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An Assessment of Acne, Stress, and Psychological Symptoms in College Students: A Daily Diary Study

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AN ASSESSMENT OF ACNE, STRESS, AND PSYCHOLOGICAL SYMPTOMS IN COLLEGE STUDENTS: A DAILY DIARY STUDY

by
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Abstract

Acne is one of the most common and burdensome skin diseases in the United States. Many factors, such as stress and psychological symptoms are believed to contribute to the development and exacerbation of this skin disease, and prior research suggests a cyclic relationship between these factors and acne. College students are known to experience heightened levels of stress and psychological morbidities; yet, most of the previous research on acne and these factors have been limited to adolescents. As such, the current study aimed to assess the relationships between acne, stress, depression, and anxiety in college students over a longitudinal period using daily diary methodology. The results suggest a relationship between daily stress and final reports of acne symptoms and acne quality of life. Contradictory to predictions, there were no significant correlations found between daily objective acne and final stress measurements; however, there were significant correlations found between daily stress and final subjective acne. Furthermore, there were no significant correlations found between daily depression and daily objective or subjective acne. Finally, there were no significant correlations between daily anxiety and daily objective acne, yet a positive relationship was found between daily anxiety and daily subjective acne. These results suggest the importance of stress in the exacerbation of acne and also demonstrate the need for more research to better understand the relationship between acne, stress, and psychological morbidities. Future studies should further investigate these relationships using longitudinal methodology.

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Introduction

The skin is the largest organ of the human body, and throughout its compositional seven layers, many functions are carried out to ensure the integrity of the epithelium and the wellbeing of the individual. Primarily, the skin contributes to thermal regulation of body temperature, sensation of external stimuli, prevention of water loss, and inhibition of the entrance of foreign bodies such as bacteria and viruses (Tortora & Grabowski, 1993). This multifaceted organ varies greatly among individuals in texture, color, and sensitivity (Rawlings, 2006). These differences in the physical properties of the skin depend on many factors such as genetic inheritance, sun-exposure, and hormones (Lees, 2013; Tortora & Grabowski, 1993), and factors such as these have also been linked to the development of different types of skin disease (Segre, 2006; Tur, 2007).

Skin disease affects millions of people worldwide and is one of the most common illnesses experienced by humans (Hay et al., 2014). In 2013, nearly 85 million Americans visited a physician because of skin disease (Lim et al., 2017). Approximately one in three people are affected by skin disease at any given time in the United States (Bickers et al., 2006; Hay et al., 2014; Seth, Cheldize, Brown, & Freeman, 2017; Svensson et al., 2018). Over 3,000 different types of skin diseases have been identified (Lynch, 1994); yet, acne, atopic dermatitis, hair loss, psoriasis, rosacea, and skin cancer have been identified as the most common and burdensome skin diseases (Bickers et al., 2006). Skin disease is ranked the 18th leading cause of health burden worldwide and similarly affects both high-income and low-income countries (Hay et al., 2014). In addition to the burden on an individual's health, a person may also experience a financial burden following the development of skin disease. In 2004, the annual estimated cost of skin disease in the United States was

$39.3 billion (Bickers et al., 2006). In 2013, the total healthcare costs of skin disease in the United States was approximately $75 billion (Lim et al., 2017).

Acne is the most common skin condition in the United States, affecting approximately 50 million Americans at any given time (Bickers et al., 2006). In addition, acne is one of the most financially burdensome of the skin diseases (Lim et al., 2017). In terms of loss of productivity due to acne and treatment costs, the total cost of this disorder in the United States exceeds $3 billion per year (Bhate & Williams, 2013). Clinically, acne occurs when the sebaceous glands around a skin pore produce sebum which is unintentionally trapped within the skin pore. Once trapped, the bacteria, *Propionibacterium acnes*, attacks the sebum and consequentially induces skin inflammation and acne (Savage & Layton, 2010). The dermatological severity of acne ranges considerably; yet, 99% of reported acne cases are classified as acne vulgaris (Simpson & Cunliffe, 2008). Acne vulgaris is characterized by non-inflamed blackheads and whiteheads and also by inflamed papules, pustules, nodules, and cysts. Acne vulgaris may induce swelling, redness, heat, pain, bleeding, and scarring, consequently resulting in great discomfort and the alteration of physical features for an individual with this condition (Lee et al., 2014; Savage & Layton, 2010). Although numerous treatment options are available, such as topical ointments, prescription drugs, face washing, blue light therapy, and hormone therapy (Bolognia, Jorizzo, & Rapini, 2008; Fry, 1997; Gold, Andriessen, & Biron, 2009), most acne treatments are perceived as only partially effective in reducing the severity of their condition (Tan, Schlosser, & Paller, 2017).

Acne often onsets in puberty, and predominantly affects adolescents and young adults (Fry, 1997). Research has shown that 85 percent of individuals between the ages of

12 and 24 will experience at least some form of minor acne (Bhate & Williams, 2013). However, acne may affect individuals of all ages, and this skin disease is not limited to a specific gender or ethnicity (Bhate & Williams, 2013; Callender et al., 2014; Perkins, Cheng, Hillebrand, Miyamoto, & Kimball, 2011).

The pathogenesis of acne is multifaceted. Biological contributions such as sebum production and hormone fluctuations are also factors that influence the development of acne (Fry, 1997; Greydanus, 2015; Yosipovitch et al., 2007). In addition, specific genes may be responsible for the activation of the biological pathways that underlie acne development. For instance, one study found that acne has nearly 80% heritably with first degree relatives (Common, Barker, & van Steensel, 2019). In addition, environmental factors such as UV ray exposure and air pollution have also been shown to play a key role in worsening acne (Ju, Zouboulis, & Xia, 2009; Lee et al., 2015; Suh, Kwon, & Youn, 2002). Other factors such as diet, personal hygiene, and sleep demonstrate rather conflicting evidence with regard to influence on acne (Çerman et al., 2016; Fiedler, Stangl, Fiedler, & Taube, 2017; Mahmood & Bowe, 2014; Wu et al., 2007). However, other psychological factors, such as stress and the presence of a mental disorder have been consistently shown to play a key role in the exacerbation of this skin disease (Ghaninejad, Samadi, Zhand, Arbabi, & Golestan, 2009; Jović et al., 2017; Yosipovitch et al., 2007).

Acne is often comorbid with other psychopathology, including depression (Callender et al., 2014; Purvis, Robinson, Merry, & Watson, 2006; Rubinow, Peck, Squillace, & Gantt, 1987; Yarpuz, Saadet, Şanli, & Özgüven, 2008), anxiety (Callender et al., 2014; Purvis et al., 2006; Rubinow et al., 1987; Yarpuz et al., 2008), social anxiety

(Yarpuz et al., 2008), suicidal ideation (Cotterill & Cunliffe, 1997; Purvis et al., 2006), decreased self-confidence (Loney, Standage, & Lewis, 2008), and stress (Taylor, Bewley, & Melidonis, 2006;Yosipovitch et al., 2007). Between 33.4% to 51.3% of all dermatological patients with skin disease have been found to have co-occurring psychiatric disorders, such as depression and anxiety (Aktan, Ozmen, & Sanli, 1998; Ghaninejad et al., 2009; Wessely & Lewis, 1989). More specifically, people with acne are far more likely to have psychological comorbidities compared to individuals without acne (Behnam, Taheri, Ghorbani, & Allameh, 2013). Skin disease, including acne, may serve as a precipitant for psychological distress (Ghaninejad et al., 2009; Hong, Koo, & Koo, 2008). In addition, acne may cause strain on self-esteem and interpersonal relationships as an individual becomes hyperaware of his skin condition, thus invoking heightened levels of social withdrawal and the development and exacerbation of these psychological comorbidities (Yarpuz et al., 2008). In addition, cyclical connections have been implicated, wherein stress has been posited to exacerbate acne (Jović et al., 2017; Taylor et al., 2006) while acne itself can induce stress (Taylor et al., 2006).

Stress is defined as an adaptive physiological response used to cope with an aversive or seemingly threatening experience (Chrousos, 2009). In response to stressors, the sympathetic nervous system is activated and followed by parasympathetic withdrawal. As the activity of the hypothalamic–pituitary–adrenal (HPA) axis is increased, the sensation of stress results (Kunz-Ebrecht, Mohamed-Ali, Feldman, Kirschbaum, & Steptoe, 2003). Although low-intensity, short-term experiences of stress can be beneficial, as in instances where stress denotes a challenge and thus enhances motivation to accomplish a task or goal (Fay & Sonnentag, 2002), heightened or

prolonged stress is associated with adverse outcomes. In many cases, such as those related to chronic stress, outcomes can be harmful to an individual's physical health and psychological state (McEwen & Seeman, 1999). Many of the negative consequences following the development of stress adversely impact cognitive, emotional, behavioral, and physiological functioning (McEwen & Seeman, 1999; Schwabe & Wolf, 2010). Stress has been linked to a host of negative outcomes such as impairment of memory, decreased immune function, and aggression (Cohen & Hamrick, 2003; Herbert & Cohen, 1993; McEwen & Seeman, 1999; Verona, Reed, II, Curtin, & Pole, 2007). In addition to these consequences, current findings enforce that stress can alter neurological pathways and increase vulnerability to the development of psychological illnesses (Wheelock et al., 2018).

The experience and severity of stress are dependent on individual variability in sympathetic nervous system reactivity (Manuck, Cohen, Rabin, Muldoon, & Bachen, 1991). Variation in stress responses are also related to individual differences in appraisal of the stressful situations, repeated stress exposure, perception of the event, and social and physical demands of the environment (Branson, Turnbull, Dry, & Palmer, 2019; Lazarus & Folkman, 1984; Porterfield, Gabella, Simmons, & Johnson, 2012; Rosen, Chang, Djurdjevic, & Eatough, 2010). Thus, the psychological underpinnings of stress are extensive and influential in development, and it is not well understood how acne contributes to these psychological aspects of stress.

The development of stress and its cascade of physiological effects may help explain the relationship between stress, the maintenance of preexisting acne, and the development of new acne. Following a stressful event, many different hormones,

primarily cortisol, are secreted throughout the body, thus inducing the response of stress (Biondi & Picardi, 1999; Negrão, Deuster, Gold, Singh, & Chrousos, 2000). Particularly, corticotropin releasing-hormone (CRH) is believed to play an important role in this process (Ganceviciene, Graziene, Fimmel, & Zouboulis, 2009; Isard et al., 2009). In a study that examined the prevalence of CRH in patients diagnosed with acne, researchers concluded that CRH as a result of stress plays a crucial role in initiating the cascade immune response which thus promotes the development of acne (Ganceviciene et al., 2009).

There is currently an abundance of literature discussing the treatment management of harmful stress, yet the research examining stress and acne is much more limited. To date, research examining the role of stress and acne has primarily been conducted among adolescents, as they are at high risk for exhibiting elevated stress as a result of their skin (Khunger & Kumar, 2012; Revol, Milliez, & Gerard, 2015). Although this may be true, acne affects all ages, and 80% of post-adolescent acne is found to be persistent acne (Khunger & Kumar, 2012). Until recently, little research has examined the role of stress in the exacerbation and maintenance of acne, especially in the post-adolescent population. Specifically, acne is commonly observed among adults (Khunger & Kumar, 2012) and is especially high in young adults (Fry, 1997).

Prior research also examines the relationship between acne and psychological conditions, yet there remains a lack of knowledge regarding the roles and extent these conditions have in the worsening of acne (Bhate & Williams, 2013). Additionally, the median age-of-onset for psychological disorders ranges from late teens to early 20s (Kessler et al., 2007), and within this age group, college students specifically report

experiencing high levels of stress (American College Health Association, 2016). Internationally, acne maintains heightened prevalence in college students (Al Robaee, 2005; Babar & Mobeen, 2019; Shahzad, Nasir, Ikram, Asmaa-ul-Haque, Qadir, & Sohail, 2011) and has been associated with increased disability of functioning (i.e. aggression, frustration, and interference with social life) in these students (Babar & Mobeen, 2019; Shahzad et al., 2011). In addition, a recent study found that acne has a greater impact on the lives of college students compared to grade-school students (Pochynok et al., 2018). Although studies have examined the relations between acne, stress and other psychological morbidities (e.g., Dalgard et al., 2015; Hazarika & Archana, 2016), there is little research examining these factors in college students. Furthermore, most of this research has been limited by methodology that is correlational, cross-sectional, and retrospective in nature.

Current Study

Taken together, evidence suggests that stress and acne in college students may have a significant impact on the psychological functioning, quality of life, and exacerbation of dermatological disorders in this population. Considering the complexity of these intertwining factors and the lack of knowledge within this area, it is crucial that further research be conducted to examine the relationship of acne, stress, and psychological morbidities within a post-adolescent population, specifically that of college students. A more in depth understanding of the relationship between these variables could result in clinical interventions that have the potential to decrease the physical condition and burden of acne upon targeting these contributing psychological factors.

Accordingly, the purpose of the current study is to examine the impact of stress and psychological symptoms on acne, as well as the impact of acne on stress and psychological symptoms across time. To further understand the connections between acne and stress, the daily diary method was utilized in the current study.

Daily diary methodology consists of longitudinal sampling in which participants recurrently answer surveys within certain temporal framework, such as a day (Bolger, Davis, & Rafaeli, 2003; Ferguson, 2005). This methodology is beneficial in that it consists of self-report measures which examine ongoing experiences, processes, and fluctuations within everyday situations (Bolger et al., 2003; Santiago et al., 2017), thus overcoming drawbacks of research that is cross-sectional and retrospective. Specifically, the daily dairy method reduces recall bias that results from retrospective measures which require the participants to consider thoughts and occurrences from previous weeks or months (Bolger et al., 2003; Ferguson, 2005; Reis & Gable, 2000). The daily diary method records the average experiences of individuals and the variance of these experiences over a specific period of time (Bolger et al., 2003; Ferguson, 2005). Furthermore, the use of this method increases ecological validity in that participants are assessed in their daily environment compared to a laboratory setting (Gunthert & Wenze, 2012).

Daily diary studies have been frequently used to research stress; however, no studies to date have used daily diary methodology to examine stress and acne. Given that daily stressors have a greater impact on psychological state compared to more chronic stressors (Monat, Lazarus, & Reevy, 2007), incorporating the daily diary methodology may be beneficial for the examination of fluctuations in stress from day-to-day and

potentially the relationship to psychological morbidities. Thus, the use of daily diary methodology has the potential to enhance knowledge regarding the temporal associations between acne and stress among college students.

In order to examine the relations between acne and stress across time and among college students, participants in the current study were undergraduate students at the University of Mississippi who endorsed acne symptoms. As an overview, participants were administered an initial survey that included baseline measures, daily diary surveys each night for fourteen days, and a survey at the end of the two weeks. The following hypotheses were examined:

1. Stress during the two-week assessment period will be positively associated with acne severity at the end of the two-week period. That is, higher levels of stress will predict worse acne symptoms.
    a. Stress during the two-week assessment period will account for unique variance in acne severity at the end of the two-week period after controlling for baseline acne severity and baseline anxiety.
2. Stress during the two-week assessment period will be negatively associated with acne quality of life at the end of the two-week period. That is, higher levels of stress will predict lower levels of acne quality of life.
    a. Stress during the two-week assessment period will account for unique variance in acne quality of life at the end of the two-week period after controlling for baseline acne severity and baseline anxiety.

3. Objective and subjective measures of acne severity during the two-week assessment period will be positively associated with stress at the end of the period. That is, worse acne symptoms will predict higher stress levels.
    a. Objective and subjective measures of acne severity during the two-week assessment period will account for unique variance in stress at the end of the two-week period after controlling for baseline acne severity and baseline anxiety.
4. Objective and subjective measures of acne severity during the two-week assessment period will be positively associated with depression and anxiety symptoms during the two-week period. That is, higher objective and subjective acne severity will be positively associated with greater symptoms of anxiety and depression.
    a. Objective and subjective measures of acne severity during the two-week assessment period will account for unique variance in both anxiety and depression during the two-week period after controlling for baseline acne severity and baseline anxiety.

Methods

Participants & Recruitment

Participants for the study ($N = 73$) were recruited using the University of Mississippi's Department of Psychology Sona Systems. Following the completion of an online screener question ("Do you currently or have you recently experienced pimples?"), undergraduate students who endorsed these symptoms were invited to participate in the study via email. All interested students who met the eligibility requirement were allowed to participate in the study by choosing an available time slot. Participants were compensated for participation by receiving credit in their psychology course.

Seventy-three students volunteered for participation in the study, and seventy-two participants were permitted to continue through the entirety of the study because they endorsed recently experiencing acne on the in-lab acne screener upon beginning participation. Participants who continued through the study identified as White (88.9%), Black (5.6%), Asian (8.3%), and American Indian/Alaskan Native (2.8%). The sample was primarily female (83.3%), with an average age of 18.46 years ($SD = .712$). Of the sample, eighteen participants were dropped due to insufficient responses on the daily diary or failure to complete the final online survey, and two participants were excluded from analyses due to careless responding (e.g., responding incorrectly on bogus items such as, "I do not understand a word of English"). In order to determine sufficient responses for the daily diary, participants must have responded within the 7:00pm to 1:00am time window on the day that the survey was administered. In addition, one participant with invariable response patterns (i.e., participant responses with a range of 0

across the 14-day span) was removed from the analysis. The final daily diary dataset consisted of 701 observations from a total of 51 participants (86.3% female).

Measures

Acne Symptoms Questionnaire. The Acne Symptoms Questionnaire was constructed by the author to assess the frequency at which participants experienced acne symptoms (e.g. oiliness of skin, blackheads, and small red bumps) over the past week.

Acne-specific Quality of Life Questionnaire (Acne-QoL). The Acne-QoL (Girman et al., 1996) is a 19-item self-report questionnaire that assess the impact of facial acne on an individual's health-related quality of life. Specifically, four domains which address this issue are assessed: Self-Perception (e.g., feel unattractive, feel embarrassed), Role-Social (e.g., going out in public, socializing), Role-Emotional (e.g., time spent treating face; medications won't treat face), and Acne Symptoms (e.g., bumps, scabbing, oily skin). Participants were provided with items such as, "In the past WEEK, how self-conscious (uneasy about oneself) did you feel about your facial acne?" and asked to evaluate each item from "extremely" to "not at all" on a seven-point Likert scale. Each of the four domains of Acne-QoL is scored independently on a scale from 0 to 30, with higher scores indicating greater impact on quality of life. Each domain has demonstrated a high internal consistency as measured by Cronbach's α. When used in clinical trials assessing the effectiveness of acne treatment options, Self-Perception, Role-Emotional, and Role-Social score between the range of 0.87 to 0.96. Whereas, the Acne Symptoms subscale ranges from 0.77 to 0.86 (Fehnel et al., 2002). These results suggest that the Acne-QoL is internally consistent and valid. The internal consistency for the current sample was excellent among the Self-Perception, Role-Emotional, and Role-Social

domains (Cronbach's α = .97, .93, and .93, respectively). Whereas the internal consistency for the Acne Symptoms domain was fairly good (Cronbach's α = .79).

Demographic Questionnaire. A demographics questionnaire examining items such as age, gender, and ethnicity was administered.

Medical History Questionnaire (MHQ). The MHQ was constructed by the author and derived from measures used in a clinical setting. This questionnaire is dermatological specific and examines items such as the prevalence and frequency of skin conditions, types of symptoms experienced, clinical dermatological diagnoses, and participant concerns about skin conditions.

Additional Acne Questionnaire. The Additional Acne Questionnaire was constructed by the author to assess the types of medication used for acne treatment, change in lifestyle habits because of acne, and elements of the participant's skin care routine, among other acne-specific items.

Overall Anxiety Severity and Impairment Scale (OASIS). The OASIS (Norman, Hami-Cissell, Means-Christensen, & Stein, 2006) is a five-item self-report measure used to examine anxiety symptom severity and frequency, avoidance of anxiety, and anxiety interference with life domains (e.g., work, school, social, home). Participants were provided with items such as, "In the past week, how often have you felt anxious?" and asked to evaluate each item from "No anxiety" to "Constant anxiety" on a five-point Likert scale. This measure is scored on a 0 to 20 scale, with higher scores being indicative of increased anxiety. A score of eight or above is indicative of a provisional diagnosis of an anxiety disorder with good specificity (71%) and sensitivity (89%; Campbell-Sills et al., 2009). Despite the brevity of the questionnaire, the OASIS has been

shown to exhibit great reliability when the measure was initially tested in a sample of undergraduate students (Cronbach's α = .80). In the study by Norman et al. (2006), the OASIS displays excellent convergent validity with the Brief Symptom Inventory 18 (r = .58), the Fear Questionnaire (r = .41), and the Spielberger Trait Anxiety Questionnaire (r = .62). The internal consistency for the current sample for the OASIS was excellent (Cronbach's α = .99).

Perceived Stress Scale (PSS). The PSS (Cohen, Kamarck, & Mermelstein, 1983) is a 14-item self-report measure of the degree to which situations in one's life are perceived as stressful. The measure was developed for community samples, and in the measure, responders are asked to select how often they face certain stressful experiences. Prior to the 10-item PSS, the initial version of the PSS included 14-items, yet because four of the items perform poorly when evaluated with exploratory factor analysis (Cohen & Williamson, 1988), the 10-item PSS was developed and is currently the most widely used version of the PSS (Taylor, 2015). The 10-item PSS was utilized in the current study. This questionnaire measures frequency and severity of perceived stress. Participants were provided with items such as, "In the last month, how often have you felt that you were unable to control the important things in your life?" and asked to evaluate each item from "never" to "very often" on a five-point Likert scale. Scores on the PSS can range from 0 to 40, with higher scores being indicative of higher perceived stress. According to the study conducted by Cohen and Williamson (1988), the 10-item PSS has satisfactory internal consistency (Cronbach α = .78), and it also has adequate concurrent validity with the average amount of stress experienced in a week (r = .39, p <

.001: Cohen & Williamson, 1988). The PSS displayed good internal consistency for the current sample (Cronbach's $\alpha = .76$).

Daily Acne Survey. Two self-report questions were used to assess the daily severity of acne. The first question "What type of acne did you experience in the past 24 hours?" was used as an objective measure of acne severity. Participants were provided with options ranging from "no acne" to "severe cystic acne" and instructed to self-diagnose the severity of their acne using the guidelines created by Gold and colleagues (2009). This self-diagnosis acne measure was developed to allow individuals to rate their acne severity in a manner consistent with clinicians. In the study by Gold and colleagues (2009), researchers found no significant differences in participants' acne ratings and clinicians' acne ratings, and 100% of the participants were able to accurately diagnose their skin condition. Therefore, it was concluded that the scale may be used as an objective measurement of acne severity, despite being diagnosed by the individual suffering from the condition.

The second question "How would you rate your acne on a 0 to 10 scale?" was constructed by the author to be used as a subjective measure of acne severity. Higher scores on this item reflect greater subjective acne severity. This question was created to record a subjective measure of an individual's skin condition, as research has found that one's perception of skin severity plays a crucial role in the development of psychological morbidities (Bewley, Taylor, Reichenberg, & Magid, 2014). The researchers strived to have both an objective and subjective measure of daily acne severity for the current study. The internal consistency for the current sample for the Daily Acne Survey was good (Cronbach's $\alpha = .76$).

Daily Anxiety Survey. The Daily Anxiety Survey is a four-item self-report measure of symptoms of anxiety that was adapted by the author to be administered daily. Questions from the OASIS (Norman et al., 2006) were selected for the daily diary portion of the study. The OASIS consists of five total questions, yet for this daily diary measure, the first question was excluded due to findings that this question had the lowest factor loading (.55) compared to the remaining questions (Campbell-Sills et al., 2009). Participants were provided with items such as, "In the past week, when you have felt anxious, how intense or severe was your anxiety?," and asked to evaluate each item based on the past 24 hour period, rather than the past week, from "Little or None" to "Extreme" on a five-point Likert scale. The internal consistency for the current sample for the Daily Anxiety Survey was nearly excellent (Cronbach's $\alpha = .89$).

Daily Depression Survey. The Daily Depression Survey is a two-item self-report measure of symptoms of depression that was adapted by the author to be administered daily. Items from the Patient Health Questionnaire-2 (PHQ-2; Kroenke, Spitzer, & Williams, 2003) were used to compromise the Daily Depression Survey. The PHQ-2 is based on the PHQ, which is a self-report measure that was developed to allow health care providers to diagnose DSM-IV disorders Spitzer, Kroenke, & Williams, 1999. Two items from the PHQ that reflect general symptoms of depression were used to compromise the Daily Depression Survey. Participants were provided with the items, "little interest or pleasure in doing things" and "feeling down, depressed, or hopeless," and asked to evaluate each item based on the past 24 hour period from "Not at all" to "8 hours or more each day" on a five-point Likert scale, with higher scores being indicative of increased

depression symptoms. The Daily Depression Survey displayed good internal consistency for the current sample (Cronbach's $\alpha = .87$).

Daily Stress Survey. The Daily Stress Survey is a one-item measure of stress that was adapted by the author to be administered daily. Participants responded to the question, "In the past 24 hours, how stressed have you been?" ranging from "0 = No stress" to "10 = Severe Stress" on an 11-point Likert scale, with higher scores being indicative of increased stress.

Procedure.

The study protocol was approved by the University of Mississippi's Institutional Review Board. Data was collected from October 14 through November 22, 2019.

Upon arrival for participation in the study, the researcher provided potential participants with a description of the purpose of the study, the procedure and tasks involved, the risks and benefits associated with participation, an explanation of confidentiality, course credit compensation, and the right to withdraw at any time during the study. Participants were provided the opportunity to ask questions, and those interested in participation signed the consent form. Those who chose not to participate were thanked for their time and allowed to leave.

Participants were first asked to complete an acne screener which consisted of the Acne Symptoms Questionnaire and the Acne-QoL. This screener was used to ensure eligibility, that all participants had recently or currently experienced acne. If the participants had experienced acne, they were permitted to continue through the remainder of the study. If the participants had not experienced acne, they were given 0.5 credits for their involvement in the study and their participation was concluded.

For the participants who experienced acne and thus were permitted to continue through the study, the next task consisted of completing an online questionnaire including the Demographic Questionnaire, MHQ, Additional Acne Questionnaire, OASIS, and PSS. Upon completion of the online questionnaire, participants were invited to participate in the second part of the study, which included receiving one text message per day for the following 14 days. Each text message included a link to Qualtrics, a secure data collection website that included the Daily Acne Survey, Daily Anxiety Survey, Daily Depression Survey, and Daily Stress Survey. Each survey took approximately five minutes to complete. The survey link was administered via text message every day at 7:00 pm, and participants were instructed to complete the survey before midnight (12:00 am). The first daily survey was administered at 7:00 pm on the same day that the participant completed the first portion of the study. A mass messaging system, where participant information was also kept confidential, was used to deliver the surveys via text message every day.

Following completion of the second portion of the study, participants received a link via email to complete the final online questionnaire which consisted of the Acne Symptoms Questionnaire, Acne-QoL, Demographic Questionnaire, Additional Acne Questionnaire, OASIS, and PSS. After completion of the final online questionnaire, or upon withdrawal from the study, participants were provided with debriefing which included information regarding the purpose of the study and contact information if participants had questions or concerns regarding the study.

Upon completion of the final online survey, participants were awarded credit that reflected their participation in the study. Participants who completed all portions of the

study received the full 3.5 credits; whereas participants who missed daily surveys or failed to complete the final online survey received prorated credit that matched their total involvement in the study.

Statistical Analyses

Data were analyzed using SPSS Statistics Version 23.0. Data was examined for missing variable and inattentive responding. Scores for the baseline and follow-up surveys were computed based on the instructions for scoring each of the questionnaires (e.g., reverse coding relevant items and summing the score). For the Daily measures, an average score was calculated for each participant using the responses across the 14 days to represent overall daily levels of subjective acne, objective acne, anxiety, stress, and depression. First, descriptive statistics were computed for all study variables. Next, zero-order correlations were computed to explore associations among the study variables. Then, hierarchical multiple regression was used to test the hypotheses by examining the degree to which predictor variables accounted for unique variance in outcome variables above and beyond relevant covariates at baseline (e.g., anxiety and acne severity).

Results

Participant Characteristics

Acne (92.2%) was reported as the most bothersome dermatological condition, followed by psoriasis (3.9%) and rosacea (3.9%). Additionally, participants rated the severity of their skin conditions as moderately severe (M = 4.98, SD = 1.84). Reported symptoms of skin conditions included currently experiencing redness (70.6%), dryness/peeling (54.9%), outbreaks (49.0%), sweating (37.3%), pain (27.5%), color changes (27.5%), itching (19.6%), and bleeding (19.6%). The face (96.1%) was found to be the most common body area for experiencing skin condition symptoms, yet some participants endorsed experiencing symptoms on their torso/back (41.2%), scalp/hair (29.4%), and neck (25.5%). Approximately half (51%) of participants reported consulting a medical provider for skin-related concerns within the past year. Furthermore, specific treatments for the reported skin conditions include topical medication (51.0%), over-the-counter topical creams/medications (47.1%), and oral medication (33.3%). With regard to cleansing, 47.1% of participants reported washing their face two times per day, and 31.4% reported washing their face one time per day. Approximately 70.6% indicated attempting to hide their skin symptoms with facial hair, makeup, and clothing. Additionally, 17.6% of participants reported clinically significant levels of anxiety (M = 3.90, SD = 3.71).

Descriptive Statistics and Zero-Order Correlations

Means and standard deviations of the study variables are reported in Table 1. Zero-order correlations among acne quality of life, acne symptoms, anxiety, stress, daily acne, daily anxiety, daily depression, and daily stress are reported in Table 2.

Consistent with Hypothesis 1, a strong positive correlation was observed between Daily Stress and Final Acne Symptoms ($r = .62$, $p < .01$), the objective acne measurement. Consistent with Hypothesis 2, moderate to strong negative correlations were found between Daily Stress and the four domains of the Final Acne QoL: Self-Perception ($r = -.58$), Role-Emotional ($r = -.62$), Role-Social ($r = -.48$), and Acne Symptoms ($r = -.61$; all ps $< .01$). Partially consistent with Hypothesis 3, weak correlations were found between Daily Subjective Acne and Final Stress ($r = .32$, $p < .05$); however, there was no significant correlation observed between Daily Objective Acne and Final Stress ($r = .24$, $p > .05$). As for the analysis of Hypothesis 4, there were no significant correlations between Daily Depression and both Daily Objective Acne ($r = .10$) or Daily Subjective Acne ($r = -.02$). Additionally, there was no significant correlation between Daily Anxiety and Daily Objective Acne ($r = .21$); however, a weak relationship was discovered between Daily Anxiety and Daily Subjective Acne ($r = .29$, $p < .05$).

Examination of Variability in Final Acne Symptom Severity Accounted for by Daily Stress

It was hypothesized (Hypothesis 1a) that stress during the two-week period would account for unique variance in acne symptom severity at the end of the two-week period after controlling for relevant variables (e.g., baseline anxiety, baseline acne severity). Results from the hierarchical multiple regression analyses are reported in Table 3. In the first step, baseline anxiety and baseline acne severity accounted for 48.7% of the variance in final acne symptom severity, ΔF (2, 48) = 22.75, $p < .001$. In the second step, daily stress accounted for an additional 8.6% of the variance in final acne symptom severity,

ΔF (1, 47) = 9.44, p = .004, with the overall model accounting for 57.3% of the variance in final acne severity. Consistent with Hypothesis 1a, daily stress emerged as a unique predictor of final acne symptom severity.

Examination of Variability in Final Acne Quality of Life Accounted for by Daily Stress

It was hypothesized (Hypothesis 2a) that daily stress during the two-week assessment period would account for unique variance in all four domains of the Acne Quality of Life questionnaire administered at the end of the two-weeks after controlling for relevant variables (e.g. baseline anxiety and baseline acne severity). Results from the hierarchical multiple regression analyses predicting Final Acne Quality of Life - Self-Perception are reported in Table 4. In the first step, baseline anxiety and baseline acne severity accounted for 26.6% of the variance in final acne severity, ΔF (2, 48) = 8.70, p = .001. In the second step, daily stress accounted for an additional 12.8% of the variance in acne quality of life, ΔF (1, 47) = 9.96, p = .003, with the overall model accounting for 39.4% of the variance in Acne Quality of Life – Self Perception. Consistent with Hypothesis 2a, daily stress emerged as a unique predictor of final Acne Quality of Life – Self Perception.

Results from the hierarchical multiple regression analyses predicting Final Acne Quality of Life - Role-Emotional are reported in Table 5. In the first step, baseline anxiety and baseline acne severity accounted for 30.1% of the variance in final acne severity, ΔF (2, 48) = 10.35, $p < .001$. In the second step, daily stress accounted for an additional 13.3% of the variance in acne quality of life, ΔF (1, 47) = 11.00, p = .002, with the overall model accounting for 43.4% of the variance in Acne Quality of Life – Role

Emotional. Consistent with Hypothesis 2a, daily stress emerged as a unique predictor of final Acne Quality of Life – Role Emotional.

Results from the hierarchical multiple regression analyses predicting Final Acne Quality of Life - Role-Social are reported in Table 6. In the first step, baseline anxiety and baseline acne severity accounted for 16.4% of the variance in final acne severity, ΔF (2, 48) = 4.71, p = .014. In the second step, daily stress accounted for an additional 10.8% of the variance in acne quality of life, ΔF (1, 47) = 6.97, p = .011, with the overall model accounting for 27.2% of the variance in Acne Quality of Life – Role Social. Consistent with Hypothesis 2a, daily stress emerged as a unique predictor of final Acne Quality of Life – Role Social.

Results from the hierarchical multiple regression analyses predicting Acne Quality of Life - Acne Symptoms are reported in Table 7. In the first step, baseline anxiety and baseline acne severity accounted for 41.2% of the variance in final acne severity, ΔF (2, 48) = 16.78, $p < .001$. In the second step, daily stress accounted for an additional 9.5% of the variance in acne quality of life, ΔF (1, 47) = 9.083, p = .004, with the overall model accounting for 50.7% of the variance in Acne Quality of Life – Acne Symptoms. Consistent with Hypothesis 2a, daily stress emerged as a unique predictor of final Acne Quality of Life – Acne Symptoms.

Examination of Variability in Final Stress Accounted for by Daily Acne Severity

It was hypothesized (Hypothesis 3a) that daily objective acne and daily subjective acne during the two-week period would account for unique variance in stress at the end of the period after controlling for baseline anxiety and baseline acne severity. Results from the hierarchical multiple regression analyses predicting final stress from daily

objective acne are reported in Table 8. In the first step of the analysis, baseline anxiety and baseline acne severity accounted for 40.5% of the variance in final stress, ΔF (2, 48) = 16.37, $p < .001$. In the second step, daily objective acne was non-significant, accounting for only an additional 0.8% of the variance in final stress, ΔF (1, 47) = 0.65, p = .426, with the overall model accounting for 41.3% of the variance in final stress. Contradictory with Hypothesis 3, daily objective acne did not emerge as a unique predictor of final stress.

Results from the hierarchical multiple regression analyses predicting final stress from daily subjective acne are reported in Table 9. In the first step of the analysis, baseline anxiety and baseline acne severity accounted for 40.5% of the variance in final stress, ΔF (2, 48) = 16.37, $p < .001$. In the second step, daily subjective acne was also nonsignificant, accounting for only an additional 1.9% of the variance in final stress, ΔF (1, 47) = 1.58, p = .215, with the overall model accounting for 42.5% of the variance in final stress. Therefore, inconsistent with Hypothesis 3a, daily subjective acne did not emerge as a unique predictor of final stress.

Examination of Variability in Daily Depression Accounted for by Daily Acne Severity

It was hypothesized (Hypothesis 4a) that daily objective and subjective acne during the two-week period would be positively associated with daily depression also during the time period after controlling for baseline anxiety and baseline acne severity. Results from the hierarchical multiple regression analyses predicting daily depression from daily objective acne are found in Table 10. In the first step of the analysis, baseline anxiety and baseline acne severity accounted for 49.9% of the variance in daily

depression, ΔF (2, 48) = 23.89, $p < .001$. In the second step, daily objective acne was non-significant, accounting for only an additional 0.3% of the variance in daily depression, ΔF (1, 47) = 0.24, $p = .63$, with the overall model accounting for 50.1% of the variance in daily depression. Therefore, daily objective acne did not emerge as a unique predictor of daily depression.

The results from the hierarchical multiple regression analyses predicting daily depression from daily subjective acne and depression are found in Table 11. In the first step of the analysis, baseline anxiety and baseline acne severity accounted for 49.9% of the variance in daily depression, ΔF (2, 48) = 23.89, $p < .001$. In the second step, daily subjective acne was also non-significant, accounting for only an additional 0.1% of the variance in daily depression, ΔF (1, 47) = 0.11, $p = .747$, with the overall model accounting for 50.0% of the variance in daily depression. Contradicting the hypothesis, daily subjective acne did not emerge as a unique predictor of daily depression.

Examination of Variability in Daily Anxiety Accounted for by Daily Acne Severity

It was hypothesized (Hypothesis 4a) that daily objective and subjective acne during the two-week period would account for unique variance in daily anxiety after controlling for baseline anxiety and baseline acne severity. Results from the hierarchical multiple regression analyses predicting daily anxiety from daily objective acne are found in Table 12. In the first step of the analysis, baseline anxiety and baseline acne severity accounted for 45.7% of the variance in daily anxiety, ΔF (2, 48) = 20.17, $p < .001$. In the second step, daily objective acne was non-significant, accounting for only an additional 3.5% of the variance in daily anxiety, ΔF (1, 47) = 3.20, $p = .080$, with the overall model

accounting for 49.1% of the variance in daily anxiety. Therefore, daily objective acne did not emerge as a unique predictor of daily anxiety.

The results from the hierarchical multiple regression analyses predicting daily anxiety from daily subjective acne are found in Table 13. In the first step of the analysis, baseline anxiety and baseline acne severity accounted for 45.7% of the variance in daily anxiety, ΔF (2, 48) = 20.17, $p < .001$. In the second step, daily subjective acne accounted for an additional 5.1% of the variance in daily anxiety, ΔF (1, 47) = 4.91, $p = .032$, with the overall model accounting for 50.8% of the variance in daily anxiety. Consistent with Hypothesis 4a, daily subjective acne did emerge as a unique predictor of daily anxiety.

Discussion

Acne is one of the most burdensome and costly dermatological diseases (Bhate & Williams, 2013; Bickers et al., 2006; Lim et al., 2017), and factors such as heightened stress and psychological disorders are known to have associations with this prevalent and debilitating skin disease (Ghaninejad, et al., 2009; Jović et al., 2017; Yosipovitch et al., 2007). Acne and its associated factors are frequently found in the post-adolescent population, specifically college students; yet, most acne research has focused on adolescents (American College Health Association, 2016; Fry, 1997; Kessler et al., 2007). The current study aimed to understand temporal associations of factors known to exacerbate and consequent acne. Findings from the current study suggest that average levels of stress over the two-week period were positively associated with the increases in acne severity at the end of this period. Additionally, average levels of stress over the two-week period were positively associated with greater interference with acne relevant quality of life domains at the end of the period. In the same manner, there was a positive correlation found between daily subjective acne ratings and final reports of stress at the end of two-weeks; however, this association does not hold true for objective acne ratings over the two-week period and final reports of stress. Furthermore, depression was not associated with objective nor subjective ratings of acne over the two-week period. Lastly, subjective ratings of acne, but not objective ratings, were associated with anxiety over the two-week period. Overall, these findings suggest that heightened perception of acne severity, as opposed to objective acne severity, may exacerbate psychological symptoms such as stress and anxiety among individuals with acne. Additionally, these findings

suggest that increases in stress may exacerbate objective acne severity and interference with quality of life.

Of the current sample, acne was the most burdensome skin condition reported (92.2%) as this was expected following the participants' completion of the screener. However, 7.8% of the sample did not endorse acne as their worst skin condition. Regarding the current study, it is beneficial that the majority of participants endorse acne as their primary skin condition, as this minimizes the influence of other skin conditions on the current findings. Another interesting discovery was that the average stress levels for both daily stress ($M = 3.46$) and final stress ($M = 15.18$) were low to moderate in this sample. These findings contradict previous literature which reports that college students experience high levels of stress (American College Health Association, 2016).

As hypothesized, average stress over the two-week period was significantly associated with increased final reports of objective acne symptoms and increased interference in quality of life domains. In conjunction, daily stress emerged as a unique predictor of Acne Severity (i.e., the final objective acne measurement) and all four domains of the Acne Quality of Life (i.e., the final subjective acne measurement), even after controlling for relevant variables such as baseline acne severity and anxiety. These conclusions support previous literature suggesting that stress plays a contributing role in the exacerbation of acne (Ganceviciene et al., 2009; Jović et al., 2017; Taylor et al., 2006) and interference with quality of life (McEwen & Seeman, 1999; Schwabe & Wolf, 2010).

Interestingly, there was no relationship between objective ratings of acne severity over the two-week span and final reports of stress. Yet, there was a significant

relationship between subjective ratings of acne severity over the two-week span and final reports of stress. After accounting for baseline acne severity and anxiety, however, subjective ratings of acne severity no longer predicted final reports of stress. These differing relationships suggest the need for further analyses to examine the precise nature of the association between acne and stress to further evaluate its cyclic nature (Taylor et al., 2006).

Finally, there were no significant correlations found between depression over the two-week period and acne over the two-week period, both objective and subjective measurements. These results also differ greatly from previous literature, as copious amounts of research support the severe impact that skin conditions have on the development and worsening of psychological disorders, specifically depression (Aktan et al., 1998; Behnam et al., 2013; Ghaninejad et al., 2009; Wessely & Lewis, 1989). Compared to previous research, this study is unique in that it was conducted prospectively over a period of two weeks, whereas prior research of acne and depression examine these variables retrospectively. These variances in experimental methodology and sample demographics may contribute to the discrepancies in the findings.

Results revealed a unique pattern among the relationship between anxiety and acne. There was no significant association between anxiety over the two-week period and objective ratings of acne severity over the two-week period, which again contradicts previous literature (Aktan et al., 1998; Behnam et al., 2013; Ghaninejad et al., 2009; Wessely & Lewis, 1989). However, there was a significant relationship between anxiety over the two-week period and subjective ratings of acne severity over the two-week period, which is consistent with previous literature (Aktan et al., 1998; Behnam et al.,

2013; Ghaninejad et al., 2009; Wessely & Lewis, 1989). Additionally, subjective acne over the two-week period was identified as a unique predictor of anxiety over the two-week period after accounting for baseline acne severity and baseline anxiety.

Similar to the importance of subjective views of acne severity in relation to stress, these findings highlight the important contribution of subjective views of acne severity in predicting anxiety. From these findings, it is important to recognize the significance of skin condition perception by its effects on the psychological well-being of the individual, specifically with regards to stress and anxiety.

Limitations

This study expands scientific knowledge and understanding of the relations between acne and psychological variables; however, several limitations must be considered. First, each questionnaire administered was self-report. This study included valid measures of objective acne, as prior studies have found the measurements to be consistent with clinician diagnoses; however, these measures are self-report and cannot truly reflect a clinician's diagnosis. For greater accuracy of objective acne measurements, future studies should aim to use the assistance of a dermatologist or healthcare provider to accurately record objective acne measurements and diagnostic assessment of psychopathology may be beneficial for classifying the severity of psychological symptoms. Also, future studies should aim to include validated measures of subjective acne in the daily diary survey.

Although researchers included attention check questions and assessed for response invariability to identify careless reporting during surveys, participants could have responded inaccurately or untruthfully and not have been removed from the

analyses. At the same time, responses that were removed due to invariability or carelessness may have been reported truthfully.

Other limitations to the current study lie within the demographics of the sample. The given percentage of females (83.3%) far outweighs males (16.7%) and thus does not accurately reflect female to male ratio of the general population. Although this impacts the generalizability of the findings, acne is more common in females (Perkins, Maglione, Hillebrand, Miyamoto, & Kimball, 2012). Additionally, the sample was predominantly White (88.9%) with an average age of 18.46 years. While this study aims to assess college students, the age range of an enrolled undergraduate in the United States is around 18 to 22 years old. Thus, the sample does not entirely reflect the standard age of a college student. On the same note, this sample consists of students enrolled in a psychology course at one university located in the Southeastern region of the United States.

Additionally, technological complications arose as the data collection progressed, which further contribute to the limitations of the methodology. Primarily, only individuals with access to cell phones were able to complete this study, as the daily diary surveys were sent via text message every day. The daily surveys were administered using a mass text message delivery service, and there occurred one instance where the company experienced an issue with the system. Consequently, there was one day during data collection where participants did not receive a daily survey. This occurrence caused some participants to fall below the data cleaning threshold of a minimum of 11 daily dairy surveys which lead to removal from analyses.

Finally, the correlational methodology of the statistical analyses warrant consideration for limitation. Because these analyses do not allow for attribution of causality, relationships determined from the analyses cannot lead to the assumption that these variables are directly dependent on one another. Employing more advanced statistical analyses with the current data may be beneficial for further understanding the within- and between-subject variability across the key items of interest; however, such analyses go beyond the scope and timeline of the current project.

Implications and Future Directions

Despite the previously stated limitations, the study adds to current knowledge within this area. Overall, the findings suggest unique temporal relationships between acne and stress, such that increased reports of stress predict later increases in objective acne severity and later interference with quality of life. These results suggest that psychological intervention may play an important role in the management of acne, and by incorporating techniques to manage and reduce stress, dermatologists could consequentially observe improvement of their patients' acne severity and the interference of acne on quality of life. Ultimately, these types of interventions may have the ability to decrease the severity of the skin disease and also the financial burden on the patient and the physician.

Because the results for the relationship between acne and anxiety are complex and occasionally conflict with the existing literature, longitudinal research is needed, including a more diverse sample to further examine these interwoven associations. Additionally, future studies should aim to include more accurate measurements of objective and subjective acne. Much literature suggests that there is a definitive

relationship between acne and psychological conditions, specifically anxiety; thus, research should assess this relationship more in depth and determine to what extent clinical diagnoses versus the individual perception of acne correlate with anxiety. Because previous literature suggests a relationship between anxiety and acne, and the current study also established a relationship between anxiety and subjective acne, there may be potential for clinical intervention. By targeting treatments for reduction in anxiety, clinicians may alleviate consequences such as an individual's acne severity perception and heightened stress. Moreover, by implementing treatments that reduce subjective acne ratings, patients with these skin conditions could possibly experience a reduction in anxiety.

Additionally, because the current study found no relationship between depression and objective or subjective acne, further research must be conducted. It is crucial that future studies incorporate daily diary methodology to accurately measure these fluctuating factors and fully understand the extent of these relationships.

In summary, this study is one of the first of its kind to examine the longitudinal connections of acne, stress, and psychological symptoms, and it further expands on the current knowledge of the relationships among these variables. Stress plays an important role in the exacerbation of acne and the impact of acne on quality of life, and if targeted, may help reduce the severity of this skin condition. Furthermore, the relationship between acne and psychological morbidities, including depression and anxiety, are not as well-defined and substantiate further examination utilizing more ecologically valid daily dairy methodology.

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Table 1.
Means and Standard Deviations of Study Variables (N=51)

Variable	*M*	*SD*
Acne Severity (Baseline)	7.60	3.72
OASIS (Baseline)	4.73	3.80
Acne-QoL Self Perception (Final)	20.84	7.02
Acne-QoL Role-Emotional (Final)	20.92	6.69
Acne-QoL Role-Social (Final)	19.00	5.25
Acne-QoL Acne Symptoms (Final)	21.65	4.87
Acne Severity (Final)	12.96	3.10
OASIS (Final)	3.90	3.71
Stress (Final)	15.18	6.36
Daily Stress	3.45	1.82
Daily Objective Acne	1.53	0.93
Daily Subjective Acne	2.98	1.72
Daily Anxiety	1.87	1.87
Daily Depression	0.85	1.06

Table 2.

Summary of Correlations for Examining all Hypotheses (N=51)

Variable	1	2	3	4	5	6	7	8	9	10	11
Daily Assessment											
1. Stress	-										
2. Objective Acne	.565**	-									
3. Subjective Acne	.666**	.754**	-								
4. Depression	.365**	-.019	.104	-							
5. Anxiety	.484**	.211	.294*	.816**	-						
Final Assessment											
6. Stress	.464**	.237	.320*	.621**	.552**	-					
7. Acne QoL (Self-Perception)	-.579**	-.352	-.630**	-.500**	-.460**	-.532*	-				
8. Acne QoL (Role-Emotional)	-.601**	-.316*	-.557**	-.499**	-.464**	-.588**	.899**	-			
9. Acne QoL (Role-Social)	-.480**	-.244	-.531**	-.553**	-.505**	-.519**	.874**	.820**	-		
10. Acne QoL (Acne-Symptoms	-.610**	-.541*	-.685**	-.405**	-.385**	-.431**	.768**	.785**	.697**	-	
11. Acne Symptoms	.617**	.599**	.559**	.227	.323*	.398**	-.615**	-.652	-.443**	-.739**	-

Note.

Daily Assessment: Stress = daily dairy stress mean score; Objective Acne = daily dairy objective acne mean score; Subjective Acne = daily dairy subjective acne mean score; Depression = the daily diary depression mean score; Anxiety = the daily dairy anxiety mean score.

Final Assessment: Stress = the Perceived Stress Scale score from the final questionnaire; Acne Symptoms = final acne self- report severity symptoms; Acne QoL= final Acne Quality of Life scores for all four domains: Self Perception, Role Emotional, Role Social, and Acne Symptoms;

*p < .05; **p < .01; ***p < .001

Table 3.
Hierarchical Regression of Daily Stress Predicting Final Acne Symptom Severity Controlling for Baseline Anxiety and Acne (Hypothesis 1)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.487	.487***
Constant	8.481	6.938	10.023	.797			
Anxiety	.021	-.155	.196	.087	.026		
Acne Symptoms	.576***	.397	.755	.089	.691		
Step 2						.573	.086**
Constant	7.732	6.227	9.238	.748			
Anxiety	-.030	-.196	.135	.082	-.037		
Acne Symptoms	.433***	.243	.623	.094	.519		
Daily Stress	.602**	.208	.995	.196	.353		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Daily Stress = daily dairy stress mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 4.
Hierarchical Regression of Daily Stress Predicting Final Acne Quality of Life (Self-Perception) Severity Controlling for Baseline Anxiety and Acne (Hypothesis 2)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.266	.266**
Constant	29.209	24.713	33.704	2.236			
Anxiety	-.529*	-1.040	-.017	.254	-.266		
Acne Symptoms	-.771**	-1.294	-.249	.260	-.379		
Step 2						.394	.128**
Constant	31.437	27.070	35.804	2.171			
Anxiety	-.376	-.856	.104	.239	-.189		
Acne Symptoms	-.345	-.897	.206	.274	-.170		
Daily Stress	-1.792**	-2.934	-.649	.568	-.432		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Daily Stress = daily dairy stress mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 5.
Hierarchical Regression of Stress Predicting Acne Quality of Life (Role Emotional) Severity Controlling for Baseline Anxiety and Acne (Hypothesis 2)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.301	.301***
Constant	29.829	25.428	34.230	2.189			
Anxiety	.-.580*	-1.081	-.079	.249	-.290		
Acne Symptoms	-.811**	-1.332	-.299	.254	-.398		
Step 2						.434	.113**
Constant	32.102	27.866	36.338	2.106			
Anxiety	-.424	-.889	.042	.231	-.212		
Acne Symptoms	-.376	-.911	.159	.266	-.185		
Daily Stress	-1.827**	-2.935	-.719	.551	-.439		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Daily Stress = daily dairy stress mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 6.
Hierarchical Regression of Daily Stress Predicting Final Acne Quality of Life (Role Social) Severity Controlling for Baseline Anxiety and Acne (Hypothesis 2)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.164	.164*
Constant	23.363	19.999	26.728	1.673			
Anxiety	-.385*	-.767	.002	.190	-.276		
Acne Symptoms	-.335	-.726	.056	.195	-.235		
Step 2						.272	.108*
Constant	24.797	21.440	28.154	1.669			
Anxiety	-.286	-.655	.083	.183	-.205		
Acne Symptoms	-.061	-.485	.363	.211	-.043		
Daily Stress	-1.153*	-2.031	-.275	.437	-.396		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Daily Stress = daily dairy stress mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 7.
Hierarchical Regression of Daily Stress Predicting Final Acne Quality of Life (Acne Symptoms) Severity Controlling for Baseline Anxiety and Acne (Hypothesis 2)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.412	.412***
Constant	28.345	25.749	30.941	.000			
Anxiety	-.143	-.438	.153	.336	-.111		
Acne Symptoms	-.792***	-1.093	-.490	.000	-.604		
Step 2						.507	.095**
Constant	29.584	27.043	32.125	1.263			
Anxiety	-.058	-.337	.221	.679	-.045		
Acne Symptoms	-.555***	-.876	-.234	.001	-.423		
Daily Stress	-.996**	-1.661	-.331	.437	-.372		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Daily Stress = daily dairy stress mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 8.
Hierarchical Regression of Daily Objective Acne Predicting Final Stress Controlling for Baseline Anxiety and Acne (Hypothesis 3)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.405	.405***
Constant	7.549	4.142	10.956	1.695			
Anxiety	.849***	.461	1.236	.193	.506		
Acne Symptoms	.476*	.080	.872	.197	.278		
Step 2						.413	.008
Constant	7.128	3.548	10.708	1.695			
Anxiety	.872***	.478	1.266	.196	.521		
Acne Symptoms	.367	-.116	.849	.240	.214		
Objective Acne	.744	-1.121	2.610	.927	.109		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Objective Acne = daily dairy objective acne mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 9.
Hierarchical Regression of Daily Subjective Acne Predicting Final Stress Controlling for Baseline Anxiety and Acne (Hypothesis 3)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.405	.405***
Constant	7.549	4.142	10.956	1.695			
Anxiety	.849***	.461	1.236	.193	.506		
Acne Symptoms	.476*	.080	.872	.197	.278		
Step 2						.425	.019
Constant	6.896	3.350	10.442	1.763			
Anxiety	.864***	.477	1.250	.192	.516		
Acne Symptoms	.307	-.171	.784	.237	.179		
Subjective Acne	.626	-.376	1.628	.498	.169		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Subjective Acne = daily dairy subjective acne mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 10.
Hierarchical Regression of Daily Objective Acne Predicting Daily Depression Controlling for Baseline Anxiety and Acne (Hypothesis 4)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.499	.499***
Constant	-.120	-.642	.402	.260			
Anxiety	.196***	.137	.256	.030	.701		
Acne Symptoms	.005	-.056	.066	.030	.018		
Step 2						.501	.003
Constant	-.080	-.631	.471	.274			
Anxiety	.194***	.133	.255	.030	.693		
Acne Symptoms	.015	-.059	.090	. 037	.054		
Objective Acne	-.070	-.357	.217	.143	-.061		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Objective Acne = daily dairy objective acne mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 11.
Hierarchical Regression of Daily Subjective Acne Predicting Daily Depression Controlling for Baseline Anxiety and Acne (Hypothesis 4)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.499	.499***
Constant	-.120	-.642	.402	.260			
Anxiety	.196***	.137	.256	.030	.701		
Acne Symptoms	.005	-.056	.066	.030	.018		
Step 2						.500	.001
Constant	-.146	-.698	.406	.274			
Anxiety	.197***	.137	.257	.030	.704		
Acne Symptoms	-.002	-.076	.073	. 037	-.006		
Subjective Acne	.025	-.131	.181	.078	.041		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Subjective Acne = daily dairy subjective acne mean score. *$p < .05$; **$p < .01$; *** $p < .001$

Table 12.
Hierarchical Regression of Daily Objective Acne Predicting Daily Anxiety Controlling for Baseline Anxiety and Acne (Hypothesis 4)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.457	.457***
Constant	.033	-.927	.992	.477			
Anxiety	.321***	.212	.430	.054	.650		
Acne Symptoms	.042	-.070	.153	.055	.083		
Step 2						.491	.035
Constant	-.225	-1.207	.758	.488			
Anxiety	.335***	.227	.444	.054	.679		
Acne Symptoms	-.025	-.157	.107	.066	-.049		
Objective Acne	.455	-.057	.967	.254	.226		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Objective Acne = daily dairy objective acne mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Table 13.
Hierarchical Regression of Daily Subjective Acne Predicting Daily Anxiety Controlling for Baseline Anxiety and Acne (Hypothesis 4)

Variable	B	95% CI for B		SE B	Beta	R^2	ΔR^2
		LL	UL				
Step 1						.457	.457***
Constant	.033	-.927	.992	.477			
Anxiety	.321***	.212	.430	.054	.650		
Acne Symptoms	.042	-.070	.153	.055	.083		
Step 2						.508	.051*
Constant	-.281	-1.247	.686	.480			
Anxiety	.328***	.223	.434	.052	.665		
Acne Symptoms	-.039	-.169	.091	.065	-.078		
Subjective Acne	.301*	.028	.574	.136	.276		

Note. Anxiety = baseline Overall Anxiety Severity and Impairment Scale (OASIS); Acne Symptoms = baseline acne self-report severity symptoms; Subjective Acne = daily dairy subjective acne mean score.
*$p < .05$; **$p < .01$; *** $p < .001$

Appendix A

Acne Symptoms Questionnaire

Acne, also known as acne vulgaris, is often identified by pimples, but also includes the experience of blackheads or whiteheads that may show up on any part of your skin. Some associated symptoms include swelling, redness, and potential scarring. In the below questions, please consider this definition of acne.

1. Have you ever been diagnosed with acne?	**Yes**	**No**
If yes, when were you first diagnosed?		
2. In the past year, have you experienced any symptoms of acne?	**Yes**	**No**
Pimples?	Yes	No
Blackheads?	Yes	No
Whiteheads?	Yes	No
Other:	Yes	No
3. Have you ever seen a doctor or other medical provider due to concerns about acne or pimples?	**Yes**	**No**
If yes, when was your last visit?		
4. Have you ever used a topical or oral treatments for acne? Examples: differin gel, proactive, clean & clear, retinoid cream, Accutane, tea tree oil	**Yes**	**No**
If yes, which treatments?		
If yes, do you currently use these treatments for acne?		
5. Have you used any other forms of treatment for your acne?	**Yes**	**No**
If yes, please list:		
6. Where you do experience your most concerning acne symptoms? (e.g., face, chest, torso, back, etc)		

7. **Acne severity.** Please rate each symptom on the below scale, thinking of the LAST WEEK.					
Oiliness of skin.	Not at all	Slightly	Moderate	Severe	Extremely severe
Blackheads	None	Some	A moderate number	Many	Extremely numerous

Small red bumps	None	A few (1-4)	Moderate Around 5	Many (6-9)	Very many (More than 10)
Large red bumps	None	A few (1-4)	Moderate Around 5	Many (6-9)	Very many (More than 10)
Pus bumps	None	A few (1-4)	Moderate Around 5	Many (6-9)	More than 10
Scabs on face	None	A few (1-4)	Moderate Around 5	Many (6-9)	More than 10
Area of discoloration on face	None	Some	Moderate Around 5	Many (6-9)	More than 10 dime-size areas (coins)
Area of the face affected by acne	None	Small area	Moderate area	Large area	Extensive area

Appendix B

Acne-Specific Quality of Life Questionnaire (Acne-QoL)

(Please check one box for each question)

1. In the past WEEK, how unattractive did you feel because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

2. In the past WEEK, how embarrassed did you feel because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

3. In the past WEEK, how self-conscious (uneasy about oneself) did you feel about your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

4. In the past WEEK, how upset were you about having facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

5. In the past WEEK, how annoyed did you feel at having to spend time every day cleaning and treating your face because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

6. In the past WEEK, how dissatisfied with your self-appearance did you feel because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

7. In the past WEEK, how concerned or worried were you about not looking your best because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

8. In the past WEEK, how concerned or worried were you that your acne medication/products were working fast enough in clearing up the acne on your face?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

9. In the past WEEK, how bothered di you feel about the need to always have medication or cover-up available for the acne on your face?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

10. In the past WEEK, how much was your self-confidence (sure of yourself) <u>negatively</u> affected because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

11. In the past WEEK, how concerned or worried were you about meeting new people because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

12. In the past WEEK, how concerned or worried were you about going out in public because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

13. In the past WEEK, how much was socializing with people a problem for you because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

14. In the past WEEK, how much was interaction with the opposite sex (or same sex if gay or lesbian) a problem for you because of your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

15. In the past WEEK, how many bumps did you have on your face?

extensive	a whole lot	a lot	a moderate amount	some	very few	none
☐	☐	☐	☐	☐	☐	☐

16. In the past WEEK, how many bumps full of pus di you have on your face?

extensive	a whole lot	a lot	a moderate amount	some	very few	none
☐	☐	☐	☐	☐	☐	☐

17. In the past WEEK, how much scabbing from your facial acne did you have?

extensive	a whole lot	a lot	a moderate amount	some	very few	none
☐	☐	☐	☐	☐	☐	☐

18. In the past WEEK, how concerned or worried were you about scarring from your facial acne?

extremely	very much	quite a bit	a good bit	somewhat	a little it	not at all
☐	☐	☐	☐	☐	☐	☐

19. In the past WEEK, how oily was your facial skin?						
extensive ☐	a whole lot ☐	a lot ☐	a moderate amount ☐	some ☐	very few ☐	none ☐

Appendix C

Adult Sociodemographic Information

How do you describe yourself?
____ Male
____ Female
____ Transgender
____ Do not identify as female, male, or transgender

What sex were you assigned at birth, on your original birth certificate?
____ Male
____ Female
What is your age (in years)? ____

What is your racial/ethnic background? (select all that apply)
American Indian or Alaska Native
Asian
Black or African American
Hispanic, Latinx, or Spanish Origin
Middle Easter or North African
Native Hawaiian or Other Pacific Islander
White
Other_____
I prefer not to answer.

Are you currently in a romantic relationship with a partner or partners?
No
Yes, one partner
Yes, I have multiple partners
If yes, are you (mark all that apply)
Not applicable
Married or in a civil union
Living together
Living apart

Do you think of yourself as:
___ Straight
___ Gay or Lesbian
___ Bisexual
___ Other _____

In the past six months, who have you had sex with?
Men only
Women only
Both men and women
I have not had sex

What is the highest grade or degree you have completed?
Some high school
High school diploma or equivalent
Vocational training
Some college
Associate's degree
Bachelor's degree
Some post undergraduate work
Master's degree
Specialist degree
Applied or professional doctorate degree (e.g., MD, JD, PharmD)
Doctorate degree (e.g., PhD, EdD)
Other, please specify: _____

Where do you live?
- Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio,
North Dakota, South Dakota, Wisconsin
- Northeast: Connecticut, Delaware, District of Columbia, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
- South: Arkansas, Alabama, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi,
North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia
- West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico,
Oregon, Utah, Washington, Wyoming
- Puerto Rico or other US territories
- Other, please specify:

Do you have biological, adopted, foster, or step children?
No
No, but I am (or my partner is) pregnant or in the process of adopting
Yes, one child
Yes, two children
Yes, three children
Yes, four or more children

**Do you have a long-lasting or chronic condition (physical, visual, auditory, cognitive or
mental, emotional, or other) that substantially limits one or more of your major life activities (your ability to see, hear, or speak; to learn, remember, or concentrate)?**
Yes, please specify:
No
I prefer not to answer

Have you been diagnosed with any disability or impairment?
Yes, please specify:
No
I prefer not to answer

Are you a student?
Not a student
Part-time student
Full-time student

What is your employment status?
Unemployed
Employed part-time (working 1-30 hours/week)
Employed full-time (working more than 30 hours a week)
Retired
Other, please specify:

Which social class do you identify with?
Poor
Working class
Middle class
Affluent

To what extent do you consider yourself a religious person?
____ Not religious at all
____ Slightly religious
____ Moderately religious
____ Very religious

To what extent do you consider yourself a spiritual person?
____ Not spiritual at all
____ Slightly spiritual
____ Moderately spiritual
____ Very spiritual

Appendix D

Medical History Questionnaire

Many of these questions ask about skin (dermatology) conditions or problems that you may have experienced in the past year. For example: rosacea, acne, psoriasis, uticaria, vitiligo, alopecia, eczema, hyperhidrosis.

1. What skin conditions or problems are you currently experiencing (within the past 4 weeks)?

2. What skin conditions or problems have you experienced in the past year (in addition to those described in #1)?

3. In the last 12 months, have you seen a medical provider (physician, nurse, dermatologist) for a skin-related problem?

4. Which condition or skin related symptoms currently bother you the most?

5. How would you rate the severity of your skin condition(s) on a scale of 0 – 10 (0= normal, 10 = very severe)? _____

6. At what age did your skin condition symptoms first begin (e.g., childhood, 1 year ago)? _____

7. Since you first experienced skin symptoms, your symptoms have been…
a. Stable
b. Worsened
c. Improved

8. Overall, how often do you experience symptoms of your skin condition?
Rarely
1-2x per year
3-6x per year
1-2x per Month
1-2x per Week
1-2x each day
Constantly

9. Please check the symptoms experienced in the past year or that you are currently experiencing (i.e., within the past 4 weeks):

Current	Past Year	Symptom
		Itching
		Redness
		Sores

		Bleeding
		Pain
		Color changes
		Rash/Hives
		Outbreak
		Dryness/Peeling
		Sweating
		Burning/stinging
		Other _____

10. Areas of body affected by skin problems/condition (check):

Current	Past Year	Area
		Face
		Neck
		Scalp/Hair
		Arms/Hands
		Legs/Feet
		Torso/Back
		Groin
		Other _____

11. How many times have you seen a medical provider for skin-related concerns in the past
year?
None
One time
2-3
4-6
7-12
13+

12. How many days have you missed from work/school/leisure activities because of your symptoms in the past year? _____

13. What treatments have you received for your skin condition(s)?
Oral Medication
- Specify: type-strength-frequency

Topical Medication
- Specify: type-strength-frequency

Botox/Injections
- Specify purpose – how many times

Surgery
- Specify – purpose – how many times

Over the counter topical creams/medications
- Type

Other
- Describe:

14. If YES to 13; Thinking about the past month, on average how would you rate your ability
to follow through with treatment instructions for your skin symptoms?
0 Very poor
1 Poor
2 Fair
3 Good
4 Very Good
5 Excellent

15. In the past month, did you miss ANY appointments with your doctors?
_____ Yes _____ No

16. About how many doctor appointments did you miss in the past month? _____ past year? _____

17. Weight:
18. Height:

19. Have you had any of these health problems in the past or currently (check all that apply)?
Arthritis/rheumatism
Allergies
Asthma
Frequent or severe headaches
Migraine
Seasonal allergies
Heart attack
High blood pressure
Diabetes
HIV/AIDS
Ulcers
Hives
Back or Neck problems
Other chronic pain
Stroke
Obesity
Heart disease
Chronic lung disease (other than asthma)

Kidney problems
Epilepsy/seizures
Skin Cancer
Other cancer

Appendix E
Additional Acne Questionnaire

How would you describe the pattern of these skin symptoms since you were first diagnosed?
Acute (onset suddenly)
Chronic
Episodic
Seasonal (occurs regularly, but are associated with seasonal patterns such as winter/cold, heat, certain things blooming, etc)
Other

When was your last medical appointment for skin-related problems?

When is your next medical appointment for skin-related problems?

What type of provider do you see for your dermatology/skin disease?
Dermatologist
General physician
Cosmetologist
Other, please specify:
How visible are your skin symptoms to other people?
Not at all visible
Slightly visible
Moderately visible
Very visible

How concerned are you that other people would see or notice your dermatology/skin symptoms?
Not at all
Slightly
Somewhat
Moderately
Extremely

Do you try to cover or hide your skin symptoms (e.g., clothes, grow a beard, make up, bandages, etc.)? Yes/no
What do you do?

How concerned are you to be intimate or engage in sexual activities with someone due to your dermatology/skin symptoms?
Not at all
Slightly
Somewhat
Moderately
Extremely

Appendix F

Overall Anxiety Severity and Impairment Scale (OASIS)

The following items ask about anxiety and fear. These symptoms may include panic attacks, situational anxieties, worries, flashbacks hypervigilence of startle. Include all of your anxiety symptoms when answering these questions. For each item, circle the number for the answer that best describes your experience *over the past week*.

1. In the past week, <u>how often</u> have you felt anxious?

0 = *No* anxiety in the past week.
1 = *Infrequent* anxiety. Felt anxious a few times.
2 = *Occasional anxiety*. Felt anxious as much of the time as not. It was hard to relax.
3 = *Frequent* anxiety. Felt anxious most of the time. It was very difficult to relax.
4 = *Constant* anxiety. Felt anxious all of the time and never really relaxed.

2. In the past week, when you have felt anxious, <u>how intense or severe was your anxiety</u>?

0 = *Little or None*: Anxiety was absent or barely noticeable.
1 = *Mild*: Anxiety was at a low level. It was possible to relax when I tried. Physical symptoms were only slightly uncomfortable.
2 = *Moderate*: Anxiety was distressing at times. It was hard to relax or concentrate, but I could do it if I tried. Physical symptoms were uncomfortable.
3 = *Severe*: Anxiety was intense much of the time. It was very difficult to relax or focus on anything else. Physical symptoms were extremely uncomfortable.
4 = *Extreme*: Anxiety was overwhelming. It was impossible to relax at all. Physical symptoms were unbearable.

3. In the past week, how often did you <u>avoid situations, places, objects, or activities</u> because of anxiety or fear?

0 = *None*: I do not avoid places, situations, activities, or things because of fear.
1 = *Infrequent*: I avoid something once in a while, but will usually face the situation or confront the object. My lifestyle is not affected.
2 = *Occasional*: I have some fear of certain situations, places, or objects, but it is still manageable. My lifestyle has only changed in minor ways. I always or almost always avoid the things I fear when I'm alone, but can handle them if someone comes with me.
3 = *Frequent*: I have considerable fear and really try to avoid the things that frighten me. I have made significant changes in my life style to avoid the object, situation, activity, or place.
4 = *All the Time*: Avoiding objects, situations, activities, or places has taken over my life. My lifestyle has been extensively affected and I no longer do things that I used to enjoy.

4. In the past week, how much did your anxiety <u>interfere with your ability to do the things you needed to do</u> at work, at school, or at home?

0 = *None*: No interference at work/home/school from anxiety

1 = *Mild*: My anxiety has caused some interference at work/home/school. Things are more difficult, but everything that needs to be done is still getting done.
2 =*Moderate*: My anxiety definitely interferes with tasks. Most things are still getting done, but few things are being done as well as in the past.
3 =*Severe*: My anxiety has really changed my ability to get things done. Some tasks are still being done, but many things are not. My performance has definitely suffered.
4 =*Extreme*: My anxiety has become incapacitating. I am unable to complete tasks and have had to leave school, have quit or been fired from my job, or have been unable to complete tasks at home and have faced consequences like bill collectors, eviction, etc.

5. In the past week, how much has anxiety <u>interfered with your</u> <u>social life and relationships</u>?

0 = *None*: My anxiety doesn't affect my relationships.
1 = *Mild*: My anxiety slightly interferes with my relationships. Some of my friendships and other relationships have suffered, but, overall, my social life is still fulfilling
2 = *Moderate*: I have experienced some interference with my social life, but I still have a few close relationships. I don't spend as much time with others as in the past, but I still socialize sometimes.
3 = *Severe*: My friendships and other relationships have suffered a lot because of anxiety. I do not enjoy social activities. I socialize very little.
4 = *Extreme*: My anxiety has completely disrupted my social activities. All of my relationships have suffered or ended. My family life is extremely strained.

Appendix G

Perceived Stress Scale

For each question choose from the following alternatives: 0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often

_____ l. In the last month, how often have you been upset because of something that happened unexpectedly?

_____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?

_____ 3. In the last month, how often have you felt nervous and stressed?

_____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?

_____ 5. In the last month, how often have you felt that things were going your way?

_____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?

_____ 7. In the last month, how often have you been able to control irritations in your life?

_____ 8. In the last month, how often have you felt that you were on top of things?

_____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?

_____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Appendix H

Daily Acne Survey

Please enter your cell phone number beginning with the area code:

What type of acne did you experience in the past 24 hours? You are welcome to use your reference sheet for judgement.
No acne
Subclinical acne
Comedonal acne
Mild acne
Moderate acne
Severe nodular acne
Severe cystic acne

How would you rate your acne on a 0 to 10 scale?
0 = none
1
2
3
4
5 = moderate
6
7
8
9
10 = severe

Appendix I

Daily Anxiety Survey

In the past 24 hours, when you have felt anxious, how intense or severe was your anxiety?

0 = *Little or None*: Anxiety was absent or barely noticeable.
1 = *Mild*: Anxiety was at a low level. It was possible to relax when I tried. Physical symptoms were only slightly uncomfortable.
2 = *Moderate*: Anxiety was distressing at times. It was hard to relax or concentrate, but I could do it if I tried. Physical symptoms were uncomfortable.
3 = *Severe*: Anxiety was intense much of the time. It was very difficult to relax or focus on anything else. Physical symptoms were extremely uncomfortable.
4 = *Extreme*: Anxiety was overwhelming. It was impossible to relax at all. Physical symptoms were unbearable.

In the past 24 hours, how often did you avoid situations, places, objects, or activities because of anxiety or fear?

0 = *None*: I do not avoid places, situations, activities, or things because of fear.
1 = *Infrequent*: I avoid something once in a while, but will usually face the situation or confront the object. My lifestyle is not affected.
2 = *Occasional*: I have some fear of certain situations, places, or objects, but it is still manageable. My lifestyle has only changed in minor ways. I always or almost always avoid the things I fear when I'm alone, but can handle them if someone comes with me.
3 = *Frequent*: I have considerable fear and really try to avoid the things that frighten me. I have made significant changes in my life style to avoid the object, situation, activity, or place.
4 = *All the Time*: Avoiding objects, situations, activities, or places has taken over my life. My lifestyle has been extensively affected and I no longer do things that I used to enjoy.

In the past 24 hours, how much did your anxiety interfere with your ability to do the things you needed to do at work, at school, or at home?

0 = *None*: No interference at work/home/school from anxiety
1 = *Mild*: My anxiety has caused some interference at work/home/school. Things are more difficult, but everything that needs to be done is still getting done.
2 =*Moderate*: My anxiety definitely interferes with tasks. Most things are still getting done, but few things are being done as well as in the past.
3 =*Severe*: My anxiety has really changed my ability to get things done. Some tasks are still being done, but many things are not. My performance has definitely suffered.
4 =*Extreme*: My anxiety has become incapacitating. I am unable to complete tasks and have had to leave school, have quit or been fired from my job, or have been unable to complete tasks at home and have faced consequences like bill collectors, eviction, etc.

In the past 24 hours, how much has anxiety <u>interfered with your</u> <u>social life and relationships</u>?

0 = *None*: My anxiety doesn't affect my relationships.
1 = *Mild*: My anxiety slightly interferes with my relationships. Some of my friendships and other relationships have suffered, but, overall, my social life is still fulfilling
2 = *Moderate*: I have experienced some interference with my social life, but I still have a few close relationships. I don't spend as much time with others as in the past, but I still socialize sometimes.
3 = *Severe*: My friendships and other relationships have suffered a lot because of anxiety. I do not enjoy social activities. I socialize very little.
4 = *Extreme*: My anxiety has completely disrupted my social activities. All of my relationships have suffered or ended. My family life is extremely strained.

Appendix J

Daily Depression Survey

Over the past 24 hours, how often have you been bothered by any of the following problems?

Little interest or pleasure in doing things

Not at all
Less than 1 hour each day
Between 1 and 3 hours each day
Between 3 and 8 hours each day
8 hours or more each day

Feeling down, depressed or hopeless

Not at all
Less than 1 hour each day
Between 1 and 3 hours each day
Between 3 and 8 hours each day
8 hours or more each day

Appendix K

Daily Stress Survey

In the past 24 hours, how stressed have you been?

0 = none
1
2
3
4
5 = moderate
6
7
8
9
10 = severe