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Association Between Life's Essential 8 and Frailty in Adults with Asthma

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Abstract

Objectives: To investigate the correlation between Life's Essential 8 (LE8) and frailty in adults with asthma using data from National Health and Nutrition Examination Survey (NHANES).
Methods: We conducted a cross-sectional study by NHANES data (2001-2018) to assess the relationship between LE8 and frailty in asthma patients. Multiple logistic regression, restricted cubic spline (RCS) analysis, and subgroup analyses were performed to evaluate potential associations.
Results: Among the 3, 238 of 91 351 participants, 1066 asthma patients demonstrated frailty and 2172 asthma patients not. When comparing the groups with moderate and high LE8 scores to the group with low LE8 scores, the odds ratios (ORs) (95% confidence intervals) for frailty in asthma were 0.39 (0.27, 0.56) and 0.15 (0.08, 0.27),respectively. Every 10-point increment of LE8 scores was negatively correlated with frailty in asthma. Similar trends were observed for health behavior and health factor scores. ORs for frailty in asthma were 0.54 (0.41, 0.72) and 0.41(0.27, 0.64) when comparing the groups with moderate and high health behavior scores to the group with low health behavior scores. ORs for frailty in asthma were 0.68 (0.48, 0.98) and 0.50 (0.28, 0.88) when comparing the groups with moderate and high health factor scores to the group with low health factor scores. ORs for frailty in asthma were 0.78 (0.72, 0.84) both in the every 10-point increment of health behavior and health factor scores.
Conclusions: Higher LE8 scores, along with health behavior and health factor scores, were linearly and inversely associated with the prevalence frailty in adults with asthma, suggesting that improved LE8 may reduce frailty risk in asthma population.

Keywords

Life's essential 8, health behavior scores, health factor scores, frailty, asthma

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Introduction

Frailty, characterized by diminished physical function and heightened vulnerability to stress, predisposes individuals to falls, disability, and increased mortality.[1] Previous studies indicated that frailty affects 10.7% of community-dwelling older adults[2] and 24% in adults over 50 years,[3] and demonstrated close positive correlation with age.[4] Therefore, frailty loads a great burden on individuals, society and public health. Asthma, a heterogeneous disease driven by chronic airway inflammation and immune abnormalities, ranks as the second the most common and leading cause of death in chronic respiratory diseases.[5] Globally, approximately 300 million people suffer from asthma, with nearly

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250 000 asthma-related deaths reported annually.[6,7] Notably, up to 10% of asthma patients suffer severe asthma and the treatment is very tricky with a high mortality.[8,9] Given their high prevalence and substantial adverse consequences, both frailty and asthma present growing public health challenges. Previous study indicated that there is close association between frailty and asthma, with shared risk factors and mechanisms.[10] Therefore, understanding the frailty risk in asthma is crucial for the intervention of asthma.[10]

Life's essential 8 (LE8), including health behaviors (such as diet, sleep time, physical activity, exposure to nicotine) and health factors (such as body mass index (BMI), non-high-density lipoprotein cholesterol (HDL-C), blood glucose and blood pressure), is widely recommended as an ideal indicator for improving and maintaining cardiovascular health (CVH). High LE8 scores were reported beneficial to chronic non-cardiovascular diseases such chronic kidney disease, stroke, nonalcoholic fatty liver disease, cancer and dementia.[11-17] However, it is not clear whether there is correlation between LE8 scores and frailty in asthma. In the present study, we explored the prevalence of frailty in asthma and assessed the role of LE8 in the prevention of asthmatic frailty, by analyzing the database of U.S. National Health and Nutrition Examination Survey (NHANES). All raw data can be downloaded from the website:https://www.cdc.gov/nchs/nhanes/?CDC_AAref_Val=https://www.cdc.gov/nchs/nhanes/index.htm.

Materials and Methods

Study Design and Population

The National Health and Nutrition Examination Survey (NHANES) is a nationwide health survey program led by the Centers for Disease Control and Prevention (CDC), designed to comprehensively assess the health and nutritional status of U.S. residents. Since its launch in 1960, the project has become one of the most important data sources in the field of public health in the United States. The early NHANES from 1960 to 1994 were conducted intermittently (every few years) rather than an annual survey. Since 1999, NHANES has been conducting surveys on a continuous basis, starting on January 1 for each new survey year, and survey data are usually published on a biennial cycle.

The data was obtained from NHANES, a cross-sectional survey, designed with stratification and multistage probability sampling. The survey protocol was approved by the National Center for Health Statistics Research Ethics Review Board.[18] Among 91 351 participants in the database of NHANES (2001-2018), 3238 individuals suffering asthma including 1066 patients with frailty and 2172 without frailty were enrolled in the study. Exclusion criteria included: age under 20 years (n = 41 150), no covariates (n = 13 865), no LE8 data (n = 13 652), and non-asthma (n = 19 446). The flow chart of the study was shown in Figure 1.

Covariates

According to previous study,[19] these individuals who answered "YES" for "Ever been told you have asthma?" in the Medical conditions questionnaire(MCQ)010 were identified as asthma patients. Coronary heart disease (CHD), cancer and family history of asthma were defined when participants self-reported in questionnairesMCQ160 C,MCQ220, MCQ300 B, respectively. Participants with diabetes were identified by self-reported diabetes(DIQ010) and use of anti-diabetic medications (DIQ070).[20] Chronic obstructive pulmonary disease (COPD) was identified by spirometry (forced expiratory volume in one second[FEV1]/forced vital capacity[FVC] < 0.7, post-bronchodilator) and questionnaires (mcq160 g and mcq160k).[21] Hypertension patients were identified by self-reported hypertension(MCQ100) and use of anti-hypertension drugs(MCQ110).[22] Other covariates in the study included sex, age, education levels, race, family income status, smoke, alcohol. Age groups were classified into 20-39 years, 40-59 years, and ≥60 years. Poverty income ratio (PIR) was scaled into low (PIR≤1.3), moderate (1.3 < PIR <3.5) and high (PIR≥3.5).[23] According to previous study,[24] never smokers were defined as these who reported never or <100 cigarettes in lifetime, former smokers were these who reported ≥100 cigarettes but no cigarette currently, current smokers reported ≥100 cigarettes and persistent smoking. Alcohol consumption was classified as never (<12 drinks forever), former (≥12 drinks in one year but no drink last year, or ≥12 drinks in all but without drinking last year), mild (1 drink/day and 2 drinks/day for female and males), moderate (≥2 drinks/day and ≥3 drinks/day for female and males, or 2≤binge drinking <5/month), heavy (≥3 drinks/day and ≥4 drinks/day for female and males or 2∼5 binged drinks/ month).[25,26] BMI was grouped as under/normal weight (BMI<25), overweight (25≤BMI<30) and obese (BMI≥30).[27]

Definition of LE8

LE8 comprises eight key cardiovascular health indicators(CVH) across two domains: health behaviors (physical activity, diet, nicotine exposure, and sleep duration) and health factors (body mass index [BMI], non-high-density lipoprotein cholesterol [non-HDL-C], blood glucose, and blood pressure).[28] According to the 2015 Healthy Eating Index (HEI), diet metrics were calculated with the first 24-hour recall information during the interview in the mobile examination center (MEC).[29] The data of physical activity, nicotine exposure and sleep time were derived from self-reported information. The measurements of weight, height, non-HDL-C, blood glucose, and blood pressure were completed in MEC.[30] According to American Heart Association (AHA), the unweighted average of these 8 indicators of which each was scored points from 0 to 100 generated the LE8 scores from 0 to 100 points. Based on the LE8 scores, the participants were assigned as low CVH (0-49 points), moderate CVH (50-79 points) and high CVH (80-100 points).[30]

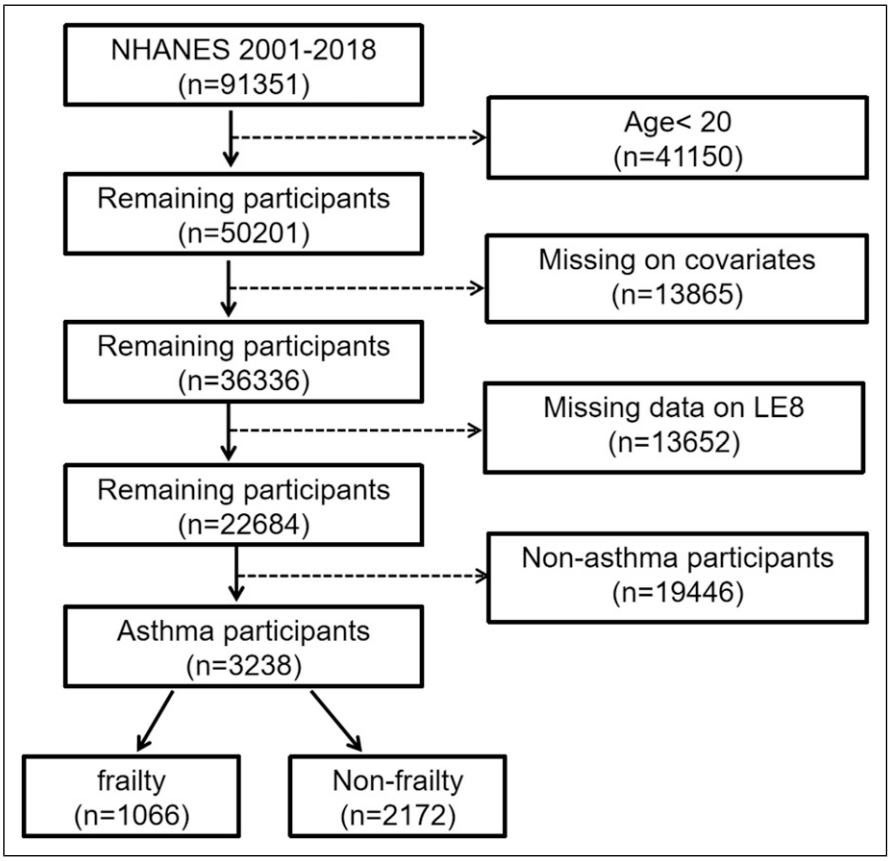

Figure 1. The Flowchart of the Study.

Definition of Frailty

Frailty was defined as a clinical syndrome characterized by multisystem physiological decline and reduced resilience to stressors. The frailty index was constructed using 49 health deficit variables from the NHANES database, with each variable coded dichotomously (0 = no deficit; 1 = presence of deficit).[31,32] The cumulative frailty score was calculated as the ratio of deficits present to the total possible deficits (n = 49), with a frailty index score >0.21 indicating frailty.[17] The higher value of frailty index, the greater serious of frailty.[33,34]

Statistical Methods

The data from NHANES were processed and analyzed with R, expressed as mean ± SD for continuous variables or as percentages for categorical variables. Continuous variables were analyzed by weighted *t*-test and categorical data were analyzed by weighted Chi-square test. The weighted multivariate logistic regression analysis was adopted to investigate the association between LE8 and frailty risk in asthma. Model 1(no adjustment of covariates), Model 2 (adjustment of age, sex, race, education level, and family income status) and Model 3 (adjustment of all covariates) were constructed. Restricted cubic spline (RCS) analyses were conducted to investigate the nonlinear relationship between LE8 and frailty risk in asthma. Subgroup analyses were performed to investigate the interactions. $P < .05$ was set as the level of statistical significance.

Results

Characteristics of Participants

Totally, 3238 asthma participants including 1066 participants with frailty and 2172 participants without frailty from the NHANES (2001-2018) were enrolled in this study, with 32.92% of prevalence of frailty in asthma. The LE8 scores in asthma patients with frailty were lower than that in asthma patients without frailty ($P < .05$). Asthma patients with frailty were older, poorer, with higher BMI, more female, larger percentage of Non-Hispanic White, higher education level than patients in asthma without frailty ($P < .05$, Table 1).

LE8 Score and Frailty in Asthma

Three models were established with multiple logistic regression and RCS analyses with different adjustment of

Table 1. Baseline Characteristics of Frailty in Asthma in the NHANES (2001-2018).

Characteristics	Total	Non-frailty	Frailty	*P* value
LE8 score (SE)	66.52(0.43)	70.49(0.46)	55.39(0.62)	<.0001
HEI-2015 diet score (SE)	36.65(0.97)	37.62(1.18)	33.92(1.43)	.04
Physical activity score (SE)	71.44(1.01)	77.41(1.09)	54.69(2.21)	<.0001
Nicotine exposure score (SE)	68.25(1.12)	72.79(1.16)	55.54(2.01)	<.0001
Sleep health score (SE)	79.20(0.64)	82.28(0.72)	70.58(1.28)	<.0001
BMI score (SE)	55.43(0.97)	59.85(0.96)	43.05(1.98)	<.0001
Blood lipids score (SE)	65.55(0.71)	67.72(0.85)	59.44(1.14)	<.0001
Blood glucose score (SE)	85.32(0.55)	90.92(0.52)	69.60(1.27)	<.0001
Blood pressure score (SE)	70.32(0.73)	75.31(0.74)	56.33(1.47)	<.0001
Age (SE)	45.60(0.43)	42.49(0.46)	54.35(0.52)	<.0001
PIR	2.96(0.06)	3.21(0.06)	2.25(0.08)	<.0001
BMI(kg/m^2)	30.23(0.21)	29.22(0.19)	33.08(0.45)	<.0001
Sex (%)[a]				<.0001
Female	1876(59.37)	1161(55.57)	715(70.02)	
Male	1362 (40.63)	1011(44.43)	351(29.98)	
Race (%)[a]				.003
Non-Hispanic White	1604(72.11)	1084(73.11)	520(69.29)	
Non-Hispanic Black	765(11.71)	484(10.63)	281(14.74)	
Mexican American	299(4.82)	211(5.02)	88(4.25)	
Other race	570(11.37)	393(11.24)	177(11.73)	
Family income status (%)[a]				<.0001
Low	1136(24.21)	624(19.20)	512(38.25)	
Middle	1113(32.89)	735(31.48)	378(36.85)	
High	989(42.90)	813(49.31)	176 (24.90)	
Education (%)[a]				<.0001
Less than high school	208(3.31)	81 (1.91)	127(7.23)	
High school	1131 (30.51)	685(27.23)	446(39.71)	
More than high school	1899(66.18)	1406(70.86)	493(53.06)	
Smoke (%)[a]				<.0001
Never	1648(52.22)	1249(58.49)	399(34.63)	
Former	817(25.17)	480(22.83)	337(31.72)	
Now	773(22.61)	443(18.68)	330(33.64)	
Alcohol (%)[a]				<.0001
Never	354(8.50)	231(8.55)	123 (8.39)	
Former	560(14.55)	248(9.97)	312(27.41)	
Mild	1101(36.43)	789(38.12)	312(31.69)	
Moderate	559(18.81)	419(19.91)	140(15.74)	
Heavy	664(21.70)	485(23.45)	179(16.77)	
BMI group (%)[a]				<.0001
Normal	808(26.99)	642(30.80)	166(16.30)	
Obese	1527(44.14)	869(38.74)	658 (59.29)	
Overweight	903(28.87)	661(30.46)	242 (24.41)	
Age group (%)[a]				<.0001
20-39	1232(40.60)	1074(49.04)	158(16.92)	
40-59	1070(35.92)	617(32.53)	453(45.45)	
>=60	936(23.47)	481(18.43)	455(37.63)	
Hypertension (%)[a]				<.0001
No	1919(64.89)	1598 (76.05)	321(33.60)	
Yes	1319(35.11)	574(23.95)	745(66.40)	
Diabetes (%)[a]				<.0001
No	2684 (87.57)	2015(94.32)	669(68.62)	
Yes	554(12.43)	157(5.68)	397(31.38)	

(continued)

Table 1. (continued)

Characteristics	Total	Non-frailty	Frailty	*P* value
CHD (%)[a]				<.0001
No	3093(95.93)	2148(98.79)	945(87.91)	
Yes	145(4.07)	24(1.21)	121(12.09)	
COPD (%)[a]				<.0001
No	2758(86.48)	1997(91.91)	761(71.25)	
Yes	480(13.52)	175(8.09)	305(28.75)	
Cancer (%)[a]				<.0001
No	2881(88.05)	2018(91.28)	863(79.00)	
Yes	357(11.95)	154(8.72)	203(21.00)	
Family history of asthma (%)[a]				.02
No	1886(58.67)	1300(60.16)	586(54.49)	
Yes	1352(41.33)	872(39.84)	480(45.51)	

The data were expressed as the mean ± SD for continuous variables or as percentages for categorical variables. *P* values were calculated by weighted t-tests and weighted chi-square tests.
Abbreviations: BMI, body mass index; PIR, Poverty income ratio; LE8, Life's Essential 8; HEI, Healthy Eating Index; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease.
[a]Unweighted frequency counts and weighted percentages are shown.

covariates or no adjustment. When compared the groups with moderate and high LE8 scores to the group with low scores, the adjusted odds ratios (ORs) (95% confidence intervals) for frailty risk in asthma were 0.39 (0.27, 0.56) and 0.15(0.08, 0.27), respectively. Every 10-point increment of LE8 scores was negatively correlated with frailty in asthma (OR0.64 [0.57, 0.73]) (Table 2, Figure 2). The ORs for frailty risk in asthma were 0.54 (0.41, 0.72) and 0.41(0.27, 0.64), respectively when comparing the groups with moderate and high health behavior scores to the group with low health behavior scores (Table 2, Figure 2). In additions, the ORs for frailty risk in asthma were 0.68 (0.48, 0.98) and 0.50 (0.28, 0.88) when comparing the groups with moderate and high health factors scores to the group with low scores. The ORs for frailty risk in asthma were all 0.78 (0.72, 0.84) in the every 10-point increment of health behaviors scores and health factors

Table 2. The Association Between LE8 and Asthma With Frailty.

	Model 1		Model 2		Model 3	
	OR (95%CI)	*P* value	OR (95%CI)	*P* value	OR (95%CI)	*P* value
LE8 scores						
	0.93(0.92.0.94)	<.0001	0.94(0.93, 0.95)	<.0001	0.96(0.94, 0.97)	<.0001
Low (0-49)	Reference		Reference		Reference	
Moderate (50-79)	0.18(0.14.0.24)	<.0001	0.23(0.17, 0.31)	<.0001	0.39(0.27, 0.56)	<.0001
High (80-100)	0.03(0.02.0.05)	<.0001	0.05(0.03, 0.09)	<.0001	0.15(0.08, 0.27)	<.0001
Per 10-point increment	0.47(0.43.0.51)	<.0001	0.53(0.48, 0.59)	<.0001	0.64(0.57, 0.73)	<.0001
Health behaviors scores						
Low (0-49)	Reference		Reference		Reference	
Moderate (50-79)	0.35(0.29.0.44)	<.0001	0.37(0.29, 0.47)	<.0001	0.54(0.41, 0.72)	<.0001
High (80-100)	0.18(0.12.0.26)	<.0001	0.22(0.15, 0.33)	<.0001	0.41(0.27, 0.64)	<.001
Per 10-point increment	0.71(0.66.0.75)	<.0001	0.72(0.67, 0.76)	<.0001	0.78(0.72, 0.84)	<.0001
Health factors scores						
Low (0-49)	Reference		Reference		Reference	
Moderate (50-79)	0.30(0.24.0.37)	<.0001	0.38(0.29, 0.49)	<.0001	0.68(0.48, 0.98)	.04
High (80-100)	0.11(0.08.0.16)	<.0001	0.20(0.13, 0.30)	<.0001	0.50(0.28, 0.88)	.02
Per 10-point increment	0.71(0.66.0.75)	<.0001	0.72(0.67, 0.76)	<.0001	0.78(0.72, 0.84)	<.0001

Model 1: no covariates were adjusted.
Model 2: age, sex, race, education level and family income status were adjusted.
Model 3 age, sex, race, education level, family income, BMI, smoke, alcohol consumption, diabetes, hypertension, CHD, COPD, family history of asthma were adjusted.
Abbreviations: LE8, Life's Essential 8; OR, odds ratio; BMI, body mass index; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease.

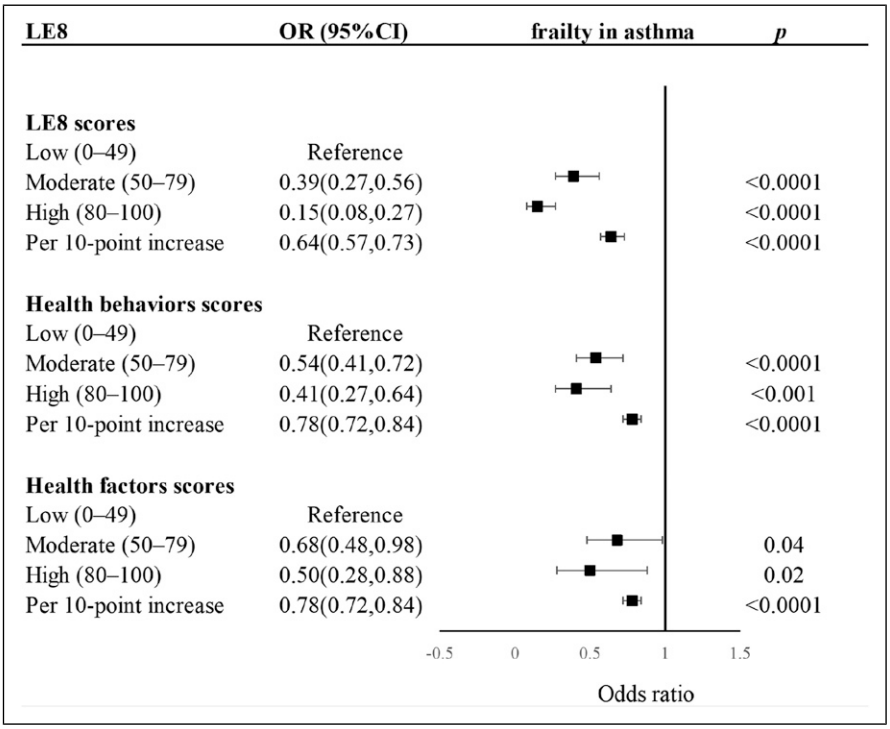

Figure 2. The Association Between LE8 and Asthma with Frailty.

scores (Table 2, Figure 2). There was a linear association between LE8 scores and frailty in asthma with a negative correlation trend(P nonlinear = 0.659), health factors scores and frailty in asthma (P nonlinear = 0.31) and between health behaviors scores and frailty in asthma (P nonlinear = 0.762) (Figure 3).

Components of LE8 and Frailty in Asthma

In Model III with adjustment of all covariates, there were significant negative associations between sleep health score, blood glucose score, blood pressure score of LE8 components with frailty risk in asthma (Table 3). Compared to the group with low sleep health score (Table 3), risks for asthma with frailty were both significantly lower in the groups with moderate and high sleep health score, with ORs 0.51(0.35.0.73) and 0.50 (0.37.0.67), respectively. Specifically, the frailty risks of asthma with were both significantly lower in the groups with moderate and high blood glucose score than that in the group with low blood glucose score, with ORs 0.37 (0.23, 0.59) and 0.20 (0.13, 0.31), respectively (Table 3). The frailty risks of asthma were significantly lower in the groups with moderate and high blood pressure score when compared with the group with low blood pressure score, with ORs 0.59 (0.41, 0.84) and 0.53(0.37, 0.75), respectively

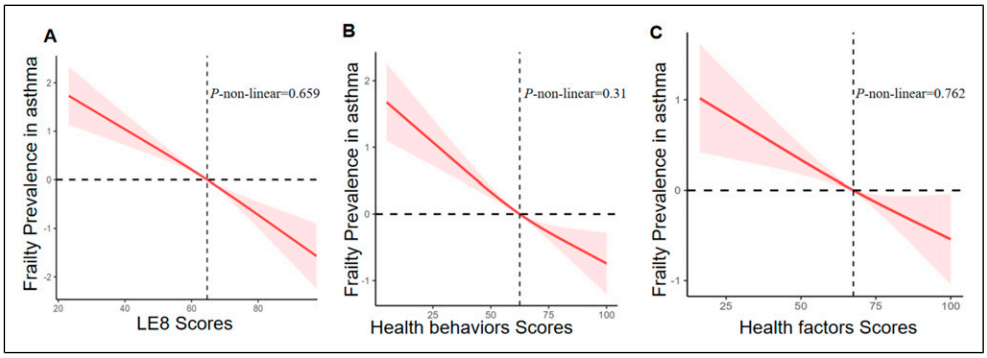

Figure 3. Dose-Response Relationships Between LE8 Scores (A), Health Behaviors Scores (B), Health Factors Scores (C), and Frailty in Asthma. ORs (Solid Lines) and 95% CIs (Shaded Areas) were Adjusted for Age, Sex, Education Level, Race, Family Income Status, BMI, Smoke, Alcohol, Diabetes, Hypertension, Coronary Heart Disease, COPD, Family History of Asthma.

Table 3. Associations Between Components of LE8 and Asthmatic Patients With Frailty.

Character	Cases/participants	OR (95% CI)	*P* value
HEI-2015 diet score			
Low (0-49)	610/1738	Reference	
Moderate (50-79)	237/761	0.92(0.68.1.23)	.56
High (80-100)	219/739	0.77(0.54.1.10)	.15
Physical activity score			
Low (0-49)	505/1008	Reference	
Moderate (50-79)	65/161	0.88(0.45.1.72)	.72
High (80-100)	496/2069	0.55(0.43.0.71)	<.0001
Nicotine exposure score			
Low (0-49)	367/868	Reference	
Moderate (50-79)	300/722	1.31(0.66.2.58)	.43
High (80-100)	399/1648	0.35(0.25.0.49)	<.0001
Sleep health score			
Low (0-49)	361/765	Reference	
Moderate (50-79)	226/746	0.51(0.35.0.73)	<.001
High (80-100)	479/1727	0.50(0.37.0.67)	<.0001
BMI score			
Low (0-49)	658/1527	Reference	
Moderate (50-79)	242/903	0.81(0.60.1.09)	.15
High (80-100)	166/808	0.55(0.37.0.81)	.003
Blood lipids score			
Low (0-49)	410/1054	Reference	
Moderate (50-79)	177/689	1.02(0.74, 1.41)	.89
High (80-100)	479/1495	0.89(0.68, 1.16)	.39
Blood glucose score			
Low (0-49)	383/526	Reference	
Moderate (50-79)	238/622	0.37(0.23, 0.59)	<.0001
High (80-100)	445/2090	0.20(0.13, 0.31)	<.0001
Blood pressure score			
Low (0-49)	396/753	Reference	
Moderate (50-79)	298/996	0.59(0.41, 0.84)	.004
High (80-100)	372/1489	0.53(0.37, 0.75)	<.001

Adjusted for age, sex, race, education level, family income status, BMI, smoke, alcohol, diabetes, hypertension, CHD, COPD, family history of asthma.
Abbreviations: HEI, Healthy Eating Index; LE8, Life's Essential 8; OR, odds ratio; BMI, body mass index; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease.

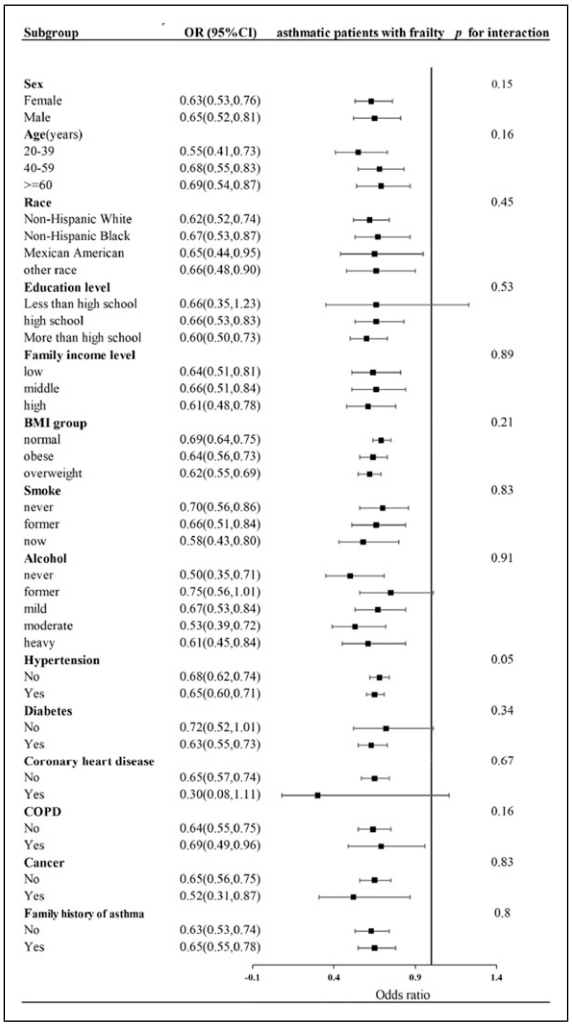

Figure 4. Subgroup Analysis of the Association Between LE8 Scores and Frailty in Asthmatic Patients. OR was Calculated as per 10-Point Increment in LE8 Score. Each Stratification was Adjusted for Age, Sex, Education Level, Race, Family Income Status, BMI, Smoke, Alcohol, Diabetes, Hypertension, CHD, COPD, Family History of Asthma.

(Table 3). Diet and blood lipids did not affect the frailty risks in asthma. Only high score (80-100) of physical activity, nicotine exposure score, BMI score could reduce the frailty risks of asthma (Table 3).

Subgroup Analysis

Subgroup analysis was conducted with stratification by age, sex, education level, race, family income, BMI, smoke status, alcohol consumption, diabetes, hypertension, CHD, COPD, family history of asthma. The negative association between LE8 scores and frailty in asthma remained stable in different subgroups (all *P* for interaction >.05) (Figure 4).

Discussion

Despite ongoing debates regarding its precise definition and prevalence, frailty has emerged as a critical public health concern, particularly in aging populations and individuals with chronic conditions.[3,35] There are different models for diagnosis of frailty, such as the phenotype model and the cumulative deficit model, and the later model has been confirmed to have higher sensitivity to predict adverse consequences.[36,37] In the present study, we employed the cumulative deficit model to construct a 49-item frailty index based on binary (yes/no) variables from the NHANES database. Consistent with established criteria, participants with a frailty index score >0.21 were classified as frailty.[17]

Existing research indicates a substantial burden of frailty among patients with chronic respiratory diseases. A study revealed that the prevalence of frailty in participants with asthma-COPD-overlap (ACO) was 60.2%.[38] The prevalence of frailty in COPD ranged from 2.6% to 80.9%.[39] However, epidemiological data on frailty specifically in asthma patients remain limited.. In this study, we investigated the relationship between LE8 and frailty in asthma adults with the NHANES data. Our analysis of NHANES data revealed a frailty prevalence of 32.92% among adults with asthma. This finding exceeds the 7.6% prevalence reported in a Korean elderly population,[40] but aligns closely with age- and sex-adjusted estimates (35.8%) from a Chinese cross-sectional study.[41] These observed differences may reflect variations in study populations, assessment methods, or sociodemographic factors.

Importantly, frailty is a preventable and reversible condition.[42] Pharmacological agents and non-pharmacological measures targeting frailty have been conducted in some trails.[43-45] However, there was no satisfactory result yet. Previous studies indicated that LE8 was certificated negative with cancer patients with frailty[17] and high LE8 score was inked to low risk of adult-onset asthma,[46] suggesting that LE8 was associated with asthma and frailty. In the present study, we confirmed that when treated as a continuous variable, LE8 scores in Model I, Model II and Model III all had protective effect on frailty odds in asthma patients. When LE8 scores were treated as categorical variables, the group with high LE8 score showed significant reduction in the frailty risk in asthma in the model with adjustment of all variables, when compared to the group with low LE8 score. Similarly, subgroups with higher health behavior and health factor scores demonstrated reduced ORs for frailty risk in asthma patients relative to their low-score counterparts.. These results indicated that higher LE8 scores were significantly associated with lower morbidity of frailty in asthma. In addition, LE8 was inversely associated with frailty in asthma in does-response. As well as, the trend of negative correlation was demonstrated in subgroup analyses. Therefore, improving CVH can reduce the occurrence of asthmatic frailty and be a good measure to prevent frailty and disability in asthma patients to increase life quality.

There were some limitations in this study. First, this was a cross-sectional study, limiting to confirm the causality between improvements in CVH and changes of frailty in asthma patients. Secondly, LE8 component data were obtained via self-reported questionnaires and 24-hour recall, which may introduce recall bias. Additionally, the study population comprised only U.S. participants, limiting the generalizability of findings to other populations due to potential regional, ethnic, or socioeconomic differences. Lastly, the models of assessment for frailty and frailty cutoffs were not identical and may produce differences in results.

Conclusion

In conclusion, the present study indicated that the prevalence of frailty in adults with asthma was very high, and frailty interventions like healthy behavior and behavior factor interventions should be given in parallel with asthma management.

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Ethical Statement

Ethics Approval

The informed consents and data can be obtained from https://www.cdc.gov/nchs/nhanes.htm.

Author Contributions

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Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

Data can be dated on the National Health and Nutrition Examination Survey Homepage.

Supplemental Material

Supplemental material for this article is available online.

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