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Implementation of the VisualDx Application by Nurse Practitioners and Physician Assistants Aimed at Improving Diagnostic Accuracy in Skin of Color Patients

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IMPLEMENTATION OF THE VISUALDX APPLICATION BY NURSE PRACTITIONERS AND PHYSICIAN ASSISTANTS AIMED AT IMPROVING DIAGNOSTIC ACCURACY IN SKIN OF COLOR PATIENTS

by

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EVIDENCE-BASED PRACTICE PROJECT REPORT

Submitted to the College of Nursing and Health Professions

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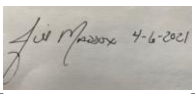
DOCTOR OF NURSING PRACTICE

2021

"I have neither given or received, nor have I tolerated other's use of unauthorized aid."



Student Date

Jeffrey A. Coto Digitally signed by Jeffrey A. Coto Date: 2021.04.06 08:27:43 -05'00'

Advisor Date

DEDICATION

I dedicate this degree to my Aunt/Godmother Kathy who passed away July 2020. I will always treasure the memory of her pointing her finger at me and saying, “get it done Jill Marie”.

ACKNOWLEDGEMENTS

I could not have done this without the support of my fiancé Daniel, God love him for his patience. Gratitude for Kathleen Kelley, MD and Kari Sculati, FNP-BC for their brainstorming, support, and tolerance during this process. An enormous thank you to my sister Jennifer and Cousin Lynne, both who spent a great deal of time talking me off the ledge.

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ABSTRACT

In 2016 the United States black population stood at over 43 million with a projected increase of 41% by 2060, and the “two or more races” category will increase by 197.8% (Vespa et al., 2020), thus intensifying the need for diagnostic accuracy of skin diseases for these demographics. The American Academy of Dermatology (https://www.aad.org, 2020) brochures as well as dermatology textbooks underrepresent skin of color (SOC) cutaneous appearance (Louie and Wilkes, 2018), and darker skin tone dermatology education is limited. This underrepresentation leads to misperceptions, misdiagnoses, and poorer outcomes. The purpose of this evidence-based practice project was evaluation of a technological tool implementation aimed at increasing Nurse Practitioner (NP) and Physician Assistant (PA) diagnostic accuracy in SOC dermatology patients in a large Northern Indiana healthcare system. NP/PA downloaded the VisualDx application (https://mobile.va.gov/app/visualdx) to their smartphone, acquired the textbook reference Atlas for Skin of Color (Jackson-Richards and Pandya, 2014), and were supplied with a Fitzpatrick Skin Type (FST) scale for skin tone reference (https://www.platinumskincare.com/). For any SOC patient where a biopsy was performed the NP/PA documented within the chart 1) skin type, 2) use of VisualDx, and 3) recorded their most confident differential first. The information was forwarded to the NP/PA via the HIPAA approved Doc Halo (https://halohealth.com/) application. A post-intervention survey determining satisfaction, ease of use, and perceived interventional tools’ level of bias was also assigned. Statistical analysis was performed via SPSS using Spearman’s Rho, Cronbach’s Alpha, and Chi-square. The proposed outcome of 90% or greater diagnostic accuracy was not achieved (42.9%), resulting in an inverse relationship with participant’s overall satisfaction of the interventional tools. Key words: (diagnos* OR exam* OR assess* OR screen* OR treat*), (educ* OR teach* OR learn* OR study* OR train* OR instruct*), (nurs* OR “advanc* pract* nurs*”), (“skin of color” OR “dark* skin” OR “black skin” OR brown skin”).

CHAPTER 1

INTRODUCTION

Background

The United States (U.S.) Census Bureau statistics on population growth reveal, that in 1990 one in five Americans were a person of color (POC) and that number is projected to increase to one in three persons by 2060 (Vespa et al., 2020). Owing to native and foreign-born immigrant reproduction, these rates could change slightly due to the closed U.S. borders brought on by COVID-19. Considering the projected increase in POC, it is imperative for dermatology providers to adapt and educate themselves on disease presentation in this demographic.

Skin of color (SOC) dermatology patients are underrepresented in textbooks (Louie and Wilkes, 2018) and patient brochures (https://www.aad.org, 2020), and provider training for patients in this subgroup is limited unless enrolled in specialized educational programs or the provider seeks knowledge independently (https://www.skinofcolorsociety.org, 2020). Advanced Practice Clinicians (APCs) such as Nurse Practitioners (NP) and Physician Assistants (PA) possess the ability to diagnose and treat dermatology patients (Machin, 2017), but due to the complexity in SOC, misdiagnoses can happen, not unlike their physician counterparts. Although there is little research concerning accurate diagnosis in dermatology SOC patients, what is known is patients with darker skin tones use less sun protection, perceive their skin as photoprotective, and believe their risk of skin cancer is minimal (Agbai et al., 2014). Persons with Fitzpatrick Skin Type (FST) IV through VI (Figure 1) do not visit the dermatologist as often as those with FST I through III and have poorer outcomes due to late-stage diagnosis and treatment (Buster et al., 2012; Dawes et al., 2016; Drenkard et al., 2019; Gelber et al., 2013; Hogue and Harvey, 2019; Huang et al., 2019; Lee et al., 2017). Skin color scales such as FST are subjective, making evaluation and diagnosis even more complicated (Ware et al., 2020).

Dermatologists, although specialty trained, often struggle to accurately diagnose skin disorders and lesions in individuals with FST IV-VI due to lack of training and available diagnostic tools.

A comprehensive literature search revealed dermatology providers need further education in SOC, yet only a small amount of literature dedicated to the diagnosis of darker skin toned patients is available, thus the implementation of Skin of Color Society and textbooks dedicated to this population (Jackson-Richards and Pandya, 2014; Kelly and Taylor, 2009). Specific tools are currently unavailable for darker skin tones except for textbooks and online references, but image and algorithm technological applications are available and have made advancements in broader skin type analysis (Carter et al., 2012; Vardell and Bou-Crick, 2012).

Figure 1

Fitzpatrick Skin Type Scale

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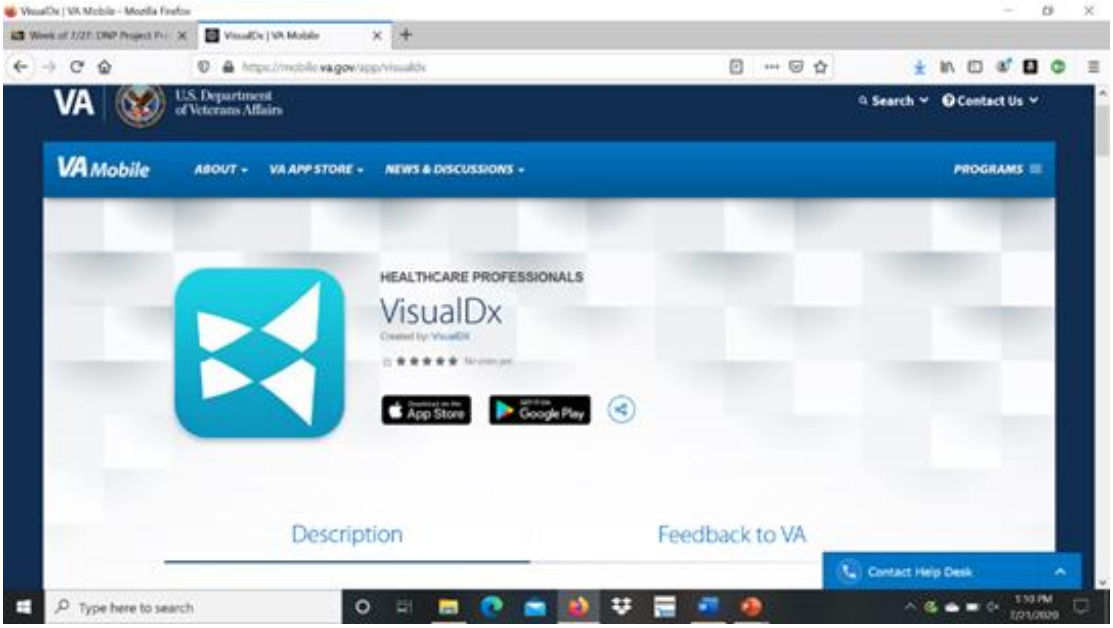
Advancements in technology have led healthcare providers toward innovative educational assistance (Burke and Littenberg 2019). VisualDx is a decision support tool (Vardell and Bou-Crick, 2012) using photographic images and algorithms to assist providers with

differential diagnoses (Figure 2). This mobile application or desktop reference has the ability to integrate with UpToDate and several other electronic healthcare platforms. Although VisualDx was originally targeted for the primary care audience, dermatology providers can implement the tool as well to expedite diagnosis and treatment.

Figure 2

VisualDx Mobile Application



Note: Reprinted from https://mobile.va.gov/app/visualdx, on July 18, 2020. Copyright permission granted March 16, 2021 by visualdx.com

The purpose of this evidence-based practice (EBP) project was to evaluate the implementation of a digital application along with a textbook reference and FST visual aid aimed at increasing APCs diagnostic accuracy in FST IV-VI.

Data from the Literature Supporting Need for the Project

National Data

The U.S. population is projected to be more ethnically diverse than ever before, and by 2060 one in three Americans (32%) will be a race other than white (Table 1). By 2060, Asians are expected to more than double, blacks will increase by >41%, and “two or more races” will increase by almost 200%, making it the largest race group in the country (Vespa et al., 2020).

State Data

Similar to the national data but limited by number of decades projected (2030), the expected population growth in Indiana revealed the most growth in the group “two or more races” at 135% (Table 2) and blacks at 26% (Kinghorn, 2008). With projected growth of almost 750,000 persons by 2030, and of those approximately 285,000 will be POC, if state population growth remains steady, the possibility of 1.2 million POC could reside in Indiana by 2060.

The statistics of population growth in POC support the need for implementing additional methods for skin-related healthcare diagnosis and treatment.

Table 1

United States Population Projections by Race

Table 3.

Population by Race and Ethnicity: Projections 2030 to 2060

The non-Hispanic White population is projected to shrink by nearly 19 million people by 2060.
(In thousands)

Characteristics	Population						Change from 2016 to 2060	
	2016		2030		2060			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total population	**323,128**	**100.0**	**355,101**	**100.0**	**404,483**	**100.0**	**81,355**	**25.2**
One race								
White	248,503	76.9	263,453	74.2	275,014	68.0	26,511	10.7
Non-Hispanic White	197,970	61.3	197,992	55.8	179,162	44.3	-18,808	-9.5
Black or African American	43,001	13.3	49,009	13.8	60,690	15.0	17,689	41.1
American Indian and Alaska Native	4,055	1.3	4,663	1.3	5,583	1.4	1,528	37.7
Asian	18,319	5.7	24,394	6.9	36,815	9.1	18,496	101.0
Native Hawaiian and Other Pacific Islander	771	0.2	913	0.3	1,125	0.3	354	45.9
Two or More Races	8,480	2.6	12,669	3.6	25,255	6.2	16,775	197.8
Hispanic	57,470	17.8	74,807	21.1	111,216	27.5	53,746	93.5
Native-born population	**279,283**	**100.0**	**301,318**	**100.0**	**335,150**	**100.0**	**55,867**	**20.0**
One race								
White	222,942	79.8	232,638	77.2	236,955	70.7	14,013	6.3
Non-Hispanic White	189,896	68.0	188,169	62.5	165,964	49.5	-23,932	-12.6
Black or African American	38,345	13.7	43,013	14.3	51,195	15.3	12,850	33.5
American Indian and Alaska Native	3,465	1.2	4,036	1.3	4,975	1.5	1,510	43.6
Asian	6,377	2.3	9,373	3.1	17,289	5.2	10,912	171.1
Native Hawaiian and Other Pacific Islander	576	0.2	686	0.2	866	0.3	290	50.3
Two or More Races	7,578	2.7	11,572	3.8	23,869	7.1	16,291	215.0
Hispanic	37,819	13.5	51,466	17.1	83,971	25.1	46,152	122.0
Foreign-born population	**43,845**	**100.0**	**53,783**	**100.0**	**69,333**	**100.0**	**25,488**	**58.1**
One race								
White	25,560	58.3	30,815	57.3	38,059	54.9	12,499	48.9
Non-Hispanic White	8,073	18.4	9,823	18.3	13,198	19.0	5,125	63.5
Black or African American	4,656	10.6	5,996	11.1	9,494	13.7	4,838	103.9
American Indian and Alaska Native	590	1.3	627	1.2	609	0.9	19	3.2
Asian	11,942	27.2	15,021	27.9	19,525	28.2	7,583	63.5
Native Hawaiian and Other Pacific Islander	195	0.4	227	0.4	259	0.4	64	32.8
Two or More Races	902	2.1	1,097	2.0	1,386	2.0	484	53.7
Hispanic	19,652	44.8	23,341	43.4	27,246	39.3	7,594	38.6

Note: The official population estimates for the United States are shown for 2016; the projections use the Vintage 2016 population estimate for July 1, 2016, as the base population for projecting from 2017 to 2060. Percentages will not add to 100 because Hispanics may be any race.
Source: U.S. Census Bureau, 2017 National Population Projections.

Note. Reprinted from *Demographic Turning Points for the United States: Population Projections for 2020 to 2060*, by Vespa, J., Medina, L., & Armstrong, D. M., 2020 retrieved from https://www.census.gov/content/dam/Census/library/publications/2020/demo/p25-1144

Table 2

Indiana Population Projections by Race

Table 1: Indiana's Projected Population Change by Race and Hispanic Origin, 2005 to 2030

	Population Estimate, 2005	Share of Total Population, 2005	Population Projection, 2030	Share of Total Population, 2030	Percent Change, 2005-2030
White	5,548,064	88.5%	6,010,300	85.6%	8%
Black	555,465	8.9%	701,500	10.0%	26%
Asian	81,802	1.3%	125,900	1.8%	54%
Two or More Races	68,084	1.1%	159,800	2.3%	135%
American Indian	18,561	0.3%	21,200	0.3%	14%
Total	**6,271,976**	**100%**	**7,018,700**	**100%**	**12%**
Non-Hispanic	5,987,066	95.5%	6,449,200	91.9%	8%
Hispanic or Latino	284,910	4.5%	569,500	8.1%	100%

Source: Indiana Business Research Center

Note. Reprinted from *Indiana Population Projections by Race and Hispanic Origin* by Kinghorn, M., 2008, retrieved July 25, 2020, from http://www.incontext.indiana.edu/2008/sept-oct/1.asp

Data from the Clinical Agency Supporting Need for the Project

Seven providers in the dermatology department within a large healthcare system in Northern Indiana agreed that diagnosing skin disorders in persons with FST IV-VI is difficult due to a lack of medical training and image availability in general medical textbooks (Kamp, J., Keultjes, E., Kelley, K., Martin, S., Pantalena, L., & Sculati, K., personal communication, 2020). In this dermatology practice, FST was only charted to determine burn risk for those patients undergoing narrow band ultraviolet light type B therapy (NBUVB) for diseases such as psoriasis, atopic dermatitis, vitiligo, and pruritis, and data tracking for patient population diversity or congruence of clinical vs histological diagnosis was non-existent. Considering the relative years

of dermatology experience in the APCs (<1-4 years), tracking congruence may have proven helpful in determining if previous didactics hit the mark, but would have resulted in lost anonymity.

Purpose of the Evidence-Based Practice Project

The purpose of this EBP project was to evaluate the implementation of a technological tool aimed at increasing APCs diagnostic accuracy in SOC dermatology patients. Considering projected population growth in POC, increased awareness, knowledge, and accuracy of diagnoses in this group is crucial.

PICOT Question

For APCs in dermatology, did implementing the tool VisualDx and providing the reference Atlas for Skin of Color (Jackson-Richards and Pandya, 2014) and FST visual aid (https://www.platinumskincare.com, 2020) result in diagnostic accuracy in patients with FST IV-VI as measured by congruence between clinical and histological diagnosis?

Significance of the EBP Project

Patients with FST IV-VI are under-represented in medical school curriculum and textbooks (Louie and Wilkes, 2018), and many perceive their dermatological care as inferior (Gorbatenko-Roth et al., 2019). There are also racial limitations of the FST rating scale (Ware et al., 2020) confounding the classification and, in turn, the appropriate diagnosis and treatment in POC. These issues contribute to poorer quality and increased cost of care, unsatisfactory patient outcomes, and racial disparities in several severe diseases such as Melanoma (Buster et al., 2012; Dawes et al., 2016; Hogue and Harvey, 2019), Scleroderma (Gelber et al., 2013); Mycosis Fungoides (Huang et al., 2019); Hidradenitis Suppurativa (Lee et al., 2017), and Lupus (Drenkard et al., 2019).

Given that skin conditions can be manifestations of internal disorders such as malignancy, anemia, infection, hormone dysfunction, vascular or abdominal/intestinal disorders to name a few, an accurate diagnosis early in the disease process is imperative. General

dermatological training in medical school as well as NP and PA programs are lacking SOC didactics. Finding new and innovative tools to assist in early, accurate diagnosis will inevitably increase positive patient outcomes. VisualDx is a quick, easy, inexpensive tool to implement in any practice with the ability to guide providers through possible differential diagnoses. Healthcare providers must adapt to the ever-changing patient demographic in order to provide high quality, effective, dermatological care and remain relevant in their profession.

CHAPTER 2

EBP MODEL AND REVIEW OF LITERATURE

Evidence-based Practice Model

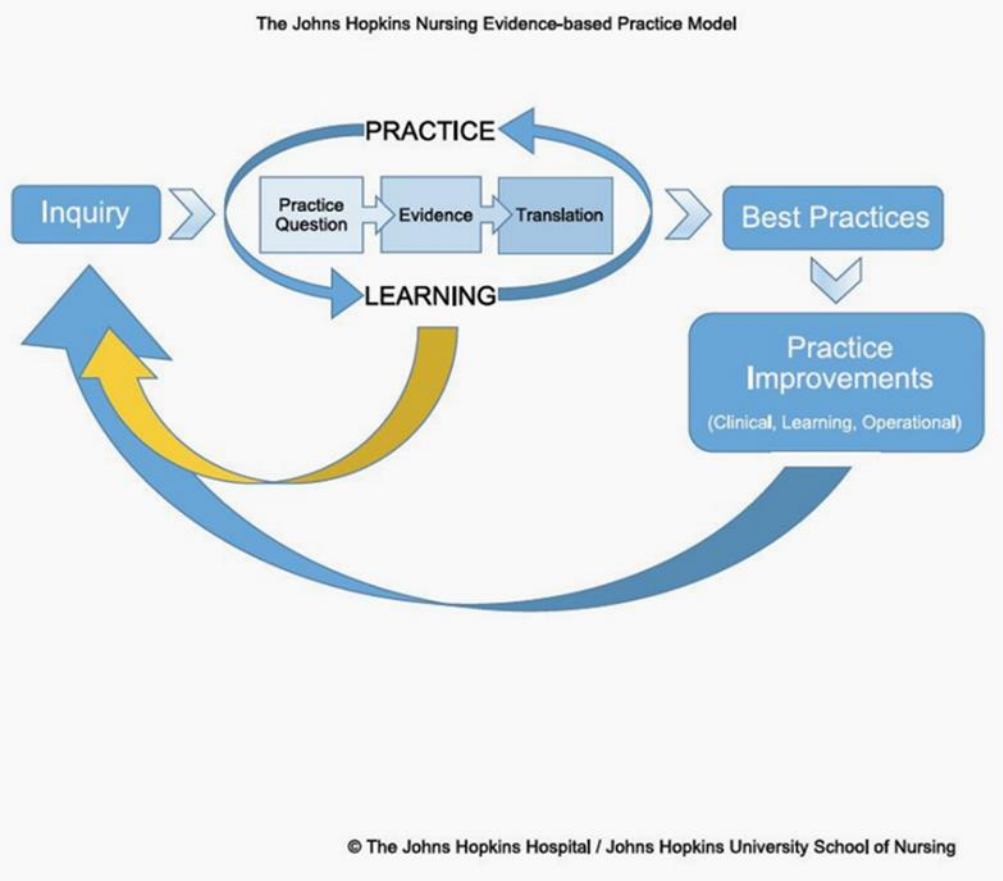
Overview of EBP Model

Evidence-based practice ensures quality, safe, reliable healthcare. The Johns Hopkins (JH) Evidence-based Practice Model (Vera, 2018) employs systematic clinical decision-making using instruments to guide the provider through the evidence critique process. Ten appendices are included for appropriate evidence appraisal. The JH model (Figure 3) is an effective approach to implementation of practice projects and is designed for providers to ensure appropriate use of evidence-based practice. The application of the JH model includes the use of a three-step process: practice question, evidence, and translation (PET). Each step has five to eight bullet points to guide the provider through the EBP process. Employing any, or all ten, of these appendices allow for appropriate evidence appraisal and implementation into clinical practice.

Found in the JH Appendix A, the PET management guide addresses the three-step process mentioned prior. Defining the problem, identifying stakeholders, recruiting the team, and determining leadership is required (Vera, 2018). The literature search begins by exploring best evidence, then appraises and synthesizes the literature resulting in recommendations for practice. Lastly, the information translates recommendation into an action plan for implementation and subsequent dissemination for further review. Within the JH Appendix B, the question development tool and patient/population/problem, intervention, comparison, and outcome (PICO) concentrates on the relevance of the problem if it was not addressed in the clinical setting. Investigation of the clinical problem, for example safety, quality, and outcomes, as well as determination of essential evidence is imperative to EBP project success. Also, in JH Appendix C, the stakeholder analysis tool guides the Doctor of Nursing Practice (DNP) student

Figure 3

Johns Hopkins Nursing EBP Model



Note: Reprinted from Johns Hopkins nursing evidence-based practice: model and guidelines. 3rd ed. By Dang, D., and Dearholt, S, 2017, retrieved July 27, 2020 from https://www.hopkinsmedicine.org/ . Copyright permission granted July 2020 by ©The Johns Hopkins Hospital/The Johns Hopkins University

to identify key participants such as managers, supervisors, administrators, patients, colleagues, providers, or even vendors. Assigning responsibility, seeking approval, and informing these individuals is paramount to a cohesive project implementation. To determine the strength of the study, JH Appendix D, evidence level and guide, is applied to each piece of supporting literature. Leveling of evidence from high (one or I) to low (five or V) with quality ratings in each level of high (A), good (B), and low (C) allow the student to appropriately critique each study. Assisting the investigator in determining what type of study was conducted is the JH Appendix E

research evidence appraisal tool. For example, one can find applicable quality ratings of quantitative, qualitative, mixed methods, meta-analysis, or systematic reviews. Within the JH Appendix F, the non-research evidence appraisal tool is used for clinical practice guidelines, position statements, expert opinions, and organizational information such as quality improvements, as well as financial and program evaluations. The individual evidence summary tool in JH Appendix G is the investigator's reference list with full citations and findings including observable measures, limitations, evidence rating and quality. The evidence synthesis and recommendation tool in JH Appendix H is the process of synthesizing the evidence, generalizing its applicability, and proposing recommendations. The action planning tool of JH Appendix I translates the evidence and identifies strengths and barriers of the project to recruit the leader and the team, confirm support, and establish critical timelines. The dissemination tool of JH Appendix J instructs the student to investigate and assess the information and develop a way to appropriately convey it to key stakeholders in any number of venues such as publication, online conferences, oral or poster presentations, or in-services.

Strengths and Limitations of EBP Model

Strengths of the JH model arise from the step-by-step processes in each appendix. Employing these tools assists the investigator with critique of evidence and implementation into clinical practice, while other models have less tools for dissemination. Appendix D was the most helpful to this investigator in qualifying relevant evidence and best practice in technological healthcare tools, racial disparities in healthcare, provider competencies and dermatological guidelines. By applying all five tenets of EBP; question, evidence, appraisal, integration, and evaluation (Melnyk and Fineout-Overholt, 2015), the JH model encourages autonomy, leadership, and engagement. A limitation of the JH model is the lengthy evaluation process which employs nineteen steps in three sections and ten appendices, while other EBP models have on average five to ten steps. The lengthy evaluation process could lead to confusion when evaluating evidence if not applied systematically.

Application of EBP Model to DNP Project

The application of the JH Model to the project was methodical. Following Appendix A, the investigator defined the practice question by following the six steps; 1) recruited APCs within the dermatology practice, 2) defined the problem as difficulty in diagnostic accuracy in SOC, 3) developed the EBP question (PICOT as mentioned above), 4) identified the stakeholders as two physicians within the practice, 5) accepted responsibility for project leadership and 6) met with stakeholders to discuss and refine the project. Evidence was collected following the five steps which included conducting a thorough internal and external search for evidence, appraising the level and quality of each piece of evidence, summarizing the individual evidence, synthesizing the overall strength and quality of the evidence, and developing project recommendations for change to be implemented within the practice. Translation was achieved in three of the eight steps by determining the relevance of the recommendations, creating an action plan, and securing the appropriate support for the project.

Strengths and Limitations of EBP Model for DNP Project

The four limitations of this project recognized were; a small, convenient sample size of four females (three NPs and one PA) in a dermatology practice at two sites in the same health care system, length of participant practice in dermatology (<1-4 years), adherence to the protocol (charting of required information, utilizing VisualDx, referencing the textbook and FST scale, sending information to the project investigator) with potential violations/omissions due to human error, volume of daily patients or time management issues, and VisualDx has typically been implemented in primary care thus dermatology nuances may exist. Increased strength and validity could be accomplished by increased number of participants, equal and increased years of educational representation of participants, inclusion of male gender, and inclusion of NPs or PAs in dermatology from a variety of healthcare institutions. Minimal cost, acceptance of innovative technological applications, and potential ease of use, as well as the participants

enthusiastic and encouraged demeanor were all strengths attributed to the project. Additionally, some of the literature reveal positive implementation and diagnoses using the VisualDx application.

Literature Search

Sources Examined for Relevant Evidence

A thorough literature search for relevant evidence (Table 3) was conducted through The Cochrane Library (Wiley), MEDLINE (Ovid), CINAHL (EBSCO), Joanna Briggs Institute (JBI), Nursing and Allied Health, Health Source: Nursing/Academic Edition and Pubmed yielding four applicable studies. Based on the minimal evidence discovered in these search engines, an additional systematic search was conducted through citation chasing and hand searching for supplementary related evidence, generating five and two studies, respectively. Key words and phrases included (diagnos* OR exam* OR assess* OR screen* OR treat*), ("skin of color" OR "dark* skin" OR "black skin" OR "brown skin"), (educ* OR teach* OR learn* OR study* OR train* OR instruct*), and (nurs* OR "advanc* pract* nurs*"). Limiters were English language, human, peer reviewed and recent in the last 10 years. Inclusion criteria comprised medical education for dermatology physicians, NPs and PAs, racial disparities in healthcare, and diagnostic tools. Exclusion criteria consisted of any study involving patient education of skin disease recognition.

Each database was explored for related studies by applying the key words and terms, several which were taken from the project PICOT (Figure 4). The Cochrane database yielded 14 studies, yet none were applicable (Table 4). JBI produced a combined guideline on ethnic diversity skin assessment (Slade, 2019), Medline exhibited the most results at 308, but only one was useful to the project (Vardell and Bou-Crick, 2012), and CINAHL possessed 86 with two pertinent studies (Louie and Wilkes, 2018; Sommers et al., 2019). Health Source: Nursing/Academic Edition contained 55, Nursing and Allied Health revealed 20, and Pubmed held 24, yet none of these databases resulted in any related studies. Citation Chasing combined with hand searching discovered seven relevant results (Dawes et al., 2016; NP Scope and

Standards, 2011; Chou et al., 2017; Lee et al., 2017; Loescher et al., 2018), (Bobonich and Nolen, 2018; Gorbatenko-Roth et al., 2019).

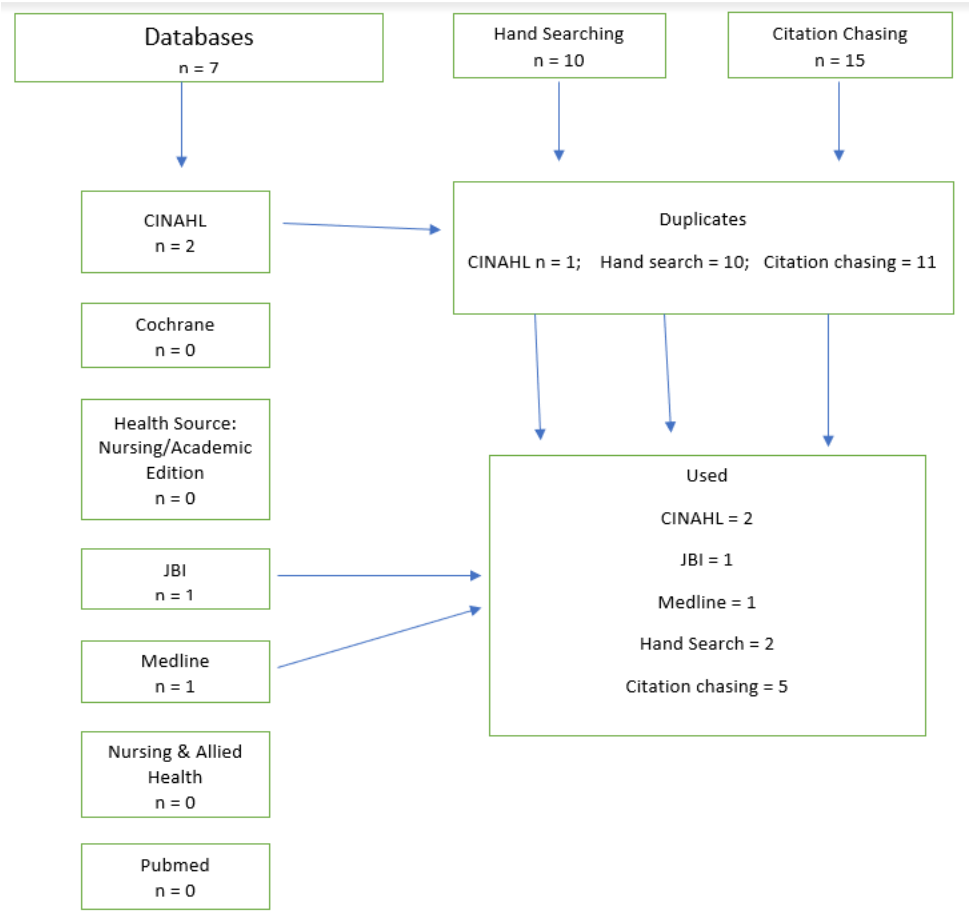
Table 3

Literature Search

Database	Keywords/Phrases	Limiters	Number of results	Number selected for use	Levels of evidence
CINAHL	(diagnos* OR exam* OR assess* OR screen* OR treat*) ("skin of color" OR "dark* skin" OR "black skin "OR "brown skin") (educ* OR teach* OR learn* OR study* OR train* OR instruct*)	English Peer reviewed 10 years	86	2	III A III A
Cochrane	"skin of color" AND assess*	10 years	14	0	
Medline	(diagnos* OR exam* OR assess* OR screen* OR treat*) ("skin of color" OR "dark* skin" OR "black skin" OR "brown skin") (educ* OR teach* OR learn* OR study* OR train* OR instruct*)	English Human 10 years	308	1	V A
JBI	"skin of color" AND assess*	English 10 years	21	1	IV B
Nursing and Allied Health	(diagnos* OR exam* OR assess* OR screen* OR treat*) ("skin of color" OR "dark* skin" OR "black skin" OR "brown skin") (educ* OR teach* OR learn* OR study* OR train* OR instruct*)	Peer reviewed 10 years	20	0	
Pubmed	(diagnos* OR exam* OR assess* OR screen* OR treat*) (educ* OR teach* OR learn* OR study* OR train* OR instruct*) (nurs* OR "advanc* pract* nurs*")	English Human 10 years	24	0	
Health Source: Nursing /Academic Edition	(diagnos* OR exam* OR assess* OR screen* OR treat*) ("skin of color" OR "dark* skin" OR "black skin" OR "brown skin") (educ* OR teach* OR learn* OR study* OR train* OR instruct*)	Peer reviewed 10 years	55	0	
Citation chasing			14	5	II A III A (2) IV A (2)
Hand searches			3	2	III A IV A

Figure 4

Literature Search PRISMA



Levels of Evidence

According to the JH Model, Level I studies must be experimental studies, randomized controlled trials (RCT), explanatory mixed method designs or systematic reviews of RCTs with or without meta-analysis. Level II evidence will encompass quasi-experimental studies, explanatory mixed methods, and systematic reviews of combinations of RCTs and quasi-experimental studies with or without meta-analysis. Nonexperimental studies, systematic review of a combination of RCTs, quasi-experimental and nonexperimental studies, nonexperimental studies with or without meta-analysis, exploratory, convergent, or multiphasic mixed methods studies, explanatory mixed method designs, or qualitative study meta-synthesis are all categorized as Level III evidence. Guidelines, expert opinions based on scientific evidence,

committee consensus, and position statements comprise Level IV. Level V evidence contains integrative reviews, literature reviews, quality improvement, financial evaluations, case reports, and expert opinions based on personal experience.

Table 4

Database Results

Database	Found	Duplicates/Evaluated/ Searched	Used
CINAHL	2	1	2
Cochrane	0	0	0
Health Source: Nursing/Academic Edition	0	0	0
JBI	1	0	1
Medline	1	0	1
Nursing and Allied Health	0	0	0
Pubmed	0	0	0
Citation Chasing	15	11	5
Hand Searching	10	10	2

Level I studies are absent in the searches for this project including during citation chasing and hand searching (Table 5). Much of the evidence relevant to this project fell into Level III and below validating the necessity for project implementation. Application of technology in dermatology was addressed by one Level II quasi-experimental study (Chou et al., 2017) and one Level V was a technological product review (Vardell and Bou-Crick, 2012). Five Level III studies were discovered which addressed skin tone (Louie and Wilkes, 2018; Sommers et al., 2019), racial disparities (Dawes et al., 2016), patient's perceptions (Gorbatenko-Roth et al., 2019), and providers competencies (Loescher et al., 2018), all applicable to the topic. All four Level IV pieces of evidence were guidelines or limited reviews by established organizations for

cutaneous examinations and recommendations (Bobonich and Nolen, 2018; NP Scope and Standards, 2011; Lee et al., 2017; Slade, 2019).

Table 5

Evidence Summary

Level	Design	Quality	Number Included
I			0
II	Quasi-experimental	A	1
III	Ecological	A	1
III	Cross sectional	A	3
III	Systematic Review	A	1
IV	Limited Review	B	1
IV	Guideline	A	2
IV	Guideline	B	1
V	Product Review	A	1

Appraisal of Relevant Evidence

Appraisal of the evidence utilizing JH Appendices D through G allowed for accurate leveled appraisals of all findings. In Appendix D, quality ratings are disseminated by the level of evidence. Levels I-III quality ratings are separated to quantitative or qualitative studies. High quality (A) quantitative studies demonstrate consistent, generalizable results with sufficient sample size and definitive conclusions. Three of the five Level III studies applicable to this project were quantitative (Dawes et al., 2016; Louie and Wilkes, 2018; Sommers et al., 2019;) while two were qualitative (Gorbatenko-Roth et al., 2019; Loescher et al., 2018) and addressed

race, skin tone, provider training, and black patients' perceptions respectively, and all had quality ratings of high (A).

Studies with reasonably consistent results and sufficient sample size with fairly definitive conclusions are rated good quality (B), while those studies where there appeared to be little evidence, small sample size, and inconsistent results to support the study are graded low quality (C). Qualitative study leveling is somewhat researcher subjective; high (A) and good (B) quality are equivalent ratings in single studies and meta-syntheses by disseminating six methods; transparency, diligence, verification, self-reflection and scrutiny, insightful interpretation, and participant-driven inquiry. Low quality (C) studies contribute little to the review of findings and may, but most likely do not, possess any of the six methods mentioned above. This literature search does not contain any low quality (C) studies.

Levels IV and V have separate quality rating criteria. In Level IV evidence, high quality (A) and good quality (B) are defined as a current (within the last five years) governmental, private, public, or professional sponsored material. The difference in A and B quality rating is A must have documentation of a systematic literature search with consistent results and definitive conclusions, while quality B may have a thorough literature search with reasonably consistent results and fairly definitive conclusions. One U.S. university sponsored limited literature review of Hidradenitis Suppurativa research cohort demographics provided statistical evidence of underrepresentation in the SOC population in both research studies and clinical trials and provided recommendations for further research, but did not clearly describe the search method relegating it to a Level IV B rating. Two of the three guidelines included in this project were current within five years, established by a national task force (Bobonich and Nolen, 2018) and international research organization (Slade, 2019), and one was within nine years by a national dermatology nursing organization (NP Scope and Standards, 2011) defining them as quality A, B, and A, respectively. Although Slade (2019) is current and appropriately sponsored, there was very little information applicable to the APC. Low quality (C) evidence is material not sponsored

by an official organization, is poorly defined with a limited search strategy and insufficient evidence to draw conclusions, this project is void of this group. In Level V evidence of quality improvement programs and financial evaluations both high (A) and good (B) quality evidence possesses clear objectives, consistent results, formal evaluation methods, definitive conclusions and consistent recommendations, but B quality will have reasonably consistent recommendations with some reference to scientific evidence, while low quality (C) evidence is unclear, missing objectives, inconsistent results, poorly defined evaluation methods, and no recommendations can be made. Level V evidence rating of integrative/literature reviews, expert opinions, case reports, community standards, clinician experience, and consumer preferences are quite similar; high quality (A) possesses definitive conclusions from scientific rationale by expert leaders in their field, good quality (B) draws fairly definitive conclusions from logical opinions by credible experts, and low quality (C) yields questionable evidence and expertise, and conclusions cannot be drawn. A product review of this project's interventional tool was sponsored by a U.S. university and rated Level V, high (A) quality (Vardell and Bou-Crick, 2012).

Level I Evidence

Unfortunately, there was no Level I evidence available for this EBP project. Although stakeholder support for the project was strong, it is evident that a gap exists in the literature regarding dermatological training and representation in SOC persons. This discrepancy solidifies the need for more research in POC and their specialized presentations and requirements for treatment. When enough EBP projects are completed on the SOC population, a large-scale systematic review can be conducted giving further validity to the need for change and implementation tools.

Level II Evidence

Chou et al. (2017). In this prospective quasi-experiment design study, sixty-four participants including both genders that were either dermatology residents or sixth year medical

students, some with previous exposure to a visually-based, computerized diagnostic decision support system (VCDDSS) such as VisualDx, found that diagnostic accuracy increased by 18.75% and user satisfaction was high when applied in the dermatological setting. Additionally, discernment of the disease accompanied enhanced judgement. Limitations of the study included lack of Asian pictures and cost. Implementing VisualDx in this EBP project did not yield increased diagnostic accuracy despite no limitation of cost.

Level III Evidence

Dawes et al. (2016). Racial disparities in melanoma survival exist. An ecological study of 96,953 patients with a cutaneous melanoma diagnosis between 1992-2009 found although whites had a higher incidence of melanoma, survival rates were worse in non-white patients. Of the 96,953 patients, 91,572 were white, 509 were black, 3293 were Hispanic, and 1219 were Asian American / Native American / Pacific Islander. Melanoma staging tools including Breslow depth, nodal involvement, ulceration, stage, and histologic subtype were collected as well as the usual demographics of age, ethnicity, etc. Black patients' poorer outcomes were related to all five melanoma demographics but overall can be attributed to late-stage diagnosis. Although socioeconomic and insurance status not collected presumably plays a role in timely lesion detection and outcomes, the need for patient education in this population is necessary since many POC believe darker skin is photo-protective, and some medical providers agree.

Gorbatenko-Roth et al. (2019). Black patient's perception of their dermatology care in a SOC clinic was evaluated in this cross-sectional study employing surveys and focus groups. Nineteen adult black patients; eighteen women and one man, were divided into four focus groups (two of same-race providers and two of different-race providers). All participants reported positive experiences regardless of provider race, but believe dermatologists need further specialized education in SOC patients. Patients who preferred a black dermatologist believe their shared culture results in increased knowledge of black skin. The authors note that as of 2008, dermatology residency program chief residents report expert SOC lectures in only

25.4% of the didactics and program directors as little as 19.5% of the curriculum. Increasing SOC education in medical programs as well as increasing diversity in the workforce could enhance clinical outcomes.

Loescher et al. (2018). NP skin cancer training is minimal unless working in the specialty of dermatology. Graduate programs have little time to dedicate to specialty concentrations and offer days to one week in dermatology education. In this updated systematic review of advanced practice nurses' (APN) skin cancer detection skills and training, the authors found that there are few educational opportunities for APNs in clinical skin exams and lesion detection. The authors search found eight literature databases revealing twelve applicable studies and note one study by Hartnett and O'Keefe (2016) in which the intervention of an online educational didactic resulted in improved skin lesion recognition as well as a 223% increase in appropriate documentation and patient education. Overall, this study revealed suitably educated APNs can identify suspicious lesions.

Louie and Wilkes (2018). Medical education in SOC should be standard in all programs. Subtle limitations exist such as underrepresentation of this population in medical textbook imagery. In this cross-sectional study the researchers selected U.S. editions of four medical textbooks in the curriculum of twenty, top-ranked U.S. medical schools and selected a total of 4146 images. After excluding images of bone, muscle, internal organs and depersonalized schematic diagrams, 1522 images were analyzed for race (white, black, POC) based on observable characteristics such a skin color, hair texture and color, eye color, and facial features. Utilizing the Massey-Martin ten-point skin color scale, subject images were matched to the skin tone palette. This study found there was more diversity in race than skin tone and there were many chapters where POC are nonexistent. Skin of color was underrepresented at the textbook, chapter, and topic levels, which may lead to medical bias and in turn racial healthcare disparities. There are textbooks completely devoted to SOC (Jackson-Richards and Pandya, 2014; Kelly & Taylor, 2009), yet none are in the general

curriculum.

Sommers et al. (2019). A prospective cross-sectional study involving 446 women was performed to determine if the FST scale (Figure 1) is valid for cancer risk assessment and determined decreased correlation with spectrophotometer measurements, raising questions about the reliability of FST. The FST was developed to determine a person's burn risk when exposed to ultraviolet rays in preparation for NBUVB light treatment in certain skin conditions. Since then, several skin type scales have been developed, but the FST remains the one most referenced. This six-point scale from Type I (fair) to Type VI (black) appears insensitive to the variety of racial and ethnic groups that make up the world's population, and interestingly use the term fair instead of white or tan further confusing the user and possibly leading to health disparities. Although this study raises questions of the validity of the FST, because it is the most widely used skin type scale and its familiarity with providers, this project used it as a reference for patients presenting to clinic with skin conditions. No bias was revealed by participants in the post project survey.

Level IV Evidence

Bobonich and Nolen (2018). This guideline from a NP task force comprised of fourteen NPs with a minimum of five years' experience each in dermatology, along with a validation panel of leadership NPs, specialty education NPs, NP organizations, and credentialing and certification organizations, achieved a consensus for entry-level competencies, followed by validation from an external panel. The guideline provides clarity of the role and quality indicators for practice of dermatology NPs. Of the four detailed competency categories; assessment, diagnosis, plan and outcomes, and implementation and evaluation, none of the thirty-six bullets address SOC. With the U.S. skin of color population growing, addressing this sub-specialty has the potential to increase positive patient outcomes.

NP Scope and Standards (2011). The Dermatology Nurses Association (DNA) NP Scope and Standards guideline does not include verbiage surrounding SOC, and this deficit is concerning. Assessment, diagnosis, and treatment is discussed, as well as scope of practice and ethics, yet no guidance is available for the POC population. The other guidelines presented in this paper (Slade, 2019; Bobonich and Nolen, 2018) address SOC patients specifically, however, the DNA lacks this information. This again highlights the need for more projects in this patient population.

Lee et al. (2017). Despite a higher incidence of Hidradenitis Suppurativa (HS) in SOC, research studies within the U.S. and abroad revealed SOC is underrepresented in both cohorts and clinical trials. Increased disease burden in this population at the quality of life and depression, genetic, anatomical, metabolic syndrome (MS), access to care, socioeconomic status, and treatment response exists. Recommendations for future research on all seven of these topics was presented as well as in increased surveillance of MS, encouraging lifestyle modifications, evaluating barriers, increased social support, initiating early screening, providing longitudinal care plans, and increasing HS knowledge in non-dermatologists.

Slade (2019). A guideline found in the Joanna Briggs Institute specifically addresses ethnic diversity. Recommended best practice and evidence summaries describe skin exam preparation including asking the patient, family, or caregiver to identify an area of normal colored skin and use natural or halogen lighting instead of fluorescent light which can create a bluish tint to the skin. Assessment should be made based on skin tone and not race or ethnicity. Exam can include palpation since rashes and lesions may not be obvious during visual inspection. Dermatology providers should be practicing all these recommendations for optimal skin care regimens, but these alone are not enough.

Level V Evidence

Vardell and Bou-Crick (2012). A graduate student (Vardell) and her advisor (Bou-Crick) provide an overview of VisualDx including a description and features. As a diagnostic decision support tool, VisualDx aids in differential diagnosis for quick point of care treatment plans by allowing the user to access more than 1,212 unique diagnoses and 24,115 unique images aimed at providing numerous differential diagnoses. Written by each subjects' experts after peer review of over 90,000 images and updated quarterly, this application also provides links to relevant PubMed articles. It has the ability to integrate with many electronic health platforms, is available in desktop and mobile versions, and has been updated with the ability to upload a photo of the patient's lesion or rash. Entering data such as clinical features, age, distribution, and time present, the user is guided to several possible diagnoses.

As evidenced by the literature results (Table 6) and absence of Level I studies, further research is needed in the SOC population and its relationship to dermatology. Of the eleven studies presented here, two addressed technology and its applicability to dermatological exams, but no specific mention of its ability to increase diagnostic accuracy in the SOC demographic. VisualDx was not advantageous in diagnosing FST IV-VI patients during this project.

Table 6

Evidence

Citation (APA)	Purpose	Design	Sample	Measurement / Outcome	Results / Findings
Bobonich, M., & Nolen, M. (2018). Competencies for dermatology nurse practitioners. Journal of the American Association of Nurse Practitioners, 30(11), 606–613. https://doi-org.ezproxy.valpo.edu/10.1097/JXX.0000000000000137	Define entry level competencies for derm NP practice	Guideline	NP task force (14 NPs) and Validation panel (task force NPs, leadership NPs, specialty education NPs, NP organizations, credentialing & certification organizations	Achieve a consensus for entry-level competencies, followed by validation from an external panel	Guideline provides clarity of the role & quality indicators for practice of derm NPs
Chou, W., Tien, P., Lin, F., & Chiu, P. (2017). Application of visually based, computerised diagnostic decision support system in dermatological medical education: a pilot study Postgraduate Medical Journal 2017;93:256-259	Investigate VisualDX, VCDDSS role in medical education and clinical practice	Prospective study; clinical diagnosis before and after use of VCDDSS and questionnaires	(51) 6th yr medical students, 13 dermatology residents, one consultant dermatologist	Sign test for diagnostic accuracy and Fisher exact test to analyse questionnaires	VCDDSS increases diagnostic accuracy by 18.75% and user satisfaction is high
Dawes, S. M., Tsai, S., Gittleman, H., Barnholtz-Sloan, J. S., & Bordeaux, J. S. (2016). Racial disparities in melanoma survival. Journal of the American Academy of Dermatology, 75(5), 983–991. https://doi-org.ezproxy.valpo.edu/10.1016/j.jaad.2016.06.006	To evaluate survival across racial groups in patients given a diagnosis of malignant melanoma	Data collection	96,953 patients from 1992-2009 in The Surveillance, Epidemiology and End Results database	n/a	Although incidence higher in whites, survival is significantly lower in non-whites
Gorbatenko-Roth, K., Prose, N., Kundu, R. V., & Patterson, S. (2019). Assessment of Black Patients' Perception of Their Dermatology Care. JAMA dermatology, 155(10), 1129–1134. Advance online publication. https://doi.org/10.1001/jamadermatol.2019.2063	To elucidate black patients' perceptions of their dermatology experience in and outside of a skin of color clinic	Cross-sectional; survey and 4 focus groups	April – June 2015 voluntary survey; 19 adults (18 women), mean age 50	Patients' ratings of SOCC and non-SOCC dermatologists in terms of interaction style, cultural awareness, and treatment satisfaction	Satisfaction would increase if dermatologists underwent enhanced residency training in skin of color, cultural competency, cost-conscious care
Lee, D. E., Clark, A. K., Shi, V. Y., Lee, D. E., Clark, A. K., & Shi, V. Y. (2017). Hidradenitis Suppurativa: Disease Burden and Etiology in Skin of Color. *Dermatology (10188665)*, *233*(6), 456–461. https://doi-org.ezproxy.valpo.edu/10.1159/000486741	Identify: gaps in knowledge & association of HS in SOC. Recommend research and care.	Review of studies	19 studies from: USA, Israel, Netherlands, Denmark, Canada, Czech Republic and 3 International	SOC have less access to dermatological care, decreased response to treatment and quality of life, increased depression, genetic, anatomical, comorbidity, and socioeconomic factors contributing to disease burden.	SOC are underrepresented in research studies and clinical trials.

Loescher, L. J., Stratton, D., Slebodnik, M., & Goodman, H. (2018). Systematic review of advanced practice nurses' skin cancer detection knowledge and attitudes, clinical skin examination, lesion detection, and training. Journal of the American Association of Nurse Practitioners, 30(1), 43–58. https://doi-org.ezproxy.valpo.edu/10.1097/JXX.0000000000000004	Updates the state of APN skin cancer knowledge & attitudes, performance of and barrier to clinical skin exam, skin lesion recognition, and training	Systematic Review	Eight literature databases; 12 studies from 2010-2016	Article retrieval; PRISMA flow chart for article selection	NPs had variable suboptimal skin cancer knowledge, even after an intervention; few skin cancer detection training opportunities for nurses exist
Louie, P., & Wilkes, R. (2018). Representations of race and skin tone in medical textbook imagery. Social Science & Medicine, 202, 38–42. https://doi-org.ezproxy.valpo.edu/10.1016/j.socscimed.2018.02.023	Whether the race and skin tone depicted in images in textbooks assigned at top medical schools reflects the diversity of the US population	Analyzed images	4146 images from 4 textbooks	Coded by race and skin tone at the textbook, chapter and topic level	There is more diversity in the presentation of race than skin tone / proportion of dark skin tone represented in all 4 books is small / several chapters contain no individuals with dark skin
NP Scope and Standards (2011). Retrieved May 12, 2020, from http://www.dnanurse.org/	Scope of practice for dermatology nurse practitioners	Guideline	Task force	Scope of Practice and Standards of Care	Assess, diagnose, treat; teach, refer, provide, educate and professional development
Slade, S. (2019). Skin Assessment: Ethnic Diversity. [BScApp (Physio), Grad Dip Manip Ther, M Musc Ther, PhD]. [Recommended Practices] [Evidence Summaries] AN: JBI7825 Year of Publication 2019	Best Practice Recommendations	Guideline	Joanna Briggs Institute	Assessment	Provide health care based on quantified skin color rather than race/ethnicity
Sommers, M. S., Fargo, J. D., Regueira, Y., Brown, K. M., Beacham, B. L., Perfetti, A. R., Everett, J. S., & Margolis, D. J. (2019). Are the Fitzpatrick Skin Phototypes Valid for Cancer Risk Assessment in a Racially and Ethnically Diverse Sample of Women? Ethnicity & Disease, 29(3), 505–512. https://doi-org.ezproxy.valpo.edu/10.18865/ed.29.3.505	Determine the criterion-related validity of self-reported FSP when compared with skin color and sunburn history	Secondary analysis; prospective study - skin injury in women following consensual sex vs sexual assault; validity using multiple regression analysis	446 women (45% white/white Hispanic, 40% black/black Hispanic, 15% other identities) genitalia injury was excluded	Self-reported FSP and sunburn history as well as physiological measures of skin color	Self-reported FSP provides a restricted range of options for people with darker skin that does not capture variation in their skin color; inaccuracy of clinical data may lead to unequal treatment or inadequate cancer risk assessment
Vardell, E., & Bou-Crick, C. (2012). VisualDx: a visual diagnostic decision support tool. Medical Reference Services Quarterly, 31(4), 414–424. https://doi-org.ezproxy.valpo.edu/10.1080/02763869.2012.724287	Description and features of VisualDx	Overview	n/a	Diagnostic decision support tool using images and features; 1,212 unique diagnoses and 24,115 unique images	Aids in differential diagnosis for quick point of care treatment plans

Construction of Evidence-based Practice

Synthesis of Critically Appraised Literature

An apparent gap exists in SOC medical education (Adelekun et al., 2020; Louie and Wilkes, 2018). People of color are underrepresented in American Academy of Dermatology (AAD) (https://www.aad.org, 2020) brochures and medical textbook images (Louie and Wilkes, 2018), and racial disparities in disease outcomes exist (Buster et al., 2012; Dawes et al., 2016; Drenkard et al., 2019; Gelber et al., 2013; Hogue and Harvey, 2019; Huang et al., 2019; Lee et al., 2017). Agbai et al. (2014) estimate black skin has an intrinsic sun protection factor (SPF) of 13.4, whereas white skin SPF is 3.3, prompting persons with darker skin tones to mistake their color as skin cancer protective and are less likely to follow up with dermatologists frequently. Gorbatenko-Roth et al. (2019) discussed black patient's perceptions of their dermatology care and noted although patients were satisfied, they acknowledged a need for additional education in darker skin tone care.

Of the three guidelines for NPs included in this paper, only one addresses ethnicity and SOC (Slade, 2019). The DNA (NP Scope and Standards, 2011) and the NP Task Force (Bobonich and Nolen, 2018) address competencies as well as scope and standards of practice, with no mention of race, ethnicity, or skin tone. Considering the SOC population growth at the national (Vespa et al., 2020) and state levels (Kinghorn, 2008), dermatology providers will require additional tools to effectively diagnose and treat this patient population.

Loescher (2018) notes that few skin exam and lesion recognition educational opportunities exist for APNs. This coupled with limited guidelines (Bobonich and Nolen, 2018; NP Scope and Standards, 2011), subjective skin tone scales (Ware et al., 2020) and lack of available educational imagery (Adelekun et al., 2020; Louie and Wilkes, 2018), establishes the demand for instruments to meet the expanding SOC population.

Available medical technology is rapidly expanding. VisualDx (Carter et al., 2012, Vardell and Bou-Crick, 2012) is an available technological tool with the potential to increase diagnostic

accuracy. Although Burke and Littenberg, (2019) found VisualDX made no difference in patient outcomes in their cluster-randomized controlled pragmatic trial, it was only implemented in primary care practices and could be an additional tool to a dermatology provider with improved descriptive skills. Vardell and Bou-Crick (2012) note VisualDx is not only compatible with UpToDate, it can also interface with electronic health care records (EHR) such as EPIC and Cerner. Successful implementation of VisualDx in this project occurred but was unable to interface with the Cerner platform utilized by this health system.

Best Practice Model Recommendation

Best practice recommendations comprise enhanced dermatological competencies (Bobonich and Nolen, 2018) in SOC (Slade, 2019) and application of analytical tools (Chou et al., 2017) to increase diagnostic accuracy. This can be achieved by implementation of the VisualDx mobile application (Carter et al., 2012; Vardell and Bou-Crick, 2012). Of course, for safe and competent care a textbook reference was available to the providers (Jackson-Richards and Pandya, 2014), and providers must also be cognizant of FST limitations (Sommers et al., 2019; Ware et al., 2020) for diagnosis and treatment in POC.

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

The purpose of this EBP project was to determine whether implementing the mobile application tool VisualDx (https://www.visualdx.com/) while providing a textbook reference (Jackson-Richards and Pandya, 2014) and Fitzpatrick Skin Type (FST) visual aid (https://www.platinumskincare.com/) would result in diagnostic accuracy in patients with FST IV-VI as measured by congruence between clinical and histological diagnosis. The population growth of SOC persons demands providers increase their knowledge in all aspects of healthcare, including dermatology. VisualDx is a technological application designed to assist in disease differential building, and ease of use via the mobile application makes it an ideal EBP project instrument.

Participants and Setting

The setting for this project was a dermatology department in a large healthcare institution in Northern Indiana employing seven providers at two locations. Participants include four dermatology APCs and two physicians within the same group. Each APC was assigned a provider number one through four to retain anonymity. All APCs in this group were women aged 30-52 years, consist of three NPs and one PA, and have less than one and no more than four years' experience as dermatology APCs. Another NP within the department with greater than ten years' experience as a dermatology NP served as the project investigator. Of the two physicians serving as facilitators, one has served as the medical director and Mohs surgeon for six years and the other has practiced general medical dermatology for greater than one year post a three-year dermatology residency.

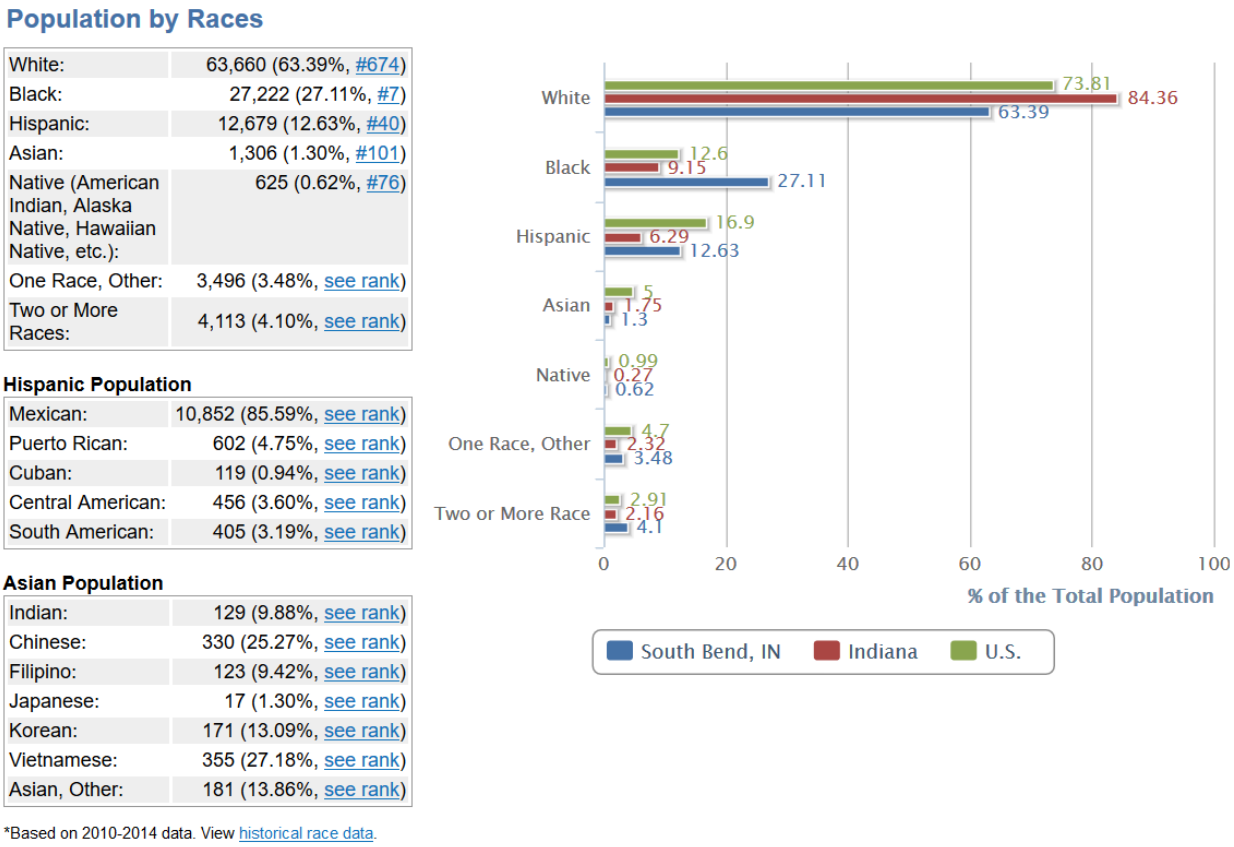
Pre-Intervention Group Characteristics

Based on 2010-2014 data (Figure 5), population characteristics of this Northwest Indiana city revealed SOC residents comprise approximately 40%, and black's individual residency

(27.11%) is more than twice the entire U.S. (12.6%) and three times more than the entire state of Indiana State (9.15%). With a study group of four APCs and combined SOC population of 41.66%, the dichotomous endpoint of projected 90% accuracy, Alpha of 0.05, Beta 0.2, and 80% power, each provider must submit data on a minimum of six patients.

Figure 5

Population by Race; South Bend, IN



Population by Races

White:	63,660 (63.39%, #674)
Black:	27,222 (27.11%, #7)
Hispanic:	12,679 (12.63%, #40)
Asian:	1,306 (1.30%, #101)
Native (American Indian, Alaska Native, Hawaiian Native, etc.):	625 (0.62%, #76)
One Race, Other:	3,496 (3.48%, see rank)
Two or More Races:	4,113 (4.10%, see rank)

Hispanic Population

Mexican:	10,852 (85.59%, see rank)
Puerto Rican:	602 (4.75%, see rank)
Cuban:	119 (0.94%, see rank)
Central American:	456 (3.60%, see rank)
South American:	405 (3.19%, see rank)

Asian Population

Indian:	129 (9.88%, see rank)
Chinese:	330 (25.27%, see rank)
Filipino:	123 (9.42%, see rank)
Japanese:	17 (1.30%, see rank)
Korean:	171 (13.09%, see rank)
Vietnamese:	355 (27.18%, see rank)
Asian, Other:	181 (13.86%, see rank)

*Based on 2010-2014 data. View historical race data.

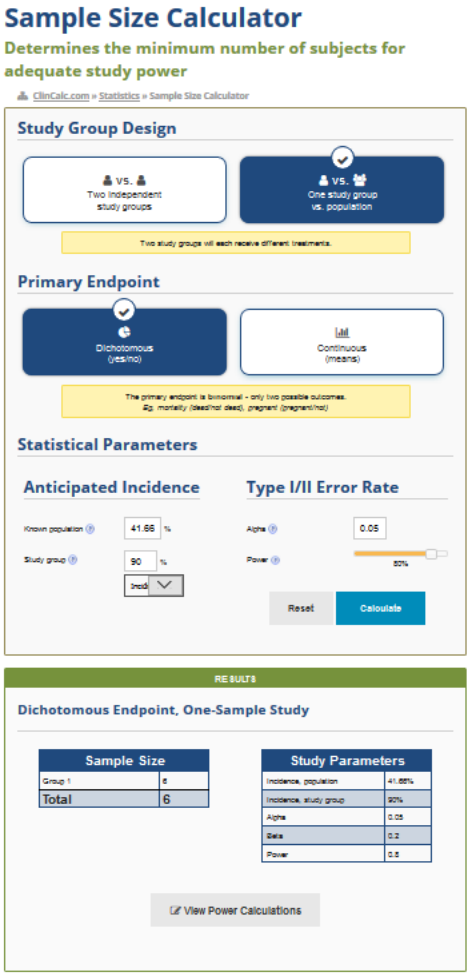
Note: Reprinted from *South Bend, IN Population and Races*. Retrieved August 23, 2020, from http://www.usa.com/south-bend-in-population-and-races.htm

Valparaiso University and the provider's health system internal review boards (IRB) granted approval. Project implementation began September 8, 2020 and data collection closed February

10, 2021 when all providers submitted patient information on a minimum of six (Figure 6) with maximum of ten patients for increased statistical power.

Figure 6

Sample Size Calculator



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Intervention

After Valparaiso and the healthcare system IRB approval, four APCs in the dermatology department were given the FST visual aid, ordered the textbook reference, and downloaded the VisualDx mobile application to their personal phones. The participants agreed to use their continuing education monies to purchase the textbook and the mobile application was free through their healthcare institution. Personal phones are already utilized by the APCs for at least twelve other applications necessary for workflow such as AAD, Camera Capture, Doc Halo, Duo, Epocrates, GoodRx, Jabber, Mohs AUC, UpToDate, Veeva Engage, Webex, Meet, and Workplace. In any patient with FST IV-VI and performing a biopsy, the APC documented in the chart 1) skin type, 2) use of VisualDx, and 3) placed their most confident differential first in the rule out section of the chart. Due to its ease of use and timely communication, the APC sent those patient's initials, date of birth (DOB) and date of service (DOS) to the investigator via the HIPAA approved Doc Halo application (Figure 7) daily or weekly to avoid loss of data. All information sent to the investigator was documented on a data collection worksheet (Table 7) on the investigator's secure work laptop and congruence between clinical and histological diagnosis was recorded. A participant post-intervention survey was given (Table 8) to determine if any or all three of the interventions were helpful and if the provider found the FST scale biased (as discovered in some of the literature discussed here).

Figure 7

Doc Halo mobile application

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Table 7

Date Collection Worksheet

Provider #1	Date of Service	Patient Initials	Skin Type IV – VI noted in chart	Clinical Diagnosis	Histological Diagnosis	Use of VisualDx noted in chart	Congruence

Provider #2	Date of Service	Patient Initials	Skin Type IV – VI noted in chart	Clinical Diagnosis	Histological Diagnosis	Use of VisualDx noted in chart	Congruence

Provider #3	Date of Service	Patient Initials	Skin Type IV – VI noted in chart	Clinical Diagnosis	Histological Diagnosis	Use of VisualDx noted in chart	Congruence

Provider #4	Date of Service	Patient Initials	Skin Type IV – VI noted in chart	Clinical Diagnosis	Histological Diagnosis	Use of VisualDx noted in chart	Congruence

Comparison

Currently, no previous data collection exists on diagnostic congruence with any skin type within this practice, and the health system's IRB chairman viewed this as a quality improvement project. Implementation of tools facilitating diagnostic accuracy with all skin types could ultimately lead to patient satisfaction, positive patient outcomes, provider confidence and possibly cost savings.

Table 8

Participant Survey

Participant Survey

Please rate your experience with *VisualDx*, *Atlas for Skin of Color,* and *Fitzpatrick Skin Type* during your participation in the Evidence Based Practice Project "Dermatology in Skin of Color", fall 2020 by marking an "X" in the appropriate box.

VisualDX	Not helpful at all	Barely helpful	Indifferent	Somewhat helpful	Very helpful
Ease of use					
Differential diagnosis					
Images					
"Skin of Color" desktop category (new 10/2020)					

Atlas for Skin of Color	Not helpful at all	Barely helpful	Indifferent	Somewhat helpful	Very helpful
Ease of use					
Differential diagnosis					
Images					

Fitzpatrick Skin Types	Not helpful at all	Barely helpful	Indifferent	Somewhat helpful	Very helpful
Ease of use					
Images					
Level of bias	Completely biased	Barely biased	Indifferent	Somewhat biased	Not biased at all

Outcomes

The primary outcome evaluated was diagnostic accuracy as measured by congruence between clinical versus histological diagnosis. The secondary outcome was dissected during the post project participant survey to determine if the tools were beneficial in determining skin type and differential diagnosis.

Time

The project began September 8, 2020 and ended February 10, 2021 when all four APCs forwarded a minimum of six and maximum of ten patient's information to the investigator as determined by power analysis. Reminder emails and text messages were sent to the APCs one week prior to implementation with directions and start date. The APCs were notified when data collection was complete.

Protection of Human Subjects

This investigator completed the NIDA six-hour clinical course on protection of human subjects (Figure 8). The data collection worksheet was kept in a file on the investigator's secure workplace laptop. The DOS, patient initials, and DOB information given to the investigator by the APCs was used to locate the patient's chart and only patient initials and DOS was documented on the flowsheet for patient identity protection. Each APC was assigned a number that only the investigator knew for documentation on the data collection sheet for participant identity protection. Informed consent (Figure 10) was obtained from the APCs and all questions were answered.

Figure 8

Protection of Human Subjects Certificate

NIDA Clinical Trials Network

Certificate of Completion

is hereby granted to

Jill Maddox

to certify your completion of the six-hour required course on:

GOOD CLINICAL PRACTICE

MODULE:	STATUS:
Introduction	N/A
Institutional Review Boards	Passed
Informed Consent	Passed
Confidentiality & Privacy	Passed
Participant Safety & Adverse Events	Passed
Quality Assurance	Passed
The Research Protocol	Passed
Documentation & Record-Keeping	Passed
Research Misconduct	Passed
Roles & Responsibilities	Passed
Recruitment & Retention	Passed
Investigational New Drugs	Passed

Course Completion Date: 6 July 2020

CTN Expiration Date: 6 July 2023

Tracee Williams, Training Coordinator

NIDA Clinical Coordinating Center

Good Clinical Practice, Version 5, effective 03-Mar-2017

This training has been funded in whole or in part with Federal funds from the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, under Contract No. HHSN271201000024C.

Figure 9

Informed Consent

Informed Consent

Purpose of the study: to determine if Advanced Practice Clinicians applying the tool VisualDx, referencing the *Atlas for Skin of Color* textbook and applying the Fitzpatrick Skin Type (FST) Scale to patients with skin types IV-VI results in diagnostic accuracy as measured by congruence between clinical and histological diagnosis. A post project survey will be given to determine each of the three tools helpfulness and if the APC found the FST biased.

Does this study involve an experimental treatment or procedure? No.

Does this study involve random assignment? No.

Expectations of study participants: Download VisualDx to your smartphone. Acquire the textbook *Atlas for Skin of Color* (Jackson-Richards & Pandya, 2014). A Fitzpatrick Skin Type scale will be provided. For any patient with Fitzpatrick Skin Type IV-VI and performing a biopsy; document 1) skin type in the physical exam portion of the chart, 2) use of VisualDx in the signature location where you typically note use of dermoscopy, and 3) place your most confident differential first in the rule out section of the chart. The APC will send those patient's initials, date of birth (DOB) and date of service (DOS) to the investigator via the HIPAA approved Doc Halo application daily to avoid loss of data. A participant post-intervention survey will also be assigned.

Risks: none

Benefits: increased knowledge of and possible increased positive patient outcomes in FST IV-VI patients.

Alternatives: opt out

Compensation: none

Expenses: VisualDx is free through your health system; *Atlas for Skin of Color* can be purchased utilizing each APCs continuing education monies, ($113.50 on Amazon), and the FST visual aid will be supplied.

Duration: September 8, 2020 until a minimum of six and maximum of ten patients per provider is collected; approximately one to three months.

Records: Records will be kept confidential on the lead investigators work laptop. Each participant will be assigned a number and only the lead investigator will have access to that information.

Lead Investigator: Jill Maddox, FNP; Facilitators: Dr. Pantalena and Dr. Kelley.

Participation: voluntary and participants may end participation at any time.

Participants: Three nurse practitioners and one physician assistant at two locations.

A copy of the consent will be given to the participant.

_____ _____

Participant Investigator

CHAPTER 4

FINDINGS

Implementation of the VisualDx application in SOC patients revealed weak correlation with use of the application and congruence between clinical and histological diagnoses, as congruence was noted in less than half of the biopsies performed. A post-project survey revealed provider satisfaction with all three tools: VisualDx, Atlas for Skin of Color (Jackson-Richards and Pandya, 2014), and FST Scale. Statistical analysis was completed using SPSS 25 and the following statistical tests were utilized for such analysis: Chi Square, Spearman's Rho, and Cronbach's Alpha.

Participants

All four APC participants in the dermatology department utilized the VisualDx application to populate diagnostic differentials for any FST IV-VI patient requiring a biopsy for diagnosis confirmation. A total of 28 shave or punch biopsies were performed during September 8, 2020 to February 10, 2021. The shave or punch biopsies were documented (Table 9) and all were included in statistical analysis. A slight majority were FST V (n = 14), compared to VI (n = 12) and IV (n = 2) (Figure 10). There was no comparison group for this EBP project nor attrition. A post project survey in Likert Scale format (Table 8) evaluating satisfaction of the implemented tools was given and all participants returned the forms promptly to the investigator.

Changes in Outcomes

Data suggests that VisualDx had little direct impact with assisting in accurate pathological diagnosis in the SOC population (Figure 11). Several extraneous variables could have impacted this such as relative years of the APCs dermatology experience, a new technological application, and more directly, patient skin type.

Table 9

Clinical and Histological Diagnoses

Clinical Diagnosis	Histological Diagnosis
Atopic Dermatitis	Atopic Dermatitis
Acanthosis Nigricans	Acanthosis Nigricans
Acrochordon	Acrochordon
Post Inflammatory Hyperpigmentation	Post Inflammatory Hyperpigmentation
Melanoma	Melanoma
Prurigo Nodularis	Furunculosis
Squamous Cell Carcinoma	Squamous Cell Carcinoma
Urticaria	Arthropod Assault
Dyshidrotic Eczema	Dyshidrotic Eczema
Tinea	Pityriasis Rosea
Lichen Planus	Medication Reaction
Seborrheic Keratosis	Seborrheic Keratosis
Erythema Nodosum	Atopic Dermatitis
Lupus	Folliculitis
Atypia	Compound Nevus
Lichen Sclerosis	Lichen Sclerosis
Seborrheic Dermatitis	Allergic Contact Dermatitis
Lupus	Medication Reaction
Lupus	Lupus
Atypia	Acral Nevi
Atypia	Dermatofibroma
Tinea	Nevus of Ota
Psoriasis	Compact Keratin
Psoriasis	Atopic Dermatitis
Dyshidrotic Eczema	Connective Tissue Disorder i.e. Lupus
Lichen Planus	Connective Tissue Disorder

Statistical Testing and Significance

Statistical and clinical significance was determined via SPSS 25 analysis and interpreted calculations. Congruence was found in only 42.9% (n = 12) of the patients versus 57.1% (n = 16) that were not (Table 10). Frequency distribution of congruence was split according to the provider, each with at least one (16.7%) and no more than 5 (83.3%) congruent diagnoses (Table 11). Two providers had more than six patients which could have allowed for a slight percentage manipulation yet revealed no significant association between provider and congruence with a $p > 0.05$ (.110) (Table 12). The association between provider, skin type and congruence can be visualized in Figure 12.

Figure 10

Fitzpatrick Skin Type Distribution

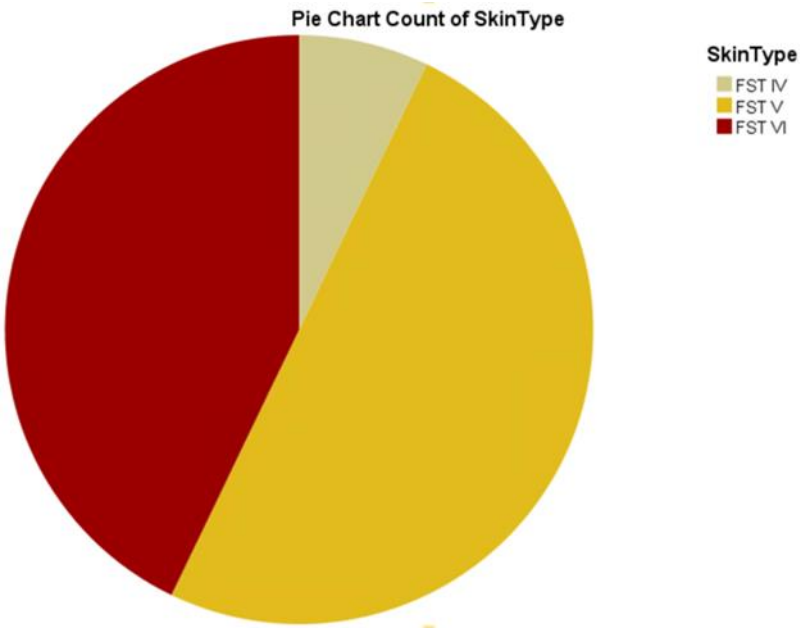


Figure 11

Congruence Distribution

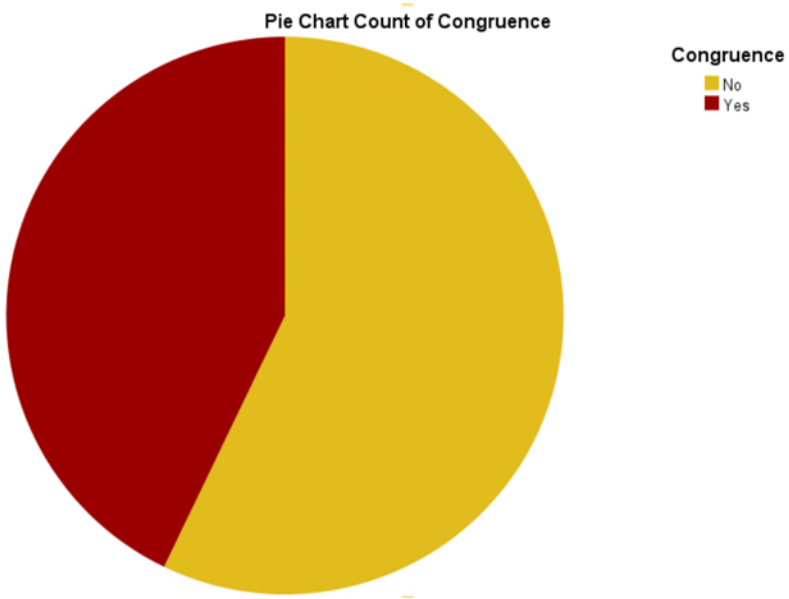


Table 10

Congruence Frequency

Congruence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	16	57.1	57.1	57.1
	Yes	12	42.9	42.9	100.0
	Total	28	100.0	100.0	

Table 11

Provider Congruence

Congruence

Provider			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	No	1	16.7	16.7	16.7
		Yes	5	83.3	83.3	100.0
		Total	6	100.0	100.0	
2.00	Valid	No	6	66.7	66.7	66.7
		Yes	3	33.3	33.3	100.0
		Total	9	100.0	100.0	
3.00	Valid	No	5	83.3	83.3	83.3
		Yes	1	16.7	16.7	100.0
		Total	6	100.0	100.0	
4.00	Valid	No	4	57.1	57.1	57.1
		Yes	3	42.9	42.9	100.0
		Total	7	100.0	100.0	

Table 12

Provider/Congruence Association

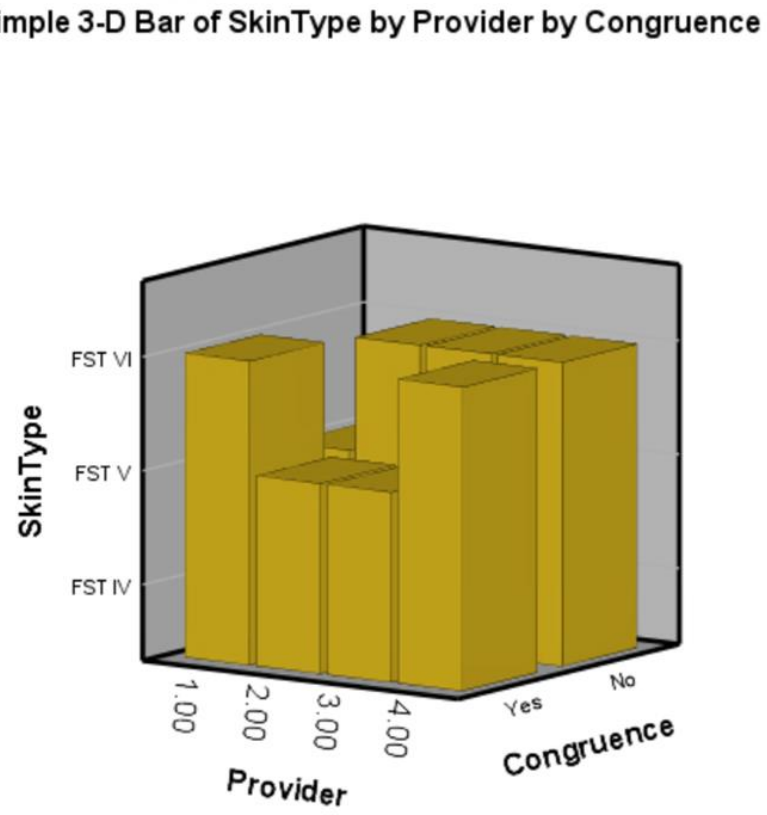
Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.028[a]	3	.110
Likelihood Ratio	6.411	3	.093
Linear-by-Linear Association	1.909	1	.167
N of Valid Cases	28		

a. 7 cells (87.5%) have expected count less than 5. The minimum expected count is 2.57.

Figure 12

Skin Type by Provider by Congruence



There was no significance found insinuating that continuous use of VisualDx lead to increased congruence (one APC improved with one congruence only at project end). A Chi square analysis was conducted to investigate whether a difference existed between congruence and skin type (Table 13). Assumptions were checked and results indicate congruence significantly differs among skin types; x2 (2) = 7.19 and p = .027. Strength of the association between the two variables was indicated by a Phi of .507 (Table 14).

Table 13

Congruence/Skin Type Difference

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.194[a]	2	.027
Likelihood Ratio	8.308	2	.016
Linear-by-Linear Association	6.935	1	.008
N of Valid Cases	28		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is .86.

Table 14

Association Strength

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.507	.027
	Cramer's V	.507	.027
N of Valid Cases		28	

Not surprisingly, FST VI had the least congruence 62.5% (n = 10) and the only two cases of FST IV were congruent, which aligns with the information in chapters one and two about the challenges of diagnosing darker skin tones (Table 15 and Figure 13).

Table 15

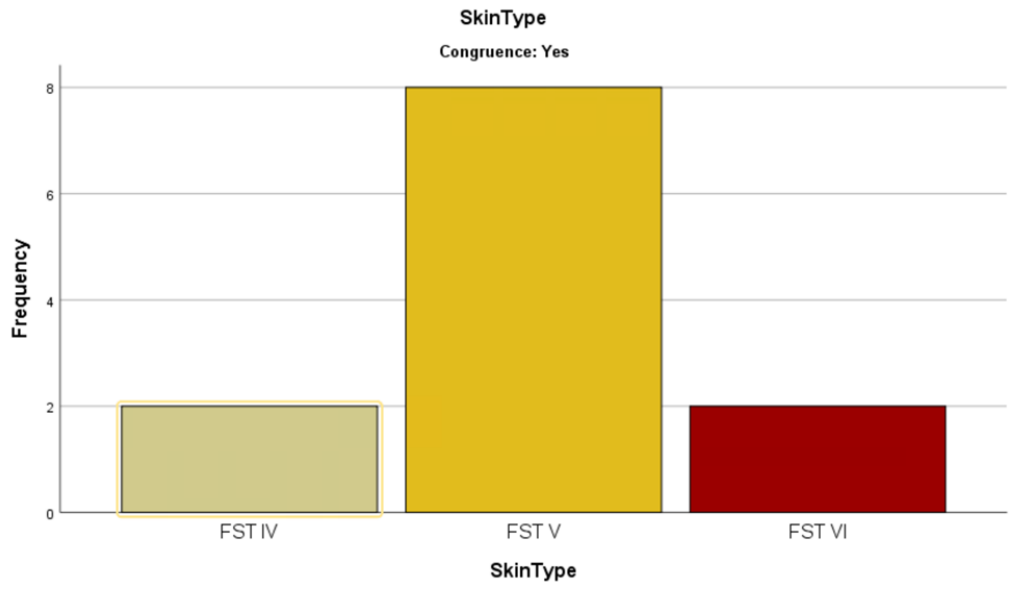
Congruence by Skin Type

SkinType

Congruence			Frequency	Percent	Valid Percent	Cumulative Percent
No	Valid	FST V	6	37.5	37.5	37.5
		FST VI	10	62.5	62.5	100.0
		Total	16	100.0	100.0	
Yes	Valid	FST IV	2	16.7	16.7	16.7
		FST V	8	66.7	66.7	83.3
		FST VI	2	16.7	16.7	100.0
		Total	12	100.0	100.0	

Figure 13

Skin Type and Congruence



Findings

Although VisualDx is an accessible, easily navigated mobile and desktop application, it does not appear to have assisted in accurate diagnosis in SOC patients. As the investigator suspected, nearly all the differentials and histological diagnoses (some duplicates) were related to inflammatory eruptions and not skin cancer (Table 9); this phenomenon is discussed in further detail in chapter 5. An argument could be made that it may be accurate in patients with lighter skin tones (FST I-III), but this project was focused on darker skin tone patients which has been shown in the literature to be more diagnostically complex.

Primary Outcome

Clinical and Histological Congruence. Congruence was found in only 12 (42.9%) of 28 biopsies revealing little assistance from the VisualDx application (Figure 11).

Satisfaction of Tools. Post project surveys revealed satisfaction with all three implemented tools. Ease of use was verbalized by all four APCs as a major factor in successful implementation. All four providers stated ease of use of the VisualDx application, three out of four stated VisualDx images were helpful (one stated somewhat helpful), and only one felt the SOC subgrouping was very helpful while the other three felt it was somewhat helpful or were indifferent. All four APCs felt the FST scale images were very helpful, ease of use was helpful for three APCs while one felt it was somewhat helpful, and three felt it was unbiased, and one was indifferent regarding bias content. The Atlas for Skin of Color (Jackson-Richards and Pandya, 2014) textbook reference was also evaluated for ease of use (two very helpful, one somewhat helpful, and one indifferent), images (two very helpful and two somewhat helpful), and differential diagnosis (two very helpful and two indifferent). All four APCs were appreciative of the tools provided.

Validity of tools. Cronbach's Alpha was performed on the post project surveys and data collection worksheet. A Cronbach's Alpha approaching 0.7 for reliability and validity revealed internal consistency of survey questions (Table 16). This rang true when discussions post

project between the investigator and the participants confirmed their opinions of the implemented tools with survey answers.

Table 16

Cronbach's Alpha Internal Consistency

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.695	.618	6

Spearman's Rho for correlations was conducted for each survey item and revealed an unremarkable negative correlation coefficient with df = 2 and p > .05 including the survey question about FST scale bias. Although the surveys state the implemented tools were helpful, the results of the congruence analysis would indicate otherwise.

Secondary Outcome

VisualDx will continue to be utilized by the dermatology APCs for differential building in complicated cases of all skin types. The desktop and mobile applications are available at no cost to all current employees within the health system and they are encouraged to use it as a trusted resource.

CHAPTER 5

DISCUSSION

Dermatology SOC patients have a higher incidence of misdiagnosis, late-stage diagnosis, and poorer outcomes than lighter skin-toned persons (Buster et al., 2012; Dawes et al., 2016; Drenkard et al., 2019; Gelber et al., 2013; Hogue and Harvey, 2019; Huang et al., 2019; Lee et al., 2018). With the United States black and “two or more races” population projection increases of 41% and nearly 200% by 2060 (Vespa et al., 2020), the need for diagnostic accuracy regarding these demographics is imperative. The answer to the PICOT question for this EBP project “For APCs in dermatology, does implementing the tool VisualDx, while providing the reference Atlas for Skin of Color (Jackson-Richards and Pandya, 2014) and FST visual aid result in diagnostic accuracy in patients with FST IV-VI as measured by congruence between clinical and histological diagnosis?”, was no. This chapter will explore the results as well as the contributory strengths and weaknesses of the project and its implications and recommendations for the future.

Explanation of Findings

VisualDx, although helpful and easily navigated by the APCs, did not increase diagnostic accuracy in this small participant group. The proposed outcome of 90% or greater diagnostic accuracy was not achieved (42.9%), resulting in an inverse relationship with participants overall satisfaction of the interventional tools. Of the 28 patients, most were FST V (n = 14), compared to VI (n = 12) and IV (n = 2). Although there was no comparison group, neither was there attrition. A post project survey noted all participants were satisfied with the implemented tools.

Only two providers saw one FST IV patient each and both were congruent, FST VI revealed 10 (62.5%) non-congruent patients and most patients were FST V with a split congruence of seven each. Frequency distribution of congruence ultimately ranged from 16.7% to 83.3% despite two providers performing more than six biopsies each. Although SOC is known to be diagnostically challenging, previous training may have created a discord between

differentials and learned materials as well as descriptors. Nearly all the differentials and histological diagnoses (some duplicates) were related to inflammatory eruptions and not skin cancer. These findings align with the challenges of diagnosing darker skin tones and the literature search results revealing racial disparities exist among these disease processes: Lupus (Drenkard et al., 2019), Scleroderma (Gelber et al., 2013), Mycosis Fungoides (Huang et al., 2019), and Hidradenitis Suppurativa (Lee et al., 2018).

Carter, Farrell, and Mason, (2012) note that technology in medicine is expanding and reviewed both the desktop version and mobile application VisualDx which was developed in 2006 as a diagnostic decision support tool for the skin, external eye, and oral mucosa. They found it contains >22,000 images of >1200 conditions and increases with peer-reviewed quarterly updates. This technology is unique in its ability to construct differential diagnoses from nine different scenarios and is four times more likely to produce an accurate diagnosis than without. The seven modules; eye, oral, pediatric skin, adult skin, pulmonary, public health, and drug reactions, implemented with lesion type, location, distribution, and key findings supplies the differential diagnoses. Data used is collected from institutions, physicians, and documented collections. It has the ability to interface with UpToDate and other EHR such as EPIC and Cerner, and is available for iPhone, iPad, iPod, and Android devices. Annual subscription cost varies from $29.99 (limited access) to $99, less for students, fellows, and residents, and free to some providers through their institution (if purchased as an organizational package). Internet connection is required for use.

Not unlike this EBP project, Burke and Littenberg, (2019) discovered VisualDX had no impact on patient outcomes in their cluster-randomized controlled pragmatic trial, but could have been limited by its cohort of primary care practices only. A comparison project including dermatology, primary care, urgent care, and rheumatology would likely yield interesting results.

Strengths and Limitations of the DNP Project

Strengths

VisualDx added a separate SOC category 10/14/2020, approximately one month into the project. The post project survey revealed one provider felt it was very helpful, two agreed it was somewhat helpful, and one was indifferent to the subcategory. Minimal cost, acceptance of innovative technological applications, and potential ease of use, as well as the participants enthusiastic and encouraged demeanor were all strengths attributed to the project. Additionally, some of the literature revealed positive implementation and diagnosis using the VisualDx application.

This practice, like most dermatology offices, send their biopsy tissue specimens to a dermatopathology lab where dermatologists and pathologists are double-boarded and specialty trained in cutaneous lesions, rashes, autoimmune diseases, etc., assisting in diagnosing complicated skin disease. This investigator did not track which lab evaluated each specimen, but both are dermatopathology laboratories and stated provider confidence exists. There was no attrition.

Limitations

Selection bias existed as all four APCs worked in the same health system department and all were female. Relative years of experience varied from less than one to four, possibly skewing the results due to inexperience. For optimal patient care it is acceptable to acknowledge the APCs may have collaborated with colleagues or used other references (UTD or additional textbooks) to arrive at a diagnosis. The APCs may not have chosen the VisualDx differential as their first choice, and tracking all differentials was not performed. There was no comparison group allowing for increased validity to implementation of any tool, nor was there data tracking of previous or concurrent education which may have been helpful in determining if previous didactics were beneficial.

Protocols may have deviated due to daily patient flow or volume, time management, human error, or technological issues. None of these were reported to the investigator. Although VisualDx is applicable to any provider attempting to diagnose and understand a cutaneous condition, it is aimed at primary care, therefore, dermatology nuances may exist. Increased strength and validity could be accomplished by increased number of participants, equal and increased years of educational representation of participants, inclusion of male gender, and inclusion of NPs or PAs in dermatology from a variety of healthcare institutions. Any deviation from the project protocol, although in the best interest of the patient, may have led to unknown errors, introducing additional bias.

Due to the Covid-19 pandemic, VisualDx allowed its users to utilize the “take a photo” option free of charge from April - December of 2020 (typically $99/year) to assist with timely cutaneous diagnosis. None of the providers purchased the photo option, instead choosing to build their differential with demographic and descriptive characteristics as outlined in the application.

Implications for the Future

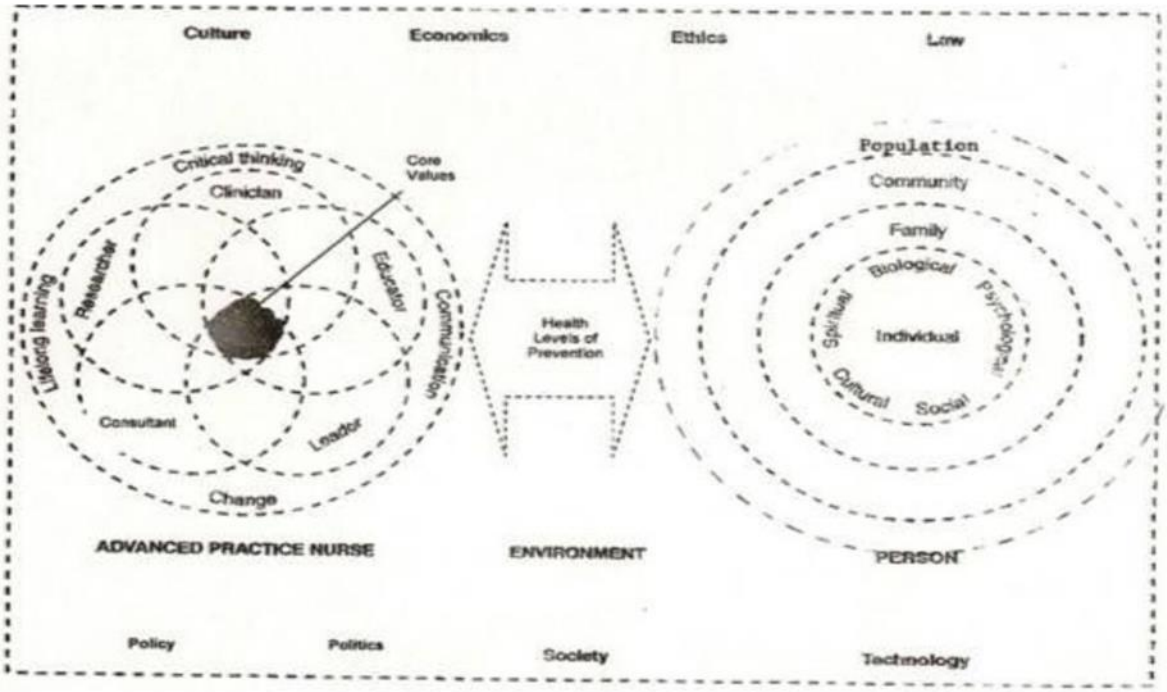
Practice

Dermatology providers have specialized training in skin disorders and lesions, with ongoing didactics contributing to their knowledge base. Although VisualDx was created for primary care and urgent care providers, this application can be useful to anyone attempting to correctly diagnose a cutaneous condition. As the Advanced Practice Nurse (APN) employs the Valparaiso University College of Nursing APN Model (Figure 14) and applies critical thinking to the environmental influences such as lack of SOC content in curriculum, he/she may transition to the leader, teacher, consultant, or life-long learner clinician treating the at-risk population with quality tools in technology, textbooks, and online resources. This change process is necessary as the societal skin type demographics are rapidly transforming. Limited to one healthcare practice, future EBP implementations would be wise to include increased numbers, additional

departments such as primary care and other specialties, equal representation of gender and further advanced training.

Figure 14

Valparaiso College of Nursing Advanced Practice Nurse Model



Note: Reprinted from https://www.valpo.edu/college-of-nursing-and-health-professions/academics/nursing/ on March 15, 2021

EBP Model

Evidence-based practice is essential for prudent, dependable, accurate healthcare. The JH Model (Vera, 2018) (Figure 3) was helpful in dissecting relevant literature for the EBP project leading the investigator to establish a strategy for VisualDx implementation. The systematic analysis of literature allows the investigator to critique the evidence with an efficient, methodical approach. What this investigator found most supportive was the JH Model's three-step process (PET), particularly Appendix D and its ability to guide one through the research studies

establishing and confirming the levels and qualities of each piece of evidence. Appendix I assists in recruiting the leader and the team as well as confirming support, but this project was so readily accepted the investigator needed only to establish critical timelines.

Research

Further research is warranted in SOC patients. Implementation of the VisualDx application in primary care and urgent care settings with data tracking of all skin types would alleviate provider stress and increase positive patient outcomes. Direct implications for nursing research include larger participant pool, longer duration of study, involve comparison groups and additional health care systems in differing demographic populations.

Education

Further education in SOC presentation, recognition, diagnosis, and treatment is warranted as gaps in all four areas exist. A study by Ware et al., (2020) in which 70% dermatologists and 30% dermatology trainees (26% identifying as SOC) were supplied electronic and in person surveys in February and March 2019 to determine how providers describe race and ethnicity as well as how they incorporate FST into their clinical practice. Of the 140 questionnaires, only 33% to 50% use FST to characterize race, ethnicity, or SOC. The authors in this study surmised medical providers believe the terms race and ethnicity are interchangeable with FST.

Race correction in algorithms and guidelines as affecting risk assessment and treatment was examined by Park, Alston, and Washington-Brown (2021). They found databases may include biased racial data in risk assessment and provided five examples: sickle cell disease, body mass index, diabetes, cardiovascular disease, and pulmonary function tests. These biases can lead to inappropriate testing, incorrectly prescribed medications, and misclassification of disease severity and impairment. Also stated in the article: race, which is not clearly defined, is often determined by self-identification, and providers often base racial categories on skin tone and physical characteristics; therefore, healthcare providers must take into consideration race

correction may not be valid in some patient evaluation and should make accommodations appropriately.

All four providers in this project documented FST and were provided a FST reference for accuracy. Skin type IV had the smallest group of patients (2) with congruence in both, yet two providers never biopsied skin type IV at all, possibly due to the demographic population that seeks dermatological treatment as referenced earlier in this paper. Type V was the largest population (14) with equal population congruence (7), and type VI (12) was only achieved in two cases, again highlighting the overall risk of darker skin tone and disease management.

Conclusion

Unfortunately, this study did not reveal increased diagnostic congruence with utilization of the VisualDx platform despite provider endorsement; and although helpful, nothing compares to education and training when attempting to accurately diagnose and establish treatment plans. The possibility exists that VisualDx is less helpful in darker skin tones due to number of available pictures or descriptors, but the collection continues to grow parallel to or at a minimum positive trajectory to SOC awareness. VisualDx can be a valuable resource for differential building and will most likely be utilized across the healthcare spectrum.

During this project, a second-year medical student from Zimbabwe named Malone Mukwende was studying at St. George's University in London and could not find teaching images for darker skin tones. This educational deficiency prompted him to begin writing his own book *Mind the gap*: A handbook of clinical signs in black and brown skin (yet to be published) that will include images and corrected medical terminology for SOC in search of inclusion and patient safety. According to an article in The Washington Post (Page, 2020), the team of three co-authors will address childhood diseases, skin cancer, inflammatory disorders and even Covid-19. The biggest hurdle has been allocation of images, which further aligns with previous mentioned SOC underrepresentation. Also mentioned in the article, incoming assistant professor at the University of Washington Patricia Louie reiterated what was previously stated

and cited in this paper (Louie and Wilkes, 2018), noting medical textbooks overrepresented light skin tones with only a 5% representation of darker skin tones. Her research also discovered the majority of South Africa's medical textbooks are equal to those in the U.S. according to image distribution despite the predominantly black population, highlighting continued structural racism (Page, 2020).

Change is critical to appropriate healthcare in a diverse population. VisualDx is a mobile resource, and along with changes in medical textbook imagery as well as content, healthcare providers should have the tools to accurately diagnose and treat patients off all skin types.

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BIOGRAPHY

Jill M. Maddox

Practicing in Dermatology since her 2009 Master's in Nursing / Family Nurse Practitioner completion at Valparaiso University and subsequent certification through the American Nurses Credentialling Center, Ms. Maddox specializes in complicated rashes in her busy, general medical dermatology practice in South Bend, IN. Her lifetime in medicine began in high school co-op as a secretary advancing to phlebotomist at a local lab. Jill expanded her medical knowledge with certification as an emergency medical technician, a brief stop in podiatry and a decade in children's dentistry. After holding a position in major surgery as a fourth-year nursing student, she then graduated with her Associate's and Bachelor's in Nursing from Indiana University South Bend in 2000 and 2001, respectively. Jill held positions in critical care units including cardiac care, emergency room, and intensive care. Her lifelong-learning mindset evolved into teaching as an ACLS instructor, guest lecturing to local universities presenting dermatology pearls to nurse practitioner students, and precepting medical residents, physician assistant, nurse practitioner, and medical students. As an ICU nurse she acquired a love for trauma, leading to specialized certifications and completing her master's/post master's nurse practitioner requirements within a Level II trauma program where she implemented two performance improvement projects: interventional radiology inferior vena cava filter (IVCF) patient tracking for device retrieval assessment and substance abuse screening brief intervention and referral (SBIR). Her master's paper "Mental Illness and the Trauma Patient: A Costly Comorbidity" was accepted for publication in 2009 by *Critical Care Nurse*. As a doctoral student at Valparaiso, her quality improvement project "Dermatology in Skin of Color" was presented at the *2020 Virtual Indiana Nursing Summit*. Jill also has memberships in the American Nurses Association and Coalition of Advanced Practice Clinicians of Northern Indiana.

ACRONYMS

AAD: American Academy of Dermatology

APC: Advanced Practice Clinician

APN: Advanced Practice Nurse

DNA: Dermatology Nurses Association

DNP: Doctor of Nursing Practice

DOB: Date of Birth

DOS: Date of Service

EBP: Evidence-based Practice

EHR: Electronic Healthcare Records

FST: Fitzpatrick Skin Type

HS: Hidradenitis Suppurativa

IRB: Internal Review Board

JBI: Joanna Briggs Institute

JH: Johns Hopkins

MS: Metabolic Syndrome

NBUVB: Narrow Band Ultraviolet B

NP: Nurse Practitioner

PA: Physician Assistant

PET: Practice question, Evidence, and Translation

PICOT: Patient/population/problem, Intervention, Comparison, Outcome and Translation

POC: People of Color

RCT: Randomized Controlled Trials

SOC: Skin of Color

SPF: Sun Protection Factor

US: United States

UTD: Up To Date

APPENDIX A

COPYRIGHT PERMISSIONS

ClinCalc

From: ClinCalc.com [mailto:contact@clincalc.com]
Sent: Sunday, February 21, 2021 8:34 AM
To: Jill Maddox
Subject: Re: Copyright permission

[**CAUTION:** This email originated from outside of Beacon. **Do not click links or open attachments** unless the sender and content are known as safe. NEVER ente your Beacon PASSWORD after following an email Web-link.]

Hi Jill,

No problem at all -- you're welcome to use the image. Good luck with your paper!

Best regards,
Sean

On Sat, Feb 20, 2021 at 4:29 PM Jill Maddox <jmaddox@beaconhealthsystem.org> wrote:

> TWIMC:
> I am a doctoral nursing candidate at Valparaiso University, Valparaiso, IN implementing an evidence-based practice project and am requesting permission to use the ClinCalc image in my paper/report that will be published on Valparaiso's institutional repository.
> My project was to implement the VisualDx digital platform for assistance in diagnosing dermatological conditions in skin of color patients. ClinCalc was utilized to determine the minimum number of subjects for adequate study power (see image below).
> The project will be non-commercial and ClinCalc will be cited for recognition.
> I appreciate your review.

Doc Halo

From: Julia Goebel [mailto:julia.goebel@halohealth.com]
Sent: Monday, March 15, 2021 6:16 PM
To: Jill Maddox
Subject: Follow-up and thanks

[**CAUTION:** This email originated from outside of Beacon. **Do not click links or open attachments** unless the sender and content are known as safe. NEVER enter your Beacon PASSWORD after following an email Web-link.]

Hello Jill,

This email serves as permission to use the Halo Health logo and/or screen capture images of the Halo Clinical Collaboration Platform in your forthcoming thesis.

Please note that "Halo Clinical Collaboration Platform" is a trademark, so that is our accepted naming convention for first use on a page, and the only time "Halo" is allowed to be used without "Health."
Any other mention of Halo requires the full name:

Halo Health
Halo Clinical Collaboration Platform™
Halo Health CCP
Halo Health platform

As I mentioned in our conversation, your use of the Halo Health platform is a fascinating use case I hadn't heard before. Congratulations on this novel solution, as well as your pursuit of your PhD.

Please let me know if I can be a resource in any way...

Sincerely,
Julia

Platinum Skincare

From: Platinum Skincare Support [mailto:support@platinumskincare.com]
Sent: Sunday, February 21, 2021 12:32 PM
To: Jill Maddox
Subject: RE: Copyright permission

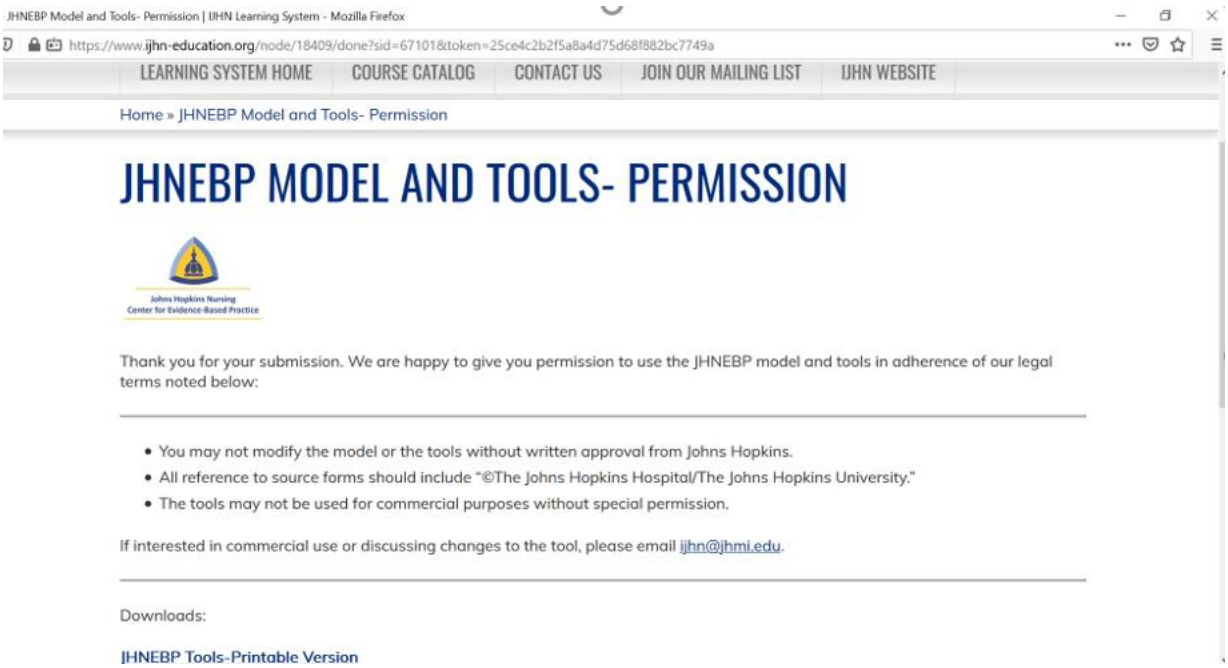
[**CAUTION:** This email originated from outside of Beacon. **Do not click links or open attachments** unless the sender and content are known as safe. NEVER enter your Beacon PASSWORD after following an email Web-link.]

Hello. You may use our artwork as long as we are cited. Jen

---------- Original Message ----------
From: Jill Maddox [jmaddox@beaconhealthsystem.org]
Sent: 2/20/2021 2:08 PM
To: support@platinumskincare.com
Subject: Copyright permission

TWIMC:
I am a doctoral nursing candidate at Valparaiso University, Valparaiso, IN implementing an evidence-based practice project and am requesting permission to use the Platinum Skin Care Fitzpatrick Scale (see below) image in my paper/report that will be published on Valparaiso's institutional repository.
My project was to implement the VisualDx digital platform for assistance in diagnosing dermatological conditions in skin of color patients and a Fitzpatrick Skin Type visual aid was provided as a reference.
The project will be non-commercial and VisualDx will be cited for recognition.
I appreciate your consideration.

JOHNS HOPKINS EBP MODEL



VisualDx

From: Audra Huber [mailto:ahuber@visualdx.com]
Sent: Tuesday, March 16, 2021 10:49 AM
To: Jill Maddox
Cc: Ashley Ayala
Subject: RE: VisualDx for Valparaiso Medical Education

[**CAUTION:** This email originated from outside of Beacon. **Do not click links or open attachments** unless the sender and content are known as safe. NEVER enter your Beacon PASSWORD after following an email Web-link.]

Hi Jill,

Yes, it was approved that you can use the VisualDx mobile app logo in the paper. I have attached my email correspondence with my VP of Marketing for your records.

I have not heard back from Valpo yet but will follow up this week.

I am excited to read your paper when it is complete. Please let us know if you need anything else.

Kind Regards,
Audra Huber
Business Development Sales Director
VisualDx
Cell: 973-670-8714