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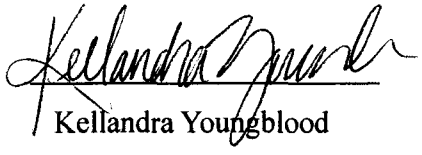

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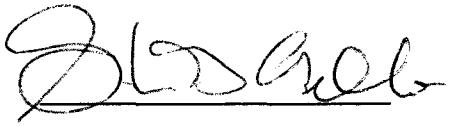

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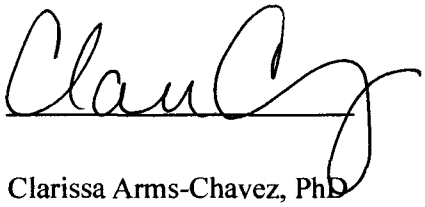

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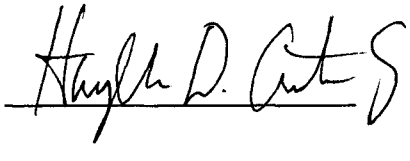

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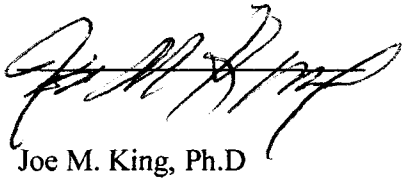

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Corticosteroid Use, Depression, and Health Related Quality of Life

Among Individuals with Asthma

by Kellandra Youngblood

A thesis submitted to the Graduate Faculty of
Auburn University Montgomery
in partial fulfillment of the requirements of the Degree of
Master of Science

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May, 2014

Keywords: asthma, asthma medication, corticosteroids, depression, quality of life

Approved by

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Abbreviations

Asthma Call Back Survey	ACBS
Behavioral Risk Factor Surveillance Survey	BRFSS
Centers for Disease Control and Prevention	CDC
Chronic Obstructive Pulmonary Disease	COPD
Corticosteroids	CS
Health Related Quality of Life	HRQOL
Inhaled Corticosteroids	ICS
National Center for Health Statistics	NCHS
Oral Corticosteroids	OS
Patient Health Questionnaire-8	PHQ-8
Quality of Life	QOL

Abstract

The purposes of this study were to determine if corticosteroid (CS) use among individuals who have asthma are more likely to report more symptoms of depression (PHQ-8) and lowered health related quality of life (HRQOL). The current study utilized survey data taken from men and women ages 18-99 who completed the 2006 Behavioral Risk Factor Surveillance Survey (BRFSS) and 2006 Asthma Call Back Survey (ACBS). Individuals who reported having asthma in the BRFSS were randomly selected to participate in the follow-up ACBS. Two studies were conducted to evaluate these phenomena. In Study 1 (PHQ-8), there were 5,453 participants. In Study 2 (HRQOL), there were 10,801 participants. The results indicate that CS use is not significantly related to depression. Results also indicate that CS use is significantly related to overall HRQOL. Moreover, higher CS use (two or more CS) is associated with lowered HRQOL.

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Asthma is an inflammation of the lung's airways that causes them to constrict or tighten, which makes breathing difficult. Asthma is a very prevalent and expensive health issue (Centers for Disease Control and Prevention; CDC, 2012; Ford et al., 2003). Depending on the severity, asthma sufferers may use a combination of treatments to effectively control and reduce symptoms. Treatments can include: rescue/maintenance inhalers, oral medication (pills), syrup, and nebulizers. These medications often include drugs such as corticosteroids (CS), leukotriene modifiers, bronchodilators, and combinations of CS and bronchodilators. Bonala et al. (2003) states that asthma treatments are typically focused on inhaled corticosteroids (ICS) as the main maintenance medication, which is complemented by long acting beta-agonists and leukotriene antagonists. Furthermore, short-acting beta-agonists and systemic CS are used as immediate relief medications (Bonala et al., 2003). Romero-Frais et al. (2005) emphasize that oral and inhaled CS are the best medical treatments for managing severe (or near-fatal) asthma. Nevertheless, CS are very popular because they mainly aid in the inhibition of pro-inflammatory genes within the body that disrupt proper lung airway functioning (Brown, Khan, & Netjek, 1999; Bonala et al., 2003). The current study focuses on the relationship between CS and depression.

Since their introduction, CS have been the primary solution for a variety of medical issues. CS therapy emerged in the 1950s to treat medical issues such as: rheumatoid arthritis, Chronic Obstructive Pulmonary Disease (COPD), Cushing's Syndrome, allergies, and asthma (Brown & Chandler, 2000; Patten & Neutel, 2000; Sin & Tu, 2001; Perantie & Brown, 2002). However, shortly after their introduction,

researchers reported that CS were causing adverse reactions (in physical, psychological, and cognitive functioning) for the patients who were being treated with CS medications (Patten & Neutel, 2000). The reactions that gained the most attention were those that caused changes in psychological functioning (Rice-McDonald, Bowler, Staines, & Mitchell, 2005; Bonala et al., 2003, Perantie & Brown, 2002; Brown & Chandler, 2001; Brown et al., 1999).

Although CS treatment is successful at reducing the inflammation that plagues asthmas sufferers, these patients are at risk for psychiatric side effects as well. Depression, mania, delusions, and hallucinations have all been reported as psychiatric side effects from treating systemic diseases and inflammatory conditions such as Cushing's syndrome and COPD with CS (Brown et al., 1999, Brown & Chandler, 2001; Sin & Tu, 2001). Patten and Neutel (2000) found that older literature (circa 1950s) contained many reports that used inadequate methods and vague definitions in gathering data on the association between CS and psychological side effects. Also, there is some evidence of a dose-response relationship between CS and psychiatric side effects (Brown & Chandler, 2001). Typically, CS dosage is matched to the severity of a person's asthma (Bonala et al., 2003) The Boston Collaborative Drug Surveillance Program (BCDSP, 1972) found that there was a significant difference in the amount of psychiatric side effects at three different CS dosage levels. Approximately 18% of the participants who received 80 mg of prednisone per day experienced psychiatric side effects compared to those who only took 41-80 mg/day (4.6%) and 40 mg/day of prednisone (1.3 %; BCDSP,1972). Bender, Lerner, and Kollasch (1988) also found a dose-dependent

relationship, such that children with severe asthma who received high doses of prednisone (an average of 61.5 mg per day) showed elevation in depression and anxiety symptoms compared to children who received low doses of prednisone (an average of 3.33 mg per day). It is also important to note that these symptoms were notable, but not enough to diagnose those children with depression (Bender et al., 1988).

Several researchers attempted to document the association of CS medication and depression. In one study, Patten and Lavorato (2001) examined several types of medication and their association with depression. CS were one of few named medications that were found to be associated with depression (Patten & Lavorato, 2001). In another study, Bonala et al. (2003) examined the relationship among ICS dosage, asthma severity, and mood changes in asthma sufferers. The researchers were particularly concerned with how these variables affect asthma sufferers' quality of life (QOL) and predict psychiatric disorders (Bonala et al., 2003). They found that there was a higher prevalence of depression and anxiety symptoms in the sample than anticipated (Bonala et al., 2003). Although high doses of ICS helped reduce asthma severity, high ICS dosage was linked to a lowered "mental" Quality of Life (QOL) score and psychiatric morbidity (Bonala et al., 2003). Finally, Romero-Frais et al. (2005) examined patients with near fatal asthma who were prescribed oral corticosteroids (OS) and how OS were related to depression and anxiety. The researchers found a strong connection to the severity and occurrence of anxiety symptoms for those near fatal asthma patients who were prescribed OS (Romero-Frais et al., 2005). However, they did not find a statistical association between depression and the OS for the near-fatal asthma patients (Romero-Frais et al., 2005).

It is also important to study asthma sufferers' health related quality of life (HRQOL) because previous literature has illustrated that asthma sufferers have impaired quality of life (Ford et al., 2003). The HRQOL is particularly helpful in evaluating the impact and burden of chronic health conditions such as asthma (Moriarty, Zack, & Kobau, 2003). The HRQOL is a brief self-report measure created by the CDC that covers all three facets of health (physical, mental, and social well-being) as stated by the World Health Organization (WHO; Moriarty et al., 2003). For example, Ford et al. (2003) surveyed asthma sufferers' HRQOL using the 2000 Behavioral Risk Factor Surveillance Survey (BRFSS). Ford et al. (2003) found an interesting relationship between asthma sufferers' disease status and their self-reported QOL. When current asthma sufferers were compared to others who formerly had asthma or did not have asthma, current asthma sufferers reported worse HRQOL overall (Ford et al., 2003). Furthermore, former asthma sufferers still experience worse quality of life when compared to those who never had asthma (Ford et al. 2003). In addition, those who currently suffer from asthma experienced an average of 10 days of impaired mental or physical health (per month), which was approximately twice the amount of days reported by individuals who do not have asthma (Ford et al., 2003). This study is important because the researchers used a very large sample (N = 163,773) to investigate asthma and QOL (Ford et al., 2003). Since there are so many individuals that suffer from this condition, the researchers wanted to emphasize the importance of improving the quality of life for asthma sufferers (Ford et al., 2003).

Literature concerning the relationship between CS and depression is scant. Research states that the evidence supporting a relationship between CS and depression is inadequately documented and validated (Patten & Neutel, 2000; Patten, 2000). Furthermore, Brown and Chandler (2001) report that previous literature shows mania symptoms may be more frequent than depression symptoms. In addition, Romero-Frais et al. (2005) found that a relationship between anxiety symptoms and CS was more significant than one between CS and depression symptoms. However, Patten and Lavorato (2001) found that CS are associated with depression. Finally, sadness, depressive symptoms, and other psychiatric issues are linked to high dosages of CS (BCDSP, 1972; Bender et al., 1988; Bonala et al., 2003).

There are several limitations of these studies that highlight the importance of and the rationale of the current study. First, the BCDSP (1972) did not fully specify which psychiatric symptoms were reported. Next, much of the previous literature used patients in hospitals who were seeking treatment for an illness (including the BCDSP, 1972; Bender et al., 1988; and Bonala et al., 2003). The participants in those studies were more than likely members of convenience samples. Also, two studies used small samples (Bender et al., 1988; Bonala et al., 2003; Romero-Frais et al., 2005). This makes it difficult to validate the relationship between CS and depression. Moreover, the results produced are not very strong in a statistical sense. Furthermore, the Romero-Frais et al. (2005) and the Bonala et al. (2003) research did not compare the side effects of the CSs to those of other medications. However, those two studies raise interesting questions that are assessed in the current study . Understanding the relationship between CS and

depression may be clarified by using a representative sample of the general population because asthma is a common, relevant and costly health issue (CDC, 2012; Ford et al., 2003). Also, this is important because little research has documented the impact of this health condition within the general population (Ford et al., 2003; Patten& Lavorato, 2001; Patten, 2000). The purposes of the current study are to overcome the limitations of the previous findings by a) comparing the effects of CS to non-CS medication on the HRQOL; b) utilizing a larger sample that is representative of the general population; and c) quantify the quality of life of asthma sufferers.

There are two goals of the current study. The first is to determine if there is an association between CS medication use and depression. The researchers hypothesize that those who suffer from asthma in the general population will report more symptoms of depression compared to those who are using non-CS medication or no medication at all. Second, the researchers hypothesize that asthma sufferers' quality of life (HRQOL) is also affected by the CS use. The researchers expect to find that those using CS medications to treat asthma will be more likely to report lowered HRQOL compared to those who are taking non-CS medication or no medication. In both studies, the effects of sex, age, race, education, and income will be controlled from the models by including them as covariates. Data and corresponding information will be gathered from the Behavioral Risk Factor Surveillance Survey and Asthma Call Back Survey (BRFSS; ACBS, 2006).

General Method

Overview

The participants in both studies are part of a larger annual survey called the BRFSS which is conducted by the CDC. Certain branches of the Centers for Disease Control (CDC) such as the National Center for Health Statistics (NCHS) are crucial in monitoring and surveying important asthma information (CDC, 2012). The NCHS has been involved in and dedicated to the Behavioral Risk Factor Surveillance Survey (BRFSS; CDC, 2012). This is a federally funded program that conducts statewide telephone surveys to assess the scope and severity of relevant health issues (CDC, 2012). The data are generated through a random-digit dialing telephone survey of adults in the U.S (CDC, 2012). States have the option to include additional survey modules to gather information about more relevant health issues specific to that location. BRFSS participants who reported having asthma were asked to participate in the Asthma Call Back Survey (ACBS; which is a follow-up of the BRFSS) that gathers more detailed information about the participants who reported suffering from asthma in the original survey. The ACBS also serves as a way to estimate present and lifetime prevalence of asthma (CDC, 2012).

In order to adequately answer the questions proposed earlier in the discussion, separate analyses were conducted on the outcome variables called depression (scores on Patient Health Questionnaire-8) and unhealthy days (HRQOL). Consequently, two different samples were selected. Only a select number of participants took the PHQ-8.

However, all of the participants included were asked to report their health related quality of life. Thus, sample two is larger than sample one.

Participants

Five thousand four hundred fifty-three participants from the 2006 Asthma Call Back Survey were used in Study 1. There were 1648 males and 3805 female participants. The participants ranged from 18 to 99 years of age, with a mean age of 51.8 years. In Study 2, 10,801 participants were used from the 2006 ACBS survey. There were 3225 males and 7576 female participants. The participants ranged from 18 to 99 years of age, with a mean age of 52.3 years. Refer to Table 2 for a full listing of participant descriptor variables for both studies.

Design and Procedure

The design of the two studies is linear regression adapted to the analysis of survey data gathered using a complex sampling strategy. Specifically, SAS proc surveyreg was used to analyze data from both studies. The two studies had identical predictor variables and covariates, but different outcome variables. The outcome variable in Study 1 is PHQ-8, a measure of depression described below. The outcome variable in Study 2 is Health Related Quality of Life, also described below.

Variables

Self-reported depression (PHQ-8) is the outcome variable in Study 1. The Patient Health Questionnaire-8 (PHQ-8) is a diagnostic measure that assesses current

depression. The PHQ-8 examines eight of the nine symptoms contained in the Diagnostic and Statistical Manual of Mental Disorders-TR-IV (DSM IV, APA 2000) that identify depressions (Jiang & Hesser, 2011). The ninth symptom (suicide ideation/self-harm) is excluded because it is difficult during telephone surveys to deliver adequate intervention if a respondent reports experiencing this behavior (Jiang & Hesser, 2011). Example items of the PHQ-8 include how many days has a person had little pleasure in doing things, had a poor appetite, and sleeping difficulty (Jiang & Hesser, 2011). This measure surveys how many days within the past two weeks has the respondent experienced symptoms of depression (Jiang & Hesser, 2011). Kroenke et al. (2001; as cited in Kroenke et al., 2008) states that a score greater than or equal to 10 indicates clinically significant depression (and higher numbers mean more severe). In addition, Kroenke et al. (2008) found that a score of 10 or more also provided 88% sensitivity and 88% specificity. Previous studies have validated this tool for use in clinical populations for diagnosing depression and as a severity measure (Kroenke et al. 2008).

Health related quality of life (HRQOL; "Healthy Days") is the outcome variable in Study 2. This is measured by the "Healthy Days" questionnaire which surveys general, physical, and mental health (Moriarty et al, 2003). This brief measure takes approximately one minute to administer (Moriarty et al., 2003). It simply asks the respondent to report their own observed mental, physical, and general health over a 30 day period (Moriarty et al., 2003). For example one question asks "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" (Moriarty et al., 2003).

Scoring is completed by combining the amount of days gathered from the poor mental and physical health questions (for a maximum of 30 days; Moriarty et al., 2003). Higher numbers of unhealthy days reported is associated with decreased HRQOL ("healthy days"). This measure has been validated in many populations (Moriarty et al., 2003). Various studies have also concluded that this measure has good construct validity (Moriarty et al., 2003). Moriarty et al. (2003) also report that this measure was found to have concurrent validity in previous research.

The predictor variable in both studies is asthma medication (CS vs. non-CS). Asthma medication refers to the course of treatment that a person is using to maintain, relieve, and control the symptoms of asthma. In Study 1, participants reported taking no CS, one CS, or two or more CS to treat their asthma (Refer to Tables 1 and 2) . In addition, participants also reported taking a range of 0 - 3+ non-CS medication to treat their asthma. Information about their current asthma medications was reported in the ACBS only.

There are also several covariates that are included in the analyses: sex, race, education, income, and asthma symptom severity. There are five possibilities for race: White, Black, Asian, Native American, or Hawaiian/Pacific Islander. Education was measured by the last type of education that the participant had completed. These levels ranged from "Never Attended School" to "College Graduate". Refer to Tables 1 and 2 for a complete listing of education. Income was measured by yearly salary in increments of $5- and $10,000. Incomes ranged from $0 to $35,000. Refer to Tables 1 and 2 for each

salary band. Asthma symptom severity was the frequency of asthma symptoms during a 30-day period as reported by participants.

Results

Study 1

A linear regression analysis using SAS *proc surveyreg* was conducted to evaluate the first hypothesis that depression is associated with CS use while controlling for potential confounding variables. The full model is significantly related to outcome variable depression ($R^2 = 0.25$, $F_{30, 5016} = 11.8$, $p < .0001$). However, neither CS use nor the use of other medications was related to depression as measured by the PHQ-8. There was no significant interaction between CS use and other asthma medications. Table 3 shows tests of effects for each variable in the model along with corresponding *F*- values and *p*-values. In this model, asthma symptom severity, educational level, annual income, age and age^2 were significantly related to depression.

Study 2

Linear regression analyses were conducted to evaluate the second hypothesis that CS and HRQOL are related. In the first analysis, the physical and mental health components of HRQOL were combined for each participants score. This combined model was significantly related to the dependent variable HRQOL ($R^2 = 0.19$, $F_{29, 9724} = 22.84$, $p < .0001$). In addition, CS are significantly related to HRQOL. There was no significant interaction between CS use and other asthma medications. Table 4 shows tests of effects for each variable in this model along with corresponding *F*-values and *p*-values.

Asthma symptom severity, sex, age, age^2, education, and income were all significant in this model.

An analysis of contrasts was conducted to further understand how CS are related to HRQOL. When the average number of unhealthy days reported by asthma sufferers who take no CS are compared to those who take one CS, there is not a significant difference ($F_{1, 9724} = .27$, p= ns). However, the difference in average number of unhealthy days reported is statistically significant between asthma sufferers who take no CS when compared to those who take two or more CS ($F_{1, 9724} = 5.5$, p =.02), and those who take one CS when compared to those who take two or more CS ($F_{1,9724} = 6.7$, p = .009). Results indicate that increasing CS use beyond one medication is related to increasing the number of unhealthy days reported. Table 6 shows each level of CS use along with mean number of unhealthy days reported.

In the last analysis, a hierarchical regression analysis was used to evaluate the particular effects of CS and drugs on HRQOL. This first step only contains the predictor variables CS and drugs and the interaction between them. This first step model is significantly related to HRQOL ($R^2 = 0.04$, $F_{11, 9983} = 8.31$, p <.0001). Both CS and Non-CS medications are significantly related to HRQOL. However, there was no significant interaction between CS and Non-CS medications in this model. Table 5 shows the tests of effects for the two variables in this model along with corresponding F-values and p-values. The second step model is essentially the same first full model (that was previously discussed for Study 2). This model contains all of the variables considered in Study 2. This second step model was significantly related to the dependent variable

HRQOL ($R^2 = 0.19$, $F_{29, 9724} = 22.84$, $p < .0001$). The hierarchical regression shows that corticosteroids account for a small but statistically significant component of the R^2 value obtained in the full model.

Discussion

The current study predicted that individuals with asthma who use CS would be more likely to report more symptoms of depression when compared to individuals who take Non-CS medication. A second hypothesis was that individuals with asthma who use CS would be more likely to report lowered HRQOL when compared to those who take Non-CS medication and those who do not take any medication. The first hypothesis was not supported. However, the second hypothesis was supported. Results from the first study indicate, that CS use among asthma sufferers is not significantly related to self-reported depression. Results from the second study indicate that CS use among asthma sufferers is significantly related to HRQOL. Furthermore, the results show that taking larger amounts of CS is related to reports of more unhealthy days and lowered HRQOL. The effects of CS on HRQOL are found while controlling for the effects of sex, race, education, income, and asthma symptom severity.

In the first study, CS were not significantly related to the asthma sufferers' depression symptoms. Previous research has shown conflicting findings. This finding does agree with the Romero-Frais et al. (2003) study that found no statistical association between CS and depression among near-fatal asthma sufferers. In contrast, this finding does not support the previous finding that CS use is related to depression (Bender et al.,

1988; Patten & Lavorato, 2001). It could be possible that the participants in the current study who use CS are not taking CS at a high enough dosage to produce an adverse reaction or elevated depression symptoms.

In the second study, results show that CS use has a small, but meaningful impact on overall HRQOL. In particular, taking larger amounts of CS (increasing beyond one CS medication) increases the likelihood of reporting more unhealthy days and lowers HRQOL. This finding supports previous research conducted by Ford et al. (2003). It may also help explain why Ford et al. (2003) found that individuals with asthma reported more unhealthy days compared to those without asthma. It could be possible that these individuals may be experiencing side effects of CS that they do not seek treatment for. Moreover, these individuals with asthma who take (more) CS medications may not realize that those seemingly unrelated side effects could be by-products of CS use.

There are several benefits generated by this research. Previous research that documented associations between CS and depression and CS and HRQOL produced extreme results. Such research used very small ,but unique samples in which it was more likely to find asthma sufferers with severe symptoms who reported more depression symptoms and lowered HRQOL (BCDSP, 1972; Bender et al., 1988; Bonala et al., 2003). The current study resolved this issue by utilizing a large representative sample from the general population. The importance of this is that these participants represent a realistic picture of what the average individual with asthma looks like. Few researchers have been able to document this picture (Ford et al., 2003; Patten & Lavorato, 2001). Average individuals with asthma may not have severe enough asthma to be hospitalized, but they

are likely able to manage asthma symptoms with routine checkups and maintenance medication. Since this is such a prevalent and expensive health issue (CDC, 2012; Ford et al., 2003), clinicians must be able to determine a profile of the average individual with asthma in order to make proper diagnoses and maximize treatment plans.

Another value of the current study is found in defining and controlling for asthma symptom severity in both studies. Bonala et al. (2003) and Ford et al. (2003) mention asthma symptom severity in their research. These two studies did not clarify what was considered severe asthma symptoms. Particularly, Bonala et al. (2003) distinguished asthma severity by such labels as mild, moderate, and severe .The issue in labeling asthma severity is that there was no clear criteria mentioned in determining how asthma severity symptoms were considered mild, moderate, or severe. In addition, Ford et al. (2003) reported that previous research indicates that HRQOL may be an indicator of asthma severity and that the adjustments in HRQOL could be related to patients' conditions (i. e. asthma severity). The researchers in the current study have made asthma symptom severity more observable by examining the frequency of symptoms (as denoted by amount of days with symptoms per month) experienced.

A third value gained in the current study is that the researchers made more complete comparisons in understanding how CS impacts depression and HRQOL when compared to Non-CS medication and no medication at all. Past research considered CS (or No medication only) as the treatment of choice for individuals with asthma (BCDSP, 1972; Bender et al., 1988, Bonala et al., 2003; Romero-Frais et al., 2005). Here in the current study, the researchers have considered all treatment options, especially ones

where an individual with asthma may not be take CS to treat asthma symptoms. Again, this information is important in understanding the average individual's experience with asthma. The current study ultimately considered a large sample of participants who manage their asthma in different ways.

Last, the findings from the current study enable better conclusions to be drawn regarding the relationships between CS and depression and CS and depression among individuals with asthma. Generally, the researchers found that, among individuals with asthma, CS use is not significantly related to depression. However, CS has a small but meaningful impact on overall HRQOL for those individuals who have asthma. Yet, there is one limitation of the current study. The researchers in the current study are not able to fully make connections between the high CS dosages observed compared to high dosages reported in other research (i.e. BCDSP, 1972; and Bender et al., 1988). This is because the current study denoted that high CS use is indicated by taking two or more CS, while the BCDSP (1972) and Bender et al. (1988) denoted high CS dosage at 80 mg/day and 61.5 mg/day, respectively. In the medical world today, high CS dosage is now lower compared to high CS dosage documented in earlier years by BCDSP (1972) and Bender et al. (1988). This information is also supported by the fact that CS use was not significantly related to depression and that there was a small impact of CS use in overall HRQOL.

In conclusion, earlier research has shown that CS are effective in treating such chronic conditions as asthma and they have also (inadequately) showed the negative side effects associated with CS use. However, with the addition of more research in this area

and the clarification of data methods over time, CS use seems to have a lesser impact on depression symptoms and general QOL than first observed. Future research on CS use among individuals with asthma should examine more specific CS dosages in relation to depression symptoms and HRQOL.

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Table 1. *Demographic Characteristics of Study 1 Sample*

Characteristic	N	Percent
Sex		
Male	1648	38.43
Female	3805	61.57
Race		
White	4376	74.83
Black or African American	335	6.27
Asian	252	5.08
Native Hawaiian or Other Pacific Islander	249	3.44
American Indian or AlaskaNative	200	10.03
Refused	41	0.36
Education Level		
Never Attended School	6	0.07
Elementary	124	1.77
Some High School	343	5.99
High School Graduate	1445	24.87
Some College or Technical School	1591	30.61
College Graduate	1937	36.60
Refused	7	0.08

Table 1 cont.

Demographics of Study 1 Sample

Annual Income		
None	506	8.81
$1- $10,000	798	12.33
$10,001- $15,000	909	14.49
$15,001-$20,000	597	10.04
$20,001-$25,000	783	13.05
$25,001-$35,000	1860	41.28
Medication: Steroids		
None	3925	76.96
1	1341	21.21
2 or more	117	1.84
Medication: Non Steroids		
None	2793	55.38
1	1155	21.24
2	817	12.61
3 or more	618	10.77

Table 2. *Demographic Characteristics of Study 2 Sample*

Characteristic	N	Percent
Sex		
Male	3225	39.09
Female	7576	60.91
Race		
White	8898	75.28
Black or African American	505	6.96
Asian	383	4.48
Native Hawaiian or other Pacific Islander	400	3.16
American Indian or Alaska Native	471	9.62
Refused	82	0.50
Education Level		
Never Attended	12	0.05
Elementary School	247	1.82
Some High School	651	6.60
High School Graduate	2695	24.45
Some College or Technical School	3303	30.38
College Graduate	3882	36.62
Refused	11	0.07

Table 2 cont.

Demographics of Study 2 Sample

Annual Income		
None	1050	9.82
$1-$10,000	1447	11.21
$10,001-$15,000	1752	14.10
$15,001-$20,000	1133	9.44
$20,001-$25,000	1539	13.00
$25,001-$35,000	3816	41.42
Medication: Steroids		
None	7697	76.37
1	2722	21.70
2 or more	251	1.93
Medication: Non Steroids		
None	5523	54.89
1	2311	21.18
2	1621	13.68
3 or more	1215	10.25

Table 3. *Test of Effects for Study 1 (PHQ-8)*

Variable	*F*-value	*p*-value
Corticosteroids	0.24	0.7868
Non-Corticosteroid Drugs	1.33	0.2636
Age	21.26	<.0001
Age^2	30.59	<.0001
Sex	2.87	0.0906
Race	1.35	0.2419
Education	6.18	<.0001
Income	16.84	<.0001
Asthma Severity	11.13	0.0009

Table 4. *Test of Effects for Study 2 (HRQOL Full Model)*

Variable	*F*-value	*p*-value
Corticosteroids	3.37	0.0345
Non-Corticosteroid Drugs	1.11	0.3419
Age	31.54	<.0001
Age^2	30.70	<.0001
Sex	6.43	0.0113
Race	1.60	0.1553
Education	5.05	0.0005
Income	23.05	<.0001
Asthma Severity	39.14	<.0001

Table 5. *Test of Effects for Study 2 (Hierarchical Regression CS and Non-CS Drugs)*

Variable	*F*-value	*p*-value
Corticosteroids	4.14	0.0160
Non-Corticosteroid Drugs	3.00	0.0292

Table 6. *Test of Contrasts - Average Number of Unhealthy Days Reported for CS Use Study 2*

Corticosteroid Use	Average number of Unhealthy Days Reported	Standard Deviation
None	8.6	23.3
One Corticosteroid	11	29.1
Two or More Corticosteroid Drugs	16.2	21.2