

Effect of Atopic Dermatitis on Quality of Life and Healthcare Resource Utilization in Saudi Arabia

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Abstract

The prevalence of atopic dermatitis (AD), spanning across from childhood through adolescence is increasing in the Middle East region. Poor Quality of Life (QoL), excessive healthcare expenditure, loss of school and workdays are considered to be the significant burden of AD. Although, QoL data is available for children affected by AD in Saudi Arabia, there is limited data for adolescents and adults. Moreover, data on healthcare resource utilization (HCRU) in Saudi Arabia is lacking. The purpose of this review was to evaluate the association between AD severity and AD-related QoL and HCRU in adolescents and adults in Saudi Arabia. It also aimed to identify the gaps in literature on AD in the above two patient populations in Saudi Arabia and provide recommendations for better management of QoL and HCRU-related issues. Extensive literature search was carried out through various search engines, such as PubMed, MEDLINE, Web of Science, and Google Scholar using different keywords. This review highlighted the lack of literature from Saudi Arabia with respect to the effect of AD on QoL and HCRU in adult and adolescent populations. The gaps in data regarding patient perception, physician knowledge, family and caregiver burden, and QoL for better AD management related HRQoL and HCRU in Saudi Arabia were also identified and recommendations to bridge these gaps were provided.

Keywords: Adolescent, quality of life, dermatitis, atopic, prevalence, Saudi Arabia.

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INTRODUCTION

Atopic dermatitis (AD) is a chronic inflammatory skin condition characterized by severe pruritus and red, dry, and inflamed skin (Alshareef, Alghamdi, Al Harfi, & Abuaziz, 2019; Birdi, Cooke, & Knibb, 2020). Although AD mainly affects children (95% of first episodes occur before 5 years of age), it is not uncommon in adults (Al-Afif *et al.*, 2019; Alshareef *et al.*, 2019; Farajzadeh, Esfandiarpour, Sedaghatmanesh, & Saviz, 2014). Adult-onset AD or AD relapsing in adults might be a serious condition, with symptoms such as hand eczema and intense pruritis (Alshareef *et al.*, 2019).

Atopic dermatitis is a significant global health issue (Birdi *et al.*, 2020; Carrera *et al.*, 2019; Langan, Irvine, & Weidinger, 2020; Laughter *et al.*, 2021),

although it is difficult to study the prevalence of AD because the data are complicated by different definitions and diagnostic criteria (Dierick *et al.*, 2020). Disability-adjusted life-years (DALYs) is a method commonly used to measure the burden of a disease. This is expressed as the difference between living a healthy life and living a life with a disease and is calculated as the years lost due to disability along with the years of life lost. In case of AD (a nonfatal disease), measurement of DALYs usually involve disability associated years lost. In terms of disease burden, AD has highest DALY burden among skin diseases and ranks 15th among non-fatal diseases (Laughter *et al.*, 2021). The global burden, in terms of DALYs due to AD, has remained stable from 1990 [global DALY rate 121; 95% uncertainty interval (UI) 65.4-121] to 2017 (123; 95% UI 66.8-205) (Laughter *et al.*, 2021), with

the highest burden found to be in the high-income countries (Urban *et al.*, 2021). Prevalence of AD has attained a plateau stage in developed countries, such as those in Europe and North America, but is increasing in other countries (Bylund, von Kobyletzki, Svalstedt, & Svensson, 2020).

The prevalence of AD is increasing in the Middle East region, but data are lacking from some countries in the region (Hasnain, Al-Qassim, Hasnain, & Al-Frayh, 2016). A study from Saudi Arabia involving young adults (average age: 21.5 ± 1.5 years) with physician-diagnosed allergic diseases (N=222), reported the prevalence of AD as 13.1% among other studied allergic diseases (Alqahtani, 2020). In another study, which was carried out across a span of 5 years on the dermatology patients (N=13,778) from the Hail region of Saudi Arabia, 25% were found to have dermatitis, with approximately half of the dermatitis patients (25%) suffering from AD (12%) (Al Shammrie & Al Shammrie, 2017). Moreover, AD prevalence in the Hail region was found to increase from 8% to 12% (Al Shammrie & Al Shammrie, 2017). As per a study in Qatar, conducted on patients with various allergies, 23% of the population had been affected by AD (Hasnain *et al.*, 2016). Health-related quality of life (HRQoL) is a good indicator for health and disease management (Dominick, Ahern, Gold, & Heller, 2002; D. H. Kim *et al.*, 2012), and AD has a greater effect on quality of life (QoL) in adults than other dermatologic conditions, such as chronic urticaria and psoriasis (J. Grob, Revuz, Ortonne, Auquier, & Lorette, 2005). Although QoL in adults with AD is notably compromised (Eckert *et al.*, 2017; J. Grob *et al.*, 2005), data regarding the same in Saudi Arabia are limited for adolescents and adults (Binyamin *et al.*, 2017; Dierick *et al.*, 2020). A US claims-based study and an EU survey showed that moderate to severe AD was associated with significant healthcare resource utilization (HCRU) (Aaron M Drucker *et al.*, 2018; Girolomoni *et al.*, 2021). However, Saudi Arabia lacks data on AD-related HCRU (Al-Afif *et al.*, 2019; Dierick *et al.*, 2020). Literature shows that as AD severity increases, HRQoL decreases (Andersen, Nyeland, & Nyberg, 2020; Birdi *et al.*, 2020; Lifschitz, 2015; Misery *et al.*, 2017). However, the difference in QoL between those with AD versus the general population has not been well-researched worldwide (D. H. Kim *et al.*, 2012). Additionally, the correlation between AD disease severity and QoL and HCRU in adult patients and also management of AD-related HRQoL has not been studied extensively in Saudi Arabia.

This narrative review was therefore undertaken to understand the correlation between AD disease severity and its effect on HRQoL & HCRU in adolescents and adults in Saudi Arabia. The review also aimed to provide recommendations to bridge the gaps in lack of data between the management of AD-related HRQoL and HCRU in Saudi Arabia.

Literature Search Strategy

This narrative review is based on a literature search carried out through PubMed, MEDLINE, Web of Science, and Google Scholar. English language publications available through November 30, 2020, were searched for by combining the search terms (as shown in the appendix) using Boolean operators “AND/OR”. Publications covering only pediatric populations (younger than 12 years) and pathophysiological, therapeutic, or diagnostic aspects of AD were excluded.

Etiology of Atopic Dermatitis in Saudi Arabia

Etiological components of AD include genetic predisposition, disruption of epidermal barrier and immune system dysregulation. A complex interaction between these factors along with the environment result in the pathogenesis of AD (Al-Shobaili, Ahmed, Alnomair, Alobead, & Rasheed, 2016). Al-Shobaili *et al.*, (2016) noted a high prevalence of positive family history and concordance in twins to be a proof that AD has a genetic predisposition (Al-Shobaili *et al.*, 2016), and family history of AD has been found to be associated with atopic diseases in studies reported from the Middle East (Abolfotouh *et al.*, 2012; Alqahtani, 2020; Farajzadeh *et al.*, 2014).

As in other parts of the world, AD etiology in Saudi Arabia is multifactorial and influenced by sex and age; genetics and race; social values; hygiene levels; climate; level of industrialization; environmental factors, such as indoor/outdoor allergens; obesity; and the immunologic and nutritional status of the patient (Al-Afif *et al.*, 2019; Al Shammrie & Al Shammrie, 2017; Alqahtani, 2020; Hasnain *et al.*, 2016). Having one atopic disorder increases the risk of AD (Al-Herz, 2018; Alqahtani, 2020).

Young adults with atopic diseases such as AD are more likely to have comorbid allergic disorders, like bronchial asthma and allergic rhinitis (Alqahtani, 2020). Females are significantly more likely to present with eczema than males (P=0.034) (Al Shammrie & Al Shammrie, 2017). Among female patients, AD was significantly associated with eye allergy (P=0.003) and family history of eczema (P=0.012) (Binyamin *et al.*, 2017). A single-center study from Jeddah, Saudi Arabia, found a higher prevalence of AD in children and women (Alshamrani *et al.*, 2019). Another hospital-based study showed that AD prevalence in Saudi women was similar to non-Saudi women (Binyamin *et al.*, 2017).

Increased AD disease burden in Saudi Arabia is also due to skin dryness caused by the high temperature and low humidity of desert climate (Al-Afif *et al.*, 2019; Al Shammrie & Al Shammrie, 2017). Additionally, racial and ethnic differences and rural versus urban division contribute differently to AD

prevalence in the Middle East (Al-Afif *et al.*, 2019; Yong & Tay, 2017). The effect of globalization and urbanization on environmental changes and allergens affect prevalence of allergic conditions (John *et al.*, 2014). Highly industrialized regions in Saudi Arabia have a significant burden of skin diseases, including AD (Al Shammrie & Al Shammrie, 2017). The literature also shows that higher socioeconomic status (SES) is generally associated with increased AD prevalence and lower SES with increased AD severity (Chung & Simpson, 2019). However, studies seeking correlation between SES and AD prevalence in Saudi Arabia are lacking.

Effect of Atopic Dermatitis on Health-Related Quality of Life in Saudi Arabia

Atopic dermatitis (AD) has been found to have a negative impact on the QoL of patients and their families (J. Holm, Agner, Clausen, & Thomsen, 2016). A recent systematic review and meta-analysis of 32 studies concluded that AD has a negative impact on QoL (Birdi *et al.*, 2020). A face-to-face interview study by Mozaffari *et al.*, (2007) showed that the mean Dermatology Life Quality Index (DLQI) and Children's Dermatology Life Quality Index (CDLQI) scores and the score of each question on both scales was significantly higher in adolescents and adults with AD versus without AD ($P < 0.001$ for both) (Mozaffari *et al.*, 2007). However, literature exploring the effect AD on QoL among adolescent and adult is scarce in Saudi Arabia.

Emotional health affected by AD in adult patients

A study from central Saudi Arabia found that the emotional domain was most affected in dermatology patients, followed by symptoms and functioning (Abolfotouh *et al.*, 2012). Personal relationships are the least affected dimension of QoL (Andrew Yule Finlay, 1996; E. Holm, Wulf, Stegmann, & Jemec, 2006; D. H. Kim *et al.*, 2012; Lundberg, Johannesson, Silverdahl, Hermansson, & Lindberg, 2000). Dressing/undressing and bath time (J. Holm *et al.*, 2016; Mozaffari *et al.*, 2007), daily activities, and pain/discomfort were noted to be some of the most highly affected parameters (Lee *et al.*, 2018). AD symptoms (e.g. itch, soreness, pain, and stinging) affect sleep, work, and stress levels, thereby affecting QoL (Alshareef *et al.*, 2019; E. Holm *et al.*, 2006; D. H. Kim *et al.*, 2012; Saif *et al.*, 2018; Sánchez- Pérez, Daudén-Tello, Mora, & Lara Surinyac, 2013) and this has been amply documented in a pediatric study from Saudi Arabia (Alzolibani, 2014). AD is also found to be associated with anxiety, stress, and depression (Ahmed, Al-Dahmash, Al-Boqami, & Al-Tebainawi, 2016; AlShahwan, 2015; Alshareef *et al.*, 2019; Girolomoni *et al.*, 2021; Mina, Jabeen, Singh, & Verma, 2015; Mleeh *et al.*, 2019; Wittkowski, Richards, Griffiths, & Main, 2004). A few Arab studies reported high prevalence of anxiety and depression among dermatology patients (Abolfotouh *et al.*, 2012; Ahmed *et al.*, 2016; AlShahwan, 2015; Mleeh *et al.*,

2019) and one study noted that patients with AD have significantly more anxiety and poorer QoL than healthy adults (Ahmed *et al.*, 2016). However, none of the studies had examined the association between these psychological parameters specifically with AD.

Unmet needs in Saudi Arabia with respect to the effect of AD on QoL

Although AD is known to be associated with stigmatization, poor self-perception, and low self-esteem (Alshareef *et al.*, 2019; Chernyshov, 2016; Zuberbier *et al.*, 2006), there are no studies exploring these aspects of QoL from the Saudi Arabia region (Alshareef *et al.*, 2019). QoL-related concerns in adolescence are a feature of AD that requires special mention (Ali, Vyas, & Finlay, 2020). Many adolescents with AD have felt alienated since childhood. They deal with misconceptions regarding AD and thus grow up, feeling different. AD does not seem to affect academic performance, but it may influence career pathways in adolescents (Ali *et al.*, 2020). These patient populations need to be addressed during study in Saudi Arabia region as well.

A US health and wellness survey showed that patients with AD had higher impairment in QoL than the patients with psoriasis (Eckert *et al.*, 2017). The International Study of Life With Atopic Eczema (ISOLATE) conducted in eight countries, including the US and United Kingdom (UK), highlight the effect of AD on QoL (Zuberbier *et al.*, 2006). The study surveyed 2002 patients >13 years old ($n=60%$) and caregivers of children ($n=40%$) with moderate to severe AD. The study found that AD flares had a negative impact on QoL, affecting concentration at school and at work and interrupting sleep for an average of 7.3 nights per flare (Zuberbier *et al.*, 2006). During a flare, the majority of patients (86%) avoid at least one type of daily activity that exposes the flare area, such as bathing or swimming or wearing skirts, shorts, or T-shirts, and about 55% of the patients worried about the next flare. AD also affected productivity: patients took leave from school or work on an average of 2.5 days per year and those with severe AD were absent for 5.3 days per year (Zuberbier *et al.*, 2006). Similar health and wellness surveys are needed from the Saudi Arabia region also, since no studies from Saudi Arabia assessing the effect of AD symptoms on QoL in adults are lacking.

In addition to the patient's QoL, the QoL of the patient's family and caregiver is also negatively affected by AD. Referred to as the Greater Patient (Ali *et al.*, 2020), this concept recognizes that it is important to address the QoL of the family and caregivers so that they can act as strong support for the patient (Ali *et al.*, 2020). It may be beneficial to practice the same in Saudi Arabia.

Factors Affecting Quality of Life Assessing Impairment on Quality of Life Effective AD Management in Adults by Improvement of AD-Related Quality of Life

Literature from the Gulf region shows that poor QoL negatively impacts the management of dermatologic conditions (Abolfotouh *et al.*, 2012; Alshareef *et al.*, 2019). High AD severity correlates with poor QoL and lower acceptance of treatment, which can create a vicious cycle (Alshareef *et al.*, 2019;

J. Holm *et al.*, 2016; D. H. Kim *et al.*, 2012; Torrelo *et al.*, 2012). Conversely, a cross-sectional study from Saudi Arabia showed that treating the factors affecting QoL helped to improve overall treatment of dermatologic conditions (Al-Hoqail, 2009). Thus, DLQI is used more commonly as an assessment tool (Al-Hoqail, 2009). AD/dermatology-specific questionnaires should be used to address QoL in AD (Table 1) because they are more likely to help improve treatment outcomes.

Table 1: Dermatology-Specific Quality-of-Life Instruments in Atopic Dermatitis

Scale	Brief Description
Adults (aged ≥18 years)	
Atopic Dermatitis Burden Scale for Adults (ABS-A) (Taïeb <i>et al.</i> , 2015)	<ul style="list-style-type: none"> • 18 items scored on a 6-point Likert scale • 4 dimensions: Daily life, Work and stress, Care & management of disease, and Economic constraints (Chernyshov <i>et al.</i>, 2017) • ABS-A score increases with AD severity • Correlates significantly with SF-12 physical and mental components and DLQI (P <0.0001 for all)
The Quality of Life Index for Atopic Dermatitis (QoLIAD) (Whalley <i>et al.</i> , 2004)	<ul style="list-style-type: none"> • 25 items scored on 2-point response (true/not true) • Score range: 0–25 • High score indicates poor QoL
The Eczema Disability Index (EDI) (Chernyshov <i>et al.</i> , 2017)	<ul style="list-style-type: none"> • 15 items; score range: 0–6 • 5 dimensions: Daily activity (5 items), Work and school (3 items), Personal relationship (2 items), 1 Leisure (4 items), and Treatment (1 item)” (Chernyshov <i>et al.</i>, 2017)
Dermatology Life Quality Index (DLQI) (A. Y. Finlay & Khan, 1994)	<ul style="list-style-type: none"> • 10 items scored on a 4-point Likert scale; score range: 0–30 • 6 dimensions: Symptoms and feelings, Daily activities, Leisure, Work and school, Personal relationships, Treatment (Chernyshov <i>et al.</i>, 2017)
Impact of Chronic Skin Disease on Daily Life’ (ISDL) (Evers <i>et al.</i> , 2008)	<ul style="list-style-type: none"> • 72 items with physical symptoms scored on visual analogue scale; mood on 5-point Likert scale and other items on 4-point Likert scale • Dermatology-specific items: Physical functioning, Skin status, Physical symptoms of itch, Pain, Fatigue, Scratching responses, and Stigmatization (Chernyshov <i>et al.</i>, 2017) • Generic questions: Psychological functioning, Disease-related impact, Illness cognitions, Social support (Chernyshov <i>et al.</i>, 2017)
Skindex-29 (Chren <i>et al.</i> , 1997)	<ul style="list-style-type: none"> • 29 items scored on 5-point Likert scale converted to a linear scale • 7 items on symptoms domain, 10 on emotional domain, and 12 on functioning domain.
Skindex-16 (Chren, Lasek, Sahay, & Sands, 2001)	<ul style="list-style-type: none"> • 16 items scored on 7-point Likert scale converted to a linear scale • Covers 3 domains: Symptoms (4 items), Emotions (7 items), and Functioning (5 items)” (Chernyshov <i>et al.</i>, 2017)
Skindex-17 (Nijsten, Sampogna, Chren, & Abeni, 2006)	<ul style="list-style-type: none"> • 17 items scored on 3-point Likert scale converted to a linear scale • 2 domains: Psychosocial and Symptoms
Freiburger quality of life index (FLQA-d)(Augustin <i>et al.</i> , 2000)	<ul style="list-style-type: none"> • 53 items • 6 dimensions (dermatology): 10 items (5 for Physical complaints, 3 for Everyday life, 2 for Social life) and 1 visual analog scale for Skin conditions (Chernyshov <i>et al.</i>, 2017) • Generic and other disease items: Allergies, Urticarial, Chronic venous insufficiency, Lymphedema, and Chronic dermatoses (Chernyshov <i>et al.</i>, 2017)
VQ-Dermato (J. J. Grob, Auquier, Martin, Lançon, & Bonerandi, 1999)	<ul style="list-style-type: none"> • 28 items scored on a scale of 0–4; score range: 0–112 • 7 domains: Self-perception, Daily living activity, Mood state, Social functioning, Leisure activity, Treatment-induced restriction, and Physical discomfort (Chernyshov <i>et al.</i>, 2017)
Impact on Quality of Life measured on Subscale	<ul style="list-style-type: none"> • 51 items scored on a 7-point Likert scale.

Scale	Brief Description
5 of Adjustment to Chronic Skin Diseases Questionnaire (Stangier, Ehlers, & Gieler, 2003)	<ul style="list-style-type: none"> 5 scales: Social anxiety/avoidance, Itch-scratch cycle, Helplessness, Anxious-depressive mood, Impact on QoL (6 items) (Chernyshov <i>et al.</i>, 2017)
Chronic Skin Disease Questionnaire (CSDQ) (Chernyshov <i>et al.</i> , 2017)	<ul style="list-style-type: none"> 4 scales: Anxiety/avoidance, Itching-scratching circle, Helplessness, Anxious-depressive moods (Chernyshov <i>et al.</i>, 2017)
Patient-oriented eczema-specific scales	
Patient-Oriented Eczema Measure (POEM) (Charman, Venn, Ravenscroft, & Williams, 2013)	<ul style="list-style-type: none"> Helps understand how patients perceive their eczema: 0–2 (clear/almost clear); 3–7 (mild); 8–16 (moderate); 17–24 (severe); 25–28 (very severe) (Charman <i>et al.</i>, 2013) Patient and doctor evaluations cannot be compared (Stalder <i>et al.</i>, 2011)
Patient-Oriented Scoring AD (PO-SCORAD) (Stalder <i>et al.</i> , 2011)	<ul style="list-style-type: none"> Adults and adolescents Subjective and objective assessment of AD severity Score range: 0–103 Has subscales: PO-SCORAD itch and sleep (score range: 0–10) Decrease in score correlates with AD improvement PO-SCORAD and clinically evaluated SCORAD correlate strongly
QoL scales for children that can be used in adolescents (aged >12 years) falling in the age category defined by the scale	
Children Dermatology Life Quality Index (CDLQI) (Lewis-Jones & Finlay, 1995)	<ul style="list-style-type: none"> Age: 4–16 years 10 items scored on a 4-point Likert scale; score range: 0–30 Questions on “symptoms, feelings, leisure time, school and holidays, relationships, sleep and treatment impact” (Chernyshov <i>et al.</i>, 2017)
DISABKIDS Atopic Dermatitis Module (ADM) (Baars, Atherton, Koopman, Bullinger, & Power, 2005)	<ul style="list-style-type: none"> Age: 8-16 years 12 items; score range: 0-100 Measures impact and stigma
Impact of AD on the family of the patient	
Family Dermatology Life Quality Index (FDLQI) (Basra, Sue-Ho, & Finlay, 2007)	<ul style="list-style-type: none"> 10 items scored on a 4-point Likert scale; score range: 0–30 FDLQI correlates significantly with patients’ DLQI scores (correlation coefficient $r=0.69$)

AD, atopic dermatitis; QoL, quality of life; SF-12, Short Form-12 Health Survey

A German randomized trial showed that a structured education program had significant positive effect on patient ability to cope with itching ($P<0.001$) and resulted in significantly improved QoL scores on Skindex-29 and the SCORAD index ($P<0.001$ for both) (Heratizadeh *et al.*, 2017). Such structured education programs can be built into the AD treatment programs in the Saudi Arabia regions.

Topical corticosteroids (TCs) are one of the main treatments of AD. Two studies from Saudi Arabia surveyed primary care physicians (PCPs) and family medicine residents (FMRs) about their knowledge regarding use of TC (Alsukait, Alshamlan, Alhalees, Alsuwaidan, & Alajlan, 2017). The study found that PCPs and FMRs do not have adequate knowledge about the benefits of TCs and highlighted multiple misconceptions as well (Alsukait *et al.*, 2017; Kokandi, 2019). Many patients with dermatologic diseases in Saudi Arabia (including those with AD) have serious reservations regarding the use of TCs (Al-Omair I, 2019; Alotaibi *et al.*, 2020; Alshareef *et al.*, 2019). These concerns may be influenced by previous experiences or the views expressed by family members, society in general, or by physicians themselves (Al-Omair I, 2019; Alotaibi *et al.*, 2020; Alshareef *et al.*,

2019). However, there are no studies from the Saudi Arabia region exploring measures that can be taken to improve acceptance of TC among patients, PCPs, and FMRs.

One area that should be given special attention is the transition period from adolescence to adulthood. The negative effect of AD on QoL seems to be more pronounced in patients in this age group (Ali *et al.*, 2020). De Vere Hunt *et al.*, (2019) found that monthly young adult clinics for patients with AD with specialist psychological support significantly improved QoL on the Teenagers' Quality of Life Index ($P<0.05$) (De Vere Hunt *et al.*, 2019). Similar clinics may be beneficial in the Saudi Arabia region as well.

Patient Perception and Quality of Life

Patients often perceive their QoL as poor, which is reflected in their poor scores on scales like POEM, PO-SCORAD, and PO-SCORAD-itch and -sleep (Silverberg *et al.*, 2019). Patient reported QoL scores on DLQI, Skindex-29, and the EQ-5D in large population studies were lower for patients with skin diseases (including AD) than in the general population (Chernyshov *et al.*, 2017). Patients’ perception of their disease and QoL is greatly affected by the attitude of

the treating physician toward their disease (Torrelo *et al.*, 2012). Poor agreement between patients and specialists has been reported to have a significant negative impact on sleep and rest and on professional and emotional fulfillment ($P < 0.001$) (Torrelo *et al.*, 2012).

Impact of Atopic Dermatitis on Healthcare Resource Utilization in Saudi Arabia

There are few data regarding HCRU in Saudi Arabia. However, significant HCRU has been reported by patients with AD (Bridgman, Block, & Drucker, 2018; Carroll, Balkrishnan, Feldman, Fleischer, & Manuel, 2005; Dierick *et al.*, 2020; A. M. Drucker *et al.*, 2017; Shrestha *et al.*, 2017; Silverberg *et al.*, 2019).

In general, HCRU includes direct costs (prescriptions, pharmacy bills, consultation cost, laboratory investigation costs) (Arima *et al.*, 2018; Bickers *et al.*, 2006; Dierick *et al.*, 2020; C. Kim *et al.*, 2015; Zuberbier *et al.*, 2006) and indirect costs (loss of work, absenteeism from work, reduced productivity due to presenteeism [coming to work despite illness] (Strózek *et al.*, 2019), and out of pocket costs [e.g., travel to doctor's clinic]) (Zink *et al.*, 2019). Indirect cost is difficult to measure because there is a lack of hard data, especially for adults (Strózek *et al.*, 2019). An employer-payer perspective study for AD found that 38% of the AD cost burden borne by employers was due to indirect costs, mainly employee disability and increased sick days (Fowler *et al.*, 2007). Because stress, anxiety, and depression are prevalent in dermatology patients in Saudi Arabia (Ahmed *et al.*, 2016), the cost of treating AD should ideally include cost of treating these psychological conditions. Also, AD management costs should include the cost of treating other comorbid atopic diseases. Large multi-center trials are required from the Saudi Arabia region to assess the economic burden of AD in this region, especially in a scenario in which AD burden is increasing.

Correlation of Disease Severity with Quality of Life and Healthcare Resource Utilization in Saudi Arabia

The literature shows a significant correlation between AD disease severity and QoL. Higher AD severity correlates with poorer QoL and lower acceptance of treatment (Alshareef *et al.*, 2019; Alzolibani, 2014; Chernyshov *et al.*, 2017; J. Holm *et al.*, 2016; D. H. Kim *et al.*, 2012; Torrelo *et al.*, 2012). However, the degree of correlation between disease severity and QoL differs with the type of study and instrument used to assess the QoL (Birdi *et al.*, 2020).

Patients with moderate to severe AD are more likely to have uncontrolled disease and report higher disease burden than patients with controlled disease (Simpson *et al.*, 2018). Irrespective of the level of disease control, moderate to severe AD has a higher burden than mild AD (Simpson *et al.*, 2018). Early

diagnosis and timely treatment may positively affect QoL and HCRU, but studies from Saudi Arabia are lacking (Al-Afif *et al.*, 2019). A pioneer survey-based study from Saudi Arabia showed that well-designed questionnaires can be used in a primary care setting for early diagnosis of AD (Sabry, 2011). The questionnaire in this study had seven sections, with 143 closed questions in Arabic on an array of symptoms (usual and unusual) of various allergic diseases. The diagnosis reached by the questionnaire significantly matched with that of the physician ($P < 0.0001$) (Sabry, 2011).

Atopic dermatitis disease severity affects patients' life in many ways. The ISOLATE study showed that patients with severe AD have significantly more sleep-affected nights compared with the total sample ($P < 0.05$) (Zuberbier *et al.*, 2006). The work and social life of patients with severe AD were significantly more likely to be affected during a flare than those with less severe AD ($P < 0.05$). Patients with severe AD take significantly more days off from work than the general population because of flares. Moreover, the focus and concentration of those who continue to work are significantly more affected ($P < 0.05$ for both) when compared to the general population (Zuberbier *et al.*, 2006). Severity of pruritus has a significant negative effect on QoL in proportion to its severity ($P < 0.05$) (Sánchez-Pérez *et al.*, 2013). Similarly, the degree of perceived stigma is significantly associated with disease severity ($P < 0.01$). A cross-sectional study from North Africa showed that severe hand eczema was significantly associated with high levels of occupational stress (Hafsia *et al.*, 2019).

Apart from affecting QoL, AD disease severity increases HCRU in both upper-income and lower middle-income countries (A. M. Drucker *et al.*, 2017; Girolomoni *et al.*, 2021; Handa, Jain, & Narang, 2015). A US claims-based study showed that AD was associated with higher HCRU across all resource categories, including outpatient department (OPD) visits, prescriptions filled, hospitalization, and emergency department (ED) visits (all $P < 0.0001$). Of these, OPD visits were the most frequently used resource category and ED visits the least frequently used. Annual direct costs are higher in patients with more severe AD (Aaron M Drucker *et al.*, 2018). The US claims-based study also showed that patients with AD had significantly higher total HCRU costs than matched controls ($P < 0.0001$). Accordingly, patients with AD had significantly higher incremental costs across all resource categories, such as OPD and ED visits, inpatient services, and prescriptions, than matched controls (all $P < 0.0001$) (Aaron M Drucker *et al.*, 2018). An EU survey showed that increased disease severity in AD was associated with increased direct and indirect costs (Girolomoni *et al.*, 2021). In India, cost of AD care is higher than for other chronic illnesses, such as diabetes, and the cost increases along with the severity (Handa *et al.*, 2015). The mean total cost

increased with increasing AD severity and ranged from Rs. 3579.00 ± 948.00 for mild AD to Rs. 6806.00 ± 3676.00 and Rs. 8991.00 ± 3129.00 for moderate and severe AD, respectively (Handa *et al.*, 2015). However, as mentioned previously, there are few HCRU-related studies from the Saudi Arabia region.

Limitations and Strengths of the Review

One known limitation of a narrative review is the study selection bias, and the present review also has a selection bias. Secondly the review aimed to involve studies mainly from Saudi Arabia, but the lack of data made it impossible to draw firm conclusions regarding the exact relationships between AD severity and QoL and HCRU. However, the main strength of this review is the robust search strategy, which added value by highlighting the lack of data from Saudi Arabia with respect to the effect of AD on QoL and HCRU. Additionally, this review helped in identifying the gaps in knowledge regarding the association between disease severity and QoL and HCRU in Saudi Arabia.

Future Directions

Health services research can add valuable information on AD (Chren, Lasek, Flocke, & Zyzanski, 1997) similar to the patient/family/caregiver education programs (Al-Zahrani, Nahar, Al-Zahrani, & Al-Zahrni, 2017; Heratizadeh *et al.*, 2017; Lapsley, 2006). A deeper insight and more qualitative approach using validated AD/dermatology-specific tools is required to understand the various aspects of HRQoL and HCRU in AD and their relationship to disease severity (Birdi *et al.*, 2020). Additionally, harmonizing outcome

measures for AD will help to bridge these gaps (Ali *et al.*, 2020).

CONCLUSION

Atopic dermatitis affects people irrespective of their age. Diagnosis and management of AD necessitates special attention. Identifying the symptoms at an early stage might help to improve HRQoL and to reduce utilization of healthcare resources. In summary, this review identified a general paucity of data regarding the management of AD-related HRQoL and HCRU among adult and adolescent populations in Saudi Arabia and how patients perceive their disease and how the attitude of their treating doctor affects their QoL. Several recommendations have been made to bridge these gaps in data (Table 2). This review also created insights into various AD- and dermatology-specific tools for measuring QoL and the need to integrate these into regular clinical practice. It also highlighted the important aspects of AD management that have been lacking in Saudi Arabia. There is a large unmet need in Saudi Arabia in addressing patient perception, physician knowledge, family, and caregiver burden, and QoL for better AD management. Additionally, many patients with AD are reluctant to seek treatment. Addressing these gaps in knowledge, along with robust collection of the QoL and HCRU data from the Saudi Arabia region and conducting awareness programs in Saudi Arabia might prove beneficial in managing AD disease burden through improvement in AD management policies and guidelines.

Table 2: Recommendations for Improving QoL- and HCRU-Related Issues That Affect AD Management in Saudi Arabia

Gap in Knowledge (Saudi Arabia)	Recommendations
<ul style="list-style-type: none"> Correlation between SES and AD prevalence are lacking Effect of adolescent and adult AD on QoL is scarce and effect on HCRU is lacking Comparative analysis to see if AD effect on QoL and HCRU is higher than other common dermatologic conditions 	<ul style="list-style-type: none"> Large multicenter cross-sectional studies are required from urban/rural/industrial regions covering all SESs to understand the severity of AD and its effect on QoL and HCRU HCRU studies need special mention because there are no data from this region. HCRU is an indicator of economic burden and can help in designing policies and intervention for better disease control
<ul style="list-style-type: none"> Transition studies covering the changing effect of AD on QoL from adolescence to adulthood 	<ul style="list-style-type: none"> Young adult clinics (De Vere Hunt <i>et al.</i>, 2019) with psychological support and career counseling should be initiated to improve QoL and confront myths about career choices; these clinics can also serve as points to collect anonymized data
<ul style="list-style-type: none"> Studies on family and caregiver QoL are lacking 	<ul style="list-style-type: none"> Interventional studies assessing the effect of improving the QoL of caregiver and family on the QoL of patient and patient's treatment is needed
<ul style="list-style-type: none"> Interventional studies assessing effect of managing QoL on AD treatment 	<ul style="list-style-type: none"> Structured educational programs covering topics such as nature of disease, attitude toward it, dealing with symptoms, stigmatization, social phobia, and occupational stress can help improve QoL. The programs should focus on both the patient and patient's family/caregivers
<ul style="list-style-type: none"> PCPs and FMRs lack knowledge on managing AD with TC 	<ul style="list-style-type: none"> Dermatology department of universities and hospitals should have continued medical education programs that cover these gaps in knowledge
<ul style="list-style-type: none"> Inconsistencies in tools being used to measure HRQoL 	<ul style="list-style-type: none"> All attempts should be made to use AD/dermatology-specific tools both in research and clinical practice

AD, atopic dermatitis; FMR, family medical resident; HCRU, healthcare resource utilization; HRQoL, health-related quality of life; PCP, primary care physician; QoL, quality of life; SES, socioeconomic status; TC, topical corticosteroid.

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CONFLICTS OF INTEREST

Yousef Binamer is a speaker and/or advisor for AbbVie, Novartis, Eli Lilly, and Janssen/Sanofi. Mohammad Fatani is a speaker, moderator, and/or advisory board member for AbbVie, Eli Lilly, Sanofi, Janssen, and Biologix, Mohammad Almohideb does not have any relevant disclosures for this article, Ali Anwar and Mohamed Rateb are full-time employees of AbbVie Biopharmaceuticals GmbH and may hold stocks or stock options.

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REFERENCES

- Abolfotouh, M. A., Al-Khowailed, M. S., Suliman, W. E., Al-Turaif, D. A., Al-Bluwi, E., & Al-Kahtani, H. S. (2012). Quality of life in patients with skin diseases in central Saudi Arabia. *International Journal of General Medicine*, 5, 633.
- Ahmed, A. E., Al-Dahmash, A. M., Al-Boqami, Q. T., & Al-Tebainawi, Y. F. (2016). Depression, anxiety and stress among Saudi Arabian dermatology patients: cross-sectional study. *Sultan Qaboos University Medical Journal*, 16(2), e217-223.
- Al-Afif, K. A. M., Buraik, M. A., Buddenkotte, J., Mounir, M., Gerber, R., Ahmed, H. M., . . . Steinhoff, M. (2019). Understanding the burden of atopic dermatitis in Africa and the Middle East. *Dermatology and Therapy*, 9(2), 223-241.
- Al-Herz, W. (2018). A systematic review of the prevalence of atopic diseases in children on the Arabian Peninsula. *Medical Principles and Practice*, 27(5), 436-442.
- Al-Hoqail, I. A. (2009). Impairment of quality of life among adults with skin disease in King Fahad Medical City, Saudi Arabia. *Journal of Family & Community Medicine*, 16(3), 105-109.
- Al-Omair I, A. L., AlSadoun DA, Altalhab S, Al-Omair AA, Alkassimi SM. (2019). Topical corticosteroid phobia among patients with dermatological diseases. *International Journal of Medicine in Developing Countries*, 3(7), 570–576.
- Al-Shobaili, H. A., Ahmed, A. A., Alnomair, N., Alobead, Z. A., & Rasheed, Z. (2016). Molecular Genetic of Atopic dermatitis: an update. *International Journal of Health Sciences*, 10(1), 96-120.
- Al-Zahrani, D., Nahar, P., Al-Zahrani, D., & Al-Zahrni, D. (2017). Knowledge, attitude, and practice of primary care physicians regarding common dermatological disorders in Abha City, Kingdom of Saudi Arabia. *IOSR Journal of Pharmacy*, 07, 89-110. doi:10.9790/3013-07020189110
- Al Shammrie, F., & Al Shammrie, A. (2017). Pattern of skin disease in Hail region of Saudi Arabia. *Journal of Dermatology & Dermatologic Surgery*, 21(2), 62-65.
- Ali, F., Vyas, J., & Finlay, A. Y. (2020). Counting the burden: atopic dermatitis and health-related quality of life. *Acta Dermato-Venereologica*, 100(12), adv00161. doi:10.2340/00015555-3511
- Alotaibi, S., Alotaibi, S., Omayrah, A., Alhusayni, M., Alshammari, N., AlAli, H., ..., & Alsenaid, A. (2020). Dermatological diseases: patients awareness and concerns about complications of topical corticosteroids in Saudi Arabia. *International Journal of Medicine in Developing Countries*, 4(5), 910-914.
- Alqahtani, J. M. (2020). Atopy and allergic diseases among Saudi young adults: a cross-sectional study. *Journal of International Medical Research*, 48(1), 0300060519899760.
- AlShahwan, M. A. (2015). The prevalence of anxiety and depression in Arab dermatology patients. *Journal of Cutaneous Medicine and Surgery*, 19(3), 297-303. doi:10.2310/7750.2014.14110
- Alshamrani, H. M., Alsolami, M. A., Alshehri, A. M., Salman, A. K., Alharbi, M. W., Alzuhayri, A. J., & Mleeh, N. T. (2019). Pattern of skin diseases in a university hospital in Jeddah, Saudi Arabia: age and sex distribution. *Annals of Saudi Medicine*, 39(1), 22-28.
- Alshareef, B. A. I., Alghamdi, S. H. O., Al Harfi, S. M. A., & Abuaziz, R. M. M. (2019). Atopic dermatitis; impact on the quality of life and patient's attitude toward its management. *International Journal of Medicine in Developing Countries*, 3(12), 1156-1161.
- Alsukait, S. F., Alshamlan, N. M., Alhalees, Z. Z., Alsuwaidan, S. N., & Alajlan, A. M. (2017). Topical corticosteroids knowledge, attitudes, and practices of primary care physicians. *Saudi Medical Journal*, 38(6), 662-665. doi:10.15537/smj.2017.6.17586
- Alzolibani, A. A. (2014). Impact of atopic dermatitis on the quality of life of Saudi children. *Saudi Medical Journal*, 35(4), 391-396.
- Andersen, L., Nyeland, M., & Nyberg, F. (2020). Higher self-reported severity of atopic dermatitis in adults is associated with poorer self-reported health-related quality of life in France, Germany,

- the UK and the USA. *British Journal of Dermatology*, 182(5), 1176-1183.
- Arima, K., Gupta, S., Gadhari, A., Hiragun, T., Kono, T., Katayama, I., ... & Eckert, L. (2018). Burden of atopic dermatitis in Japanese adults: analysis of data from the 2013 national health and wellness survey. *Journal of Dermatology*, 45(4), 390-396. doi:10.1111/1346-8138.14218
 - Augustin, M., Zschocke, I., Seidenglanz, K., Lange, S., Schiffler, A., & Amon, U. (2000). Validation and clinical results of the FLQA-d, a quality of life questionnaire for patients with chronic skin disease. *Dermatology and Psychosomatics / Dermatologie und Psychosomatik*, 1(1), 12-17. doi:10.1159/000017503
 - Baars, R. M., Atherton, C. I., Koopman, H. M., Bullinger, M., & Power, M. (2005). The European DISABKIDS project: development of seven condition-specific modules to measure health related quality of life in children and adolescents. *Health and Quality of Life Outcomes*, 3(1), 70. doi:10.1186/1477-7525-3-70
 - Basra, M. K., Sue-Ho, R., & Finlay, A. Y. (2007). The family dermatology life quality index: measuring the secondary impact of skin disease. *British Journal of Dermatology*, 156(3), 528-538. doi:10.1111/j.1365-2133.2006.07617.x
 - Bickers, D. R., Lim, H. W., Margolis, D., Weinstock, M. A., Goodman, C., Faulkner, E., ... & Dall, T. (2006). The burden of skin diseases: 2004 a joint project of the American Academy of Dermatology Association and the Society for Investigative Dermatology. *Journal of the American Academy of Dermatology*, 55(3), 490-500. doi:10.1016/j.jaad.2006.05.048
 - Binyamin, S. T., Algamal, F., Yamani, A. N., Labani, M. S., Alaqbi, F. H., Baeshen, A. A., ... & Aljunaid, M. A. (2017). Prevalence and determinants of eczema among females aged 21 to 32 years in Jeddah city–Saudi Arabia. *Our Dermatology Online*, 8(1), 22.
 - Birdi, G., Cooke, R., & Knibb, R. C. (2020). Impact of atopic dermatitis on quality of life in adults: a systematic review and meta-analysis. *International Journal of Dermatology*, 59(4), e75-e91.
 - Bridgman, A. C., Block, J. K., & Drucker, A. M. (2018). The multidimensional burden of atopic dermatitis: an update. *Annals of Allergy, Asthma, & Immunology*, 120(6), 603-606. doi:10.1016/j.anai.2018.03.009
 - Bylund, S., von Kobyletzki, L. B., Svalstedt, M., & Svensson, Å. (2020). Prevalence and incidence of atopic dermatitis: a systematic review. *Acta Dermato-Venereologica*, 100(12), adv00160. doi:10.2340/00015555-3510
 - Carrera, Y. I. L., Al Hammadi, A., Huang, Y.-H., Llamado, L. J., Mahgoub, E., & Tallman, A. M. (2019). Epidemiology, diagnosis, and treatment of atopic dermatitis in the developing countries of Asia, Africa, Latin America, and the Middle East: a review. *Dermatology and Therapy*, 9(4), 685-705.
 - Carroll, C. L., Balkrishnan, R., Feldman, S. R., Fleischer, A. B., Jr., & Manuel, J. C. (2005). The burden of atopic dermatitis: impact on the patient, family, and society. *Pediatric Dermatology*, 22(3), 192-199. doi:10.1111/j.1525-1470.2005.22303.x
 - Charman, C. R., Venn, A. J., Ravenscroft, J. C., & Williams, H. C. (2013). Translating patient-oriented eczema measure (POEM) scores into clinical practice by suggesting severity strata derived using anchor-based methods. *British Journal of Dermatology*, 169(6), 1326-1332. doi:10.1111/bjd.12590
 - Chernyshov, P. V. (2016). Stigmatization and self-perception in children with atopic dermatitis. *Clinical, Cosmetic and Investigational Dermatology*, 9, 159-166. doi:10.2147/ccid.S91263
 - Chernyshov, P. V., Tomas-Aragones, L., Manolache, L., Marron, S. E., Salek, M. S., Poot, F., ... & Finlay, A. Y. (2017). Quality of life measurement in atopic dermatitis. Position paper of the European Academy of Dermatology and Venereology (EADV) task force on quality of life. *Journal of the European Academy of Dermatology and Venereology*, 31(4), 576-593. doi:10.1111/jdv.14058
 - Chren, M. M., Lasek, R. J., Flocke, S. A., & Zyzanski, S. J. (1997). Improved discriminative and evaluative capability of a refined version of Skindex, a quality-of-life instrument for patients with skin diseases. *Archives of Dermatology*, 133(11), 1433-1440.
 - Chren, M. M., Lasek, R. J., Sahay, A. P., & Sands, L. P. (2001). Measurement properties of Skindex-16: a brief quality-of-life measure for patients with skin diseases. *Journal of Cutaneous Medicine and Surgery*, 5(2), 105-110. doi:10.1007/bf02737863
 - Chung, J., & Simpson, E. L. (2019). The socioeconomics of atopic dermatitis. *Annals of Allergy, Asthma, & Immunology*, 122(4), 360-366.
 - De Vere Hunt, I., Chapman, K., Wali, G., Bullus, S., Fisher, R., Matin, R. N., & McPherson, T. (2019). Establishing and developing a teenage and young adult dermatology clinic with embedded specialist psychological support. *Clinical and Experimental Dermatology*, 44(8), 893-896. doi:10.1111/ced.13950
 - Dierick, B. J., van der Molen, T., Flokstra-de Blok, B. M., Muraro, A., Postma, M. J., Kocks, J. W., & van Boven, J. F. (2020). Burden and socioeconomics of asthma, allergic rhinitis, atopic dermatitis and food allergy. *Expert Review of Pharmacoeconomics & Outcomes Research*, 20(5), 437-453.
 - Dominick, K. L., Ahern, F. M., Gold, C. H., & Heller, D. A. (2002). Relationship of health-related quality of life to health care utilization and

- mortality among older adults. *Aging Clinical and Experimental Research*, 14(6), 499-508.
- Drucker, A. M., Qureshi, A. A., Amand, C., Villeneuve, S., Gadkari, A., Chao, J., ... & Eckert, L. (2018). Health care resource utilization and costs among adults with atopic dermatitis in the United States: a claims-based analysis. *Journal of Allergy and Clinical Immunology: In Practice*, 6(4), 1342-1348.
 - Drucker, A. M., Wang, A. R., Li, W. Q., Severson, E., Block, J. K., & Qureshi, A. A. (2017). The burden of atopic dermatitis: summary of a report for the National Eczema Association. *Journal of Investigative Dermatology*, 137(1), 26-30. doi:10.1016/j.jid.2016.07.012
 - Eckert, L., Gupta, S., Amand, C., Gadkari, A., Mahajan, P., & Gelfand, J. M. (2017). Impact of atopic dermatitis on health-related quality of life and productivity in adults in the United States: an analysis using the national health and wellness survey. *Journal of the American Academy of Dermatology*, 77(2), 274-279. e273.
 - Evers, A. W., Duller, P., van de Kerkhof, P. C., van der Valk, P. G., de Jong, E. M., Gerritsen, M. J., ... & Kraaijaak, F. W. (2008). The impact of chronic skin disease on daily life (ISDL): a generic and dermatology-specific health instrument. *British Journal of Dermatology*, 158(1), 101-108. doi:10.1111/j.1365-2133.2007.08296.x
 - Farajzadeh, S., Esfandiarpour, I., Sedaghatmanesh, M., & Saviz, M. (2014). Epidemiology and clinical features of atopic dermatitis in Kerman, a desert area of Iran. *Annals of Dermatology*, 26(1), 26-34.
 - Finlay, A. Y. (1996). Measurement of disease activity and outcome in atopic dermatitis. *British Journal of Dermatology*, 135(4), 509-515.
 - Finlay, A. Y., & Khan, G. K. (1994). Dermatology life quality index (DLQI)-a simple practical measure for routine clinical use. *Clinical and Experimental Dermatology*, 19(3), 210-216. doi:10.1111/j.1365-2230.1994.tb01167.x
 - Fowler, J. F., Duh, M. S., Rovba, L., Buteau, S., Pinheiro, L., Lobo, F., ... & Kosicki, G. (2007). The direct and indirect cost burden of atopic dermatitis: an employer-payer perspective. *Managed Care Interface*, 20(10), 26-32.
 - Girolomoni, G., Luger, T., Nosbaum, A., Gruben, D., Romero, W., Llamado, L. J., & DiBonaventura, M. (2021). The economic and psychosocial comorbidity burden among adults with moderate-to-severe atopic dermatitis in Europe: analysis of a cross-sectional survey. *Dermatology and Therapy*, 11(1), 117-130.
 - Grob, J., Revuz, J., Ortonne, J., Auquier, P., & Lorette, G. (2005). Comparative study of the impact of chronic urticaria, psoriasis and atopic dermatitis on the quality of life. *British Journal of Dermatology*, 152(2), 289-295.
 - Grob, J. J., Auquier, P., Martin, S., Lançon, C., & Bonerandi, J. J. (1999). Development and validation of a quality of life measurement for chronic skin disorders in french: VQ-Dermato. The RéseauEpidémiologie en Dermatologie. *Dermatology*, 199(3), 213-222. doi:10.1159/000018250
 - Hafsia, M., Kacem, I., El Maalel, O., Maoua, M., Brahem, A., Aroui, H., ... & Mrizek, N. (2019). Relationship between hand eczema severity and occupational stress: a cross-sectional study. *Dermatology Research and Practice*, 2019, 8301896. doi:10.1155/2019/8301896
 - Handa, S., Jain, N., & Narang, T. (2015). Cost of care of atopic dermatitis in India. *Indian Journal of Dermatology*, 60(2), 213. doi:10.4103/0019-5154.152573
 - Hasnain, S. M., Al-Qassim, A., Hasnain, S., & Al-Frayh, A. (2016). Emerging status of asthma, allergic rhinitis and eczema in the Middle East. *Journal of Disease and Global Health*, 7(3), 128-136.
 - Heratizadeh, A., Werfel, T., Wollenberg, A., Abraham, S., Plank-Habibi, S., Schnopp, C., ... & Kupfer, J. (2017). Effects of structured patient education in adults with atopic dermatitis: multicenter randomized controlled trial. *Journal of Allergy and Clinical Immunology*, 140(3), 845-853.e843. doi:10.1016/j.jaci.2017.01.029
 - Holm, E., Wulf, H., Stegmann, H., & Jemec, G. (2006). Life quality assessment among patients with atopic eczema. *British Journal of Dermatology*, 154(4), 719-725.
 - Holm, J., Agner, T., Clausen, M. L., & Thomsen, S. (2016). Quality of life and disease severity in patients with atopic dermatitis. *Journal of the European Academy of Dermatology and Venereology*, 30(10), 1760-1767.
 - John, L. J., Ahmed, S., Anjum, F., Kebab, M., Mohammed, N., Darwich, H., ... & Sreedharan, J. (2014). Prevalence of allergies among university students: a study from Ajman, United Arab Emirates. *ISRN Allergy*, 2014.
 - Kim, C., Park, K. Y., Ahn, S., Kim, D. H., Li, K., Kim, D. W., ... & Seo, S. J. (2015). Economic impact of atopic dermatitis in Korean patients. *Annals of Dermatology*, 27(3), 298-305.
 - Kim, D. H., Li, K., Seo, S. J., Jo, S. J., Yim, H. W., Kim, C. M., ... & Kim, J. W. (2012). Quality of life and disease severity are correlated in patients with atopic dermatitis. *Journal of Korean Medical Science*, 27(11), 1327.
 - Kokandi, A. A. (2019). Family medicine trainees' knowledge about topical corticosteroids in Jeddah, Saudi Arabia. *The Open Dermatology Journal*, 13, 13-18. doi:10.2174/1874372201913010013
 - Langan, S. M., Irvine, A. D., & Weidinger, S. (2020). Atopic dermatitis. *Lancet*, 396(10247), 345-360.

- Lapsley, P. (2006). The double benefits of educational programmes for patients with eczema. *British Medical Journal (Clinical research ed.)*, 332(7547), 936.
- Laughter, M., Maymone, M., Mashayekhi, S., Arents, B., Karimkhani, C., Langan, S., ... & Flohr, C. (2021). The global burden of atopic dermatitis: lessons from the global burden of disease study 1990–2017. *British Journal of Dermatology*, 184(2), 304-309.
- Lee, S. H., Lee, S. H., Lee, S. Y., Lee, B., Lee, S. H., & Park, Y. L. (2018). Psychological health status and health-related quality of life in adults with atopic dermatitis: a nationwide cross-sectional study in South Korea. *Acta Dermato-Venereologica*, 98(1), 89-97. doi:10.2340/00015555-2797
- Lewis-Jones, M. S., & Finlay, A. Y. (1995). The children's dermatology life quality index (CDLQI): initial validation and practical use. *British Journal of Dermatology*, 132(6), 942-949.
- Lifschitz, C. (2015). The impact of atopic dermatitis on quality of life. *Annals of Nutrition and Metabolism*, 66(Suppl. 1), 34-40.
- Lundberg, L., Johannesson, M., Silverdahl, M., Hermansson, C., & Lindberg, M. (2000). Health-related quality of life in patients with psoriasis and atopic dermatitis measured with SF-36, DLQI and a subjective measure of disease activity. *Acta Dermato-Venereologica*, 80(6), 430-434.
- Mina, S., Jabeen, M., Singh, S., & Verma, R. (2015). Gender differences in depression and anxiety among atopic dermatitis patients. *Indian Journal of Dermatology*, 60(2), 211. doi:10.4103/0019-5154.152564
- Misery, L., Seneschal, J., Ezzedine, K., Héas, S., Merhand, S., Reguiat, Z., & Taieb, C. (2017). Atopic dermatitis is associated with poor quality of life in adult patients. *Value in Health*, 20(9), A808.
- Mleeh, N. T., Alshamrani, H. M., Basyouni, R. N., Alshehri, K. A., Algethami, M. R., & Sehlo, M. G. (2019). Prevalence and predictors of depression among dermatology clinic patients in a teaching hospital, Jeddah, Saudi Arabia. *Journal of Family Medicine and Primary Care*, 8(7), 2496-2501.
- Mozaffari, H., Pourpak, Z., Pourseyed, S., Farhoodi, A., Aghamohammadi, A., Movahadi, M., ... & Moin, M. (2007). Quality of life in atopic dermatitis patients. *Journal of Microbiology, Immunology and Infection*, 40(3), 260-264.
- Nijsten, T. E., Sampogna, F., Chren, M. M., & Abeni, D. D. (2006). Testing and reducing skindex-29 using Rasch analysis: Skindex-17. *Journal of Investigative Dermatology*, 126(6), 1244-1250. doi:10.1038/sj.jid.5700212
- Sabry, E. Y. (2011). Prevalence of allergic diseases in a sample of Taif citizens assessed by an original Arabic questionnaire (phase I) a pioneer study in Saudi Arabia. *Allergologia et Immunopathologia*, 39(2), 96-105.
- Saif, G. A. B., Alotaibi, H. M., Alzolibani, A. A., Almodihesh, N. A., Albraidi, H. F., Alotaibi, N. M., & Yosipovitch, G. (2018). Association of psychological stress with skin symptoms among medical students. *Saudi Medical Journal*, 39(1), 59.
- Sánchez-Pérez, J., Daudén-Tello, E., Mora, A. M., & Lara Surinyac, N. (2013). Impact of atopic dermatitis on health-related quality of life in Spanish children and adults: the PSEDA study. *Actas Dermo-Sifiliográficas*, 104(1), 44-52. doi:10.1016/j.ad.2012.03.008
- Shrestha, S., Miao, R., Wang, L., Chao, J., Yuce, H., & Wei, W. (2017). Burden of atopic dermatitis in the United States: analysis of healthcare claims data in the commercial, medicare, and medical databases. *Advances in Therapy*, 34(8), 1989-2006. doi:10.1007/s12325-017-0582-z
- Silverberg, J. I., Gelfand, J. M., Margolis, D. J., Boguniewicz, M., Fonacier, L., Grayson, M. H., ... & Simpson, E. L. (2019). Atopic dermatitis in US adults: from population to health care utilization. *Journal of Allergy and Clinical Immunology: In Practice*, 7(5), 1524-1532.e1522. doi:10.1016/j.jaip.2019.01.005
- Simpson, E. L., Guttman-Yassky, E., Margolis, D. J., Feldman, S. R., Qureshi, A., Hata, T., ... & Gadkari, A. (2018). Association of inadequately controlled disease and disease severity with patient-reported disease burden in adults with atopic dermatitis. *JAMA Dermatology*, 154(8), 903-912.
- Stalder, J. F., Barbarot, S., Wollenberg, A., Holm, E. A., De Raeve, L., Seidenari, S., ... & Taïeb, A. (2011). Patient-oriented scorad (PO-SCORAD): a new self-assessment scale in atopic dermatitis validated in Europe. *Allergy*, 66(8), 1114-1121. doi:10.1111/j.1398-9995.2011.02577.x
- Stangier, U., Ehlers, A., & Gieler, U. (2003). Measuring adjustment to chronic skin disorders: validation of a self-report measure. *Psychological Assessment*, 15(4), 532-549. doi:10.1037/1040-3590.15.4.532
- Strózek, J., Samoliński, B. K., Kłak, A., Gawińska-Drużba, E., Izdebski, R., Krzych-Fałta, E., & Raciborski, F. (2019). The indirect costs of allergic diseases. *International Journal of Occupational Medicine and Environmental Health*, 32(3), 281-290.
- Taïeb, A., Boralevi, F., Seneschal, J., Merhand, S., Georgescu, V., Taieb, C., & Ezzedine, K. (2015). Atopic dermatitis burden scale for adults: development and validation of a new assessment tool. *Acta Dermato-Venereologica*, 95(6), 700-705. doi:10.2340/00015555-1945
- Torrelo, A., Ortiz, J., Alomar, A., Ros, S., Prieto, M., & Cuervo, J. (2012). Atopic dermatitis: impact on quality of life and patients' attitudes toward its

management. *European Journal of Dermatology*, 22(1), 97-105.

- Urban, K., Chu, S., Giese, R. L., Mehrmal, S., Uppal, P., Nedley, N., & Delost, G. R. (2021). The global, regional, and national burden of atopic dermatitis in 195 countries and territories: an ecological study from the global burden of disease study 2017. *JAAD international*, 2, 12-18.
- Whalley, D., McKenna, S. P., Dewar, A. L., Erdman, R. A., Kohlmann, T., Niero, M., ... & Van Assche, D. (2004). A new instrument for assessing quality of life in atopic dermatitis: international development of the quality of life index for atopic dermatitis (QoLIAD). *British Journal of Dermatology*, 150(2), 274-283.
- Wittkowski, A., Richards, H. L., Griffiths, C. E., & Main, C. J. (2004). The impact of psychological and clinical factors on quality of life in individuals with atopic dermatitis. *Journal of Psychosomatic Research*, 57(2), 195-200.
- Yong, A. M.-Y., & Tay, Y.-K. (2017). Atopic dermatitis: racial and ethnic differences. *Dermatologic Clinics*, 35(3), 395-402.
- Zink, A. G. S., Arents, B., Fink-Wagner, A., Seitz, I. A., Mensing, U., Wettemann, N., ... & Ring, J. (2019). Out-of-pocket costs for individuals with atopic eczema: a cross-sectional study in nine European countries. *Acta Dermato-Venereologica*, 99(3), 263-267. doi:10.2340/00015555-3102
- Zuberbier, T., Orlow, S. J., Paller, A. S., Taïeb, A., Allen, R., Hernanz-Hermosa, J. M., ... & Simon, J. C. (2006). Patient perspectives on the management of atopic dermatitis. *Journal of Allergy and Clinical Immunology*, 118(1), 226-232.

Appendix: Keywords used to search literature

“Saudi Arabia”, “Middle East”, “United Arab Emirates”, “UAE”, “Gulf Countries”, “Arab”, “Atopic Dermatitis”, “AD”, “Atopic Eczema”, “Eczema”, “Atopy”, “Quality of Life”, “QoL”, “HRQoL”, “Well-Being”, “Health Status”, “Quality of Life Index”, “Mental Status”, “Measuring Impact”, “Disease Pattern”, “Disease Burden”, “Health Care Resource Utilization”, “HCRU”, “Economic Burden”, “Cost”, “Disability”, “Patient Perception”, “Patient Satisfaction”, “Chronic Care”, “Family Impact”, “Psychological Impact”, “Occupational Impact”, “Medical Impact”, “Medical Outcomes”, “Medication Use”, or “Hospital Use”.