checklist ranged from 62 to 95% with a specificity of 35 to 97; checklist revisions increased sensitivity.

Three-Point Checklist

Three-point checklist is a shortened version of the seven-point checklist. Many providers opt for this method due to simplicity, ease of recall, and sensitivity of 79% to 91% and specificity of 71 to 72% for melanoma as well as pigmented BCC (Jaimes & Marghoob, 2022). The three criteria examined are asymmetry of color and structure in one or

two perpendicular axes, pigment network with irregular holes and thick lines, and any type of blue and/or white color (DermNetNZ, 2008a). One point is given for each criterion that is found within the lesion, and a score of two or more warrants a biopsy or referral to specialist. This checklist does not examine the finer structures within a lesion and is used to triage lesions.

CASH Algorithm

CASH algorithm evaluates four features of pigmented lesions including color, architectural disorder, symmetry, and homogeneity or heterogeneity (Marghoob & Jaimes, 2020). The presence of color in the lesion is evaluated first, with a possible score of one to six dependent upon the number of colors observed. Suspicion for melanoma is low when one to two colors are present, medium for three to four colors, and high for five to six colors. Then, architectural disorders are evaluated subjectively and can score zero to two points. A score of zero is given to lesions whose structures and colors appear to have mostly organized distribution. One point is given to lesions with structures that have lost their uniformity and are distributed in an irregular manner. A second point is given if the colors and structures in a lesion appear to be completely disorganized and chaotic. Symmetry is considered next and can score zero to two points. Bi-axial symmetry scores no points, mono-axial symmetry is given one point, and bi-axial asymmetry will score two points. Finally, homogeneity or heterogeneity of dermoscopic structures is evaluated. Structures assessed include network, streaks/pseudopods, dots/globules, blue-white veil, regression structures, polymorphous vessels, and blotches (DermNetNZ, 2008b; Marghoob & Jaimes, 2020). The scores for each feature are added and may range from two to 17. A CASH score of seven or less is likely to be benign, and an eight or higher is suspicious of melanoma. Sensitivity and specificity of this algorithm are 87 to 98% and 67 to 68% respectively (Marghoob & Jaimes, 2020).

PASS Algorithm

PASS algorithm is a new, easy, three-step method that demonstrates good diagnostic accuracy regardless of the examiner's experience. The acronym helps the provider to remember the steps in lesion examination polychromy (P), asymmetry (A), and specific structures (SS) and is scored on a scale zero to four (Avilés-Izquierdo et al., 2023). Polychromy or the presence of three or more colors including light brown, dark brown, black, blue/gray, red/pink, and white would score one point. Next the symmetry of color and/or structures is assessed; if there is asymmetry in one or two axes, one point is scored. In the final step, the lesion is assessed for presence of melanoma-specific dermoscopic structures such as, atypical pigmented network, irregular globules, irregular blotches, streaks, negative pigment network, regression structures, blue-white veil, shiny white streaks, milky red areas, pseudolacunae, rainbow pattern, and irregular vessels. The lesion is scored one point for the presence of one melanoma-specific dermoscopic structure, and two points if the lesion exhibits two or more structures. A lesion is considered suspicious for melanoma and biopsy is recommended for a PASS score greater than or equal to three. The PASS score of three or higher has a sensitivity of 91.9% and specificity of 87% with an 88.4% diagnostic accuracy for melanoma.

Non-Pigmented Lesions

Prediction Without Pigment

The PWP algorithm is used to determine if biopsy is appropriate or not on an amelanotic lesion (Jaimes & Marghoob, 2022). First the examiner will assess the lesion for ulceration on NEE and with dermoscopy, if ulceration is found history of trauma to the lesion should be ascertained. If there is ulceration without a history or unknown history of trauma the lesion should be biopsied. Next, the lesion is assessed for white clues. White clues include white lines

that are reticular or polarizing specific and keratin clues that are only present in palpable lesions and appear as white circles, white structureless areas, and surface keratin. If any white clues are present biopsy is recommended, otherwise the algorithm is continued. The following step is to examine the vascular structure and pattern of the lesion. The significance of vasculature is dependent on if the lesion is flat or raised. Flat lesions with monomorphous vascular pattern do not require biopsy, while a polymorphous vascular pattern is considered suspicious, and biopsy should be completed. Raised lesions categorize vessels into non-specific and specific vessel arrangements. Specific vessel arrangements are described as radial, branched, serpiginous, and centered. If a raised lesion has a specific vessel arrangement as described above, no biopsy is indicated, and any non-specific vessel arrangement would suggest the need for biopsy.

Pigmented and Non-Pigmented Lesions

Triage Amalgamated Dermoscopy Algorithm

TADA may be used for both melanocytic and nonmelanocytic lesions and is used to decide if the provider should provide reassurance, continue monitoring the lesion, or if biopsy or referral is indicated. This method has shown to be a great tool in the detection of all skin cancers, with a sensitivity of 94.8% and specificity of 72.3% (Jaimes & Marghoob, 2022; T. Rogers et al., 2016). This algorithm is broken down into three steps; the first of which is to determine if the lesion is an angioma, dermatofibroma, or SK. If the lesion corresponds with any of these neoplasms reassurance of the benign condition is provided to the patient. If the lesion is not one the benign growths listed above the provider proceeds to step two. In this part of the algorithm, the provider must determine if there is any disorder or asymmetry of colors and structures. If distribution of colors and structures seem to be chaotic this would prompt the provider that biopsy or referral is needed. If no disorder is seen the algorithm is continued. In the final step the

examiner assesses for the presence of structures and colors within the lesion. Structures that should be noted and would indicate need for biopsy include negative network, streaks or globules forming a starburst pattern, polymorphous or monomorphous vessels, or ulceration without history of trauma. Additionally, lesions with colors that are suspicious of melanoma, such as blue-black, gray, or white, should be biopsied or referred to an expert. If the lesion does not appear to have any of the colors or structures previously mentioned, then assurance and future monitoring is warranted (Jaimes & Marghoob, 2022).

Limitations

While dermoscopy has been shown to be a valuable tool to aid in skin cancer identification, limitations do exist. Most notably the cost of the device, training, and knowledge continue to be barriers to use in primary care (Fee et al., 2019; Jones et al., 2019). A popular dermatoscope company, Dermlite, sells devices ranging anywhere from about $300 to $1,700, and providers without training are not likely to spend the money on a device they do not know how to use (Dermlite, n.d.). When dermoscopy is used by providers with limited experience or training, the overall accuracy for diagnosing skin lesions is decreased (Marghoob & Jaimes, 2020; Sawyers et al., 2020). More limitations appear when considering the knowledge needed to identify dermoscopic structures, which is a necessary part of nearly every dermoscopic algorithm. Even among experts, there is considerable interobserver disagreement in assessment of dermoscopic structures, patterns and organization (Carrera et al., 2016). When put in the hands of non-experts there are likely to be structures that are mislabeled. While dermoscopic evaluation may help evaluate lesion structures, there are malignant lesions that lack the criteria listed in algorithms to identify correct diagnosis (Marghoob & Jaimes, 2022a).

Summary

Dermoscopy is a noninvasive technique that has been shown to be beneficial in the examination of skin lesions, by both experts and non-experts. With proper training and algorithm selection, PCPs can use dermatoscopes to improve their confidence in lesion identification and increase early skin cancer detection while reducing the number of unnecessary biopsies or referrals.

Theoretical Framework

The goal of practice improvement projects is to implement EBP to facilitate a change in clinical practice. EBP is the practice of incorporating the most up to date scientific research into clinical practice to improve quality of care and patient outcomes. When integrating EBP into a new setting a model or framework should be used to structure the implementation. The practice improvement project will be guided by Roger's Diffusion of Innovation theory.

Diffusion of Innovation

Diffusion of Innovation (DOI) theory was developed by E.M. Rogers in 1962 and explains how an innovative idea or product spreads through a group of individuals, and results in the uptake of said innovation (LaMorte, 2022; E. M. Rogers, 2003). This theory helps to understand how diffusion can influence different types of adopters, important characteristics of innovations, and aids in uptake of an innovation. The framework of DOI will be used to facilitate adoption of dermoscopy by PCPs in clinical practice.

Diffusion

Diffusion is a social process that happens between individuals after learning about a new idea such as dermoscopy use in primary care. Key principles of diffusion include innovation,

communication channel, time, and social system. Optimization of these principles may accelerate innovation adoption rates (Dearing & Cox, 2018).

Innovation is defined as something that is perceived as new, this may be a thought, product, or practice. The innovation in this practice improvement project is the use of dermoscopy in primary care. Communication channels play a significant role in diffusion; if information about an innovation is not disseminated, there will be no individuals aware of the innovation that may consider its' adoption. Rogers identified two communication channels mass media and interpersonal communication (2003). Interpersonal channels such as email, face-to-face communication and training, surveys, and educational materials will be used in the practice improvement project. Primarily interpersonal communication was chosen for this project because to generate peer conversations and interest in an innovation (Kaminski, 2011; Singer, 2016). The third principle is time, which is important because the adoption of an innovation is a gradual change that happens within an individual and within a group. The diffusion process starts with the introduction of an innovation and ends in the rejection or adoption of innovation. Dermoscopy will be introduced to PCPs in the summer of 2023 and be available for use in their practice until November, 2023. Social systems are groups or organizations consist of individuals that connect to solve a problem or accomplish a common goal and are the final principle responsible for successful diffusion (Dearing & Cox, 2018). The social system in which this innovation will be promoted consists of PCPs at Sanford Health's Southpointe Family Medicine Clinic (SPFM).

Adopters

Within every organization there are different adopter categories; knowing the various types of adopters will facilitate faster and higher rate of acceptance of an innovative practice.

Adopter categories include innovators, early adopters, early majority, late majority, and laggards. Each adopter type requires using different strategies to promote the acceptance of innovation, and using individualized strategies is a necessity.

Innovators are individuals that are interested in new ideas and like to be the first to try a new practice. Usually, this group only needs to know about an innovation to be interested in experimenting with its use. Innovators often introduce new ideas to their peers, which makes them vital in diffusion between social systems (LaMorte, 2022; Singer, 2016). Early adopters are viewed as role models or leaders within their social system, they know that changes need to be made, which makes them more comfortable with adopting innovations. These leaders do not need information to convince them to change, rather they prefer training on use or how to implement an innovation (Kaminski, 2011; LaMorte, 2022). Early adopters are vital as they provide feedback of innovations to peers within their organizations. Opinions of trusted leaders reduce the uncertainty of other adopter groups and increases general acceptance of an innovation within their social system (Singer, 2016). Early majority and late majority each make up approximately one third of adopters; adoption of innovation by these groups is crucial because of their large numbers. The early majority will accept an innovation more readily than most individuals, however they must be appealed to through peer reviews and evidence of effectiveness (LaMorte, 2022). The late majority are slow to adopt and make sure that their investment in an innovation will be valuable in return. Late majority adopters are more likely to adopt a practice if they have heard many others have successfully done so (Singer, 2016). The remaining individuals are considered laggards, they are averse to change and are difficult to convince of acceptance to change. Individuals in this category are usually persuaded to accept innovation through statistics, fear, and peer pressure (LaMorte, 2022).

Attributes of Innovations

Rate of acceptance of innovation is greatly affected by the characteristics of innovations. There are five perceived attributes of innovations; relative advantage, compatibility, complexity, trialability, and observability (E. M. Rogers, 2003). Generally, innovations are more widely accepted when they are seen as advantageous, compatible, triable, and observable, while boasting a low complexity. Carefully considering the innovation characteristics prior to its' introduction can help anticipate adopters' reservations and ability to provide reassurance.

Relative advantage is the adopter's perception that an innovation is better than the current idea or practice in use, this perception increases rate of adoption (Dearing & Cox, 2018). Research has shown the advantages of dermoscopy, and this information will be shared prior to training at SPFM. PCPs at SPFM will need to determine if dermoscopy is advantageous to their own practice.

Compatibility of the innovation with the adopters' values, experiences, and needs will greatly affect acceptance. The innovation is unlikely to be adopted if the innovation goes against an individual's values, or they perceive the innovation as unnecessary (Rogers, 2003; Singer, 2016). Key stakeholders at SPFM have voiced feelings that dermoscopy would be a valuable service to be able to offer to their patients.

The difficulty or complexity of use of an innovation can be a particularly troublesome attribute when trying to increase acceptance (Rogers, 2003; Singer, 2016). An innovation that is more difficult is less likely to be adopted. Dermoscopy is typically regarded as a complex practice only used by specialists. Hopefully, with training being offered to providers at SPFM, PCP perception of difficulty will be reduced enough, that complexity is not a barrier to acceptance.

Trialability is the amount of time an innovation can be experimented with before an individual is asked to commit to adoption, when ample time to experiment with an innovation is given, acceptance is higher (LaMorte, 2022; Singer, 2016). The providers at SPFM will have approximately three months to use dermatoscopes in their practice before asking their intentions on adoption of dermoscopy.

Lastly, observability is the ability for the adopter to see the success they have during experimental use of an innovation. If successful integration of a practice is apparent to the adopter and their peers, it is very likely that the innovation will be accepted throughout the social system (Dearing & Cox, 2018; Singer, 2016). Dermoscopy is a very visual tool, and with training, providers will be able to identify skin structures they have never seen before. The ability to see these structures and triage lesions, along with close monitoring or histological comparison after biopsy, providers will be able to track their success over the implementation period.

Summary

DOI theory conveys how new ideas and practices spread within different social systems and become an accepted standard. Familiarity with the various adopter categories and positive innovation characteristics facilitate early and rapid adoption of an innovation. Appealing to different adopter groups at SPFM, leveraging key stakeholder support, and optimizing attributes of dermoscopy may help to increase use of dermatoscopes in primary care.

CHAPTER 3: METHODS

Overall Project Design

The aim of this practice improvement project was to improve the knowledge and confidence of PCPs at SPFM in diagnosing and triaging skin lesions. The innovative nature of this project aligned with Sanford Health's mission to improve the human condition through exceptional care and innovation (Sanford Health, n.d.-a). Before the project was implemented, Katlyn Dobberstein APRN, CNP, and key stakeholders had verbalized interest in dermoscopy training and were considering the procurement of dermatoscopes for provider use. At that time, there were no providers at SPFM who used dermoscopy in their practice.

Similar to the prior practice improvement projects implemented by Hencley (2017), Lubitz (2020), Peters (2020), and Wolden (2023), the co-investigator created a dermoscopy training module for the providers at SPFM followed by clinical practice with dermatoscopes. The educational PowerPoint was made available in-person and on demand with embedded questions to assess provider understanding. Before receiving training, a pre-survey with questions regarding their current understanding and comfort with skin examinations was distributed. After completing the education section, the co-investigator provided SPFM with two educational binders and two dermatoscopes for PCPs to utilize in practice.

This EBP project focused on training PCPs in the use of dermoscopy to enhance their confidence and ability to detect early signs of skin cancer. Project objectives were designed to educate providers on dermatoscope use and skin lesion triaging to increase their confidence and frequency of skin cancer screening.

Implementation Plan

EBP projects followed a model to implement research into clinical practice. The Iowa Model of Evidence-Based Practice was utilized in this practice improvement project to facilitate the integration of dermoscopy into PCPs' practice at SPFM. A logic model was created to review the resources, interventions, and outcomes of the project.

Evidence-based Practice Model

The Iowa Model of Evidence-Based Practice was a systematic approach to implementing the best available evidence into a clinical setting (Iowa Model Collaborative et al., 2017). Marita G. Titler and her colleagues at the University of Iowa developed the framework in the 1990s to guide healthcare practitioners in utilizing evidence to enhance patient outcomes (Rycroft-Malone & Bucknall, 2010). The Iowa Model was updated in 2017 to incorporate advancements in healthcare, such as the integration of electronic data, strengthened interprofessional teamwork, and greater patient involvement (Iowa Model Collaborative et al., 2017).

The model consisted of seven steps, with multiple feedback loops incorporated in the model to assess and modify the previous steps taken (Melnyk & Fineout-Overholt, 2019). The model started with identifying a clinical problem or question that required an evidence-based solution. Then, literature was reviewed to find the best available evidence-based intervention for implementation. After implementation, the project was evaluated, and the results were disseminated to other professionals and organizations. Evaluation and dissemination created a cyclical process; once the guideline was implemented and results disseminated, the process could be repeated to refine and improve the guideline. The EBP model was employed as a guide for the practice improvement project, and detailed discussion is presented in the following paragraphs.

Topic Selection

Choosing a topic was the first step of the Iowa Model. A topic could arise from a variety of sources, such as patient care experiences, quality improvement initiatives, or new research findings (Iowa Model Collaborative et al., 2017). The identification of a topic was a crucial step in the Iowa Model of EBP, as the topic set the stage for the development of evidence-based interventions and the improvement of patient care. Review of literature indicated that PCPs lacked adequate training in identifying skin cancer, even though they were frequently the first healthcare professionals consulted by patients regarding concerning lesions (Fee et al., 2019; Jones et al., 2020; Stratton & Loescher, 2020). Additionally, interest in dermoscopy was expressed to the co-investigator by clinical preceptors who are primary care providers, as well as providers in occupational medicine, and walk-in clinics. While dermatoscopes could be a sizable one-time expense, they work for many years and have been shown to improve PCPs' ability to identify skin lesions, increasing early skin cancer detection and improving patient outcomes (Dinnes et al., 2018; Fee et al., 2022).

Question or Purpose

The next step in the Iowa Model was to state the question or purpose of the project. The problem or question had to be clearly defined and relevant to the clinical setting, with the potential for a positive impact on patient outcomes, quality of care, or cost-effectiveness. The purpose established a foundation for subsequent steps in the Iowa Model and ensured that necessary steps and measures were taken to achieve the intended goal of the EBP (Iowa Model Collaborative et al., 2017). The purpose of this practice improvement project was to educate PCPs about the use of dermoscopy to enhance their confidence in identifying and triaging skin lesions using dermatoscopes, thus improving skin cancer screening in the primary care setting.

After selecting a topic and establishing the project's purpose, assessing whether that specific topic held priority was crucial (Iowa Model Collaborative et al., 2017). If the organization did not hold value in the topic or purpose there would be no buy-in from stakeholders, making implementation difficult. The topic may have needed to be reconsidered if the values and priorities of the organization and the project purpose were not aligned. Sanford Health is dedicated to enhancing the well-being of the communities it serves through innovation and exceptional care. The organization determined that dermoscopy training for PCPs and improved skin cancer screening would be a priority for their organization. Because of the presence of key stakeholders Andrew Larson and Katlyn Dobberstein, SPFM was an ideal location for initiating implementation.

Team Formation

Once a priority topic was identified, a team is assembled to aid in the development, implementation, and evaluation of the project. In health care settings team members often include providers, nurses, clinic leadership, stakeholders, and specialists. Collaboration within the team ensured an effective EBP project would be produced and delivered. The committee created for this EBP project included Dean Gross, Ph.D., FNP-BC, committee chair; Kolby Schaeffer Fraase DNP, MS, BSN, RN-BC, committee chair; Lisa Montplaisir, Ph.D., graduate appointee; and Katlyn Dobberstein, APRN, CNP, an outside expert.

Evidence Retrieval

Once the clinical problem or question was identified, the team gathered all relevant information about the problem, including the scope, impact, and potential causes. This information was obtained from various sources, such as clinical records, patient data, staff feedback, and relevant literature. The Cochrane Database of Systematic Reviews (Cochrane),

PubMed, and Cumulative Index to Nursing and Allied Health Literature were used in the search for evidence-based literature. Key terms used in the search of these databases included skin cancer screening, dermoscopy, primary care, dermoscopy education, dermoscopy training, actinic keratosis, basal cell carcinoma, squamous cell carcinoma, and melanoma. The online databases provided evidence on the occurrence and frequency of skin cancer, the pathophysiology of skin lesions, and the utilization of dermoscopy in practical applications, as well as dermoscopy training. Evidence-based literature was also gathered from textbooks and professional healthcare websites, and hand searching.

Synthesis and Appraisal of Evidence

According to the Iowa Model, after evidence was collected, appraisal is needed to determine the quality and strength of each article, and the overall evidence. A topic with sufficient evidence enabled a plan for a practice change to be implemented. In this EBP project, quantitative and qualitative evidence were gathered and showed strong support for dermoscopy training in primary care to increase and improve skin cancer screenings. The next step in the project was to design the practice change.

Project Design

Literature recommendations aimed to enhance practice and emphasized guidelines, practicality, pertinence, and efficacy. The Iowa Model required the developer to address resources and all approvals that would be necessary for project implementation. The resources needed to implement dermoscopy training at SPFM included access to the internet and online platforms like Yuja, Qualtrics, as well as access to dermatoscopes, and materials for educating providers on dermoscopy and skin lesion identification. Approval from both Sanford Health and North Dakota State University (NDSU) was required prior to project implementation. Part of the

approval process for both was to present an implementation plan and evaluation plan, which is discussed further in the "Evidence-based Project Interventions/Activities," "Resources," and "Clinical Outcomes and Evaluations" sections below. The last aspect of this step was to create the training materials that would be used during implementation.

EBP Implementation

Once the project implementation plan was approved, the co-investigator was able to start collecting baseline data and project implementation. Support from key stakeholders as well as clinic providers were needed to facilitate participation and integration of dermoscopy. Implementation occurred from August to November, which was determined by the facility and clinic leadership, along with input from PCPs to determine the best time to initiate training. Following implementation, data on the confidence, attitudes, and accuracy of PCPs in utilizing dermoscopy were collected.

Sustaining the Practice Change

To ensure the sustainability of the practice change, providers were encouraged to follow up on biopsies and referrals made for skin lesions, encouraging further learning and enhanced confidence in dermoscopy use. Hopefully, providers and clinic leadership found dermoscopy to be a useful tool and invested in devices for continued provider use. Furthermore, printed resources remained with the clinic, and educational videos are available to Sanford Health for the ability to implement at other organizational family medicine clinics.

Dissemination

Finally, after implementation and collection of results, the information was synthesized. Synthesis of the project results were disseminated by the co-investigator to SPFM stakeholders and providers, poster presentation at the North Dakota Nurse Practitioner Association's

(NDNPA) annual pharmacology conference, as well as potential publications in professional journals whose target audiences are PCPs. Dissemination of the project results allows for repetition and improvement of implementation of the EBP.

Summary

The Iowa Model offered a superior, evidence-based framework for implementing EBP in clinical practice, which was essential for enhancing healthcare and patient outcomes. The framework was applied to develop and implement dermoscopy education intervention for primary care providers, with the aim of improving their knowledge and skills in skin cancer diagnosis.

Setting

The setting for the project was SPFM in Fargo, North Dakota, a primary care clinic that offers annual physicals, child wellness checks, chronic disease management, geriatric care, gynecological and obstetric services, sports physicals, and urgent care services (Sanford Health, n.d -a). The clinic's medical providers included seven physicians, four physician associates, and four nurse practitioners. Sanford Health’s mission is to improve the human condition through exceptional care, innovation, and discovery (Sanford Health, n.d.-b)

Sample/Sample Size/Recruitment

The inclusion criteria for participating in the project included being a PCP working at SPFM, which consisted of 15 providers. There were no exclusion criteria, but providers were asked about their previous experience in dermoscopy. The final sample size for the project was estimated to be ten providers.

Recruitment of PCPs at SPFM occurred via email, and with recruitment posters placed in clinic breakrooms. The initial email was sent one month prior to the scheduled education session

and included project details, including the purpose, objectives, estimated timeline, and significance to provider practice. The training session was held in person as a 'lunch and learn' meeting. A quick response (QR) code was linked in the PowerPoint for providers to complete the Qualtrics pre-module survey prior to the training session, and in emails for providers unable to attend in person. Prior to beginning the survey, providers were asked to electronically sign the consent form and provide a 4-digit number that allowed their survey to remain anonymous to the co-investigator, while allowing for individual pre- and post-survey comparison. Immediately following the education session, a second email was sent by the co-investigator to all PCPs with another brief description of the project and links to the Qualtrics pre-module survey and the asynchronous module for those unable to attend in-person training. Before the implementation of the project, Internal Review Board approval from NDSU and Sanford Health was obtained.

Evidence-based Project Interventions/Activities

The co-investigator created a presentation for PCPs at SPFM, which mimicked prior practice improvement projects conducted by Hencley (2017), Lubitz (2020), Peters (2020), and Wolden (2023). An online module was created on the Yuja Enterprise Video Platform to present the education to providers interested in participation who were unable to attend in person. The training information was offered via a PowerPoint presentation (Appendix P) created by the co-investigator. The training PowerPoint reviewed common skin lesions and the review of the PASS algorithm with integrated quiz questions. The PASS algorithm, an evidence-based approach, has demonstrated both quick and straightforward usability alongside diagnostic accuracy, prompting utilization in this EBP (Avilés-Izquierdo et al., 2023). Embedded quiz questions were all multiple-choice format, and tested providers on the identification of benign and malignant dermoscopic images. The first three quiz questions were asked prior to PASS algorithm training

and the second set of questions was asked after algorithm training. The comparison of pre-algorithm training questions (Appendix L) and post-algorithm training questions (Appendix M) were used to assess changes in knowledge. Following the education session two dermatoscopes and two binders containing information about using the PASS algorithm were provided to SPFM and kept in a central location for easy access to providers. In the following 3 months, providers were asked to use the dermatoscopes for triaging lesions and for skin cancer screening during annual physical examinations. During the implementation period the co-investigator was available by email and to meet in-person as needed to answer provider questions or concerns about dermoscopy and the PASS algorithm. Monthly informal check-ins were also conducted by the co-investigator for reminders to continue using dermoscopy and availability of co-investigator in answering questions regarding dermoscopy.

Two weeks prior to the end of the implementation period, the Qualtrics post-survey was sent via email to providers. They were asked again to input the last four digits of their phone number to link their answers to their pre-survey questions. This was used to reassess provider, confidence, dermoscopy use, and ability to identify and triage skin lesions. The survey questions were adapted from Hencley's (2017) practice improvement project with permission and can be found in Appendix G.

Resources

The project required support from SPFM leadership, providers, and the Sanford Health organization to ensure successful implementation. Clinic supervisor, Andrew Larson, and supervisory committee member Katlyn Dobberstein APRN, CNP, were key stakeholders in this project, and were crucial to the project's successful adoption. All providers including physicians and advanced practice providers at SPFM were welcome to participate in the project. The co-

investigator was responsible for providing education, and assistance in the implementation of dermoscopy use in the clinic. After implementation the co-investigator evaluated results of surveys and quiz questions regarding provider confidence and knowledge to utilize dermoscopy. The dissertation supervisory committee was involved in development of the project as well as guidance on implementation.

Technology needed for the project included two dermatoscopes that were provided by the NDSU School of Nursing. Password protected computers, internet access, and email access was used for successful communication with providers, and training sessions. Qualtrics was used to design pre- and post-surveys, while the Yuja Enterprise Video Platform was utilized to create the module. The surveys and module were disseminated in person at SPFM and via e-mail to providers unable to attend in person. Expenses for the project encompassed the printing and materials utilized for the two educational binders supplied to the SPFM providers, as well as lunch for providers that attended in person. The printed materials included PowerPoint presentation outline of the training session, skin lesion images, and the PASS algorithm.

Clinical Outcomes and Evaluation

Evaluation of the practice improvement project outcomes requires assessment of individual objectives. Appraisal of the objectives and outcomes were aided by use of the logic model (Appendix O). Further discussion of the objective evaluation is presented below.

Objective One

Objective one was to develop and implement an educational module on dermoscopy and skin lesion triaging for PCPs at Southpointe Family Medicine Clinic by August 2023. Evaluation of this objective was obtained by completion of the dermoscopy training module and

dissemination to the PCPs at SPFM in person and by emailing the training session link to providers unable to attend in person.

Objective Two

Objective two was to increase PCP knowledge in use of dermatoscopes and identifying and triaging skin lesions over the implementation period until November 2023. Evaluation of the change in knowledge will be assessed from pre and post PASS algorithm training quiz questions (Appendix L and M), pre-survey question eight and post-survey questions six and seven (Appendix H and I).

Objective Three

Objective three was to improve PCPs confidence in skin lesion identification over the implementation period until November 2023. Change in provider confidence was analyzed by comparing pre-survey questions five and six and post-survey questions three and four (Appendix H and I).

Objective Four

Objective four was to increase SPFM PCPs interest in utilizing dermoscopy following the implementation period. Assessment of practitioner intent to use dermoscopy in their practice was evaluated using pre-survey question seven post-survey questions five and eight (Appendix H and I).

CHAPTER 4: RESULTS

The practice improvement project utilized data gathered from both face-to-face training sessions and an online module. Commencing on August 17th, 2023, and concluding on November 20th, 2023 this project had a three-month implementation period, targeting PCPs at SPFM in Fargo, ND. Participation in the module and surveys was entirely voluntary for the providers. Out of the 15 PCPs within SPFM, five providers completed the pre-training survey alongside either the in-person training or the online module and three providers completed the post-implementation survey. One of the post-survey respondents did not complete the initial pre-survey, meaning there were two participants that filled out both the pre- and post-surveys.

The link to the pre-training survey was provided prior to the training to those attending in person and was found at the beginning of the online module. The link to the online module was sent out after the completion of the in-person training and prior to dermatoscopes being delivered to SPFM. The link to the post-implementation survey was sent to participants two weeks before the conclusion of the implementation phase. The post-training survey link remained open for one week following the three-month implementation period, allowing a three-week window for providers to complete the post-implementation survey.

Sample Demographics

Five health care providers participated in the practice improvement project at SPFM. Of the providers that attended in-person, 2 were NPs, 1 was a PA, and 2 were MDs. None of the providers felt they had any prior education or training on dermoscopy. No additional demographic information was asked of the participants.

Data Analysis

Descriptive data analysis was employed to assess both the pre- and post-module surveys. These Likert-style surveys were generated using Qualtrics and sent out to SPFM providers via email. For participants that completed online training, the surveys were accessible through a QR code embedded in the module, which was also distributed via email to the providers. Bar graphs, presenting results from questions in both the pre- and post-surveys, were generated from the reports of these Qualtrics surveys. Furthermore, analysis of the SPFM providers' Yuja module quiz questions were combined with answers of those participating in person and was presented in bar graph format. The collected survey data be found in the subsequent sections.

Data Results

Evaluation of the data results focused on analyzing the four project objectives 1) develop and implement an educational module on dermoscopy and skin lesion triaging for PCPs at SPFM by August 2023; 2) increase PCP knowledge in use of dermatoscopes and identifying and triaging skin lesions over the implementation period until November 2023; 3) improve PCPs confidence in skin lesion identification over the implementation period until November 2023; 4) increase SPFM PCPs interest in utilizing dermoscopy following the implementation period.

Quantitative survey data collection included five-point Likert scale responses of *strongly agree, agree, disagree,* and *strongly disagree*. The surveys contained an additional five-point Likert scale question with participant response choices including *novice, advanced beginner, competent, proficient,* and *expert*. The post-survey included one additional closed-ended "*yes*" or "*no*" question. The pre-survey included eight Likert-style questions (Appendix H), while the post survey included seven Likert-style questions and one closed-ended question (Appendix I).

Quantitative data was also utilized to collect results from the quiz questions in the in-person training and the online Yuja module (Appendix L and M). There were six questions in the in-person and online training with images used following permission from DermNet NZ (Appendix K). The first three questions were posed prior to training on the PASS algorithm, and the last three questions were queried following PASS algorithm training. Four providers were able to complete these questions at the in-person training, while the fifth provider was unable to attend the whole presentation and opted to retake the training and complete quiz questions via the online module.

Objective One

Develop and implement an educational module on dermoscopy and skin lesion triaging for PCPs at Southpointe Family Medicine Clinic by August 2023. The live module, crafted by the co-investigator via PowerPoint, was delivered to the SPFM providers on August 17th, 2023. Quiz questions for the in-person session were incorporated into the PowerPoint, and responses were monitored in-person using Mentimeter. An online module was generated utilizing the same PowerPoint, integrated with the Yuja Enterprise Video Platform, ensuring consistency with the in-person training, and featuring the same embedded quiz questions. Immediately after the live training, the link to access the online module was distributed to the SPFM providers.

Objective Two

Increase PCP knowledge in use of dermatoscopes and identifying and triaging skin lesions over the implementation period until November 2023. Evaluation of this objective depended on responses from both pre- and post-surveys, as well as answers of quiz questions. One survey question asked, *what do you consider your current level of knowledge of dermoscopy*? In the pre-survey, three providers indicated a novice level, while two providers

stated an advanced beginner status. In the post-survey, one provider indicated a novice level, while two providers responded they felt competent.

In the post-implementation survey, providers were asked to respond to the statement, *I feel that I will be able to make more accurate referrals following the implementation of dermoscopy using the PASS method.* One provider agreed and two providers strongly agreed with the statement.

Outcomes of quiz questions presented during both the in-person and online modules were then utilized to assess objective two. The first three questions were asked before the providers received education about the PASS algorithm, while questions four, five, and six were presented after PASS algorithm education. Each question was presented in a multiple-choice format and required providers to identify a skin lesion based on the provided image.

For the first question, two of four in-person providers and one online participant answered correctly, yielding an overall accuracy of 60%. Question two was correctly answered by all four in-person providers and the online participant, resulting in a 100% accuracy rate. Question three, which was an image of a benign lesion, had one out of four in-person providers and the online participant answering correctly, resulting in a 40% accuracy rate.

In question four, one provider reported an issue with the Mentimeter software and was unable to respond. Of the remaining participants, one out of three in-person providers and the online participant answered correctly, producing a 50% accuracy rate. Questions five and six were answered correctly by all four in-person providers and the online participant, resulting in a 100% accuracy rate for both. The overall accuracy rate for questions prior to PASS algorithm training was 66.7%, while after PASS algorithm training, the accuracy rose to 85.7%.

Objective Three

Improve PCPs confidence in skin lesion identification over the implementation period until November 2023. There were two questions on the pre- and post-surveys that focused on confidence in lesion identification with use of dermoscopy. Regarding the first statement, *I feel confident with the practice of dermoscopy*, one provider strongly disagreed, three disagreed, and one agreed. On the post-survey one provider disagreed, and two providers agreed. The second statement was: *I feel confident in my ability to triage skin lesion using dermoscopy and the PASS method.* On pre-survey two providers strongly disagreed, two disagreed, and one agreed with this statement. On the post-survey, one provider disagreed, and two agreed with this statement.

Objective Four

Increase SPFM PCPs interest in utilizing dermoscopy following the implementation period. In the pre- and post-surveys, providers responded to the statement, *I feel that using dermoscopy will benefit my practice and my patients*. On the pre-survey one provider disagreed with this statement, one provider agreed, and three providers strongly agreed. On the post-survey one provider agreed and two strongly agreed. A question only asked on the post-survey evaluated providers interest in continuing to use dermoscopy after the implementation period*; Do you plan on buying or requesting your organization purchase a dermatoscope following the dermoscopy training module?* Two providers planned to buy or request their organization purchase a dermatoscope and one did not.

Additional Survey Statements and Questions

Below are the findings from additional survey statements and inquiries. Although not directly tied to the objectives, these aided in assessing participants' background knowledge about

skin cancer and dermoscopy. These statements and inquiries are further examined in the discussion chapter.

I am knowledgeable about skin cancer prevalence and screening strategies. This statement gauged the initial knowledge of providers regarding skin cancer, prior to the introduction of a module concentrating on dermoscopy for identifying and triaging skin lesions. Pre-survey answers showed four providers agreed and one strongly agreed. On the post survey two providers agreed and one strongly agreed.

I feel confident performing naked eye skin examinations. This statement aimed to assess initial level of comfort regarding skin examinations in the absence of dermoscopy. The pre-survey showed four providers agreed and one strongly agreed. On post-survey all three respondents agreed.

I have received prior education and/or training on dermoscopy. The intention of this statement was to comprehend past educational and training experiences related to dermoscopy before introducing the module and dermatoscopes. Pre-survey results determined two providers strongly disagreed and three providers agreed. This question was omitted from the post-implementation survey due to the focus on dermoscopy training and education prior to the initiation of this practice improvement project.

I have previous experience using dermoscopy in clinical practice. This statement sought to evaluate any prior practical experience with dermoscopy within a clinical environment. The pre-survey results were as follows; one strongly disagreed, three disagreed, and one agreed. This question was not included in the post-implementation survey because the question specifically assesses experience prior to the implementation of this project.

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

Summary

Skin cancer stands as the predominant type among all cancers found in the United States. While constituting a small portion of all skin cancers, melanoma remains the deadliest. Projections for 2023 include approximately 97,610 new cases of melanoma diagnosed, and nearly 8,000 deaths (American Cancer Society [ACS], 2023). While primary prevention notably influences skin cancer incidence and considerable progress has been made in treatment methods that decrease melanoma mortality rates, the secondary prevention strategy, such as visual skin examinations remain pivotal in significantly improving morbidity and mortality rates associated with skin cancer (National Cancer Institute, 2019).

Rates of skin cancer are still increasing, making PCPs vital in conducting and advocating for skin examinations (Fee et al., 2022). Naked-eye skin examinations are a safe and cost-effective measure for detecting and prioritizing skin cancers. However, accuracy of identifying skin lesions using visual skin examination techniques employed by PCPs is variable (Loescher et al., 2018; Swetter & Geller, 2022). Utilizing a dermatoscope enhances lesion differentiation and can be utilized as part of skin examinations. After proper training, dermoscopy improves accuracy of identifying suspicious lesions as well as increased confidence of providers evaluating those lesions (De Bedout et al., 2021; Jones et al., 2019; Marghoob & Jaimes, 2022a). Furthermore, with dermoscopy training providers need to do fewer biopsies to detect melanoma (Seiverling et al., 2023). When providers feel confident in the examination they are performing they are more likely to continue to use that examination technique. These principles of knowledge, confidence, and continued use and benefit to patients are supported by previous

practice improvement projects, which utilized dermoscopy training followed by hands-on practice (Hencley, 2017; Lubitz, 2020; Peters, 2020; Wolden, 2023).

Training sessions on the PASS algorithm and practical experience with dermoscopy were conducted as part of this improvement project. The project aimed to boost the confidence of PCPs and refine their skills in triaging skin lesions while improving identification using dermoscopy.

The subsequent sections delve deeper into the examination of the four project objectives, synthesizing the project findings. Cautionary interpretations were drawn from the results, considering the limited sample size of four in-person and one online provider at SPFM.

Discussion

Objective One

The first objective was to develop and implement an educational module on dermoscopy and skin lesion triaging for PCPs at SPFM by August 2023. This objective was met by using in-person training at SPFM, as well as an online module that was distributed via email to providers unable to attend the in-person training.

The online module was created via Yuja Enterprise Video Platform utilizing the same PowerPoint presentation that was made for in-person training by the co-investigator with integrated quiz questions. The content within the PowerPoint presentation included basic skin cancer and dermoscopy concepts, pictures of melanoma specific signs, and information about the PASS algorithm. PASS was chosen because the algorithm was new, evidence-based, shown to be quick and easy to use, as well as diagnostically accurate (Avilés-Izquierdo et al., 2023).

Following the in-person training, two binders containing the PowerPoint with skin cancer and dermoscopy education, as well as an infographic (Appendix N) about the PASS algorithm,

and two dermatoscopes were left at nurses' stations within the clinic for providers use in clinic. The module was sent to all the PCPs at SPFM via email following the in-person training on August 17th, 2023. The email also provided a link to the online module which included the pre-implementation survey. Providers were asked to complete the module within two weeks though they would have access to the module and binders for three months. Despite the deadline, the one online participant did not complete the module until early to mid-September, when the co-investigator made her first monthly site visit during implementation.

Objective Two

Objective two was to increase PCP knowledge in use of dermatoscopes and identifying and triaging skin lesions over the three-month implementation period. This objective was met and was evaluated with pre-survey question eight, and post survey questions six and seven as well as the results of the embedded quiz questions that were completed in-person and from the online module.

While one of the responses on the post-survey was created by a participant that did not complete the pre-survey, viewing the two responses from the participants that completed both the pre-survey and post-survey, results show that one participant still felt like a novice in using dermoscopy, they felt they would be able to make referrals with greater accuracy after learning how to use dermoscopy and the PASS algorithm. The other participants felt their knowledge about dermoscopy increased from novice to competent and agreed that they would be able to make more accurate referrals after dermoscopy education. The provider that did not complete the pre-survey felt that after dermoscopy training they could make more accurate referrals using the PASS algorithm and felt competent in utilizing dermoscopy. These results indicate that there was a slight improvement with self-assessed knowledge of dermoscopy, which is consistent with

previous projects showing improved self-assessed knowledge following dermoscopy training and hands-on use of dermoscopy in practice (Hencley, 2017; Lubitz, 2020; Peters, 2020; Wolden, 2023).

Answers to embedded quiz questions indicated that providers did become more accurate in their lesion identification. Questions one, two, and three assessed accuracy of lesion identification prior to learning the PASS algorithm and overall accuracy was 66.7%. Providers then received training in the PASS algorithm which included education on melanoma specific signs. The accuracy of lesion identification rose to 85.7%. The increase in accuracy of lesion identification shows the providers did increase their knowledge. This correlates with studies showing improved diagnostic accuracy after short dermoscopy training sessions (Augustsson & Paoli, 2019; De Bedout et al., 2021; Jones et al., 2019; Marghoob & Jaimes, 2022b)

When comparing benign to premalignant/malignant answers, providers had perfect accuracy on both sections determining which lesions were either dysplastic nevi or melanoma and should be biopsied. However, providers did improve in the post-training section at determining when a lesion was benign. This finding demonstrates that having PASS algorithm training did not decrease the number of potential dysplastic nevi or melanomas that were missed. Having PASS algorithm training decreased the likelihood that a benign lesion would have been sent for referral or unnecessarily biopsied. The PASS algorithm effectively decreased the number of lesions needed to biopsy to diagnose dysplastic nevi and melanoma, as well as increased overall knowledge of lesion identification. These results are consistent with a study that showed dermoscopy training in PCPs decreased the number of biopsies needed to detect melanoma (Seiverling et al., 2023).

Objective Three

Project objective three was to improve PCPs confidence in skin lesion identification over the implementation period until November 2023. Pre-survey questions five and six and post-survey questions three and four were utilized to assess this objective, which was met. At SPFM 20% of the providers agreed and 80% disagreed or strongly disagreed with the pre-implementation statement, *I feel confident with the practice of dermoscopy.* On post-implementation survey 66.7% agreed and 33.3% disagreed with the same statement. The provider that disagreed with this statement on the post-survey did not complete the pre-survey, so the co-investigator was unable tell if they had even a mild increase in confidence. The providers that did complete both the pre- and post-surveys increased their confidence levels, showing an overall increase in confidence.

Pre-survey question six stated, *I feel confident in my ability to triage skin lesions using dermoscopy and the PASS method*. Prior to dermoscopy training and hands-on practice, one provider agreed to with this statement, while two providers disagreed, and two providers strongly disagreed with this statement. Post-implementation analysis showed that two providers agreed they were confident while one provider disagreed. While increased confidence with triaging using dermoscopy and the PASS algorithm was only a slight increase, results do show an overall improvement. The improvement in confidence shown by both of these questions are similar to previous projects and studies which examined comfort and confidence levels with dermoscopy following training courses (Fee et al., 2019; Hencley, 2017; Lubitz, 2020; Peters, 2020; Wolden, 2023).

Objective Four

The final objective was to increase SPFM PCPs interest in utilizing dermoscopy following the implementation period and was partially met. This objective utilized survey questions to make inferences on the subjective benefit of dermoscopy and the sustainability of the practice improvement. In response to the survey statement, *I feel that using dermoscopy will benefit my practice and my patients*, 20% disagreed, 20% agreed, and 60% strongly agreed. After training and implementation 33.3% agreed and 66.7% strongly agreed. Results reflected a slight increase in the percentage of providers that believed dermoscopy to be a beneficial practice for themselves and patients.

The second question related to this objective was asked only after implementation as a "yes" or "no" style question, *Do you plan on buying or requesting your organization purchase a dermatoscope following training?* 33.3% of providers did not plan on purchasing, or requesting the organization to purchase a dermatoscope, while the remaining 66.7% did plan to purchase or request a dermatoscope. When looking deeper at these two questions, the results show that while each provider agreed that dermoscopy would be beneficial, one provider still did not plan to utilize dermoscopy in the future. Further exploration would be needed to identify provider reasoning for not planning to continue use of dermoscopy. There have been multiple barriers to dermoscopy use explored in previous studies. Frequently cited reasons include time constraints during clinic visits and lack of regular use leading to lack of proficiency (Fee et al., 2019; Jones et al., 2019; Wolden, 2023).

Following the project's implementation, Sanford Health opened a new primary care clinic in Horace, ND, under the same management as SPFM. Upon assessing the level of provider interest in dermoscopy, management found there was significant interest among providers.

Consequently, as part of the supply budgeting for the clinic, the decision was made to allocate resources for a dermatoscope. This proactive step reflects the commitment to integrating dermoscopy into clinical practice, potentially enhancing dermatologic care for patients at the Horace clinic.

Project Framework

The Iowa Model of Evidence-Based Practice and Diffusions of Innovations (DOI) theory were used throughout this project to facilitate implementation of EBP in the clinical setting. The Iowa Model guided the project's evolution, encompassing various stages such as topic selection, team establishment, retrieval and synthesis of evidence, and ongoing evaluation throughout the implementation phase. The Iowa Model was especially helpful throughout the implementation phase and served as a reference point to evaluate and foster the sustainability of the practice change. Sustainability was unlikely without providing resources to providers, continuously monitoring and analyzing outcomes, and offering positive reinforcement (Iowa Model Collaborative et al., 2017).

The DOI theory was crucial in the success of the practice improvement project, and facilitation of behavior change and the adoption of dermoscopy by PCPs. This theory guided the project co-investigator from initiation, assisting in the selection of dermoscopy as an innovation and determining effective communication channels for dissemination. Moreover, the DOI theory helped to identify different types of adopters within the target population, a critical step in improving project adoption (Dearing & Cox, 2018; E. M. Rogers, 2003). While visiting the site, the co-investigator was able to categorize providers as enthusiastic and eager to try dermoscopy as well as those who were more cautious and skeptical about adopting this practice. Understanding adopter categories allowed for the creation of strategies designed to target the

most providers in each category. This knowledge prompted the co-investigator to include evidence and literature to entice those that were more skeptical, and using quick simple training for those that were more eager to try dermoscopy.

Recommendations

After completing this project, various recommendations were considered to enhance future projects and research concerning the implementation of dermoscopy in primary care settings. Feedback from providers during informal monthly check-ins suggested that scheduling the in-person meeting further in advance would have facilitated greater attendance among providers. Proactive scheduling could accommodate individuals who prefer a conventional face-to-face lecture format while also considering the constraints of busy patient schedules. In addition to proactive scheduling, the training session could have been offered to more providers within Sanford Health via virtual attendance using platforms such as Zoom, or Webex.

Future practice improvement projects with a similar focus should include further questions for providers if they do not plan on utilizing dermoscopy in the future. Further analysis could be achieved by adding an open-ended question in the post-survey. If a provider answers "no" to the question, *Do you plan on buying or requesting your organization purchase a dermatoscope following the dermoscopy training module,* there could be a follow-up question asking the provider to state their reasoning. Asking these questions would allow for further analysis of barriers to dermoscopy and more insight into providers' attitudes toward dermoscopy. Numerous studies have already delved into providers' perceived barriers to dermoscopy (Fee et al., 2019; Jones et al., 2019; Wolden, 2023). Gathering additional data on these barriers serves the purpose of identifying and ultimately overcoming these obstacles, leading to a higher adoption rate of dermoscopy.

Recommendations to enhance the integration of dermoscopy into primary care is by ensuring proper reimbursement for use of the tool. The amount of training needed for proficient use paired with the absence of reimbursement is commonly cited as an obstacle in adopting dermoscopy within clinical practice (Fee et al., 2019). Advocating for an endorsed current procedural terminology (CPT) code for dermoscopy, ensuring reimbursement for providers, would motivate them to invest the necessary time and training to master dermoscopy skills. Having an incentive structure encourages healthcare professionals to become proficient in dermoscopy techniques. The CPT code and reimbursement would also facilitate monitoring of dermoscopy utilization, accuracy in diagnosis, and rates of referral.

Many of the co-investigator's DNP student cohort recommended that implementing dermoscopy training as part of their curriculum would be beneficial for their future practice. Training could be implemented as part of curriculum in a practicum course that has an emphasis on specialties. As noted by survey results, only one of the five providers had prior training or education on dermoscopy. By implementing dermoscopy training as part of curriculum for NP and PA students, and primary care residency programs, more providers would be equipped to utilize this tool proficiently, increasing the number of early adopters of dermoscopy entering practice. In existing studies that focus on dermoscopy training for PCPs, there was lack of consensus on the competency standards required for dermoscopy application in primary care practice. The absence of competency standards poses challenges in evaluating and comparing the efficacy of educational programs by accrediting bodies. Further investigation would be needed to establish a standardized curriculum specifically tailored for PCPs in dermoscopy. An approach worth considering involves using an evidence-based, accurate, and simplified diagnostic

algorithm such as PASS, as a pilot program to enhance dermoscopy education (Avilés-Izquierdo et al., 2023).

Recent research indicates that conducting dermoscopy workshops to train medical students, PA students, primary care residents, and NPs on TADA has led to improved accuracy in identifying malignant skin lesions (Cyr et al., 2021; Middleton et al., 2023). These studies suggest the training of students as novice dermoscopists can significantly improve their ability to deliver improved dermatologic care to patients. Introducing dermoscopy into the didactic education of established NP, PA, and medical school programs will equip future PCPs with the skills needed to offer improved clinical care while evaluating skin lesions. This integration would ensure that upcoming healthcare professionals are skilled at using dermoscopy, ultimately benefiting patient care in dermatology assessments.

Dissemination

The dissemination of research results represents a pivotal stage in any project and serves to advance knowledge and encourage ongoing exploration within the interested communities. To initiate the dissemination process during the project's implementation phase, a poster presentation was created, highlighting the project background, design, and initial survey findings. The poster was presented at the NDNPA Annual Pharmacology Conference in Bismarck in September 2023.

Upon completion of the implementation phase and subsequent data analysis, the outcomes of this practice improvement initiative will be shared with both the providers and the management team at SPFM via email. Communication will include an executive summary (Appendix Q) along with a digital copy of the online module.

The digital copy of the online module will be able to be downloaded by the providers who were invited to participate in this practice improvement project. The digital copy of the training module will serve as a valuable resource for PCP future reference. Additionally, clinic management will have access to the module and can share the training with PCPs within Sanford Health who express an interest in learning more about dermoscopy. Dissemination of the completed module aims to facilitate broader access to educational material among healthcare professionals interested in dermoscopy training within the Sanford Health network.

To further expand the reach of dissemination to the healthcare community, there is a potential opportunity for future publication of this practice improvement project in an academic journal. Journals including The Journal of the American Association of Nurse Practitioners or Advances in Family Practice Nursing Journal are platforms that would be appropriate for sharing the findings and insights derived from this project.

Strengths and Limitations

The practice improvement project was implemented in-person at SPFM and via an online module. Having the training session available to providers in-person and online allowed for providers with different learning preferences and to be able to complete dermoscopy training. Those that prefer face-to-face training had the option to attend in person, and those with busy schedules, and who are technologically savvy were able to view on their own time online. While this was a great starting point for dermoscopy training, the reach of the project was limited by the number providers that were invited to attend the education. To reach a broader audience this project could have been implemented at all Sanford Health FM area primary care clinics, or as an online training module for any providers within Sanford Health interested in dermoscopy.

In previous studies, providers reported the time to learn dermoscopy as a barrier to use, and decreasing training time can slightly reduce provider hesitation to learn this important tool (Fee et al., 2019; Jones et al., 2019; Wolden, 2023). Unlike most studies that conduct training sessions lasting one to two hours, this training session was notably shorter, lasting only 20 minutes. A condensed timeframe significantly minimizes the commitment required from providers to grasp the usage of a tool for which they currently do not receive reimbursement. While a shorter training session offers advantages, such as reduced time commitment for providers, shortened training also presents a downside. The chosen algorithm, although accurate and user-friendly, specifically targets pigmented skin lesions. Consequently, this approach may overlook less common amelanotic melanomas and other typically non-lethal non-pigmented skin cancers like SCC or BCC since the algorithm does not cover these variations.

Application to the APRN Role

The findings from this practice improvement project hold significant relevance for the role of advanced practice registered nurses (APRNs). First and foremost is the APRNs pivotal role in providing preventive healthcare services to patients, focusing on identifying risk factors and addressing conditions early to decrease patient morbidity and mortality. APRNs conduct regular physical exams and screening tests, to detect diseases at their initial stages. If APRNs utilize NEE they can further extend their secondary prevention to improve the morbidity and mortality rates associated with skin cancer (Brown et al., 2022). Continued increases in skin cancer prevalence makes APRNs an integral part of early detection and treatment of skin cancer via thorough skin examinations (American Cancer Society [ACS], 2023).

While NEE is an important aspect of secondary prevention of skin cancers, using NEE in combination with dermoscopic evaluation of suspicious lesions increases the diagnostic accuracy

skin lesions and decreases unnecessary biopsies (Jaimes & Marghoob, 2022; Jones et al., 2019; Seiverling et al., 2023). Results from this practice improvement project align with findings from these studies showing improvement in knowledge and confidence with lesion identification and triaging following dermoscopy training and implementation into clinical practice. Primary care APRNs utilizing dermoscopy can significantly enhance their accuracy in identifying both benign and malignant lesions. Increased accuracy contributes to improved patient outcomes by potentially reducing unnecessary procedures and subsequent healthcare costs.

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APPENDIX A: IRB APPROVAL

CC: Hayli Ova <hayli.bauer@ndsu.edu>

NDSU NORTH DAKOTA STATE UNIVERSITY

**** It was noted that your original approval letter was not sent on July 3rd. Please file this letter as your original exempt determination.****

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*).

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

Sincerely,
[redacted]
Institutional Review Board Office
NORTH DAKOTA STATE UNIVERSITY

phone: 701.231.8995
fax: 701.231.8098
kristy.shirley@ndsu.edu
ndsu.irb@ndsu.edu

For more information regarding IRB Office submissions and guidelines, please consult https://www.ndsu.edu/research/for_researchers/research_integrity_and_compliance/institutional_review_board
This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

APPENDIX B: IRB AMMENDMENT APPROVAL

CC: Hayli Ova [redacted]

NDSU NORTH DAKOTA STATE UNIVERSITY

The protocol amendment request and all included documentation for the above-referenced project have been reviewed and approved via the procedures of the North Dakota State University Institutional Review Board.

Thank you for cooperating with NDSU IRB procedures, and best wishes for a successful study.

Sincerely,
Institutional Review Board
NORTH DAKOTA STATE UNIVERSITY

phone: 701.231.8995
fax: 701.231.8098
kristy.shirley@ndsu.edu
ndsu.irb@ndsu.edu

For more information regarding IRB Office submissions and guidelines, please consult https://www.ndsu.edu/research/for_researchers/research_integrity_and_compliance/institutional_review_board_
This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

APPENDIX C: SANFORD HEALTH LETTER OF AGREEMENT

SANFORD HEALTH

DATE

Re: Letter of Agreement for Onsite Nursing Research/EBP/PI projects and studies - Sanford Fargo

This is to confirm that we agree to collaborate with **North Dakota State University** on **PI project** entitled Dermoscopy Education to Improve Provider Confidence in Skin Cancer Identification, conducted by North Dakota State University graduate student/faculty **Hayli Ova.**

After review and approval by the Sanford Nursing Research Council, nursing projects and studies are referred to Sanford Research and the Sanford Institutional Review Board (IRB) to determine Human Subjects research status, level of risk, or exemption from Board review.

Procedures for this project/study include: a) education on dermoscopy and the PASS algorithm provided to primary care providers with full disclosure and provider consent b) anonymous survey and quiz questions completed by providers. If a minimum of information is necessary to the project or study, and is to be collected from patient medical records, data access will be approved by the Sanford Privacy Office. Precautions are in place so that information will not be identifiable.

We understand that any protected health information, such as names, addresses, social security numbers, medical record numbers, account numbers, birthdates, admission and discharge dates, that is abstracted from medical records for research purposes will be completely de-identified. De-identified data will be kept private using Qualtrics and will remain inaccessible to the principal investigator. There will be no data transfer. Analysis will be conducted on inaccessible, password protected computers. Aggregate Sanford Health clinical data will remain confidential and will not be shared outside of the organization without specific authorization.

This letter confirms that we are aware of the conduct of this project in **Sanford Southpointe Family Medicine** Clinic and agree to collaborate with the investigator.

Sincerely,

Signed Authorized Department Signature
Title

5/18/2023
Date

Theresa Larson

Theresa Larson, MSN, BSN, RN
Vice President of Nursing & Clinical Services

5/22/2023
Date

APPENDIX D: SANFORD HEALTH IRB EXEMPTION

SANFORD HEALTH

NOT HUMAN RESEARCH

May 19, 2023

Dear Katy Dobberstein:

The IRB reviewed the following submission:

Type of Review:	Initial Study via Non-Committee Review
Title of Study:	DERMOSCOPY EDUCATION TO IMPROVE PROVIDER CONFIDENCE IN SKIN CANCER IDENTIFICATION: DERMOSCOPY EDUCATION TO IMPROVE PROVIDER CONFIDENCE IN SKIN CANCER IDENTIFICATION
Investigator:	Katy Dobberstein Mentor for student Hayli Ova
IRB ID:	STUDY00003262
Special Determinations:	None

The IRB determined, on 5/19/2023, that the proposed activity is not human research. Sanford IRB review and approval is not required.

Although this project has been determined not to be human research, the use and disclosure of Protected Health Information (PHI) is still subject to Sanford operational approval and HIPAA requirements. If the IRB has not approved a waiver of HIPAA authorization, you may still be required to obtain HIPAA authorization. Here is a link to a HIPAA Authorization form (Medical Information Release). Please contact the Sanford Privacy Office at privacyoffice@sanfordhealth.org for questions related to meeting Sanford privacy and HIPAA requirements after you have obtained the appropriate operational approval for your project.

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are being considered and there are questions about whether IRB review is needed, please submit a study modification to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

For questions please contact the IRB Office: eIRB@sanfordhealth.org.

Template Revision: May 2, 2019

APPENDIX E: PERMISSION TO USE AND/OR REPRODUCE THE IOWA MODEL (2015)

Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote...

KJ Kimberly Jordan - University of Iowa Hospitals and Cli

To Ova, Hayli

Reply | Reply All | Forward

Thu 4/13/2023 10:47 AM

This sender survey-bounce@survey.uiowa.edu is from outside your organization.

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.

Iowa Model - 2015.pdf

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Reference: 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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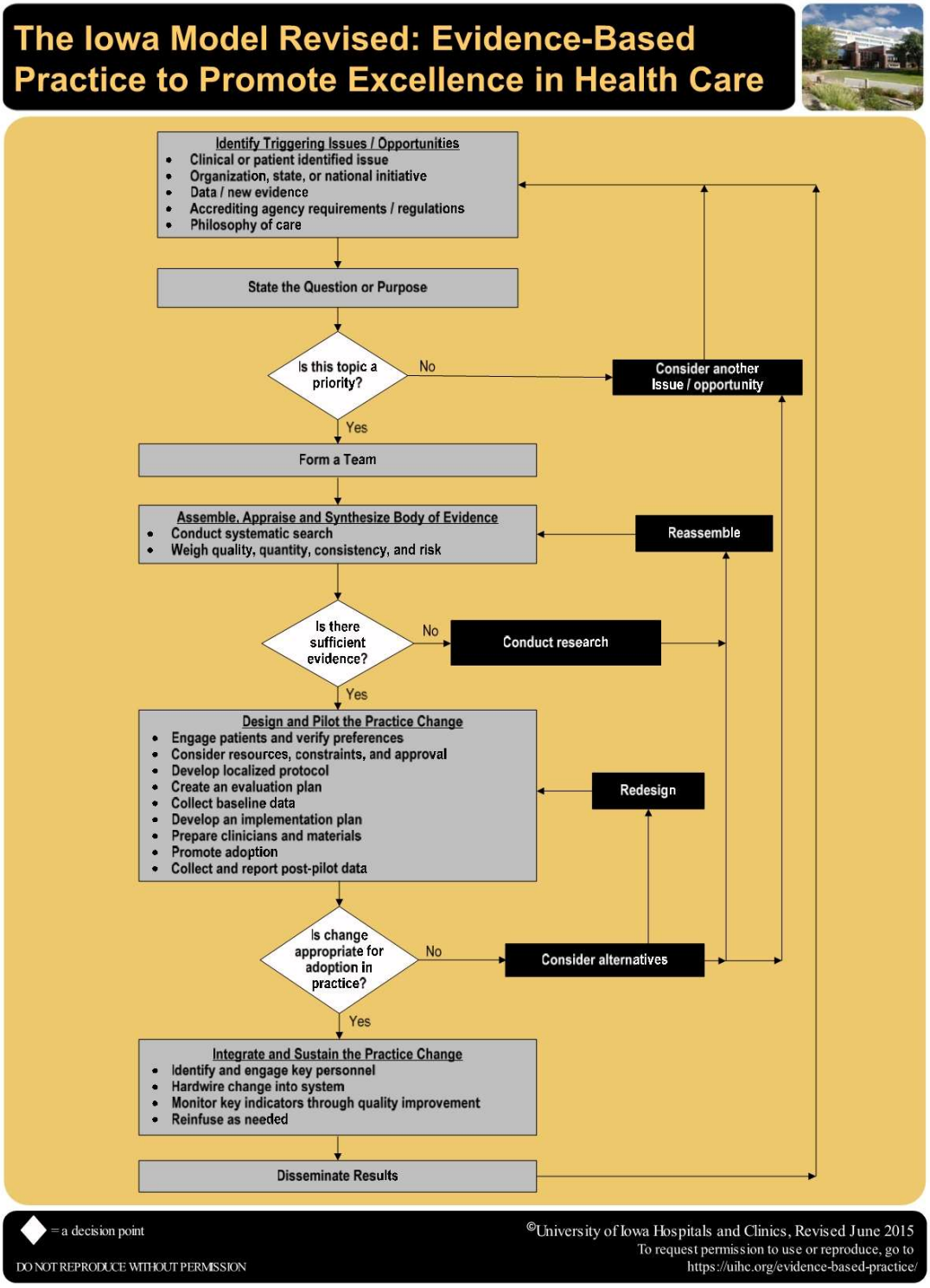
Please contact UIHCNursingResearchandEBP@uiowa.edu or 319-384-9098 with questions.

APPENDIX F: THE IOWA MODEL OF EVIDENCE-BASED PRACTICE



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APPENDIX G: PERMISSION TO USE AND/OR REPRODUCE HENCLEY 2017 SURVEYS

From: Erin Gazich <emhencle@cord.edu>
Sent: Tuesday, May 16, 2023 11:48 AM
To: Ova, Hayli
Subject: Re: Dermoscopy Dissertation

Hi Hayli,

Yes, you have my permission to use my surveys and add questions as well. Hope everything is going well!
Erin

From: Ova, Hayli [redacted]
Sent: Monday, May 15, 2023 10:37 AM
To: Erin Gazich <emhencle@cord.edu>
Subject: Dermoscopy Dissertation

Hi Erin,

I am replicating your dermoscopy project, as Dean has already discussed with you. I will be replicating the study with Sanford Southpointe family practice providers. With your permission I would like to use your surveys and potentially add some questions. Please let me know ff that would be okay, and you are comfortable with giving me permission to use your surveys as a part of my project.

Thank you,

Hayli Ova RN, BSN
North Dakota State University
Doctorate of Nursing Practice Student

APPENDIX H: SPFM PRE-IMPLEMENTATION SURVEY

PRE-MODULE SURVEY

Healthcare providers: Please fill out the following survey to assist the co-investigator in identifying current strengths and needs with your experience with dermoscopy. Participation iscompletely voluntary, yet greatly appreciated.

Please list the last 4 digits of your phone number here to help track pre-and post-survey results anonymously_____.

1-Strongly Disagree 2-Disagree 3-Agree 4-Strongly Agree

I am knowledgeable about skin cancer prevalence and screening strategies	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel confident performing naked eye skin examinations	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I have received prior education and/or training on dermoscopy	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I have previous experience using dermoscopy in clinical practice	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel confident with the practice of dermoscopy	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel confident in my ability to triage skin lesions using dermoscopy and the PASS method.	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel that using dermoscopy will benefit my practice and my patients	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree

What do you consider your current level of knowledge of dermoscopy?	-1- Novice	-2- Advanced beginner	-3- Competent	-4- Proficient	-5- Expert

Permission to use/reproduce granted (See APPENDIX G)

APPENDIX I: SPFM POST-IMPLEMENTATION SURVEY

POST-MODULE SURVEY

Healthcare providers: Please fill out the following survey to assist the co-investigator in identifying current strengths and needs with your experience with dermoscopy. Participation iscompletely voluntary, yet greatly appreciated.

Please list the last 4 digits of your phone number here to help track pre-and post-survey results anonymously_____.

1-Strongly Disagree 2-Disagree 3-Agree 4-Strongly Agree

I am knowledgeable about skin cancer prevalence and screening strategies	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel confident performing naked eye skin examinations	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel confident with the practice of dermoscopy	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel confident in my ability to triage skin lesions using dermoscopy and the PASS method.	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel that using dermoscopy will benefit my practice and my patients	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree
I feel that I will be able to make more accurate referrals following the implementation of dermoscopy using the PASS method.	-1- Strongly Disagree	-2- Disagree	-3- Agree	-4- Strongly agree

What do you consider your current level of knowledge of dermoscopy?	-1- Novice	-2- Advanced beginner	-3- Competent	-4- Proficient	-5- Expert

Do you plan on buying or requesting your organization purchase a dermatoscope following the dermoscopy training module?	Yes	No

Permission to use/reproduce granted (See APPENDIX G)

APPENDIX J: PROJECT PARTICIPATION CONSENT

NDSU **North Dakota State University**
Department of Nursing
Aldevron Tower 540
NDSU Dept. 2670
PO Box 6050
Fargo, ND 58108-6050
701.231.7395

Dermoscopy Education to Improve Provider Confidence in Skin Cancer Identification

My name is Hayli Ova. I am a graduate student in the Doctorate of Nursing Practice program at North Dakota State University, and I am conducting a research project to improve provider confidence and knowledge in identifying skin cancers using dermoscopy. It is our hope, that with this research, we will learn more about how to increase skin cancer screening in primary care.

Because you are a primary care provider at Southpointe Family Medicine Clinic, you are invited to take part in this research project. Your participation is entirely your choice, and you may change your mind or quit participating at any time, with no penalty to you.

It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known risks. These known risks include: time taken learning about dermoscopy, and the possibility that you may not have improvement in your skin cancer identification abilities.

By taking part in this research, you may benefit by having increased knowledge in skin cancer identification, as well as confidence in dermoscopy use. However, you may not get any benefit from being in this study. Benefits to others are likely to include earlier identification of skin cancer, improved patient outcomes, decreased health care costs, and fewer unnecessary referrals.

It should take about 5 minutes to complete the questions about your experience and thoughts on dermoscopy and skin cancer screening. It should take about 20 minutes to complete the training on dermoscopy. You will receive lunch if you attend the training in person.

This study is anonymous. That means that no one, not even members of the research team, will know that the information you give comes from you.

If you have any questions about this project, please contact me at [redacted] or contact my advisor at [redacted]

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701.231.8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu.

Thank you for your taking part in this research.

APPENDIX K: PERMISSION TO USE DERMNET NZ IMAGES

Thank you 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 and you link back to our site. 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.

APPENDIX L: DERMOSCOPY MODULE PRE-PASS TRAINING QUIZ AND ANSWERS

Hx: Patient presents with this lesion; you believe it is most likely _____

A. Melanoma/Dysplastic Nevus
B. Solar Lentigo
C. Nevus
D. Unsure

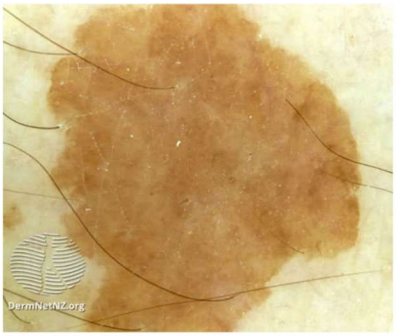
Used with permission from dermnetnz.org *Answer: C*

Hx: Patient presents with this lesion; you believe it is most likely _____

A. Melanoma/Dysplastic Nevus
B. Solar Lentigo
C. Nevus
D. Unsure

Used with permission from dermnetnz.org *Answer: A*

Hx: Patient presents with the above lesion; you believe it is most likely _____



A. Melanoma/Dysplastic Nevus
B. Solar Lentigo
C. Nevus
D. Unsure

Used with permission from dermnetnz.org *Answer: B*

APPENDIX M: DERMOSCOPY MODULE POST-PASS TRAINING QUIZ AND ANSWERS

Hx: Patient presents with this lesion; you believe it is most likely _____

A. Melanoma/Dysplastic Nevus
B. Solar Lentigo
C. Nevus
D. Unsure

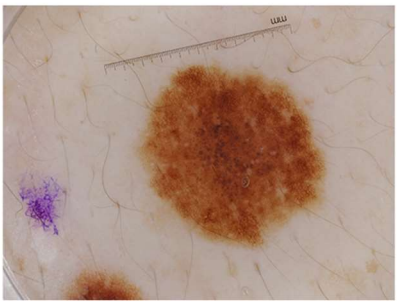


Image from UpToDate *Answer: C*

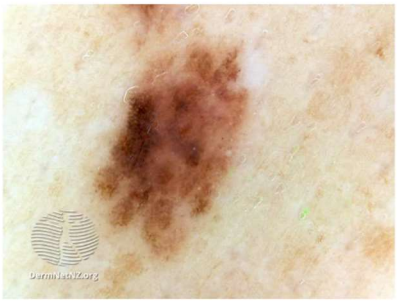
Hx: Patient presents with this lesion; you believe it is most likely _____

A. Melanoma /Dysplastic Nevus
B. Seborrheic Keratosis
C. Nevus
D. Unsure

Image from dermoscopy.wordpress.com *Answer: A*

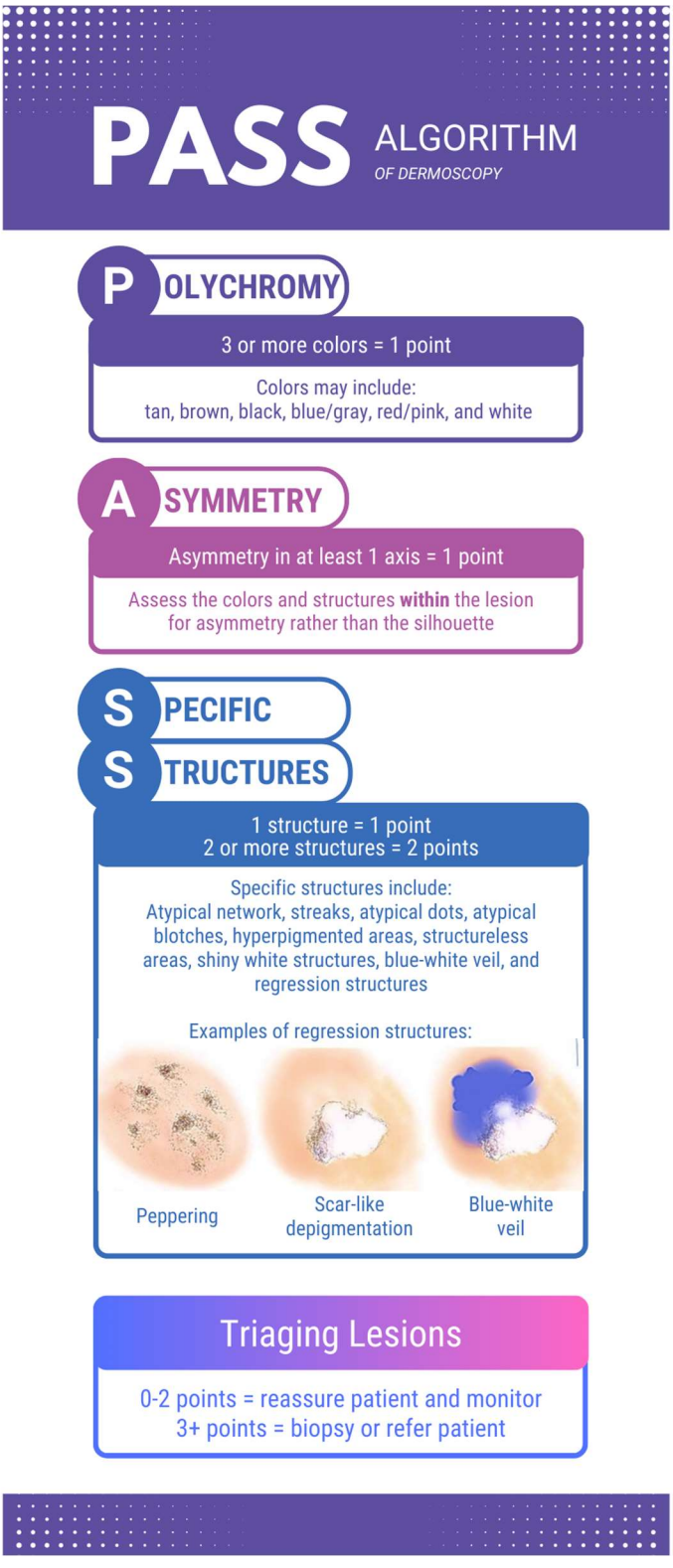
Hx: Patient presents with this lesion; you believe it is most likely _____

A. Melanoma/Dysplastic Nevus
B. Solar Lentigo
C. Nevus
D. Unsure



Used with permission from dermnetnz.org *Answer: A*

APPENDIX N: PASS INFOGRAPHIC



APPENDIX O: LOGIC MODEL

Inputs

- Time for developing educational module
- Educational binders
- Southpointe Family Medicine PCPs
- Patients at Southpointe
- Dermatoscopes
- PASS algorithm

Activities

- Recruitment of PCPs at Southpointe Family Medicine
- Development of educational module on dermoscopy
- Hold educational session for providers to learn and practice dermoscopy
- Educational module and dermatoscopes lent to Southpointe clinic
- Practice use of dermoscopy in clinical setting by PCPs at Southpointe Family Medicine
- Conduct site visits for answering questions as requested by providers

Outputs

- 3-month implementation period for PCPs to use dermoscopy in the clinical setting
- Pre and post education surveys
- Educational materials and PASS algorithm in binder

Short Term Outcomes

- Improved PCP knowledge about dermoscopy and lesion triage
- Enhanced PCP confidence in use of dermoscopy
- Increased PCP intent to use dermoscopy in practice

Long Term Outcomes

- Improved management of skin lesions with use of dermoscopy
- Continued use of dermoscopy in practice
- Decreased number of unnecessary biopsies and referrals to dermatology

APPENDIX P: TRAINING MODULE POWERPOINT

Dermoscopy Education to Improve Provider Confidence in Skin Cancer Identification

Hayli Ova

Objectives

- Basic dermoscopy introduction
- Learn PASS algorithm and application to skin lesions
- Practice lesion identification and triage
- Hands-on practice with dermatoscopes

Your participation is completely voluntary. If you consent to proceeding with this training, please scan the QR code to fill out a short survey.

Background

- Why dermoscopy training?
  - Improve accuracy of skin lesion identification (Sawyers et al., 2020).
  - Diagnostic accuracy of all lesions improved from 76.4% to 90%
  - Diagnostic accuracy of melanoma lesions improved from 76.9% to 95.0%
- A little bit about melanoma (Davis et al., 2019)
  - Originates within melanocytes (pigment cells) in the basal layer of the epidermis
  - Accounts for 4% of all skin cancers, and causes about 75% of all skin cancer deaths
  - Risk factors
    - History of blistering sunburns, lighter skin color, blond or red hair, having many, irregularly shaped, sized, or colored moles, weakened immune system, or an inherited genetic predisposition to develop melanoma

Dermoscopy

- Polarized vs non-polarized
  - Contact and fluid immersion
  - Layers
  - Colors and structures
- 2 non-polarized dermatoscopes will be available for use for the next 3 months

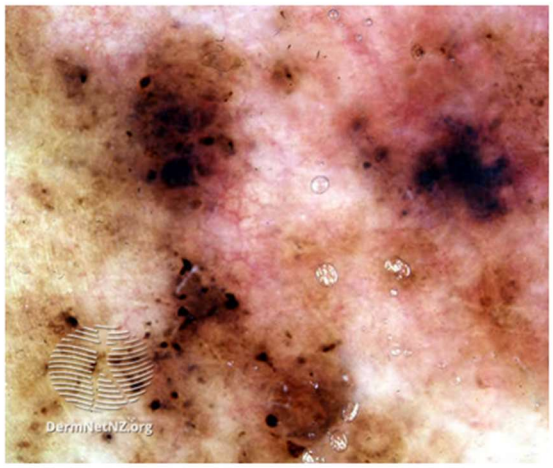
PASS

- Polychromy (3 or more colors = 1pt)
- Asymmetry (asymmetry in at least 1 axis = 1pt)
- Specific Structures (1 structure = 1pt, 2 or more structures = 2pts)
  - 0-2 pts = reassure and monitor
  - 3+ pts = biopsy or refer to specialist

(Avilés-Izquierdo et al., 2023)

Polychromy

- Colors that may be seen on dermoscopy
  - tan, brown, black, blue/gray, red/pink, and white



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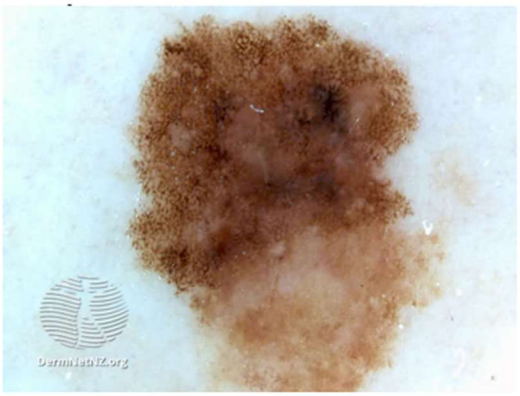
Asymmetry



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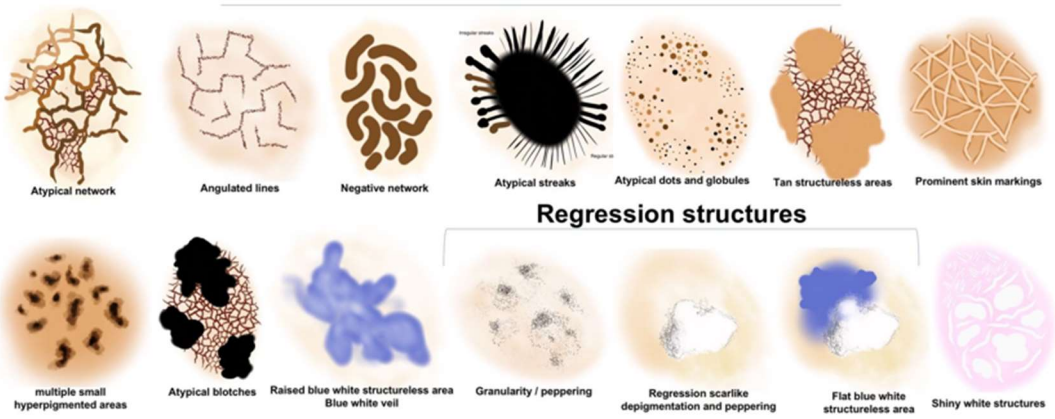
Melanoma Specific Structures



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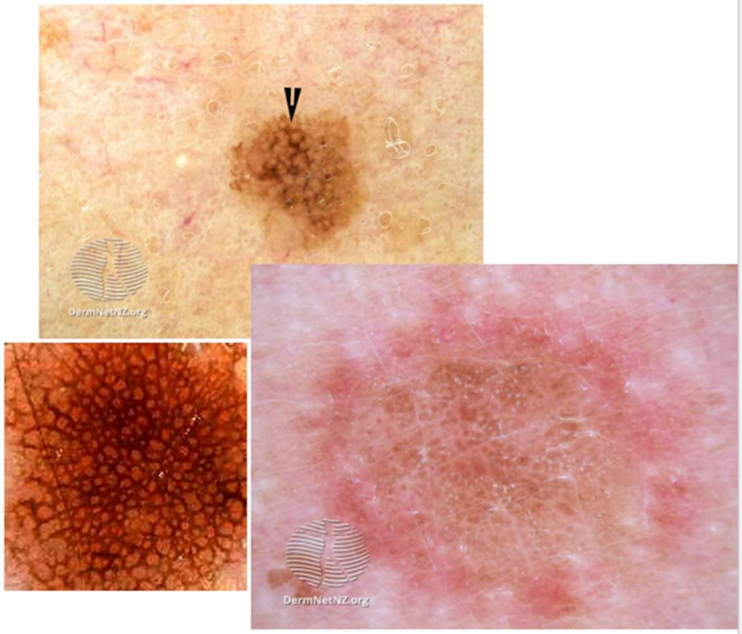
Atypical Network/Negative Network

- Atypical Network
  - Irregularly meshed with lines of varying size, color, thickness, or distribution
  - Non-uniform
  - May end abruptly at the periphery
- Negative Network
  - White reticular pattern with elongated and curved brown structures



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Atypical Streaks & Starburst Pattern

- Uniform peripheral streaks, dots, or globules
- May appear organized, but will only appear in a focal location around the periphery

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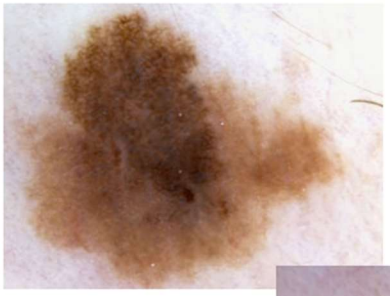
Atypical Dots/Globules & atypical Blotches

- Atypical Dots/Globules
  - Distributed asymmetrically
  - Are not clustered in the center and are associated with an atypical network
- Atypical Blotches
  - Off-center blotch
  - Presence of multiple blotches
  - May have irregular shapes and hues

Used with permission from dermnetnz.org

Tan Structureless Areas & Multiple Hyperpigmented Areas

- Tan structureless areas
  - Areas with typical network are broken up by tan areas that are void of any structures
- Multiple hyperpigmented areas
  - Multiple hyperpigmented areas within a lesion that are irregularly shaped
  - The structures may be one darker color or multiple colors



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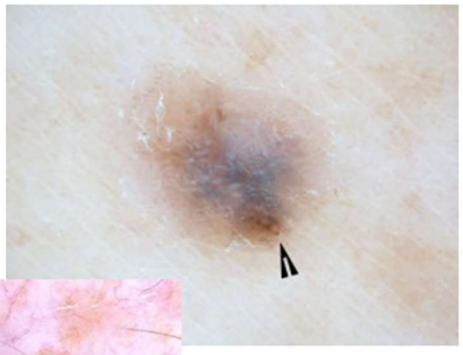
Blue-White Veil

- Blue-white or greyish veil over raised areas
- Blue-grey structures including dots or globules



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Shiny White Structures

- White lines, blotches, and strands (seen with polarized light)
- White circles (seen with polarized and non-polarized light)

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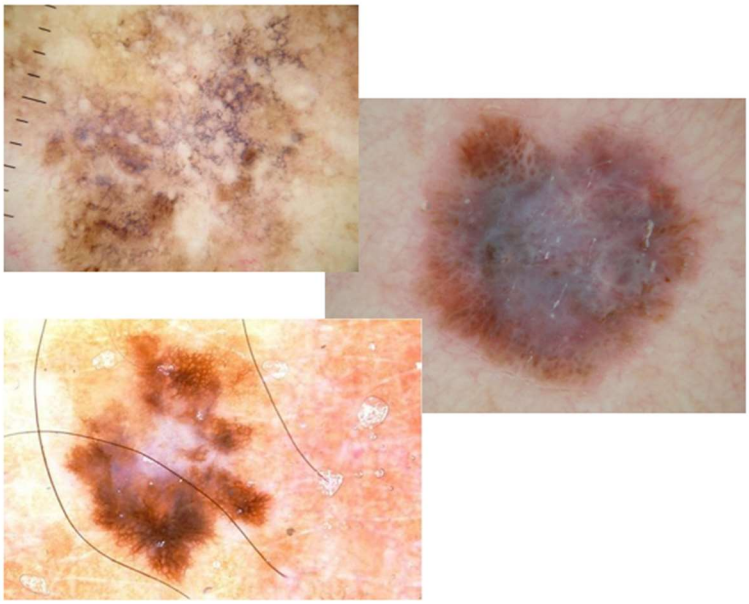
Regression Structures

Appear on flat, non-palpable areas

- Granularity or peppering
  - Multiple very small nondescript, blue-grey dots
- Scar-like depigmentation
  - White discoloration of the lesion, which is lighter than the surrounding normal skin
- Blue-white veil (remember this is over a flat area)
  - Focal, ill-defined area of blue pigmentation with an overlying white "ground-glass" haze
  - Does not occupy the entire lesion



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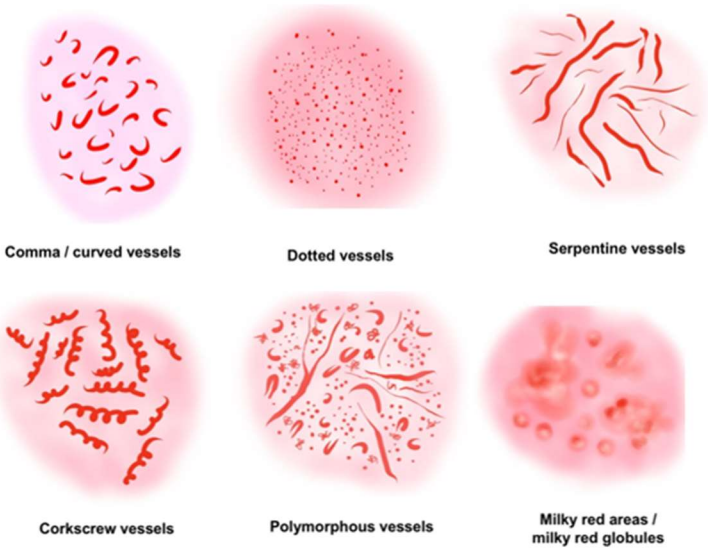
Atypical Vessels

- Comma
- Dotted
- Serpentine/linear
- Corkscrew
- Polymorphous
  - Any combination of other atypical vessel types
  - Most common combination is dotted and serpentine
- Milky red areas/globules
  - Edges of vessels or globules are not well demarcated



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Thank you for participating!

Please let me know if you have any further questions about dermoscopy, or the pass algorithm.

Hayli.bauer@ndus.edu

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APPENDIX Q: EXECUTIVE SUMMARY

Dermoscopy Education to Improve Provider Confidence in Skin Caner Identification

Practice Improvement Project

Problem

Skin cancer is the most common form of cancer in the United States and is becoming more prevalent with at least 9,500 individuals in the United States being diagnosed each year. Melanoma makes up about 4% of these skin cancers, but accounts for about 75% of all skin cancer deaths.

Primary care providers (PCPs) are often patients first contact with a healthcare provider for concerning skin lesions, however many providers lack confidence in identification and triaging of skin lesions. PCPs typically use naked-eye examination, which can lead to inconsistency in diagnosis between providers depending on which technique is used and varying knowledge of skin lesions. Inconsistencies in diagnosis can lead to missed skin cancers, as well as unnecessary biopsies and referrals.

Dermatoscopes are a non-invasive tool that can be used to enhances lesion structures and allows for greater differentiation and more accurate lesion identification. Use of dermoscopy in primary care has been shown to increase early detection of skin cancer, improving patient outcomes as well as decreasing unnecessary biopsies and referrals.

Results

A comparison of results from pre- and post-implementation surveys showed a perceived:

- Increase in knowledge in identifying and triaging skin lesions
- Increase in confidence using dermoscopy
- Benefit of dermoscopy in the primary care setting

A comparison of module questions results showed improvement in lesion identification of almost 20% after learning the PASS algorithm of dermoscopy. There was a notable increase in accuracy of benign lesion, which ultimately decreases number of unnecessary biopsies and referrals.

Recommendations

- Providing the educational module on dermoscopy and the PASS algorithm to PCPs interested in incorporating dermoscopy into their practice
- Continued use of dermoscopy and the PASS algorithm on patients with suspicious lesions
- Administrative support for purchasing of dermatoscopes at primary care clinics