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Implementation of a Cost-Effective Treatment Algorithm for the Management of Acne Vulgaris in College Students

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IMPLEMENTATION OF A COST-EFFECTIVE TREATMENT ALGORITHM FOR THE MANAGEMENT OF ACNE VULGARIS IN COLLEGE STUDENTS

by

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DEDICATION

This project is dedicated to my wonderful family and friends. To my fiancé, Brandon Burke, you have always been by my side throughout the numerous years I have spent in school and I could not have done it without you. Thank you for your unwavering support and belief in me as I obtained my DNP degree. To my parents, Joe and Amy Borsilli, thank you for your endless love, support, and encouragement with all my endeavors. I would not have been able to accomplish this much in life without you both. I would also like to thank my loving grandmother, Marilyn Kash, my late grandfather, George Kash, and my grandfather, Joe Borsilli, for their endless support as well. Finally, to all the friends I have grown near and dear with over the years, thank you for always being there for me.

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ABSTRACT

Acne is one of the most common skin disorders in the United States, occuring in over 5.1 million Americans. Of those with acne, 53.8% are adults between the ages of 18 and 44 years old (American Academy of Dermatology [AAD], 2017). Acne can lead to multiple issues such as scarring, poor self-esteem, anxiety, and depression (Zaenglein et al., 2016). Acne can also negatively impact quality of life (Cengiz & Gurel, 2020). The purpose of this evidence-based project was to develop a cost-effective treatment algorithm for the management of acne vulgaris in adult college students. A literature search determined the best and most cost-effective agents to manage acne are benzoyl peroxide 2.5%, adapalene 0.1%, clindamycin phosphate 1%, and doxycycline. These agents are used in varying combinations based on acne severity level, which can range from clear, almost clear, mild, moderate, severe, and very severe. A treatment algorithm was developed based on the literature recommendations and implemented by two nurse practitioners at a university student health center located in Northwest Indiana. Two groups of participants were included in this study, an intervention group that received treatment and a comparison group that did not receive treatment. The primary outcome being measured was participant quality of life measured by the Acne-Specific Quality of Life (Acne-QoL) Questionnaire, which is separated into four specific domains. Participants completed this questionnaire during baseline visits and again after 6 weeks of treatment. Data were analyzed using paired-samples *t* tests for both the intervention and comparison groups, as well as a mixed-design ANOVA between groups. For the intervention group there were statistically significant increases in quality of life for the self-perception (t (9) = -3.171, p = .011), role-emotional (t (9) = -2.675, p = .025), and acne symptoms (t (9) = -3.48, p = .007) domains. No statistically significant difference was found between mean baseline and 6-week scores for the comparison group. There was also no statistically significant difference between the two groups. The results from this project can be implemented into practice to provide consistent management of acne vulgaris and to improve patient quality of life.

CHAPTER 1

INTRODUCTION

Background

Acne is one of the most common skin disorders in the United States, primarily affecting adolescents and young adults (AAD, 2017). Acne is typically first seen in adolescents during puberty; however, it can continue into adulthood (Pandis, 2020; Zaenglein et al., 2016). In 2013 alone, over 5.1 million Americans were seen in the health care setting for treatment of acne. Among those individuals, 53.8% were between the ages of 18 and 44 years old (AAD, 2017). Acne poses a significant cost burden to patients as it was reported in 2013 that acne accounted for $846 million dollars in medical costs. Lost productivity for patients and caregivers was also noted to be $398 million dollars (AAD, 2017). Not only does acne have a high-cost burden on patients, but it can also cause other physical or psychological issues such as scarring, poor self-esteem, anxiety, and depression (Zaenglein et al., 2016). These factors can lead to an overall negative impact on an individual's quality of life (Cengiz & Gurel, 2020).

There are different variants of acne including acne vulgaris, acne mechanica, acne fulminans, and chloracne, among others (Wolff et al., 2017). Acne vulgaris, or common acne, is the most prevalent type, occuring in 99% of acne cases (Ramli et al., 2012). The pathophysiology of acne vulgaris involves four key processes including inflammation, abnormal desquamation of keratinocytes, increased or altered sebum production, and colonization of *Propionibacterium acnes* (Pandis, 2020). Puberty triggers increased hormone stimulation which then increases sebum production in pilosebaceous follicles. The abnormal desquamation of keratinocytes causes the pilosebaceous follicles to become clogged, leading to the formation of primary lesions, also known as comedones. There are two types of comedones, open and closed. Open comedones are also known as blackheads and closed comedones as whiteheads. Open comedones are the result of an obstruction at the follicular head and closed comedones

occur due to swelling of the follicular duct. Closed comedones are the precursor to inflammatory lesions, such as papules and pustules, which occur due to inflammatory materials that surround the comedone (Pandis, 2020). Nodules and cysts may also develop with acne vulgaris (Wolff et al., 2017).

Data from the Literature Supporting Need for the Project

As previously stated, acne vulgaris is one of the most common skin disorders in the United States (AAD, 2017). Acne vulgaris primarily affects adolescents and young adults, and it is estimated that 85% of individuals between the ages of 12 and 24 years old have at least a mild form of acne (Bhate & Williams, 2013). This specific age population comprises most college students, who are young adults. Acne can have many detrimental effects for these young adults, including scarring, poor self-esteem, anxiety, and depression (Zaenglein et al., 2016). The negative impacts acne can have on mental health have also been outlined by Singam et al. (2019), in which an analysis of the 2002-2012 United States National Inpatient Sample was conducted to determine associations between acne vulgaris and comorbid mental health disorders in hospitalized pediatric and adult patients. In this study, the authors determined acne vulgaris can be associated with numerous comorbid mental health disorders including anxiety, depression, adjustment disorders, schizophrenia, suicidal risk, personality disorders, attention deficit disorder/attention deficit hyperactivity disorder and other conduct disorders, alcohol-related disorders, childhood and adolescent psychiatric illnesses, development disorders, impulse control disorders, cognitive disorders, a history of mental health disorders, and substance use disorders (Singam et al., 2019). Individuals suffering from acne vulgaris can also have trouble with emotion regulation, which can negatively impact quality of life (Cengiz & Gurel, 2020).

The negative impacts of mental health disorders and difficulty with emotion regulation caused by acne vulgaris can make a young adult's life in college more challenging. These factors may also lead to lower academic performances as well (Girman et al., 1996). College

itself can be a stressful time for most young adults in general, and this increased stress can also be a major trigger for acne vulgaris (Pandis, 2020). Not only does stress contribute to acne exacerbations, but poor diet choices may also lead to an increase in acne. Specifically, there have been associations between diets with a high glycemic load and increased acne exacerbations. It is thought that dairy products may also play a role in acne exacerbations as well (Pandis, 2020).

Data from the Clinical Agency Supporting Need for the Project

The clinical site for this EBP project was a university student health center located in Northwest Indiana. The director of the student health center, who also works as a family nurse practitioner (FNP) at the clinic, determined there was a need for a treatment algorithm to adequately treat patients presenting to the clinic with acne. A chart review also determined there were inconsistent prescribing trends for the treatment of acne over a period of 3 years. Acne severity levels were also not consistently assigned to patients, in which only 22% of patients seen in the clinic for acne received a severity level of either mild or moderate. These severity levels were based on provider judgement, as there was no standardized acne grading scale used within the student health center during this time period.

Purpose of the Evidence-Based Practice Project

The purpose of this EBP project is to improve patient quality of life using a cost-effective treatment algorithm for the management of acne vulgaris in adult college students. The goal of cost-effective treatment is to reduce any financial barriers patients may have when obtaining treatment for acne.

PICOT Question

The PICOT question developed for this project was: in adult college students diagnosed with acne vulgaris at the university's student health center (P), how does a cost-effective acne treatment algorithm (I) compared to current practice without an algorithm (C) impact participant quality of life measured by the Acne-QoL questionnaire (O) over a 6-week period (T)?

Significance of the EBP Project

Young adults have a high prevalence of acne vulgaris, which can cause significant issues related to mental health (Singam et al., 2019), difficulty with emotion regulation (Cengiz & Gurel, 2020), as well as scarring and poor self-esteem (Zaenglein et al., 2016). During college, there are also many changes that are occurring in a young adult's life that can contribute to acne vulgaris, including increased levels of stress and unhealthy eating habits. Treatment for acne can also be costly, and many college students are typically on a budget. Overall, the development of a cost-effective treatment algorithm can help to alleviate the financial burden experienced by students seeking treatment for acne vulgaris, as well as to ensure treatment is adequately managed based on acne severity level. The treatment algorithm can also serve as a standardized treatment modality to ensure consistency and easy to follow guidance for healthcare providers.

CHAPTER 2

EBP MODEL AND REVIEW OF LITERATURE

Evidence-based Practice Model

Overview of EBP Model

After careful review of the various EBP models, the revised Iowa Model was selected as a guide for the development, implementation, and sustainability of this EBP project. The model was originally developed at the University of Iowa Hospitals and Clinics (UIHC) by a group of nurses to develop a process for EBP. The model was also recently revised and validated in 2017 in an attempt to stay current with changes in the healthcare field (Iowa Model Collective, 2017). The Iowa Model is based on Martha Rogers' Diffusion of Innovations theory and was developed based on the scientific problem-solving process for use among interdisciplinary healthcare providers (Melynk & Fineout-Overholt, 2019). This model features a series of seven steps incorporated with feedback loops, as well as three decision points in between steps to assist in the guidance of the EBP process.

Step one of the Iowa Model involves identifying triggering issues or opportunities. The trigger or opportunity can arise from clinical- or patient-identified issues; organizational, state, or national initiatives; data or new evidence; accrediting agency requirements or regulations; or philosophy of care (Melynk & Fineout-Overholt, 2019). This then leads into the next step of stating the question or purpose. This step involves the development of a PICOT question, and ultimately, this step helps to reinforce the focus of the EBP process. Following step two, there is a decision point in which it must be determined if the selected topic is a priority. If the answer is no, the first feedback loop is encountered, and another issue or opportunity should be explored that is a higher priority. If answered yes, the EBP process is continued into step three: form a team. The team is composed of key stakeholders and organizational leaders to lead the process of practice change (Melynk & Fineout-Overholt, 2019). Step four involves the process of

assembling, appraising, and synthesizing the body of evidence through a systematic search. Following this step, another decision point must be made to determine if there is sufficient evidence. If there is not, a feedback loop is followed in which research must be conducted and then reassembled. If there is sufficient evidence, the process continues into step five. This step includes designing and piloting the practice change which involves engaging patients and verifying preferences; considering resources, constraints, and approvals; developing localized protocols; creating an evaluation plan; collecting baseline data; developing an implementation plan; preparing clinicians and materials; promoting adoption; and collecting and reporting post-pilot data (Melynk & Fineout-Overholt, 2019). After completing these various tasks within step five, another decision point is encountered to determine if the change is appropriate for adoption in practice. If the change is not appropriate, another feedback loop is followed to consider alternatives and to then redesign the change. If the change is appropriate, the EBP process continues to step six: identify and sustain the practice change. For this step, tasks include identifying and engaging key personnel, hardwiring the change into the system, monitoring key indicators through quality improvement, and reinforcing as needed (Melynk & Fineout-Overholt, 2019). Finally, the process ends at step seven which includes disseminating the results to promote EBP among other clinicians and organizations.

Application of EBP Model to DNP Project

The steps of the Iowa Model were followed throughout the duration of this project to serve as a guide for the EBP process. The triggering issue was identified by the director of the student health center after determining there was inconsistency of treatment for acne vulgaris among health care providers. Thus, it was determined that a treatment algorithm for acne vulgaris would benefit the health care providers and their patients. Key stakeholders were identified to form the team and included patients, staff nurses, health care providers, and the health center director. After this step, a thorough literature search was conducted to determine the best evidence available for managing acne vulgaris. Evidence was appraised to determine

the level and quality ratings and was then synthesized to reflect best practice recommendations. Based on these synthesized recommendations, a treatment algorithm was developed with a plan to begin implementing said algorithm at the student health center among the health care providers. This plan was communicated to the key stakeholders for implementation. Primary outcomes were also identified for the evaluation phase of this project. Based on the evaluation, sustainability of the practice change was discussed with stakeholders to continue utilizing the treatment algorithm in practice.

Strengths and Limitations of EBP Model for DNP Project

One strength of the Iowa Model includes the practicality and ease of use of the model. The seven steps are clearly identified and the decision points between steps two, four, and five allow the user to determine if the project is progressing in the right direction. The various feedback loops also help the user return to previous steps to revise a project as needed. This simplicity makes using the revised Iowa Model an easy process among both novice and expert clinicians. Another identified strength of this model involves the recent revisions to stay current with the ever-changing healthcare field. Revisions were recently made to address “an explosion of synthesized evidence, national and international initiatives promoting adoption of EBP, enhanced interprofessional collaboration, widespread use of electronic data, emergence of implementation science, pay for performance, and enhanced patient engagement” (Iowa Model Collective, 2017, p. 175).

One limitation of the Iowa Model would be the time required to complete the various steps. There are multiple tasks for each step, especially for steps four, five, and six. This may pose a problem when clinicians and key stakeholders are limited on time for the completion of a project. However, time can be saved throughout the project as mentioned before with the use of the decision points and feedback loops that are presented throughout the model. These decision points and feedback loops are beneficial in that time will not be wasted if the project does not meet the necessary criteria to continue. Overall, the strengths greatly outweigh the one

limitation of this model and this model provided an excellent framework for the duration of this project.

Literature Search

Sources Examined for Relevant Evidence

An extensive literature search was conducted to identify best practice interventions for the management of acne vulgaris. Multiple databases were systematically searched including Cochrane Library, Joanna Briggs Institute (JBI), Turning Research into Practice (TRIP) Medical Database, MEDLINE via EBSCO, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Cochrane Library and JBI were selected based on their collection of high levels of evidence. TRIP Medical Database was utilized as it includes various clinical practice guidelines. CINAHL and MEDLINE were also selected based on their large collections of scholarly evidence. Citation chasing from relevant sources was also completed to ensure a thorough literature search was conducted. Keywords utilized for the final literature search included acne, “acne vulgaris”, “comedonal acne”, Medical Subject Heading (MeSH) term “Acne Vulgaris”, MeSH term “Dermatologic Agents”, CINAHL subject heading “Acne Vulgaris”, and CINAHL subject heading “Dermatologic Agents”, all in varying combinations based on the selected database.

Inclusion criteria consisted of a date range from 2015 to 2020, English language, scholarly/peer-reviewed sources, adolescent age group (13-18 years), and all adults age group (19 years and older). Within the TRIP Medical Database, the inclusion criteria “guidelines” was also utilized. Exclusion criteria consisted of adolescents younger than 18 years old and evidence based on other variants of acne such as acne fulminans, acne varioliformis, acne aestivalis, and acne tropica. Studies involving the use of isotretinoin were also excluded after completing a cost analysis of various acne treatment regimens as isotretinoin is a more expensive medication. It was determined through the literature search that the vast majority of evidence suggests treatment should involve the use of topical and systemic medications. Thus,

studies involving diet, complementary and alternative medicine (CAM), light/laser therapy, and herbal remedies were excluded. Evidence involving the use of oral contraceptives were also excluded based on their exclusive use within female patient populations.

The initial literature search began in the Cochrane Library database. The first search utilized within this database involved the keywords (acne OR “acne vulgaris” OR “comedonal acne”) AND (treat* OR interven* OR manag*) with limiters of the past five years. This search yielded 93 results, many of which were irrelevant to the topic. At the advice of the Valparaiso University library liaison, Kimberly Whalen, the keywords treat*, interven*, and manag* were omitted from the search based on the yielded results. Acne was also removed as a keyword based on advice from the library liaison as the use of this keyword was yielding evidence where acne could have been simply mentioned within a piece of evidence, without regard to the selected topic. With the removal of these keywords, a final search was conducted involving the keywords “acne vulgaris” OR “comedonal acne.” This final search yielded 14 results, of which five were reviewed and one accepted for use within this project.

The next database searched was JBI. The search was kept simple within this database based on recommendations made by the library liaison. Thus, this search involved the use of the single keyword acne. A date limit of the last five years was also utilized within this database. This search yielded 21 results. Many results were deemed irrelevant to the topic, thus only one piece of evidence was reviewed. This piece of evidence was later excluded from the project based on the exclusion criteria as it involved the treatment modality of oral contraceptives to manage acne vulgaris.

The TRIP medical database was utilized next. Keywords included “acne vulgaris” OR “comedonal acne.” The limiters of last five years and USA guidelines were used as well, which yielded 39 results. After careful consideration, a decision was made to remove USA guidelines and to search guidelines from all countries within this database. USA guidelines seemed too restrictive as guidelines from other countries can provide valuable information for use here in

the USA. After modifying the search, a total of 118 sources were found. Three of those sources were selected for use in this project.

To continue the literature search, MEDLINE via EBSCO was searched next. The initial search within this database was too broad and resulted in 1,525 sources. Thus, the addition of MeSH headings was utilized to narrow the search. The next search involved the keywords (MeSH heading “Acne Vulgaris” OR “comedonal acne”) AND (interven* OR treat* OR manag*) with the limiters English language, last five years, and scholarly/peer reviewed. This only brought the number of sources down to 1,058. Based on the previous advice of the library liaison, the keywords interven*, treat*, and manag* were eliminated. However, a new keyword was needed to narrow the results further, as the search remained too broad. Thus, the MeSH heading “Dermatologic Agents” was utilized as this heading was deemed relevant to the search topic. The final search for this database involved the keywords MeSH heading (MH “Acne Vulgaris” OR “comedonal acne”) AND MeSH heading (MH “Dermatologic Agents”). Further limiters of adolescent (13-18 years) and all adult (19+ years) were also applied. This final search yielded 212 results, of which two were selected for use in this project.

The final database searched was CINAHL. Based on the search from MEDLINE via EBSCO, the same keywords and limiters were utilized within this database as well. The MeSH headings used in MEDLINE via EBSCO were switched to CINAHL subject headings for this selected database, as these headings were the same in CINAHL. This search resulted in 34 results, of which seven were duplicates from MEDLINE via EBSCO. A total of nine sources were reviewed, however, none were selected for use in this project based on the inclusion and exclusion criteria.

Citation chasing was also utilized during the literature search. A total of 14 sources were identified from previously reviewed sources, and two were selected for use. One clinical practice guideline was selected from a Cochrane Library systematic review. The other selected piece of

evidence was a descriptive study referenced in an article previously reviewed that was originally found in MEDLINE via EBSCO.

In total, this systematic literature search yielded 413 pieces of evidence. Numerous pieces of evidence were eliminated based on simple review of titles and abstracts. Articles were also removed if they were duplicates previously found within other databases. A total of 65 pieces of evidence were reviewed, and the final decision to include eight pieces of evidence was made based on this review. Data from the literature search is represented in Table 2.1. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) process is also shown in Figure 2.1.

Table 2.1

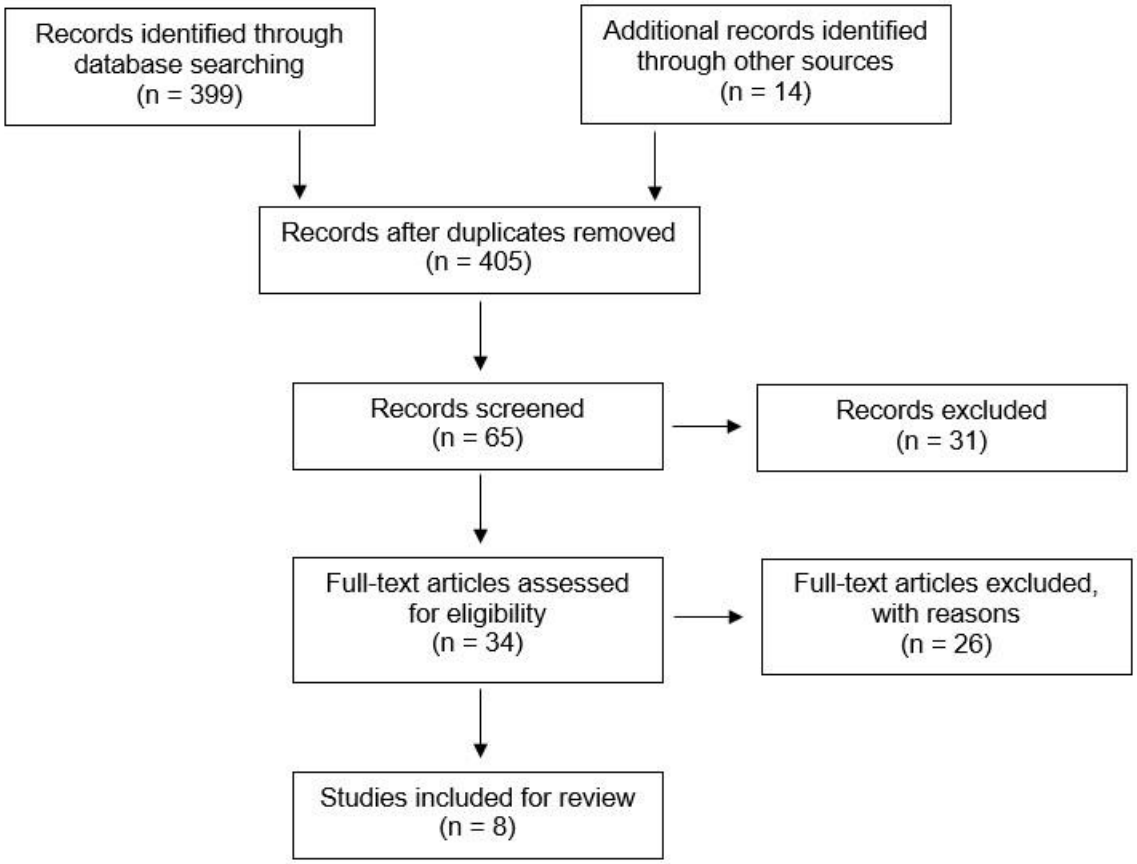
Evidence Search Table

Database	Yielded	Duplicates	Reviewed	Accepted
Cochrane	14	0	5	1
JBI	21	0	1	0
TRIP	118	0	4	3
MEDLINE	212	1	32	2
CINAHL	34	7	9	0
Citation Chase	14	0	14	2
Total	413	8	65	8

Note. Databases are listed in order of searches performed.

Figure 2.1

PRISMA Flow Chart of Literature Review



Levels of Evidence

The Melynk and Fineout-Overholt's (2019) Hierarchy of Evidence was used for leveling the evidence for this project. This hierarchy consists of a seven-level ranking system ranging from Level I to Level VII. These levels are depicted as a pyramid, with the Level I evidence at the top representing high-level evidence and Level VII evidence at the bottom of the pyramid representing lower-level evidence. Evidence becomes more generalizable to patient populations and has a lower risk of bias as each level of the pyramid grows from the bottom up. This criterion allows for a degree of confidence that interventions defined within the evidence will perform as they are intended to produce desired health outcomes (Melynk & Fineout-Overholt, 2019). The Level I evidence includes systematic reviews, meta-analyses, and clinical practice guidelines based on Randomized Controlled Trials (RCTs). Level II evidence consists of single RCTs, while Level III evidence consists of nonrandomized controlled studies. Continuing through the pyramid, Level IV evidence is obtained from controlled cohort studies and Level V evidence is obtained from uncontrolled cohort studies. Level VI evidence consists of case studies, case series, qualitative studies, descriptive studies, EBP implementation, and Quality Improvement (QI) projects. Finally, Level VII evidence is defined as evidence based on expert opinion. In total, eight pieces of evidence were selected for use in this project, including one systematic review (Level I), one meta-analysis (Level I), four clinical practice guidelines (Level I), and two descriptive studies (Level VI). Levels of evidence are summarized in Table 2.2.

Table 2.2

Levels of Evidence

Level	Included	Quality	Design
I	6	High (5) Good (1)	Systematic Review (1) Meta-Analysis (1) Clinical Guideline (4)
VI	2	High (1) Good (1)	Descriptive Study (2)

Appraisal of Relevant Evidence

Appraisal of the selected evidence was completed using the Johns Hopkins Research and Non-Research Evidence Appraisal Tools. The Johns Hopkins Research Appraisal Tool is used to appraise the quality of quantitative and qualitative research studies, mixed-method studies, systematic reviews with or without meta-analyses, and meta-syntheses. Thus, this tool was used to appraise the one systematic review, one meta-analysis, and two descriptive studies. The remaining evidence was appraised using the Johns Hopkins Non-Research Appraisal Tool. This tool is used to evaluate evidence such as clinical practice guidelines, consensus or position statements, literature reviews, integrative reviews, expert opinion, QI projects, financial or program evaluations, case reports, community standards, clinician experience, and consumer preference (Dang & Dearholt, 2017).

The Johns Hopkins Research and Non-Research Appraisal Tools are completed by answering a series of questions to determine quality of evidence. These questions follow an algorithm that determines whether evidence is ranked as high, good, or low quality. Using the Research Appraisal Tool, quantitative evidence is ranked as high quality if the evidence meets the following criteria: “consistent, generalizable results; sufficient sample size for the study design; adequate control; definitive conclusions; consistent recommendations based on comprehensive literature review that includes thorough reference to scientific evidence” (Dang & Dearholt, 2017, p. 286). Evidence is ranked as good quality if the following criteria are met: “reasonably consistent results; sufficient sample size for the study design; some control, and fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence” (Dang & Dearholt, 2017, p. 286). Finally, evidence is ranked as low quality with the following criteria: “little evidence with inconsistent results; insufficient sample size for the study design; conclusions cannot be drawn” (Dang & Dearholt, 2017, p. 286). This particular tool was used to evaluate one systematic review, one meta-analysis, and two descriptive studies.

The Johns Hopkins Non-Research Appraisal Tool was used to appraise the remainder of the evidence, all of which were clinical practice guidelines. This type of evidence is ranked as high quality when the following criteria are met: “material officially sponsored by a professional, public, or private organization or a government agency; documentation of a systematic literature search strategy; consistent results with sufficient numbers of well-designed studies; criteria-based evaluation of overall scientific strength and quality of included studies and definitive conclusions; national expertise clearly evident; developed or revised within the past five years” (Dang & Dearholt, 2017, p. 295). For evidence to qualify as good quality, the clinical practice guideline needs to met the following criteria: “material officially sponsored by a professional, public, or private organization or a government agency; reasonably thorough and appropriate systematic literature search strategy; reasonably consistent results, sufficient numbers of well-designed studies; evaluation of strengths and limitations of included studies with fairly definitive conclusions; national expertise clearly evident; developed or revised within the past five years” (Dang & Dearholt, 2017, p. 295). Finally, evidence is ranked as low quality or major flaw for the following criteria: “material not sponsored by an official organization or agency; undefined, poorly defined, or limited literature search strategy; no evaluation of strengths and limitations of included studies; insufficient evidence with inconsistent results; conclusions cannot be drawn; not revised within the past five years” (Dang & Dearholt, 2017, p. 295). After utilizing the appraisal tools for all eight pieces of selected evidence, six pieces of evidence were deemed as high quality and two as good quality. Appendix A provides a table with a summary of all evidence and the corresponding appraisal.

Level I Evidence

Asai et al. (2015). This clinical practice guideline focused on adapting and updating clinical recommendations from a previous guideline published by the European Dermatology Forum (EDF), which was also used within this project (Nast et al., 2016). Overall, recommendations were made to evaluate and treat acne vulgaris in both pediatric and adult

patients based on their acne severity level, which ranged from comedonal, mild papulopustular, moderate papulopustular, and severe papulopustular/nodular acne. The Canadian Skin Patient Alliance has officially endorsed this guideline and it is also recognized by the Canadian Dermatology Association and Acne and Rosacea Society of Canada. A thorough literature search was conducted based on the methods used in the EDF guideline, which will be further discussed for Nast et al. (2016). This search was updated from March 2010 to July 2015. The inclusion criteria for evidence included human/clinical studies, systematic reviews, meta-analyses, RCTs, and controlled prospective studies. Recommendations for evaluating acne involved determining the type, extent, and distribution of acne. This should be completed by using a scale of clear, almost clear, mild, moderate, and severe/extreme. This scale can help to determine changes over time after treatment has been initiated. Assessing patients' quality of life through direct inquiry or with instruments such as the Cardiff Acne Disability Index (CADI) was also deemed to be helpful. Asai and colleagues (2015) provided a multitude of treatment recommendations for the varying grades of acne. Such treatment recommendations from this clinical practice guideline are summarized in the results and findings section of Appendix A.

Overall, this clinical practice guideline meets the criteria for high quality on the Johns Hopkins Non-Research Appraisal Tool. While the authors did not specify how many or what types of evidence they selected after the thorough literature search was completed, they did provide adequate inclusion criteria that suggests only high-level evidence was utilized to develop this guideline. The endorsement and recognition by various professional organizations in Canada also suggest this guideline is of merit and value. Recommendations were clearly stated; based on the supporting evidence identified during the literature search; and were assigned strengths of recommendations including high, medium, low, negative, and open strength. Recommendations included in the evidence for this project were those consisting of high and medium categories. Those meeting the low, negative, and open strength categories were excluded from the evidence.

Friedman et al. (2016). The purpose of this meta-analysis was to discuss the effectiveness of combination adapalene 0.1%/benzoyl peroxide 2.5% (A-BP) gel used for the treatment of acne. Overall, data was reviewed from 14 clinical studies with a total of 2,358 subjects that were treated with A-BP. Outcomes measured within this piece of evidence included lesion count, IGA, and tolerability of medication. The lesion counts were assessed at baseline and during each subsequent visit. Post-baseline lesion count was subtracted from the baseline lesion count to determine clinical improvement. Tolerability was assessed using a 4-point scale ranging from none to severe to evaluate dryness, erythema, scaling, and stinging or burning. These outcomes were measured over a period of 4 weeks. When compared to baseline data, total lesion counts decreased 40.8% after four weeks. It was also noted that inflammatory and noninflammatory lesions decreased 46.2% and 37.5%, respectively, from baseline to week 4. Tolerability was ranked as none or mild for most subjects. Results from the four categories of tolerability included 34.2% of subjects rating dryness as none and 49.0% as mild; 34.2% rating erythema as none and 44.4% as mild; 43.3% rating scaling as none and 42.8% as mild; and 38.2% rating stinging or burning as none and 38.6% as mild. Ultimately, it was determined that A-BP is well-tolerated, with minimal irritation, among subjects. These results also suggest that A-BP can be used as a quick and effective treatment for various severity levels of acne, in which improvement can be seen within as little as four weeks.

This meta-analysis was rated as good quality based on the critical appraisal. Results are consistent and were obtained from a large sample of subjects. The authors conclusions are clear and based on the review of 14 clinical studies. However, this meta-analysis lacks a description of the literature search used to obtain the included studies, thus resulting in a quality rating of good. The included sources are high levels of evidence, so this provides reassurance that results are consistent and generalizable.

Le Cleach et al. (2017). The purpose of this clinical practice guideline was to provide updates to the 2007 guideline for acne developed by the French Society of Dermatology. These

updates were focused on addressing the use of antibiotics, isotretinoin, and hormonal therapy for the treatment of acne vulgaris. In addition to these updates, a treatment algorithm for acne in both adults and adolescents was updated and presented within this guideline. A thorough literature search was conducted to find evidence published between the years 2007 and 2014. This initial search was then updated to include references up to July of 2016. In total, 128 pieces of evidence were selected for inclusion within this guideline. The inclusion criteria for sources of evidence consisted of systematic reviews, RCTs, and observational studies. Treatment recommendations from this clinical practice guideline are summarized in the results and findings section of Appendix A.

Overall, this clinical practice guideline was rated as high quality. It was not only developed by the French Society of Dermatology but was also supported by the French National Authority for Health. Documentation of a systematic literature search was included, and although the number and type of evidence is not explicitly noted within this guideline, the inclusion criteria suggest that high level evidence was selected for use. Clear and consistent recommendations are made based on the selected evidence.

Nast et al. (2016). This was another clinical practice guideline with recommendations for the treatment of acne vulgaris. These guidelines were developed by the EDF with a focus to improve the care of acne patients, reduce serious conditions and scarring caused by acne, promote treatment adherence, and reduce antibiotic resistance. This particular guideline is categorized as a S3 guideline, meaning this is both an evidence- and consensus-based medical guideline (Charite, 2020). A systematic literature search was conducted from 2010 to 2015. Inclusion criteria for evidence consisted of RCTs that evaluated various acne treatments. Overall, 154 studies were selected for inclusion within this guideline. Recommendations were provided for both the evaluation and treatment of acne vulgaris. Ultimately it was determined there is no recommended global system for measuring acne severity. Classification of acne for the purposes of this guideline included comedonal acne, mild-moderate papulopustular acne,

severe papulopustular acne/moderate nodular acne, and severe nodular acne/conglobate acne. The subjective grading of acne severity, in addition to lesion counts, is considered practical for clinical practice. Also, quality of life measures are recommended for acne management. Again, no specific scale or questionnaire for evaluating quality of life has been identified. Treatment recommendations from this clinical practice guideline are summarized in the results and findings section of Appendix A.

This clinical practice guideline was rated as high quality after completing a critical appraisal using the Johns Hopkins Non-Research Appraisal Tool. A high-quality rating was assigned as the guideline was developed by the EDF; a professional organization founded by European dermatologists with backgrounds in academia (EDF, 2020). A systematic literature search was also conducted involving RCTs, and a sufficient number of studies were selected to be included within this guideline. The recommendations outlined in this guideline were also clearly and consistently stated.

Yang et al. (2020). This systematic review aimed to address the effectiveness of using benzoyl peroxide (BP) for the treatment of acne. A thorough literature search was conducted in multiple databases until February 2019. In total, 120 RCTs with 29,592 subjects were included within this review. Subjects within the selected RCTs had either mild, moderate, or severe acne. The two primary outcomes measured were participant self-assessment of acne improvement using a Likert or Likert-type scale and withdrawal due to adverse events. Secondary outcomes included investigator-assessed changes in lesion counts, percentage of participants considered clear or almost clear on the IGA scale, changes in quality of life, reduction of *C. acnes* strains, and percentage of participants experiencing adverse events. Comparisons were made between BP and 47 other acne treatments, with five main comparisons consisting of placebo/no treatment, adapalene, clindamycin, erythromycin, and salicylic acid.

The first comparison was BP and placebo/no treatment where participant self-assessment of improvement was slightly better with the BP group (RR = 1.27). However,

participants were more than twice as likely to withdraw from BP treatment due to adverse effects (RR = 2.13). Next, comparisons were made between BP and adapalene. There was no difference for participant self-assessment of treatment improvement (RR = 0.99), however, participants were again more likely to withdraw from BP treatment due to adverse effects (RR = 1.85). When comparing BP to clindamycin, participant self-assessment was slightly better within the BP group (RR = 0.95), but once again participants were almost twice as likely to withdraw due to adverse events (RR = 1.93). For the BP and erythromycin comparisons, there was no data available for participant self-assessment of improvement. Also, there was no difference between withdrawal rate between the two groups (RR = 1.0). Finally, there was no data available for either primary outcomes for BP or salicylic acid comparison groups. These results suggest that when compared to placebo or no treatment, BP may provide better outcomes regarding patient self-assessment of improvement. While there was a high rate of withdrawal due to adverse events caused by BP within the various comparison groups, these adverse events were mostly related to tolerability issues involving irritation, erythema, pruritis, or skin burning. These adverse events were mild to moderate in most cases as well. Even with this in consideration, the results from this study indicate that BP may be an effective treatment option for acne vulgaris.

Based on a careful and critical appraisal, this piece of evidence was rated as high quality using the Johns Hopkins Research Appraisal Tool. This high-quality rating was assigned based on the thorough literature search that was conducted and documented within the last five years. This literature search also resulted in a sufficient number of RCTs that were included to ultimately develop this systematic review. Also, recommendations from this systematic review are clearly and consistently stated.

Zaenglein et al. (2016). The purpose of this clinical practice guideline was to provide updated recommendations on the management of acne vulgaris in adolescent and adult patients. This update served to replace an older version of this guideline published in 2007. This

guideline was developed in accordance and approved by the AAD. A thorough literature search was conducted between May 2006 and September 2014. Overall, no universal acne grading system is recommended for determining acne severity level. Although a specific grading system was not identified, it is recommended that a grading system be selected by clinicians and be consistently used to determine acne severity and response to treatment. Treatment recommendations from this clinical practice guideline are summarized in the results and findings section of Appendix A.

After careful appraisal, this clinical practice guideline was deemed good quality. This piece of evidence meets the criteria of being sponsored by the AAD, conducting a thorough literature search, and having clear and consistent recommendations. However, there is no mention of how many and what type of evidence were ultimately selected for inclusion, resulting in a lower quality level. Normally, this would be rated as low quality based on the failure to meet these criteria, however, there was mention that 242 pieces of evidence were retained for a final review after sorting through evidence. These sources were selected based on relevancy, as well as the highest level of available evidence. This suggests that high levels of evidence were ultimately utilized to make the recommendations within this guideline, providing reassurance that this is good quality evidence.

Level VI Evidence

Gollnick, Friedrich, et al. (2015). This descriptive study aimed to determine the effectiveness and safety of combination adapalene 0.1%/benzoyl peroxide 2.5% for long-term management of moderate to severe acne vulgaris. This study took place within 178 centers in Germany. Observations were made among 5,141 patients with a diagnosis of moderate or severe acne vulgaris for safety assessments, and of those patients, 5,131 were selected for efficacy assessments. Diagnosis was based on grades 4-12 of the Leeds Revised Acne Grading Scale. Observations took place for a period of nine months. Patients were also selected based on indications for either A-BP alone or in combination with other acne treatment

regimens. Both safety and tolerability were assessed using a 4-step scale, including none, mild, moderate, or severe, to evaluate local skin irritation. Skin irritation was defined as having issues such as erythema, dryness, desquamation, burning or stinging, and pruritis. Assessments were made at each follow up visit. Patient-rated tolerability of treatment was also assessed at each follow up visit using a 4-step scale including measures of very good, good, satisfactory, and poor. Adverse drug reactions were assessed during each visit as well. Efficacy was measuring using the Leeds Revised Acne Grading System, as well as physician assessment rated as very good, good, satisfactory, or poor. These assessments were made to note any changes in the severity of acne at each visit.

Overall, acne severity decreased from 5.6 ± 1.5 at baseline to 3.3 ± 1.9 at three months after initiation of treatment and down to 1.9 ± 1.9 at nine months based on the Leeds Revised Acne Grading System. After treatment, 420 patients (8.2%) experienced completely clear, meaning no visible lesions, at three months and 1,326 patients (25.8%) at nine months. Treatment was similar between patients who received A-BP alone and those who were receiving A-BP in combination with a systemic antibiotic. Physician assessment of treatment efficacy was rated as good or very good for 83.1% of patients. Patient assessment of tolerability was rated as good or very good for 90.2% of patients. Overall, 49.5% of patients experienced some type of skin irritation. Of the 49.5% of patients, 30.7% experienced dryness, 24.3% experienced erythema, and 22.4% experienced desquamation. Adverse drug reactions occurred in only 40 patients (0.008%).

Using the Johns Hopkins Research Appraisal Tool, this study was deemed high quality based on the consistent and generalizable results reported in this study. An adequate sample size of 5,131 patients were also included within this study to support the high quality rating. Definitive conclusions and recommendations are drawn from the study, suggesting the safe and efficacious use of A-BP for the treatment of moderate to severe acne vulgaris.

Gollnick, Funke, et al. (2015). The purpose of this descriptive study was to determine efficacy and patient adherence with adapalene 0.1%/benzoyl peroxide 2.5 % in patients with moderate inflammatory acne between the ages of 12 and 20 years old. A total of 2,780 patients were observed for 12 weeks within 314 dermatology centers throughout Germany. The outcomes assessed within this study included skin irritation, tolerability, changes in severity of acne, efficacy of treatment, and treatment adherence. Skin irritation was assessed using a scale of none, mild, moderate, or severe to rate the degree of erythema, dryness, desquamation, burning or stinging, and pruritis at each follow up visit. Adverse drug reactions were also noted at each visit. Physician rated tolerability was assessed using a 4-item scale of very good, good, satisfactory, or poor. Also, the Leeds Revised Acne Grading System was used to assess changes in the severity of acne. Efficacy of treatment was assessed by physicians using another 4-item scale of very good, good, satisfactory, and poor. Patients also assessed efficacy of treatment using a 6-item scale of completely cured, marked improvement, moderate improvement, slight improvement, no change, or worsened. Finally, treatment adherence was assessed using a 4-item questionnaire at the final visit by asking the following questions: do you remember the name of the (last) drug(s) you took, have you tolerated the(se) drug(s) well, have you ever stopped taking the(se) drug(s) because you thought it would do more harm than good, and have the(se) drug(s) been useful for you?

Ultimately, acne severity decreased from 4.8 ± 0.9 at baseline to 2.1 ± 1.6 at the end of 12 weeks based on the Leeds Revised Acne Grading System. Efficacy was rated by physicians as good or very good in 79.2% of patients. Skin irritation was rated as none (19%), mild (51%), moderate (24%), and severe (6%) among patients. Tolerability was rated as good or very good by physicians for 82.8% of patients. Also, 63.2% of patients were considered adherent to treatment based on the 4-item questionnaire. Finally, 82.3% of patients were either satisfied or very satisfied with treatment, while physicians rated treatment as good or very good for 80.1% of patients.

Using the Johns Hopkins Research Appraisal Tool, this study was also deemed high quality based on the consistent and generalizable results reported in this study. An adequate sample size of 2,780 patients were also included within this study to support the high quality rating. Definitive conclusions and recommendations are drawn from the study, suggesting the safe and efficacious use of A-BP for the treatment of moderate inflammatory acne vulgaris.

Construction of Evidence-based Practice

Synthesis of Critically Appraised Literature

After critical appraisal, the included pieces of evidence were synthesized to identify common themes. Various acne vulgaris treatments were presented throughout the literature, with common themes of utilizing BP, adapalene, topical clindamycin, and systemic doxycycline. Other common themes identified within the evidence were the use of acne measurement scales to determine the severity of acne vulgaris and quality of life measurements.

Benzoyl Peroxide

The use of BP has been indicated for the treatment of acne vulgaris either alone (Asai et al., 2015; Le Cleach et al., 2017; Yang et al., 2020) or in combination with other acne treatments, such as adapalene, topical clindamycin, or systemic doxycycline (Asai et al., 2015; Friedman et al., 2016; Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Le Cleach et al., 2017; Nast et al., 2016; Zaenglein at al., 2016). Overall, BP alone is indicated for the treatment of comedonal acne (Asai et al., 2015; Le Cleach et al., 2017). The use of BP in combination with adapalene for mild and moderate acne was also evident within the literature (Asai et al., 2015; Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Le Cleach et al., 2017; Nast et al., 2016; Zaenglein et al., 2016). Similarly, BP in combination with topical clindamycin for the treatment of mild and moderate acne was evident, however, fewer pieces of evidence focused on this combination treatment compared to the combination of BP and adapalene for mild and moderate acne (Asai et al., 2015; Nast et al., 2016; Zaenglein et al., 2016). For severe acne, BP can be used in combination with both adapalene and systemic

doxycycline (Asai et al., 2015; Le Cleach et al., 2017; Nast et al., 2016). Also, it appears BP in combination with both adapalene and systemic doxycycline is indicated for treatment of very severe acne (Nast et al., 2016). Formulations of BP vary, however, based on the literature it appears BP 2.5% is preferred (Friedman et al., 2016; Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Nast et al., 2016; Yang et al., 2020).

Adapalene

Adapalene can be utilized for the treatment of acne vulgaris either alone (Asai et al., 2015; Nast et al., 2016) or in combination with other acne treatments, such as BP, topical clindamycin, or systemic doxycycline (Asai et al., 2015; Friedman et al., 2016; Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Nast et al., 2016). Adapalene was indicated for the treatment of comedonal acne (Asai et al., 2015; Nast et al., 2016), as well as for mild and moderate acne when combined with BP (Asai et al., 2015; Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Nast et al., 2016). Also, for severe acne adapalene can be used in combination with both BP and systemic doxycycline (Asai et al., 2015; Le Cleach et al., 2017; Nast et al., 2016). Adapalene, systemic doxycycline, and BP were also indicated for the treatment of very severe acne (Nast et al., 2016). Just like with BP, formulations of adapalene can vary. Based on the evidence, adapalene 0.1% was the most commonly used agent (Friedman et al., 2016; Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Nast et al., 2016).

Topical Clindamycin

Topical clindamycin is another treatment option indicated for the treatment of acne vulgaris. This medication is used in combination with BP to treat mild and moderate acne vulgaris (Asai et al., 2015; Nast et al., 2016; Zaenglein et al., 2016). It is also mentioned that antibiotics used for the treatment of acne should be used in conjunction with other medications and never as monotherapy to decrease the risk of antibiotic resistance (Asai et al., 2015; Le

Cleach et al., 2017; Nast et al., 2016; Zaenglein et al., 2016). Thus, this supports the previous mentioned evidence of utilizing topical clindamycin with BP for acne vulgaris treatment.

Systemic Doxycycline

The use of systemic doxycycline is reserved for treating severe (Asai et al., 2015; Le Cleach et al., 2017; Nast et al., 2016) and very severe acne (Nast et al., 2016). For severe acne, doxycycline is combined with both BP and adapalene (Asai et al., 2015; Le Cleach et al., 2017; Nast et al., 2016). This combination is also the same with very severe acne (Nast et al., 2016). As mentioned previously for topical clindamycin, antibiotics should never be used as monotherapy to decrease the risk of antibiotic resistance (Asai et al., 2015; Le Cleach et al., 2017; Nast et al., 2016; Zaenglein et al., 2016). Thus, doxycycline combined with other acne treatments is supported by the evidence. There was no specific recommended dosage mentioned within the literature for the use of doxycycline.

Acne Measurement Scales

Ultimately, the evidence suggests there is no universally recommended grading scale for acne vulgaris (Nast et al., 2016; Zaenglein et al., 2016). However, clinicians should personally select and consistently use a grading system to determine changes over time and to measure response to treatment (Asai et al., 2015; Nast et al., 2016; Zaenglein et al., 2016). The evidence also suggests that patient self-assessed quality of life can be used to measure the impact acne has on an individual's life and well-being (Asai et al., 2015; Nast et al., 2016; Yang et al., 2020). Similarly, Likert or Likert-type scales can be used as a type of patient self-assessment to determine the severity of acne as perceived by the patient themselves (Gollnick, Friedrich, et al., 2015; Gollnick, Funke, et al., 2015; Yang et al., 2020).

Best Practice Model Recommendation

The synthesis of evidence suggests that treatment agents vary for each classification of acne vulgaris. For comedonal acne, it is recommended to use either BP 2.5% or adapalene 0.1%. For mild and moderate acne, treatment regimens are the same for both classifications.

There was more evidence to suggest combination adapalene 0.1% and BP 2.5% is preferred, however, there was some evidence to suggest combination BP 2.5% and clindamycin was also effective. Based on the amount of available evidence, combination adapalene 0.1% and BP 2.5% should be utilized as first-line therapy, followed by BP 2.5% and clindamycin used as second-line therapy. Finally, for severe and very severe acne, a combination of BP 2.5%, adapalene 0.1%, and systemic doxycycline should be used for treatment. All medications synthesized from the literature were reviewed using GoodRx to ensure they were in face cost-effective options. Also, based on the evidence, patient self-assessment of quality of life and acne severity should ultimately be measured.

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

The purpose of this EBP project is to improve patient outcomes a cost-effective treatment algorithm for the management of acne vulgaris. The goal of cost-effective treatment is to reduce any financial barriers patients may face when obtaining treatment for acne vulgaris. The implementation of this EBP project aims to improve patient quality of life. Treatment of acne is important as patients with acne may experience issues with mental health disorders (Singam et al., 2019), difficulty with emotion regulation (Cengiz & Gurel, 2020), as well as scarring and poor self-esteem (Zaenglein et al., 2016), which all can impact a patient's quality of life. Overall, this practice change aims to combat these issues and to ultimately provide patient satisfaction with acne treatment that will lead to an improved quality of life.

Setting and Participants

Implementation of this EBP project took place at a university student health center located in Northwest Indiana. This particular student health center provides services that are focused on delivering primary health care to students. Services include administration of immunizations, wellness exams, and problem visits, among others. The clinic is staffed by a physician, two FNPs, a psychiatric nurse practitioner, a registered nurse, a registered dietitian, and a receptionist. One of the FNPs also serves as the health center director as well. Permission for project implementation was granted by the health center director on April 15, 2020.

The population of interest for this project was adult college students aged 18 years and older with a diagnosis of acne vulgaris. This served as the inclusion criteria for the project. Participants were also required to be able to speak and understand both verbal and written English to be included in this project. Participants that were excluded from the study included patients younger than 18 years old, patients who were pregnant or breastfeeding, and patients

with any type of cognitive impairment. Such participants were excluded from the project for safety reasons.

Recruitment of participants began on September 21, 2020 and lasted until March 19, 2021. Participants for this project were recruited through multiple measures including the use of a flyer (Appendix B) posted in the front lobby at the student health center, information sent to students via email and posted to social media platforms from the official student health center accounts, and by meeting with students virtually in the classroom setting. The social media platforms utilized for recruitment included Facebook, Instagram, and Twitter. The information sent to participants in the email and posted to social media is available in Appendix C. The project manager did not have direct access to the student health center email and social media accounts, so information was sent by the health center director who regularly manages these accounts.

Pre-Intervention Group Characteristics

After completing recruitment activities, a total of 17 participants were initially recruited for this project. Pre-intervention group characteristics of these participants were briefly analyzed using descriptive statistics. Participant ages ranged from 18 to 24 years old with a mean age of 21.0 years (*SD* = 2.23). The majority of participants were female (64.7%), Caucasian (94.1%), and single (94.1%). For highest level of education completed, 23.5% completed high school, 47.1% completed some college without receiving a degree, 23.5% had a Bachelor's degree, and 5.9% had a Master's degree. For primary employment, 5.9% reported working full-time, 17.6% reported working part-time, and 76.5% identified themselves as students for their employment status. Finally, 35.3% of participants reported their annual household income as less than $19,999; 5.9% reported making between $20,000 and $34,999; 23.5% reported making between $50,000 and $74,999; 23.5% reported making between $75,000 and $99,999; and 11.8% reported making over $100,000.

Prior to project implementation, the project manager also collected data from the student health center's electronic medical record (EMR) system to determine how acne vulgaris was treated by healthcare providers in the past between August 2017 to July 2020. Overall, 23 charts were reviewed and these revealed inconsistency of acne vulgaris treatment during this specified time period. Various treatment regimens were used, in varied dosages and combinations, and included salicylic acid, BP, tretinoin, adapalene, topical clindamycin, topical erythromycin, systemic minocycline, and systemic doxycycline. Acne severity levels were also not consistently assigned to patients, in which only 22% of the 23 reviewed charts contained documentation of an acne severity level of either mild or moderate.

Intervention

The intervention for this EBP project involved the use of a cost-effective treatment algorithm for acne vulgaris by two FNPs at the student health center. This algorithm was developed based on the synthesized evidence from the literature search as discussed above in Chapter 2. A copy of the treatment algorithm is included in Appendix D. The algorithm has three first-line treatment categories and one second-line treatment category based on the levels of acne severity identified by the modified IGA scale. The IGA scale is currently recommended by the United States Department of Health and Human Services (USDHHS) Food and Drug Administration (FDA) Center for Drug Evaluation and Research (CDER) for use in clinical trials to measure acne severity (FDA, 2018). A sample IGA scale was published in a draft guidance for acne vulgaris treatment by the USDHHS FDA CDER in 2005 which contains five levels of acne severity, including clear, almost clear, mild, moderate, and severe (FDA, 2005). The IGA scale used for the intervention in this project was modified from the USDHHS FDA CDER sample IGA scale to include a sixth treatment category, very severe, as the synthesized evidence from the literature search provided specific recommendations for the treatment of very severe acne. Modifying the scale to include this category would allow for consistent treatment across the entire spectrum of acne severity. This modified IGA scale can be found in Appendix

E. A detailed policy on how to implement the treatment algorithm was also developed for provider use and is available in Appendix F. Dosing information for each medication was also included within both the treatment algorithm and policy for provider reference. In addition, copies of the treatment algorithm and policy were provided to each FNP. A copy of the treatment algorithm was also posted in the medication room at the student health center for easy reference.

During the recruitment process, potential participants were asked to contact the project manager in an effort to explain the project in detail and enroll the participants in the project. After explaining the project in depth, participants were asked if they would like to enroll in the project and schedule an appointment at the student health center. In an effort to compare data between participants who received the intervention and those who did not, the project manager decided to use two participant groups to obtain as much data as possible. Participants who agreed to schedule an appointment at the student health center made up the intervention group. Participants who declined treatment at the student health center were asked to enroll in the project to serve as a comparison group. Both groups of participants were asked to fill out an informed consent document (Appendix G), demographic form (Appendix H), and the baseline Acne-QoL questionnaire. These documents were sent to the participants via email.

For the participants in the intervention group, the next step was to schedule an appointment at the student health center to have their acne treated. At the student health center, participants would be seen by one of the FNP providers who would then examine the participant and grade his or her acne severity by using the modified IGA scale. Providers documented the acne severity for participants in the student health center's EMR. Based on the results from the modified IGA scale, the provider would then follow the treatment algorithm to prescribe the appropriate medications. The student health center was able to keep BP, clindamycin phosphate, and doxycycline stocked on hand for participants to take home immediately after their visit, if wished to do so. Adapalene was the only medication that was

unable to be kept at the student health center and a prescription was provided for participants to fill at a pharmacy of their choice instead. Prescriptions for the other medications were also available to participants if they did not choose to purchase them directly from the student health center. Participants were also instructed on the appropriate use of their medications during their visit, including dosage instructions, time of day to use the medication, and potential side effects.

Follow up for the intervention group was conducted 6 weeks following each individual participant's initial visit at the student health center. Follow-up for participants in the comparison group also took place after 6 weeks from initially filling out their baseline Acne-QoL questionnaire. The follow-up Acne-QoL questionnaire was sent to each individual participant's email to fill out and send back to the project manager. Participants were also contacted by phone to remind them to complete the 6-week questionnaire. Participants were encouraged to ask any questions they had during these follow-up periods as well.

Comparison

Comparisons for the project were made between the intervention group and comparison group after the 6-week period. These comparisons were made based on the data collected from the baseline and 6-week Acne-QoL questionnaires. The intervention group also served as its own comparison group, as comparisons were made based on the data from the baseline and 6-week Acne-QoL questionnaires completed within this group. These comparisons aim to identify any significant changes that may have occurred due to the intervention of treating acne with the treatment algorithm.

Outcomes

The primary outcome selected for this project was patient self-assessment of quality of life as measured by the Acne-QoL questionnaire. The project manager obtained permission to use this questionnaire for the duration of the project. This questionnaire was developed for use in clinical trials to assess the quality of life of patients between the ages of 13-35 years old who have facial acne. The questionnaire has also been indicated for use in the clinic or dermatology

office settings (Girman et al., 2003). The Acne-QoL is a self-administered, 19-item questionnaire that focuses on four specific areas relating to how facial acne impacts quality of life and how severe the patient perceives his or her acne. These four areas include self-perception, role-emotional, role-social, and acne symptoms. The self-perception domain involves asking questions focused on feelings of self-consciousness, unattractiveness, or dissatisfaction with appearance. The domain of role-emotional assesses the emotional effect acne has on the participant. Role-social focuses on questions that determine the impact acne has on the participant's social relationships. Finally, the acne symptoms domain assesses the physical symptoms caused by acne (Girman et al., 2003). There are five questions asked within each domain, except role-social in which only four questions are asked. Responses for the domains self-perception, role-emotional, and role-social range from 0 to 6 as follows: 0) extremely, 1) very much, 2) quite a bit, 3) a good bit, 4) somewhat, 5) a little bit, and 6) not at all. Responses to the domain acne symptoms ranges from 0 to 6 as well, however the responses are slightly different compared to the other domains and are as follows: 0) extensive, 1) a whole lot, 2) a lot, 3) a moderate amount, 4) some, 5) very few, and 6) none. To score the questionnaire, the questions associated with each domain are added together so each participant has a total of four scores, one for each domain. The domains of self-perception, role-emotional, and acne symptoms are scored out of 30 points, while role-social is scored out of 24 points. Higher scores within each domain are associated with an increased quality of life (Girman et al., 2003). A copy of the Acne-QoL questionnaire can be found in Martin et al. (2001).

The Acne-QoL has been measured for both validity and reliability in a previous study. According to Fehnel et al. (2002), the Acne-QoL demonstrated reliability via internal consistency in which the domains of self-perception, role-emotional, and role-social were measured across three time-points using Cronbach's alpha and results ranged from 0.87 to 0.96. The acne symptoms domain was also measured in this way and ranged from 0.77 to 0.86. Results greater than 0.7 are considered acceptable levels of reliability, however, results closer to 1.0

demonstrate higher levels of reliability. Fehnel et al. (2002) also mentioned convergent validity of the Acne-QoL questionnaire was demonstrated with evidence of modest negative correlations when compared to total lesion counts and a facial acne global assessment scale. These results suggested that clinician reported acne severity was associated with patient reported quality of life.

In addition to the Acne-QoL questionnaire, providers measured acne severity using a modified IGA scale. This scale was modified to include a very severe category of acne (Grade 5), as the highest grade on the original IGA scale is severe (Grade 4). The original IGA scale has not been tested for validity. However, this scale does have a moderate intra-rater reliability (K = 0.606) and a fair inter-rater reliability (K = 0.3119) (Agnew et al., 2016). Finally, demographic data for this project was also collected by having participants fill out a demographic form during their baseline visit, prior to being seen by the provider.

Following implementation of the project, data analysis was completed using IBM Statistical Package for Social Sciences (SPSS) Base 25. Descriptive statistics including means and frequencies were used for the demographic characteristics of participants. Demographic data were also compared between the two groups via Chi-square tests of independence and independent-samples *t* test. Pre- and post-intervention data for the intervention group and comparison group were analyzed using paired-samples *t* tests. Pre- and post-intervention data between both the intervention and comparison groups were analyzed using a mixed-design analysis of variance (ANOVA) test.

Time

This project had a rolling recruitment of participants which lasted from September 21, 2020 and lasted until March 19, 2020. Project implementation began on September 16, 2020 and follow up with participants lasted until April 30, 2021. This period of time allowed for an adequate number of participants to be enrolled into the project to ensure ample data was collected for data analysis.

Protection of Human Subjects

Human subjects were protected throughout the duration of the project. An online training course was completed by the project manager on April 7, 2020 through the Collaborative Institutional Training Initiative (CITI) titled Social Behavioral Educational Researchers. A certificate of completion was provided by CITI and is available in Appendix I. An expedited application through the Institutional Review Board (IRB) at Valparaiso University was also completed. After review of the application, exempt approval for the project was obtained from the IRB on September 9, 2020. Written consent was obtained from all participants after reviewing the purpose of the project, risks, benefits, confidentiality, and voluntary participation. All data collected for the duration of the project was kept secured via a lockbox and password protected computer. A code sheet was also utilized to help protect the participants identities. This code sheet, along with documents containing participants personal information, were destroyed at the completion of this project.

CHAPTER 4

FINDINGS

The purpose of this EBP project was to implement a cost-effective treatment algorithm at the university student health center to manage acne vulgaris in adult college students. The primary outcome of quality of life was measured using participant self-reported assessments via the Acne-QoL questionnaire. This outcome was measured at baseline visits and during a follow-up period 6-weeks after baseline measurements.

Participants

Size and Characteristics

The pre-intervention group consisting of 17 participants completed baseline measurements of the Acne-QoL questionnaire as identified in Chapter 3. Of these 17 participants, 14 ultimately completed the 6-week Acne-QoL questionnaire for the follow-up period, resulting in an attrition rate of 17.6%. Ten of these participants were included in the intervention group, while four participants were included in the comparison group. Demographic data were collected and analyzed using descriptive statistics for the 14 total participants in this project. Demographic data collected from participants included age, gender, ethnicity/race, marital status, highest level of education completed, employment status, and annual household income. Demographic data between the intervention group and comparison group were also analyzed using inferential statistics to determine if there were any significant differences between the two groups.

Intervention Group

Participant ages ranged from 18 to 24 years old with a mean age of 21.20 years (*SD* = 2.44). The majority of participants were male (60%) and Caucasian (90%). Also, the majority of participants reported their marital status as single (90%), had already completed some college without yet obtaining a degree (40%), reported being a student for their primary employment

status (70%), and made an annual household income of less than $19,999 (40%). A summary of the detailed descriptive statistics of the participants within the intervention group is included in Table 4.1.

Acne severity based on provider assessments using the modified IGA scale for this group included: 1) almost clear (20%), 2) mild (30%), 3) moderate (30%), and 4) severe (20%). None of the participants had acne classified as very severe (Grade 5) based on the modified IGA scale. For participants with acne categorized as almost clear, 100% received treatment with topical BP. For those with mild acne, 33.3% received treatment with combination topical BP and adapalene and the remaining 66.6% received treatment with combination topical BP and topical clindamycin. For those with moderate acne, 100% received treatment using combination topical BP and topical clindamycin. Finally, those with severe acne received the only treatment option available for this level of severity on the treatment algorithm, which consisted of combination topical BP, topical adapalene, and systemic doxycycline (100%).

Comparison Group

Participant ages ranged from 20 to 23 years old with a mean age of 21.75 years (*SD* = 1.26). All participants were female (100%), Caucasian (100%), and single (100%). The majority of participants had a high school diploma or GED reported as their highest level of education completed (50%), reported being a student for their primary employment status (75%), and made an annual household income of less than $19,999 (50%). The detailed descriptive statistics of the participants are summarized in Table 4.1.

Table 4.1

Demographic Characteristics

Demographic	Intervention Group (*n* = 10) *n* (%)	Comparison Group (*n* = 4) *n* (%)
Age		
Mean/*SD*	21.20/2.44	21.75/1.25
Range	18 – 24	20 – 23
Gender		
Male	6 (60)	0 (0)
Female	4 (40)	4 (100)
Race/Ethnicity		
Caucasian	9 (90)	4 (100)
Asian	1 (10)	0 (0)
African-American	0 (0)	0 (0)
Hispanic	0 (0)	0 (0)
Martial Status		
Single	9 (90)	4 (100)
Married	1 (10)	0 (0)
Divorced	0 (0)	0 (0)
Widowed	0 (0)	0 (0)
Highest level of education		
High school/GED	2 (20)	2 (50)
Some college	4 (40)	1 (25)
Associate’s degree	0 (0)	0 (0)

Bachelor’s degree	3 (30)	1 (25)
Master’s degree	1 (10)	0 (0)
Doctoral degree	0 (0)	0 (0)
Employment Status		
Full time	1 (10)	0 (0)
Part time	2 (20)	1 (25)
Unemployed	0 (0)	0 (0)
Student	7 (70)	3 (75)
Homemaker	0 (0)	0 (0)
Retired	0 (0)	0 (0)
Self-employed	0 (0)	0 (0)
Unable to work	0 (0)	0 (0)
Annual Household Income		
Less than $19,999	4 (40)	2 (50)
$20,000 - $34,999	1 (10)	0 (0)
$35,000 - $49,999	0 (0)	0 (0)
$50,000 - $74,999	2 (20)	1 (25)
$75,000 - $99,999	3 (30)	0 (0)
Over $100,000	0 (0)	1 (0)

Changes in Outcomes

This EBP project addressed the following PICOT question: in adult college students diagnosed with acne vulgaris at the university's student health center (P), how does a cost-effective acne treatment algorithm (I) compared to current practice without an algorithm (C) impact participant quality of life measured by the Acne-QoL questionnaire (O) over a 6-week period (T)? The primary outcome measured for this project was participant quality of life as measured by the Acne-QoL questionnaire.

Statistical Testing and Significance

For data entry and analysis, SPSS Version 25 was utilized. Paired-sample *t* tests were used to compare the mean baseline and 6-week scores from each domain of the Acne-QoL questionnaire for both the intervention group participants and comparison group participants. A mixed-design ANOVA was also utilized for each domain category to compare the mean baseline and 6-week Acne-QoL questionnaire scores between the intervention group and comparison group. To conclude the data analysis, Cronbach's alpha was calculated to determine the reliability of the Acne-QoL questionnaire by measuring baseline and 6-week participant responses within all four domains. Statistical significance for all analyses was determined as $p < .05$.

Findings

Participants

An independent-samples *t* test was used to compare the mean ages of both the intervention group and comparison groups. No statistically significant difference was found between the two groups (t (12) = -.422, p = .681). Also, chi-square tests of independence were used to compare differences in gender and race between both groups. There was a statistically significant difference in gender between the intervention group and comparison group (χ^2 (1) = 4.2, p = .04). There was no statistically significant difference in race between the intervention and comparison group (χ^2 (1) = .431, p = .512).

Primary Outcome

A paired-samples *t* test were calculated to compare the mean baseline and 6-week scores from each domain of the Acne-QoL questionnaire for the intervention group. For the self-perception domain, the mean baseline score was 18.90 (*SD* = 7.17) and the mean 6-week score was 23.80 (*SD* = 7.39). A statistically significant increase in scores from baseline to 6 weeks was found (*t* (9) = -3.171, *p* = .011). For the role-emotional domain, the mean baseline score was 18.10 (*SD* = 7.03) and the mean 6-week score was 23.70 (*SD* = 6.39). A statistically significant increase in scores from baseline to 6 weeks was also found for this domain (*t* (9) = -2.675, *p* = .025). For the role-social domain, the mean baseline score was 20.60 (*SD* = 3.78) and the mean 6-week score was 20.80 (*SD* = 5.18). A significant difference was not found between the means for this domain (*t* (9) = -.165, *p* = .872). Finally, for the acne symptoms domain, the mean baseline score was 17.60 (*SD* = 3.92) and the mean 6-week score was 21.70 (*SD* = 5.62). A statistically significant increase in scores from baseline to 6 weeks was found (*t* (9) = -3.48, *p* = .007). A visual representation of these findings is included in Figure 4.1.

A paired-samples *t* test was also calculated to compare the mean baseline and 6-week scores from each domain of the Acne-QoL questionnaire for the comparison group as well. For the self-perception domain, the mean baseline score was 8.50 (*SD* = 10.47) and the mean 6-week score was 20.75 (*SD* = 7.59). No statistical significance was found between these scores (*t* (3) = -3.174, *p* = .05). For the role-emotional domain, the mean baseline score was 9.25 (*SD* = 10.53) and the mean 6-week score was 19.0 (*SD* = 9.56). No statistical significance was found between these scores (*t* (3) = -1.928, *p* = .149). For the role-social domain, the mean baseline score was 15.50 (*SD* = 5.75) and the mean 6-week score was 18.25 (*SD* = 7.63). No statistical significance was found between these scores (*t* (3) = -1.117, *p* = .345). Finally, for the acne symptoms domain, the mean baseline score was 13.25 (*SD* = 8.02) and the mean 6-week score was 18.75 (*SD* = 2.63). No statistical significance was found between these scores either (*t* (3) = -1.718, *p* = .184). A visual representation of these findings is included in Figure 4.2.

Figure 4.1

Intervention Group Mean Scores Over Time

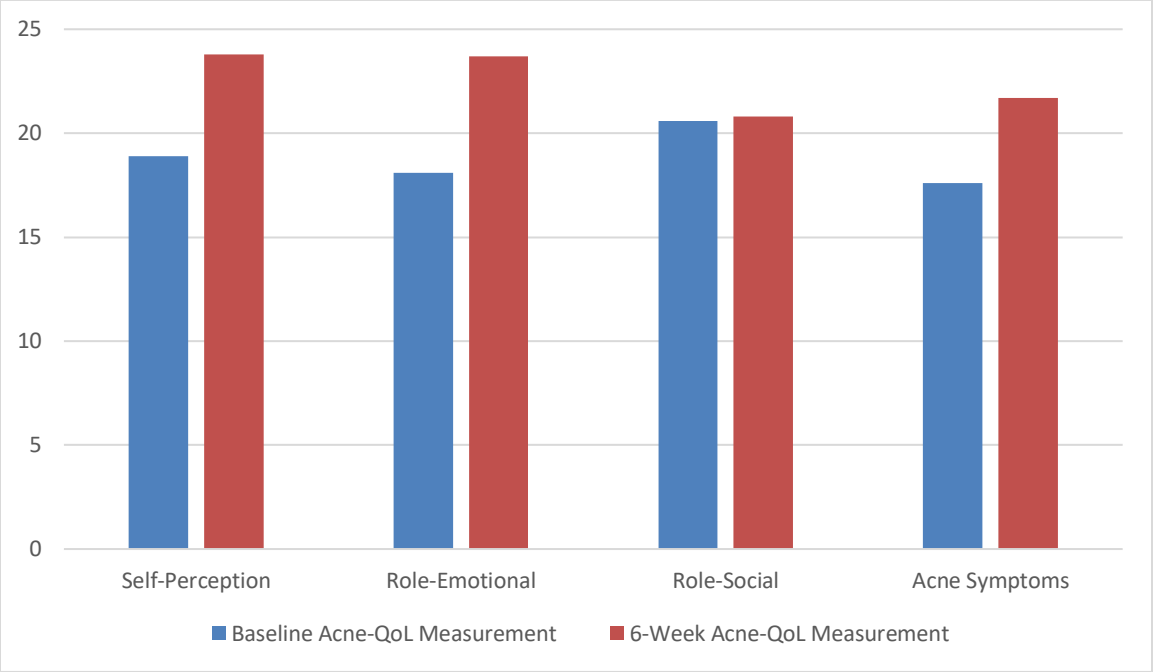
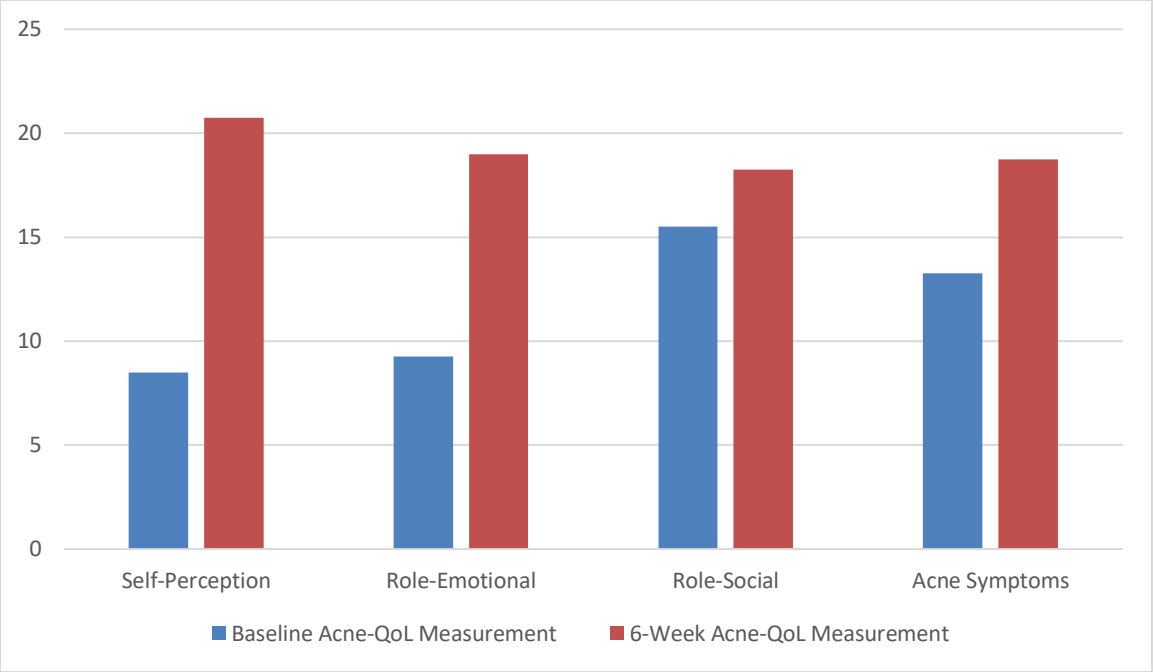


Figure 4.2

Comparison Group Mean Scores Over Time



To analyze the differences between the intervention and comparison groups, a mixed-design ANOVA was calculated for each domain on the Acne-QoL questionnaire. For the self-perception domain, total mean scores for both groups were 15.93 (*SD* = 9.20) at baseline and 22.79 (*SD* = 7.35) at 6-weeks. For this domain, there was no statistically significant interaction between time of measurement on the Acne-QoL questionnaire and group type on the overall mean self-perception scores (F (1,12) = 4.26, p = .061). There was also no statistically significant difference between group types (F (1,12) = 2.628, p = .131). However, the effect of time did show a statistically significant difference in mean self-perception scores at the different time points for both groups (F (1,12) = 25.168, p < .001).

For the role-emotional domain, total mean scores for both groups were 15.57 (*SD* = 8.78) at baseline and 22.36 (*SD* = 7.37) at 6-weeks. There was no statistically significant interaction between time of measurement and group type on the overall mean role-emotional scores (F (1,12) = .842, p = .377). There was also no statistically significant difference found between group types either (F (1,12) = 2.944, p = .112). A statistically significant difference was found for the effect of time for both groups in this case (F (1,12) = 11.522, p = .005).

For the role-social domain, total mean scores for both groups were 19.14 (*SD* = 4.81) at baseline and 20.07 (*SD* = 5.78) at 6-weeks. There was also no statistically significant interaction between time of measurement of the Acne-QoL questionnaire and group type on the overall role-social scores (F (1,12) = 1.091, p = .317). No statistically significant difference was found between group types (F (1,12) = 1.852, p = .199) or for the effect of time as well (F (1,12) = 1.46, p = .250).

Finally, for the acne symptoms domain, total mean scores for both groups were 16.36 (*SD* = 5.44) at baseline and 20.86 (*SD* = 5.04) at 6-weeks. This domain followed suite with the first two domains, in that there was no statistically significant interaction between time of measurement on the Acne-QoL questionnaire and group type on the overall mean scores (F (1,12) = .271, p = .612). There was also no statistically significant difference between group

types (F (1,12) = 1.784, p = .206). However, the effect of time did show a statistically significant difference in mean acne symptoms scores at the different time points for both groups (F (1,12) = 12.746, p = .004).

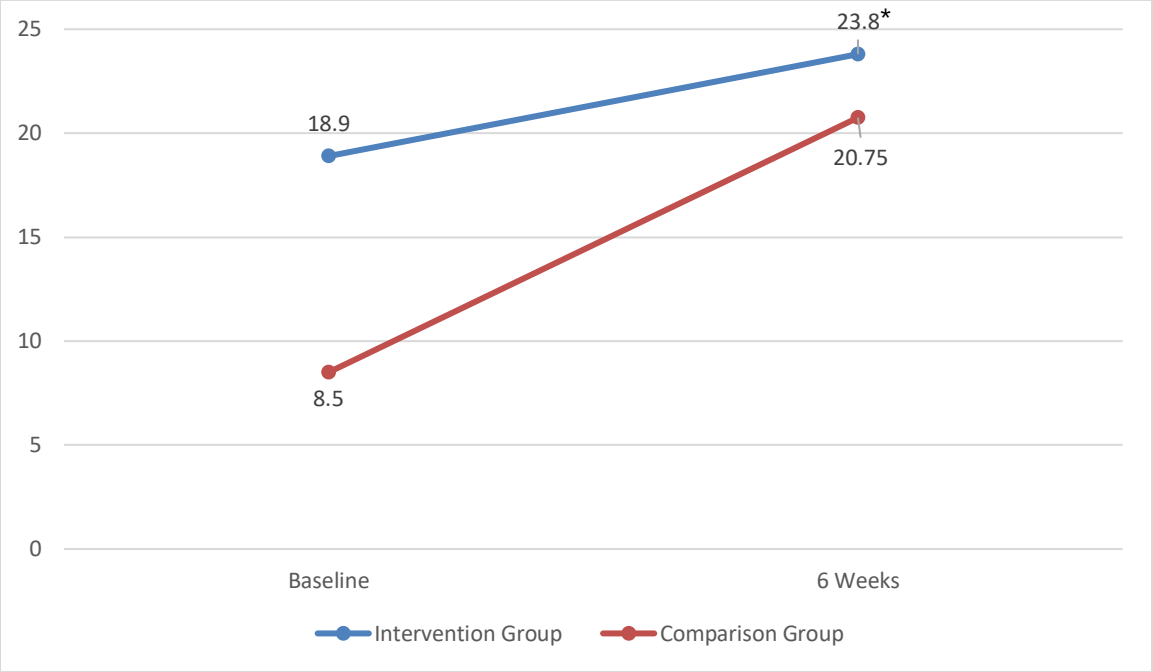
Overall comparisons of mean domain scores between the intervention group and comparison group can be found in Figure 4.3, Figure 4.4, Figure 4.5, and Figure 4.6.

Acne-QoL Reliability

To measure the reliability of the Acne-QoL questionnaire, Cronbach's alpha was calculated for each of the four domains using scores from both the baseline and 6-week measurements. Overall, high levels of internal consistency were found for all four domains for both the baseline and 6-week measurements. The following Cronbach's alpha levels were found for the baseline measurements for each domain: self-perception (0.96), role-emotional (0.95), role-social (0.82), and acne symptoms (0.79). Six-week measurements included: self-perception (0.96), role-emotional (0.92), role-social (0.97), and acne symptoms (0.81).

Figure 4.3

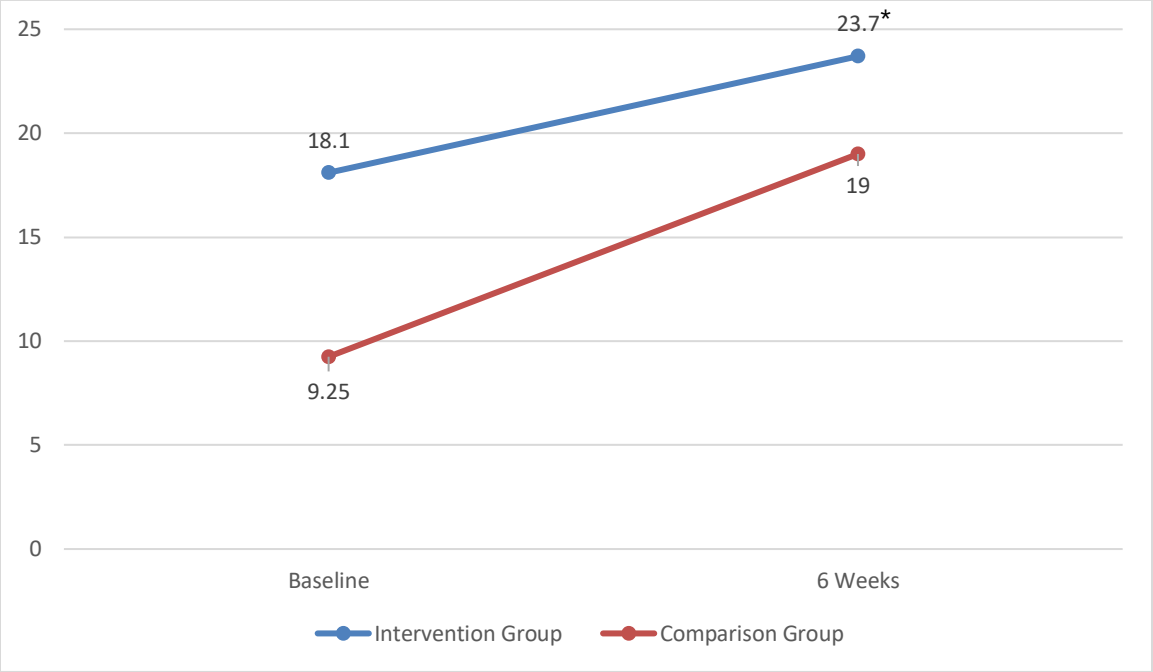
Self-Perception Domain Mean Scores



Note. *statistically significant increase found ($p < .05$)

Figure 4.4

Role-Emotional Domain Mean Scores



Note. *statistically significant increase found ($p < .05$)

Figure 4.5

Role-Social Domain Mean Scores

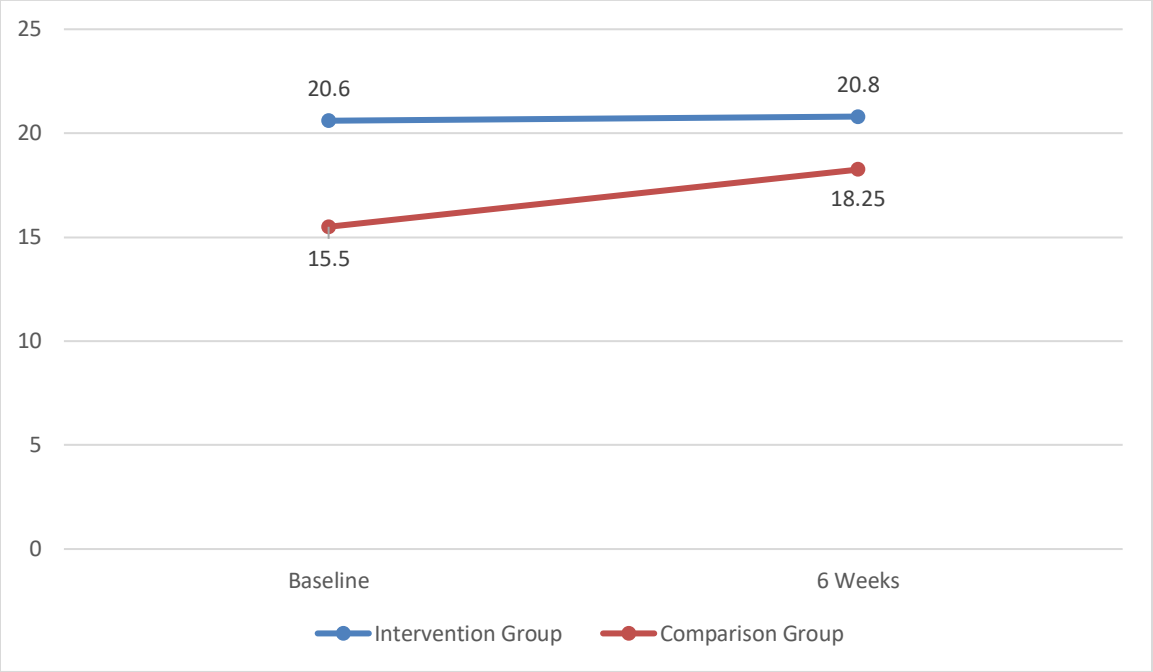
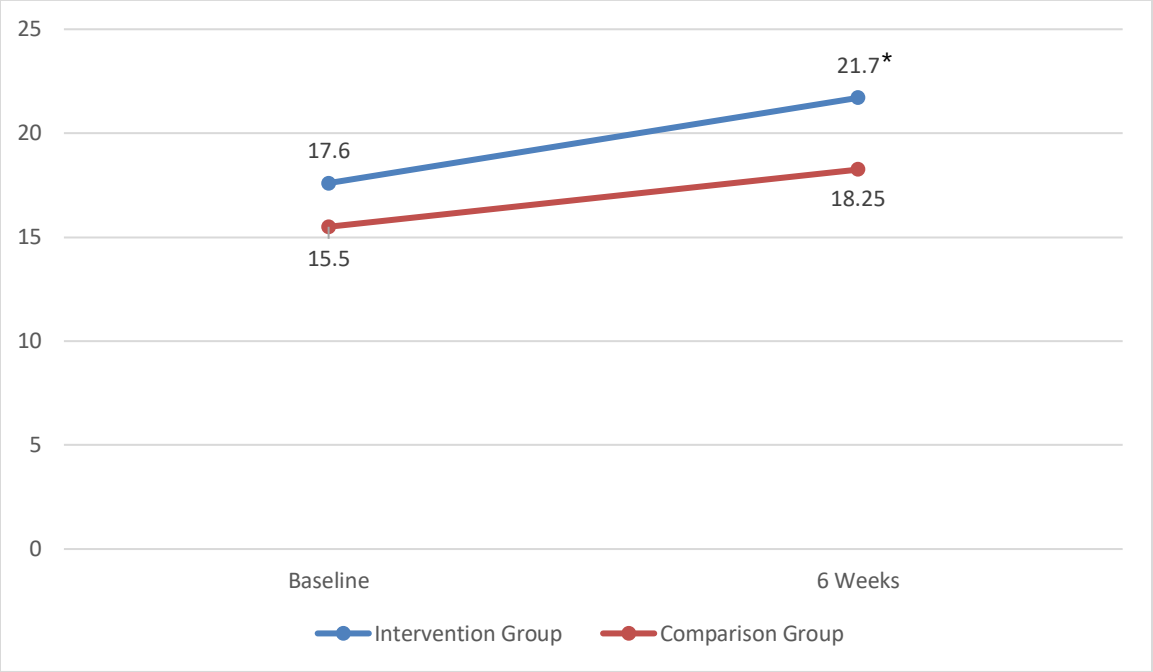


Figure 4.6

Acne Symptoms Domain Mean Scores



Note. *statistically significant increase found ($p < .05$)

CHAPTER 5

DISCUSSION

The purpose of this EBP project was to improve participant quality of life through the implementation of a cost-effective treatment algorithm for the management of acne vulgaris in adult college students. This project served to answer the following PICOT question: in adult college students diagnosed with acne vulgaris at the university's student health center (P), how does a cost-effective acne treatment algorithm (I) compared to current practice without an algorithm (C) impact participant quality of life measured by the Acne-QoL questionnaire (O) over a 6-week period (T)? In this chapter the project findings will be discussed and interpreted, the strengths and limitations of the project will be explored, and implications for future practice will be provided.

Explanation of Findings

Overall, project findings supported the effectiveness of using a cost-effective treatment algorithm for the management of acne vulgaris in adult college students. Results were consistent with previous uses of the Acne-QoL questionnaire in the literature, in which statistical significance was yielded for the self-perception, role-emotional, and acne symptoms domains supporting improvement of quality of life. The only exception to this were the findings for the role social domain, in which statistical significance was not found. Participant findings and the primary outcome of quality of life will be discussed further in this section. A discussion regarding the findings relating to reliability of the Acne-QoL questionnaire will also be provided.

Participant Findings

Demographic data for participants were analyzed to determine if any significant differences existed between the intervention group and comparison group. Overall, there were no statistically significant differences between the two groups regarding age (p = .681) or race (p = .512). Mean age for the intervention group was 21.20 years (SD = 2.44) and was 21.75

years (*SD* = 1.26) for the comparison group. The predominant race for participants was Caucasian for both the intervention group (90%) and comparison group (100%). A statistically significant difference did exist between the two groups regarding gender ($p = .04$) in which the intervention group ($n = 10$) comprised of six males (60%) and four females (40%) did differ from the comparison group ($n = 4$) which was made up of entirely female participants (100%), suggesting the groups did differ from one another. This is likely the result of having such a small sample size of 14 total participants and a larger sample size would most likely lead to more equal gender distributions between each group.

Quality of Life

Based on the paired-samples *t* test that was calculated for the intervention group, a statistically significant increase in quality of life was found for three of the four domains on the Acne-QoL questionnaire after completing 6 weeks of treatment. Participants mean scores significantly increased for the self-perception ($p = .011$), role-emotional ($p = .025$), and acne symptoms ($p = .007$) domains. For the role-social domain, there was no statistically significant increase in quality of life for this group ($p = .872$). However, the role-social domain did have the highest mean at baseline ($M = 20.60$, $SD = 3.78$) compared to the other four domains, which suggests participants may have already been relatively satisfied with their quality of life in this particular domain prior to receiving treatment. The increase in quality of life for the self-perception, role-social, and acne symptoms domains is consistent with the findings by Fehnel et al. (2002); however, significant results were also noted for the role-social domain within this study. This inconsistent finding for the role-social domain may be due to the project's smaller sample size, as the study by Fehnel et al. (2002) was comprised of a much larger sample size of 591 patients. The paired-samples *t* test was also used to compare the mean baseline and 6-week Acne-QoL domain scores for the comparison group as well. While there were increases in the overall mean scores for each domain, none of these increases were statistically significant.

Overall, there was no statistically significant interaction between the time of measurement (baseline and 6 weeks) and group type (intervention and comparison) for any of the four domains on the Acne-QoL questionnaire after calculating a mixed-design ANOVA. There was also no statistically significant difference in the mean scores for each domain between the intervention group and comparison group, regardless of time. However, there was a statistically significant increase in mean scores over time for both groups in the self-perception ($p < .001$), role-emotional ($p = .005$), and acne symptoms ($p = .004$) domains. There was no statistically significant increase in mean scores over time for either group in the role-social domain ($p = .250$). These results suggest that group type did not have an influence on the increased quality of life for participants, as the total mean scores for both the intervention group and comparison group improved after 6 weeks. However, it is worth mentioning that after comparing the mean scores between the two groups, the intervention group did have higher mean scores after 6 weeks for each domain as depicted in Figure 4.3, Figure 4.4, Figure 4.5, and Figure 4.6. Again, while there was no statistically significant difference between the intervention group and comparison group, the findings for the intervention group do suggest some clinical significance.

The comparison groups increase in scores could have been caused if participants possibly receiving care elsewhere during the project's timeline. During recruitment, participants were not assessed as to whether they were receiving concurrent treatment for acne vulgaris from another source or if they had planned to receive treatment during the 6-week time frame. If participants within this group were undergoing treatment during the project time period, this may have influenced the increase in Acne-QoL questionnaire scores. The increase in scores could also be related to participant self-awareness of acne during the project time period in which participants may have been taking proactive measures to combat acne due to their participation in the project. Proactive measures to combat acne could include the use of over-the-counter (OTC) acne medications, facial cleansers, and overall better hygiene techniques, that may have

overall lead to an improvement in the comparison groups acne, leading to increased scores on the Acne-QoL questionnaire after 6 weeks.

Acne-QoL Reliability

Cronbach's alpha calculations were used to determine the internal consistency of the four domains featured within the Acne-QoL questionnaire. Overall, high levels of internal consistency were found for all domains for both the baseline and 6-week Acne-QoL questionnaire measurements. For the baseline measurement, self-perception was noted as 0.96, role-emotional as 0.95, role-social as 0.82, and acne symptoms as 0.79. For the 6-week measurement, self-perception was 0.96, role-emotional was 0.92, role-social was 0.97, and acne symptoms was 0.81. These results demonstrate high levels of internal consistency as reliable results should be greater than 0.7, with results closer to 1.0 demonstrate an even higher level of reliability. These findings are consistent with the literature in which Fehnel et al. (2002) reported Cronbach's alpha ranges of 0.87 to 0.96 for the self-perception, role-emotional, and role-social domains of the Acne-QoL questionnaire and a range of 0.77 to 0.86 for the acne symptoms domain.

Strengths and Limitations of the DNP Project

Strengths

One of the main strengths of this project was the ability to provide affordable medications to college students. In general, medications for skin care can be costly, so one of the main goals for this project was to select medications that were relatively affordable for patients. This is especially important for college students who may already have a limited financial budget. The ability to keep these medications on hand at the student health center also helped to ensure patients had immediate access to the required treatment regimens. Overall, utilizing recommended agents that are affordable for college students and keeping medication on hand can help to eliminate any financial barriers the students may face and increases access to treatment for acne vulgaris.

The use of the revised Iowa Model also served as a strength throughout the duration of this project. The model was utilized as a guide for the development, implementation, and sustainability of this EBP project. This model involves seven main steps including (a) identifying the triggering issue or opportunity, (b) stating the question or purpose, (c) forming a team, (d) assembling, appraising, and synthesizing the body of evidence, (e) designing and piloting the practice change, (f) identifying and sustaining the practice change, and (g) disseminating the results (Melynk & Fineout-Overholt, 2019). Overall, this model served as a good fit throughout the entire duration of the project. The simplicity and easy-to-follow steps within the revised Iowa Model were helpful for the project manager as a novice to the EBP project process. The stop points and feedback loops within the model also helped serve as a guide to ensure the project stayed on track and remained true to the intended purpose.

Another strength of this project was the positive response, support, and receptiveness of using the acne treatment algorithm by the FNPs. The health center director, who was also one of the FNPs who helped implement the treatment algorithm, identified and recognized the need for simplified and consistent management of acne vulgaris at the student health center. The internal identification of the need to change practice at the student health center helped to ensure that enough time and dedication were provided to implement the project to its full extent. Both FNPs were very helpful throughout the implementation process and very receptive to the practice change. The rest of the office staff at the student health center were also very supportive of the practice change. The office staff were very helpful in ensuring participants scheduled their appointments and provided discussions with participants regarding any concerns they may have had regarding their insurance coverage of the office visit. Overall, the staff receptiveness allowed for a smooth transition for the change in practice and helped promote the success of this project. One of the FNPs at the student health center also stated to the project manager that she plans to continue using the treatment algorithm and that she has heard many students state they were satisfied with their acne treatment. The positive response

noted throughout the duration of this project will hopefully allow for long lasting sustainability in the future.

Limitations

The main limitation encountered during this project was the small sample size of participants. Recruitment efforts were made to reach virtually all students on campus, however, buy-in to the project was very low. Originally, there were only six participants who were interested in the project, with five completing both the baseline and 6-week Acne-QoL questionnaires. This limited amount of data was insufficient to run data analysis reports in SPSS, so further recruitment was necessary to gather an ample amount of data. Original recruitment efforts to reach potential participants consisted of displaying a poster at the student health center, in various academic buildings throughout campus, and in the main student center on campus; an email sent to 2,881 students on campus; and project information posts to Facebook, Twitter, and Instagram. After deeming it necessary to recruit more participants, another email was sent to students in an attempt to enroll more participants in the project. In addition to this, the project manager met with students in the classroom setting to discuss the project in more detail and to answer any questions potential participants had. After meeting with the participants in the classroom setting, a Google Form was sent to all students in the class with questions related to their interest in participating in the project. If the students answered that they were interested in the project, the Google Form prompted them to fill out the demographic form to get the enrollment process started. The project manager then reviewed these responses and contacted the participants to fill out the informed consent document and the baseline Acne-QoL questionnaire, which were sent to participants via email. Participants were then assisted to schedule an appointment at the student health center. This process allowed for the addition of 11 new participants to the project.

Another limitation to this project was the limited time students spent on campus due to COVID-19 restrictions. Many students were completing remote learning during the fall and

spring semesters and were not physically on campus, limiting the number of walk-in appointments at the student health center. There was also an extended 2-month break between semesters that was implemented due to COVID-19 that further limited student presence on campus. Telehealth visits were utilized at the student health center to reach students that were off campus during these times, however, accurate physical assessment of acne vulgaris is limited when using telehealth measures compared to the assessments that take place during in-person visits. This project may have been able to reach a larger number of participants if it was implemented at a different period in time.

One final limitation of this project were the costs associated with the student health center visits. Participants enrolled in the student health center insurance plan were not billed for their visit at the student health center, however, those with other insurance plans did have associated costs such as co-pays or deductibles. Some participants also stated the student health center did not accept their insurance plan; thus, they would be personally responsible for all costs associated with the appointment. This ultimately limited participation for the project as multiple students verbalized to the project manager that they did not wish to participate in the project if they had to pay any out-of-pocket costs for the visit.

Implications for the Future

The findings from this EBP project have provided valuable information for the advanced practice nursing profession related to the management of acne vulgaris in primary care settings. Implications regarding practice, EBP model, research, and education will be discussed in detail. These implications can be used to guide and improve future EBP projects and practice changes regarding the management of acne vulgaris.

Practice

Best practice recommendations for the cost-effective management of acne vulgaris suggest that treatment agents vary depending on the severity level of acne. It is also recommended to have patients complete self-assessments of quality of life to determine the

effectiveness of treatment regimens. Based on these recommendations, a cost-effective treatment algorithm was developed to manage acne vulgaris in adult college students and the Acne-QoL questionnaire was selected as an appropriate tool to measure participant quality of life. The implementation of this project became standard practice at the university student health center, with the hopes this practice change will be sustained into the future. Sustainability was supported through the development of a policy and by providing copies of the acne treatment algorithm to the FNPs employed at the student health center. Unfortunately, copyright laws were in place that prevent reproduction of the Acne-QoL questionnaire for use at the student health center, leaving the health center without the means necessary to measure patient quality of life in the same way this project did. However, other measurement tools are available for use and have been mentioned in the literature such as the Acne-Q4 or CADI (Asai et al., 2015). Overall, the use of a treatment algorithm to provide cost-effective, consistent management of acne vulgaris and the use of patient self-assessments of quality of life are encouraged for all primary care offices to provide best practice care to patients.

Implications for future EBP projects can benefit from a few key changes. Future projects would benefit from a larger sample size to better generalize findings to the general population. A comparison group would also not be necessary for implementing future projects and was only utilized in this project due to limited student buy-in to receiving treatment at the student health center. If a comparison group is utilized in future projects, it would also be beneficial to assess potential participants if they are currently receiving acne treatment elsewhere or plan to receive treatment throughout the duration of the project prior to including these participants in the project. Comparison groups should also be assessed as to any changes they have made in their skin care routine throughout the duration of the project. The original plans for this project also involved having participants return to the student health center after 6 and 12 weeks of treatment to have one of the FNPs reassess their acne severity using the modified IGA scale to determine if provider-assessed severity levels had changed over time. These plans were no

longer feasible due to the limited student buy-in to the project, and a 6-week follow-up period with no provider-assessments of acne was utilized instead. Including provider-assessments of acne severity will provide another quantitative measure to determine if acne is truly improving or not, which is recommended throughout the literature (Asai et al., 2015; Nast et al., 2016; Zaenglein et al., 2016). Also, incorporating a time frame of at least 12 weeks would allow ample time to determine if a particular treatment regimen is working for the participant. The follow-up appointment taking place at 6 weeks also allows for the opportunity to change medications if necessary if there is no improvement in the participant's acne. Overall, the inclusion of provider-assessment of acne severity and increasing the project timeline to 12 weeks would also be beneficial for future projects.

EBP Model

The revised Iowa Model was utilized as a guide for the development, implementation, and sustainability of this EBP project. The seven steps outlined within this model helped serve as a guide to ensure the project stayed on track and remained true to the intended purpose. The simplicity and easy-to-follow steps within the revised Iowa Model helped guide the novice project manager throughout the entire EBP project process. The ease of use and detailed steps outlined within the revised Iowa Model allows the model to be utilized by both novice and expert clinicians. Future projects can benefit from utilizing the revised Iowa Model for a variety of different project topics and populations.

Research

Further research is needed to explore the use of a cost-effective treatment algorithm in other settings, such as the dermatology specialty setting. A dermatology setting may provide a larger sample size of patients with acne vulgaris for implementation of the algorithm, which may lead to more generalizable results. Girman et al. (2003) also states the Acne-QoL questionnaire is appropriate for dermatology specialty settings. The dermatology specialty setting would also be appropriate to evaluate other treatment options, regardless of cost, such as isotretinoin.

Isotretinoin was another medication commonly referenced in the literature for use of severe acne vulgaris. This medication is typically prescribed by dermatologists and is rather costly, which is why it was excluded from this project. However, research on the impact other treatment options for acne vulgaris have on patient quality of life would be beneficial. Additional research should also focus on adolescent and middle-aged adult populations as well, as acne typically begins in adolescence and can continue into adulthood (Pandis, 2020; Zaenglein et al., 2016).

Education

Education is an important component advanced practice nurses need to address with their patients. Participants in this project were educated about how to use the selected medications, potential side effects of the medications, the purpose of therapy, and any appropriate follow-up times. Education about how and when to use selected medications is very important as topical medications may need to be used during certain times of the day and may also need to be used before or after another topical medication. Not only is patient education important, but provider education about acne vulgaris is equally important and should be implemented as well. For this project, FNPs were educated on how to properly assess acne vulgaris using the modified IGA scale and how to appropriately manage acne based on the identified severity level using the treatment algorithm. FNPs were educated that the treatment algorithm was developed based on the best practice recommendations identified in the literature. Education for providers allows for familiarity with managing acne vulgaris so patients can receive quality, high-level care.

Conclusion

Results from this project support the effectiveness of implementing a cost-effective treatment algorithm for the management of acne vulgaris in adult college students to improve patient quality of life. Statistical significance was found for three of the four Acne-QoL domains which shows an improvement in quality of life was achieved for those who received treatment with the treatment algorithm at the student health center. While there was no statistically

significant difference between the intervention group and comparison group, the results are still relevant to the overall clinical significance of improving quality of life among patients. Sustainability of this project was discussed with the student health center director to allow for the continued use of the treatment algorithm for future students seen at the health center for acne vulgaris. Overall, the development of this treatment algorithm and the use of the Acne-QoL questionnaire has patient interests in mind to ensure consistent, cost-effective, and best practice care is provided to improve patient quality of life.

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BIOGRAPHICAL MATERIAL

Ms. Borsilli graduated Summa Cum Laude from Valparaiso University with a Bachelor of Science in Nursing (BSN) degree in 2017. Since graduation, she has worked at Community Hospital in Munster, Indiana on a medical-surgical unit that specializes in orthopedics and serves as a step-down neurological unit. At work, she enjoys the opportunity to orient and precept new graduate nurses on her unit. She also serves as a clinical instructor for undergraduate nursing students at Valparaiso University. Ms. Borsilli is currently attending Valparaiso University to obtain her Doctor of Nursing Practice (DNP) degree, with an anticipated graduation date of May 2021. She is also a member of multiple professional organizations, including the American Association of Nurse Practitioners, American Nurses Association, and Sigma Theta Tau Zeta Epsilon Chapter. Upon submission of her evidence-based practice abstract, Ms. Borsilli's work was selected for a poster presentation at the University of Iowa Health Care 28th National EBP Conference that will take place in April 2021. Her project was inspired by her interest in dermatology. Her other interests include gastroenterology, orthopedics, and nursing education. She hopes to one day work in a specialty setting and hopes to expand on her clinical instructor role to continue teaching in the nursing profession.

ACRONYM LIST

AAD: American Academy of Dermatology

A-BP: Adapalene-Benzoyl Peroxide

Acne-QoL: Acne-Specific Quality of Life Questionnaire

ANOVA: Analysis of Variance

BP: Benzoyl Peroxide

CADI: Cardiff Acne Disability Index

CAM: Complementary and Alternative Medicine

CDER: Center for Drug Evaluation and Research

CINAHL: Cumulative Index to Nursing and Allied Health Literature

CITI: Collaborative Institutional Training Initiative

DNP: Doctor of Nursing Practice

EBP: Evidence-Based Practice

EDF: European Dermatology Forum

EMR: Electronic Medical Record

FDA: Food and Drug Administration

FNP: Family Nurse Practitioner

IGA: Investigator Global Assessment

IRB: Institutional Review Board

JBI: Joanna Briggs Institute

MeSH: Medical Subject Heading

OTC: Over-the-Counter

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis

QI: Quality Improvement

RCTs: Randomized Controlled Trials

SPSS: Statistical Package for Social Sciences

TRIP: Turning Research into Practice

UIHC: University of Iowa Hospitals and Clinics

USDHHS: United States Department of Health and Human Services

Appendix A

Appraisal of Evidence

Citation (APA)	Purpose	Design	Sample	Measurement/ Outcomes	Results/Findings	Level/ Quality
Asai, Y., Baibergenova, A., Dutil, M., Humphrey, S., Hull, P., Lynde, C., Poulin, Y., Shear, N. H., Tan, J., Toole, J., & Zip, C. (2015). Management of acne: Canadian clinical practice guideline. *Canadian Medical Association Journal, 188*(2), 118-126.	Provide recommendations for the evaluation and treatment of acne vulgaris based on severity (comedonal acne, mild papulopustular, moderate papulopustular, and severe papulopustular/nodular acne).	Clinical Practice Guideline Adapted and expanded upon from the European Dermatology Forum guideline.	Pediatric and adult age groups with acne vulgaris. A thorough literature search was conducted based on the methods used in the European Dermatology Forum guideline. This original search was updated from March 2010 to July 2015. Inclusion criteria for this guideline consisted of human/clinical studies, systematic reviews, meta-analyses, RCTs, and controlled prospective studies.	Evaluation to determine type, extent, and distribution of acne should be completed using a scale of clear, almost clear, mild, moderate, and severe/extreme. This scale determines change over time. The overall goal is a change of two grades or achieving clear or almost clear after treatment. Assessing patient's quality of life through direct inquiry or with the use of the Acne-Q4 or Cardiff Acne Disability Index (CADI) instruments can be helpful.	Comedonal Acne – topical retinoids*, benzoyl peroxide (BP), combination clindamycin + BP, and combination adapalene + BP have a medium strength recommendation. Mild-to-Moderate Papulopustular Acne – combination adapalene + BP and combination clindamycin + BP have a high strength recommendation. BP, topical retinoids*, systemic antibiotics** combined with BP +/- topical retinoids*, and combined oral contraceptives have a medium strength recommendation. Severe Acne – oral isotretinoin monotherapy has a high strength recommendation. Systemic antibiotics** combined with BP +/- a topical retinoid* has a medium strength recommendation.	Level I High Quality

					*adapalene or tazarotene preferred **tetracycline or doxycycline preferred	
Friedman, A., Waite, K., Brandt, S., & Meckfessel, M. H. (2016). Accelerated onset of action and increased tolerability in treating acne with a fixed-dose combination gel. *Journal of Drugs in Dermatology, 15*(2), 231-236.	Discuss the effectiveness of combination adapalene 0.1%/benzoyl peroxide 2.5% (A-BP) gel on the treatment of acne.	Meta-Analysis	Reviewed data from 14 clinical studies with a total of 2,358 subjects that were treated with A-BP.	Lesion counts were assessed at baseline and at each visit. The post-baseline lesion count was subtracted from the baseline lesion count to determine improvement. Investigator global assessment (IGA) scores were assessed using a scale of 0 (clear) to 4 (very severe). Tolerability of medications was assessed using 4-point scales (ranging from none to severe) to evaluate dryness, erythema, scaling, and stinging/burning.	"Median total lesion counts decreased 40.8% from baseline to week 4" (p. 232). "Subjects with IGA scores of moderate to severe at baseline had a slightly better improvement compared to subjects with an IGA score of mild…however, subjects with an IGA score of mild at baseline had better improvement in noninflammatory lesion reductions compared to subjects with baseline IGA scores of moderate to severe" (p. 232). Inflammatory and noninflammatory lesions decreased 46.2% and 37.5%, respectively, from baseline to week 4. Tolerability was ranked as none or mild with the majority of subjects (see Figure 4).	Level I Good Quality
Gollnick, H. P. M., Friedrich, M.,	Determine effectiveness and	Descriptive Study	The study took place within 178 centers in	Safety and tolerability were assessed using	Acne severity decreased from 5.6 ± 1.5 at baseline to 3.3 ±	Level VI

Peschen, M., Pettker, R., Pier, A., Streit, V., Jostingmeyer, P., Porombka, D., Rojo Pulido, I., & Jackel, A. (2015). Safety and efficacy of adapalene 0.1%/benzoyl peroxide 2.5% in the long-term treatment of predominantly moderate acne with or without concomitant medication – results from the non-interventional cohort study ELANG. *Journal of the European Academy of Dermatology and Venereology, 29*(S4), 15-22.	safety of combination adapalene 0.1%/benzoyl peroxide 2.5% (adapalene-BP) for the long-term management of moderate to severe acne.		Germany. Observations were made among 5,131 patients with moderate to severe acne (grades 4-12 on the Leeds Revised Acne Grading Scale). Observations took place over a period of nine months. Patients were selected based on whether “acne therapy with adapalene-BP alone or in combination with other drugs was indicated” (p. 17).	a 4-step scale (none, mild, moderate, severe) to evaluate local skin irritation including issues such as erythema, dryness, desquamation, burning/stinging, and pruritis at each follow up visit. Overall tolerability with treatment was also assessed using a 4-step scale (very good, good, satisfactory, poor) at baseline and during the final visit. Adverse drug reactions were assessed during each visit as well. Efficacy was measured using the Leeds Revised Acne Grading System and physician assessment (very good, good, satisfactory, poor) to note changes in the severity of acne at each visit. Patient assessment of efficacy was measured at 3 months as well as “time to	1.9 at 3 months and 1.9 ± 1.9 at 9 months based on the Leeds Revised Acne Grading System. After treatment, 420 patients (8.2%) experienced completely clear (no visible lesions) at 3 months and 1326 patients (25.8%) at 9 months. Treatment was similar between patients who received adapalene-BP alone and those who were receiving adapalene-BP in combination with a systemic antibiotic. Physician assessment of treatment efficacy was rated as good or very good for 83.1% of the patients. Tolerability was rated as good or very good for 90.2% of patients. 49.5 of patients experienced skin irritation (dryness 30.7%; erythema 24.3%; and desquamation 22.4%).	High Quality

				onset of action observed by the patient" (p. 17) using a 6-item scale (completely resolved, marked improvement, moderate improvement, mild improvement, no change, worsened)		
Gollnick, H. P. M., Funke, G., Kors, C., Titzmann, T., Jostingmeyer, P., & Jackel, A. (2015). Efficacy of adapalene/benzoyl peroxide combination in moderate inflammatory acne and its impact on patient adherence. *Journal of the German Society of Dermatology, 13*(6), 557-565.	Determine efficacy and patient adherence with adapalene 0.1%/benzoyl peroxide 2.5% (adapalene-BP) in patients with moderate inflammatory acne.	Descriptive Study	A total of 2,780 patients with moderate inflammatory acne were observed for 12 weeks within 314 dermatology centers throughout Germany. Patients were between the ages of 12 and 20 years old.	Skin irritation was assessed using a scale (none, mild, moderate, severe) to rate degree of erythema, dryness, desquamation, burning/stinging, and pruritis at each follow up visit. Adverse drug reactions were also noted at each follow up visit. Physicians rated tolerability using a 4-item scale (very good, good, satisfactory, poor). The Leeds grading system was used to assess changes in the severity of acne.	Acne severity decreased from 4.8 ± 0.9 at baseline to 2.1 ± 1.6 at 12 weeks based on the Leeds scale. Efficacy was rated by physicians as good or very good in 79.2% of patients. Skin irritation was rated as none (19%), mild (51%), moderate (24%), and severe (6%). Tolerability was rated as good or very good by physicians for 82.8% of patients. Overall, 63.2% of patients were considered adherent to treatment. 82.3% of patients were either satisfied or very satisfied with treatment and physicians rated treatment as good or very good for 80.1% of patients.	Level VI High Quality

				Efficacy of treatment was assessed by the physicians using a 4-item scale (very good, good, satisfactory, poor). Patients also assessed efficacy using a 6-item scale (completely cured, marked improvement, moderate improvement, slight improvement, no change, worsened). Treatment adherence was assessed using a 4-item questionnaire at the final visit.		
Le Cleach, L., Lebrun-Vignes, B., Bachelot, A., Beer, F., Berger, P., Brugere, S., Chastaing, M., Do-Pham, G., Ferry, T., Gand-Gavanou, J., Guigues, B., Join-Lambert, O., Henry, P., Khallouf, R., Lavie, E., Maruani, A., Romain, O., Sassolas, B., Tran, V. T., & Guillot, B. (2017). Guidelines for the management	Provide recommendations on the treatment of acne vulgaris.	Clinical Practice Guideline	A literature search was conducted to find relevant references between 2007 and September 2014. This search was then updated to include references up to July 2016. A total of 128 references were included in this guideline. Selection criteria included systematic reviews, RCTs, and observational studies.	The Global Acne Severity scale was used as the basis for recommendations and the development of the treatment algorithm.	Almost clear skin – benzoyl peroxide or a topical retinoid is recommended for first line treatment. Mild – benzoyl peroxide and a topical retinoid is recommended for first line treatment. Moderate – benzoyl peroxide and a topical retinoid OR the previously mentioned treatment with the addition of oral doxycycline or lymecycline is recommended for first line treatment.	Level I High Quality

of acne: Recommendations from a French multidisciplinary group. *British Journal of Dermatology, 177*, 908-913.					Severe – oral doxycycline or lymecycline, benzoyl peroxide, and a topical retinoid are recommended for first line treatment. Oral isotretinoin can be considered for first line treatment if risk of scarring is high. Very severe – Oral isotretinoin is recommended for first line treatment. Oral doxycycline and lymecycline should be limited to 3 months. These medications should also be combined with topical therapies.	
Nast, A., Dreno, B., Bettoli, V., Bukvic Mokos, Z., Degitz, K., Dressler, C., Finlay, A. Y., Haedersdal, M., Lambert, J., Layton, A., Lomholt, H. B., Lopez-Estebaranz, J. L., Ochsendorf, F., Oprica, C., Rosumeck, S., Simonart, T., Werner, R. N., & Gollnick, H. (2016). European evidence-	Provide recommendations for the treatment of acne vulgaris.	Clinical Practice Guideline	A thorough literature search was conducted from 2010 to July 2015. Inclusion criteria involved RCTs that evaluated acne treatments. Overall, data from 154 studies were utilized to form this guideline.	No recommended global system for measuring acne severity has been identified. Subjective grading of acne severity, in addition to lesion counts, is considered practical for clinical practice. Classification of acne for this guideline consisted of 1)	Comedonal Acne – topical retinoids* have a medium strength recommendation. Mild to Moderate Papulopustular Acne – Adapalene + BP or BP + clindamycin has a high strength of recommendation. Azelaic acid, BP, topical retinoid*, topical clindamycin + tretinoin, or systemic antibiotic** + adapalene have a medium strength recommendation.	Level I High Quality

based (S3) guideline for the treatment of acne. European Dermatology Forum.				comedonal acne, 2) mild-moderate papulopustular acne, 3) severe papulopustular acne/moderate nodular acne, and 4) severe nodular acne/conglobate acne. Quality of life measures is recommended for acne management. No one questionnaire is recommended over the others.	Severe Papulopustular/Moderate Nodular Acne – isotretinoin has a high strength recommendation. Systemic antibiotic** + adapalene, systemic antibiotic** + azelaic acid, or systemic antibiotic** + adapalene + BP have a medium strength recommendation. Severe Nodular/Conglobate Acne – isotretinoin has a high strength recommendation. Systemic antibiotic** + azelaic acid or systemic antibiotic** + adapalene + BP have a medium strength recommendation. *Adapalene is preferred ** Doxycycline or lymecycline are preferred	
Yang, Z., Zhang, Y., Mosler, E. L., Hu, J., Li, H., Zhang, Y., Liu, J., & Zhang, Q. (2020). Topical benzoyl peroxide for acne. *Cochrane Database of Systematic Reviews*.	Evaluate the effectiveness of using BP for the treatment of acne	Systematic Review	A thorough literature search was conducted in multiple databases until February 2019. A total of 120 RCTs with 29,592 subjects were included within this review.	The primary outcomes measured were participant self-assessment of acne improvement using a Likert scale and withdrawal due to adverse events. Secondary outcomes included investigator-assessed changes in	BP compared to placebo/no treatment – participant self-assessment of improvement was slightly better compared to placebo/no treatment (RR = 1.27). However, participants were twice as likely to withdraw from BP treatment due to adverse effects (RR = 2.13).	Level I High Quality

			Subjects within the studies had either mild, moderate, or severe acne.	lesion counts, percentage of participants considered clear or almost clear on the IGA scale, changes in quality of life, reduction of *C acnes* strains, and percentage of participants experiencing adverse events. Comparisons were made between BP and 47 other acne treatments. The main comparisons were placebo/no treatment, adapalene, clindamycin, erythromycin, and salicylic acid.	BP compared to adapalene – There was no difference of participant self-assessment of improvement between treatment with BP and adapalene (RR = 0.99). However, participants were more likely to withdraw from BP treatment due to adverse effects (RR = 1.85). BP compared to clindamycin – Participant self-assessment was slightly better with the clindamycin group compared to BP (RR = 0.95). BP group was almost twice as likely to withdraw due to adverse effects (RR = 1.93). BP compared to erythromycin – No data was available for participant self-assessment. There was no difference between withdrawal rate between the two groups (RR = 1.0). BP compared to salicylic acid - No data was available for primary outcomes.	
Zaenglein, A. L., Pathy, A. L., Schlosser, B. J., Alikhan, A., Baldwin, H. E., Berson, D. S.,	Provide updated recommendations on the management acne vulgaris in	Clinical Practice Guideline	A thorough literature search was conducted between May 2006 and September 2014 to	No universal acne grading system is recommended.	Mild Acne – BP, topical retinoid, or topical combination therapy* are recommended as first line treatment.	Level I Good Quality

Bowe, W. P., Graber, E. M., Harper, J. C., Kang, S., Keri, J. E., Leyden, J. J., Reynolds, R. V., Silverberg, N. B., Gold, L. F. S., Tollefson, M. M., Weiss, J. S., Dolan, N. C., Sagan, A. A., . . . Bhushan, R. (2016). Guidelines of care for the management of acne vulgaris. *Journal of the American Academy of Dermatology, 74*(5), 945-973.e33.	adolescent and adult patients.		update the previous guideline from 2007.	The use of a consistent grading system among clinicians is recommended to determine acne severity and response to treatment.	Moderate Acne –topical combination therapy*, oral antibiotic*** + topical retinoid + BP, or oral antibiotic*** + topical retinoid + BP + topical antibiotic** is recommended for first line treatment. Severe Acne – oral antibiotic*** + topical combination therapy* or oral isotretinoin is recommended as first line treatment. *BP + topical antibiotic** OR retinoid + BP OR retinoid + BP + topical antibiotic** **clindamycin 1% is the preferred topical antibiotic ***doxycycline or minocycline are the preferred oral antibiotics	

Appendix B

Poster for Recruitment

TIRED OF DEALING WITH ACNE?

Have you been dealing with acne lately? Have you noticed new or increased acne after wearing your face mask? If you answered yes to either question, the Student Health Center is here to help!

If you are interested in making an appointment to treat your acne, please contact Cristina Borsilli, VU DNP Student at:

(219) 671-7344 or cristina.borsilli@valpo.edu

Appendix C

Email and Social Media Recruitment Information

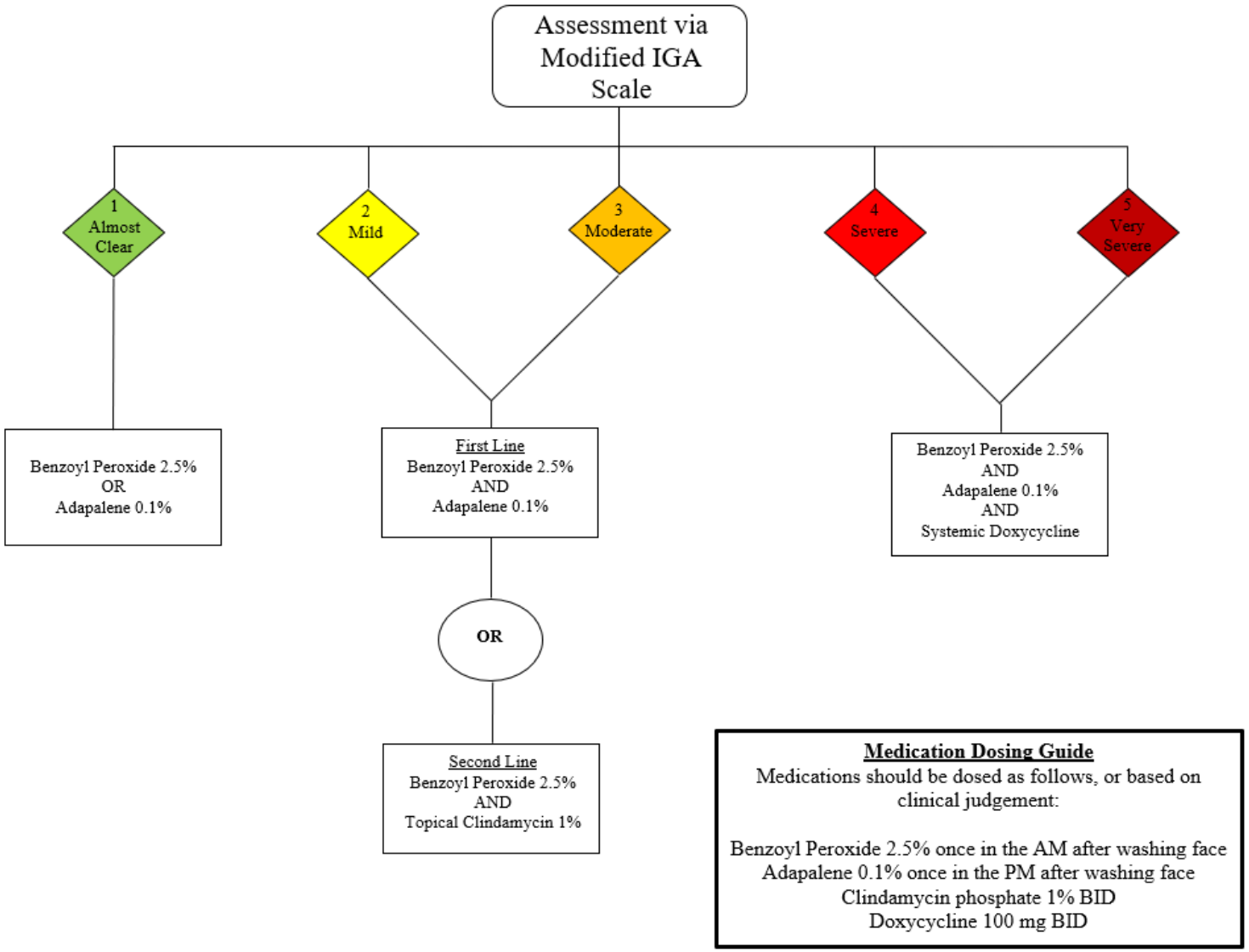
Have you been dealing with acne lately or noticed increased acne after wearing your face mask all day? Great news, the student health center is here to help!

If you are interested in making an appointment to treat your acne, please contact Cristina Borsilli, Valpo DNP Student at cristina.borsilli@valpo.edu. Let's get your skin clear again!

Cristina is a registered nurse and can assist you with making an appointment at the student health center, as well as answer any questions you may have about treating acne.

Appendix D

Acne Treatment Algorithm



Appendix E

Modified IGA Scale

Grade	Description
0	Clear skin with no inflammatory or noninflammatory lesions
1	Almost clear; rare noninflammatory lesions with no more than one small inflammatory lesion
2	Mild severity; greater than Grade 1; some inflammatory lesions with no more than a few inflammatory lesions (papules/pustules only, no nodular lesions)
3	Moderate severity; greater than Grade 2; up to many noninflammatory lesions and may have some inflammatory lesions, but no more than one small nodular lesion
4	Severe; greater than Grade 3; up to many noninflammatory lesions and may have some inflammatory lesions, but no more than a few nodular lesions
5	Very severe; greater than Grade 4; many noninflammatory and inflammatory lesions and more than a few nodular lesions; cystic lesions may be present
Note:	Noninflammatory lesions: open (blackheads) or closed (whiteheads) comedones Inflammatory lesions: papules, pustules, and nodules

Modified from U.S. Department of Health and Human Services Food and Drug Administration Center for Drug Evaluation and Research (CDER) Investigator Global Assessment (IGA) Scale

Food and Drug Administration. (2005). *Guidance for industry acne vulgaris: Developing drugs for treatment* (Docket ID. FDA-2005-D-0461-0002). U.S. Department of Health and Human Services. https://www.regulations.gov/document?D=FDA-2005-D-0461-0002

Appendix F

Acne Treatment Policy

	Policy & Procedure
Owner:	Policy Origin Date: 2020
Function: Patient Care	Effective Date: Sept. 2020
Department(s): Health Center	Reviewed/Recommended By: Health Center Director
Scope: Physician, Nurse Practitioner	Approved By:
	Approval Date:

Treatment Algorithm for the Management of Acne Vulgaris

Departments Affected: Health Center

Scope of Practice: Nurse Practitioner

Policy Statement:

This policy/procedure provides instructions for using a treatment algorithm to manage patients presenting to the health center with acne vulgaris.

Procedure:

1. Using the modified Investigator Global Assessment (IGA) scale, rate the patient's acne severity as either 0) clear, 1) almost clear, 2) mild, 3) moderate, 4) severe, or 5) very severe. See notes for IGA scale.

2. Based on the modified IGA severity rating, use the treatment algorithm to determine the appropriate medications to manage the patient's acne.

    a. For acne rated as 1) almost clear, it is recommended to use either topical benzoyl peroxide 2.5% or topical adapalene 0.1%
    b. For acne rated as 2) mild or 3) moderate, it is recommended to use both topical benzoyl peroxide 2.5% and topical adapalene 0.1% as first line agents. There are also strong recommendations for the use of both topical benzoyl peroxide 2.5% and topical clindamycin 1%, however, these should be used as second line agents based on the greater amount of evidence that favors the first line agents.
    c. For acne rated as 4) severe or 5) very severe, it is recommended to use a combination of topical benzoyl peroxide 2.5%, topical adapalene 0.1%, and systemic doxycycline.

3. Medications should be dosed and administered* as follows or based on clinical judgement:

    a. Topical benzoyl peroxide 2.5% once in the morning after washing face
    b. Topical adapalene 0.1% once in the evening after washing face
    c. Topical clindamycin 1% twice daily
    d. Systemic doxycycline 100 mg twice daily

Notes:

*Benzoyl peroxide 2.5%, clindamycin phosphate 1%, and doxycycline will be kept on hand at the student health center. A prescription for adapalene 0.1% will be required for the student.

Appendix G

Informed Consent Form

Code #_____

Title of EBP Project
Implementation of a Cost-Effective Treatment Algorithm for the Management of Acne Vulgaris in College Students

Principal Investigator
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Purpose of EBP Project
You are being asked to take part in an evidence-based practice (EBP) project. Before you decide to participate, it is important that you understand why this EBP project is being done and what it will involve. Please read the following information carefully. Please ask the principal investigator if there is anything that is not clear or if you need more information.

The purpose of this EBP project is to determine the effects of using a treatment algorithm for the management of acne. Treatments included within the algorithm have been selected based on the best available evidence and affordability.

Project Procedures
During appointments at the student health center, the principal investigator will determine if you are being seen for acne, are 18 years and older, and are not currently pregnant or breastfeeding. If these factors are met, the health care provider (either a doctor or nurse practitioner) will assess the severity of your acne and then follow the treatment algorithm developed for this project to treat your acne. The treatment algorithm determines which type of medication should be used for different levels of acne based on severity. Acne can be classified as clear, almost clear, mild, moderate, severe, or very severe. The medications included in the treatment algorithm include benzoyl peroxide, adapalene, clindamycin, and doxycycline. These medications have all been previously used and approved for practice and are not experimental in any way. During your first visit, you will also be asked to fill out a questionnaire about your acne. After your first visit at the health center, you will be asked to fill out the questionnaire again after 6 weeks to see if there has been any improvement with the treatment you were prescribed. This EBP project will last approximately 6 weeks.

Risks
Potential risks for participating in this EBP project are minimal and involve embarrassment related to acne and potential side effects from the medications used to manage acne. These side effects can include redness, dryness, itching, burning/stinging, or peeling of the skin; rashes; nausea; vomiting; or diarrhea. In rare cases allergic reactions, sun sensitivity, face or eyelid

swelling, lip or tongue swelling, or liver issues may occur. Let the principal investigator or healthcare provider know if you experience any of these. There may also be drug interactions that can occur with these medications. You should let the health care provider know about all of the medications you are currently taking, including over-the-counter medications as well as vitamins, supplements, or herbal remedies.

Benefits

There are multiple benefits of participating in this EBP project. You will be receiving treatment based on recommendations from the best available evidence. The goals of using these treatment options are to improve your acne while being affordable. The primary investigator hopes to gain valuable information about the use of a treatment algorithm and acne severity scales for treating acne. The results from this EBP project may help to advance nursing practice and knowledge as well.

Confidentiality

All efforts will be made by the primary investigator to keep your personal information confidential. All records containing your personal information will be kept in a locked box with access permitted only to the primary investigator. To further increase confidentiality, a code will be assigned to you for questionnaire forms. Any information stored on a computer will be password protected and accessed only by the primary investigator.

Contact Information

If you have questions at any time about this EBP project, or you experience adverse effects as the result of participating in this EBP project, you may contact the primary investigator whose contact information is provided on the first page. If you have questions regarding your rights as a project participant, or if problems arise which you do not feel you can discuss with the primary investigator, please contact the Valparaiso University Institutional Review Board at valpoirb@valpo.edu or 219-464-5798.

Voluntary Participation

Your participation in this EBP project is voluntary. It is up to you to decide whether or not to take part in this project. If you decide to take part in this EBP project, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this EBP project will not affect the relationship you have, if any, with the principal investigator or health care providers. If you withdraw from the EBP project before data collection is completed, your data will be destroyed.

You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this EBP project.

Participant's Signature_____ Date _____
Investigator's Signature_____ Date _____

Appendix H

Demographic Form

Implementation of a Cost-Effective Treatment Algorithm for the Management of Acne Vulgaris in College Students

Principal Investigator: Cristina Borsilli, BSN, RN, DNP Student Valparaiso University

Demographic Form

Instructions: Please answer the questions provided below by printing your responses and checking the appropriate boxes. Return this form to the principal investigator when you are finished. The purpose of this form is to collect relevant demographic data of each participant involved in the EBP project. All responses contained in this document will be kept confidential.

1. **Date: ____/____/____**
2. **Name: _____**
3. **Phone Number: _____**
4. **Email: _____**
5. **Age: _____**
6. **Gender:** □ Female □ Male
7. **Ethnicity/Race:**

   □ African American
   □ Asian
   □ Caucasian
   □ Hispanic
   □ Native American
   □ Other: _____
   □ Unknown
   □ Prefer not to answer

8. Marital Status: □ Single □ Married □ Divorced/Separated □ Widowed

9. Highest Level of Education Completed:

□ Less than high school
□ High school/GED
□ Some college (no degree)
□ Associate's degree (2-year degree)
□ Bachelor's degree (4-year degree)
□ Master's degree
□ Doctoral degree

10. Employment Status:

□ Full time (40 or more hours per week)
□ Part time (up to 39 hours per week)
□ Unemployed and currently seeking work
□ Unemployed and not currently seeking work
□ Student
□ Homemaker
□ Retired
□ Self-employed
□ Unable to work

11. Annual Household Income:

□ Less than $19,999
□ $20,000 to $34,999
□ $35,000 to $49,999
□ $50,000 to $74,999
□ $75,000 to $99,999
□ Over $100,000

Appendix I

CITI Completion Certificate