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Thesis

**BEHAVIORAL HEALTH CLINICS IN THE TREATMENT OF
PSYCHOSOCIAL COMORBIDITIES OF PEDIATRIC ACNE**

by

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ABSTRACT

Acne is one of the most common skin conditions worldwide, affecting 80% of people between the ages of 11 and 30 with over \$3 billion dollars spent annually on treatment in the United States alone. While the visible symptoms of acne (comedones and inflammatory lesions) are well-known, acne is more than skin-deep. Up to 85% of adolescents with acne will experience a negative psychosocial outcome related to their skin condition. The most common negative outcomes are anxiety, depression, body dysmorphic disorder, decreased self-esteem, and decreased quality of life. These comorbidities can be extremely detrimental if unrecognized and untreated; acne is the second-most common skin condition to end in suicide.

One of the major difficulties in providing well-rounded care for the acne patient beyond their dermatologic needs has been the identification of these psychosocial comorbidities. There is no current standard for evaluating for the presence of these symptoms and they can be difficult to elicit in a pediatric population. While surveys can screen for symptoms (the Children's Dermatology Life Quality Index; the Cardiff Acne Disability Index), they are infrequently used. Subsequently, necessary treatment for these symptoms is foregone when the problem goes unrecognized.

In order to better identify and treat the negative psychosocial impacts of acne, a multidisciplinary approach involving a concurrent medical and psychological approach is

recommended. Examples include support groups, educational interventions, and multidisciplinary clinics. The aim of this proposed study is to evaluate the utility of a multidisciplinary behavioral health clinic in which patients are seen by a dermatologist and a psychologist at the same session. With this model, the dermatologist can evaluate the patients' skin and encourage them to discuss how their acne may be impacting their life. Then, the psychologist can offer advice on what may help each patient's individual symptoms. This advice may include coping strategies or referrals to specialists for further support.

Patients will attend the clinic monthly and their progress will be recorded via Children's Dermatology Life Quality Index scores, acne severity, and psychological diagnoses made at the clinic. It is predicted that the multidisciplinary behavioral health clinic will reveal previously undiagnosed psychological conditions in acne patients, improve patients' quality of life, and improve the severity of their acne. This is clinically significant in providing a comprehensive treatment approach to the pediatric acne patient, recognizing that the symptoms and outcomes of acne are more than skin deep.

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LIST OF ABBREVIATIONS

AAP	American Academy of Pediatrics
BDD	Body Dysmorphic Disorder
BMC.....	Boston Medical Center
BP.....	Benzoyl Peroxide
BUMC.....	Boston University Medical Campus
CADI.....	Cardiff Acne Disability Index
CDLQI	Children’s Dermatology Life Quality Index
DA.....	Dermatitis Artefacta
DHT	5- Alpha- Dihydrotestosterone
DLQI.....	Dermatology Life Quality Index
DRESS	Drug Rash with Eosinophilia and Systemic Symptoms
GAD	Generalized Anxiety Disorder
IBD.....	Inflammatory Bowel Disease
IRB.....	Institutional Review Board
SJS	Stevens-Johnson Syndrome
T-QoL	Teenager’s Quality of Life Index
UC.....	Ulcerative Colitis

INTRODUCTION

Background

Acne is a common, inflammatory disease of the pilosebaceous unit present in over 80% of people between the ages of 11-30. It is the eighth most common skin condition worldwide and third most common skin condition in the United States with nearly \$3 billion dollars spent annually on treatment in the United States alone¹. Onset typically occurs during puberty and its pathophysiology involves abnormal colonization of *Cutibacterium acnes* (*C. acnes*), hyperkeratinization, androgen-mediated increase in sebum production, and inflammation. Appearance is characterized by non-inflammatory lesions (open and closed comedones) and inflammatory lesions (papules, pustules, nodules, and cysts). Acne treatment depends on severity, ranging from topical medications for mild acne to oral systemic therapy for moderate and severe acne.

Acne is known to be associated with numerous psychosocial consequences, which can be especially detrimental in adolescents who are already going through a significant cognitive and emotional developmental period. Up to 80% of adolescents with acne will experience a negative psychosocial outcome related to their condition with the three most common being anxiety, depression, and body dysmorphic disorder. Acne can also impair patients' quality of life, self-esteem, and result in higher rates of suicidal ideation.² It is important for medical providers to identify these symptoms in their acne patients through surveys or patient encounters. Once these symptoms are identified, a multidisciplinary approach to treatment involving behavioral health specialists is recommended to provide a well-rounded treatment for both the patient's skin and their mental health.

Statement of the Problem

While it is known that acne can prove extremely detrimental to the mental health of adolescent patients, few studies have been performed to assess how a multidisciplinary treatment approach can improve disease outcomes. Most studies recommend that a psychosocial treatment be included in the care plan but they do not describe how this should be done or how they would improve outcomes, specifically. Some clinicians have created programs that incorporate both dermatologists and behavioral health specialists, such as adolescent psychologists, in one clinic. However, few studies have assessed how patients' conditions, both physical and psychosocial, have improved before and after treatment at these clinics. Furthermore, most of the research involving these multidisciplinary clinics have included either a wide variety of skin conditions or one particular condition other than acne. No studies have been performed to evaluate the utility of multidisciplinary dermatology and behavioral health clinics specifically for acne.

Hypothesis

Adolescent acne patients who attend a behavioral health clinic, consisting of a dermatologist and psychologist, in addition to the medical treatment of their condition will show an improvement in both the severity of their disease and the negative psychosocial outcomes that result from it. These clinics will also identify previously undiagnosed mental health disorders. Acne severity will not correlate with the severity of the patients' mental health disorders.

Objectives and Specific Aims

This study aims to establish and evaluate the utility of behavioral health clinics in the treatment of acne in adolescent dermatology patients. We will evaluate the severity of their acne, identify the psychosocial problems that the patients are experiencing as a result, and track their progress over time in order to see how these improve as a result of treatment. Specific aims of this study are as follows:

- Evaluate the severity of patients' acne before and after treatment at the clinic.
- Identify negative psychosocial comorbidities that the patients' experience as a result of their acne.
- Quantify the severity of patients' quality of life before and after treatment at the clinic.

REVIEW OF THE LITERATURE

Overview

Epidemiology

With a prevalence of 80% in people age 11-30, acne is the eighth most common skin condition and accounts for nearly 20% of dermatology visits worldwide.³⁻⁴ In the United States, it represents one of the top three most common skin conditions with over three billion dollars spent annually on treatment.¹

The onset of acne typically coincides with the onset of puberty, reaching a peak by age 15-18. However, it can start as early as age 6 and remain problematic throughout adulthood. The onset of the disease occurs earlier for males and they tend to experience severe acne at a younger age, towards the beginning of puberty. For girls, onset of acne occurs later in puberty and women continue to experience a higher prevalence than men after their teenage years. Women are also more likely to seek out dermatologic assistance than men.⁵ Several studies have compared the prevalence of acne in different ethnic groups with most showing no statistically significant difference between black and white subjects; acne is one of the most common dermatologic conditions in both groups.¹ Additionally, acne is more common and starts at a younger age in people with a family history of acne. Family history of acne also correlates with more severe disease and refractoriness to treatment.⁶

Pathophysiology

Acne is a disease of the pilosebaceous unit, which consists of the hair follicle, hair shaft, and sebaceous gland. Pilosebaceous units are found on the skin of all parts of the body

except for the palms, soles, and lower lip. There are four basic pathophysiologic mechanisms contributing to the formation of acne: abnormal colonization of *Curibacterium acnes* (*C. acnes*), hyperkeratinization, androgen-mediated increase in sebum production, and inflammation.⁷

C. acnes is a gram-positive bacterium that is part of the normal flora in human skin. While studies have not found that acne severity is correlated with bacterial load, it is hypothesized that its role in disease is due to its production of inflammatory mediators, such as interleukins-1 β , -8 and -12, and TNF α . These inflammatory mediators cause rupture of comedones and inflammation of the surrounding skin.⁸

Hyperkeratinization, or buildup of keratin in the skin due to abnormal sloughing of keratinocytes, causes the formation of microcomedones under the surface of the skin several weeks before a visible comedone appears. Hyperkeratinization can be caused by an overproduction of sebum.

One cause of this sebum overproduction is androgen stimulation, as both testosterone and 5- α -dihydrotestosterone (DHT) stimulate sebaceous gland activity. Sebaceous glands contain the enzyme required to convert testosterone to DHT, thus leading to higher androgen levels. This process occurs in both men and women.

Lastly, inflammation occurs at all phases of acne development via the upregulation of inflammatory mediators in the skin and release of inflammatory mediators by *C. acnes*. These inflammatory mediators include E-selectin, vascular adhesion molecule-1, interleukins, and integrins upregulated by keratinocytes, as well as cyclooxygenases upregulated by sebaceous glands.⁷

Symptoms

The most common sites for acne are the face, neck, chest, back, and upper arms.⁹ The two primary categories of acne lesions are inflammatory and noninflammatory.

Noninflammatory lesions consist of open and closed comedones. Closed comedones, or “whiteheads,” are plugged follicles covered by an entire layer of epidermis and look like small skin-colored papules. Open comedones, or “blackheads,” are plugged follicles that are not covered by a layer of epidermis. The keratin in the follicle oxidizes when exposed to air, thus appearing black.⁷

Inflammatory lesions include papules, pustules, nodules, and cysts. A papule is a red inflamed bump, typically less than 5 millimeters in diameter, which can be painful. It develops from a comedone that has irritated surrounding skin. A pustule can be larger and is filled with white or yellow pus. Nodules and cysts represent a more severe form of acne with the potential to scar. A nodule is greater than 5 millimeters in diameter with no visible center and is usually hard and painful under the surface of the skin. A cyst is a deep, fluid-filled lump that can be extremely painful. They also have the ability to connect to each other under the skin.⁷ These lesions with the potential to scar can result in lifelong sequelae far beyond their immediate presentation, as disfigurement from severe acne is known to lead to increased rates of depression, anxiety, and suicidal ideation.¹

Acne severity can be clinically classified as mild, moderate, or severe (Table 1) per the guidelines of the American Academy of Pediatrics (AAP). This classification is typically based on the number of lesions, types of lesions, and amount of skin involved. Though there are several grading systems that can be used to assess the severity of a

patient’s acne, most assessments are made on a subjective, clinical interpretation by the provider.¹⁰

Table 1. AAP Acne Severity Grading Scale

Acne Severity	Lesion Types	Lesion Distribution
Mild	Comedonal Inflammatory Mixed	Central face common Scattered, superficial
Moderate	Comedonal Inflammatory Mixed	More widespread Potential for scarring
Severe	Inflammatory Nodular Mixed	Extensive skin involvement Widespread, deep Potential for widespread scarring

Treatment

Treatment modalities target the four pathophysiologic determinants of acne and are tailored to the specific type of acne present. Because of the chronic nature of disease, treatment typically lasts for a minimum of six months with a low level of maintained treatment after that period for any recurring symptoms.¹¹ Per the AAP, treatment of acne can be difficult in the pediatric population due to potential medication interactions and their impact on growth and development. The best approach is to use the least aggressive medication regimen that is effective and that does not encourage the development of antibiotic resistance¹⁰. With this in mind, the most up to date AAP guidelines for the treatment of pediatric acne can help guide providers in their treatment modalities based on the severity of their patients’ acne (**Table 2**).

Table 2. AAP Treatment Recommendations for Pediatric Acne

Acne Severity	Treatment Modality(ies)	Pathophysiologic Mechanism	Considerations
Mild	Benzoyl peroxide (BP) + Twice daily face washing	Targets <i>C. acnes</i>	Increased risk of sunburn, sunscreen use recommended
	Topical Retinoid	Comedolytic Anti-inflammatory	Can cause skin irritation; concurrent moisturizer use recommended
Moderate	Topical Retinoid		
	Topical Antibiotic (clindamycin, erythromycin) + BP	Targets <i>C. acnes</i>	Use in combination with BP to prevent <i>C. acnes</i> resistance
	Oral Antibiotic (doxycycline, minocycline)	Targets <i>C. acnes</i> Anti-inflammatory	Doxycycline and minocycline for patients age ≥ 8 years
Severe	Topical Retinoid + BP + Oral Antibiotic		
	Hormonal Therapy (spironolactone, oral contraceptives)	Antiandrogen	Oral contraceptives only in pubertal females
	Oral Isotretinoin	Targets <i>C. acnes</i> Decreases hyperkeratinization Anti-inflammatory Antiandrogen	Most effective Teratogenic Screen for depression prior to use Possible associations with bone changes and IBD

Mild acne requires only over the counter treatment. Current recommendations suggest twice daily face washing with a soap-free cleanser and topical benzoyl peroxide (BP). BP targets *C. acnes* by destroying its cell wall and also has comedolytic and anti-

inflammatory properties. It can be used as monotherapy in mild to moderate acne, as well as part of combination therapy for severe or treatment refractory acne. Importantly, BP helps limit the development of *C. acnes* resistance to antibiotics when topical or oral antibiotics are also used in the treatment plan¹⁰.

Another treatment option for mild to moderate acne is topical retinoids, such as tretinoin. Topical retinoids are comedolytic and anti-inflammatory and prevent the formation of new comedones and inflammatory lesions. These topical agents are typically well-tolerated and should be used with moisturizer to prevent stinging and dryness of the skin. Topical antibiotics, such as clindamycin and erythromycin, are another option for moderate acne. These agents target *C. acnes* to reduce bacterial load, which reduces the inflammation cascade that causes comedone rupture.¹¹ However, topical antibiotics should not be used as monotherapy due to the development of bacterial resistance. It should only be used in combination with BP to prevent resistance.¹⁰

For severe acne or moderate acne refractory to topical treatments, systemic therapy is the next step in the therapeutic ladder. An oral antibiotic, such as doxycycline or minocycline, can provide strong antibacterial and anti-inflammatory effects. However, doxycycline and minocycline should be used only in patients aged of 8 or older due to their side effect profiles. Doxycycline can result in photosensitivity so patients should wear sunscreen daily with use. Minocycline can cause hyperpigmentation of the skin and, rarely, drug hypersensitivity. This includes drug-induced lupus, drug rash with eosinophilia and systemic symptoms (DRESS) syndrome, and Stevens-Johnson syndrome (SJS). Precaution must be taken to avoid combining both topical and oral

antibiotics in order to avoid the development of bacterial resistance to therapy. For children under the age of 8, systemic antibiotic therapy is not recommended due to its significant side effect profile. However, erythromycin, azithromycin, and trimethoprim/sulfamethoxazole may be used with extreme caution in severe cases with monitoring for dangerous adverse effects such as toxic epidermal necrolysis and SJS.¹⁰

Antiandrogen therapy, such as hormonal oral contraceptives or spironolactone, can help treat moderate to severe hormonal acne in women by decreasing sebum production caused by high androgen presence. Oral contraceptives should be given only to women who have reached puberty and patients should be asked about smoking history and family history of thrombotic events prior to starting therapy.

The most effective oral therapy for severe acne is isotretinoin, more commonly known by its former brand name, Accutane.¹² It is the only acne medication with effects on all four components of acne pathophysiology, making it powerful in fighting severe, nodulocystic acne. With proper use, isotretinoin has up to an 80-90% rate of effectiveness after six months of use with a low recurrence rate. However, its use must be closely monitored due to its side effect profile with regular checks of liver enzymes and triglyceride levels.

The side effect profile of isotretinoin is extensive. Isotretinoin is teratogenic and patients' pregnancy status should be monitored monthly to avoid harm to a potential fetus.¹⁰ There is also a possible association with bone changes, though the relationship is controversial. Animal studies have found an increased risk of bone fracture or hyperostosis with prolonged use of isotretinoin but there is conflicting data from human studies regarding

changes in bone mineralization.¹⁰ Most studies agree that a single course of isotretinoin does not cause bone changes.^{13,14} Hyperostosis is known to be associated with long-term retinoid use, though this outcome is rare in patients taking retinoids for acne.¹⁰ There may also be a relationship between isotretinoin and inflammatory bowel disease (IBD), specifically ulcerative colitis (UC). One study of 85 cases of IBD patients taking isotretinoin found that 68% of cases of IBD were “probably” caused by the isotretinoin¹⁵; however, several other large case-control studies have found no such association.^{15,16,17} Confounders to this association include concurrent antibiotic use that can predispose patients to developing IBD and that IBD often develops around the same age that severe acne develops in adolescents.¹⁰ Also of note, there have been reports of depression and suicidal ideation amongst users; however, the data is mixed on whether isotretinoin actually causes depression and suicide.¹⁸ Nevertheless, all patients are carefully screened for depression before starting isotretinoin.¹¹

Psychosocial Impact of Acne in Adolescents

Acne is considered a psychodermatological disease, a disease that has manifestations in both the mind and the skin. There are two categories of psychodermatological disease: primary psychiatric disease with dermatologic symptoms and primary dermatologic disease with psychiatric symptoms. Acne is an example of the latter.¹⁹ Up to 80% of adolescents with acne will experience a negative psychosocial effect of acne during their disease course, including depression, anxiety, low self-esteem, unemployment, body dysmorphic disorder (BDD), and a decreased quality of life.² Acne severity has not been shown to correlate with likelihood of developing these comorbidities; adolescents with

mild to moderate acne have been found to have similar rates of these comorbidities when compared to adolescents with more severe acne.²⁰

These psychiatric conditions are especially significant during one's teenage years, as adolescents are already psychologically vulnerable during these critical years of cognitive maturation. Additionally, acne is the second most common skin condition to result in suicide, making identification of psychological comorbidities of dire importance in the evaluation of adolescents with acne.²¹ This issue is particularly important for teenagers growing up in the 21st century, in a culture that places heavy emphasis on physical appearance. The widespread use of social media amongst teenagers allows a greater opportunity for comparison to their peers, emphasizing that they are "different" because of their acne.²⁰

Several studies have highlighted the association of psychological comorbidities present in adolescents with acne compared to control groups with the most common diagnoses being anxiety, depression, and BDD. In one study of 104 adolescents with acne, 16.3% presented with a new diagnosis of generalized anxiety disorder (GAD) during their disease course while only 5.6% of their acne-free control group peers did²¹. In another study, adolescents with acne were at a 3.45 times greater risk of developing anxiety compared to their acne-free peers.² The presence of anxiety during adolescence is associated with several adverse outcomes: irritability, difficulty in school, increased likelihood of substance abuse, difficulty forming relationships, physical sequelae such as chronic abdominal pain or difficulty sleeping, and avoidance of normal routines.²² Early

identification of these problems is key in diagnosis and treatment, especially in the context of acne.

Rates of depression in adolescents with acne are slightly lower than rates of anxiety with one study finding 11.5% of participants having a new diagnosis of depression during their disease course and another that adolescents with acne are 2.46 times more likely to develop depression than their acne-free peers.^{2,15} The identification and treatment of depression in teens with acne is critical, as the consequences of depression in teens can be devastating. They can experience emotional changes such as sadness, irritability, loss of interest in their usual activities, low self-esteem, feelings of worthlessness, self-criticism, and trouble concentrating. Physically, they can experience loss of energy, insomnia, changes in appetite, slowed thoughts or speech, and worsening hygiene. Behavioral consequences of teenage depression include social isolation, worsened performance in school, and social isolation from family and peers. Importantly, these teens are at a much higher risk of self-injurious or suicidal thoughts.²³ Therefore, early detection is of utmost importance in preventing these outcomes.

The third common psychological comorbidity of adolescent acne, BDD, is defined as an obsessive-compulsive spectrum disorder involving a preoccupation with a perceived defect in physical appearance that is not observable or significant to others and results in repetitive, obsessive behaviors and thoughts.²⁴ Skin conditions are the most common cause of obsessions in adolescents and common compulsive behaviors among acne patients with BDD include picking, comparing themselves to others, and use of makeup. The sequelae of BDD in adolescence can be detrimental to development.

Negative outcomes include social isolation, self-consciousness, and decreased performance in school. Most significant, up to 81% of adolescents with BDD have suicidal ideations and 44% attempt suicide.²⁵ Again, this highlights the importance and the need for providers to identify these potential outcomes in their adolescent acne patients.

Beyond the psychiatric diagnoses that can accompany acne, two other important negative psychosocial outcomes include impaired self-esteem and impaired quality of life amongst patients. In one survey of 18-year-old students, those with acne reported lower self-attitude, feelings of usefulness, sense of pride, self-worth, and body satisfaction than their peers without acne.²⁶ In another, adolescents with acne had a lower quality of life than adults with similar acne severity, according to the Dermatology Life Quality Index (DLQI). The aspects of life that were affected based on this questionnaire include physical symptoms of disease, performance at school or work, social relationships, family relationships, and daily activities such as running errands and exercising.¹⁹ The social impacts of acne can have significant negative impacts on nearly all aspects of everyday life for patients. Furthermore, acne during the formative years of adolescence can have especially detrimental effects, causing dissatisfaction to the patient and worsening their outlook on life and relationships. Though they are not psychiatric diagnoses, it is important to identify these issues in acne patients as early as possible in order to avoid these negative outcomes and to improve quality of life in patients.

Identifying Psychosocial Comorbidities in Patients

The prompt assessment for and identification of psychosocial comorbidities in acne patients is the only way that these outcomes can be treated appropriately. This identification starts at the first visit, where providers can use a variety of skills and tools to assess their acne patients.

Foremost, it is important for the provider to be able to elicit psychosocial concerns in talking with their patients, since patients and parents may not be aware of these problems²⁷. In particular, adolescents may show symptoms of anxiety and depression in different ways than adults so it is up to the provider to be aware of these differing presentations. For example, adolescents with anxiety may present with frequent nightmares, difficulty concentrating at school, frequent absences from school due to anxiety, and need for reassurance from adults that everything is going to be okay.²⁸ Adolescents with depression may present with anger and irritability rather than sadness and they may continue to maintain close relationships with their friends, while distancing themselves from adults.²⁹ However, providers can struggle in identifying these symptoms verbally. In one study, dermatologists brought up conversations about mental health in only 39% of their interviews and detected anxiety or depression in only 25% of their patients²⁷. Consequently, screening tools can provide a much more reliable elicitation of psychosocial impacts of disease in patients and standardize how patients are evaluated.

There are several questionnaires specific to pediatric and adolescent patients that assess how their acne has impacted them beyond their physical symptoms. One of these

is the Children’s Dermatology Life Quality Index (CDLQI), designed for children aged 4-16 years. It consists of 10 questions (Table 3) on how much their skin conditions have affected different aspects of their daily lives such as their emotions, friendships, extracurricular activities, sleep, and academics. It differs from the version for adults, the Dermatology Life Quality Index (DLQI), by eliminating questions related to sexual relationships and work. The higher the numerical score of the questionnaire, the more of an impact the disease has had on the patient.²⁷

Designed to assess impact related to acne specifically, the Cardiff Acne Disability Index (CADI) is another commonly used tool. This is a shorter version of the Acne Disability Index and is designed for teenagers. It asks five questions (Table 3) about the physical, emotional, and social impacts that their disease has had on them. Scores have not been shown to be correlate with acne severity, consistent with the notion that acne can psychosocially impact patients regardless of whether disease is mild or severe. However, scores do improve after successful treatment.³⁰ With these short questionnaires, providers can easily begin to assess for psychosocial symptoms of disease and use the results as a starting point for appropriate treatment beyond skincare alone.

Table 3. Acne Symptom Screening Questionnaires

CDLQI	1. Over the last week, how itchy, "scratchy", sore or painful has your skin been?
	2. Over the last week, how embarrassed or self conscious, upset, or sad have you been because of your skin?
	3. Over the last week, how much has your skin affected your friendships?
	4. Over the last week, how much have you changed or worn different or special clothes/shoes because of your skin?
	5. Over the last week, how much has your skin trouble affected going out, playing, or doing hobbies?

	6. Over the last week, how much have you avoided swimming or other sports because of your skin trouble?
	7. If school time: Over the last week, how much did your skin problem affect your school work? If vacation time: how much over the last week, has your skin problem interfered with your enjoyment of the vacation?
	8. Over the last week, how much trouble have you had because of your skin with other people calling you names, teasing, bullying, asking questions or avoiding you?
	9. Over the last week, how much has your sleep been affected by your skin problem?
	10. Over the last week, how much of a problem has the treatment for your skin been?
CADI	1. As a result of having acne, during the last month have you been aggressive, frustrated, or embarrassed?
	2. Do you think that having acne during the last month interfered with you daily social life, social events or relationships with members of the opposite sex?
	3. During the last month have you avoided public changing facilities or wearing swimming costumes because of your acne?
	4. How would you describe your feelings about the appearance of your skin over the last month?
	5. Please indicate how bad you think your acne is now: a) The worst it could possibly be, b) A major problem, c) A minor problem, d) Not a problem.

Psychosocial Treatment

After a positive screen, providers can approach both the patient and their family members to discuss next options. They may choose to further investigate the results of the screen by discussing the scores with the patient to express their concern for the patient's wellbeing. It is important, especially in a pediatric population, that the provider remains empathetic and understanding in order to establish a trusting relationship with the patient and his or her family. They can ask follow-up questions to elaborate on some of the answers in the screen to gain a better understanding of their concerns and ask family members for changes that they have noticed in the patient's behavior. At this

point, the provider can decide next steps: continue monitoring these symptoms at the dermatology clinic, suggest follow-up with a primary care provider, or set up a referral to a psychologist or psychiatrist³¹. In some cases, counseling for the parents is also beneficial, as better parental understanding of their child's skin condition has been shown to improve outcomes in the condition²⁷.

Unfortunately, there are several barriers preventing patients from successfully following up on their referrals to psychiatry. First, there is simply a lack of pediatric psychiatrists available to fulfill the needs of many communities. This can shift the responsibility of helping patients through their psychosocial symptoms onto dermatologists and primary care providers, many of whom do not have substantial training in pediatric and adolescent psychiatry³². This problem can be further exacerbated by the fact that, for many patients, referrals mean more appointments and more of their time spent at doctors' offices. They need to make additional phone calls, go to different offices, and interact with more people, especially if referrals are made to psychiatrists outside the group that the patient initially presented to.

Beyond referrals to psychiatrists, another form of treatment in pediatric dermatology is participation in behavioral health intervention. Behavioral therapies implemented during childhood, such as healthy lifestyle interventions or participation in support groups, have been found to have a positive impact on health both at the time of treatment in childhood and once children reach adulthood.³³ These immediate and lasting impacts can prove very powerful in the treatment of many conditions, particularly acne, which can last throughout the lifetime.

One effective type of behavioral therapy that can be easily utilized by pediatric patients and their families is support groups. They are designed to create a sense of community for people suffering from the same or similar conditions, where they can share their stories and coping strategies. Importantly for conditions like acne, they have been found to be especially helpful in helping people with diseases that have significant effects on physical appearance. Beyond help for the patients, parents can also learn how other families help their children and be reassured that they are not going through their difficulties alone. The utility of these groups can be enhanced even further when a physician participates in the group with the families. They can provide education regarding the condition without the time constraints of a clinic setting and themselves learn about what their patients are going through so they can improve their practice in the future.³⁴

Establishing Behavioral Health Clinics

An emerging method of treatment for the psychosocial outcomes of many skin conditions, including acne, is multidisciplinary behavioral health clinics. These clinics combine dermatologic and psychological treatments in one setting, addressing both the physical and mental impacts of disease. Though these clinics fall under the umbrella of psychodermatology, identifying them as “behavioral health” clinics eliminates the stigma of the patient having a psychiatric illness. It also normalizes the presence of psychosocial outcomes with dermatologic diseases, helping patients accept that their experiences are not out of the ordinary.³⁵

An interdisciplinary care team for pediatric dermatology patients has been found to be extremely effective in treatment. This is for several reasons: having psychologists work with patients eliminates the burden on dermatologists of providing psychological care when they may not be familiar with treatment standards; patients have to attend fewer appointments; dermatologists spend less time finding appropriate referrals; and combined clinics are more cost effective than having to see multiple providers separately. Importantly, these interdisciplinary clinics can educate providers in many other fields about best practices in treating patients who present with symptoms of disease beyond their own specialty.³⁶

Existing Research

Article 1: The evaluation of psychiatric comorbidity, self-injurious behavior, suicide probability, and other associated psychiatric factors (loneliness, self-esteem, life satisfaction) in adolescents with acne: A clinical pilot study

A study by Eroglu et al. assessed the presence of a number of psychosocial outcomes in adolescent acne patients, including psychiatric disease, life satisfaction, self-esteem, loneliness, and self-injurious behavior. One hundred four patients with acne aged 14-18 were recruited and selected for this study from patients at the Dermatology Clinic at the Suleyman Demirel University in Turkey. These patients were compared to 102 participants who did not have acne but were of similar age and demographics as their counterparts with acne. Both groups took a number of surveys to assess for the presence of the preceding variables.

Outcomes of the study found that 37.5% of patients with acne were diagnosed with a psychiatric disorder, whereas only 15.7% of patients in the control group were ($p < 0.001$). The three most common diagnoses were generalized anxiety disorder, posttraumatic stress disorder, and major depressive disorder. Additionally, patients with acne reported worse scores in life satisfaction ($p = 0.001$), loneliness ($p = 0.004$), self-esteem ($p < 0.001$), self-assessment ($p = 0.038$), and hostility ($p = 0.045$) compared to adolescent counterparts without acne. Seventy percent of patients with acne also reported the presence of self-injurious behavior compared to only 26% of patients without acne. The most commonly reported self-injurious behaviors were prevention of wound healing, hair picking, scratching, and pinching. Rates of suicidal ideation did not differ between the two groups.

Interestingly, scores for many of these variables were worse for acne patients with a psychiatric diagnosis than for acne patients without a psychiatric disease. In particular, scores for loneliness, negative self-assessment, and suicide probability were worse in acne patients with major depressive disorder. Additionally, quality of life scores were lower for acne patients with any psychiatric disease than for acne patients without a psychiatric diagnosis.

The impact of this study is substantial. The authors recognize the commonality and seriousness of concomitant psychiatric diagnoses with acne and recommend that screenings for these outcomes be present at every visit with the dermatologist. The authors also recommend a multidisciplinary approach for adolescent acne treatment with both dermatologists and psychiatrists.

This study has several limitations. First, selection bias was possible with the use of participants from a dermatology clinic. This limits the generalizability of the study to adolescents who have been evaluated by a dermatologist for their acne, and may not be generalizable to those with acne who have not been to a clinic for treatment. Secondly, results are subject to recall bias with subjective rather than objective analysis of their mental health. Similarly, adolescents may be reluctant to share their full experiences due to embarrassment, resulting in underreporting. Lastly, it is difficult to prove causation using a cross-sectional study and there may have been other factors in the participants' lives explaining their outcomes. Reverse causality could also be at play, with negative life experiences influencing the acne. Despite these limitations, this study highlights the need for concurrent psychological and medical, or psychodermatologic, treatment for acne in adolescents.²¹

Article 2: Dermatitis artefacta and artefactual skin disease: the need for a psychodermatology multidisciplinary team to treat a difficult condition

One of the first studies designed to assess the effectiveness of a psychodermatologic approach to treatment for a specific skin disease was performed by Mohandas et al. The researchers reviewed the case notes of 28 patients with dermatitis artefacta (DA) who were treated at the psychodermatology clinic at the Royal London Hospital between 2003 and 2011. DA is a condition in which lesions and excoriations are self-inflicted by the patient, usually as a manifestation of an underlying psychological or emotional stressor. The most common place for these self-inflicted lesions is the face, followed by the legs, hands, forearms, and trunk, making it a very visually-noticeable condition. The patients

treated for DA with this multidisciplinary, psychodermatology approach ranged in age from 13 to 70 with 86% of the patients being female and 32% being less than 16 years old.

The treatment for each patient involved attending appointments with a dermatologist and an adult psychologist or psychiatrist concurrently. All participants under the age of 16 had a child or adolescent mental health specialist present, in addition to the adult psychologist or psychiatrist. Patients attended these appointments for various amounts of time, from as few as two appointments to see improvement in their condition to up to four years of treatment.

Treatment outcomes were highly successful. Most (72%) of patients had either complete resolution or great improvement of their DA, 21% saw some improvement with continued follow-ups, and 7% did not attend their follow-up appointments. Importantly, the underlying psychological stressors that were causing the DA were identified and 39% of patients were newly diagnosed with a coexisting psychosocial disorder, such as anxiety or depression. Establishing a trusting patient-provider relationship was also shown to make patients feel comfortable in their treatment and encouraged them to continue attending their appointments.

This study was useful to gain insight into the success of including both dermatologic and psychological care in patients with difficult skin conditions but there were limitations. Foremost, this study looked at patients with DA with different disease courses from acne in that DA has a premeditating psychological stressor causing the visible symptoms and is rare compared to acne. Additionally, the study had a small

sample size and was subject to selection bias due to the nature of a retrospective case review and rarity of the disease. Lastly, DA does not have a well-established disease course so it is difficult to compare outcomes based on treatment as a clinic such as this compared to more more traditional forms of medical treatment.³⁷

Article 3: Establishing and developing a Teenage and Young Adult dermatology clinic with embedded specialist psychological support

Hunt et al. developed a similar approach in multidisciplinary care of skin conditions in 2013. In this study, researchers developed a teen and young adult dermatology clinic embedded with staff psychologists whom the patients could see to address the psychosocial outcomes of their disease process. Patients with various skin conditions (N=80) were followed throughout the course of their treatment at this clinic and outcomes were measured using the Teenagers' Quality of Life Index (T-QoL) and surveys regarding their satisfaction with the clinic.

Designed for adolescents between the ages of 11 and 17, the clinic begins treatment by having the patients fill out a T-QoL. The patients then have an appointment with a dermatologist during which the results of the questionnaire are reviewed and medical treatment is offered. The patients then have the option to seek further same-day care with a staff adolescent psychologist in a one-on-one consultation to discuss how their disease has impacted them and offer different behavioral health interventions to help them overcome these challenges. These include cognitive behavioral therapy, mindfulness exercises, and help in creating a support network with the patients' family and friends. The patients are not required to see the psychologist but they are always

there if desired. In 2016, 52% of patients who attended the clinic sought treatment from the psychologist.

Though the clinic was available to patients with any skin condition, data on quality of life improvement was only analyzed for 13 patients with the two most common skin conditions seen at the clinic in 2016: eczema ($n = 9$) and psoriasis ($n = 4$). Patients who were analyzed attended at least two sessions with the psychologist. For patients with eczema, there was a statistically significant improvement in their T-QoL scores after their treatment ($p = 0.01$). T-QoL scores also improved for patients with psoriasis but the sample size was too small for results to be statistically significant ($p = 0.12$). Forty-one patients with any skin condition and seen at the clinic in 2016 responded to a patient experience survey given after their treatment. Responses were extremely positive with 100% reporting that they were “satisfied” or “very satisfied” with their appointments.

This study provides great insight into the benefits of providing concurrent medical and psychological treatment for adolescents with difficult skin conditions, showing that the quality of life of their patients improved after at least two visits with the psychologist. Patients also benefited from having both services at one clinic so that they did not have to travel to multiple locations. However, this study has limitations. First, the sample size of patients whose T-QoL scores were analyzed was extremely small and focused on only two skin conditions. Additionally, the results of the patient satisfaction survey were subject to bias as it is possible that only those who had a positive experience responded to the survey. Importantly, patients at this clinic were not required to utilize the psychologist. These patients were also included in the analysis of the satisfaction survey

This makes it difficult to determine whether the satisfied patients used the psychologist as well and limited the number of patients whose T-QoL scores could be analyzed in this study. Lastly, no data was collected on improvement in the skin condition itself.³⁸

Article 4: Improvement of pruritus and quality of life of children with atopic dermatitis and their families after joining support groups

Another form of psychosocial treatment of skin disease, support groups, has been shown to be helpful not only for patients, but for their families as well. Weber et al. found that, for children with atopic dermatitis, support groups improved both the disease outcome and quality of life in their patients. Atopic dermatitis, or eczema, is a common skin condition characterized by dryness and pruritus, causing extreme discomfort both physically and mentally. Similar to acne, atopic dermatitis can lead to anxiety, depression, decreased quality of life, and negative implications at school and with social relationships.

Thirty-six patients with atopic dermatitis, aged of 2-16, and their families were chosen to participate in this study. Half of the patients were randomly selected to participate in the support groups and the other half were part of the control group. Those who received the intervention participated in support groups twice a month for six months with an average attendance rate of 75%. The children and their parents were part of different support groups. In the children's group, activities were run by a psychiatrist and focused on education about the disease and creative activities, such as drawing or performing skits. Parents' meetings were run by a dermatologist that facilitated discussions about the parents' experience with their child's disease.

Participants took surveys regarding the severity of their pruritis and their quality of life (using the CDLQI) before and after treatment. After six months, results of the intervention were extremely successful. More patients who attended the support group reported improvement in their pruritis than those in the control group ($p = 0.023$). Similarly, patients in the intervention group showed greater improvement in their quality of life scores compared to those in the control group ($p < 0.01$) with the areas showing the most improvement being leisure and personal relationships. Additionally, support groups gave parents a sense of belonging in a community, new advice on how to help their children, and helped establish a strong relationship with the provider. These results suggest that support groups can improve both disease state and psychosocial sequelae of disease in children and adolescents with atopic dermatitis and may have similar results in patients with acne, as both diseases have similar psychosocial effects.

One limitation of this study is its generalizability to other skin conditions, such as acne. While acne is problematic due to its effect on physical appearance, the main issues caused by atopic dermatitis are pruritis and skin dryness. However, psychosocial outcomes between the two diseases are similar. Additionally, results of the surveys were subject to recall bias, as the surveys could be filled out up to 24 months after the conclusion of the treatment. Improved outcomes could have been caused by factors besides the benefits of the support group.³⁹

Article 5: Role of behavioral health in management of pediatric atopic dermatitis

In another study on pediatric atopic dermatitis, Klinnert et al. performed a literature review of studies assessing various behavioral health treatment modalities for the disease

and their success in both disease management and impact on patients and their families. One intervention that led to improvement in both severity of disease and quality of life was education about the disease itself and different coping mechanisms. Education aimed at the patients helped them control their scratching habits and stress levels; education for families helped them provide better support for their children. It is recommended that a multidisciplinary team involving the medical provider and behavioral health specialists, such as a psychologist, provide this education. Other tools that behavioral health specialists can use for intervention are cognitive-behavior therapy, parenting behavior training, biofeedback techniques for stress control, mindfulness therapy, and sleep consultations.

The article also introduces the concept of a “biopsychosocial” model of care that addresses physical symptoms, thoughts and behaviors, and relationship and community outcomes that can result from atopic dermatitis. This model has three steps: 1) assess the patients and their families for both physical and psychosocial outcomes, 2) provide interventions to address those outcomes, and 3) maintain these interventions to ensure successful long-term disease management. It is important that the assessment be focused towards the age at which the patient presents for treatment. For example, adolescents with atopic dermatitis typically have had the disease for many years and have established their own coping mechanisms for accompanying pruritis and skin dryness. Thus, assessment should be focused on psychosocial outcomes that are common at this vulnerable stage of mental development, such as anxiety, depression, and relationships with their families and friends.

Successful interventions must be carried out by an interdisciplinary team consisting of a medical provider and behavioral health specialist. For long-term success, it is crucial that the clinicians share the same goals for the patients and their families. One successful example of this multidisciplinary, biopsychosocial approach that researchers analyzed was at the Atopic Dermatitis Center at Boston Children's Hospital. At this center, an allergist provided both a physical assessment and education about the disease. Simultaneously, a child psychologist addressed coping mechanisms and stress management techniques for the patients and their families. Though this example had both the medical provider and the behavioral health specialist in the same clinic, the study authors state that they could also be in different settings and have successful outcomes.

This study proves very powerful in assessing the benefits of combined medical and behavioral health interventions for a well-rounded treatment for pediatric patients with atopic dermatitis. Given that the psychosocial outcomes of atopic dermatitis are similar to those of acne, similar behavioral health interventions could be equally as impactful. However, this study has its limitations. Like the previous study, its generalizability is limited due to its focus on atopic dermatitis only. Additionally, findings were subject to selection bias as there was no systemic search method described and the authors may have only chosen articles with positive findings. That said, it provides several suggestions for a comprehensive treatment not only involving the wellbeing of pediatric patients but their entire families as well.⁴⁰

Need for Further Research

A review of the literature emphasizes the need for a more well-rounded acne treatment that prioritizes mental health in addition to physical wellbeing. Acne has the potential to lead to numerous negative outcomes in young patients, including decreased quality of life, comorbid psychiatric disorders, and suicidal ideation. Research shows that psychosocial interventions have been successful for other dermatologic conditions with similar outcomes, such as dermatitis artefacta or atopic dermatitis. However, few studies have examined the utility of psychosocial intervention for acne specifically. It is also known that a multidisciplinary treatment approach is recommended for ensuring that both acne and its negative psychosocial outcomes are properly identified and treated. There has not yet been a study performed that examines acne patients' outcomes after treatment at a behavioral health clinic with simultaneous treatment by a dermatologist and psychologist or psychiatrist. Such a clinic could fill the need for proper identification and treatment of acne and its psychosocial comorbidities. The following study aims to assess these outcomes in adolescent acne patients after several sessions at one of these clinics by treating the patients' acne, identify psychosocial comorbidities, and improve patients' quality of life.

METHODS

Study Design

This project will be a single-arm before and after study in which pediatric acne patients will attend a behavioral health clinic designed to evaluate and improve the negative psychosocial outcomes of their skin condition. Treatment at this clinic is an adjunct to the medical care of their acne. Patients' quality of life, psychosocial comorbidities, and acne severity will be measured via surveys and clinical evaluation at their first session, at their third session, and at their last session at the clinic.

Study Population and Sampling

The study population will consist of patients who are treated at the behavioral health clinic in the pediatric dermatology department at Boston Medical Center (BMC), within a given year. More specifically, the inclusion criteria are that the patient: is aged 10-16 years; has a diagnosis of acne; and is experiencing symptoms of a negative psychosocial condition concurrently with his or her acne.

The patient pool will be selected as a sample of convenience, and all patients willing to participate in the study will be treated at the behavioral health clinic. It is estimated that 20 acne patients will participate in this study over the year. This is based on historical figures regarding the number of acne patients fitting the inclusion criteria who have been treated at this clinic in the past.

Intervention

The intervention for those pediatric acne patients experiencing negative psychosocial outcomes of their disease is to attend a behavioral health clinic to identify and

appropriately treat these issues. Patients will attend these clinic sessions once a month and each session will be between 30-60 minutes. Patients will attend a minimum of three sessions at the clinic but can attend as many as needed to see improvement. Participants in the session will include: the patient; the patient's dermatologist; and a licensed psychologist. Parents may be present at the session if they so choose; however, the dermatologist, psychologist, or patient can request that the parent(s) not be present.

The structure of each session will be discussion-driven and targeted at the patient's presenting symptoms and complaints. Though the conversation will be different in each session for each patient, a general outline of a typical session is as follows. First, the dermatologist will ask patients about their acne severity and whether their treatment regimen is helping, how acne is impacting their day-to-day life, and whether they are experiencing any difficulties from a psychosocial standpoint. At this point, the dermatologist may alter the patient's treatment regimen. After elicitation of the patients' symptoms and complaints, the psychologist will address these issues with targeted responses. These may include suggestions for coping strategies (such as meditation or mindfulness exercises), advice on how to create supportive networks with friends and family members, and referrals to further services and specialists. Examples include referrals to social workers for further assistance with social supports in the home, psychiatrists for medical treatment of psychiatric illnesses like anxiety or depression, psychologists for cognitive behavioral therapy, and neurologists for medical consultations of identified neurologic conditions.

Study Variables and Measures

The primary outcome measures will include quality of life, psychiatric diagnoses identified at the clinic, and acne severity. Quality of life will be assessed via the questionnaire numerical values of the CDLQI (Appendix 1). The CDLQI is a short, 10-question survey that assesses how the patient's skin condition has affected different aspects of their daily life such as their emotions, friendships, extracurricular activities, sleep, and academics. Psychological conditions diagnosed at the clinic will be assessed clinically by the dermatologist and psychologist. Acne severity will be assessed clinically as mild, moderate, or severe, as outlined by the AAP acne severity scale¹⁰ (Table 1). The goal is to obtain an improvement in measures for quality of life and acne severity and identify previously undiagnosed psychological conditions so that they can receive proper treatment.

Project variables include the patients' age, gender, and past medical history, including previously diagnosed psychological conditions. These demographics will be obtained using the patients' medical records.

Potential confounders for this study include whether a patient has already been receiving psychosocial support for their conditions outside of the behavioral health clinic, how many sessions the patient attends, whether the patient attends all of his or her scheduled sessions, the patient's willingness to act on the advice and interventions given in the clinic, the patient's adherence to his or her medical acne treatment regimen, the patient's support system outside of the clinic, and the patient's self-awareness and

understanding of his or her condition. Data on these factors will be collected and recorded during the course of the study within the patient's chart.

Recruitment

While being roomed prior to the patient's first session at the behavioral health clinic at the pediatric dermatology department at BMC, the patient will be screened to see if he/she is an meets inclusion criteria for the study. If the patient appropriately fits the inclusion criteria, the research assistant will describe the study to the patient, ask if he/she wants to participate, and ask the parent if they agree. Then, they will be offered consent and assent forms to be signed by a parent and the patient, respectively.

Data Collection

After the patient has been recruited into study, his/her demographic factors will be obtained from the medical record and will be organized into a Microsoft Excel document. This data will then be combined with that of the other patients in the study to assess the overall effect of the intervention. The document will be encrypted for security of patient data. Each participant will be tracked in the document using an individual identification code in order to preserve anonymity. This code will consist of their first initial, last initial, first digit of their medical record number (MRN), and last digit of their MRN.

While being roomed prior to first session at the behavioral health clinic, he/she will complete the CDLQI survey. The survey will be completed by hand and turned in to the dermatologist at the start of the session, and this will serve as the patient's baseline quality of life score. Patients will complete this survey again while being roomed prior to

their third session and again prior to their last session at the clinic. After each session, the data from the survey will be transferred into the Microsoft Excel document.

Acne severity will be also be assessed by the dermatologist during the first, third, and last session at the clinic. The dermatologist will record his/her findings in the patient's chart and this data will also be transferred into the Microsoft Excel document.

Psychological conditions diagnosed at the clinic will be evaluated clinically by the dermatologist and psychologist at each session. Findings will be recorded in the patient's chart and the diagnoses will be transferred into the Microsoft Excel document.

Data Analysis

After the period of one year, the data compiled in the Microsoft Excel document will be utilized to test the hypotheses of this study. The data on CDLQI scores will be used to obtain a mean and standard deviation for each of the three sets of survey results. The data will be placed in a bar graph with error bars to observe the change in scores after multiple sessions at the clinic. Then, the difference in CDLQI scores at visits one, two, and three will be compared using a repeated measures ANOVA test ($\alpha = 0.05$). If the results are significant, the mean CDLQI scores at each visit will be compared using a paired t-test ($\alpha = 0.05$)

Data on acne severity will be used to create a bar graph displaying how many patients were classified as having mild, moderate, or severe acne at the first, third, and last session at the clinic. Then, a table will be created showing the percentage of patients who changed categories (i.e. the percentage of patients who went from severe to moderate, moderate to mild, etc) between the first and the last session. In order to

compare how CDLQI scores correlate with acne severity, a repeated measures ANOVA test ($\alpha = 0.05$) will be performed using CDLQI scores from visits one, two, and three. Then, a student's t-test ($\alpha = 0.05$) will be used to compare CDLQI and acne severity.

The third variable of the study, psychiatric diagnoses made at the clinic, will be analyzed descriptively by counts and proportions of each diagnosis. Data from the Microsoft Excel document will be compiled into a table organized by the diagnosis and how many patients presented with that diagnosis. The table will also include how many patients already had a psychiatric diagnosis in their past medical history before attending the clinic, and how many of those were newly diagnosed at the clinic.

Timeline and Resources

The multidisciplinary team involved in the behavioral health clinic includes a pediatric dermatologist, a psychologist, and research assistant. The study will take place at the pediatric dermatology department at BMC, providing space for the clinic sessions to take place. A statistician consultation will be required for interpretation and analysis of data. The study will be performed over the period of one year, with 12 months of data collection and one month of data analysis (Table 4).

Table 4. Proposed Project Timeline

September 2021	IRB Submission
November 2021 – November 2022	Recruit eligible patients and conduct study
December 2022	Data analysis and study completion

Institutional Review Board

The study protocol will be submitted for review to the Boston University Medical Campus (BUMC) IRB for expedited review. This study design includes data collection and analysis through survey and interview of children under the age of 18, which meets 45 CFG 46.404 criteria for expedited review. Consent of a parent or a legal guardian and assent of the child will be required, as children are considered a vulnerable population.

CONCLUSION

Discussion

The aim of this study is to understand the benefits of a behavioral health treatment plan in addition to the medical treatment of pediatric acne, a condition with substantial psychosocial impacts that go beyond what is visible on a patient's skin. This will be one of the first studies to analyze the potential benefits of a multidisciplinary behavioral health clinic in the treatment of pediatric acne and its psychosocial sequelae. The results will provide clinically-based evidence for the importance of addressing the negative psychosocial impacts of pediatric acne and how a behavioral health clinic can improve patient outcomes.

This study design has significant advantages compared to similar studies. While previous research advocates for the implementation of some sort of psychosocial treatment of acne, studies often lack how this treatment should be approached. This study offers an approach in the form of a behavioral health clinic. Furthermore, while the use of similar multidisciplinary treatment teams has been studied for other pediatric skin conditions such as atopic dermatitis or psoriasis, no studies have been performed to evaluate their usefulness for pediatric acne, specifically.

There are some anticipated obstacles that may be encountered during this study. First, it may be difficult to recruit enough eligible patients to participate in the study in order to obtain adequate statistical power, given that the behavioral health clinic is available to patients with many different skin conditions. Only patients with acne are eligible to participate in the study. Another anticipated obstacle is making sure that

participants attend all of their sessions at the clinic and implement the suggestions and referrals that they are given at each session. Similarly, it may be difficult to ensure that patients are following their acne medication regimens.

A major limitation of this study is small sample size. The study is being conducted on patients with one specific condition at one behavioral health clinic, limiting the number of patients eligible to participate. Consequently, the sample size may not be large enough to perform specific subgroup analyses. Another limitation is that participants in the study may present with a wide variety of psychosocial symptoms related to their acne. It is possible that different psychiatric conditions will respond differently to the treatment at the clinic and the sample size is too small to identify statistically significant differences. These limitations are due to the fact that this project is a single arm before and after study analyzing preliminary data regarding the utility of the intervention. After this study, next steps would be to expand the design to a larger sample size as a cohort study comparing outcomes to patients who are not receiving the intervention.

Summary

Acne is a common disease of the pilosebaceous unit of the skin, presenting as noninflammatory comedones or inflammatory lesions such as papules, pustules, nodules, and cysts. Standard medical treatment ranges based on acne severity from topical to systemic therapies. However, treating the visible symptoms of acne is not enough. A comprehensive treatment plan is necessary to address the symptoms of acne that are not visible -- the psychosocial symptoms. The association between acne and negative

psychosocial sequelae is well known, especially in the pediatric population. The most common issues that occur concurrently with acne are anxiety, depression, body dysmorphic disorder, low self-esteem, and decreased quality of life. If unrecognized and untreated, these outcomes can have potentially devastating effects on children and adolescents, who are already going through extreme psychological and social changes as they undergo critical years in cognitive maturation.

While it is known that patients would benefit from a psychosocial treatment to address these consequences of their acne, what is lacking is concrete methods on how to diagnose these conditions, deploy psychosocial treatment, and the effectiveness of that treatment. Some pediatric dermatologists have investigated the usefulness of support groups for patients and their families³⁹, while others have established clinics where patients have the opportunity to see a psychologist in the same clinic after their appointment with the dermatologist.³⁸ Both of these have proved useful. One study found the utility of having patients talk to a dermatologist and psychologist at the same time, similar to this proposed study.³⁷ However, none of these studies addresses acne alone. There is a significant knowledge gap in the treatment of the negative psychosocial impacts of acne and no existing research on the success of psychosocial interventions. This study aims to fill this gap by investigating how a behavioral health clinic with a dermatologist and psychologist can improve outcomes of pediatric acne.

It is hoped that this study confirms the utility of a behavior health clinic in the identification of negative psychosocial outcomes of pediatric acne, treatment of these outcomes, and improvement in patients' quality of life. The clinic embraces the

multidisciplinary approach of concurrent treatment by a dermatologist and a psychologist; each can use their different skill sets to elicit dialog from patients, which can lead to the development of a unique treatment plan. With this approach, the physical and the mental diagnoses can be addressed at the same time. This allows for fewer appointments, less treatment time, and, most importantly, the establishment of a strong patient-provider bond. Ultimately, acne patients will benefit from a behavior health clinic from both a dermatologic and psychologic standpoint, providing an all-encompassing treatment approach to the potentially devastating psychosocial outcomes of acne.

Clinical significance

Acne is one of the most common skin conditions worldwide, affecting 85% of individuals aged 11-30.¹ Though diagnosed as a skin condition, acne is more than skin deep. It is estimated that up to 80% of individuals with acne will experience a negative psychosocial outcome as a result of their acne, regardless of the severity of their disease.² With potential sequelae such as anxiety, depression, body dysmorphic disorder, low self-esteem, and decreased quality of life, it is important to recognize these very common outcomes and have an effective method of addressing them.

Through participation in a behavior health clinic that allows patients to be treated by a dermatologist and a psychologist at the same time, patients will have the opportunity to receive treatment for all possible outcomes of their disease, both physical and mental. Our aim is to show that the behavioral health clinic identifies these outcomes and improves patients' quality of life that may have been negatively impacted by their

disease. By providing more information regarding a psychosocial approach to acne treatment, this study can help providers better identify and understand their patients' needs beyond medication alone. These findings may also be expanded to the treatment of other skin conditions, as psychosocial symptoms are present in many other common diseases, such as atopic dermatitis, psoriasis, and vitiligo. Additionally, with the extremely high prevalence of acne and likelihood of primary care providers treating the disease, it is important that they recognize its impacts beyond the skin. The results of this study may encourage primary care providers to take more time to identify psychosocial sequelae of their patients' primarily physical conditions and help expand management options.

APPENDIX

APPENDIX 1

Children's Dermatology Life Quality Index (CDLQI)⁴¹

The CDLQI and user license can be obtained here

<https://www.cardiff.ac.uk/medicine/resources/quality-of-life-questionnaires/childrens-dermatology-life-quality-index>

LIST OF JOURNAL ABBREVIATIONS

Adolesc Psychiatry	Adolescent Psychiatry
Am J Gastroenterol	American Journal of Gastroenterology
Ann Allergy Asthma Immunol	Annals of Allergy, Asthma, and Immunology
Arch Dermatol	Archives of Dermatology
Australas J Dermatol	Australasian Journal of Dermatology
Br J Dermatol	British Journal of Dermatology
Clin Cosmet Investig Dermatol	Clinical, Cosmetic, and Investigational Dermatology
Clin Exp Dermatol	Clinical and Experimental Dermatology
Dermatology	Dermatology
Int J Dermatol	International Journal of Dermatology
J Am Acad Dermatol	Journal of the American Academy of Dermatology
JAMC	Journal of Ayub Medical College Abbottabad
J Can Acad Child Adolesc Psychiatry	Journal of the Canadian Academy of Child and Adolescent Psychiatry
J Cosmet Dermatol	Journal of Cosmetic Dermatology
J Dermatol Nurses Asso	Journal of the Dermatology Nurses' Association

J Eur Acad Dermatol Venereol	Journal of the European Academy of Dermatology and Venereology
Nat Rev Dis Primer	Nature Reviews Disease Primers
Pediatr Dermatol	Pediatric Dermatology
Sci Rep	Scientific Reports
Semin Cutan Med Surg	Seminars in Cutaneous Medicine and Surgery
Transl Behav Med	Translational Behavioral Medicine

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