

Role of Knowledge of Asthma and Psychosocial Factors in Adherence and Health Outcomes of Asthma Patients

A thesis submitted during May 2023 to the
Centre for Health Psychology, School of Medical Sciences, University of Hyderabad in
partial fulfilment of the requirements for the
Award of the degree of
Doctor of Philosophy in Psychology

By

P. Sharon Shulamite
Research Scholar
Registration No: 17CPPH01

Supervisor

Dr N.D.S. Naga Seema
Assistant Professor



Centre for Health Psychology
School of Medical Sciences
University of Hyderabad
Central University Campus P.O.
Hyderabad – 500 046, Telangana, India

May, 2023

DECLARATION

I, P. Sharon Shulamite, hereby declare that this thesis entitled "*Role of Knowledge of Asthma and Psychosocial Factors in Adherence and Health Outcomes of Asthma Patients*", submitted by me under the guidance and supervision of Dr N.D.S. Naga Seema, Assistant Professor is a bonafide research work which is also free from plagiarism. I also declare that it has not been submitted previously, in part or in full, to this university or any other University or Institution for the award of any degree or diploma.

A report on plagiarism statistics from the University Librarian is included in appendix.

Date: 22/05/2023

P. Sharon Shulamite
(P. Sharon Shulamite)
Registration No.: 17CPPH01

// Countersigned //

Naga Seema
22/05/2023
(Dr. N.D.S. Naga Seema)
Supervisor

Dr. N.D.S. NAGA SEEMA
Assistant Professor
Centre for Health Psychology
University of Hyderabad
Hyderabad-500 046



CERTIFICATE

This is to certify that the thesis entitled “*Role of Knowledge of Asthma and Psychosocial Factors in Adherence and Health Outcomes of Asthma Patients*”, submitted by P. Sharon Shulamite, Research Scholar, bearing Registration No.: 17CPPH01 in partial fulfilment of the requirements for the award of Doctor of Philosophy in Psychology in the Centre for Health Psychology, School of Medical Sciences, is a bonafide work carried out by her under my supervision and guidance.

This thesis is free from plagiarism and has not been submitted previously in part or in full, to this University or any other University or Institution for the award of any degree or diploma.

Further, the student has the following publication before submission of the thesis for adjudication and has produced evidence for the same in the form of reprint in the relevant area of her research.

1. Seema, N., Sharon, P. S., Rana, S., & Nautiyal, A. (2022). Impact of Positive Health Resources on Psychological Distress in Elderly with Chronic Illness: Revelations from Latent Profile Analysis. *Indian Journal of Gerontology*, 36(1), 45-67.

Papers presented in seminars and conferences

1. “Spirituality and Social Support as Predictors in Combating Psychological Distress among Elderly” in 54th National and 23rd International Conference of Indian Academy of Applied Psychology (IAAP), Kurukshetra, Haryana, India. (February 14-16th, 2019).
2. “Relationship between Reproductive Health Knowledge, Attitude and Well-being among Adolescent Girls” in 54th National and 23rd International Conference of Indian Academy of Applied Psychology (IAAP), Kurukshetra, Haryana, India. (February 14-16th, 2019).

3. "Seeking Social Support: A Pathway to Foster Positive Wellbeing in Persons with Cardio-vascular Diseases" in National Seminar on 'Wellbeing across Lifespan' conducted by Centre for Health Psychology, University of Hyderabad. (October 25-27th, 2017).
4. "Sources of Information on Reproductive Health among Late-adolescents" in International seminar conducted by S.V University, Tirupati. (September 25-26th, 2017)

Further, the student has passed the following courses towards fulfilment of coursework requirement for Ph.D.

Course Code	Name	Credits	Pass/ Fail
HP 826	Theory Paper I*	4	Pass
HP 827	Book Review Paper II	4	Pass
HP 828	Review Paper III	4	Pass
HP 829	Empirical Paper IV	4	Pass

*Research Methodology and Advanced Statistics

Nagadeema.
22/05/2023
Supervisor

Dr. N.D.S. NAGA SURESH
Assistant Professor
Centre for Health Psychology
University of Hyderabad
Hyderabad-500 046

G. Pradheef
22.05.23
Head
Centre for Health Psychology

अध्यक्ष / Head
स्वास्थ्य मनोविज्ञान केन्द्र
Centre for Health Psychology
हैदराबाद विश्वविद्यालय / University of Hyderabad
हैदराबाद / Hyderabad-500 046, भारत / India

[Signature]
22/5
Dean
School of Medical Sciences
सकाय अध्यक्ष
Dean
चिकित्सा विज्ञान संकाय
School of Medical Sciences

Acknowledgements

“Living in a state of gratitude is the gateway to grace” (Arianna Huffington)

From the bottom of my heart, I offer a deep sense of gratitude and profuse thanks to my Research Supervisor and mentor Dr N.D.S. Naga Seema, Assistant Professor, Centre for Health Psychology, for her ingenious support, care, motivation, and mentorship throughout my journey without which this thesis would have been an impossibility. Her dynamic supervision moulded me to be what I am today. Words cannot adequately express my thankfulness and admiration.

My special thanks to all the research advisory committee members, Dr G. Padmaja, Dr Suvashisa Rana, and Dr Meera Padhy, who have made significant contributions in shaping my research work.

I thank all the senior consultants and the medical experts for permitting me to collect data from their patients. Their support and encouragement are praiseworthy. Special thanks to Dr Bakht Singh Kennedy, General Physician, Dr Joseph Benjamin, Head of the Department of Oncology, M & J Cancer Hospitals, Hyderabad, and Dr Paramjyothi, Head of Pulmonology Department, Nizam’s Institute of Medical Sciences, Secunderabad. My special thanks to the Superintendents and Medical officers of Telangana Urban and Rural Primary Health Centres in Sangareddy, Jogipet, Patancheru, and Lingampally for their untiring support.

I express my gratitude and appreciation to my beloved fellow scholars, Anuradha Nautiyal, Binoy, Nikhil Raj, and my seniors, Dr Aarti Nagpal, Dr Aarthi Rajendran, and Dr Asher, for their constant motivation and precious suggestions throughout my research work.

I am indebted to my parents, Mr P. Ratnam and Mrs P. Vijaya, who sacrificed their lives to endow me with the best education. I am grateful for the way they have nourished me and taught me the values of life and their perennial encouragement in life's journey. I am thankful to my dearest sister Dr Monica Grace for her immense love and support in blending my personal and academic strengths.

I am grateful to all the participants who participated in this study. Despite their physical distress and tribulations, every participant uncomplainingly supported and responded positively during the data collection.

I am thankful to my friends and well-wishers of the university who stood by me in my academic career. I also thank the church members, brothers, and sisters for their unceasing prayers and blessings. I am delighted that they have continued to pray for me.

The Lord GOD Almighty, who created me and is my Saviour, deserves the most gratitude since He walks with me, watches over me, and treats me like an apple of His eye. My sincere thanks to God for providing the health, strength, insight, and understanding necessary to realise my PhD research dream.

P. Sharon Shulamite

Abstract

Maintaining a healthy lifestyle is one of the greatest challenges in the contemporary society. Despite the advances in science and technology, the chronic illness condition poses a serious threat to an individual's health. Asthma is one such chronic illness condition whose origin is greatly influenced by psychological factors. It has been reported that poor asthma management is the primary factor for mortality rates and its incidence is invariably increasing. This study explores the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients, assesses the role of knowledge of asthma and psychosocial factors in adherence, and health outcomes of asthma patients and also examines the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories. A correlational design using survey method is used. The standardized measures are administered on 285 participants. The descriptive statistics, Pearson's *r*, multiple regression analysis (step-wise), and 2×3 two-way ANOVA are computed. Our analyses show significant negative relationship between knowledge of asthma, adherence, and health outcomes. Social support, knowledge of asthma interventions, knowledge of asthma symptoms, and self-efficacy significantly predict adherence. However, knowledge of asthma, depression, anxiety, and stress significantly predict poor health outcomes. Further, older asthma patients from urban settings have adequate knowledge of asthma, lower symptoms and triggers, high self-efficacy, and received social support when compared to rural asthma patients. Moreover, adherence is found to be high among rural early and middle adults. We also observe that there is no significant relationship between knowledge of asthma and adherence; but social support plays a significant role and predict greater adherence. Further, we observe that depression, anxiety, and stress lead to poor health outcomes. Limitations, future directions, and implications are discussed.

Table of Contents

<i>Declaration</i>	<i>ii</i>
<i>Certificate</i>	<i>iii</i>
<i>Acknowledgements</i>	<i>v</i>
<i>Abstract</i>	<i>vii</i>
<i>List of Tables</i>	<i>x</i>
<i>Abbreviations</i>	<i>xi</i>
Chapter I	1-13
INTRODUCTION	1
Problem statement.....	2
Psychology and Asthma	3
Theoretical framework	9
The rationale of the study	11
Purpose statement	12
Chapter II	14-24
REVIEW OF LITERATURE	14
Socio-demographic factors and asthma	14
Knowledge of asthma.....	15
Psychological factors affecting asthma	16
Social support and asthma	18
Self-efficacy and asthma	18
Adherence and asthma	20
Health outcomes and asthma	22
Summary	23
Research questions.....	24
Objectives	24
Hypotheses	24
Chapter III	25-31
METHOD	25
Design	25
Pilot study.....	25
Participants	26
Instruments	27
Procedure.....	30

Chapter IV	32-61
RESULTS	32

Chapter V	62-75
DISCUSSION AND CONCLUSION	62
Limitations and future directions	73
Implications	74
Conclusion	75

REFERENCES	76-102
-------------------------	---------------

Appendix I: Socio-demographic Form

Appendix II: Asthma Knowledge Questionnaire

Appendix III: Depression Anxiety and Stress Scale (DASS)

Appendix IV: Interpersonal Support Evaluation List

Appendix V: Self-efficacy for Managing Chronic Diseases

Appendix VI: Adherence Scale in Chronic Disease

Appendix VII: Asthma Quality of Life Questionnaire

Appendix VIII: Asthma Symptom Questionnaire

Appendix IX: Approval of the Institutional Ethics Committee (IEC)

Appendix X: Informed Consent Form

Appendix XI: Plagiarism Report

Appendix XII: Publication

List of Tables

Table No.	Table Title	Page No.
1.	<i>Correlations between predictors (knowledge of asthma and psychosocial factors) and criterion (adherence and health outcomes) in asthma patients (N = 285)</i>	34
2.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Adherence (N = 285)</i>	37
3.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (activity limitation) (N = 285)</i>	39
4.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (symptom control) (N = 285)</i>	41
5.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (emotional function) (N = 285)</i>	43
6.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (exposure to environmental stimuli) (N = 285)</i>	45
7.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting asthma symptoms (severity) (N = 285)</i>	47
8.	<i>Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting asthma symptom (frequency) (N = 285)</i>	50
9.	<i>Means, Standard Deviations, and 2 × 3 Two-Way ANOVA for Knowledge and its dimensions</i>	52
10.	<i>Means, Standard Deviations, and 2 × 3 Two-Way ANOVA for dimensions of psychological factors</i>	54
11.	<i>Means, Standard Deviations, and 2 × 3 Two-Way ANOVA for Adherence and health-outcome dimensions</i>	58

Abbreviations

APA:	American Psychological Association
CDC:	Centre for Disease Control
COPD:	Chronic Obstructive Pulmonary Disease
DASS:	Depression Anxiety and Stress Scale
GBD:	Global Burden of Diseases
GINA:	Global Initiative for Asthma
HPA:	Hypothalamic Pituitary Adrenal axis
HR-QOL:	Health Related Quality of Life
ISPOR:	International Society for Pharmacoeconomics and Outcomes Research
PSNS:	Parasympathetic Nervous System
SCT:	Social Cognitive Theory
SNS:	Sympathetic Nervous System
WHO:	World Health Organisation

Chapter I

INTRODUCTION

Maintaining a healthy lifestyle is one of the greatest challenges in the contemporary society. Despite the advances in science and technology, the chronic illness condition poses a serious threat to an individual's health. The World Health Organization (1948) defines health as "a state of physical, mental, and social well-being, and not merely the absence of disease or infirmity". It is evident that in addition to physical health, psychological and social health also play an essential role in determining the health and illness of an individual. Asthma is one of the illnesses whose origin is significantly impacted by psychological factors. Sir William Osler (1892) stated asthma as 'a neurotic affection'. Asthma is also commonly attributed to asthma nervosa due to its psychogenic roots. Psychological factors can affect treatment adherence, impacting symptom display and health outcomes. Hence, psychological and social factors are indispensable in examining the health outcomes of asthma patients.

Asthma is derived from a Greek word meaning "panting with sound and wheezing". An asthmatic episode causes a patient with breathing difficulties, wheezing, coughing, and feeling of chest tightness. During an asthmatic episode, the air-way lining in the lungs swell and are stimulated. The mucus production arises in the airway and muscles encompassing the airway begin to contract, together, this causes a decrease in the flow of air (Lupone, 2013). The Global Initiative for Asthma [GINA] (2001) defined asthma as "a chronic inflammatory disorder of the airways; the chronic inflammation causes an associated increase in airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing". These episodes are characterized by extensive airway restrictions that can be upturned either automatically or with therapy (Bateman et al., 2008).

Prevalence of Asthma

Globally, about 300 million people are affected with asthma. It is estimated that the prevalence of asthma rises by 50% every ten years (Braman, 2006; Shafazand & Colice, 2004). During the year 2019, it was approximated that 262 million people worldwide died from asthma which accounted for 4, 55,000 deaths worldwide (Paramita & Nikolaus, 2022). Further, it can be implied that everyday about 1000 people die from asthma, and its incidence is invariably increasing (Strachan et al., 2022). The Centre for Disease Control [CDC] (2020) stated that the mortality rates have grown by more than 50% across all gender, age categories, and ethnicities, and for children the fatality rates increased by 80% over the past three decades. Women surpassed 65% death rate than men (CDC, 2000). In the Indian scenario, nearly 37 million are asthmatics. Also, India is popularly recognised as the asthma capital of the world as it accounts for 11.1% of the worldwide burden of asthma (Chafle, 2021). Despite, the health care professionals and patients awareness of asthma, it has been reported that the poor asthma management is the primary factor for mortality rates (Sánchez-Borges et al., 2011).

Problem Statement

Based on extensive literature, a large number of people are victims of asthma worldwide. Discounting physical factors, numerous psychological variables contribute to asthma, influencing asthma patients' psychological, social, physical, and spiritual well-being. The prevalence of asthma and poor asthma management are the primary factors for mortality rates in Indian adults is a grave concern. Health psychologists are exploring this area to help asthma patients' in managing symptoms and other conditions associated with asthma through holistic approach.

Empirical insights suggest that a lack of knowledge of asthma, typical triggers, and psychological and social risk factors results in poor management, poor health-related quality of life, and detrimental health outcomes in Indian adult asthma patients. Although there are several studies on asthma, significant research questions and objectives remain unanswered. Hence, the present study is proposed to explore the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients; assess the role of knowledge of asthma and psychosocial factors in adherence, and health outcomes of asthma patients; examine the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories. Therefore, it is imperative that a correlational survey be aimed to explore the relationship, examine the role and patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories.

Psychology and Asthma

Though asthma is a non-communicable disease, it is considered a psychosomatic illness traditionally. Franz Alexander (1950) invented the term ‘Holy Seven Psychosomatic Diseases’—bronchial asthma, rheumatic arthritis, peptic ulcer, colitis caused by ulcers, hypertension, and neural dermatitis in the area of psychosomatic medicine. In the field of psychosomatic medicine, several studies have pointed out those psychological factors such as anxiety, depression, stress, and lack of self-control impact asthmatics poor management of their condition and sometimes even death. Therefore, a biopsychosocial approach accounts to benefit the asthma patients’ towards better management and enhanced quality of life.

In addition to psychological and behavioural factors, biological factors and environmental factors interact and impact the outcomes of asthma. Biological factors

include genetic pre-disposition, poor lung capacity (Graff et al., 2020). Environmental factors include pollution, exposure to sulphur dioxide, cold temperatures, humidity, and dust (Lee et al., 2019). Further, the poor health outcomes in asthma patients is influenced by poor knowledge of asthma, low adherence towards medication, exercise, and diet.

Knowledge of asthma is a key element that influences health outcomes in the form of better management of asthma. Knowledge is defined as information in action (Grayson & O' Dell, 1998). Knowledge refers to facts, information, and skills acquired via education or experience; this also refers to one's theoretical or practical comprehension of a subject. Knowledge, in general, having three components: (1) a human presumption or cognitive depiction of a scenario, (2) accurate conformity with the real scenario (i.e., is true), and (3) justifications based on logical and empirical considerations. Knowledge can also be divided into three major domains; they are personal, procedural, and propositional. Personal knowledge is based on first-hand experience, eccentric interests, and biographical facts. Procedural knowledge is the understanding of the steps required to accomplish things, like playing football or driving car. Basic beliefs about the community and what we actually know is referred to as propositional knowledge.

Knowledge of asthma is derived from health knowledge. Health knowledge is defined as facts, information, and abilities gained through education or experience and the theoretical or practical comprehension of a subject associated with health and health care (Chin et al., 2011). Knowledge of asthma symptoms, triggers, and interventions comprises familiarity, knowledge, or understanding gained through experience or education. Having knowledge of asthma, symptoms, triggers, and interventions benefit asthma patients' in managing the condition better.

Asthma accentuates the risk of life time *anxiety*. In a gist there is a bi directional asthma-anxiety relationship. Anxiety is a psychosocial factor that has a significant impact on asthma

patients. Patients with asthma experience anxious thoughts and feelings and exaggerate their symptoms, which worsen their condition. According to the American Psychological Association [APA] (n.d.-a), anxiety is a mood that is accompanied by tense feelings, agitated thoughts, and physical symptoms like perspiration, shaking, dizziness, or a rapid heartbeat. Anxiety disorders are significantly associated with asthma (Del Giacco et al., 2016). The signs of anxiety and mood disorders have also been linked to asthma (Scott et al., 2007; Katon et al., 2004). Patients suffering with asthma frequently experience anxiety issues due to symptoms like hard antsy thinking or opinions, nervousness, trouble focusing, sleeping difficulty, exhaustion, irritability, and anomalous pain and discomfort.

Anxiety and depression often align with each other. Depression has a significant impact on asthma sufferers. Approximately 280 million of the world's population have depression (Institute for Health Metrics and Evaluation [IHME], 2019). The individual experiences feeling of sadness, absence of interest, lack of appetite, sleep difficulties, hopelessness, and thoughts of self-harm or suicide. Research evidence suggests that asthma often concur with depression. As the depression is reported, the symptoms of asthma get worse (Choi et al., 2017; Yakar et al., 2007). A combination of social, psychological, and biological factors promotes depression. Depression is strongly linked with several non-communicable diseases (WHO, 2017). Chronic illnesses such as cardio-vascular disease, cancer, and respiratory illnesses such as asthma impact depression. As a consequence of the difficulties encountered while controlling their illness condition, asthma patients suffer from multiple conditions and can additionally suffer from depression.

Psychological stress is a risk factor and affects the pathophysiology of asthma. Individuals who are stressed often display psychological symptoms such as anxiety and depression. The body's reaction to any change that necessitates adaptation or response is known as stress (Selye, 1982). The symptoms of stress are breathlessness or a racing heart, extreme tiredness or difficulty falling asleep, severe headaches, drowsiness, and tremors,

hypertension, muscle spasms, abdomen or digestive problems, and a weakened immune system. Stress is significantly associated with asthma symptomatology. Asthma symptoms may worsen under stress, which can exacerbate the asthmatic's condition. Stress is classified as acute stress, chronic stress, and episodic acute stress. Acute stress is typically brief, chronic stress is long-lasting, and episodic acute stress is brief but more frequent. Asthma patients with acute or chronic stress have very poor asthma health outcomes (Landeo-Gutierrez & Celedón, 2020). Research shows that psychological stress increases upper respiratory tract infections (Cohen et al., 1991). The bronchoconstriction occurs during stressful situations in 15-30% of asthma patients (Tal & Miklich, 1976).

Social networks and support systems can be helpful in managing asthma, this in turn boosts asthma condition and minimise the harmful effects of environmental triggers. Further, social support results a variety of consequences on the individuals' physical and mental health (Wright et al., 1998). There is a significant interaction between socio-environmental and individual behaviour in managing any chronic illnesses. Delivering support helps asthma patients handle physical, psychological, and social compulsions. Family, neighbours, friends, colleagues, religious bodies, and primary caregivers comprise social support. Sometimes, in the form of offering financial help and direct physical assistance contains tangible support (APA, n.d.-b). Social support is defined as the support which is "given by others and emerges through interpersonal relationships" (Hirsh, 1981). House (1981) illustrated four kinds of encouraging behaviours believed to be capable of social support: (1) Emotional support—empathy, compassion, affection, faith, self-worth, concern, and attentiveness are all examples of emotional support; (2) Instrumental support - includes aid in charitable, monetary support, labor, time, or any other form of direct assistance; (3) Informational support—include guidance, recommendations, directions, and knowledge for dealing with individual and social issues; (4) Appraisal support involves Encouragement, input, peer evaluation and self-assessment. Social support is referred as

knowledge, help, care received from individuals, appreciated, and acclaimed (Cohen & Wills, 1985; Shumaker & Brownell, 1984; Zhou, 2014). There are different types of social support. These supportive resources can be emotional, informational, tangible, and appraisal. Asthma patients who receive emotional support better manage their sickness. A good indication of emotional support is nurturing (e.g., nurturance). Informational support received by the patient's is significantly impacted through quick recuperation aided by the healthcare professional's accurate information. The patient will benefit from companionship through the sense of support and belonging provided by family members. Support provided to the patient through any material items is referred to as tangible support (Cohen & Wills, 1985). The availability of social support is a key psychosocial component that affects asthma sufferers significantly and sometimes anger, depression, and social alienation occurs due to a lack of social support from friends, family, and co-workers (Sloand et al., 2021). Cohen et al. (1997) identified a link between social connectedness with lowered risk of common cold, less mucus production, enhanced ciliary clearance, and reduced viral shedding. Hence, the present study examined psychosocial factors as a significant variable.

Every aspect of human endeavour is influenced by *Self-efficacy*. Self-efficacy is described as an individual's faith or conviction in their capacity to carry out behaviour successfully. Self-efficacy has been used as a fundamental element in educational interventions designed to help patients' live their lives to their fullest potential (Sales et al., 2008). A greater level of self-efficacy in connection with mutual patient attitude can constructively affect health practice in various ways, along with greater treatment regimen and medication adherence, increased effort committed to disease management, and higher patient persistence during flare-ups (Wigal et al., 1993). Asthma self-efficacy refers to the ability to correctly interpret symptoms and carry out appropriate self-care (Van der Palen et al., 1997). Asthma patients usually possess low self-efficacy due to inability to figure out

the triggers and manage the condition. The self-management practices that can serve to enhance asthma control are determined by self-efficacy. Asthma control is a major significant therapeutic goal and necessarily attained and maintained with help of self-management (Matza et al., 2004). Self-efficacy and adult patients quality of life are found to be strongly correlated (Mammen & Rhee, 2012; Martin *et al.*, 2009; Lavoie *et al.*, 2008). Indicators of depression contribute to poorer asthma outcomes involving both biological mechanisms and an inability to effectively engage in daily self-management (Allen et al., 1994; Rubin, 1993). Self-efficacy, symptoms of depressive disorders and unrealistic expectations are highly significant as they are potentially changeable and may provide new possibilities for long term management of asthma (González-Conde et al., 2019). According to Bandura (1977), higher self-efficacy benefits health outcomes through constructive behaviours and reduce asthma flare-ups. Irrational goals for therapy may result in poorer health outcomes which causes patients dissatisfaction towards treatment and poor adherence (Iversen et al., 1998).

Adherence is a sizable marker of health outcomes. Adherence is the level to which an individual's actions match the suggestions of a health care practitioner. The extent to which the patients' behaviour matches agreed recommendations from the prescriber (Hutchins et al., 2015). Adherence refers to the extent of a person's behaviour in engaging medication, practicing a diet regimen, and creating lifestyle modification with the recommendations from the health care provider (WHO, 2003; Haynes et al., 1979). A variety of factors are likely to impact adherence. Adherence constraints can be classified as patient, primary caregiver, and health care system interconnections. Knowledge to improve treatment adherence is still lacking, and poor adherence to prescribed medications, diet, and exercise continues to have a negative impact on outcomes (Gheorghiade & Zannad, 2005). Asthma

patients with higher adherence display lower exacerbations and better health outcomes (George & Bender, 2019).

Health outcomes are referred as the happenings which take place as a consequence of treatment (Oleske & Islam., 2019). Lee and Leung (2014) defined health outcomes as the health effects caused by the medication of a health issue or by dealing with the healthcare system. Health outcomes can be objective and subjective. Objective outcomes are used to assess personal ambitions; subjective outcomes are used to assess patients' knowledge of medical settings and their participation. Any impairment, injury, infection, dysfunction, symptom, biological condition, or health status is considered a health outcome which can be positive or negative. Quality of life and patient happiness are examples of health outcomes, along with whether a particular disease's prognosis improves or deteriorates. Also, most importantly to measure asthma health outcomes, symptom assessment is a primary concern (Krishnan et al., 2012). Frequency of asthma symptoms have been identified through treatment errors resulting poor asthma outcomes (Price et al., 2017). Having uncontrolled asthma is associated with lower quality of life and poor health outcomes (Lozier et al., 2019). In the present study, health outcomes are operationalized and evaluated by assessing asthma health-related quality of life, frequency, and severity of asthma symptoms.

Theoretical framework

Health Belief Model

The Health belief model proposed by Rosenstock (1990) was employed as a theoretical framework. Health-related behaviour consists of two components – the motive to prevent disease, and the belief towards preventing negative health behaviours for better health outcomes. In asthma patients perception plays an important role in minimizing symptoms and preventing asthma. Positive perception towards management of asthma significantly influences asthma patients' and increases asthma control. The six constructs of

health belief model helps in understanding asthma patients' perception of asthma in the form of *perceived susceptibility and perceived severity* of symptoms and increased risk, *perceived benefits* of psychosocial factors such as social support and self-efficacy, and *perceived barriers* or psychosocial risks including anxiety, depression, and stress. Further, *cue to action* is influenced by means of asthma patients' knowledge of their triggers and act accordingly towards adherence to medication, exercise, diet, and high *self-efficacy* successively determines health outcomes.

Social Cognitive Theory

The social cognitive theory coined by Bandura (1986) contends that environment, cognition, and other personal factors influence behaviour. In this theory, behaviour of an individual is largely regulated by cognitive processes along with prior experiences. In asthma patients' the response of cognitive actions leads to behavioural outcomes like adherence. Environment and cognitions allied with knowledge helps in identifying the triggers and preventing asthma attacks for better management of the condition. For achieving better health outcomes, this theory is beneficial across all communities for understanding individuals' experiences, *behaviour capability*, and socio-environmental interaction through *reciprocal determinism*. By means of social interaction and support, the reciprocal determinism facilitates health enhancing behaviours like adherence by means of *observational learning* and *reinforcements*. The proposed study also examines the role of *self-efficacy* in asthma patients' *expected health outcomes*.

Theory of Planned Behaviour

The theory of planned behaviour put forth by Ajzen (1991) predicts a person's particular behaviour. An individuals' behaviour is anticipated based on his/her intentions, self-control, and attitudes. Successful outcome of behaviour depends on an individual's attitude and intention. The theory of planned behaviour has the ability to assist asthma patients to change

their behaviour and minimize exacerbations, reduce psychological risks, enhance social support, and adhere to medication, diet, and exercise. The six elements of theory of planned behaviour help in demonstrating an individual's true impact on the behaviour by judging through *attitudes* and *behavioural intentions* by way of protective health behaviours for better health outcomes. Further, *social and subjective norms* wherein certain set of behaviours and perception of accepting or rejecting particular health behaviour for example medication, diet, exercise, and seeking social support influences asthma patients across cultural and geographical settings. Asthma patients' *perception* of the triggers facilitates or discourages adherence behaviour. Such varying perceptions give rise to changes in *behavioural control*.

The rationale of the study

Asthma is a condition that is becoming increasingly prevalent around the world with highest mortality in adults. Empirical insights suggests that lack of knowledge of asthma, typical triggers, psychological, and social risk factors results in poor management, poor health related quality of life, and detrimental health outcomes. The effect of stress on asthma is one of the major causes in aggravating the condition. Anxiety-related symptoms and depression limits asthmatics ability to engage in activities and worsen their health outcomes. This study scientifically explores the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of adult asthma patients. It also assesses the role of knowledge of asthma and psychosocial factors in adherence and health outcomes. Further, it examines the patterns of variations in knowledge of asthma, psychosocial factors, adherence and health outcomes across geographical settings and age categories. There is a need to study the adherence of asthma patients in the contemporary world. As asthma health management is the greatest challenge, exploring the relationship between knowledge, depression, stress, anxiety, social support, and self-efficacy largely benefits not only in the field of research but also provides an opportunity to patients and

practitioners for better management. For this, adherence is crucial to overall long-term health and well-being! Quantitative research method using correlational survey design will be adopted. The present study will partially replicate the previous studies but in a new context and also emerge new findings in the light of geographical contexts and age classifications and the like. The results will have significant implications for education, psychosocial factors, adherence, and health outcomes of asthma patients. The findings will have potential benefits for future research, policy makers, academics, and health care providers in enhancing new avenues for treatment.

Purpose statement

The purpose of the study is to explore the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes in asthma patients. The study also aims to assess the role of knowledge of asthma and psychosocial factors in adherence and health outcomes in asthma patients. A quantitative approach is used to address three specific research questions: (1) What is the trend of relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients? (2) How do knowledge of asthma and psychosocial factors play a role in adherence and health outcomes of asthma patients? (3) What are the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories? This study is based on a quantitative approach employing a correlational design through the survey method. Pearson's product moment correlations were done to answer the first research question. The second research question was answered using the multiple regression analysis (step-wise) method. The 2×3 Two-Way between-subjects ANOVA was performed to answer the third research question.

The thesis is prepared by following the guidelines of the APA Publication Manual (7th ed). There are five chapters in the thesis. *Chapter I (Introduction)* comprises the problem under study, the theoretical framework, and the major concept and constructs of

the study. The chapter focuses on an introduction to asthma, the prevalence of asthma, psychosocial factors, adherence, and health outcomes. *Chapter II (Review of Literature)* consists of empirical and theoretical studies, research questions, objectives, and hypotheses. *Chapter III (Method)* contains five sections—Design, Pilot study, Participants, Instruments, and Procedure. *Chapter IV (Results)* presents results comprising statistical analyses and tables. *Chapter V (Discussion and Conclusion)* covers discussion, limitations, future directions, implications, and conclusion, along with two separate sections—*References* and *Appendixes*.

Chapter II

REVIEW OF LITERATURE

In chapter II, an extensive review of literature has been conducted and systematically organized. Exhaustive review was done on asthma in relation with knowledge, psychosocial factors, adherence, and health outcomes. The studies presented in this chapter are primarily limited to asthma-related articles published for the past ten years.

Socio-demographic factors and asthma

The prevalence of asthma is determined by family history of diseases, occupational status, age, gender, place of living, comorbidity, history of smoking, across the globe (Shine et al., 2019; Kumar & Ram, 2017; Kaplan et al., 2019; Taponen et al., 2017). Gender also plays a major role where it has a larger impact on women due to hormonal imbalance (Koper et al., 2017). Asthma prevalence is high in the age group of 45 to 64 years (Ross et al., 2013). The prevalence of asthma in elderly women is 6–17% and continues to increase. Older asthma patients die due to poor diagnosis and slow treatment (Dunn et al., 2018). Growing age especially in older patients are likely to develop comorbidities leads to clustering of diseases (Divo et al., 2014) particularly among women (Tomisa et al., 2021). In comparison to young adults, the positive correlation between patients' age and severe asthma increased by 3.09 times in middle adults and 5.7 times in older adults, and asthma severity is location-dependent; therefore, those who live in cities are less prone to asthma than those who live in rural areas (Tilahun et al., 2022). The Global Asthma Network (2014) stated that urban and rural areas excessively suffer from asthma. Residents from unclean rural households often use stack of firewood, crop leftovers, and cakes made of cow dung for cooking are diagnosed with asthma. They are often under-diagnosed of allergic reactions and poor access to treatment (Desalu et al., 2021; Kumar & Ram, 2017).

Knowledge of asthma

Lack of health knowledge is a universal community health concern that confines an individual's capacity to manage chronic illnesses such as asthma (Sørensen et al., 2012). It is also related with increased unplanned casualties and hospital admissions (Eckman et al., 2012). Due to prolonged asthma condition and oral corticosteroids (OCS) treatments, asthma patients take more oral drugs to reduce the exacerbations caused due to the severity of asthma due to limited knowledge (Song et al., 2021). Asthma patients should understand the basic pathophysiology in order to understand about triggers, exacerbations, how their lungs work, administer emergency medication during flare ups (Mancuso et al., 2010). Although the level of asthma knowledge is low; it can be improved by means of education which will help to improve asthma management, fewer hospitalisations, and enhanced quality of life. Many studies show that asthma knowledge and patient education are correlated i.e., higher the education, higher is the asthma knowledge (Nguyen et al., 2018).

Gender, age, and duration of the disease also contributes to asthma knowledge. However, asthma patients with longer duration in general had greater knowledge and improved quality of life. Younger patients performed better than older patients and women had better knowledge than men (Nguyen et al., 2018; Gibson et al., 1995). Limited asthma education improves perceived symptoms but do not upgrade health outcomes in adult asthma patients (Gibson, 2002). Asthma increases the threat of several other diseases may further deteriorate asthma symptoms and increase flare-ups, especially if untreated (Kaplan et al., 2020). Asthma patients' sufficient knowledge helps them to competently and confidently self-manage their condition (Robinson et al., 2022). Providing self-management support through routine health check-up and a detailed treatment plan improves asthma outcomes (Salim et al., 2022).

Psychological factors affecting asthma

Asthma is a psychosomatic condition. Psychological factors play a crucial role in asthma. Anxiety affects more than half of all asthmatic patients (Dudeney et al., 2017). Anxiety disorders are significantly associated with asthma and have a bi-directional relationship with each other (Del Giacco et al., 2016). In addition, mood and anxiety disorders have been linked to asthma symptoms (Scott et al., 2007; Katon et al., 2004). Anxiety disorders are commonly co-occurring in asthma patients. Smith et al. (2014) discussed that in asthma patients, anxiety is a comorbid condition and directs to reduced management of the condition resulting poor health outcomes (Katon et al., 2004). De Miguel et al. (2011) indicated that high anxiety and illness perception impact severe asthma symptoms. Anxiety-provoking family dynamics and emotional components trigger asthma flare-ups and are associated with the severity of the condition. Anxiety was found to be high in female asthma patients (Licari et al., 2019). Severe asthma can be improved by psychological interventions involving family therapy (Rejno et al., 2019).

Depression is a significant factor in asthma. Patients with uncontrolled asthma suffer from depression. Also, symptoms of asthma are intensified with depression (Yakar et al., 2007). Asthma and depression often coexist and has an impact on the diagnosis and outcome of the disease (Choi et al., 2017). Depression has a strong correlation to quality of life, corticosteroid use, and hospitalization (Kullowatz et al., 2007). Shin et al. (2018) opined that depression is associated with high amounts of inflammatory mediators in the body. Symptoms of depression were linked to a greater perception of asthmatic disability. In older persons, the association between depression and asthma outcomes is significantly influenced by over perception of asthma symptoms (Feldman et al., 2021). Depression lowers health related quality of life and increases exacerbations, poorer control, and the need for inhalers (Opolski & Wilson, 2005). Female asthma patients were depressed than male

counterparts (Lu et al., 2018). In a study, women showed poor compliance for treatment, low self-evaluation and poor control of environmental triggers, resulting in poor asthma control (Frieri et al., 2015). Treating depression considerably enhances quality of life, overall health, and reduction of depressive symptoms. As a result, it will increase adherence, promote breathing and respiratory function, and lead to more effective asthma control (Van Lieshout & MacQueen, 2008; Grosso et al., 2019).

Stress has an influence on increased upper respiratory tract infections (Cohen et al., 1991). The connection between stress and asthma is vivid. Stress can have long-term effects on a person's biology, illness development, and management. Miller et al. (2007) reported that the relationship between stress and asthma linking type 1 helper cells and type 2 helper cells and pro-inflammatory cytokines heighten the inflammation in the airway resulting in increased asthma exacerbations. The immunologic and biological mechanism impacts psychological stress which can increase the clinical symptoms of asthma (Chen & Miller, 2007). Stress can be divided into active and passive, which will have deleterious effects on asthma. Both active and passive stressors can activate sympathetic nervous system and obstructs the airway causing inflammatory driven asthma exacerbations (Plourde et al., 2017). High rates of chronic stress increases asthma morbidity (Barnhouse & Jones, 2019). Asthma impacts adults stress levels. An 18-month prospective study by Sandberg et al. (2000) found that recurrent stress, traumatic events and experiences increased asthma condition by double-fold. Stress at home environment or at working place will deteriorate the medication adherence and worsens asthma control and outcomes (Wisnivesky et al., 2010; Landeo-Gutierrez et al., 2020). Robinson et al. (2020) recommended psychological screening as mandatory requirement to evaluate if asthma patients are undergoing through psychological issues.

Social support and asthma

Krishner (2003) examined that interpersonal relationships and support from friends, family, peers, and health care providers facilitated asthma control. Social support reduces the sense of powerlessness and facilitates treatment adherence in asthma patients (Makinen et al., 1999; Patterson & McGrath, 2000). Loerbroks et al. (2010) highlighted that low social support and depression increases the risk of asthma in adults.

Sloand et al. (2021) revealed that low social support was strongly related to low medical adherence and high frequency of asthma symptoms (Lind et al., 2013). Social networks are crucial in preparing adolescents to take care of themselves emotionally (Coupey, 1998). A link was found between parental interaction and patients' adherence in managing chronic illnesses (Schlenk & Hart, 1984; Schobinger et al., 1993). Lack of social support advances to the development of asthma, and social support can be increased by facilitating more effective coping mechanisms (Cohen & Wills, 1985). Lack of social support from family members, peers and colleagues greatly affects the quality of life of the asthma patients (Metting et al., 2016). Shum et al. (2017) contradicted that asthma patients reported high social support from home care givers. A recent work of Greenfield et al. (2023) summarised that older adults with lower asthma self-efficacy received more social support nevertheless displayed worse asthma outcomes whereas Lind et al. (2015) concluded that asthma patients received emotional support mainly from partners and family members and minimally from patient associations and support groups.

Self-efficacy and asthma

Increased self-efficacy is vital for the management of chronic illnesses (Chlebowy & Garvin, 2006; Bartholomew et al., 1998). Asthma self-efficacy is the ability to accurately examine the symptoms and adhere to the directions of health care providers with appropriate

self-care (Mancuso et al., 2010). A lack of self-efficacy is associated to poor quality of life, emotional stress, and negative physiological repercussions in asthma patients (Martin & Mc Neil, 2009). Asthma control and self-efficacy are positively related (Mohajjel et al., 2013). Self-efficacy through behavioural modification increases clinical outcomes (Martin et al., 2009). Chen et al. (2010) discussed that asthma patients with high self-efficacy manifest self-care behaviours. Further, high levels of self-efficacy indicated high control illness, and low levels of self-efficacy displayed pessimistic and depressing symptoms, which exacerbate their condition. Hence, increasing asthma patients' self-efficacy would enable them to develop a comprehensive self-care regimen.

There are large number of studies that describe (e.g. Lavoie et al., 2008; Heydari et al., 2015; Bolman et al., 2011; Talreja et al., 2012; Sleath et al., 2022; Mohajjel et al., 2013; Bodenheimer et al., 2002; Unni & Farris, 2011) the link between self-efficacy and management of asthma symptoms with greater control of asthma, improved quality of life, and higher adherence to medication. Self-efficacy can be developed to enhance better asthma outcomes, as low self-efficacy worsens asthma outcomes (Mancuso et al., 2001). As a result, improvements in self-efficacy among asthma patients may lead to enhanced self-management and illness control (Valizadeh et al., 2014; Ayala et al., 2009).

A study by Campbell et al. (2006) revealed that asthma patients' self-efficacy is associated with various bodily responses. In asthma patients, lower self-efficacy was related to elevated parasympathetic activity and airflow obstruction during unpleasant emotions in daily life with increased hospitalizations, and emergency department visits (Scherer & Bruce, 2001; Ejebe et al., 2015). Hence, self-efficacy is a strong indicator of self-management and health outcomes in asthma patients. Asthma patients with high self-efficacy display protective self-care behaviours, which contributes to effective asthma management (Chen et al., 2010).

Adherence and asthma

Engelkes et al. (2015) revealed that asthma sufferers show lower adherence. Age, education level, knowledge about asthma, medication, duration of illness, severity of symptoms, and doctor –patient communication all affect adherence (Baiardini et al., 2015). Adherence rates in asthma differ widely from 22% to 78% (Krigsman et al., 2007). Previously, Jones et al. (2003) revealed that medication adherence in asthma patients remains to be 30–40% in practice.

Asthma attacks are reinforced by poor adherence towards medication, and increased hospital visits (Blake, 2017). Low adherence estimated for 24% of asthma symptoms such as exacerbations and 60% of hospitalization; conversely, most intervention studies reported increased adherence but did not necessarily lead to improving clinical outcomes (Bårnes & Ulrik, 2015).

Greater symptom control is linked to higher adherence, which in turn lowers the occurrence of exacerbations and asthma-related mortality (George & Bender, 2019). Gillissen (2007) found that asthma patients were more likely to follow their prescribed treatment plans if they thought their specific medications were very important. Conversely, asthma patients who worried about their doctors prescribing too many medications were less likely to do so. A recent study by Rafi et al. (2022) concluded that rural patients from middle-class households showed least dedication to treatment than urban patients. Enhancing adherence through the promotion of pharmaceutical beliefs and favourable perceptions of the disease lead to better control and a higher quality of living (Riccelli et al., 2020). In older adults, depressive symptoms were related to worse symptom control, poor quality of living, and lower adherence to treatment regimens (Krauskopf et al., 2013). Asthma attacks are enhanced by poor adherence towards medication, and frequent hospital visits (Blake, 2017). Rafi et al. (2022) postulated that younger asthmatics regardless of

gender, were likely to be non-adherent to asthma treatment. Non adherence to inhalers leads to poor asthma control and increased healthcare access (Dima et al., 2015). Thus, Ayele and Tegegn (2017) prescribed inhalation therapy to increase adherence.

Murphy et al. (2012) summarised that asthmatics with poor asthma control do not take their medication as prescribed, and this non-adherence is associated with poor clinical outcomes. Suboptimal adherence to medications leads to worse clinical outcomes and higher healthcare utilization, and has been linked with one-third of asthma fatalities. (Normansell, 2017; Robinson et al., 2003; Sumino & Cabana, 2013; Dima et al., 2015). Being young, having moderate asthma and poor contact with the healthcare provider are indicators of poor adherence. In contrast, greater adherence was associated with healthcare professionals fixed-combination medication prescription (Williams et al., 2007; Apter et al., 1998; Bårnes & Ulrik, 2015).

According to Bourdin et al. (2012) poor adherence has a significant impact on asthma control, quality of life, and health outcomes e.g. poor control, exacerbations, hospitalizations, poor lung function, and often leads to an overestimation of asthma severity. Inversely, higher adherence and better health outcomes are strongly connected, and shows enhanced symptom management and fewer fatalities (George & Bender, 2019). High adherence to conventional Mediterranean diet enhances effective asthma management in adults (Barros et al., 2008). As a result, it is advised that high consumption of fruits and vegetables lowers asthma risk and enhances asthma control (Guilleminault et al., 2017).

Toennesen et al. (2018) observed that combining diet and exercise improves asthma management in non-obese patients. Despite the fact that physical activity enhances asthma outcomes such as disease control, pulmonary function, and overall well-being, many asthma patients remain non-adherent to exercise due to the lack of knowledge or misconception that they should restrict exercise participation (Nyenhuis et al., 2022). Smits et al. (2020)

elaborated that patients' perceptions of asthma, medicines, fear of counter effects of medications, quality of doctor patient communication, family support, social support, availability of drug and its cost, and education significantly influence patients' adherence to asthma treatments (Rifat et al., 2013; Gamble et al., 2011; Hassan et al., 2020).

Health outcomes and asthma

There are different types of coping measures which asthma patients may adapt in the process of managing the disease to have better health outcomes (Baiardini et al., 2015). Asthma impacts a patient's overall happiness and asthma health related quality of life, and affects disease progresses (Adeyeye et al., 2017). Helgeson et al. (2018) identified that health evaluations play an important role in effective management of asthma and contributes to increased health outcomes. Accurate assessment of health outcomes is crucial to ensure appropriate treatment and improve patients' lives and clinical outcomes (McDonald et al., 2018; De Albornoz & Chen, 2021). Exposure to chemical pollution for a prolonged period of time results in asthma symptoms and worsened health and well-being in asthma patients (Chatkin et al., 2021; Landrigan et al., 2018). Yung et al. (2019) established that asthma triggers increases the frequency and severity of asthma exacerbations and decreases the health outcomes. Asthma patients with anxiety-related symptoms limit their ability to engage in activities and deteriorate health outcomes (McLeish et al., 2019). Asthma has a significant impact on asthma patients' health related quality of life and well-being (Thompson et al., 2013; Siroux et al., 2008). Poor health related quality of life in asthma patients may escalate the probability of acute exacerbations necessitating hospitalization, whereas improved symptom control in asthma patients enhances subjective well-being (Magid et al., 2004; Schatz et al., 2008; Shinan-Altman & Katzav, 2021). Asthmatics' health related quality of life declines with age, and older patients report poor health outcomes,

conversely, adolescent asthma patients reported poor health (Kannan et al., 2015; Van Der Laan et al., 2021; Cui et al., 2015).

Summary

To conclude this section, the literature identified that previous studies demonstrated patients' knowledge of asthma and its role in asthma management. Further, the studies have emphasized that psychosocial factors such as anxiety, and depression worsen symptoms, diagnosis, and prognosis of asthma. Stress has a deleterious impact on asthma, even causing morbidity. Higher self-efficacy was shown to bring about behavioral change among asthma patients. Conversely, lower self-efficacy decreased quality of life and asthma management. Furthermore, a lack of social support may contribute to the development of psychological distress, and high social support facilitates treatment outcomes. The review reveals that asthma sufferers exhibit lower adherence whereas higher adherence is associated with better management of the condition. Even though considerable studies have explored the relationship between knowledge and psychosocial factors, very few have explored this relationship among asthma patients especially in the Indian context. Despite previous studies showing that geographical settings profoundly affected the health outcomes of asthma patients, these variables have not been explored much in the Indian context. Similarly, studies have shown that the majority of asthma patients are unaware of managing psychosocial factors, as a result of which their asthma symptoms are exacerbated. Overall, these studies highlight the need for a holistic exploration of psychosocial factors, behavioural factors, and health outcomes of asthma patients. In summary, little is known about the interrelationships between knowledge of asthma, psychosocial factors, adherences, and health outcomes in asthma patients in the Indian context.

Research Questions

There are three specific research questions.

1. What is the trend of relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients?
2. How do knowledge of asthma and psychosocial factors play a role in adherence and health outcomes of asthma patients?
3. What are the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories?

Objectives

The main objectives of the study are

1. To explore the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients;
2. To assess the role of knowledge of asthma and psychosocial factors in adherence, and health outcomes of asthma patients;
3. To examine the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories.

Hypotheses

It is hypothesised that

1. There will be correlation between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients.
2. The knowledge of asthma, psychosocial factors will play significant role in adherence and health outcomes of asthma patients
3. The patterns of knowledge of asthma, psychosocial factors, adherence, and health outcomes will vary in asthma patients across geographical settings and age categories.

Chapter III

METHOD

This chapter consists of five headings, such as design, pilot study, participants, instruments, and procedure.

Design

Based on the principles of quantitative research, the study involved a correlational design using a survey method to explore the relationship and assess the role of knowledge and psychosocial factors in adherence and health outcomes in asthma patients.

The study primarily had four variables: knowledge, psychosocial factors, adherence, and health outcomes. First, knowledge had three dimensions, such as knowledge of symptoms, knowledge of triggers, and knowledge of interventions. Second, psychosocial factors included five domains, such as depression, anxiety, stress, social support, and self-efficacy. Third, adherence was a composite score. Fourth, health outcomes included asthma health-related quality of life and asthma symptoms—severity and frequency.

The predictors were knowledge and psychosocial factors. The criteria were adherence and health outcomes. Further, the study adopted a 2 (geographical setting) $\times$ 3 (age category) factorial design to examine the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories. The first factor was the geographical setting having two levels, such as urban and rural. The second factor age group comprised three levels: early adults, middle adults, and older adults.

Pilot study

Before conducting the actual study, a pilot study was carried out involving a small sample of asthma patients ($n = 100$). The main objectives of the pilot study were to assess

the feasibility and parsimony of the actual research. The pilot study provided hands-on experience with the availability and accessibility of the study sample. The pilot study verified the readability and applicability of all the research instruments. The pilot study provided information about the duration and assessment of an individual participant. Thus, the pilot study facilitated the protocol and smooth conduct of the actual study.

Participants

The participants included ($N = 285$) asthma patients. The participants were drawn primarily from community and hospital based settings. The sample were recruited from two geographical settings such as urban ($n_1 = 102$) and rural ($n_2 = 183$) of various districts of Telangana state in India. The participants fell under three age categories such as early adults (20-39 years; $n_1 = 138$), middle adults (40-59 years; $n_2 = 96$), and older adults (60 years and above; $n_3 = 51$).

Purposive sampling was used to recruit the participants. Duration of asthma up to 25 years was considered. Asthma patients belonging to the above categories having known psychiatric disorders, any surgery, and critical conditions were excluded from the study. Basing on the inclusion and exclusion criteria, the investigator initially established contact with 340 potential participants in the study. Thus, there were 310 participants participated in the study. As 25 participants voluntarily omitted some of the items of the instruments, they were excluded from the data set. In this way, 285 participants were included in the data for analysis. Of the initial sample of 285 asthma patients 55% were women, and 45% were men. In this sample, 70% were married, 30% were unmarried. In asthma patients, 74% belonged to nuclear family, and 26% belonged to joint family.

Twenty six percent (26%) of participants had only asthma as a chronic illness. Although, thirty one percent (31%) of participants had asthma with other chronic illness such as diabetes. Further, thirty three percent (33%) participants had hypertension, two

percent (2%) had cancer, one percent (1%) suffered chronic kidney disease, and four percent (4%) of the participants were affected with arthritis.

Fifteen percent (15%) of patients did not have any formal education, twenty seven percent (27%) had primary education, thirty percent (30%) of the participants completed higher secondary, and twenty six percent (26%) of them completed higher education.

Instruments

There are seven standardized instruments used in the study. In addition to these, a Socio-demographic form was also used (*See Appendix I*).

Asthma Knowledge Questionnaire

To identify knowledge of asthma, the asthma knowledge questionnaire developed by Ho et al. (2003) was adapted and administered to patients with asthma (Alshagga et al., 2011). The scale consisted of 25 items using a dichotomous scale (yes = 1, no = 0). The score ranges between 0 and 25. The higher the scores, higher was the knowledge of asthma. It measures three dimensions of knowledge of asthma such as symptoms, triggers and interventions. The questionnaire has adequate reliability and validity (Cronbach's $\alpha = 0.69$). Examples of items for asthma knowledge questionnaire are : 'Coughing is not a symptom of asthma', 'Asthma is due to inflammation in the lungs'. (*See Appendix II*).

Depression Anxiety and Stress Scale

For the purpose of measuring psychosocial factors, depression, anxiety, and stress scale was administered. This brief version DASS- 21 was developed by Lovibond and Lovibond (1995). It measures adverse emotional states such as level of depression, anxiety, and stress. This scale has 21-items with 7- items from each domain. The responses were based on a 4- point severity/frequency pattern of responses in which 0- indicated, "Did not apply to me at all, 1- Applied to me to some degree, or some of the time, 2- Applied to me

to a considerable degree or a good part of time, 3- Applied to me very much or most of the time”. Its scores for depression, anxiety, and stress are calculated by summing the scores for the relevant items. Lovibond and Lovibond (1995) proposed cut-off scores for standard markers are normal, moderate, and severe. The reliability for the subscales depression, anxiety, and stress indicated adequate (Cronbach’s $\alpha = 0.81, 0.89, \& 0.78$) respectively. Example of statements related to depression, anxiety, and stress are: “I couldn’t seem to experience any positive feeling at all, I was worried about situations in which I might panic and make a fool of myself, and I found it difficult to relax”. (See Appendix III).

Interpersonal Support Evaluation List

In order to measure social support, interpersonal support evaluation list shortened version–12 items scale was administered to the participants. This short version of interpersonal evaluation list was developed by Cohen et al. (1985). This scale consists of 12 items and measures three dimensions of perceived social support such as appraisal support, belonging support, and tangible support. Each dimension is assessed by 4 statements on a 4-point Likert scale. The responses included “definitely false, probably false, probably true, and definitely true.” The scores for appraisal support, belonging support, and tangible support are analysed by adding the scores for the relevant items. The reliability of the scale was adequate (Cronbach’s $\alpha = .88 - .90$). Examples of items for social support are: “There is someone I can turn to for advice about handling problems with my family, If I was stranded 10 miles from home, there is someone I could call who could come and get me”. (See Appendix IV).

Self-efficacy for Managing Chronic Disease

The self-efficacy for managing chronic disease scale was developed by Lorig et al. (2001). This scale primarily measures various factors that are mostly common in chronic

diseases such as symptom control, role function, emotional functioning, communicating with physicians. This scale contains 6-items measured on a 10 point Likert scale ranging from “1- not at all confident to 10- totally confident”. Higher the score, higher was the self-efficacy. The internal consistency reliability was adequate (Cronbach’s $\alpha = 0.91$). Examples of items for self-efficacy are: “How confident do you feel that you can keep the physical discomfort or pain of your disease from interfering with the things you want to do?, How confident do you feel that you can do things other than just taking medication to reduce how much your illness affects your everyday life?”. (See Appendix V).

Adherence Scale in Chronic Diseases

To evaluate patients' adherence to prescribed medicines adherence scale in chronic diseases developed by Buszko et al. (2016) was administered on asthma patients. This scale is adapted widely across patients with hypertension, diabetes, and cardio-vascular diseases (Kosobucka et al., 2018). Adherence scale in chronic diseases consists 8 items, with five multiple choice varying responses. The score range between 0-32 with scores less than 24, 24 to 28 and more than 29 showing low, medium and high adherence respectively. The scale established enough reliability as well as validity (Cronbach’s $\alpha = 0.74$). Examples of items on adherence are: “Do you always remember to take all your medications according to your doctor’s instructions?”, “Do you adjust the dosing of your medications according to how you feel?”. (See Appendix VI).

Asthma Quality of Life Questionnaire

The Asthma Quality of life questionnaire was developed by Juniper et al. (1992). This measures asthma health related quality of life in four areas, such as activity limitations, symptom control, emotional function, exposure to environmental stimuli. This scale consisted of 32 items involving a 7-point Likert scale. The scale ranges from 1- Severely

impaired to 7 - Not at all impaired. The test-retest reproducibility of the questionnaire was adequate (Cronbach's $\alpha > .90$). Examples of items for asthma quality of life questionnaire are: "How often during the past two weeks did you feel you had to avoid a situation or environment because of cigarette smoke?", "How much discomfort or distresses have you felt over the last two weeks as a result of chest tightness?". (See Appendix VII).

Asthma Symptom Questionnaire

For measuring asthma symptoms, asthma symptom questionnaire developed by Steen et al. (1994) was administered on asthma patients. This measures frequency of asthma symptoms and severity of asthma symptoms. This scale includes 10 items with a 5-point Likert scale. The responses for severity of asthma symptoms were based on a 5 - point pattern indicating 1 - Never, 2 - On one of the days, 3 - On several days, 4 - On most days, and 5 - Everyday. The responses for frequency of asthma symptoms were based on a 5 - point pattern indicating that 1 - Does not apply to me, 2 - No bother at all, 3 - Not much bother, 4 - Much bother, and 5 - Very much bother. Minimum score for severity and frequency is "1" and maximum score is "50". Sufficient reliability score and validity of the questionnaire was acquired (Cronbach's $\alpha = 0.86- 0.87$). Examples for the items of asthma symptom checklist are: "How much did you bother because of the breathlessness during exercise?", "How many days have you experienced breathlessness during exercise?". (See Appendix VIII).

Procedure

Ethical approval from the Institutional Ethics Committee of the University of Hyderabad was obtained prior to the conduct of study. The investigator identified key informants from the community and contacted the potential rural participants from the rural areas of Hyderabad district. In addition to this, the investigator also contacted the authorities

of hospitals, primary health centres, and health clinics located in the twin-city of Hyderabad and Secundrabad to seek their permissions for inclusion of potential urban participants in the study. The investigator, thus, chose the participants on the basis of inclusion and exclusion criteria. After explaining the informed consent to the participants, signature was obtained based on their willingness. Socio-demographic form was also given to the participants and requested to fill. In few cases, where the participants were not able to read and write, structured interview method was followed and the investigator noted the responses given by the participants. After this preliminary process, each participant individually answered to items of the research instruments. Self-report method was followed when the participant was able to read and write. In cases, where participants were illiterate, structured interview method was followed. During this process, doubts of each participant were clarified. Each participant took approximately 45-50 minutes to respond to the items of the research instruments. At the end, a debriefing was done to each participant.

Chapter IV

RESULTS

Results and their analyses are included in this chapter. The procedure of data cleaning was carried out after the obtained quantitative data were entered into IBM SPSS Statistics 20.0. All objectives and hypotheses were taken into account when selecting the relevant statistical tests. The primary statistical analysis consists of descriptive statistics, Pearson's r , multiple regression using step-wise method, and two-way ANOVA. The underlying assumptions of each statistical test were examined. All statistical analyses were conducted with an alpha level of .05. Wherever necessary, the Cohen's (Cohen, 1988) cut-off criteria for effect size were applied.

Based on the objectives, the findings and analyses are organised into three main sections: (1) to explore the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients, (2) to assess the role of knowledge of asthma and psychosocial factors in adherence, and health outcomes of asthma patients, and (3) to examine the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories. The first paragraph of each objective includes the type of data, the name of the statistical test, and the testing of assumptions before moving on to the analyses. Tables and figures are used to present the results.

The *first* objective was to explore the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients. The descriptive statistics (M , SD) and Pearson's product moment correlation (r) were performed since the data were ratio and interval.

The product moment correlation coefficients between the criterion and predictor variables were displayed in Table 1. The predictor variables included knowledge of asthma

(symptoms, triggers, and interventions), and psychosocial factors (depression, anxiety, stress, social support and self-efficacy). Further, social support comprised three components such as appraisal support, belonging support, and tangible support. The criterion consisted of adherence and health outcomes. Health outcomes were operationalised and estimated using measures such as asthma health-related quality of life and its dimensions such as activity limitation, symptom control, emotional function, and exposure to environmental stimuli. The frequency and severity of asthma symptoms were also included under health outcomes.

We can derive from the Table 1 that knowledge of asthma symptoms was negatively correlated with two dimensions of health-related quality of life such as activity limitation ($r = -.15, p < .01$) and symptom control ($r = -.12, p < .05$). Knowledge of asthma triggers was positively correlated with frequency of asthma symptoms ($r = .17, p < .01$) and severity of asthma symptoms ($r = .25, p < .01$). Further, Knowledge of asthma interventions was positively correlated with three dimensions of health-related quality of life such as activity limitation ($r = .16, p < .01$), symptom control ($r = .14, p < .05$), and exposure to environmental stimuli ($r = .15, p < .05$).

It was evident that depression was negatively correlated with four dimensions of health-related quality of life such as activity limitation ($r = -.28, p < .01$), symptom control ($r = -.23, p < .01$), emotional function ($r = -.23, p < .01$), and exposure to environmental stimuli ($r = -.17, p < .01$). However, depression was positively correlated with frequency of asthma symptoms ($r = .15, p < .01$). Further, anxiety was negatively correlated with all dimensions of health-related quality of life such as activity limitation ($r = -.31, p < .01$), symptom control ($r = -.23, p < .01$), emotional function ($r = -.23, p < .01$), and exposure to environmental stimuli ($r = -.21, p < .01$). It was also observed that anxiety was positively correlated with frequency of asthma symptoms ($r = .19, p < .01$) and severity of asthma

Table 1

Correlations between predictors (Knowledge of asthma and psychosocial factors) and criterion (adherence and health outcomes) in asthma patients (N = 285)

		Adherence	Health outcomes				
		AL	SC	EF	EES	FAS	SAS
Knowledge of asthma							
KAS	-.09	-.15**	-.12*	-.10	-.05	-.01	-.03
KAT	.09	-.00	-.05	-.07	-.12	.17**	.25**
KAI	-.06	.16**	.14*	.11	.15*	-.08	-.02
Psychosocial factors							
Depression	.02	-.28**	-.23**	-.23**	-.17**	.15**	.05
Anxiety	.04	-.31**	-.23**	-.23**	-.21**	.19**	.14*
Stress	-.02	-.29**	-.18**	-.23**	-.16**	.18**	.19**
Appraisal support	.36**	.07	.08	.07	.03	.26**	.36**
Belonging support	.20**	-.03	.03	.06	-.02	.34**	.35**
Tangible support	.37**	-.01	-.01	.00	-.08	.37**	.42**
Self-efficacy	-.00	-.00	.12	.16**	.05	.12*	.20**

Note. AL: Activity limitation, SC: Symptom control, EF: Emotional function, EES: Exposure to environmental stimuli, FAS: Frequency of asthma symptoms, SAS: Severity of asthma symptoms, KAS: Knowledge of asthma symptoms, KAT: Knowledge of asthma triggers, KAI: Knowledge of asthma interventions,

* $p < .05$, ** $p < .01$.

symptoms ($r = .14, p < .05$). Similarly, stress was found to be negatively correlated with all the dimensions of health-related quality of life such as activity limitation ($r = -.29, p < .01$), symptom control ($r = -.18, p < .01$), emotional function ($r = -.23, p < .01$), and exposure to environmental stimuli ($r = -.16, p < .01$). On the other hand, stress was positively correlated with frequency of asthma symptoms ($r = .18, p < .01$) and severity of asthma symptoms ($r = .19, p < .01$).

All the three dimensions of social support, appraisal support was positively correlated with adherence ($r = -.36, p < .01$), whereas positively correlated with frequency of asthma symptoms ($r = .26, p < .01$) and severity of asthma symptoms ($r = .36, p < .01$). However, belonging support was positively correlated with adherence ($r = .20, p < .01$), frequency of asthma symptoms ($r = .34, p < .01$), and severity of asthma symptoms ($r = .35, p < .01$). The tangible support was found to be positively correlated with adherence ($r = .37, p < .01$), frequency of asthma symptoms ($r = .37, p < .01$), and severity of asthma symptoms ($r = .42, p < .01$).

From the Table 1, it was also observed that self-efficacy was positively correlated with emotional function ($r = .16, p < .01$), frequency of asthma symptoms ($r = .12, p < .05$), and severity of asthma symptoms ($r = .20, p < .01$).

The *second* objective was to assess the role of knowledge of asthma and psychosocial factors in adherence, and health outcomes of asthma patients. Multiple regression step-wise method was run. Before running multiple regression step wise method, its major assumptions like linear relationship, normal distribution, and multi-collinearity were tested.

As the knowledge scores were in ratio data and psychosocial factors scores were interval data, multiple linear regression analysis using step-wise method was computed ($N = 285$) by IBM SPSS statistics 20.0. For this analysis, there were ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was adherence scores. The major assumptions for multiple linear regressions were tested.

Table 2 shows the results of the multiple linear regression analysis using step-wise method. The table contains the number of steps, constant (C), R^2 , R^2 -change (ΔR^2), unstandardized regression coefficients (B), standard error of beta (SEB), standardized regression coefficients (β), and t-value with significance levels.

From Table 2, it is observed that multiple linear regression analysis step-wise method give rise to five models. The tangible support in Step 1 was found to be a significant predictor ($\beta = .37$, $t = 6.78$, $p < .001$). The model explained statistically significant 14% proportion of variance in adherence, $R^2 = .14$, $F = (1,283)$, $p < .001$.

In Step 2, appraisal support was added ($\beta = .20$, $t = 2.86$, $p < .001$) and the model explained significantly 2% more variance. Thus, the model comprising tangible support and appraisal support explained statistically significant 16% proportion of variance in adherence, $R^2 = .16$, $F = (1,282)$, $p < .001$.

In Step 3, knowledge of asthma interventions was added ($\beta = -.18$, $t = -3.29$, $p < .01$) and the model explained significantly 3% more variance. Thus, the model comprising tangible support, appraisal support, and knowledge of asthma interventions explained statistically significant 19% proportion of variance in adherence, $R^2 = .19$, $F = (1,281)$, $p < .01$.

Table 2

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Adherence (N = 285)

Step and predictor variable	C	R²	ΔR²	B	SE B	β	t
Step-1	1.83	.14					
Tangible Support			-	.76	.11	.37	6.78***
Step-2	.87	.16	.02				
Tangible Support				.51	.14	.25	3.54***
Appraisal Support				.43	.15	.20	2.86***
Step-3	2.94	.19	.03				
Tangible Support				.55	.14	.27	3.88***
Appraisal Support				.50	.15	.23	3.36**
Knowledge Intervention				-.71	.21	-.18	-3.29**
Step-4	5.21	.22	.03				
Tangible Support				.60	.14	.29	4.27***
Appraisal Support				.60	.15	.28	3.96***
Knowledge Intervention				-.70	.21	-.18	-3.28**
Self-efficacy				-.57	.19	-.17	-3.03**
Step-5	6.49	.23	.01				
Tangible Support				.63	.14	.31	4.50***
Appraisal Support				.58	.15	.27	3.89***
Knowledge Intervention				-.63	.21	-.16	-2.98**
Self-efficacy				-.54	.19	-.16	-2.83**
Knowledge Symptoms				-.50	.23	-.12	-2.20*

*Note: *p < .05, **p < .01, ***p < .001*

In Step 4, self-efficacy was added ($\beta = -.17$, $t = -3.03$, $p < .01$) and the model explained significantly 3% more variance. Thus, the model comprising tangible support, appraisal support, knowledge of asthma interventions and self-efficacy explained statistically significant 22 % proportion of variance in adherence, $R^2 = .22$, $F = (1,280)$, $p < .01$.

Finally in Step 5, knowledge of asthma symptoms was added ($\beta = -.12$, $t = -2.20$, $p < .05$) and the model explained significantly 1% more variance. Thus, the model comprising tangible support, appraisal support, knowledge of asthma interventions, self-efficacy and knowledge of asthma symptoms explained statistically significant 23% proportion of variance in adherence, $R^2 = .23$, $F = (1,279)$, $p < .05$.

Hence, the five significant predictors tangible support ($\beta = .37$, $t = 6.78$, $p < .001$), appraisal support ($\beta = .20$, $t = 2.86$, $p < .001$), knowledge of asthma interventions ($\beta = -.18$, $t = -3.29$, $p < .01$), self-efficacy ($\beta = -.17$, $t = -3.03$, $p < .01$) and knowledge of asthma symptoms ($\beta = -.12$, $t = -2.20$, $p < .05$), predicted adherence in asthma patients.

Table 3 shows the analysis for ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was health outcome (activity limitation).

Table 3 denotes the results of the multiple linear regression analysis using step-wise method. The table contains the number of steps, constant (C), R^2 , R^2 -change (ΔR^2), unstandardized regression coefficients (B), standard error of beta (SEB), standardized regression coefficients (β), and t-value with significance levels.

It is observed from Table 3 that multiple linear regression analysis step-wise method give rise to three models. In Step 1, anxiety was found to be a significant predictor

Table 3

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (activity limitation) (N = 285)

	<i>C</i>	<i>R</i> ²	ΔR^2	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Step-1	5.50	.09	-				
Anxiety				-.05	.01	-.31	-5.43***
Step- 2	6.05	.12	.03				
Anxiety				-.05	.01	-.32	-5.70***
Knowledge symptoms				-.14	.05	-.17	-3.12**
Step-3	5.63	.15	.02				
Anxiety				-.04	.01	-.30	-5.35***
Knowledge symptoms				-.16	.05	-.20	-3.53***
Knowledge interventions				.11	.04	.15	2.66**

*Note: *p < .05, **p < .01, ***p < .001*

($\beta = -.31, t = -5.43, p < .001$). The model explained statistically significant 9% proportion of variance in health outcome (activity limitation), $R^2 = .09, F = (1,283), p < .001$.

In Step 2, knowledge of asthma symptoms was added ($\beta = -.17, t = -3.12, p < .01$) and the model explained significantly 3% more variance. Thus, the model containing anxiety and knowledge of asthma symptoms explained statistically significant 12% proportion of variance in health outcome (activity limitation), $R^2 = .12, F = (1,282), p < .01$.

In Step 3, knowledge of asthma interventions was added ($\beta = .15, t = 2.66, p < .01$) and the model explained significantly 2% more variance. Thus, the model containing anxiety, knowledge of asthma symptoms and knowledge of asthma interventions explained statistically significant 15% proportion of variance in health outcome (activity limitation), $R^2 = .15, F = (1,281), p < .01$.

Hence, the three significant predictors anxiety ($\beta = -.31, t = -5.43, p < .001$), knowledge of asthma symptoms ($\beta = -.17, t = -3.12, p < .01$) and knowledge of asthma interventions ($\beta = .15, t = 2.66, p < .01$) predicted health outcome (activity limitation).

Table 4 shows the analysis for ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was health outcome (symptom control).

From Table 4, it is observed that multiple linear regression analysis step-wise method give rise to four models. In Step 1, depression was found to be a significant predictor ($\beta = -.23, t = -3.99, p < .001$). The model explained statistically significant 5% proportion of variance in health outcome (symptom control), $R^2 = .05, F = (1,283), p < .001$.

In Step 2, knowledge of asthma symptoms was added ($\beta = -.16, t = -2.80, p < .01$) and the model explained significantly 3% more variance. Thus, the model comprising

Table 4

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (symptom control) (N = 285)

Step and predictor variable	C	R²	ΔR²	B	SE B	β	t
Step-1	5.40	.05	-				
Depression				-.03	.01	-.23	-3.99***
Step-2	5.97	.08	.03				
Depression				-.04	.01	-.26	-4.45***
Knowledge symptoms				-.14	.05	-.16	-2.80*
Step-3	5.60	.09	.01				
Depression				-.03	.01	-.23	-3.96***
Knowledge symptoms				-.15	.05	-.18	-3.06**
Knowledge interventions				.09	.05	.12	2.03*
Step-4	6.15	.11	.02				
Depression				-.04	.01	-.27	-4.51***
Knowledge symptoms				-.14	.05	-.16	-2.73**
Knowledge interventions				.12	.05	.15	2.58**
Knowledge triggers				-.10	.04	-.15	-2.48*

*Note: *p < .05, **p < .01, ***p < .001*

depression and knowledge of asthma symptoms explained statistically significant 8% proportion of variance in health outcome (symptom control), $R^2 = .08$, $F = (1,282)$, $p < .01$.

In Step 3, knowledge of asthma interventions was added ($\beta = .12$, $t = 2.03$, $p < .05$) and the model explained significantly 1% more variance. Thus, the model comprising depression, knowledge of asthma symptoms, and knowledge of asthma interventions explained statistically significant 9% proportion of variance in health outcome (symptom control), $R^2 = .09$, $F = (1,281)$, $p < .05$.

In Step 4, knowledge of asthma triggers was added ($\beta = -.15$, $t = -2.48$, $p < .05$) and the model explained significantly 2% more variance. Thus, the model comprising depression, knowledge of asthma symptoms, knowledge of asthma interventions and knowledge of asthma triggers explained statistically significant 11% proportion of variance in health outcome (symptom control), $R^2 = .11$, $F = (1,280)$, $p < .05$.

Hence, the four significant predictors depression ($\beta = -.23$, $t = -3.99$, $p < .001$), knowledge of asthma symptoms ($\beta = -.16$, $t = -2.80$, $p < .01$), knowledge of asthma interventions ($\beta = .12$, $t = 2.03$, $p < .05$), and knowledge of asthma triggers ($\beta = -.15$, $t = -2.48$, $p < .01$), predicted health outcome (symptom control).

Table 5 shows the analysis for ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was health outcome (emotional function).

From Table 5, it is evident that multiple linear regression analysis step-wise method give rise to three models. In Step 1, depression was found to be a significant predictor

Table 5

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (emotional function) (N = 285)

Step and predictor variable	C	R²	ΔR²	B	SE B	β	t
Step-1	5.46	.05	-				
Depression				-.04	.01	-.23	-4.06***
Step-2	6.33	.08	.03				
Depression				-.05	.01	-.29	-4.81***
Knowledge triggers				-.12	.04	-.17	-2.81**
Step-3	6.69	.09	.01				
Depression				-.05	.01	-.30	-5.04***
Knowledge triggers				-.11	.04	-.15	-2.45*
Knowledge symptoms				-.11	.05	-.12	-2.11*

*Note: *p < .05, **p < .01, ***p < .001*

($\beta = -.23$, $t = -4.06$, $p < .001$). The model explained statistically significant 5% proportion of variance in health outcome (emotional function), $R^2 = .05$, $F = (1,283)$, $p < .001$.

In Step 2, knowledge of asthma triggers was added ($\beta = -.17$, $t = -2.81$, $p < .01$) and the model explained significantly 3% more variance. Thus, the model comprising depression and knowledge of asthma triggers explained statistically significant 8% proportion of variance in health outcome (emotional function) $R^2 = .08$, $F = (1,282)$, $p < .01$.

In Step 3, knowledge of asthma symptoms was added ($\beta = -.12$, $t = -2.11$, $p < .05$) and the model explained significantly 1% more variance. Thus, the model comprising depression, knowledge of asthma triggers, and knowledge of asthma symptoms explained statistically significant 9% proportion of variance in health outcome (emotional function) $R^2 = .09$, $F = (1,281)$, $p < .05$.

Hence, the three significant predictors depression ($\beta = -.23$, $t = -4.06$, $p < .001$), knowledge of asthma triggers ($\beta = -.17$, $t = -2.81$, $p < .01$), and knowledge of asthma symptoms ($\beta = -.12$, $t = -2.11$, $p < .05$), predicted health outcome (emotional function).

Table 6 depicts the analysis for ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was health outcome (exposure to environmental stimuli).

From Table 6, it is noticed that multiple linear regression analysis step-wise method give rise to three models. In Step 1, anxiety was found to be a significant predictor ($\beta = -.21$, $t = -3.55$, $p < .001$). The model explained statistically significant 4% proportion of variance in health outcome (exposure to environmental stimuli), $R^2 = .04$, $F = (1,283)$, $p < .001$.

In Step 2, knowledge of asthma triggers was added ($\beta = -.14$, $t = -2.43$, $p < .05$) and the model explained significantly 2% more variance. Thus, the model comprising anxiety

Table 6

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting Health outcome (exposure to environmental stimuli) (N = 285)

Step and predictor variable	C	R²	ΔR²	B	SE B	B	t
Step-1	5.37	.04	-				
Anxiety				-.04	.01	-.21	-3.55***
Step-2	6.06	.06	.02				
Anxiety				-.04	.01	-.22	-3.84***
Knowledge triggers				-.11	.04	-.14	-2.43*
Step-3	5.64	.09	.03				
Anxiety				-.04	.01	-.20	-3.54***
Knowledge triggers				-.15	.04	-.19	-3.25**
Knowledge intervention				.16	.05	.18	2.99**

*Note: *p < .05, **p < .01, ***p < .001*

and knowledge of asthma triggers explained statistically significant 6% proportion of variance in health outcome (exposure to environmental stimuli), $R^2 = .06$, $F = (1,282)$, $p < .05$.

In Step 3, knowledge of asthma interventions was added ($\beta = .18$, $t = 2.99$, $p < .01$) and the model explained significantly 3% more variance. Thus, the model comprising anxiety, knowledge of asthma triggers, and knowledge of asthma interventions explained statistically significant 9% proportion of variance in health outcome (exposure to environmental stimuli), $R^2 = .09$, $F = (1,281)$, $p < .01$.

Hence, the three significant predictors anxiety ($\beta = -.21$, $t = -3.55$, $p < .001$), knowledge of asthma triggers ($\beta = -.14$, $t = -2.43$, $p < .05$), and knowledge of asthma interventions ($\beta = .18$, $t = 2.99$, $p < .01$), predicted health outcome (exposure to environmental stimuli).

Table 7 shows the analysis for ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the three dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was asthma symptoms (severity).

From Table 7, it is visible that multiple linear regression analysis step-wise method give rise to six models. In Step 1, tangible support was found to be a significant predictor ($\beta = .42$, $t = 7.77$, $p < .001$). The model explained statistically significant 18% proportion of variance in severity of asthma symptoms, $R^2 = .18$, $F = (1,283)$, $p < .001$.

In Step 2, stress was added ($\beta = .21$, $t = 3.95$, $p < .001$) and the model explained significantly 4% more variance. Thus, the model comprising tangible support and stress explained statistically significant 22% proportion of variance in severity of asthma symptoms, $R^2 = .22$, $F = (1,282)$, $p < .001$.

Table 7

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting asthma symptoms (severity) (N = 285)

Step and predictor variable	C	R²	ΔR²	B	SE B	B	t
Step-1	-.71	.18	-				
Tangible support				1.02	.13	.42	7.77***
Step-2	-3.66	.22	.04				
Tangible support				1.04	.13	.43	8.12***
Stress				.20	.05	.21	3.95***
Step-3	-5.06	.24	.02				
Tangible support				.74	.16	.30	4.56***
Stress				.21	.05	.23	4.35***
Appraisal support				.51	.17	.20	2.93**
Step-4	-3.18	.26	.02				
Tangible support				.78	.16	.32	4.81***
Stress				.21	.05	.22	4.26***
Appraisal support				.57	.17	.22	3.27**
Knowledge interventions				-.61	.25	-.13	-2.47**
Step- 5	-5.77	.28	.02				
Tangible support				.73	.16	.30	4.57***
Stress				.22	.05	.23	4.52***
Appraisal support				.46	.17	.18	2.66**
Knowledge interventions				-.78	.25	-.17	-3.10**
Knowledge triggers				.66	.23	.17	2.92**
Step- 6	-7.86	.29	.01				
Tangible support				.69	.16	.28	4.30***
Stress				.25	.05	.27	4.95***
Appraisal support				.41	.18	.16	2.36*
Knowledge interventions				-.76	.25	-.16	-3.04**
Knowledge triggers				.58	.23	.15	2.53*
Self-efficacy				.47	.23	.12	2.00*

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

In Step 3, appraisal support was added ($\beta = .20, t = 2.93, p < .01$) and the model explained significantly 2% more variance. Thus, the model comprising tangible support, stress and appraisal support explained statistically significant 24% proportion of variance in severity of asthma symptoms, $R^2 = .24, F = (1,281), p < .01$.

In Step 4, knowledge of asthma interventions was added ($\beta = -.13, t = - 2.47, p < .01$) and the model explained significantly 2% more variance. Thus, the model comprising tangible support, stress, appraisal support, and knowledge of asthma interventions explained statistically significant 26% proportion of variance in severity of asthma symptoms, $R^2 = .26, F = (1,280), p < .01$.

In Step 5, knowledge of asthma triggers was added ($\beta = .17, t = 2.92, p < .01$) and the model explained significantly 2% more variance. Thus, the model comprising tangible support, stress, appraisal support, knowledge of asthma interventions and knowledge of asthma triggers explained statistically significant 28% proportion of variance in severity of asthma symptoms, $R^2 = .28, F = (1,279), p < .01$.

Finally in Step 6, self-efficacy was added ($\beta = .12, t = 2.00, p < .05$) and the model explained significantly 1% more variance. Thus, the model comprising tangible support, stress, appraisal support, knowledge of asthma interventions, knowledge of asthma triggers and self-efficacy explained statistically significant 29% proportion of variance in severity of asthma symptoms, $R^2 = .29, F = (1,278), p < .05$.

Hence, the six significant predictors tangible support ($\beta = .42, t = 7.77, p < .001$), stress ($\beta = .21, t = 3.95, p < .001$), appraisal support ($\beta = .20, t = 2.93, p < .01$), knowledge of asthma interventions ($\beta = -.13, t = - 2.47, p < .01$), knowledge of asthma triggers ($\beta = .17, t = 2.92, p < .01$) and self-efficacy ($\beta = .12, t = 2.00, p < .05$), predicted severity of asthma symptoms.

Table 8 shows the analysis for ten predictors – three dimensions of knowledge of asthma (symptoms, triggers, and interventions), depression, anxiety, stress, the three dimensions of social support (tangible, appraisal, and belonging support), and self-efficacy. The criterion was frequency of asthma symptoms.

From Table 8, it is observed that multiple linear regression analysis step-wise method give rise to five models. In Step 1, tangible support was found to be a significant predictor ($\beta = .37$, $t = 6.75$, $p < .001$). The model explained statistically significant 14% proportion of variance in frequency of asthma symptoms, $R^2 = .14$, $F = (1,283)$, $p < .001$.

In Step 2, depression was added ($\beta = .26$, $t = 4.83$, $p < .001$) and the model explained significantly 7% more variance. Thus, the model comprising tangible support and depression explained statistically significant 20% proportion of variance in frequency of asthma symptoms, $R^2 = .20$, $F = (1,282)$, $p < .001$.

In Step 3, belonging support was added ($\beta = .24$, $t = 3.66$, $p < .001$) and the model explained significantly 4% more variance. Thus, the model comprising tangible support, depression, and belonging support explained statistically significant 24% proportion of variance in frequency of asthma symptoms, $R^2 = .24$, $F = (1,281)$, $p < .001$.

In Step 4, knowledge of asthma interventions was added ($\beta = -.14$, $t = -2.54$, $p < .05$) and the model explained significantly 2% more variance. Thus, the model comprising tangible support, depression, belonging support, and knowledge of asthma interventions explained statistically significant 26% proportion of variance in frequency of asthma symptoms, $R^2 = .26$, $F = (1,280)$, $p < .05$.

Finally in Step 5, knowledge of asthma triggers was added ($\beta = .16$, $t = 2.76$, $p < .01$) and the model explained significantly 2% more variance, $R^2 = .28$, $F = (1,279)$, $p < .01$. Thus, the model comprising tangible support, depression, belonging support, knowledge of

Table 8

Summary of multiple regression analysis (Stepwise) for knowledge and psychosocial factors (depression, anxiety, stress, three dimensions of social support, and self-efficacy) predicting asthma symptom (frequency) (N = 285)

Step and predictor variable	C	R²	ΔR²	B	SE B	β	T
Step-1	1.74	.14	-				
Tangible support				1.22	.18	.37	6.75***
Step-2	-3.97	.20	.07				
Tangible support				1.44	.18	.44	8.01***
Depression				.31	.06	.26	4.83***
Step-3	-6.01	.24	.04				
Tangible support				.99	.21	.30	4.60***
Depression				.35	.06	.30	5.54***
Belonging support				.73	.20	.24	3.66***
Step-4	-2.86	.26	.02				
Tangible support				1.06	.21	.32	4.92***
Depression				.33	.06	.28	5.08***
Belonging support				.75	.20	.25	3.81***
Knowledge interventions				-.85	.33	-.14	-2.54*
Step- 5	-6.98	.28	.02				
Tangible support				.98	.21	.30	4.55***
Depression				.37	.06	.31	5.62***
Belonging support				.70	.19	.24	3.60***
Knowledge interventions				-1.05	.34	-.17	-3.10**
Knowledge triggers				.85	.31	.16	2.76**

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

asthma interventions, and knowledge of asthma triggers explained statistically significant 28% proportion of variance in frequency of asthma symptoms.

Hence, the five significant predictors tangible support ($\beta = .37, t = 6.75, p < .001$), depression ($\beta = .26, t = 4.83, p < .001$), belonging support ($\beta = .24, t = 3.66, p < .001$), knowledge of asthma interventions ($\beta = -.14, t = -2.54, p < .05$), and knowledge of asthma triggers ($\beta = .16, t = 2.76, p < .01$), predicted frequency of asthma symptoms.

The *third* objective was to examine the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories. Two-way ANOVA was run. Before running Two-way ANOVA, its major assumptions like normal distribution and homogeneity of variance were tested. The results were discussed in the tables.

Table 9 displays 2 (geographical settings) $\times$ 3 (age categories) ANOVA done on knowledge of asthma scores yielded significant main effects of geographical settings, $F(1,279) = 6.33, p < .05$, with medium effect size (partial $\eta^2 = .02$), indicating that in the urban setting, older adults revealed more knowledge ($M = 15.14, SD = 3.82$) than early adults and middle adults ($M = 14.31, SD = 3.27$, and $M = 13.00, SD = 2.84$). The main effect of age category was found to be not significant, $F(2,279) = .21, p = .81$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = 2.60, p = .08$.

Further, knowledge of asthma symptoms scores illustrated significant main effects of geographical settings, $F(1,279) = 4.31, p < .05$, with medium effect size (partial $\eta^2 = .02$), indicating that in the urban setting, older adults revealed more knowledge ($M = 4.36, SD = 1.55$) than early adults and middle adults ($M = 3.87, SD = 1.50$, and $M = 3.60, SD = 1.11$). The main effect of age category was found to be not significant, $F(2,279) = .90, p = .41$.

Table 9

Means, Standard Deviations, and 2 × 3 Two-Way ANOVA for Knowledge and its dimensions

Age Categories (AC)	Geographical Settings (GS)				ANOVA			
	Urban		Rural		Effect	F ratio	df	η^2
	M	SD	M	SD				
Knowledge								
Early Adult	14.31	3.27	13.00	2.84	GS	6.33*	1	.02
Middle Adult	13.67	3.12	13.93	3.13	AC	.21	2	-
Older Adult	15.14	3.82	12.86	3.09	GS×AC	2.60	2	.-
Knowledge-Symptoms								
Early Adult	3.87	1.50	3.58	1.22	GS	4.31*	1	.02
Middle Adult	3.67	1.11	3.57	1.21	AC	.90	2	-
Older Adult	4.36	1.55	3.57	1.57	GS×AC	.90	2	-
Knowledge-Triggers								
Early Adult	6.43	1.68	5.77	1.69	GS	6.56*	1	.02
Middle Adult	6.04	1.97	6.12	1.68	AC	.27	2	-
Older Adult	6.93	1.49	5.68	1.58	GS×AC	2.23	2	-
Knowledge-Interventions								
Early Adult	4.02	1.51	3.65	1.45	GS	.27	1	-
Middle Adult	3.96	1.40	4.25	1.42	AC	1.15	2	-
Older Adult	3.86	1.70	3.62	1.42	GS×AC	1.25	2	-

Note. N = 285; GS = geographical setting; AC = age category.

* $p < .05$.

The interaction effect of geographical settings $\times$ age categories was found to be not significant, $F(2,279) = .90, p = .41$.

Also, knowledge of asthma triggers scores delineated significant main effects of geographical settings, $F(1,279) = 6.56, p < .05$, with medium effect size (partial $\eta^2 = .02$), indicating that in the rural setting, middle adults revealed more knowledge ($M = 6.12, SD = 1.68$) than early adults and older adults ($M = 5.77, SD = 1.69$, and $M = 5.68, SD = 1.58$). The main effect of age category was found to be not significant, $F(2,279) = .27, p = .76$. The interaction effect of geographical settings $\times$ age categories was found to be not significant, $F(2,279) = 2.23, p = .10$.

Knowledge of asthma intervention scores noted no significant main effects of geographical settings, $F(1,279) = .27, p = .61$, no significant main effects of age category $F(2,279) = 1.15, p = .32$, and no significant interaction effects of geographical settings and age categories $F(2,279) = 1.25, p = .29$, indicating that there is no difference in the level of knowledge across different age groups in urban and rural settings.

In Table 10, depression scores outlined no significant main effects of geographical settings, $F(1,279) = 1.44, p = .23$, no significant main effects of age category, $F(2,279) = 2.24, p = .11$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .18, p = .83$.

Similarly, anxiety scores clarified no significant main effects of geographical settings, $F(1,279) = 1.41, p = .24$, no significant main effects of age category, $F(2,279) = 1.35, p = .26$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .78, p = .46$. Also, stress scores yielded no significant main

Table 10

Means, Standard Deviations, and 2 × 3 Two-Way ANOVA for dimensions of psychological factors

Age Categories (AC)	Geographical Settings (GS)				ANOVA			
	Urban		Rural		Effect	F ratio	df	η^2
	M	SD	M	SD				
Depression								
Early Adult	14.30	9.08	15.32	7.87	GS	1.44	1	-
Middle Adult	12.74	8.00	13.30	6.79	AC	2.24	2	-
Older Adult	11.14	8.36	13.51	6.72	GS×AC	.18	2	-
Anxiety								
Early Adult	15.31	8.16	17.04	8.30	GS	1.41	1	-
Middle Adult	14.96	5.45	14.43	6.13	AC	1.35	2	-
Older Adult	13.36	7.80	15.84	6.71	GS×AC	.78	2	-
Stress								
Early Adult	14.23	7.72	15.25	7.55	GS	1.71	1	-
Middle Adult	12.89	8.69	14.35	6.21	AC	1.02	2	-
Older Adult	12.43	5.67	13.95	6.74	GS×AC	.03	2	-
Social Support								
Early Adult	17.97	6.71	18.79	6.71	GS	6.16*	1	.02
Middle Adult	20.33	8.35	18.59	7.68	AC	.91	2	-
Older Adult	21.07	7.60	14.46	6.68	GS×AC	4.32*	2	.03
Appraisal Support								
Early Adult	6.18	2.55	6.14	2.45	GS	4.31*	1	.01
Middle Adult	6.52	3.11	6.19	2.54	AC	1.60	2	-
Older Adult	6.43	3.46	4.51	2.29	GS×AC	2.06	2	-
Belonging Support								
Early Adult	5.56	2.74	6.05	2.99	GS	2.80	1	-
Middle Adult	6.67	3.41	6.19	3.34	AC	1.10	2	-
Older Adult	6.93	2.53	4.76	2.90	GS×AC	3.10*	2	.02

Age Categories (AC)	Geographical Settings (GS)				ANOVA			
	Urban		Rural		Effect	F ratio	df	η^2
	M	SD	M	SD				
Tangible Support								
Early Adult	6.23	2.74	6.60	2.57	GS	7.06**	1	.02
Middle Adult	7.15	2.64	6.22	2.96	AC	.25	2	-
Older Adult	7.71	3.20	5.19	2.57	GS×AC	4.71*	2	.03
Self-efficacy								
Early Adult	5.84	1.81	5.23	1.79	GS	8.42**	1	.03
Middle Adult	6.05	1.54	5.51	1.65	AC	.89	2	-
Older Adult	6.32	1.47	5.40	1.45	GS×AC	.18	2	-

Note. N = 285; GS = geographical setting; AC = age category.

* $p < .05$, ** $p < .01$.

effects of geographical settings, $F(1,279) = 1.71, p = .19$, no significant main effects of age category, $F(2,279) = 1.02, p = .36$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .03, p = .97$.

Social support scores revealed significant main effects of geographical settings, $F(1,279) = 6.16, p < .05$, with medium effect size (partial $\eta^2 = .02$), indicating that in the urban setting, older adults revealed more social support ($M = 21.07, SD = 7.60$) than early adults and middle adults ($M = 17.97, SD = 6.71$, and $M = 20.33, SD = 8.35$). The main effect of age category was found to be not significant, $F(2,279) = .91, p = .41$. The interaction effect of geographical settings $\times$ age categories was found to be significant, $F(2,279) = 4.32, p < .05$, with medium effect size (partial $\eta^2 = .03$). This stated that there was a significant difference of social support between early adults, middle adults and older adults belonging to urban and rural settings.

Appraisal support scores yielded significant main effects of geographical settings, $F(1,279) = 4.31, p < .05$, indicating that in the rural setting, early adults and middle adults ($M = 6.14, SD = 2.45, M = 6.16, SD = 2.54$) exhibit more appraisal support than older adults ($M = 4.51, SD = 2.29$). The main effect of age category was found to be not significant, $F(2,279) = 1.60, p = .20, \eta^2 = .01$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = 2.06, p = .13, \eta^2 = .01$.

Belonging support scores showed no significant main effects of geographical settings, $F(1,279) = 2.80, p = .09$. The main effect of age category was found to be not significant, $F(2,279) = 1.10, p = .33$. The interaction effect of geographical settings $\times$ age categories was found to be significant, $F(2,279) = 3.10, p < .05$, with medium effect size (partial $\eta^2 = .02$). This stated that there was a significant difference of belonging support between early adults, middle adults and older adults belonging to urban and rural settings.

Tangible support scores revealed significant main effects of geographical settings, $F(1,279) = 7.06$, $p < .01$, with medium effect size (partial $\eta^2 = .02$), indicating that in the urban setting, older adults and middle adults revealed more tangible support ($M = 7.71$, $SD = 3.20$ & $M = 7.15$, $SD = 2.64$) than early adults ($M = 6.23$, $SD = 2.74$), in rural settings, early and middle adults reveal more tangible support ($M = 6.60$, $SD = 2.57$ & $M = 6.22$, $SD = 2.96$) than older adults ($M = 5.19$, $SD = 2.57$). The main effect of age category was found to be not significant, $F(2,279) = .25$, $p = .78$. The interaction effect of geographical settings $\times$ age categories was found to be significant, $F(2,279) = 4.71$, $p < .05$, with medium effect size (partial $\eta^2 = .03$). This stated that there was a significant difference of tangible support between early adults, middle adults and older adults belonging to urban and rural settings.

Self-efficacy scores indicated significant main effects of geographical settings, $F(1,279) = 8.42$, $p < .01$, with medium effect size (partial $\eta^2 = .03$), explaining that in the urban setting, early adults possess higher self-efficacy ($M = 5.84$, $SD = 1.81$) than middle adults and older adults ($M = 6.05$, $SD = 1.54$, $M = 6.32$, $SD = 1.47$). The main effect of age category was found to be not significant, $F(2,279) = .89$, $p = .41$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .18$, $p = .83$.

Table 11 reveals adherence scores and suggested no significant main effects of geographical settings, $F(1,279) = .09$, $p = .77$. The main effect of age category was found to be significant, $F(2,279) = 6.82$, $p < .01$, with medium effect size (partial $\eta^2 = .05$), indicating that in the urban setting, early adults exhibit greater adherence ($M = 7.48$, $SD = 5.82$) than middle adults and older adults ($M = 5.56$, $SD = 4.37$, and $M = 6.00$, $SD = 4.85$); in rural setting, early adults exhibit greater adherence ($M = 8.49$, $SD = 6.88$) than middle

Table 11

Means, Standard Deviations, and 2 × 3 Two-Way ANOVA for Adherence and health-outcome dimensions

Age Categories (AC)	Geographical Settings (GS)				ANOVA			
	Urban		Rural		Effect	F ratio	df	η^2
	M	SD	M	SD				
Adherence								
Early Adult	7.48	5.82	8.49	6.88	GS	.09	1	-
Middle Adult	5.56	4.37	6.03	5.03	AC	6.82**	2	.05
Older Adult	6.00	4.85	3.81	3.12	GS×AC	1.33	2	-
Quality of life								
Early Adult	4.82	1.22	4.75	1.13	GS	1.90	1	-
Middle Adult	5.22	.87	4.96	1.04	AC	1.91	2	-
Older Adult	5.07	1.00	4.75	1.07	GS×AC	.31	2	-
Activity limitation								
Early Adult	4.65	1.31	4.62	1.12	GS	.33	1	-
Middle Adult	4.99	.97	4.94	.99	AC	2.66	2	-
Older Adult	5.02	.92	4.82	.98	GS×AC	.09	2	-
Symptom control								
Early Adult	4.91	1.27	4.81	1.20	GS	2.39	1	-
Middle Adult	5.34	.94	4.99	1.13	AC	1.94	2	-
Older Adult	4.99	1.00	4.68	1.11	GS×AC	.32	2	-
Emotional function								
Early Adult	4.86	1.34	4.84	1.23	GS	1.64	1	-
Middle Adult	5.18	1.05	5.01	1.29	AC	1.15	2	-
Older Adult	5.31	1.03	4.84	1.19	GS×AC	.52	2	-
Exposure to environmental stimuli								
Early Adult	4.76	1.41	4.75	1.31	GS	3.96*	1	.01
Middle Adult	5.26	.99	4.79	1.23	AC	1.12	2	-
Older Adult	5.18	1.31	4.57	1.34	GS×AC	1.25	2	-

Age Categories (AC)	Geographical Settings (GS)				ANOVA			
	Urban		Rural		Effect	F ratio	df	η^2
	M	SD	M	SD				
Asthma symptoms-Frequency								
Early Adult	10.43	9.41	13.05	10.02	GS	.01	1	-
Middle Adult	7.56	7.85	7.84	8.12	AC	7.63**	2	.05
Older Adult	8.21	6.94	5.62	7.69	GS×AC	1.48	2	-
Asthma symptoms-Severity								
Early Adult	6.97	7.38	7.61	6.97	GS	.08	1	-
Middle Adult	5.26	7.36	4.67	6.15	AC	6.17**	2	.04
Older Adult	4.00	5.43	3.16	5.41	GS×AC	.31	2	-

Note. N = 285; GS = geographical setting; AC = age category.

* $p < .05$, ** $p < .01$.

adults and older adults ($M = 6.03$, $SD = 5.03$, and $M = 3.81$, $SD = 3.12$). The interaction effect of geographical settings $\times$ age categories was found to be not significant, $F(2,279) = 1.33$, $p = .27$.

Similar findings done on quality of life scores signified no significant main effects of geographical settings, $F(1,279) = 1.90$, $p = .17$, and no significant main effects of age category, $F(2,279) = 1.91$, $p = .15$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .31$, $p = .73$. Activity limitation scores implied no significant main effects of geographical settings, $F(1,279) = .33$, $p = .56$, and no significant main effects of age category, $F(2,279) = 2.66$, $p = .07$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .09$, $p = .91$. Symptom control scores pointed out no significant main effects of geographical settings, $F(1,279) = 2.39$, $p = .12$, no significant main effects of age category, $F(2,279) = 1.94$, $p = .14$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .32$, $p = .73$.

Emotional function scores denoted no significant main effects of geographical settings, $F(1,279) = 1.64$, $p = .20$, no significant main effects of age category, $F(2,279) = 1.15$, $p = .32$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = .52$, $p = .59$. Exposure to environmental stimuli scores yielded significant main effects of geographical settings, $F(1,279) = 3.96$, $p < .05$, with small effect size (partial $\eta^2 = .01$) indicating that in the urban setting, early adults are highly prone to exposure to environmental stimuli ($M = 4.76$, $SD = 1.41$) than middle adults and older adults ($M = 5.26$, $SD = .99$, and $M = 5.18$, $SD = 1.31$). The main effect of age category was found to be not significant, $F(2,279) = 1.12$, $p = .33$. The interaction effect of geographical settings $\times$ age categories was also found to be not significant, $F(2,279) = 1.25$, $p = .29$.

Frequency of asthma symptoms scores represented no significant main effects of geographical settings, $F(1,279) = .01$, $p = .93$. The main effect of age category was found to be significant, $F(2,279) = 7.63$, $p < .01$, with medium effect size (partial $\eta^2 = .05$), indicating that in the urban setting, early adults exhibit more frequency of asthma symptoms ($M = 10.43$, $SD = 9.41$) than middle adults and older adults ($M = 7.56$, $SD = 7.85$, and $M = 8.21$, $SD = 6.94$); in rural setting, early adults exhibit more frequency of asthma symptoms ($M = 13.05$, $SD = 10.02$) than middle adults and older adults ($M = 7.84$, $SD = 8.12$, and $M = 5.62$, $SD = 7.69$). The interaction effect of geographical settings $\times$ age categories was found to be not significant, $F(2,279) = 1.48$, $p = .23$.

Severity of asthma symptoms scores connoted no significant main effects of geographical settings, $F(1,279) = .08$, $p = .78$. The main effect of age category was found to be significant, $F(2,279) = 6.17$, $p < .01$, with medium effect size (partial $\eta^2 = .04$), indicating that in the urban setting, early adults exhibit more severity of asthma symptoms ($M = 6.97$, $SD = 7.38$) than middle adults and older adults ($M = 5.26$, $SD = 7.36$, and $M = 4.00$, $SD = 5.43$); in rural setting, early adults exhibit more severity of asthma symptoms ($M = 7.61$, $SD = 6.97$) than middle adults and older adults ($M = 4.67$, $SD = 6.15$, and $M = 3.16$, $SD = 5.41$). The interaction effect of geographical settings $\times$ age categories was found to be not significant, $F(2,279) = .31$, $p = .73$.

Chapter V

DISCUSSION AND CONCLUSION

In this chapter, discussion of the findings is presented in the light of the research questions, objectives, and hypothesis of the study. Along with important findings and conclusions; limitations, future directions, and implications are also outlined.

The *first objective* was to explore the relationship between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients.

The results confirms a negative relationship between knowledge of asthma symptoms and health outcomes. This suggests that knowledge of asthma symptoms significantly decreased activity limitation and symptom control. This finding broadly supports the work of Yang et al. (2003) which showed that after receiving education about asthma, asthma patients' physical activity was enhanced with reduced symptoms. Moreover, knowledge of asthma interventions showed a significant positive correlation with activity limitation and symptom control. This implies that high knowledge of asthma intervention increased better management of activity limitation and symptom control. This accords with Kotses et al. (1995) indicating that after receiving asthma education as an intervention, asthma patients symptoms declined. Similar study by Van Sickle et al. (2013) reported that asthma patient's symptoms reduced and enhanced activity control after an education program on asthma symptom management.

Accordingly, knowledge of asthma triggers positively correlated with frequency and severity of asthma symptoms signifying that there was likelihood of an increase in asthma symptoms frequency and severity as the triggers can occasionally be beyond the control of the asthma patients. Despite having the knowledge about asthma triggers, there was a probability of increase in asthma symptoms frequency and severity. This study widely supports the work of Yung et al. (2019) that patients with asthma experience a number of

triggers that were likely to increase the frequency and severity of asthma exacerbations. Therefore, it is suggested that awareness of asthma interventions in asthma patients showed lower rates of symptom persistence and activity limitation (Bonner & Carr, 2002). Moreover, this study is consistent with that of Miravittles and Soler-Cataluna (2017) who identified that asthma interventions promote lesser exposure to environmental stimuli as result knowledge about asthma triggers and symptoms enhances quality of life with better health outcomes in asthma patients. These results further supports the idea of Mancuso et al. (2000). However, the results did not reveal any correlation between knowledge of asthma and adherence.

The study reported that activity restriction, symptom management, emotional function, and exposure to environmental stimuli all negatively related to depression as a psychosocial component. Asthma patients with depression have poor activity limitation, poorer symptom control, decreased emotional function, and higher exposure to ambient stimuli. Participants with asthma frequently experience hopelessness and a lack of enthusiasm in life, which limits their ability to engage in social activities and exercise, control their coughing, wheezing, and heavy breathing, and exposes from severely to harmful and exacerbating environments. Patients with asthma often had high levels of frustration and a fear of forgetting or missing to take their medications due to depression and asthmatic condition. However, the findings show a significant positive link between depression and asthma symptoms frequency. We can infer from this that asthmatics who are depressed experience asthma symptoms more frequently. This is in line with that of Mancuso et al. (2000) who found that asthma patients with depression and with asthma symptoms frequency reported lower health-related quality of life. Asthma symptoms frequency is largely dependent on their involuntary and uncontrolled thought process. A study conducted by Sastre et al. (2018) revealed that depression is common in asthma

patients and is linked to more frequent asthma symptoms, increased use of medical resources, and inadequate asthma control.

Activity restriction, symptom control, emotional function, and exposure to environmental stimuli all negatively correlated with anxiety as one of the psychosocial components. This shows that asthma patients with anxiety have reduced activity limitations, which are manifested through a variety of behaviours including withdrawing from everyday activities and not going for a walk or skipping regular exercise. Due to poor symptom control brought on by worry, there will be more discomfort, including shortness of breath and chest heaviness. A higher exposure to environmental stimuli like dust, air pollution, and strong perfumes exaggerate the condition of asthma patients, which was another reason why anxiety was the cause of reduced emotional functioning. Frequent worries about the condition and being afraid of being out of breath also contribute to anxiety.

The findings also show a strong positive connection between anxiety and asthma symptom frequency and severity. This means that when asthma patient feels anxious, their symptoms such as trouble breathing, heavy wheezing, and coughing occur more frequently and are more severe, and often worry patients. The findings of the existing study are in line with the study done by Labor et al. (2017) which found that anxiety creates more frequent and persistent exacerbations with detrimental health outcomes in asthma patients. The study is supported by Stanescu et al. (2019) who found that anxiety and depression significantly diminished quality of life across all domains such as activity limitation, symptom control, emotional function, and exposure to environmental stimuli.

Activity restriction, symptom management, emotional function, and exposure to environmental stimuli are all negatively correlated with stress, which was one of the psychosocial elements that make up human behaviour. This means that activities such as running, climbing stairs, and everyday exercises are restricted for asthma patients who are

under stress, which negatively affects their ability to control their symptoms by aggravating their condition. Higher stress is associated with higher activity limitation and also higher symptom control (Kopel et al., 2017). Due to the worries and frustration brought on by the disease, the stressed-out asthma sufferer lacks emotional equilibrium and was incapable of any emotional state they were experiencing. Thus, chronic stress may increase airway inflammation in response to viral and environmental exposures, resulting in asthma flare-ups (Landeo-Gutierrez et al., 2020). A study by Palumbo et al. (2020) corroborates the idea that persistent stress triggers inflammatory alterations and heighten asthmatic flare-ups. Stress can also put an asthmatic patient in a scenario where they exposed to a lot of environmental irritants, which make their symptoms worse. The findings matches with Bowler (2004) that in asthmatics, stress occurs not as a result of inflammation but also from exposure to environmental stressors like air pollution. Lower the perceived stress better will be the quality of life regarding symptom frequency and severity, daily activities/ limitations and emotional function and also asthma control (Georga et al., 2019). The findings also show a substantial positive link between stress and asthma symptoms frequency and severity, showing that the more stressed one was the more frequently and severely the condition was manifested. Asthma patients frequently experience increased levels of tension and nervousness, which increases asthma symptoms frequency and severity.

Social support and its dimensions appraisal support, belonging support and tangible support were positively related to adherence. Research study by Sloand et al. (2021) reported on adolescents that social support helps in understanding self-management, particularly adherence. Appraisal support had a significant positive relationship with adherence. This revealed that asthma patients with high appraisal support had higher adherence. Asthma patient's appraisal support was high when showed interest to share private worries or fears and getting advice and suggestions from friends for handling

problems as a result of this the adherence to medicine, exercise, and diet increased. Belonging support also had a significant positive relationship with adherence. This shows that if belonging support was high then adherence of asthma patient was also high. Asthma patients with belonging support had a feeling of having someone at their side at any time supported for higher adherence. Tangible support also had a significant positive relationship with adherence. This indicates that if higher tangible support greater was the adherence of asthma patients. Tangible support refers to finding a person, who could help them in their daily chores, or accompanying for a walk which serves the asthma patient in greater adherence.

Social support with all the dimensions such as appraisal support, belonging support and tangible support had a significant positive relationship with asthma symptom frequency and severity. Remarkably, present social support increased wheezing, breathlessness, and coughing exceptionally due to the triggers. Despite having strong social support, asthma patients nevertheless had more frequent and severe asthma symptoms since some triggers cannot be prevented. Margolis et al. (2022) suggested that social support has a direct negative impact on reduced symptom frequency, and severity which is the underlying cause for the poor asthma control and decreased functional mobility.

Self-efficacy had a significant positive relationship with emotional function, asthma symptom frequency and severity. The asthma patients often feel emotionally strong due to the confidence to perform certain tasks. As their confidence increases, they emotionally grow strong. Martin and Mc Neil (2009) explained the link between self-efficacy and emotional stress, both of which have direct negative physiological implications that is on frequency and severity of asthma symptoms. Results also suggested that higher the self-efficacy maximum was the asthma symptoms frequency and severity.

Hence, the first hypotheses that there will be correlation between knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients is partially accepted.

The *second objective* was to assess the role of knowledge of asthma and psychosocial factors in adherence, and health outcomes of asthma patients.

The components of social support like tangible support, appraisal support together, and other variables like knowledge of asthma interventions, knowledge of asthma symptoms, and self-efficacy significantly contributed in predicting adherence.

Asthma patients who received tangible support predicted higher adherence. Tangible support is a direct material aid or another type of concrete help. For example, helping the patient in household chores and taking care of plants or house. Results are consistent with a study done by O'Connor et al. (2019) who found that while managing asthma, tangible support had a stronger influence on treatment adherence than other forms of support, such as emotional support or social network size. Further, appraisal support also predicted adherence in asthma patients. Asthma patients often worry without knowing ways to the condition. When someone is available to provide advice on managing the fears and worries, participants gain assistance during the condition. As appraisal support is offered, participants will be urged to follow their medical regimens for diet, medication and exercise resulting in greater adherence (Helgeson et al., 2018).

Notably, knowledge of asthma interventions and knowledge of asthma symptoms predicted lower adherence. The findings can be corroborated with the study done by Clark et al. (2010). Further, studies show that people who have knowledge about asthma symptoms, typical triggers, and risk factors are more prone to poor asthma management resulting in poor adherence (Eassey et al., 2019).

It can be interpreted that ineffective self-management can be caused due to low health literacy, repeated change of dosage of medicines by physicians, and a lack of patient-centered treatment, would likely to contribute non-adherence in asthma patients. Also high self-efficacy accounted to low adherence in asthma patients. Despite having confidence in preventing discomfort, pain, or emotional distress in day-to-day life activities, asthma patients hardly adhered to purchase medicine, remember to take medication and its right amount of dosage causing poor adherence. Multiple barriers to adherence such as knowledge of asthma, treatment or inability to plan, organize, perform tasks related to asthma control, and treating challenges as problems. This is consistent with the research done by Rhee et al. (2018).

In the present study, activity limitation, symptom control, emotional function, and exposure to environmental stimuli, severity of asthma symptoms, and frequency of asthma symptoms comprises health outcomes. Results indicated that psychosocial factors and knowledge of asthma, significantly predicted health outcomes. For instance, anxiety was found to be significant predictors of activity limitation and exposure to environmental stimuli. Having higher discomfort, shortness of breath, and heaviness in chest contributes to an inability to exercise, and withdrawing from daily activities. Further, anxiety also predicted increased exposure to dust, air pollution, and strong perfumes. Supporting studies indicated that asthma patients typically experience anxiety-related symptoms and problems, which can limit their ability to engage in activities and worsen their health outcomes (McLeish et al., 2019). Evidence from various studies suggests that environmental influences predict development of anxiety through early experiences and characterised by greater tendency to see or process upcoming events as being beyond one's control, which could indicate a psychological vulnerability for anxiety (Chorpita & Barlow, 1998).

Depression accounted for symptom control and emotional function in asthma patients. Due to depressive conditions such as down heartedness, hopelessness significantly contributed to poor symptom control such as chest tightness, shortness of breath, wheezing, coughing, and difficulty in breathing, and also fears of asthma attacks. Similar study by Bitsko et al. (2014) found that patients having depression are associated with poor symptom control with decreased health outcomes. Depressive symptoms can predict poor health outcomes, such as functional impairment, the need for rescue medication, and the frequency of emotional triggers (Weinstein et al., 2019).

Stress predicted severity of asthma symptoms in asthma patients. Asthma patients with high stress over-react to situations, easily agitated, and intolerance indicated breathlessness while exercising and wheezing which are significant symptoms of asthma condition. Several other studies confirm that cytokine production is more when the individual has higher levels of stress and is also associated with increased severity of asthma symptoms having impact on health outcomes (Wright et al., 1998; Vig et al., 2006).

Tangible support and appraisal support were considered as strong predictors of severity of asthma symptoms. Asthma patients who received tangible and appraisal support such as daily chores as well as advice and suggestions in dealing with difficult situations accounted for less severity of asthma symptoms. An effective tangible support and appraisal support encourage adolescents to develop into successful, independent adults, which in turn heighten a sense of personal accountability for controlling one's own severity of asthma symptoms (Sin et al., 2005).

Social support dimensions such as tangible support and belonging support together predicted frequency of asthma symptoms. Asthma patients getting help in daily household tasks as tangible support and having someone by their side whenever they wanted comprises belonging support anticipated lesser frequency of asthma symptoms. Margolis et al. (2022)

summarized that targeted material, such as tangible support and belonging support, has a direct impact on reducing asthma symptom frequency, indicating that it may be used as a resource in the management of asthma.

High self-efficacy estimated less severity of asthma symptoms. Asthma patients showed high confidence in avoiding discomfort, pain, and distress minimised the chronicity of asthma symptoms such as shortness of breath and excessive wheezing. A sense of high self-control in asthma patients indicated better health outcomes. This finding is consistent with Ramsey et al. (2021) who confirms that participants with higher self-efficacy had less severe asthma symptoms such as less pain, less wheezing, and a more relaxed life.

Hence, the second hypotheses stated that the knowledge of asthma, psychosocial factors will play significant role in adherence and health outcomes of asthma patients is accepted.

The **third objective** was to examine the patterns of variations of knowledge of asthma, psychosocial factors, adherence, and health outcomes of asthma patients across geographical settings and age categories.

According to the geographical settings, asthma patients from urban settings had adequate knowledge of asthma when compared to rural asthma patients. Due to the aging factor, results further showed that older asthma patients belonging to urban settings had good knowledge of asthma. This can be interpreted that due to access to health facilities, literacy, socio-economic status, and awareness of health is greater when compared to rural settings. A study done by Yuan et al. (2015) highlights that socio-economic status was closely related to the educational level which in turn affects the knowledge of asthma in urban settings.

Similarly, knowledge of asthma dimensions like knowledge of asthma symptoms and knowledge of asthma triggers was high in urban older adults. It can be noted that knowledge of asthma symptoms such as heavy breathing, coughing, wheezing and knowledge of asthma triggers such as exposure to dust, perfumes, and pollution was found to be higher in urban older asthma patients than rural. A similar study by Yousef et al. (2015) discovered that urban older adults had greater knowledge of asthma symptoms, and triggers when compared to rural asthma patients. However, knowledge of asthma interventions remains same in urban and rural asthma settings. Psychosocial dimensions like depression, anxiety, and stress were found to be similar across urban and rural asthma patients.

Social support was significantly influenced by geographical settings, i.e., urban older adults received higher social support than rural. Several studies corroborate with the findings. Social support was estimated to help improve the mental health and quality of life of the individual who is dealing with it among urban older adults (Kurowska & Blaszcuk, 2013). The knowledge and experience of older adults due to education perceived more social support in urban settings (Lou, 2010). It might occur as a result of higher educations associated interpersonal and communication skills improvement. These abilities enhance the ability to build strong relationships within the family and allow for a more efficient use of the help offered.

Urban asthma patients received greater appraisal support when compared to rural asthma patients. Urban asthma patients getting advices, sharing their fears and worries helped them in receiving greater appraisal support. Findings are in agreement with Chruściel et al. (2018) who reported that appraisal support plays an important role in enhancing self-esteem, handling situations, and improving well-being.

Urban and rural asthma patients received similar belonging support. Older urban adults received greater belonging support than in rural settings. Older adults, who live with children and grandchildren, received higher belonging support, which was associated to overwhelming feeling of connection and encouraging of ties. The results agree with Inoue et al. (2020) who revealed that sense of belonging was enhanced in older adults when individuals believed that they have access to emotional support, which entails the availability of affective assistance such as caring, love, and empathy from others.

Further, urban older asthma patients received greater tangible support than rural counterparts. Urban older adults often receive financial aid as tangible support. They also rely on the help with daily tasks like purchasing food, medication, and arranging for transport as they cannot perform these on their own. The results corroborate with the study done by Nakash et al. (2021) who suggested that urban older adults reported higher levels of perceived tangible support.

Urban older asthma patients had greater self-efficacy than rural counterparts. Urban older asthma patients had belief in themselves that they can perform any task given to them and it shows the confidence in exercising their motivation, actions, and interactions with others. Self-efficacy was greater in urban population due to self-esteem and confidence in oneself to manage the condition (Leonard et al., 2022), which was used as mechanism in self-care of older asthma patients (Turi et al., 2021).

Results further showed significant influence of adherence and health outcomes across urban and rural asthma patients in three different age categories.

Rural early and middle adults showed higher adherence when compared to urban counterparts. Due to many psychological and practical observations, such as early asthma diagnosis, health awareness camps, trust in healthcare professionals, medication adherence,

avoidance of stigma associated with using medication, higher cognitive ability, affordability, and access to therapy was found to indicate higher adherence. The results were in line with the study done by Braido et al. (2016) who found that adherence was higher in rural early asthma patients due to medication adherence and disease awareness.

The health outcomes comprise health related quality of life and its dimensions. In addition, the health outcomes also measured asthma symptom frequency and severity. The results opined that exposure to environmental stimuli significantly influenced urban middle asthma patients. Urban middle asthma patients had higher exposure to allergens both outdoors like exposure to dust, air pollution, and pollen, and indoors like mites, strong perfumes, and pet animal allergens. The study done by Li et al. (2016) corroborates with the results that urban middle asthma patients had greater exposure to dust and air pollution than rural settings.

Rural early adults, experienced high frequency and severity of asthma symptoms. This indicated that being young and living in rural set-up exposed asthma patients to shortness of breath, coughing, and wheezing at higher rate. Early adults experience higher frequency and severity due to lack of knowledge, obesity, smoking, low socioeconomic status, eosinophilia, increased Immunoglobulin E (Ig E), and elevated fractional exhaled nitric oxide (Fe NO) among rural asthma patients (Trivedi & Denton., 2019).

Thus, the third hypothesis stated that the patterns of knowledge of asthma, psychosocial factors, adherence, and health outcomes will vary in asthma patients across geographical settings and age categories is accepted.

Limitations and Future directions

The study done on asthma patients included the adult population, it excluded children. Future research may be aimed at including vast heterogeneous sample suffering

from asthma which will enable to explore the knowledge, psychosocial factors, adherence, and health outcomes such that effective interventions will help to manage the condition effectively. The research design was limited to quantitative research. Qualitative research method could not be considered owing to the severity of asthma conditions of patients. It is recommended that future study may be taken up with a mixed method approach with appropriate interventions. A strong focus was aimed at one particular geographical setting. Therefore the study has an influence of region specific. Future research should aim at including different geographical settings widely. Promote awareness regarding knowledge of asthma in rural settings and the need of adherence in urban settings.

Implications

The results have significant ramifications for the physical and mental well-being of asthma patients. The present study has established the theoretical models - health belief model, social cognitive theory, and theory of reasoned action in the context of asthma patient's adherence and health outcomes. The findings of the study are valid and have potential for future research. The effect of depression on asthma severity and adherence to medical regime would be a good future line of research. Findings suggest health psychological interventions for rural asthma patients. The findings of the study significantly contribute to screening of asthma patients' knowledge, psychosocial factors, adherence, and health outcomes as part of asthma management. Further, findings indicated policy makers towards screening and health psychological interventions in enhancing mobility as new avenues for research and treatment options. The study high-lighted two geographical settings such as urban and rural and three specific age categories such as early, middle, and older asthma patients representing the uniqueness of heterogeneity.

Conclusions

Having knowledge of symptoms, depression, anxiety, and stress are connected to poor health-outcomes. The frequency and severity of asthma symptoms are independent in nature as the findings revealed that knowledge of asthma triggers, depression, anxiety, stress, presence of tangible support, appraisal support, belonging support, and high self-efficacy augmented the frequency and severity of asthma symptoms. The knowledge of asthma does not have any association with adherence. However, greater social support partnered high adherence. Also, high self-efficacy distinctly matched with greater emotional function. Knowledge of asthma symptoms and interventions envisaged adherence. The presence of tangible support, appraisal support, and high self-efficacy prognosticate for higher adherence of asthma patients'. Depression and anxiety anticipated for poor health outcomes. The frequency and severity of asthma does not relay on tangible support, appraisal support, self-efficacy, and stress. Due to the fact that the triggers of asthma are unavoidable and beyond the control of asthma patients. It was confirmed that older asthma patients are aware of knowledge of asthma, and received high social support which in turn enhanced their self-efficacy. Due to the presence of frequency and severity of asthma symptoms, the early and middle age categories of asthma patients in rural settings adhere to exercise and medication.

References

- Adeyeye, O. O., Adewumi, T. A., & Adewuya, A. O. (2017). Effect of psychological and other factors on quality of life amongst asthma outpatients in Lagos, Nigeria. *Respiratory Medicine*, 122, 67–70. <https://doi.org/10.1016/j.rmed.2016.12.002>
- Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Alexander, F. (1950). Psychosomatic medicine, its principles and applications. *Journal of Allergy*, 21(6), 565. [https://doi.org/10.1016/0021-8707\(50\)90111-0](https://doi.org/10.1016/0021-8707(50)90111-0)
- Allen, G. M., Hickie, I., Gandevia, S. C., & McKenzie, D. K. (1994). Impaired voluntary drive to breathe: a possible link between depression and unexplained ventilatory failure in asthmatic patients. *Thorax*, 49(9), 881–884. <https://doi.org/10.1136/thx.49.9.881>
- Alshagga, M. A., Al-Dubai, S. A., Muhamad Faiq, S. S., & Yusuf, A. A. (2011). Use of complementary and alternative medicine among asthmatic patients in primary care clinics in Malaysia. *Annals of Thoracic Medicine*, 6(3), 115–119. <https://doi.org/10.4103/1817-1737.82438>
- American Psychological Association (n.d.-a). *Anxiety*. <https://www.apa.org/topics/anxiety>
- American Psychological Association (n.d.-b). *APA Dictionary of Psychology*. <https://dictionary.apa.org/>
- Apter, A. J., Reisine, S. T., Affleck, G., Barrows, E., & ZuWallack, R. L. (1998). Adherence with twice-daily dosing of inhaled steroids. Socioeconomic and health-belief differences. *American Journal of Respiratory and Critical Care Medicine*, 157(6 Pt 1), 1810–1817. <https://doi.org/10.1164/ajrccm.157.6.9712007>
- Ayala, G. X., Yeatts, K., & Carpenter, D. M. (2009). Brief report: Factors associated with asthma management self-efficacy among 7th and 8th grade students. *Journal of Pediatric Psychology*, 34(8), 862-868. <https://doi.org/10.1093/jpepsy/jsn134>.
- Ayele, A. A., & Tegegn, H. G. (2017). Non adherence to inhalational medications and associated factors among patients with asthma in a referral hospital in Ethiopia, using validated tool TAI. *Asthma Research and Practice*, 3(1). <https://doi.org/10.1186/s40733-017-0035-0>

- Baiardini, I., Sicuro, F., Balbi, F., Canonica, G. W., & Braidò, F. (2015). Psychological aspects in asthma: Do psychological factors affect asthma management?. *Asthma Research and Practice*, 1(1), 1-6. <https://doi.org/10.1186/s40733-015-0007-1>
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioural change. *Psychological Review*, 84(2), 191–215. <https://doi.org/10.1037/0033-295x.84.2.191>
- Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice Hall.
- Barnes, C. B., & Ulrik, C. S. (2015). Asthma and adherence to inhaled corticosteroids: current status and future perspectives. *Respiratory Care*, 60(3), 455–468. <https://doi.org/10.4187/respcare.03200>
- Barnhouse, M. M., & Jones, B. L. (2019). The Impact of Environmental Chronic and Toxic Stress on Asthma. *Clinical Reviews in Allergy & Immunology*, 57(3), 427–438. <https://doi.org/10.1007/s12016-019-08736-x>
- Barros, R., Moreira, A., Fonseca, J., Ferraz de Oliveira, J., Delgado, L., Castel-Branco, M. G., Haahtela, T., Lopes, C., & Moreira, P. (2008). Adherence to the Mediterranean diet and fresh fruit intake are associated with improved asthma control. *Allergy*, 63(7), 917–923. <https://doi.org/10.1111/j.1398-9995.2008.01665.x>
- Bartholomew, L. K., Parcel, G. S., & Kok, G. (1998). Intervention mapping: a process for developing theory and evidence-based health education programs. *Health Education & Behavior*, 25(5), 545-563. <https://doi.org/10.1177/10901981980250>
- Bateman, E. D., Hurd, S. S., Barnes, P. J., Bousquet, J., Drazen, J. M., FitzGerald, M., Gibson, P., Ohta, K., O’Byrne, P., Pedersen, S. E., Pizzichini, E., Sullivan, S. D., Wenzel, S. E., & Zar, H. J. (2008). Global strategy for asthma management and prevention: GINA executive summary. *European Respiratory Journal*, 31(1), 143–178. <https://doi.org/10.1183/09031936.00138707>
- Bitsko, M. J., Everhart, R. S., & Rubin, B. K. (2014). The adolescent with asthma. *Paediatric Respiratory Reviews*, 15(2), 146–153. <https://doi.org/10.1016/j.prrv.2013.07.003>

- Blake, K. V. (2017). Improving adherence to asthma medications. *Current Opinion in Pulmonary Medicine*, 23(1), 62–70.
<https://doi.org/10.1097/mcp.0000000000000334>
- Bodenheimer, T. (2002). Patient Self-management of Chronic Disease in Primary Care. *JAMA*, 288(19), 2469. <https://doi.org/10.1001/jama.288.19.2469>
- Bolman, C., Arwert, T. G., & Völlink, T. (2011). Adherence to prophylactic asthma medication: Habit strength and cognitions. *Heart & Lung*, 40(1), 63-75.
<https://doi.org/10.1016/j.hrtlng.2010.02.003>.
- Bonner, C. J., & Carr, B. (2002). Medication compliance problems in general practice: Detection and intervention by pharmacists and doctors. *The Australian Journal of Rural Health*, 10(1), 33–38. <https://doi.org/10.1046/j.1440-1584.2002.00406.x>
- Bourdin, A., Halimi, L., Vachier, I., Paganin, F., Lamouroux, A., Gouitaa, M., Vairon, E., Godard, P., & Chanez, P. (2012). Adherence in severe asthma. *Clinical & Experimental Allergy*, 42(11), 1566–1574. <https://doi.org/10.1111/j.1365-2222.2012.04018.x>
- Bowler, R. P. (2004). Oxidative stress in the pathogenesis of asthma. *Current Allergy and Asthma Reports*, 4(2), 116–122. <https://doi.org/10.1007/s11882-004-0056-7>
- Braido, F., Brusselle, G., Guastalla, D., Ingrassia, E., Nicolini, G., Price, D., Roche, N., Soriano, J. B., & Worth, H. (2016). Determinants and impact of suboptimal asthma control in Europe: The international cross-sectional and longitudinal assessment on asthma control (LIAISON) study. *Respiratory Research*, 17(1).
<https://doi.org/10.1186/s12931-016-0374-z>
- Braman, S. S. (2006). The global burden of asthma. *Chest*, 130(1 Suppl), 4S–12S.
https://doi.org/10.1378/chest.130.1_suppl.4S
- Buszko, K., Obońska, K., Michalski, P., Kosobucka, A., Jurek, A., Wawrzyniak, M., Stolarek, W., Pietrzykowski, Ł., Andruszkiewicz, A., & Kubica, A. (2016). The Adherence Scale in Chronic Diseases (ASCD). The power of knowledge: the key to successful patient — health care provider cooperation. *Medical Research Journal*, 1(1), 37–42. <https://doi.org/10.5603/mrj.2016.0006>
- Campbell, T. S., Lavoie, K. L., Bacon, S. L., Scharf, D., Aboussafy, D., & Ditto, B. (2006). Asthma self-efficacy, high frequency heart rate variability, and airflow

- obstruction during negative affect in daily life. *International Journal of Psychophysiology*, 62(1), 109-114. <https://doi.org/10.1016/j.ijpsycho.2006.02.005>
- Centers for Disease Control and Prevention. (2000). Blood lead levels in young children--United States and selected states, 1996-1999. *MMWR. Morbidity and Mortality Weekly Report*, 49(50), 1133-1137.
<https://www.cdc.gov/resultmmwr/preview/mmwrhtml/mm4950a3.htm>
- Centers for Disease Control and Prevention. (2020). Outbreak of lung injury associated with the use of e-cigarette, or vaping, products. Retrieved from https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html
- Chafle, H. (2021, May 4). World Asthma Day: Keep stress & anxiety at bay. Strong emotions can trigger an attack. *The Economic Times. Panache*.
<https://economictimes.indiatimes.com/magazines/panache/world-asthma-day-keep-stress-anxiety-at-bay-strong-emotions-can-trigger-an-attack/articleshow/82382991.cms?from=mdr>
- Chatkin, J., Correa, L., & Santos, U. (2021). External environmental pollution as a risk factor for asthma. *Clinical Reviews in Allergy & Immunology*, 62, 72-89.
<https://doi.org/10.1007/s12016-020-08830-5>
- Chen, E., & Miller, G. E. (2007). Stress and inflammation in exacerbations of asthma. *Brain, Behaviour, and Immunity*, 21(8), 993-999.
<https://doi.org/10.1016/j.bbi.2007.03.009>
- Chen, S. Y., Sheu, S., Chang, C. S., Wang, T. H., & Huang, M. S. (2010). The Effects of the self-efficacy method on adult asthmatic patient self-care behaviour. *Journal of Nursing Research*, 18(4), 266-274. <https://doi.org/10.1097/nrj.0b013e3181f33f>
- Chin, J., Morrow, D. G., Stine-Morrow, E. A., Conner-Garcia, T., Graumlich, J. F., & Murray, M. D. (2011). The process-knowledge model of health literacy: evidence from a componential analysis of two commonly used measures. *Journal of Health Communication*, 16(3), 222-241. <https://doi.org/10.1080/10810730.2011.604702>
- Chlebowy, D. O., & Garvin, B. J. (2006). Social support, self-efficacy, and outcome expectations. *The Diabetes Educator*, 32(5), 777-786.
<https://doi.org/10.1177/0145721706291760>

- Choi, Y. J., Park, Y. S., Kim, N., Kim, Y. S., Lee, S. M., Lee, D. H., & Jung, H. C. (2017). Gender differences in ghrelin, nociception genes, psychological factors and quality of life in functional dyspepsia. *World Journal of Gastroenterology*, 23(45), 8053–8061. <https://doi.org/10.3748/wjg.v23.i45.8053>
- Chorpita, B. F., & Barlow, D. H. (1998). The development of anxiety: the role of control in the early environment. *Psychological Bulletin*, 124(1), 3–21. <https://doi.org/10.1037/0033-2909.124.1.3>
- Chruściel, P., Kulik, T., Jakubowska, K., & Nalepa, D. (2018). Differences in the perception of social support among rural area seniors-A cross-sectional survey of polish population. *International Journal of Environmental Research and Public Health*, 15(6), 1288. <https://doi.org/10.3390/ijerph15061288>
- Clark, N. M., Shah, S., Dodge, J. A., Thomas, L. J., Andridge, R. R., & Little, R. J. (2010). An evaluation of asthma interventions for preteen students. *The Journal of School Health*, 80(2), 80–87. <https://doi.org/10.1111/j.1746-1561.2009.00469.x>
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203771587>
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310–357. <https://doi.org/10.1037/0033-2909.98.2.310>
- Cohen, S., Doyle, W. J., Skoner, D. P., Rabin, B. S., & Gwaltney, J. M. (1997). Social ties and susceptibility to the common cold. *JAMA*, 277(24), 1940–1944
- Cohen, S., Mermelstein, R., Kamarck, T., & Hoberman, H. M. (1985). Measuring the functional components of social support. *Social Support: Theory, Research and Applications*, 73–94. https://doi.org/10.1007/978-94-009-5115-0_5
- Cohen, S., Tyrrell, D. A., & Smith, A. P. (1991). Psychological stress and susceptibility to the common cold. *The New England Journal of Medicine*, 325(9), 606–612. <https://doi.org/10.1056/NEJM199108293250903>
- Coupey, S (1998). *Chronic illness* (M.M. Fisher, S. K. Schonberg, & E. M. Alderman, Eds.). Mosby.

- Cui, W., Zack, M. M., & Zahran, H. S. (2015). Health-related quality of life and asthma among united states adolescents. *The Journal of Pediatrics*, 166(2), 358–364. <https://doi.org/10.1016/j.jpeds.2014.10.005>
- De Albornoz, S. C., & Chen, G. (2021). Relationship between health-related quality of life and subjective wellbeing in asthma. *Journal of Psychosomatic Research*, 142, 110356. <https://doi.org/10.1016/j.jpsychores.2021.110356>
- de Miguel Díez, J., Barrera, V. H., Maestu, L. P., Garrido, P. C., García, T. G., & García, R. J. (2011). Psychiatric comorbidity in asthma patients: Associated factors. *Journal of Asthma*, 48(3), 253–258. <https://doi.org/10.3109/02770903.2011.554943>
- Del Giacco, S. R., Cappai, A., Gambula, L., Cabras, S., Perra, S., Manconi, P. E., Carpiello, B., & Pinna, F. (2016). The asthma-anxiety connection. *Respiratory Medicine*, 120, 44–53. <https://doi.org/10.1016/j.rmed.2016.09.014>
- Desalu, O. O., Adeoti, A. O., Ojuawo, O. B., Aladesanmi, A. O., Oguntoye, M. S., Afolayan, O. J., Bojuwoye, M., & Fawibe, A. E. (2021). Urban–rural differences in the epidemiology of asthma and allergies in Nigeria: A population-based study. *Journal of Asthma and Allergy*, 14, 1389–1397. <https://doi.org/10.2147/jaa.s333133>
- Dima, A. L., Hernandez, G., Cunillera, O., Ferrer, M., & De Bruin, M. (2015). Asthma inhaler adherence determinants in adults: Systematic review of observational data. *The European Respiratory Journal*, 45(4), 994–1018. <https://doi.org/10.1183/09031936.00172114>
- Divo, M., Martinez, C. a. R., & Mannino, D. M. (2014). Ageing and the epidemiology of multimorbidity. *The European Respiratory Journal*, 44(4), 1055–1068. <https://doi.org/10.1183/09031936.00059814>
- Dudeney, J., Sharpe, L., Jaffe, A., Jones, E. B., & Hunt, C. (2017). Anxiety in youth with asthma: A meta-analysis. *Pediatric Pulmonology*, 52(9), 1121–1129. <https://doi.org/10.1002/ppul.23689>
- Dunn, R. J. K., Busse, P. J., & Wechsler, M. E. (2018). Asthma in the elderly and late-onset adult asthma. *Allergy*, 73(2), 284–294. <https://doi.org/10.1111/all.13258>

- Eassey, D., Reddel, H. K., Foster, J. M., Kirkpatrick, S., Locock, L., Ryan, K., & Smith, L. (2019). "...I've said I wish I was dead, you'd be better off without me": A systematic review of people's experiences of living with severe asthma. *The Journal of Asthma*, 56(3), 311–322.
<https://doi.org/10.1080/02770903.2018.1452034>
- Eckman, M. H., Wise, R. E., Leonard, A. C., Dixon, E., Burrows, C., Khan, F., & Warm, E. J. (2012). Impact of health literacy on outcomes and effectiveness of an educational intervention in patients with chronic diseases. *Patient Education and Counseling*, 87(2), 143–151. <https://doi.org/10.1016/j.pec.2011.07.020>
- Ejebe, I. H., Jacobs, E. A., & Wisk, L. E. (2015). Persistent differences in asthma self-efficacy by race, ethnicity, and income in adults with asthma. *Journal of Asthma*, 52(1), 105–113. <https://doi.org/10.3109/02770903.2014.947429>
- Engelkes, M., Janssens, H. M., de Jongste, J. C., Sturkenboom, M. C., & Verhamme, K. M. (2015). Medication adherence and the risk of severe asthma exacerbations: a systematic review. *European Respiratory Journal*, 45(2), 396–407.
<https://doi.org/10.1183/09031936.00075614>
- Feldman, J. M., Becker, J., Arora, A., DeLeon, J., Torres-Hernandez, T., Greenfield, N., Wiviott, A., Jariwala, S., Shim, C., Federman, A. D., & Wisnivesky, J. P. (2021). Depressive symptoms and overperception of airflow obstruction in older adults with asthma. *Psychosomatic Medicine*, 83(7), 787–794.
<https://doi.org/10.1097/psy.0000000000000951>
- Frieri, M., O'Connor, M., & Nassef, M. (2015). Asthma, stress, and depression in women. *Allergy and Asthma Proceedings*, 36(4), 256–261.
<https://doi.org/10.2500/aap.2015.36.3847>
- Gamble, J., Stevenson, M., & Heaney, L. G. (2011). A study of a multi-level intervention to improve non-adherence in difficult to control asthma. *Respiratory Medicine*, 105(9), 1308–1315. <https://doi.org/10.1016/j.rmed.2011.03.019>
- Georga, G., Chrousos, G., Artemiadis, A., Panagiotis, P. P., Bakakos, P., & Darviri, C. (2019). The effect of stress management incorporating progressive muscle relaxation and biofeedback-assisted relaxation breathing on patients with asthma: A randomised controlled trial. *Advances in Integrative Medicine*, 6(2), 73–77.
<https://doi.org/10.1016/j.aimed.2018.09.001>

- George, M., & Bender, B. G. (2019). New insights to improve treatment adherence in asthma and COPD. *Patient Preference and Adherence, Volume 13*, 1325–1334. <https://doi.org/10.2147/ppa.s209532>
- Gheorghiade, M., & Zannad, F. (2005). Modern management of acute heart failure syndromes. *European Heart Journal Supplements*, 7(suppl_B), B3-B7. <https://doi.org/10.1093/eurheartj/sui006>
- Gibson, P. G., Henry, R. L., Vimpani, G. V., & Halliday, J. (1995). Asthma knowledge, attitudes, and quality of life in adolescents. *Archives of Disease in Childhood*, 73(4), 321-326. <http://dx.doi.org/10.1136/adc.73.4.321>
- Gibson, P. G., Powell, H., Wilson, A., Hensley, M. J., Abramson, M. J., Bauman, A., Walters, E. H., & Roberts, J. J. L. (2002). Limited (information only) patient education programs for adults with asthma. *The Cochrane Database of Systematic Reviews*, 2002(1), CD001005. <https://doi.org/10.1002/14651858.CD001005>
- Gillisen, A. (2007). Patients' adherence in asthma. *Journal of Physiology and Pharmacology*, 58(5), 205–222.
- Global Asthma Network. (2014). *Global Asthma Report 2014*. http://globalasthmareport.org/2014/Global_Asthma_Report_2014.pdf
- Global Initiative for Asthma. (2001). *Global Strategy for Asthma Management and Prevention*, Bethesda, MD: NIH NHLBI. <http://www.ginasthma.org/>
- González-Conde, V., Pérez-Fernández, V., Ruiz-Esteban, C., & Valverde-Molina, J. (2019). Impact of self-efficacy on the quality of life of children with asthma and their caregivers. *Archivos De Bronconeumologia*, 55(4), 189–194. <https://doi.org/10.1016/j.arbres.2018.07.008>
- Graff, S., Bricmont, N., Moermans, C., Henket, M., Paulus, V., Guissard, F., Louis, R., & Schleich, F. (2020). Clinical and biological factors associated with irreversible airway obstruction in adult asthma. *Respiratory Medicine*, 175, 106202. <https://doi.org/10.1016/j.rmed.2020.106202>
- Grayson, C. J., & O'dell, C. (1998). *If only we knew what we know: The transfer of internal knowledge and best practice*. Simon and Schuster.
- Greenfield, N., Becker, J., Jariwala, S., Wisnivesky, J., Federman, A., & Feldman, J. M. (2023). The relationship between social support, self-efficacy, and asthma

- outcomes in older adults. *Journal of Asthma*, 1–9.
<https://doi.org/10.1080/02770903.2023.2196560>
- Grosso, A., Pesce, G., Marcon, A., Piloni, D., Albicini, F., Gini, E., Marchetti, P., Battaglia, S., Ferrari, M., Fois, A., Piccioni, P., Antonicelli, L., Verlato, G., & Corsico, A. G. (2019). Depression is associated with poor control of symptoms in asthma and rhinitis: A population-based study. *Respiratory Medicine*, 155, 6–12.
<https://doi.org/10.1016/j.rmed.2019.06.025>
- Guilleminault, L., Williams, E., Scott, H., Berthon, B., Jensen, M., & Wood, L. (2017). Diet and asthma: Is it time to adapt our message? *Nutrients*, 9(11), 1227.
<https://doi.org/10.3390/nu9111227>
- Hassan, M., Davies, S. W., Trethewey, S. P., & Mansur, A. H. (2020). Prevalence and predictors of adherence to controller therapy in adult patients with severe/difficult-to-treat asthma: A systematic review and meta-analysis. *Journal of Asthma*, 57(12), 1379–1388. <https://doi.org/10.1080/02770903.2019.1645169>
- Haynes, R. B., Taylor, D. W., & Sackett, D. L. (1979). *Compliance in health care*. Johns Hopkins University Press.
- Helgeson, V. S., Jakubiak, B. K., Van Vleet, M., & Zajdel, M. (2018). Communal coping and adjustment to chronic illness: Theory update and evidence. *Personality and Social Psychology Review*, 22(2), 170–195.
<https://doi.org/10.1177/1088868317735767>
- Heydari, H., Dolatshahi, B., Mahdavian, A., & Eslaminejad, A. (2015). Asthma control on the basis of perceived stress, locus of control, and self-efficacy in patients with adult asthma. *Practice in Clinical Psychology*, 3(2), 137–143.
<http://jpcp.uswr.ac.ir/article-1-261-en.html>
- Hirsch, B. J. (1981). Social networks and the coping process: Creating personal communities. In B. Gottlieb (Ed.). *Social networks and social support*. Sage Publications.
- Ho, J., Bender, B. G., Gavin, L. A., O'Connor, S. L., Wamboldt, M. Z., & Wamboldt, F. S. (2003). Relations among asthma knowledge, treatment adherence, and outcome. *The Journal of Allergy and Clinical Immunology*, 111(3), 498–502.
<https://doi.org/10.1067/mai.2003.160>

- House, J. S. (1981). *Work stress and social support*. Addison-Wesley Publishing Company.
- Hutchins, D. S., Zeber, J. E., Roberts, C. S., Williams, A. F., Manias, E., & Peterson, A. M. (2015). Initial medication adherence—review and recommendations for good practices in outcomes research: An ISPOR medication adherence and persistence special interest group report. *Value in Health*, 18(5), 690–699.
<https://doi.org/10.1016/j.jval.2015.02.015>
- Inoue, Y., Wann, D. L., Lock, D., Sato, M., Moore, C., & Funk, D. C. (2020). Enhancing older adults' sense of belonging and subjective well-being through sport game attendance, team identification, and emotional support. *Journal of Aging and Health*, 32(7-8), 530-542. <https://doi.org/10.1177/0898264319835654>
- Institute for Health Metrics and Evaluation (2019). *Global burden of disease study*.
<https://vizhub.healthdata.org/gbd-results>
- Iversen, M. D., Daltroy, L. H., Fossel, A. H., & Katz, J. N. (1998). The prognostic importance of patient pre-operative expectations of surgery for lumbar spinal stenosis. *Patient Education and Counseling*, 34(2), 169–178.
[https://doi.org/10.1016/s0738-3991\(97\)00109-2](https://doi.org/10.1016/s0738-3991(97)00109-2)
- Jones, C. K., Santanello, N. C., Boccuzzi, S. J., Wogen, J., Strub, P., & Nelsen, L. M. (2003). Adherence to prescribed treatment for asthma: Evidence from pharmacy benefits data. *Journal of Asthma*, 40(1), 93–101. <https://doi.org/10.1081/jas-120017212>
- Juniper, E. F., Guyatt, G. H., Epstein, R. S., Ferrie, P. J., Jaeschke, R., & Hiller, T. K. (1992). Evaluation of impairment of health-related quality of life in asthma: Development of a questionnaire for use in clinical trials. *Thorax*, 47(2), 76–83.
<https://doi.org/10.1136/thx.47.2.76>
- Kannan, J., Bernstein, D., Bernstein, C., Ryan, P., Bernstein, J., Villareal, M., Smith, A., Lenz, P., & Epstein, T. (2015). Significant predictors of poor quality of life in older asthmatics. *Annals Allergy Asthma Immunology*, 115 (3), 198-204.
<https://doi.org/10.1016/j.anai.2015.06.021>
- Kaplan, A., Hardjojo, A., Yu, S., & Price, D. (2019). Asthma Across Age: Insights From Primary Care. *Frontiers in Pediatrics*, 7, 162.
<https://doi.org/10.3389/fped.2019.00162>

- Kaplan, A., Szeffler, S. J., & Halpin, D. M. (2020). Impact of comorbid conditions on asthmatic adults and children. *NPJ Primary Care Respiratory Medicine*, 30(1), 36. <https://doi.org/10.1038/s41533-020-00194-9>.
- Katon, W. J., Richardson, L., Lozano, P., & McCauley, E. (2004). The relationship of asthma and anxiety disorders. *Psychosomatic Medicine*, 66(3), 349–355. <https://doi.org/10.1097/00006842-200405000-00010>
- Kirshner, M. (2003). Preliminary exploration of online social support among adults with asthma. In *AMIA Annual Symposium Proceedings* (Vol. 2003, p. 895). American Medical Informatics Association.
- Kopel, L. S., Petty, C. R., Gaffin, J. M., Sheehan, W. J., Baxi, S. N., Kanchongkittiphon, W., Fu, C., Gold, D. R., & Phipatanakul, W. (2017). Caregiver stress among inner-city school children with asthma. *The Journal of Allergy and Clinical Immunology: In Practice*, 5(4), 1132–1134.e3. <https://doi.org/10.1016/j.jaip.2017.02.026>
- Koper, I., Hufnagl, K., & Ehmann, R. (2017). Gender aspects and influence of hormones on bronchial asthma – secondary publication and update. *World Allergy Organization Journal*, 10, 46. <https://doi.org/10.1186/s40413-017-0177-9>
- Kosobucka, A., Michalski, P., Pietrzykowski, Ł., Kasprzak, M., Obońska, K., Fabiszak, T., Felsmann, M., & Kubica, A. (2018). Adherence to treatment assessed with the adherence in chronic diseases scale in patients after myocardial infarction. *Patient Preference and Adherence*, 12, 333–340. <https://doi.org/10.2147/PPA.S150435>
- Kotses, H., Bernstein, I., Bernstein, D. I., Reynolds, R. V., Korbee, L., Wigal, J. K., Ganson, E., Stout, C., & Creer, T. L. (1995). A self-management program for adult asthma. Part I: Development and evaluation. *Journal of Allergy and Clinical Immunology*, 95(2), 529–540. [https://doi.org/10.1016/S0091-6749\(95\)70315-2](https://doi.org/10.1016/S0091-6749(95)70315-2)
- Krauskopf, K., Sofianou, A., Goel, M. S., Wolf, M. S., Wilson, E., Martynenko, M., Halm, E. A., Leventhal, H., Feldman, J. M., Federman, A. D., & Wisnivesky, J. P. (2013). Depressive symptoms, low adherence, and poor asthma outcomes in the elderly. *Journal of Asthma*, 50(3), 260–266. <https://doi.org/10.3109/02770903.2012.757779>
- Krigsman, K., Nilsson, J. L. G., & Ring, L. (2007). Refill adherence for patients with asthma and COPD: Comparison of a pharmacy record database with manually

- collected repeat prescriptions. *Pharmacoepidemiology and Drug Safety*, 16(4), 441–448. <https://doi.org/10.1002/pds.1321>
- Krishnan, J. A., Lemanske, R. F., Canino, G., Elward, K. S., Kattan, M., Matsui, E. C., Mitchell, H., Sutherland, E. R., & Minnicozzi, M. (2012). Asthma outcomes: Asthma Symptoms. *The Journal of Allergy and Clinical Immunology*, 129(3), S124–S135. <https://doi.org/10.1016/j.jaci.2011.12.981>
- Kullowatz, A., Kanniess, F., Dahme, B., Magnussen, H., & Ritz, T. (2007). Association of depression and anxiety with health care use and quality of life in asthma patients. *Respiratory Medicine*, 101(3), 638–644. <https://doi.org/10.1016/j.rmed.2006.06.002>
- Kumar, P. P., & Ram, U. (2017). Patterns, factors associated and morbidity burden of asthma in India. *PLoS ONE*, 12(10), e0185938. <https://doi.org/10.1371/journal.pone.0185938>
- Kurowska, K., & Blaszczyk, W. (2013). The impact of support on the quality of life of the residents of a nursing home. *Psychogeriatrics Polska*, 10(1), 33–40.
- Labor, M., Labor, S., Jurić, I., Fijačko, V., Popović Grle, S., & Plavec, D. (2017). Long-term predictors of anxiety and depression in adult patients with asthma. *Wiener Klinische Wochenschrift*, 129(19–20), 665–673. <https://doi.org/10.1007/s00508-017-1203-1>
- Landeo-Gutierrez, J., & Celedón, J. C. (2020). Chronic stress and asthma in adolescents. *Annals of Allergy, Asthma & Immunology*, 125(4), 393–398. <https://doi.org/10.1016/j.anai.2020.07.001>
- Landeo-Gutierrez, J., Forno, E., Miller, G. E., & Celedón, J. C. (2020). Exposure to violence, psychosocial stress, and asthma. *American Journal of Respiratory and Critical Care Medicine*, 201(8), 917–922. <https://doi.org/10.1164/rccm.201905-1073pp>
- Landrigan, P. J., Fuller, R. A., Acosta, N. J. R., Adeyi, O., Arnold, R. M., Basu, N., Baldé, A. B., Bertollini, R., Bose-O'Reilly, S., Boufford, J. I., Breysse, P. N., Chiles, T. C., Mahidol, C., Coll-Seck, A. M., Cropper, M. L., Fobil, J. N., Fuster, V., Greenstone, M., Haines, A., . . . Zhong, M. (2017). The Lancet Commission on pollution and health. *The Lancet*, 391(10119), 462–512. [https://doi.org/10.1016/s0140-6736\(17\)32345-0](https://doi.org/10.1016/s0140-6736(17)32345-0)

- Lavoie, K. L., Bouchard, A., Joseph, M., Campbell, T. S., Favreau, H., & Bacon, S. L. (2008). Association of asthma self-efficacy to asthma control and quality of life. *Annals of Behavioral Medicine*, 36(1), 100–106. <https://doi.org/10.1007/s12160-008-9053-8>
- Lee, A. M., & Leung, S. S. K. (2014). Health Outcomes. In *Springer eBooks* (pp. 2730–2735). https://doi.org/10.1007/978-94-007-0753-5_1251
- Lee, S. W., Yon, D. K., James, C. C., Lee, S., Koh, H. Y., Sheen, Y. H., Oh, J. W., Han, M. Y., & Sugihara, G. (2019). Short-term effects of multiple outdoor environmental factors on risk of asthma exacerbations: Age-stratified time-series analysis. *The Journal of Allergy and Clinical Immunology*, 144(6), 1542–1550. <https://doi.org/10.1016/j.jaci.2019.08.037>
- Leonard, S. I., Turi, E. R., Céspedes, A., Liu, J., Powell, J. S., & Bruzzese, J.-M. (2022). Asthma knowledge, self-efficacy, and self-management among rural adolescents with poorly controlled asthma. *The Journal of School Nursing*, 105984052211160. <https://doi.org/10.1177/10598405221116017>
- Li, F., Li, F., Huang, D., Yang, J., Song, Y., & Zeng, G. (2016). Heavy metals in road dust from Xiandao District, Changsha City, China: characteristics, health risk assessment, and integrated source identification. *Environmental Science and Pollution Research*, 23(13), 13100–13113. <https://doi.org/10.1007/s11356-016-6458-y>
- Licari, A., Ciprandi, R., Marseglia, G., & Ciprandi, G. (2019). Anxiety/depression changes are associated with improved asthma control perception in asthmatic adolescents after adequate management. *European Annals of Allergy and Clinical Immunology*, 51(04), 190. <https://doi.org/10.23822/eurannaci.1764-1489.97>
- Lind, N., Nordin, M., Palmquist, E., & Nordin, S. (2013). Psychological distress in asthma and allergy: The västerbotten environmental health study. *Psychology, Health & Medicine*, 19(3), 316–323. <https://doi.org/10.1080/13548506.2013.806814>
- Lind, N., Nordin, M., Palmquist, E., Claeson, A. S., Millqvist, E., & Nordin, S. (2015). Coping and social support in asthma and allergy: The västerbotten environmental health study. *Journal of Asthma*, 52(6), 622–629. <https://doi.org/10.3109/02770903.2014.991970>

- Loerbroks, A., Apfelbacher, C. J., Bosch, J. A., & Stürmer, T. (2010). Depressive symptoms, social support, and risk of adult asthma in a population-based cohort Study. *Psychosomatic Medicine*, 72(3), 309–315.
<https://doi.org/10.1097/PSY.0b013e3181d2f0f1>
- Lorig, K. R., Sobel, D. S., Ritter, P. L., Laurent, D., & Hobbs, M. (2001). Effect of a self-management program on patients with chronic disease. *Effective Clinical Practice: ECP*, 4(6), 256–262.
- Lou, V. W. Q. (2010). Life satisfaction of older adults in Hong Kong: The role of social support from grandchildren. *Social Indicators Research*, 95(3), 377–391.
<https://doi.org/10.1007/s11205-009-9526-6>
- Lovibond, S.H., & Lovibond, P.F. (1995). *Manual for the Depression Anxiety Stress Scales*. Sydney: Psychology Foundation.
- Lozier, M. J., Zahran, H. S., & Bailey, C. M. (2019). Assessing health outcomes, quality of life, and healthcare use among school-age children with asthma. *The Journal of Asthma*, 56(1), 42–49. <https://doi.org/10.1080/02770903.2018.1426767>
- Lu, Z., Chen, L., Xu, S., Bao, Q., Ma, Y., Guo, L., Zhang, S., Huang, X., Cao, C., & Ruan, L. (2018). Allergic disorders and risk of depression: A systematic review and meta-analysis of 51 large-scale studies. *Annals of Allergy, Asthma & Immunology*, 120(3), 310–317.e2. <https://doi.org/10.1016/j.anai.2017.12.011>
- Lupone, B. (2013). American Academy of Allergy, Asthma & Immunology (AAAAI)—2013 Annual Meeting, San Antonio, Texas, USA - February 22–26, 2013. *Drugs of the Future*, 38(3), 205. <https://doi.org/10.1358/dof.2013.38.3.1955365>
- Magid, D. J., Houry, D. E., Ellis, J. L., Lyons, E. E., & Rumsfeld, J. S. (2004). Health-related quality of life predicts emergency department utilization for patients with asthma. *Annals of Emergency Medicine*, 43(5), 551–557.
<https://doi.org/10.1016/j.annemergmed.2003.11.021>
- Mäkinen, S., Suominen, T., & Lauri, S. (1999). What asthma patients know about their illness and its treatment. *Clinical Nurse Specialist*, 13(6), 277–282.
<https://doi.org/10.1097/00002800-199911000-00009>

- Mammen, J., & Rhee, H. (2012). Adolescent asthma self-management: A concept analysis and operational definition. *Pediatric Allergy, Immunology, and Pulmonology*, 25(4), 180–189. <https://doi.org/10.1089/ped.2012.0150>
- Mancuso, C. A., Peterson, M. G., & Charlson, M. E. (2000). Effects of depressive symptoms on health-related quality of life in asthma patients. *Journal of General Internal Medicine*, 15(5), 301–310. <https://doi.org/10.1046/j.1525-1497.2000.07006.x>
- Mancuso, C. A., Rincon, M., McCulloch, C. E., & Charlson, M. E. (2001). Self-efficacy, depressive symptoms, and patients' expectations predict outcomes in asthma. *Medical Care*, 39(12), 1326–1338. <https://doi.org/10.1097/00005650-200112000-00008>
- Mancuso, C. A., Sayles, W., & Allegrante, J. P. (2010). Knowledge, attitude, and self-efficacy in asthma self-management and quality of life. *Journal of Asthma*, 47(8), 883–888. <https://doi.org/10.3109/02770903.2010.492540>
- Margolis, R. H. F., Dababnah, S., Sacco, P., Jones-Harden, B., Bollinger, M. E., Butz, A., & Bellin, M. H. (2022). The effects of caregiver social support and depressive symptoms on child medication adherence and asthma control. *Journal of Racial and Ethnic Health Disparities*, 9(4), 1234–1242. <https://doi.org/10.1007/s40615-021-01065-w>
- Martin, M. A., Catrambone, C. D., Kee, R. A., Evans, A. T., Sharp, L. K., Lyttle, C., Rucker-Whitaker, C., Weiss, K. B., Shannon, J. J., & Chicago Initiative to Raise Asthma Health Equity Investigative Team (2009). Improving asthma self-efficacy: developing and testing a pilot community-based asthma intervention for African American adults. *The Journal of Allergy and Clinical Immunology*, 123(1), 153–159.e3. <https://doi.org/10.1016/j.jaci.2008.10.057>
- Martins, R. K., & McNeil, D. W. (2009). Review of motivational interviewing in promoting health behaviours. *Clinical Psychology Review*, 29(4), 283–293. <https://doi.org/10.1016/j.cpr.2009.02.001>
- Matza, L. S., Swensen, A. R., Flood, E. M., Secnik, K., & Leidy, N. K. (2004). Assessment of health-related quality of life in children: A review of conceptual, methodological, and regulatory issues. *Value in Health*, 7(1), 79–92. <https://doi.org/10.1111/j.1524-4733.2004.71273.x>

- McDonald, V. M., Hiles, S. A., Jones, K., Clark, V., & Yorke, J. (2018). Health-related quality of life burden in severe asthma. *The Medical Journal of Australia*, 209(S2). <https://doi.org/10.5694/mja18.00207>
- McLeish, A. C., Kraemer, K. M., & O'Bryan, E. M. (2019). Discomfort intolerance in relation to asthma outcomes. *Cognitive Therapy and Research*, 43(1), 24-31. <https://doi.org/10.1007/s10608-018-9965-y>
- Metting, E., van der Molen, T., & Kocks, J. (2016). Loneliness and lack of social support severely influences patients' quality of life. Secondary findings from our focus group study in asthma and COPD patients. *European Respiratory Journal*, 48(60). <https://doi.org/10.1183/13993003.congress-2016.pa729>
- Miller, G. E., Chen, E., & Zhou, E. S. (2007). If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. *Psychological Bulletin*, 133(1), 25–45. <https://doi.org/10.1037/0033-2909.133.1.25>
- Miravitlles, M., & Soler-Cataluña, J. J. (2017). GOLD in 2017: A view from the spanish COPD guidelines (GesCOPD). *Archivos de Bronconeumología (English Edition)*, 53(3), 89–90. <https://doi.org/10.1016/j.arbr.2017.01.015>
- Mohajjel Aghdam, A., Hasankhani, H., Gharemoammadlu, R., & Esmaeily, M. (2013). Relation of patients self-efficacy with control of asthma symptoms. *Journal of Gorgan University of Medical Sciences*, 15(2), 70–76. <http://goums.ac.ir/journal/article-1-1722-en.html>
- Murphy, A. C., Proeschal, A., Brightling, C. E., Wardlaw, A. J., Pavord, I., Bradding, P., & Green, R. H. (2012). The relationship between clinical outcomes and medication adherence in difficult-to-control asthma. *Thorax*, 67(8), 751–753. <https://doi.org/10.1136/thoraxjnl-2011-201096>
- Nakash, M., & Bouhnik, D. (2021). Should knowledge management in organizations be rebranded?. *VINE Journal of Information and Knowledge Management Systems*. <https://doi.org/10.1108/vjikms-09-2021-0193>
- Nguyen, V. P., Huynh, T. T. H., & Chavannes, N. H. (2018). Knowledge on self-management and levels of asthma control among adult patients in Ho Chi Minh City, Vietnam. *International Journal of General Medicine*, Volume 11, 81–89. <https://doi.org/10.2147/ijgm.s157050>

- Normansell, R., Kew, K. M., & Stovold, E. (2017). Interventions to improve adherence to inhaled steroids for asthma. *Cochrane Database of Systematic Reviews*, 4(4). <https://doi.org/10.1002/14651858.CD012226.pub2>
- Nyenhuis, S. M., Kahwash, B., Cooke, A., Gregory, K. L., Greiwe, J., & Nanda, A. (2022). Recommendations for physical activity in asthma: A work group report of the AAAAI sports, exercise, and fitness committee. *The Journal of Allergy and Clinical Immunology: In Practice*, 10(2), 433–443. <https://doi.org/10.1016/j.jaip.2021.10.056>
- O'Connor, R., Benavente, J. Y., Arvanitis, M., Curtis, L. M., Eldeirawi, K., Hasnain-Wynia, R., Federman, A. D., Hebert-Beirne, J., & Wolf, M. S. (2019). Perceived adequacy of tangible social support and associations with health outcomes among older primary care patients. *Journal of General Internal Medicine*, 34(11), 2368–2373. <https://doi.org/10.1007/s11606-019-05110-7>
- Oleske, D. M., & Islam, S. S. (2019). Role of epidemiology in the biopharmaceutical industry. In T. Doan, C. Renz, M. Bhattacharya, F. Lievano, L. Scarazzini (Eds.), *Pharmacovigilance: A Practical Approach* (pp. 69-87).
- Opolski, M., & Wilson, I. (2005). Asthma and depression: a pragmatic review of the literature and recommendations for future research. *Clinical Practice and Epidemiology in Mental Health*, 1(1), 1-7. <https://doi.org/10.1186/1745-0179-1-18>
- Osler, W. (1892). *The Principles and Practice of Medicine*. D. Appleton and Company.
- Palumbo, M. L., Prochnik, A., Wald, M. R., & Genaro, A. M. (2020). Chronic stress and glucocorticoid receptor resistance in asthma. *Clinical Therapeutics*, 42(6), 993–1006. <https://doi.org/10.1016/j.clinthera.2020.03.002>
- Paramita, V., & Nikolaus, C. O. (2022). Asthma and fatty acid imbalance: Is the omega-3 supplement beneficial in asthma?. *Lux Mensana Journal of Scientific Health*, 216-225. <https://doi.org/10.56943/jsh.v1i4.188>
- Patterson, R., & McGrath, K. G. (2000). The “Peter Pan” syndrome and allergy practice: facilitating adherence through the use of social support. *Allergy and Asthma Proceedings*, 21(4), 231–233. <https://doi.org/10.2500/108854100778248845>
- Plourde, A., Lavoie, K. L., Raddatz, C., & Bacon, S. L. (2017). Effects of acute psychological stress induced in laboratory on physiological responses in asthma

- populations: A systematic review. *Respiratory Medicine*, 127, 21–32.
<https://doi.org/10.1016/j.rmed.2017.03.024>
- Price, D., Román-Rodríguez, M., McQueen, R. B., Bosnic-Anticevich, S., Carter, V., Gruffydd-Jones, K., Haughney, J., Henrichsen, S. H., Hutton, C., Infantino, A., Lavorini, F., Law, L., Lisspers, K., Papi, A., Ryan, D., Ställberg, B., Van Der Molen, T., & Chrystyn, H. (2017). Inhaler errors in the CRITIKAL study: type, frequency, and association with asthma outcomes. *The Journal of Allergy and Clinical Immunology: In Practice*, 5(4), 1071-1081.e9.
<https://doi.org/10.1016/j.jaip.2017.01.004>
- Rafi, M. A., Tahmin, C. I., Tashrik, S., Bonna, A. S., Jannat, F., Mily, S. J., Shrestha, A. B., Seemanta, S., Rashid, A., Mahjabeen, M., Nura, N., Shahriar, T., Mahadi, A. R., Ahmed, K., Hasan, M. J., Haque, M. A., & Hossain, M. G. (2022). Adherence to inhalers and associated factors among adult asthma patients: an outpatient-based study in a tertiary hospital of Rajshahi, Bangladesh. *Asthma Research and Practice*, 8(1), 1. <https://doi.org/10.1186/s40733-022-00083-7>
- Ramsey, K. A., Vaughan, C., Wagner, B. M., McGuire, J. F., & Gioia, G. A. (2021). Impact of self-efficacy and affective functioning on paediatric concussion symptom severity. *Journal of the International Neuropsychological Society*, 27(9), 875–882. <https://doi.org/10.1017/S1355617720001320>
- Rejnö, G., Lundholm, C., Öberg, S., Lichtenstein, P., Larsson, H., D’Onofrio, B., Larsson, K., Saltvedt, S., Brew, B. K., & Almqvist, C. (2019). Maternal anxiety, depression and asthma and adverse pregnancy outcomes – a population based study. *Scientific Reports*, 9(1). <https://doi.org/10.1038/s41598-019-49508-z>
- Rhee, H., Wicks, M. N., Dolgoff, J. S., Love, T. M., & Harrington, D. (2018). Cognitive factors predict medication adherence and asthma control in urban adolescents with asthma. *Patient Preference and Adherence*, 12, 929–937.
<https://doi.org/10.2147/PPA.S162925>
- Riccelli, M. G., Goldoni, M., Poli, D., Mozzoni, P., Cavallo, D., & Corradi, M. (2020). Welding fumes, a risk factor for lung diseases. *International Journal of Environmental Research and Public Health*, 17(7), 2552.
<https://doi.org/10.3390/ijerph17072552>

- Rifaat, N., Abdel-Hady, E., & Hasan, A. A. (2013). The golden factor in adherence to inhaled corticosteroid in asthma patients. *Egyptian Journal of Chest Diseases and Tuberculosis*, 62(3), 371–376. <https://doi.org/10.1016/j.ejcdt.2013.07.010>
- Robinson, D., Campbell, D. A., Durham, S. R., Pfeffer, J., Barnes, P. J., & Chung, K. F. (2003). Systematic assessment of difficult-to-treat asthma. *The European Respiratory Journal*, 22(3), 478–483. <https://doi.org/10.1183/09031936.03.00017003>
- Robinson, P., Jayasuriya, G., Haggie, S., Uluer, A., Gaffin, J. M., & Fleming, L. (2022). Issues affecting young people with asthma through the transition period to adult care. *Paediatric Respiratory Reviews*, 41, 30–39. <https://doi.org/10.1016/j.prrv.2021.09.005>
- Robinson, R., Barber, K., Jones, G., Blakey, J., & Burhan, H. (2020). Exploring the relationship between generalised anxiety/depression scales and asthma-specific quality of life/control questionnaires in a specialist asthma clinic. *Journal of Asthma*, 58(7), 912–920. <https://doi.org/10.1080/02770903.2020.1744640>
- Rosenstock, I. M. (1990). The health belief model: Explaining health behavior through expectancies. In K. Glanz, F. M. Lewis, & B. K. Rimer (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 39–62). Jossey-Bass/Wiley.
- Ross, J. A., Yang, Y., Song, P. X., Clark, N. M., & Baptist, A. P. (2013). Quality of life, health care utilization, and control in older adults with asthma. *The Journal of Allergy and Clinical Immunology: In Practice*, 1(2), 157–162. <https://doi.org/10.1016/j.jaip.2012.12.003>
- Rubin, N. J. (1993). Severe asthma and depression. *Archives of Family Medicine*, 2(4), 433–440. <https://doi.org/10.1001/archfami.2.4.433>
- Sales, J., Fivush, R., & Teague, G. W. (2008). The role of parental coping in children with asthma's psychological well-being and asthma-related quality of life. *Journal of Pediatric Psychology*, 33(2), 208–219. <https://doi.org/10.1093/jpepsy/jsm068>
- Salim, H., Young, I., Lee, P. Y., Shariff-Ghazali, S., Pinnock, H., & RESPIRE collaboration. (2022). Insights into how Malaysian adults with limited health literacy self-manage and live with asthma: A Photovoice qualitative study. *Health Expectations*, 25(1), 163–176. <https://doi.org/10.1111/hex.13360>

- Sánchez-Borges, M., Capriles-Hulett, A., & Caballero-Fonseca, F. (2011). Asthma care in resource-poor settings. *The World Allergy Organization Journal*, 4(4), 68–72. <https://doi.org/10.1097/WOX.0b013e318213598d>
- Sandberg, S., Paton, J. Y., Ahola, S., McCann, D. C., McGuinness, D., Hillary, C. R., & Oja, H. (2000). The role of acute and chronic stress in asthma attacks in children. *The Lancet*, 356(9234), 982–987. [https://doi.org/10.1016/S0140-6736\(00\)02715-X](https://doi.org/10.1016/S0140-6736(00)02715-X)
- Sastre, J., Crespo, A., Fernandez-Sanchez, A., Rial, M., Plaza, V., González, F. C., López, J. J., Rianza, M. M., Orenes, M. M., Montaña, P. P., Toro, M. T., Balaguer, C. A., Girones, M. A., Martinez, C. B., Martín, I. F., Delgado, P. G., Calahorra, M. M., Carrasco, G. M., Pacheco, R. R., ... Arazuri, N. S. (2018). Anxiety, depression, and asthma control: changes after standardized treatment. *The Journal of Allergy and Clinical Immunology: In Practice*, 6(6), 1953–1959. <https://doi.org/10.1016/j.jaip.2018.02.002>
- Schatz, M., Zeiger, R. S., Mosen, D., & Vollmer, W. M. (2008). Asthma-specific quality of life and subsequent asthma emergency hospital care. *The American Journal of Managed Care*, 14(4), 206–211.
- Scherer, Y. K., & Bruce, S. (2001). Knowledge, attitudes, and self-efficacy and compliance with medical regimen, number of emergency department visits, and hospitalizations in adults with asthma. *Heart & Lung*, 30(4), 250–257. <https://doi.org/10.1067/mhl.2001.116013>
- Schlenk, E. A., & Hart, L. K. (1984). Relationship between health locus of control, health value, and social support and compliance of persons with diabetes mellitus. *Diabetes Care*, 7(6), 566–574. <https://doi.org/10.2337/diacare.7.6.566>
- Schöbinger, R., Florin, I., Reichbauer, M., Lindemann, H., & Zimmer, C. (1993). Childhood asthma: Mothers' affective attitude, mother-child interaction and children's compliance with medical requirements. *Journal of Psychosomatic Research*, 37(7), 697–707. [https://doi.org/10.1016/0022-3999\(93\)90098-z](https://doi.org/10.1016/0022-3999(93)90098-z)
- Scott, K. M., Von Korff, M., Ormel, J., Zhang, M. Y., Bruffaerts, R., Alonso, J., Kessler, R. C., Tachimori, H., Karam, E., Levinson, D., Bromet, E. J., Posada-Villa, J., Gasquet, I., Angermeyer, M. C., Borges, G., de Girolamo, G., Herman, A., & Haro, J. M. (2007). Mental disorders among adults with asthma: results from the

- World Mental Health Survey. *General Hospital Psychiatry*, 29(2), 123–133.
<https://doi.org/10.1016/j.genhosppsy.2006.12.006>
- Selye, H. (1982). History and present status of the stress concept. In L. Goldberger & S. Breznitz (Eds.), *Handbook of Stress: Theoretical and Clinical aspects* (pp. 7–17). Free Press.
- Shafazand, S., & Colice, G. (2004). Asthma: the epidemic has ended, or has it?. *Chest*, 125(6), 1969–1970. <https://doi.org/10.1378/chest.125.6.1969>
- Shin, J.-H., Roh, D., Lee, D.-H., Kim, S. W., Kim, S. W., Cho, J. H., Kim, B.-G., & Kim, B.Y. (2018). Allergic rhinitis and rhinosinusitis synergistically compromise the mental health and health-related quality of life of Korean adults: A nationwide population-based survey. *PLoS ONE*, 13(1), e0191115.
<https://doi.org/10.1371/journal.pone.0191115>
- Shinan-Altman, S., & Katzav, K. (2021). The relationship between illness representations, alexithymia, coping strategies and subjective well-being among persons with asthma. *Journal of Asthma*, 58(7), 932–938.
<https://doi.org/10.1080/02770903.2020.1741610>
- Shine, S., Muhamud, S., & Demelash, A. (2019). Prevalence and associated factors of bronchial asthma among adult patients in Debre Berhan Referral Hospital, Ethiopia 2018: a cross-sectional study. *BMC Research Notes*, 12(1).
<https://doi.org/10.1186/s13104-019-4670-9>
- Shum, M., Poureslami, I., Liu, J., & FitzGerald, J. M. (2017). Perceived barriers to asthma therapy in ethno-cultural communities: the role of culture, beliefs and social support. *Health*, 09(07), 1029–1046. <https://doi.org/10.4236/health.2017.97075>
- Shumaker, S. A., & Brownell, A. (1984). Toward a theory of social support: Closing conceptual gaps. *Journal of Social Issues*, 40(4), 11–36.
<https://doi.org/10.1111/j.1540-4560.1984.tb01105.x>
- Sin, M., Kang, D., & Weaver, M. (2005). Relationships of asthma knowledge, self-management, and social support in African American adolescents with asthma. *International Journal of Nursing Studies*, 42(3), 307–313.
<https://doi.org/10.1016/j.ijnurstu.2004.06.013>

- Siroux, V., Boudier, A., Antó, J. M., Cazzoletti, L., Accordini, S., Alonso, J. A., Cerveri, I., Corsico, A., Gulsvik, A., Jarvis, D. I., De Marco, R., Marcon, A., Marques, E. A., Bugiani, M., Janson, C., Leynaert, B., & Pin, I. (2008). Quality-of-life and asthma-severity in general population asthmatics: Results of the ECRHS II study. *Allergy*, 63(5), 547–554. <https://doi.org/10.1111/j.1398-9995.2008.01638.x>
- Sleath, B., Carpenter, D. M., Davis, S., Garcia, N., Reuland, D. S., Tudor, G., & Loughlin, C. E. (2022). Adolescent asthma management self-efficacy and responsibility: Impact on asthma control and quality-of-life. *Journal of Asthma*, 60(2), 331–338. <https://doi.org/10.1080/02770903.2022.2051541>
- Sloand, E., Butz, A., Rhee, H., Walters, L., Breuninger, K., Pozzo, R. A., Barnes, C. M., Wicks, M. N., & Tumiel-Berhalter, L. (2021). Influence of social support on asthma self-management in adolescents. *The Journal of Asthma*, 58(3), 386–394. <https://doi.org/10.1080/02770903.2019.1698601>
- Smith, S. M. S., Sonogo, S., Ketcheson, L., & Larson, J. L. (2014). A review of the effectiveness of psychological interventions used for anxiety and depression in chronic obstructive pulmonary disease. *BMJ Open Respiratory Research*, 1(1), e000042. <https://doi.org/10.1136/bmjresp-2014-000042>
- Smits, D., Brigis, G., Pavare, J., Urtane, I., Kovalovs, S., & Barengo, N. C. (2020). Factors related to poor adherence in Latvian asthma patients. *Allergy, Asthma & Clinical Immunology*, 16(1). <https://doi.org/10.1186/s13223-020-0414-6>
- Song, W., Won, H., Lee, S. Y., Park, H. W., Cho, Y. S., Chung, K. F., Heaney, L. G., & Joung, W. J. (2021). Patients' experiences of asthma exacerbation and management: a qualitative study of severe asthma. *ERJ Open Research*, 7(2), 00528–02020. <https://doi.org/10.1183/23120541.00528-2020>
- Sørensen, K., Van Den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., Brand, H., & (HLS-EU) Consortium Health Literacy Project European. (2012). Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health*, 12(1), 80. <https://doi.org/10.1186/1471-2458-12-80>
- Stanescu, S., Kirby, S. E., Thomas, M., Yardley, L., & Ainsworth, B. (2019). A systematic review of psychological, physical health factors, and quality of life in adult asthma. *NPJ Primary Care Respiratory Medicine*, 29(1), 1-11. <https://doi.org/10.1038/s41533-019-0149-3>

- Steen, N., Hutchinson, A., McColl, E., Eccles, M. P., Hewison, J., Meadows, K. A., Blades, S. M., & Fowler, P. (1994). Development of a symptom based outcome measure for asthma. *BMJ*, *309*(6961), 1065–1068.
<https://doi.org/10.1136/bmj.309.6961.1065>
- Strachan, D. P., Rutter, C. E., Asher, M. I., Bissell, K., Chiang, C. Y., El Sony, A., Ellwood, E., Ellwood, P., García-Marcos, L., Marks, G. B., Morales, E., Mortimer, K., Pearce, N., Pérez-Fernández, V., Robertson, S., Silverwood, R. J., & Global Asthma Network Phase I Study Group (2022). Worldwide time trends in prevalence of symptoms of rhinoconjunctivitis in children: Global Asthma Network Phase I. *Pediatric Allergy and Immunology*, *33*(1), e13656.
<https://doi.org/10.1111/pai.13656>
- Sumino, K., & Cabana, M. D. (2013). Medication adherence in asthma patients. *Current Opinion in Pulmonary Medicine*, *19*(1), 49–53.
<https://doi.org/10.1097/mcp.0b013e32835b117a>
- Tal, A., & Miklich, D. R. (1976). Emotionally induced decreases in pulmonary flow rates in asthmatic children. *Psychosomatic Medicine*, *38*(3), 190–200. <https://doi.org/10.1097/00006842-197605000-00005>
- Talreja, N., Soubani, A. O., Sherwin, R. L., & Baptist, A. P. (2012). Modifiable factors associated with severe asthma exacerbations in urban patients. *Annals of Allergy, Asthma & Immunology*, *109*(2), 128-132.
<https://doi.org/10.1016/j.anai.2012.06.010>.
- Taponen, S., Lehtimäki, L., Karvala, K., Luukkonen, R., & Uitti, J. (2017). Correlates of employment status in individuals with asthma: a cross-sectional survey. *Journal of Occupational Medicine and Toxicology*, *12*(1), 19. <https://doi.org/10.1186/s12995-017-0165-6>
- Thompson, P. J., Salvi, S., Lin, J., Cho, Y. M., Eng, P., Manap, R. A., Boonsawat, W., Hsu, J., Faruqi, R., Moreno-Cantu, J. J., Fish, J. E., & Ho, J. C. (2013). Insights, attitudes and perceptions about asthma and its treatment: Findings from a multinational survey of patients from 8 Asia-Pacific countries and Hong Kong. *Respirology*, *18*(6), 957–967. <https://doi.org/10.1111/resp.12137>
- Tilahun, D., Michael, M., Gashaye, M., Melkamu, E., & Mekoya, T. (2022). Retrospective cross-sectional study of asthma severity in adult patients at the Jimma Medical

- Center, Ethiopia. *Scientific Reports*, 12(1), 11483. <https://doi.org/10.1038/s41598-022-15807-1>
- Toennesen, L. L., Meteran, H., Hostrup, M., Wium Geiker, N. R., Jensen, C. B., Porsbjerg, C., Astrup, A., Bangsbo, J., Parker, D., & Backer, V. (2018). Effects of exercise and diet in nonobese asthma patients—a randomized controlled trial. *The Journal of Allergy and Clinical Immunology: In Practice*, 6(3), 803–811. <https://doi.org/10.1016/j.jaip.2017.09.028>
- Tomisa, G., Horváth, A., Sánta, B., Keglevich, A., & Tamási, L. (2021). Epidemiology of comorbidities and their association with asthma control. *Allergy, Asthma & Clinical Immunology*, 17(1), 95. <https://doi.org/10.1186/s13223-021-00598-3>
- Trivedi, M., & Denton, E. (2019). Asthma in children and adults-what are the differences and what can they tell us about asthma?. *Frontiers in Pediatrics*, 7, 256. <https://doi.org/10.3389/fped.2019.00256>
- Turi, E. R., Reigada, L. C., Liu, J., Leonard, S. I., & Bruzzese, J. M. (2021). Associations among anxiety, self-efficacy, and self-care in rural adolescents with poorly controlled asthma. *Annals of Allergy, Asthma & Immunology*, 127(6), 661–666.e1. <https://doi.org/10.1016/j.anai.2021.09.010>
- Unni, E. J., & Farris, K. B. (2011). Determinants of different types of medication non-adherence in cholesterol lowering and asthma maintenance medications: A theoretical approach. *Patient Education and Counseling*, 83(3), 382–390. <https://doi.org/10.1016/j.pec.2011.02.017>
- Valizadeh, L., Zarei, S., Zamanazadeh, V., Bilan, N., Nasiri, K., & Howard, F. (2014). The effects of triggers' modifying on adolescent self-efficacy with asthma: A randomized controlled clinical trial. *Journal of Caring Sciences*, 3(2), 121–129. <https://doi.org/10.5681/JCS.2014.013>
- Van Der Laan, S. E., De Hoog, M. L. A., Nijhof, S. L., Gehring, U., Vonk, J. M., Van Der Ent, C. K., & Wijga, A. H. (2021). Mental well-being and general health in adolescents with asthma: the prevention and incidence of asthma and mite allergy birth cohort study. *Data Archiving and Networked Services (DANS)*, 233, 198-205.e2. <https://doi.org/10.1016/j.jpeds.2021.01.074>
- Van der Palen, J., Klein, J. J., & Seydel, E. R. (1997). Are high generalised and asthma-specific self-efficacy predictive of adequate self-management behaviour among

- adult asthma patients?. *Patient Education and Counseling*, 32(1 Suppl), S35–S41.
[https://doi.org/10.1016/s0738-3991\(97\)00094-3](https://doi.org/10.1016/s0738-3991(97)00094-3)
- Van Lieshout, R. J., & Macqueen, G. (2008). Psychological factors in asthma. *Allergy, Asthma, and Clinical Immunology*, 4(1), 12–28. <https://doi.org/10.1186/1710-1492-4-1-12>
- Van Sickle, D., Magzamen, S., Truelove, S., & Morrison, T. (2013). Remote monitoring of inhaled bronchodilator use and weekly feedback about asthma management: An open-group, short-term pilot study of the impact on asthma control. *PLoS ONE*, 8(2), e55335. <https://doi.org/10.1371/journal.pone.0055335>
- Vig, R. S., Forsythe, P., & Vliagoftis, H. (2006). The role of stress in asthma: insight from studies on the effect of acute and chronic stressors in models of airway inflammation. *Annals of the New York Academy of Sciences*, 1088(1), 65–77. <https://doi.org/10.1196/annals.1366.023>
- Weinstein, S. M., Pugach, O., Rosales, G., Mosnaim, G. S., Walton, S. M., & Martin, M. A. (2019). Family chaos and asthma control. *Pediatrics*, 144(2), e20182758. <https://doi.org/10.1542/peds.2018-2758>
- Wigal, J. K., Stout, C., Brandon, M., Winder, J. A., McConaughy, K., Creer, T. L., & Kotses, H. (1993). The knowledge, attitude, and self-efficacy asthma questionnaire. *Chest*, 104(4), 1144–1148. <https://doi.org/10.1378/chest.104.4.1144>
- Williams, L. K., Joseph, C. L., Peterson, E. L., Wells, K., Wang, M., Chowdhry, V. K., Walsh, M., Campbell, J., Rand, C. S., Apter, A. J., Lanfear, D. E., Tunceli, K., & Pladevall, M. (2007). Patients with asthma who do not fill their inhaled corticosteroids: A study of primary nonadherence. *The Journal of Allergy and Clinical Immunology*, 120(5), 1153–1159. <https://doi.org/10.1016/j.jaci.2007.08.020>
- Wisnivesky, J. P., Lorenzo, J., Feldman, J. M., Leventhal, H., & Halm, E. A. (2010). The relationship between perceived stress and morbidity among adult inner-city asthmatics. *Journal of Asthma*, 47(1), 100–104. <https://doi.org/10.3109/02770900903426989>
- World Health Organization. (1948). Constitution in basic documents. Geneva: World Health Organization. <https://www.who.int/about/governance/constitution>

- World Health Organization. (2017, March 30). "Depression: let's talk" says WHO, as depression tops list of causes of ill health. *Geneva: World Health Organization*. <https://www.who.int/news/item/30-03-2017--depression-let-s-talk-says-who-as-depression-tops-list-of-causes-of-ill-health>
- World Health Organization. (2003). *Adherence to long-term therapies: evidence for action*. World Health Organization. <https://apps.who.int/iris/handle/10665/42682>
- Wright, R. J., Rodriguez, M., & Cohen, S. (1998). Review of psychosocial stress and asthma: an integrated biopsychosocial approach. *Thorax*, 53(12), 1066–1074. <https://doi.org/10.1136/thx.53.12.1066>
- Yakar, T., Baran, A., Güngör, S., Altinsoy, B., Yalçınsoy, M., Can, G., & Akkaya, E. (2007). The factors affecting Beck depression scale in asthmatic patients. *Tuberkuloz Ve Toraks*, 55(1), 11-17. <https://www.ncbi.nlm.nih.gov/pubmed/17401789>
- Yang, M. L., Chiang, C. H., Yao, G., & Wang, K. Y. (2003). Effect of medical education on quality of life in adult asthma patients. *Journal of the Formosan Medical Association*, 102(11), 768-774. <https://scholars.lib.ntu.edu.tw/bitstream/123456789/42982/1/27.pdf>
- Yousef, H. A., Koura, M., & Yousef, A. A. (2015). Knowledge about bronchial asthma management in primary health care physicians in Al-Khobar City, Saudi Arabia. *Journal of Family & Community Medicine*, 22(1), 1–7. <https://doi.org/10.4103/2230-8229.149567>
- Yuan, X., Tao, Y., Zhao, J. P., Liu, X. S., Xiong, W. N., Xie, J. G., Ni, W., Xu, Y. J., & Liu, H. G. (2015). Long-term efficacy of a rural community-based integrated intervention for prevention and management of chronic obstructive pulmonary disease: A cluster randomized controlled trial in China's rural areas. *Brazilian Journal of Medical and Biological Research*, 48(11), 1023–1031. <https://doi.org/10.1590/1414-431x20154385>
- Yung, J., Osahan, S., Friedman, S. M., Li, J., & Cone, J. E. (2019). Air pollution/irritants, asthma control, and health-related quality of life among 9/11-exposed individuals with asthma. *International Journal of Environmental Research and Public Health*, 16(11), 1924. <https://doi.org/10.3390/ijerph16111924>

Zhou, E. S. (2014). Social Support. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 6161–6164). Springer Netherlands.
https://doi.org/10.1007/978-94-007-0753-5_2789

Appendix I

Socio-demographic Form

ID No: _____

1. Name :_____

2. Age :_____

3. Gender Male ☐ Female ☐ Others ☐

4. Educational Qualification : _____

5. Occupation :_____

6. Marital Status Unmarried ☐ Married ☐ Separated ☐ Divorced ☐ Widowed ☐

7. Type of family Joint Family ☐ Nuclear Family ☐

8. Duration of Asthma :_____

9. Place of Residence :_____

10. Presence of Co-morbidities Yes ☐ No ☐
 If yes, specify_____

Appendix II

Asthma Knowledge Questionnaire

Instructions: There are 25 statements below with options ‘Yes’ or ‘No’. Please read each statement carefully. There is no right or wrong answer. Please mark (✓) in one of the appropriate option against each statement. When you have finished, please check that you have answered all the statements.

S No.	Statement	Options	
1	Coughing is not a symptom of asthma	Yes ☐	No ☐
2	Asthma is due to inflammation in the lungs	Yes ☐	No ☐
3	Smoking in the home can make asthma worse.	Yes ☐	No ☐
4	Asthma attacks can happen when you breathe things like paint fumes, gasoline, smoke, or pollution.	Yes ☐	No ☐
5	Keeping an asthma attack from happening is something only a doctor can do.	Yes ☐	No ☐
6	If you start to have an asthma attack, you might notice a tight feeling in your chest before wheezing starts.	Yes ☐	No ☐
7	A peak flowmeter is used to make sure your sinuses are open.	Yes ☐	No ☐
8	If asthma symptoms such as tightness and wheezing do not occur for several years, person has outgrown his/her asthma.	Yes ☐	No ☐
9	Asthma is an emotional or psychological disease.	Yes ☐	No ☐
10	Most persons with asthma have to go to the hospital for asthma attacks.	Yes ☐	No ☐
11	For some people, asthma becomes less severe as they get older.	Yes ☐	No ☐
12	Doctors are not really sure why some people have asthma, but they know what can start an attack.	Yes ☐	No ☐
13	With appropriate treatment, most persons with asthma should lead a normal life with no restrictions on activities.	Yes ☐	No ☐
14	Anger, crying, or laughing can start an asthma attack.	Yes ☐	No ☐
15	If you don't have asthma by the time you are 40 years old, you will never get it.	Yes ☐	No ☐
16	Persons with asthma should not play sports in which they have to run a lot.	Yes ☐	No ☐
17	In persons with asthma, asthma sometimes starts after a viral respiratory illness.	Yes ☐	No ☐
18	An allergen is the antibody missing in people with asthma.	Yes ☐	No ☐
19	It is possible for your asthma to be worse without noticing a change in your breathing.	Yes ☐	No ☐
20	Exercising in cold weather can start an asthma attack.	Yes ☐	No ☐
21	Fish and birds are both good pets for persons with asthma.	Yes ☐	No ☐
22	A rescue inhaler (i.e., bronchodilator) is taken to reduce inflammation in the lungs.	Yes ☐	No ☐
23	Some asthma medications don't work unless you take them every day.	Yes ☐	No ☐
24	You don't need to shake most asthma medication inhalers before using them.	Yes ☐	No ☐
25	Fewer people have asthma today than 10 years ago.	Yes ☐	No ☐

Appendix III

Depression Anxiety and Stress Scale-21 (DASS-21)

Instructions: There are 21 statements. Please read each statement and select the options below and circle them. The options are presented in the form of numbers 0, 1, 2 or 3 which indicates how much the statement applied to you over the past month. There are no right or wrong answers. Do not spend too much time on any statement. When you have finished, please check that you have answered all the statements.

The rating scale is as follows:

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree or a good part of time
- 3 Applied to me very much or most of the time

S No.	Statement	Options			
1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (e.g. in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Appendix IV

Interpersonal Support Evaluation List

Instructions: There are 12 statements to identify the perceptions of social support. Each statement may or may not be true about you. For each statement circle "*Definitely true*" if you are sure it is true about you and "*Probably true*" if you think it is true but is not absolutely certain. Similarly, you should circle "*Definitely false*" if you are sure the statement is false and "*Probably false*" if you think it is false but is not absolutely certain. When you have finished, please check that you have answered all the statements.

S No	Statements	Options			
1	If I wanted to go on a trip for a day (for example, to the country or mountains), I would have a hard time finding someone to go with me.	Definitely false	Probably false	Probably true	Definitely true
2	I feel that there is no one I can share my most private worries and fears with.	Definitely false	Probably false	Probably true	Definitely true
3	If I were sick, I could easily find someone to help me with my daily chores.	Definitely false	Probably false	Probably true	Definitely true
4	There is someone I can turn to for advice about handling problems with my family.	Definitely false	Probably false	Probably true	Definitely true
5	If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me.	Definitely false	Probably false	Probably true	Definitely true
6	When I need suggestions on how to deal with a personal problem, I know someone I can turn to.	Definitely false	Probably false	Probably true	Definitely true
7	I don't often get invited to do things with others.	Definitely false	Probably false	Probably true	Definitely true
8	If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc.).	Definitely false	Probably false	Probably true	Definitely true
9	If I wanted to have lunch with someone, I could easily find someone to join me.	Definitely false	Probably false	Probably true	Definitely true
10	If I was stranded 10 miles from home, there is someone I could call who could come and get me.	Definitely false	Probably false	Probably true	Definitely true
11	If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it.	Definitely false	Probably false	Probably true	Definitely true
12	If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me.	Definitely false	Probably false	Probably true	Definitely true

Appendix V

Self-efficacy for Managing Chronic Disease

Instructions: There are 6 statements. We would like to know how confident you are in doing certain activities. For each of the following statements, please circle the number that corresponds to your confidence that you can do the tasks regularly at the present time. The response options ranges from 1 to 10, '1 indicates not at all confident' and '10 indicates totally confident'. There are no right or wrong answer. When you have finished, please check that you have answered all statements.

S No.	Statements	Response Options		
1	How confident do you feel that you can keep the fatigue caused by your disease from interfering with the things you want to do?	Not at all Confident	<u>1 2 3 4 5 6 7 8 9 10</u>	Totally Confident
2	How confident do you feel that you can keep the physical discomfort or pain of your disease from interfering with the things you want to do?	Not at all Confident	<u>1 2 3 4 5 6 7 8 9 10</u>	Totally Confident
3	How confident do you feel that you can keep the emotional distress caused by your disease from interfering with the things you want to do?	Not at all Confident	<u>1 2 3 4 5 6 7 8 9 10</u>	Totally Confident
4	How confident do you feel that you can keep any other symptoms or health problems you have from interfering with the things you want to do?	Not at all Confident	<u>1 2 3 4 5 6 7 8 9 10</u>	Totally Confident
5	How confident do you feel that you can do the different tasks and activities needed to manage your health condition so as to reduce your need to see a doctor?	Not at all Confident	<u>1 2 3 4 5 6 7 8 9 10</u>	Totally Confident
6	How confident do you feel that you can do things other than just taking medication to reduce how much your illness affects your everyday life?	Not at all Confident	<u>1 2 3 4 5 6 7 8 9 10</u>	Totally Confident

Appendix VI

Adherence Scale in Chronic Diseases

Instructions: There are 8 statements to know your adherence levels. Each statement has five options. Read the options carefully and choose the option by marking a tick (✓) as appropriate to you. There are no right or wrong answers. When you have finished, please check that you have answered all the statements.

1. Do you always remember to take all your medications according to your doctor's instructions?

- ☐ A. Always
- ☐ B. Almost always
- ☐ C. Sometimes
- ☐ D. Hardly ever
- ☐ E. Never

2. Do you find purchasing of the medications prescribed by your doctor a significant financial burden?

- ☐ A. No, it is insignificant.
- ☐ B. It is burdensome, but acceptable.
- ☐ C. It is financially cumbersome, but with some effort I can still afford to buy all my medications.
- ☐ D. Occasionally I cannot afford to buy all my medications.
- ☐ E. Frequently I cannot afford to buy all my medications.

3. Do you happen to change the dosing of your medications without prior consultation with your doctor?

- ☐ A. Never.
- ☐ B. Only occasionally.
- ☐ C. Sometimes.
- ☐ D. Frequently.
- ☐ E. I do not adhere to my doctor's recommendations at all.

4. Do you adjust the dosing of your medications according to how you feel?

- ☐ A. No, I strictly follow the prescribed dosing, no matter how I feel.
- ☐ B. Yes, I reduce the dosage of some medications when I feel good.
- ☐ C. Yes, I skip doses of some medications when I feel good.
- ☐ D. Yes, I temporarily discontinue some medications when I feel good.
- ☐ E. Yes, I discontinue all medications when I feel good.

5. On the appearance of medication-related side effects (e.g. stomach pain, liver pain, rash, lack of appetite, oedema):

- ☐ A. I seek medical attention instantly.
- ☐ B. I reduce the dosage of the medication and attempt to expedite the elective appointment with my doctor.
- ☐ C. I discontinue the medication and attempt to expedite the elective appointment with my doctor.
- ☐ D. I discontinue the medication and wait for the next elective appointment with my doctor.

☐ E. I discontinue all my medications and wait for the next elective appointment with my doctor.

6. Do you find all your medications necessary for your health?

☐ A. Yes, I do.

☐ B. I find most of my medications to be beneficial for my health.

☐ C. I find only some of my medications to be beneficial for my health.

☐ D. I find some of my medications to be beneficial for my health, while the others to be harmful for me.

☐ E. I find the majority of my long-term medications to be harmful for me.

7. Does your doctor inquire about medication-related problems that you might possibly experience?

☐ A. Yes, on every appointment.

☐ B. Yes, he/she usually does.

☐ C. Yes, but only sometimes.

☐ D. Yes, but only occasionally.

☐ E. No, never.

8. Do you tell truth when asked by your doctor about medication-related problems?

☐ A. Yes, always.

☐ B. Almost always.

☐ C. I try to be honest, but sometimes it is hard to admit to non-compliance with doctor's recommendations

☐ D. Sometimes yes, another time no.

☐ E. No, I don't. I find it's my own private business.

Appendix VII

Asthma Quality of Life Questionnaire

Instructions: Please identify the activities below in which you are having difficulty in performing such activity due to asthma. *If more than five activities are identified, then choose the five most important activities from the following list.* There are 32 statements. Each statement has seven response options. Read each statement carefully and indicate how much you have been limited by your asthma during the last two weeks by choosing one of the following options from the activity list.

- | | |
|---|---|
| ☐ Bicycling | ☐ Playing with pets |
| ☐ Dancing | ☐ Playing with children |
| ☐ Doing home maintenance | ☐ Playing sports |
| ☐ Doing housework or Gardening | ☐ Singing |
| ☐ Hurrying | ☐ Doing regular social activities |
| ☐ Jogging, exercising, or running | ☐ Having physical intimacy/ relationship |
| ☐ Laughing | ☐ Talking |
| ☐ Mopping or scrubbing the floor | ☐ Running upstairs |
| ☐ Visiting friends or relatives | ☐ Going for a walk |
| ☐ Walking upstairs or uphill | ☐ Woodwork or carpentry |
| ☐ Carrying out your activities at work | |

1) Activity 1_____

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress
- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

2) Activity 2_____

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress
- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

3) Activity 3_____

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress

- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

4) Activity 4 _____

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress
- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

5) Activity 5 _____

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress
- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

6) How much discomfort or distress have you felt over the last two weeks as a result of chest tightness?

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress
- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

7) In general, how often during the last two weeks have you felt concerned about having asthma?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

8) How often during the past two weeks did you feel short of breath as a result of your asthma?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

9) How often during the past two weeks did you experience asthma symptoms as a result of being exposed to cigarette smoke?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

10) How often during the past two weeks did you experience a wheeze in your chest?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

11) How often during the past two weeks did you feel you had to avoid a situation or environment because of cigarette smoke?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

12) How much discomfort or distress have you felt over the past two weeks as a result of coughing?

- ☐ 1. A very great deal of discomfort or distress
- ☐ 2. A great deal of discomfort or distress
- ☐ 3. A good deal of discomfort or distress

- ☐ 4. A moderate amount of discomfort or distress
- ☐ 5. Some discomfort or distress
- ☐ 6. Very little discomfort or distress
- ☐ 7. No discomfort or distress

13) How often during the past two weeks did you feel frustrated as a result of your asthma?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

14) How often during the past two weeks did you experience a feeling of chest heaviness?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

15) How often during the past two weeks did you feel concerned about the need to take medication for your asthma?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

16) How often during the past two weeks did you feel the need to clear your throat?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

17) How often during the past two weeks did you experience asthma symptoms as a result of being exposed to dust?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

18) How often during the past two weeks did you experience difficulty breathing out as a result of your asthma?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

19) How often during the past two weeks did you feel you had to avoid a situation or environment because of dust?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

20) How often during the past two weeks did you wake up in the morning with asthma symptoms?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

21) How often during the past two weeks did you feel afraid of not having your asthma medication available?

- ☐ 1. All of the time
- ☐ 2. Most of the time

- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

22) How often during the past two weeks were you bothered by heavy breathing?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

23) How often during the past two weeks did you experience asthma symptoms as a result of the weather or air pollution outside?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

24) How often during the past two weeks have you been woken at night by your asthma?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

25) How often during the past two weeks have you had to avoid or limit going outside because of the weather or air pollution?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

26) How often during the past two weeks did you experience asthma symptoms as a result of being exposed to strong smells or perfume?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

27) How often during the past two weeks did you feel afraid of getting out of breath?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

28) How often during the past two weeks did you feel you had to avoid a situation or environment because of strong smells or perfume?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

29) How often during the past two weeks has your asthma interfered with getting a good night's sleep?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time
- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

30) How often during the past two weeks have you had the feeling of fighting for air?

- ☐ 1. All of the time
- ☐ 2. Most of the time
- ☐ 3. A good bit of the time

- ☐ 4. Some of the time
- ☐ 5. A little of the time
- ☐ 6. Hardly any of the time
- ☐ 7. None of the time

31) Think of the overall range of activities that you would have liked to have done during the past two weeks. How much has your range of activities been limited by your asthma?

- ☐ 1. Severely limited-most activities not done
- ☐ 2. Very limited
- ☐ 3. Moderately limited-several activities not done
- ☐ 4. Slightly limited
- ☐ 5. Very slightly limited-very few activities not done
- ☐ 6. Hardly limited at all
- ☐ 7. Not limited at all-have done all activities that I wanted to do

32) Overall, among all the activities that you have done during the past two weeks, how limited have you been by your asthma?

- ☐ 1. Totally limited, couldn't do activity at all
- ☐ 2. Extremely limited
- ☐ 3. Very limited
- ☐ 4. Moderate limitations
- ☐ 5. Some limitation
- ☐ 6. A little limitation
- ☐ 7. Not at all limited

Appendix VIII

Asthma Symptom Questionnaire

Instructions: There are 10 statements about asthma symptom *frequency* and *severity*. Read each statement carefully and tick (✓) in the box that best describes how you have been feeling in the last month. The response options for asthma symptom frequency ranges from 'Never to Everyday'. The response options for asthma symptom severity ranges from 'Does not apply to me to Very much bother'. There is no right or wrong answer. When you have finished, please check that you have answered all the statements.

S No.	Statements	Response Options				
A. Asthma Symptom Frequency						
1	How many days have you experienced breathlessness during exercise?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
2	How many days have you experienced breathlessness during day when not exercising?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
3	How many days have you Wheezed during day?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
4	How many days have you been Coughing during day?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
5	How many days have you wheezed during night?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
6	How many days have you experienced breathlessness at night?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
7	How many days have you been Coughing at night?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
8	How many days have you experienced Disturbed sleep?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday

9	How many days have you experienced fear because of asthma?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday
10	How many days have you experienced feeling of tightness in chest?	☐ Never	☐ On one or a few days	☐ On several days	☐ On Most days	☐ Everyday

B. Asthma Symptom Severity

1	How much did you bother because of the breathlessness during exercise?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
2	How much did you bother because of breathlessness during day when not exercising?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
3	How much bother did the wheezing cause?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
4	How much did the cough bother you?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
5	How much bother did the wheezing cause?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
6	How much breathlessness did bother you?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
7	How much did the cough bother you?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
8	How much bother did the disturbed sleep cause?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
9	How much did fear of asthma bother you?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother
10	How much did feeling of tightness in chest bother you?	☐ Does not apply to me	☐ No bother at all	☐ Not much bother	☐ Much bother	☐ Very much bother

Appendix IX



Institutional Ethics Committee University of Hyderabad

Justice TNC Rangarajan
Chairperson

Prof. Geeta K. Vemuganti
Member Secretary

Decision Letter of Institute Ethics Committee

IEC No.	UH/IEC/2020/252	Date of review	18-02-2020
Application No:			
Project Title:	Role of Knowledge of Asthma and Psychosocial factors in adherence and health outcomes of Asthma patients.		
Principal Investigator/ Co-PI:	PI: P. Sharon Shulamite CI: Dr. N.D.S. Naga Seema		
Participating Institutes if any	----	Approval from Participating Institute	---
Documents received and reviewed	Protocol & ICF		
In case of renewal submission of update	----		
Decision of the IEC:	Approved after the conditions suggested at the IEC meeting were fulfilled on 05.03.2020 Duration: One year from date of approval		
Any other Comments Requirements for conditional Approval	----		
Members Present	Sri Justice Rangarajan, Prof. Geeta K. Vemuganti, Dr. C.T. Anitha, Dr. Savitri Sharma, Dr. Suvashisa Rana, and Dr. Insaf Ahmed		

Please note:

- Any amendments in the protocol must be informed to the Ethics committee and fresh approval taken.
- Any serious adverse event must be reported to the Ethics Committee within 48 hours in writing (mentioning the protocol No. or the study ID)
- Any advertisement placed in the newspapers, magazines must be submitted for approval.
- The results of the study should be presented in any of the academic forums of the hospital annually.
- If the conduct of the study is to be continued beyond the approved period, an application for the same must be forwarded to the Ethics Committee.
- It is hereby confirmed that neither you nor any of the members of the study team participated in the decision making/voting procedures.

Chairperson

(Justice Rangarajan)

Member Secretary

(Prof. Geeta K Vemuganti)

Appendix X

INFORMED CONSENT FORM Centre for Health Psychology University of Hyderabad

Title of the study: Role of Knowledge of Asthma and Psychosocial Factors in Adherence and Health Outcomes of Asthma Patients.

Researchers: P. Sharon Shulamite (Ph. D Research Scholar) & Dr. N. D. S Naga Seema (Assistant Professor)

Organization: Centre for Health Psychology, University of Hyderabad, Central University Campus PO, Hyderabad-500046, India. Telephone No. +91-40-23134790

In order to participate in this study, it is important and necessary to give your informed consent. By signing this informed consent, you are indicating that you understand the nature of the research and your role in the study and that you agree to participate in the same.

There is no right or wrong answer. You will also be asked to provide confidential and personal information about yourself. However there is no known potential harm or risks involved for you in the study.

Please consider the following before you sign the informed consent form,

- I understand that I am participating in a psychological study. ☐
- I understand that my identity will not be linked with my data, and all the information I provide will be confidential. ☐
- I understand that I will be provided with an explanation of research in which I participated and be given name and email id of an individual to contact if I have questions about this research. ☐
- I understand that certain facts about the study might be withheld from me, and the investigator might not tell me the full purpose of the study. However, the complete facts and true purpose of the study will be revealed to me on completion of the questionnaire. ☐
- I understand that my participation in the study is completely voluntary and that I can withdraw any time. ☐
- I am aware that I am not receiving any kind of incentives for the study and that I can approach the researcher any time regarding clarifications of doubts. ☐

By voluntarily signing this form I am stating that I understand all the information given above and that I am above 18 years of age, and consent to participate in the study.

NAME: _____

NAME: P. Sharon Shulamite

Signature of the participant

Signature of the researcher

Date: __/__/____

Date: __/__/____

Appendix XI

Role of knowledge of asthma and psychosocial factors in adherence and health outcomes of asthma patients

by P Sharon Shulamite



Librarian
Indira Gandhi Memorial Library
UNIVERSITY OF HYDERABAD
Central University P.O.
HYDERABAD-500 046.

Submission date: 17-May-2023 04:09PM (UTC+0530)

Submission ID: 2095349767

File name: MAIN_TEXT_Sharon_Shulamite_PhD_Thesis.docx (141.61K)

Word count: 19928

Character count: 110398

Role of knowledge of asthma and psychosocial factors in adherence and health outcomes of asthma patients

ORIGINALITY REPORT

10%	6%	5%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Hyderabad, Hyderabad Student Paper	2%
2	hdl.handle.net Internet Source	1%
3	"Abstracts PCNE working conference 2015", International Journal of Clinical Pharmacy, 2015 Publication	1%
4	"Abstracts", Annals of Behavioral Medicine, 04/2010 Publication	1%
5	"Session Abstracts", Annals of Behavioral Medicine, 04/2009 Publication	1%
6	irjpms.com Internet Source	1%
7	mafiadoc.com Internet Source	<1%

8	cyberleninka.org Internet Source	<1 %
9	Urrutia, Isabel, Urko Aguirre, Silvia Pascual, Cristóbal Esteban, Aitor Ballaz, Itziar Arrizubieta, and Iñaki Larrea. "Impact of Anxiety and Depression on Disease Control and Quality of Life in Asthma Patients", <i>Journal of Asthma</i> , 2012. Publication	<1 %
10	Gina Villar, Joanne Arciuli, Helen Paterson. "Linguistic Indicators of a False Confession", <i>Psychiatry, Psychology and Law</i> , 2013 Publication	<1 %
11	eprints.whiterose.ac.uk Internet Source	<1 %
12	researchonline.ljmu.ac.uk Internet Source	<1 %
13	Patricia L. Hardré, Alicia O. Burris. "What contributes to teaching assistant development: differential responses to key design features", <i>Instructional Science</i> , 2010 Publication	<1 %
14	pure.uvt.nl Internet Source	<1 %
15	doi.org Internet Source	<1 %

16

www.gerontologyindia.com

Internet Source

<1 %

17

Shana M. Wilson, Aimee W. Smith, Beth G. Wildman. "Teachers' perceptions of youth with obesity in the classroom", *Advances in School Mental Health Promotion*, 2015

Publication

<1 %

18

scholarscompass.vcu.edu

Internet Source

<1 %

19

David J. Madden, Linda K. Langley, Rebecca C. Thurston, Wythe L. Whiting, James A. Blumenthal. "Interaction of Blood Pressure and Adult Age in Memory Search and Visual Search Performance", *Aging, Neuropsychology, and Cognition*, 2010

Publication

<1 %

20

eprints.qut.edu.au

Internet Source

<1 %

21

Submitted to University of Greenwich

Student Paper

<1 %

22

scholarbank.nus.edu.sg

Internet Source

<1 %

23

www.verywellmind.com

Internet Source

<1 %

24

Submitted to Barry University

Student Paper

<1 %

25	www.mdpi.com Internet Source	<1 %
26	www.science.gov Internet Source	<1 %
27	ro.uow.edu.au Internet Source	<1 %
28	core.ac.uk Internet Source	<1 %
29	fui.edu.pk Internet Source	<1 %
30	Submitted to Royal College of Surgeons in Ireland Student Paper	<1 %
31	Submitted to University of Southampton Student Paper	<1 %
32	research.library.mun.ca Internet Source	<1 %
33	Erickson, Steven R., and Duane M. Kirking. "Variation in the distribution of patient-reported outcomes based on different definitions of defining asthma severity", Current Medical Research and Opinion, 2004. Publication	<1 %
34	docksci.com Internet Source	<1 %

35 Harald Hamre. "Anthroposophic therapy for asthma: A two-year prospective cohort study in routine outpatient settings", Journal of Asthma and Allergy, 2009

Publication

<1 %

36 Submitted to University of Liverpool

Student Paper

<1 %

37 digital.library.unt.edu

Internet Source

<1 %

38 tigerprints.clemson.edu

Internet Source

<1 %

Exclude quotes On

Exclude matches < 14 words

Exclude bibliography On

Appendix XII

Indian Journal of GERONTOLOGY

(a quarterly journal devoted to research on ageing)

Vol. 36 No. 1, 2022

EDITOR
K.L. Sharma

EDITORIAL BOARD

<i>Biological Sciences</i>	<i>Clinical Medicine</i>	<i>Social Sciences</i>
B.K. Patnaik	Vivek Sharma	Uday Jain
Bhaweshwar Singh	Prashanth Reddy	N.K. Chadha
S.P. Sharma	Shiv Gautam	Yatindra Singh Sisodia

CONSULTING EDITORS

A.V. Everitt (London), Harold R. Massie (New York),
Sally Newman (U.S.A.), Lynn McDonald (Canada),
Vinod Kumar (New Delhi), V.S. Natarajan (Chennai),
Gireswar Mishra (New Delhi), Arun. P. Bali (Delhi),
D. Jamuna (Tirupati), Arup K. Benerjee (U.K.),
Indira J. Prakash (Bangalore),
Sandra P. Hirst (Calgary, Canada),
P. Uma Devi (Kerala)

MANAGING EDITOR

Monica Rao

Contents

1. Effect of Bioactive Compound (-)-Epicatechin of <i>Phyllanthus Niruri</i> on Hepatic Stress Markers and Lipid Metabolic Profiles in D-galactosamine Induced Hepatitis in Aged Rats	1
<i>B. Shanmugam, K.R. Shanmugam, S. Ravi, K. Sathyavelu Reddy</i>	
2. Lower and Upper Body Flexibility Alterations in Senior Population of Punjab as a Function of Life Style Differences	13
<i>Pawandeep Kaur and Nishan Singh Deol</i>	
3. Impact of Out-of-Pocket Expenditure in Healthcare Seeking Behaviour of Geriatric Population in Rural Kerala	29
<i>Sindhu Joseph</i>	
4. Impact of Positive Health Resources on Psychological Distress in Elderly with Chronic Illness: Revelations from Latent Profile Analysis	45
<i>Naga Seema, P. Shulamite Sharon, Suvashisa Rana and Anuradha Nautiyal</i>	
5. Psychological States, Self-esteem, Leisure Motivation and Quality of Life among Institutionalized and Non-institutionalized Older Adults	68
<i>Padmaja Gadiraju, Sofiya Thomas, and C. Vanlalbruaii</i>	
6. Mobility Pattern of Elderly Population in Kolkata	81
<i>Sanchari Chandra and Sabiha Baig</i>	
7. Healthy Space for Ageing: Embedding Smart Home Technology	98
<i>Jayashree Dey</i>	
8. Retirement Transitions and Social Support among Teachers	113
<i>Deepthi Saligram and Venkatesha Murthy, C.G.</i>	
9. 'Ageing and Alone': Analysing Health Implications of being a Left Behind Elderly Parents in Kashmir	128
<i>Shahida Akhtar, Wakar Amin Zargar, and Shazia Manzoor</i>	
10. Impact of Covid-19 Pandemic on Mental Health of Community-Dwelling Older Adults	142
<i>Moghe Supriya A., and Nupoor Kulkarni</i>	

Indian Journal of Gerontology

2022, Vol. 36, No. 1, pp. 45–67

ISSN: 0971–4189, UGC No. – List B, Science–121

Impact of Positive Health Resources on Psychological Distress in Elderly with Chronic Illness: Revelations from Latent Profile Analysis

*Naga Seema, P. Shulamite Sharon, Suvashisa Rana,
and Anuradha Nautiyal*

Centre for Health Psychology, School of Medical Sciences,
University of Hyderabad, Hyderabad, (Telangana)

ABSTRACT

This study aimed to identify homogenous positive health resources profiles among the elderly with chronic illnesses and examined their impact on psychological distress. A Purposive sample of 120 elderly participants (60 males and 60 females) of ages varying from 60 years and above, with chronic illness, was administered three measures – Spiritual Index of Well-Being, Interpersonal Support Evaluation List (shortened version–12 items), Depression Anxiety Stress Scales (DASS–21). The tidy LPA package in R version 4.0.5 for latent profile analysis – a model-based clustering was used in the analysis of data. A three-profile solution provided the best fit for the data. The emerged latent profiles were named as high, moderate, and low positive health resources sub-groups. The high positive health resources sub-group reported significantly lower psychological distress compared to the other two sub-groups. The emerged three latent profiles of the elderly with chronic illness were confounded by the level of education and illness condition.

Keywords: Elderly with chronic illness, Spiritual well-being, Social support, Psychological distress,

Chronic disease is known for its prolonged course of illness or incurability. Chronic diseases are generally characterised by uncertain etiology, multiple risk factors, a long latency period, a prolonged course of illness, non-ontagious origin, functional impairment or disability, and incurability (McKenna and Collins, 2010). Existing evidence across the globe indicate that the elderly population suffers from chronic multiple health problems (World Health Organization, 2015). As the population ages, increasing numbers of people will live with at least one chronic condition (Stanton, *et al.*, 2007). Thus, the chronic illness of the elderly in the family is a growing concern.

Also, as age declines, physical and mental health deteriorates. Thus, elderly people are prone to physical and emotional health problems (Shin and Sok, 2012). Moreover, as living longer has its limitations, the dynamics of physical and mental health in the elderly are complex. Nevertheless, health is implied as a positive notion in terms of well-being and ability (Nordenfelt, 2017). Maintenance of health is reflected in terms of understanding the concept of positive health (Walmer, 1958). Positive health is an individual's ability to adapt and self-manage (Huber, *et al.*, 2011). Positive health comprises bodily functions, mental functions, perception, spiritual dimension, quality of life, social and societal participants, and daily functioning (Ibid.). Hence, it takes the positive health assets or resources as an approach to enhance health and longevity (Seligman, 2008).

The WHO (2021) suggests, "good general health and social care is important for promoting older people's health, preventing disease, and managing chronic illnesses." Over the last two decades, research has shed more light on the elements of living well despite chronic illness (Stanton, *et al.*, 2007). Moreover, self-perceived health is observed to be a significant predictor of mortality, physical morbidity, and disability among elderly people (Salman and Lee, 2019). Emphasising the healthy lifestyle of the elderly despite the presence of multidimensional challenges of chronic illness is therefore, desirable.

Spiritual well-being as a positive health resource is a significant factor that relates to an individual's meaning and purpose in life. Spiritual well-being is replicated in the value of relationships that an individual has with oneself, others, the environment, and God (King and Boyatzis, 2015; Linton, *et al.*, 2016).

Social support as a positive domain of health resources originates from social networks and relationships towards the well-being of individuals. It is believed that the quality of social support influences health differently (Windsor, *et al.*, 2016; Xing, *et al.*, 2017). Social support plays a pivotal role in various aspects of late life. Research findings suggest that social support is not only important for functional status in late life (Hajek, *et al.*, 2017), but also acts as a protective factor in decreasing both the vulnerability of older people and the risk of elder mistreatment (Melchiorre, *et al.*, 2013). The elderly with social support tend to have lower blood pressure (Birditt, *et al.*, 2012). Bennett and Shepherd (2013) have investigated that absence or lack of social support indicates major depressive symptoms in the elderly with chronic illnesses. Besides, low or no social support negatively impacts on elderly quality of life. Nevertheless, research findings suggest that a positive family environment facilitates positive growth among chronic illness patients (Rana and Nandinee, 2016).

Objectives of the Study

The purpose of the study was to identify the homogenous latent profiles of positive health resources among the elderly with chronic illnesses and examine their impact on psychological distress. The study has addressed three specific research questions: (1) Despite having a chronic illness, how do different elderly experience the important aspects of positive health resources at the same time? (2) Do the elderly with chronic illness differ in their psychological distress depending on their latent profile of positive health resources? (3) What are the significant confounding variables that influence their positive health resources?

Material and Methods

Participants

The participants included 120 elderlies with atleast one chronic illness (equal number of men and women) selected through purposive sampling from twin-city of Hyderabad and Secunderabad in the Telangana State of India. The age of the participants varied from 60 to 79 years. The participants were divided into two age groups: 60 to

69-year (64.2%) and 70 to 79-year (35.8%). Thus, 35 per cent of the participants had one chronic illness and 65 per cent of participants had more than one chronic illness. The participants with known psychiatric conditions were excluded from the study.

Measures Used

Spiritual Index of Well-Being (SIWB)

The Spiritual Index of Well-being (SIWB; Daaleman and Frey, 2004) measures spirituality in patient populations in health-related quality-of-life studies. The SIWB has 12 items with a 5-point Likert scale ranging from 1 = Not at all to 5 = Very true. The SIWB comprises two sub-scales – self-efficacy and life scheme. Each sub-scale has six items. Thus, the maximum score of a sub-scale was 30 and the minimum score was 6. A high score indicated a higher level of spirituality. With adequate psychometric properties, SIWB is observed to be a valid and reliable instrument (self-efficacy subscale: $\alpha = .86$, test-retest $r = .77$; life scheme subscale: $\alpha = .89$, test-retest $r = .86$; and whole scale: $\alpha = .91$, test-retest $r = .79$; (Ibid.).

Interpersonal Support Evaluation List (shortened version–12 items)

Interpersonal Support Evaluation List (ISEL; shortened version–12 items; (Cohen, *et al.*, 1985) is a shortened version of the original ISEL (40 items; Cohen and Hoberman, 1983) that measures the perceived social support. The measure consists of 12 items and three subscales – appraisal support, belonging support, and tangible support. Each item uses a 4-point scale ranging from 1 = Definitely false to 4 = Definitely true. Half of the items are reverse scored. Each sub-scale has four items. A higher score indicates a higher level of social support. The reliability and validity of the ISEL shortened version–12 items are observed to be adequate (Merz, *et al.*, 2014).

Depression Anxiety Stress Scales (DASS)

Depression Anxiety Stress Scales – DASS–21 version (Lovibond and Lovibond, 1995; DASS web page, 2018) has 21 items, each measured on a 4-point scale ranging from 0 = Did not apply to me at all to 3 = Applied to me very much or most of the time. DASS–21 has

three self-report scales to measure the emotional states of depression, anxiety, and stress. Each scale has seven items. A higher score indicates a higher level of depression, anxiety, and stress. The DASS-21 is, however, based on a dimensional rather than a categorical conception of psychological disorder. This scale is widely used because of its adequate psychometric properties and relevance.

Important demographic data of the participants, such as their gender, age, level of education, and illness condition was also collected from the participants.

Procedure

An informed consent form was specifically designed and used in this study as it involved assessment without having any potential risks. The participants were individually approached and the purpose of the study and proper instructions were explained to them. The participants were given assurance about the confidentiality of their responses. They were also informed that in the measures there would not be any 'right' or 'wrong' responses as there would be individual differences. The participants were informed that they had the right to withdraw from the study at any point in time. Further doubts about the assessment were clarified by the investigator. Participants were included only after understanding and signing their informed consent forms. The response for each item was recorded. The time to complete the measures ranged between 25–30 minutes. In case of any doubts regarding any item, clarification was given.

Statistical Analysis of Data

R version 4.0.5, RStudio Version 1.4.1106 with appropriate packages, and Microsoft Excel 2019 for analysing the obtained data were used.

To examine the profile of positive health resources of elderly with chronic illness, latent profile analysis (LPA) was run primarily using *tidy lap* package (Rosenberg, *et al.*, 2018) along with other associated packages of R. The *tidy lap* package is a simple interface for conducting and evaluating LPA models (Rosenberg, *et al.*, 2018). LPA – a model-based clustering (Hennig, *et al.*, 2015; Scrucca, *et al.*, 2017) –

is one of the most commonly used and relevant applications of the general mixture model where all measured variables are continuous (Pastor, *et al.*, 2007; Harring and Hodis, 2016). LPA is a statistical method for identifying homogeneous subgroups (latent profiles) within heterogeneous samples based on a set of measures. According to Rosenberg, *et al.*, (2018), “the *tidy* lap package allows users to specify different models that determine whether and how different parameters (i.e. means, variances, and covariances) are estimated, and to specify and compare different solutions based on the number of profiles extracted”. In LPA, the researcher specifies the number of hypothesized profiles in the data. For each participant, the probability of being in a given profile is estimated, and classification into one of the profiles is determined by that individual’s highest-profile probability (Cohen, *et al.*, 2017).

LPA was used to detect homogeneous groups (latent profiles) using five aspects of positive health resources during old age – two domains of spiritual well-being (*self-efficacy* and *life-scheme*) and three domains of social support (*appraisal support*, *belonging support*, and *tangible support*). LPA was computed on the entire sample ($N = 120$). One- to four-profile solutions using the above five aspects of positive health resources of elderly with chronic illness were also calculated. Out of six LPA models, the researchers specified Model 1, where variances = equal and covariances = 0.

Results

Table 1 shows commonly used fit statistics, such as Aikake information criterion (AIC), Bayesian information criterion (BIC), entropy, minimum of the diagonal of the average latent class probabilities for most likely class membership by assigned class (Prob. Min), maximum of the diagonal of the average latent class probabilities for most likely class membership by assigned class (Prob. Max), the proportion of the sample assigned to the smallest class (N Min.), proportion of the sample assigned to the largest class (N Max.), and the p-value of bootstrapped likelihood ratio test (BLRT_p) for one- through four-profile solutions for the sample.

Table 1
Parameters of fit for one- to four-profile solutions for positive health resource of elderly with chronic illness

<i>Number of profiles</i>	<i>AIC</i>	<i>BIC</i>	<i>Entropy</i>	<i>Prob. Min</i>	<i>Prob. Max</i>	<i>N Min.</i>	<i>N Max.</i>	<i>BLRT_p</i>
1	3,012.74	3,040.62	–	–	–	–	–	–
2	2,832.09	2,876.69	.91	.97	.99	.46	.54	.009
3	2,772.20	2,833.52	.87	.92	.95	.22	.45	.009
4	2,768.02	2,846.07	.82	.83	.92	.18	.33	.089

Note: AIC: Aikake information criterion; BIC: Bayesian information criterion; Prob. Min.: Minimum of the diagonal of the average latent class probabilities for most likely class membership, by assigned class; Prob. Max.: Maximum of the diagonal of the average latent class probabilities for most likely class membership, by assigned class; N Min.: Proportion of the sample assigned to the smallest class; N Max.: Proportion of the sample assigned to the largest class; BLRT_p: the p-value of bootstrapped likelihood ratio test.

As shown in Table 1, lower the value of the model information indicators, including AIC and BIC, better is the latent profile solution with increasing numbers of latent profiles. Compared to two-, three-profile solution had lower AIC and BIC. Entropy is a measure of classification uncertainty, where 1 reflects complete certainty of classification and 0 complete uncertainty (Celeux and Soromenho, 1996). Thus, entropy values close to one show good classification accuracy. The three-profile solution had an entropy of 0.87 which was greater than the four-profile solution. Though the AIC value of the four-profile solution was lower than the three-profile solution, the BLRT_p was not significant (BLRT_p = 0.08). Thus, based on the maximum number of fit statistics, the supremacy of the three-profile solution over alternative solutions was ascertained and the three-profile solution was considered the best-fitting model.

The elderly with chronic illness were divided into three profiles (sub-groups) by LPA. Profile 1 was the largest sub-group, which had 54 elderly participants, accounting for 45 per cent. This profile was characterised by the highest mean scores on all five aspects of positive health resources and was labelled the “*high positive health resources*” sub-group. Profile 2 consisted of 39 elderly participants accounting for 32.5 per cent. This profile was characterised by moderate scores on all

five aspects of positive health resources and was labelled the “*moderate positive health resources*” sub-group. Profile 3 was the smallest sub-group comprising 27 elderly participants (22.5%). This sub-group was characterised by the lowest mean scores on all five aspects of positive health resources and was labelled the “*low positive health resources*” sub-group. Table 2 reports the mean and standard deviation values on five aspects of positive health resources defining the latent profiles, total sample, and by profile.

Table 2

Mean and standard deviation values on five aspects of positive health resource defining profiles, total sample, and by profile

Variable	Total	Latent profiles		
		High	Moderate	Low
<i>Spiritual well-being</i>				
Self-efficacy	23.43 (4.59)	26.11 (2.55)	24.36 (2.29)	16.70 (3.49)
Life scheme	24.51 (4.75)	26.65 (2.38)	25.72 (4.33)	18.48 (3.86)
Social support				
Appraisal support	13.18 (2.22)	15.15 (0.79)	12.10 (1.45)	10.81 (1.62)
Belonging support	13.36 (1.94)	14.72 (1.37)	11.90 (1.43)	12.74 (1.74)
Tangible support	12.86 (2.34)	14.72 (1.29)	11.41 (1.70)	11.22 (2.10)
<i>n</i>	120	54	39	27
% of total sample	100	45	32.5	22.5

Note: Figures in parentheses are standard deviations

Figure 1 shows the profile plot for the three-profile solution using the standard scores (z-scores) of five aspects of positive health resources.

As the minimum and maximum scores of the five aspects of positive health resources varied, we calculated their z-scores ($N = 120$) to compare across the three latent profiles in the profile plot in Figure 1. Though the high positive health resources sub-group was higher in all the five aspects of positive health resources than the other two sub-groups, it was closer to the moderate positive health resources sub-group in the life scheme. Nevertheless, the low positive health resources sub-group was higher in belonging support than the

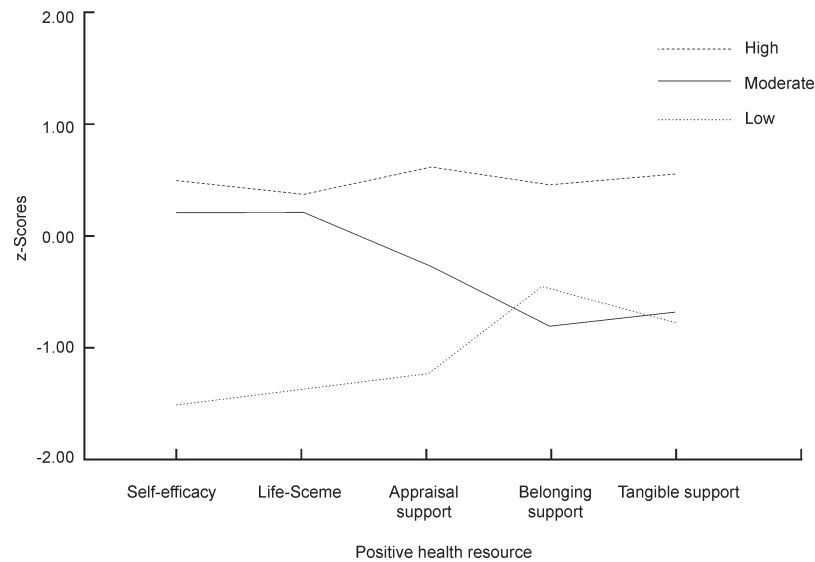
Figure 1*Profile of five aspects of positive health resource of elderly with chronic illness*

Figure 1: z-Scores of the five aspects of positive health resource across three latent profiles (sub-groups) of elderly with chronic illness – elderly with high positive health resource, moderate positive health resource, and low positive health resource.

moderate positive health resources sub-group, whereas both the sub-groups were closer to each other intangible support.

Impact of the profile of positive health resources on the psychological distress of elderly with chronic illness

After exploring and interpreting each identified latent profile from the best-fitting solution, we computed One-way ANOVA to examine how the elderly with chronic illness varied in their psychological distress (depression, anxiety, and stress) depending on their latent profile of positive health resources. The means, standard deviations, 95 per cent confidence intervals, and the results of One-way ANOVA on depression, anxiety, and stress are reported in Table 3.

Table 3
Comparison of psychological distress across three latent profiles (sub-groups)

	<i>High (n = 54)</i>		<i>Moderate (n = 39)</i>		<i>Low (n = 27)</i>			
	95% CI		95% CI		95% CI			
<i>Variables</i>	<i>M</i> <i>(SD)</i>	<i>Lower</i> <i>Upper</i>	<i>M</i> <i>(SD)</i>	<i>Lower</i> <i>Upper</i>	<i>M</i> <i>(SD)</i>	<i>Lower</i> <i>Upper</i>	<i>F</i> (2,117)	<i>Partial</i> η^2
Depressio n	4.89 (2.82)	3.64 6.14	9.64 (5.27)	8.17 11.11	17.70 (6.32)	15.94 19.47	68.93***	.54
Anxiety	4.41 (4.28)	3.01 5.80	10.26 (6.21)	8.62 11.90	19.85 (5.17)	17.88 21.82	80.44***	.58
Stress	5.96 (5.95)	4.45 7.48	8.97 (5.35)	7.19 10.76	18.44 (5.30)	16.30 20.59	44.96***	.43

Note: *** $p < .001$

From Table 3, it is observed that the One-way ANOVA conducted on the depression scores of the elderly with chronic illness revealed a statistically significant effect of the profile of positive health resources, $F(2,117) = 68.93$, $p < .001$. The effect size was large (Partial $f^2 = .54$) suggesting about 54 per cent of the variance of depression scores was due to the differences in the profile of positive resources of the elderly with chronic illness. Post-hoc comparisons using Tukey's HSD test were run for multiple comparisons between the latent profiles (sub-groups). From the results of the Tukey's HSD test, it is revealed that the elderly participants belonging to the low positive health resources sub-group ($M = 17.70$, $SD = 6.32$) were significantly more depressed compared to their counterparts in the moderate positive health resources sub-group ($M = 9.64$, $SD = 5.27$, $p < .001$) and high positive health resources sub-group ($M = 4.89$, $SD = 2.82$, $p < .001$). Moreover, the elderly participants belonging to the moderate positive health resources sub-group were significantly more depressed compared to their counterparts in the high positive health resources sub-group ($p < .001$).

The One-way ANOVA conducted on the anxiety scores of the participants showed a statistically significant effect of the profile of positive health resources, $F(2,117) = 80.44$, $p < .001$. The effect size was large (Partial $f^2 = .58$) suggesting about 58 per cent of the variance of anxiety scores was due to the differences in the profile of positive

health resources of the elderly with chronic illness. From the results of Tukey's HSD test, it is revealed that the anxiety scores of the elderly participants belonging to the low positive health resources sub-group ($M = 19.85$, $SD = 5.17$) were significantly higher compared with their counterparts in the moderate positive health resources sub-group ($M = 10.26$, $SD = 6.21$, $p < .001$) and high positive health resources sub-group ($M = 4.41$, $SD = 4.28$, $p < .001$). Moreover, the elderly participants belonging to the moderate positive health resources sub-group had significantly higher anxiety scores compared to their counterparts in the high positive health resources sub-group ($p < .001$).

The One-way ANOVA conducted on the stress scores of the participants showed a statistically significant effect of the profile of positive health resources, $F(2,117) = 44.96$, $p < .001$. The effect size was large (Partial $f^2 = .43$) suggesting about 43 per cent of the variance of stress scores was due to the differences in the profile of positive health resources of the elderly with chronic illness. From the results of Tukey's HSD test, it is revealed that the elderly participants belonging to the low positive health resources sub-group were observed to be significantly more stressful ($M = 18.44$, $SD = 5.30$) compared with their counterparts in the moderate positive health resources sub-group ($M = 8.97$, $SD = 5.35$, $p < .001$) and high positive health resources sub-group ($M = 5.96$, $SD = 5.95$, $p < .001$). Moreover, the elderly participants belonging to the moderate positive health resources sub-group were significantly more stressed compared with their counterparts in the high positive health resources sub-group ($p = .032$).

Confounding variables in understanding the positive health resources of the elderly with chronic illness

After examining the impact of the profile of positive health resources on the psychological distress of elderly with chronic illness, we used the χ^2 test to examine the association between profile membership and the important demographic characteristics of the elderly with chronic illness to identify the confounding variables. The frequency and percentage of the cases under each important

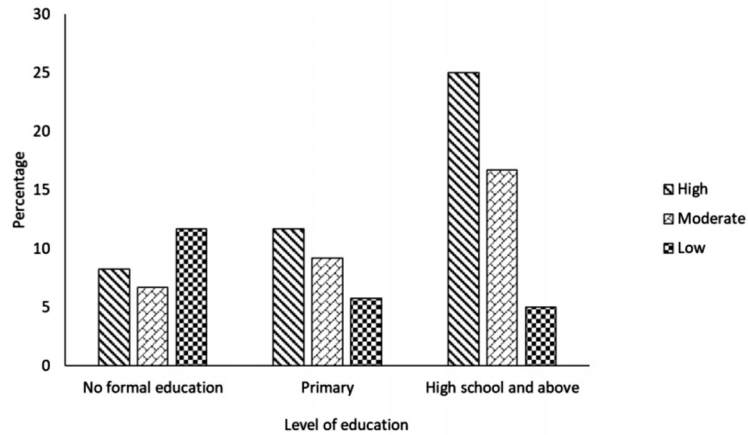
demographic characteristic and the results of the χ^2 are presented in Table 4.

Table 4
Association between the latent profiles and the important demographic characteristics of the elderly with chronic illness

Demographic Characteristics	Latent profiles			χ^2
	High (n = 54)	Moderate (n = 39)	Low (n = 27)	
	f(%)	f(%)	f(%)	
<i>Gender</i>				
Female	25 (20.8)	21 (17.5)	14 (11.7)	0.56, p = .754
Male	29 (24.2)	18 (15.0)	13 (10.8)	
<i>Age</i>				
60–69 years	32 (26.7)	27 (22.5)	18 (15.0)	1.07, p = .585
70–79 years	22 (18.3)	12 (10.0)	9 (7.5)	
<i>Level of education</i>				
No formal education	10 (8.3)	8 (6.7)	14 (11.7)	12.92, p = .012
Primary	14 (11.7)	11 (9.2)	7 (5.8)	
High school and above	30 (25.0)	20 (16.7)	6 (5.0)	
<i>Illness condition</i>				
One illness	13 (10.8)	21 (17.5)	8 (6.7)	9.26, p = .010
More than one illness	41 (34.2)	18 (15.0)	19 (15.8)	

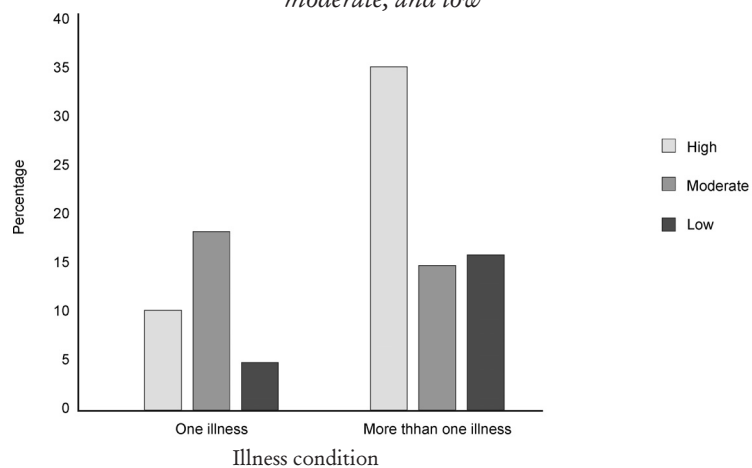
To determine whether the three profiles of elderly participants were confounded by gender, a Profile (3) X Gender (2) χ^2 test of association was computed. The results indicated that the number of male and female patients was not significantly different across the three clusters, $\chi^2 = 0.56$, $p = .754$. Similarly, no significant association was observed between three latent profiles and two age groups, $\chi^2 = 1.07$, $p = .585$. Nevertheless, the results of Profile (3) X Education (3) χ^2 test of association revealed that the levels of education of the elderly with chronic illness were significantly different across the three latent profiles, $\chi^2 = 12.92$, $p = .012$. Out of the three profiles, the high positive health resources sub-group had a comparatively higher percentage of elderly with high school and above level of education (25%). The percentages of the levels of education across three profiles are presented in Figure 2.

Figure 2
Level of education of the elderly across three latent profiles (sub-groups) – high, moderate, and low



Further, the results of the χ^2 test found a significant association between three latent profiles and two illness conditions, $\chi^2 = 9.26$, $p = .010$. Among the three profiles, the high positive health resources sub-group had a comparatively higher percentage of elderly with more than one illness condition (34.2%). The percentages of the illness conditions across three profiles are presented in Figure 3.

Figure 3
Presence of one or more illnesses across three latent profiles (sub-groups)-high, moderate, and low



Discussion

The first question in this study has sought to determine how different elderly with chronic illness experience important aspects of positive health resources at the same time. Through LPA, we have identified three meaningful homogeneous latent profiles or sub-groups in the elderly participants with chronic illness based on their experience of five important aspects of positive health resources – two domains of spiritual well-being (*self-efficacy* and *life-scheme*) and three domains of social support (*appraisal support*, *belonging support*, and *tangible support*). Thus, the elderly with chronic illness, who initially formed a group, have been classified into three homogenous latent profiles or sub-groups – *high positive health resources sub-group*, *moderate positive health resources sub-group*, and *low positive health resources sub-group* – when their positive health resources are taken into consideration. The findings suggest that the aspects of positive health resources, specifically spiritual well-being and social support, are not uniformly experienced by the elderly with chronic illness. The disparity in degree and kind of positive health resources in terms of spiritual well-being and social support leads with the occurrence of different homogenous profiles or sub-groups.

The second question in this study focuses on how the elderly with chronic illness differ in their psychological distress depending on their latent profile of positive health resources. In this study, psychological distress is operationalised through three distinct constructs, such as depression, anxiety, and stress. The findings posit that there is a significant effect of the latent profile of positive health resources on the psychological distress of the elderly with chronic illness. The results reveal that the elderly with chronic illness falling under the high positive health resources sub-group have reported significantly low levels of depression, anxiety, and stress compared with the elderly in the moderate positive health resources sub-group and low positive health resources sub-group. The elderly with chronic illness falling under the low positive health resources sub-group has reported the highest level of depression, anxiety, and stress.

The present study contributes to the literature studies in various directions. The findings are consistent with recent studies stating that higher wellbeing and social support have been associated with lesser psychological distress in the elderly. There is a shred of evidence showing an association between low levels of spiritual beliefs with poor mental health. (Wilt, *et al.*, 2017). Another study showed that strong social support is a good predictor of improved mental health conditions in the elderly (Gyasi, *et al.*, 2018). Moreover, meaningful interpersonal relations help minimize psychological stress and enhances endocrine and immune functioning in the elderly (Yang, *et al.*, 2016). Psychological distress was associated with social dysfunction in the elderly (Matud and García, 2019). Self-efficacy which is effective through support from neighbours or friends further increases health-promoting behaviours and healthy ageing (Wu and Sheng, 2019). Also, self-efficacy in the presence of perceived social support mediates psychological wellbeing factors (Fatima, *et al.*, 2018).

The third question in this research is to explore the major confounding variables affecting the positive health resources of the elderly with chronic illness. The results show that the identified three latent profiles or sub-groups of the elderly are not confounded by gender and age group. This suggests that experiencing positive health resources in terms of spiritual well-being and social support is not dependent on the gender or age group of the elderly. For this, the elderly participants of both the gender and age groups are distributed across the three latent profiles.

On the contrary, a longitudinal study revealed that older women reported higher levels of spirituality than men, and those who had a religion reported higher scores of spirituality than their counterparts who had no religion, and also older adults who reported higher levels of social support and flexibility also reported higher levels of spirituality (Bailly, *et al.*, 2018). In a community-dwelling, elderly women with at least one chronic illness were considered in the study, results show that social support has been associated with high sociability and lower depression (Warner, *et al.*, 2019). Among elderly men, tangible support, affectionate support, overall support, and positive social interactions cognitive decline slow down contribute to (Pillemer, *et al.*, 2018). Age

and gender have many inclinations in outcome measures and subjective measures like spiritual well-being, mental health, health-related quality of life, post-traumatic growth, and positive self-regard. Also, Age and gender have curvilinear effects on spiritual well-being and health-related quality of life (Roberts, *et al.*, 2019).

Nevertheless, significant associations are observed between the identified three latent profiles and the levels of education and illness condition of the elderly with chronic illness. This indicates that the identified three latent profiles of the elderly with chronic illness are confounded by levels of education and illness condition. One interesting finding is that out of the three latent profiles, the high positive health resources sub-group has a comparatively higher percentage of elderly with high school and above level of education. This signifies that the elderly participants with a higher level of education are more resourceful in terms of their spiritual well-being and social support. Education appears to foster positive health despite the challenges of chronic illness in elderly participants. Similarly, it is somewhat surprising that the high positive health resources sub-group has a comparatively higher percentage of elderly with more than one illness condition. This finding suggests that when there is a presence of more than one chronic illness condition the elderly participants seek more positive health resources in terms of spiritual well-being and social support. When the complexities increase, the orientation towards positive health resources also enhances in the elderly population.

In agreement with the present study, education plays a significant role in the social well-being of the elderly (Singh and Kiran, 2015). Elderly men having at least one chronic comorbid condition perceived better quality of life than elderly women (Deshmukh, *et al.*, 2015). Moreover, systematic reviews in Asia and across 13 countries reported a strong association between social support and depression (Schwarzbach, *et al.*, 2014). 85.20 per cent of elderly Chinese had at least one chronic disease (Wu and Sheng, 2019).

During our review, we have never come across any studies using LPA on the positive health resources of the elderly with chronic illness regarding their spiritual well-being and social support. This

study appears to be the first study to use the *tidy LPA* package to identify latent profiles of positive health resources of elderly with chronic illness. Thus, the findings of our study have brought new dimensions of research in the area of positive living despite the challenges of chronic illness during old age. The yields in this study are unique compared to those of others as the study has adopted a new technique to examine the impact of spiritual well-being and social support, two important aspects of positive health, on three distinct dimensions of psychological distress (depression, anxiety, and stress) of the elderly population. It is also understood that LPA could be a parsimonious method to model positive health resources heterogeneity in any participants with chronic illness.

Consistent with the existing literature, this study has observed that the elderly having high positive health resources are less vulnerable to depression, anxiety, and stress. The level of education and illness condition as confounding variables is one of the striking findings of the study. What is curious about the findings is that the latent profile having a high level of positive health resources has a comparatively higher percentage of elderly having higher education level and more than one chronic illness condition.

Limitations

Nevertheless, the most important limitation lies in the fact that the participants are chosen from one region. Therefore, the role of culture has not been studied. More research needs to be carried out by adopting a mixed-method research design for further exploration in this area involving elderly participants from various regions. The study has practical implications as well. It supports the formulation of integrated psychosocial interventions towards minimising the psychological distress factors – depression, anxiety, and stress. The study suggests the need for health psychologists under geriatric care at the individual and community levels.

Conclusion and Suggestions

The findings of the study posit that there is a significant impact of positive health resources on psychological distress in the elderly with

chronic illness. The emerged three latent profiles or sub-groups of elderly with chronic illness are confounded by the level of education and illness condition. The findings of the study are suggestive of an interaction between spiritual well-being, social support, psychological distress, and demographic characteristics of the elderly with chronic illness. More research, however, is required to develop a deeper understanding of the area by involving a mixed-method design with elderly participants from various regions.

Acknowledgments: The researchers would like to express their deep gratitude to all the elderly participants for their kind and voluntary participation.

References

- Bailly, N., Martinent, G., Ferrand, C., Agli, O., Giraudeau, C., Gana, K., and Roussiau, N. (2018). Spirituality, social support, and flexibility among older adults: A five-year longitudinal study. *International Psychogeriatrics*, 30(12), 1745–1752.
- Bennett, K.S., and Shepherd, J.M. (2013). Depression in Australian women: The varied roles of spirituality and social support. *Journal of Health Psychology*, 18(3), 429–438.
- Birditt, K.S., Newton, N., and Hope, S. (2014). Implications of Marital/Partner Relationship Quality and Perceived Stress for Blood Pressure Among Older Adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 69(2), 188–198.
- Celeux, G. and Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification*, 13, 195–212.
- Cohen, J.R., Menon, S.V., Shorey, R.C., Le, V.D., and Temple, J.R. (2017). The distal consequences of physical and emotional neglect in emerging adults: A person-centered, multi-wave, longitudinal study. *Child Abuse and Neglect*, 63, 151–161.
- Cohen, S., and Hoberman, H. (1983). Positive events and social supports as buffers of life change stress. *Journal of Applied Social Psychology*, 13, 99–125.

- Cohen, S., Mermelstein, R., Kamarck, T., and Hoberman, H.M. (1985). Measuring the functional components of social support. In Sarason, I.G. and Sarason, B.R. (eds), *Social support: theory, research, and applications*. The Hague, Netherlands: Martinus Nijhoff.
- Daaleman, T.P., and Frey, B.B. (2004). The Spirituality Index of Well-Being: A new instrument for health-related quality-of-life research. *The Annals of Family Medicine*, 2(5), 499–503.
- DASS web page (July 26, 2018). Retrieved from <http://www2.psy.unsw.edu.au/groups/dass/>
- Deshmukh, P.R., Dangre, A.R., Rajendran, K.P., and Kumar, S. (2015). Role of social, cultural, and economic capitals in perceived quality of life among old age people in Kerala, India. *Indian Journal of Palliative Care*, 21(1), 39–44.
- Fatima, S., Sharif, S., and Khalid, I. (2018). How does religiosity enhance psychological well-being? Roles of self-efficacy and perceived social support. *Psychology of Religion and Spirituality*, 10(2), 119–127.
- Feng, Z., Lugtenberg, M., Franse, C., Fang, X., Hu, S., Jin, C., et al. (2017). Risk factors and protective factors associated with incident or increase of frailty among community-dwelling older adults: A systematic review of longitudinal studies. *PLoS ONE* 12(6). e0178383.
- Gyasi, R.M., Phillips, D.R., and Abass, K. (2019). Social support networks and psychological wellbeing in community-dwelling older Ghanaian cohorts. *International Psychogeriatrics*, 31(7), 1047–1057.
- Hajek, A., Brettschneider, C., Mallon, T., van der Leeden, C., Mamone, S., Wiese, B., Weyerer, S., Werle, J., Fuchs, A., Pentzek, M., Riedel-Heller, S.G., Stein, J., Bickel, H., Weeg, D., Hesel, K., Wagner, M., Maier, W., Scherer, M., Luck, T., and König, H.-H. (2017). How does social support affect functional impairment in late life? Findings of a multicenter prospective cohort study in Germany. *Age and Ageing*, 46(5), 813–820.
- Harring, J.R., and Hodis, F.A. (2016). Mixture modeling: Applications in educational psychology. *Educational Psychologist*, 51(3–4), 354–367.

- Hennig, C., Meila, M., Murtagh, F., and Rocci, R. (eds). (2015). *Handbook of Cluster Analysis*. New York: Chapman and Hall/CRC.
- Huber, M., Knottnerus, J.A., Green, L., van der Horst, H., Jadad, A.R., Kromhout, D., Leonard, B., Lorig, K., Loureiro, M. I., van der Meer, J. W., Schnabel, P., Smith, R., van Weel, C., and Smid, H. (2011). How should we define health? *BMJ (Clinical research ed.)*, 343, d4163.
- King, P.E., and Boyatzis, C. (2015). Religious and spiritual development. In M. E. Lamb and R. M. Lerner (eds), *Handbook of child psychology and developmental science: Socioemotional processes* (7th ed. Vol. 3, pp. 975–1021). Hoboken, NJ: John Wiley and Sons.
- Linton, M. J., Dieppe, P., and Medina-Lara, A. (2016). Review of 99 self-report measures for assessing wellbeing in adults: exploring dimensions of well-being and developments over time. *BMJ Open*, 6(7), 1–16.
- Lovibond, S.H. and Lovibond, P.F. (1995). *Manual for the Depression Anxiety and Stress Scales* (2nd ed.). Sydney: Psychology Foundation.
- Matud, M.P., and García, M. C. (2019). Psychological distress and social functioning in elderly Spanish people: A gender analysis. *International Journal of Environmental Research and Public Health*, 16(3), 341.
- McKenna, M., and Collins, J. (2010). Current issues and challenges in chronic disease control. In P. L. Remington, R. C. Brownson, and M. V. Wegner (eds), *Chronic Disease Epidemiology and Control* (2nd ed., pp. 1–24). Washington (DC). American Public Health Association.
- Melchiorre, M.G., Chiatti, C., Lamura, G., Torres-Gonzales, F., Stankunas, M., Lindert, J., Ioannidi-Kapolou, E., Barros, H., Macassa, G., and Soares, J.F.J. (2013). Social Support, Socio-Economic Status, Health and Abuse among Older People in Seven European Countries. *PLOS ONE*, 8(1), e54856.
- Merz, E.L., Roesch, S.C., Malcarne, V.L., Penedo, F.J., Llabre, M.M., Weitzman, O.B., Navas-Nacher, E.L., Perreira, K.M., Gonzalez, F., Ponguta, L.A., Johnson, T.P., and Gallo, L.C. (2014). Validation of Interpersonal Support Evaluation List–12 (ISEL–12) scores among English- and Spanish-Speaking Hispanics/Latinos

- from the HCHS/SOL Sociocultural Ancillary Study. *Psychological Assessment*, 26(2), 384–394.
- Moberg, D.O., and Others. (1971). *Spiritual Well-Being: Background and Issues* (White House Conference on Aging). Superintendent of Documents, US Government Printing Office, Washington, D. C.
- Montero, I. and Leon, O.G. (2007). A guide for naming research studies in Psychology. *International Journal of Clinical and Health Psychology*, 7(3), 847–862.
- Nordenfelt, L. (2017). On concepts of Positive Health. In T. Schramme and S. Edwards (eds), *Handbook of the Philosophy of Medicine*. Springer, Dordrecht.
- Pastor, D.A., Barron, K.E., Miller, B.J., and Davis, S.L. (2007). A latent profile analysis of college students' achievement goal orientation. *Contemporary Educational Psychology*, 32(1), 8–47.
- Pillemer, S., Ayers, E., and Holtzer, R. (2019). Gender-Stratified Analyses Reveal Longitudinal Associations Between Social Support and Cognitive Decline in Older Men. *Aging and Mental Health*, 23(10), 1326–1332.
- Rana, S., and Nandinee, D. (2016). Profile of adolescents' positive emotions: An indicator of their psychological well-being. *Psychological Studies*, 61(1), 32–39.
- Rana, S., Kumar, G.L., Seema, N., and Nandinee, D. (2021). Profile of diabetes patients' chronic illness care in India and its role in their adherence. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 15(1), 303–308.
- Rana, S., Rufus, N., Seema, N.D. S.N., and Nandinee, D. (2016). Role of expressed emotion and gender in adversarial growth of people with type 2 diabetes. *Journal of the Indian Academy of Applied Psychology*, 42(2), 264–272.
- Roberts, L., Banyard, V., Grych, J., and Hamby, S. (2019). Well-being in rural Appalachia: Age and gender patterns across five indicators. *Journal of Happiness Studies*, 20(2), 391–410.
- Rosenberg, J.M., Beymer, P.N., Anderson, D.J., Van Lissa, C.J., and Schmidt, J. A. (2018). tidyLPA: An R Package to Easily Carry Out Latent Profile Analysis (LPA) Using Open-Source or Commercial Software. *Journal of Open Source Software*, 3(30), 978

- Salman, A., and Lee, Y.-H. (2019). Spiritual practices and effects of spiritual well-being and depression on elders' self-perceived health. *Applied Nursing Research*, 48, 68–74.
- Schwarzbach, M., Lupp, M., Forstmeier, S., *et al.* (2014). Social relations and depression in late life-a systematic review. *International Journal of Geriatric Psychiatry*, 29, 1–21.
- Scrucca, L., Fop M., Murphy T. B., and Raftery A. E. (2017). mclust 5: clustering, classification and density estimation using Gaussian finite mixture models. *The R Journal*, 8(1), 205–233.
- Seligman, M.E.P. (2008). Positive Health. *Applied Psychology*, 57(s1), 3–18.
- Shin, S.H. and Sok, S.R. (2012). A comparison of the factors influencing life satisfaction between Korean older people living with family and living alone. *International Nursing Review*, 59(2), 252–258.
- Singh, B., and Kiran, U.V. (2015). Impact of educational status on social well-being of elderly. *International Journal of Research*, 2(1), 350–356.
- Stanton, A.L., Revenson, T.A., and Tennen, H. (2007). Health Psychology: Psychological Adjustment to Chronic Disease. *Annual Review of Psychology*, 58(1), 565–592.
- Steptoe, A., Deaton, A., and Stone, A.A. (2015). Subjective well being, health, and ageing. *The Lancet*, 385(9968), 640–648.
- Walmer, C.R. (1958). The Concept of Positive Health. *American Association of Industrial Nurses Journal*, 6(3), 26–29.
- Warner, C.B., Roberts, A.R., Jeanblanc, A.B., and Adams, K.B. (2019). Coping resources, loneliness, and depressive symptoms of older women with chronic illness. *Journal of Applied Gerontology*, 38(3), 295–322.
- Wilt, J.A., Grubbs, J.B., Pargament, K.I., and Exline, J.J. (2017). Religious and spiritual struggles, past and present: Relations to the big five and well-being. *The International Journal for the Psychology of Religion*, 27(1), 51–64.
- Windsor, T.D., Rioseco, P., Fiori, K.L., Curtis, R.G., and Booth, H. (2016). Structural and functional social network attributes moderate the association of self-rated health with mental health in midlife and older adults. *International Psychogeriatrics*, 28(1), 49–61.

- World Health Organization. (2015). *World report on aging and health*; Geneva 27, Switzerland
- World Health Organization. (2021a). "Ageing." Retrieved April 25, 2021, from https://www.who.int/health-topics/ageing#tab=tab_1
- World Health Organization. (2021b). "Mental health of older adults (12 December 2017)." Retrieved April 25, 2021, from <https://www.who.int/news-room/fact-sheets/detail/mental-health-of-older-adults>
- Wu, F., and Sheng, Y. (2019). Social support network, social support, self-efficacy, health-promoting behaviour and healthy aging among older adults: A pathway analysis. *Archives of Gerontology and Geriatrics*, 85, 103934.
- Xing, C., Zhang, X., and Cheng, S.T. (2017). Would more social partners leads to enhanced health? The paradox between quantity and quality. *PsyCh journal*, 6(3), 219–227.
- Yang, Y.C., Boen, C., Gerken, K., Li, T., Schorpp, K., and Harris, K.M. (2016). Social relationships and physiological determinants of longevity across the human life span. *Proceedings of the National Academy of Sciences of the United States of America*, 113(3), 578–583.