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Original Study

Impact of Adverse Childhood Experiences in a Student-Run Free Clinic Population

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Abstract

Background: Adverse childhood experiences (ACEs) correlate with development of chronic disease and early death. High ACEs are more common in underserved populations. The objective is examining how ACE scores correlate to the presence and severity of chronic diseases in student-run free clinic (SRFC) populations.
Methods: This study took place at the University of Arkansas for Medical Sciences (UAMS) 12th Street Health and Wellness Center, an SRFC in Little Rock, Arkansas. Included were patients diagnosed with at least one of the following: hypertension, diabetes, depression, chronic headaches, and chronic obstructive pulmonary disease. Surveys were administered to determine the amount and type of ACEs, and scores were calculated. Relative risks for effects of ACE exposure were assessed on chronic disease. Univariate and multivariate analyses for ACE and chronic disease association was conducted.
Results: A total of 75 patients completed the survey. Prevalence of ACEs $\geq$1 among UAMS patients was 61 (81.3) and more common in women and non-smokers. Exposure to physical abuse showed 55% higher risk of more than one chronic disease than without exposure. Patients reporting 3-4 or $\geq$5 ACEs had 2.00 or 1.69 times the risk of having more than one chronic disease compared to no ACEs in an adjusted analysis, respectively.
Conclusions: ACEs were more prevalent in this SRFC than the general public. Exposure to more ACEs was associated with an increased risk for having one or more chronic disease. The study provides novel evidence of the increased risk this SRFC population has for ACEs and identifies a possible need for additional resources.

Introduction

The University of Arkansas for Medical Sciences (UAMS) 12th Street Health and Wellness Center (HWC) is a student-run free clinic (SRFC) providing primary medical care to the underserved community in Little Rock, Arkansas. Patient demographics are consistent with those at a higher risk for having a significant Adverse Childhood Experience (ACE) score—largely low income, African American, Hispanic, and multiracial.[1] Although exposure to ACEs correlates with development of chronic disease, risky behaviors, and early death,[2-3] there is negligible training on ACEs in most primary care settings.[4] ACE awareness in the free clinic setting may provide better outcomes for patients at risk for adverse health conditions.

Original ACE research was conducted by Felitti et al. in 1997. ACEs were categorized into physical abuse, psychological abuse, sexual abuse, and household dysfunction (which are further divided into violence towards mother, substance abuse, mental illness, parental divorce, and incarcerated relative). Felitti et al. developed a standardized questionnaire to survey the prevalence of these categories of abuse,[2] which has since been adapted into different formats. The CDC gathers

information on the prevalence of adults with ACEs through the Behavioral Risk Factor Surveillance System (BRFSS). The 2011-2014 BRFSS research found that out of the 214,157 respondents across all levels of income and ethnicities,[5] about 61.5% reported one or more ACE.

Recent research has focused on associations between ACEs and specific chronic diseases. In particular, cardiovascular diseases, diabetes, depression, frequent headaches, and chronic obstructive pulmonary disease (COPD) are commonly studied among patients with significant ACE scores.[6] The pathophysiology behind this association has been attributed to dysregulation in the hypothalamic-pituitary-adrenal axis, caused by chronic toxic stress and excessive release of cortisol. This dysfunctional response leads to dangerous consequences on healthcare outcomes and overall mortality.[7] In a nationwide study conducted by Campbell et al., people with diabetes who reported one or more ACEs had a 132% increase in mortality after 20 years, versus patients who only had diabetes, only one ACE, or no ACEs.[8] Kreatsoulas et al. later discovered that not only were patients with a high ACE score at a higher risk for developing cardiovascular disease, but the risk was more evident in patients less than 40 years old.[9] Another common finding is the presence of a dose-response between ACE score and prevalence/severity of chronic diseases.[10]

Due to systemic barriers to healthcare access, the underserved population is especially vulnerable to having their ACE history overlooked.[11] The BRFSS recently found that higher ACE scores were significantly more common in historically underserved populations including African American, Hispanic, multiracial, low socioeconomic, and lesbian, gay, bisexual, queer (LGBTQ) people.[5] These populations are at higher risk for being uninsured or underinsured, and more likely to receive care through an SRFC or the emergency department.[12,13] Although countless articles demonstrate these correlations, screening for ACEs in primary care settings is still fairly uncommon.[4] Utilization of an ACE screen in SRFC settings may quickly identify high risk patients requiring focused attention to improve outcomes and prevent comorbidities.[14,15]

There are no known studies examining ACE scores in the free clinic setting. Therefore, the primary objective of this study was to evaluate the 12th Street HWC population for the prevalence of ACEs in patients with at least 1 of the 5 commonly associated diseases previously mentioned. Additionally, researchers aimed to assess the relationship of the number and type of ACE exposures with the presence of chronic disease and the development of specific chronic diseases.

Methods

Study Setting & Patient Population

The 12th Street HWC was established by a group of healthcare professionals and students from the UAMS. Interprofessional student teams develop management plans for patients guided by a diverse board of healthcare professionals. The clinic's patient population consists mostly of minority groups, including LGBTQ, African Americans, and Hispanics. Interpreters are present to translate for Spanish-speaking patients.

The study design was a case-control, observational study. Patients 18 years of age or older, and English- or Spanish-speaking, were screened for study eligibility. Study participants were selected based upon the presence of one or more of the following disease states on the patient problem list: hypertension, diabetes, depression, chronic headaches, and COPD. Patient problem lists were compiled in the patient charts under the guidance of healthcare professionals. These charts were used by the research team to identify which patients presenting to clinic met inclusion criteria and would be offered a survey. These chronic disease states were selected due to the prevalence of their reporting in current ACE literature, as well as their prevalence in this patient population.[6]

Data Collection & Instrument

An adapted version of the original "ACE Questionnaire" from the Felitti et al. study was utilized and obtained from the Centers for Disease Control and Prevention (CDC) website (Online Appendix 1).[16] The questionnaire was processed through the UAMS Health Literacy Department for reading comprehension and Spanish translation (Online Appendix 2). Participants meeting inclusion criteria were approached by students and asked to complete a paper based standard ACE

survey in their desired language (English or Spanish). Interpreters helped any Spanish-speaking patients requiring assistance. In order to protect anonymity of participants, it was asked that names were not written onto the survey forms. Duplicate surveys were excluded based on identical demographic information and repeat clinic visits.

The survey consists of 10 "Yes/No" questions that ask about specific types of abuse. An ACE score of 0 indicates no history of trauma or abuse, and an ACE score of 10 indicates severe trauma or abuse. After patients completed the form, students in the project recorded the responses on a private digital spreadsheet. The patient's demographics (age, gender, race, and smoking status) and health information were confirmed through the clinic's electronic medical records (EMR). Only investigators of the project had access to review or edit the data set. Data collection took place over three months from November of 2019 until January of 2020.

Primary Outcome

The primary outcome measure was the number of chronic diseases per patient. This was a binary variable, categorized as the presence of only one chronic disease or more than one chronic disease.

Evaluation of ACE Prevalence

The primary exposure of interest was the presence or absence of ACEs. The patient's calculated ACE score (0-10 scale) was coded as a binary variable, indicating either the presence of at least one ACE (ACE score >0) or the absence of ACEs (ACE score=0). We also assessed the category of each specific ACE, including psychological abuse, physical abuse, sexual abuse, physical neglect, emotional neglect, and any household dysfunction. Household dysfunction was further classified into divorce, violence towards mother, substance abuse, mental illness, and incarcerated relative. Each specific ACE category was recorded as a binary variable (Yes/No).

Additional demographic variables were measured, including age, race, and smoking status. The prevalence of ACEs was assessed by demographic characteristics and disease status of participants. Differences in demographic characteristics and ACEs between people with one and people with more than one chronic disease were analyzed using Chi-square tests for categorical variables and t-test for continuous variables.

Evaluation of the Relationship with ACEs and Development of One or More Chronic Disease

The secondary outcome was the type of chronic disease per patient. This was a binary variable and categorized as the presence or absence of any of the five specific diseases (hypertension, diabetes, depression, chronic headaches, or COPD). For the final analysis, COPD was not assessed due to the small sample size (N=1).

We used a log-binomial regression model to estimate the relative risks for the effect of ACE exposure on chronic disease.[17,18] The ACE score was coded as a binary variable and an ordinal variable. To evaluate the dose-response relation in ACE score and the risk of chronic diseases, ACE scores were categorized into 0, 1, 2, 3-4, and ≥5. Cochran-Armitage test was conducted for trend analysis. Both univariate and multivariate analyses for the association between ACE and chronic disease were conducted. Confounders were selected based on prior knowledge in literature using directed acyclic graph, including age, gender, and race.[19-21] Smoking was considered an intermediate in the relation between ACE and chronic disease. A p-value less than 0.05 was considered statistically significant. All analyses were performed in SAS version 9.4 and R version 3.6.3.[22,23]

Results

Prevalence of Chronic Diseases

A total of 75 patients were recruited into the study. The differences in demographic characteristics and ACEs by one or more than one chronic disease are shown in Table 1. A total of 38 patients had one chronic disease, 33 patients had two chronic diseases, and four patients had three chronic diseases. If the patient had two or three chronic diseases it was combined as one group (N=37).

Prevalence of ACEs

Figure 1 shows the total prevalence of ACEs (score ≥1) and the prevalence by sex, race/ethnicity, smoking status, and age group. The overall

Table 1. Demographics of Study Population

Characteristic, N (%)	One Chronic Disease (N=38)	More Than One Chronic Disease (N=37)	p
Age, mean (SD)	43.9 (13.2)	45.8 (11.1)	0.50
Gender			0.13
Male	20 (53)	13 (35)	-
Race			0.11
NH-White	1 (3)	4 (11)	-
NH-Black	8 (21)	13 (35)	-
Hispanic	29 (76)	20 (54)	-
Smoking			0.19
Yes	8 (21)	13 (35)	-
No	24 (63)	15 (40)	-
Unknown	2 (5)	1 (3)	-
Psychological abuse			0.005*
Yes	7 (18)	18 (49)	-
Sexual abuse			0.09
Yes	6 (16)	12 (32)	-
Emotional neglect			0.28
Yes	10 (26)	14 (38)	-
Physical neglect			0.57
Yes	15 (40)	17 (46)	-
Any household dysfunction†			0.004*
Yes	14 (37)	26 (70)	-
Divorce			0.41
Yes	11 (29)	14 (38)	-
Violence towards mother			0.05
Yes	6 (16)	13 (35)	-
Substance abuse			0.002*‡
Yes	4 (11)	16 (43)	-
Mental illness			0.21
Yes	5 (13)	9 (24)	-
Incarcerated relative			0.43[b]
Yes	2 (5)	4 (11)	-

SD: Standard Deviation; NH: Non-Hispanic
**p<0.05*
†Household dysfunction includes any one or more events including divorce, violence towards mother, substance abuse, mental illness, and incarcerated relative.
‡Fisher's exact test

prevalence of ACEs was 61 (81.3). Females showed a higher prevalence of ACEs (85.7%) compared to males (75.8%). The presence of ACEs was similar among different race/ethnicity groups (80.0-81.6%). Non-smokers had a higher prevalence of ACEs (84.3%) than smokers (71.4%). Patients in the 35-49 age group showed a higher prevalence of ACEs compared to other age groups. Figure 2 shows the proportion of each ACE type. The highest prevalence of ACE among participants was psychological abuse (47.0%), followed by physical neglect (42.7%) and physical abuse (33.3%). The lowest prevalence of ACE type was incarcerated relative (8.0%).

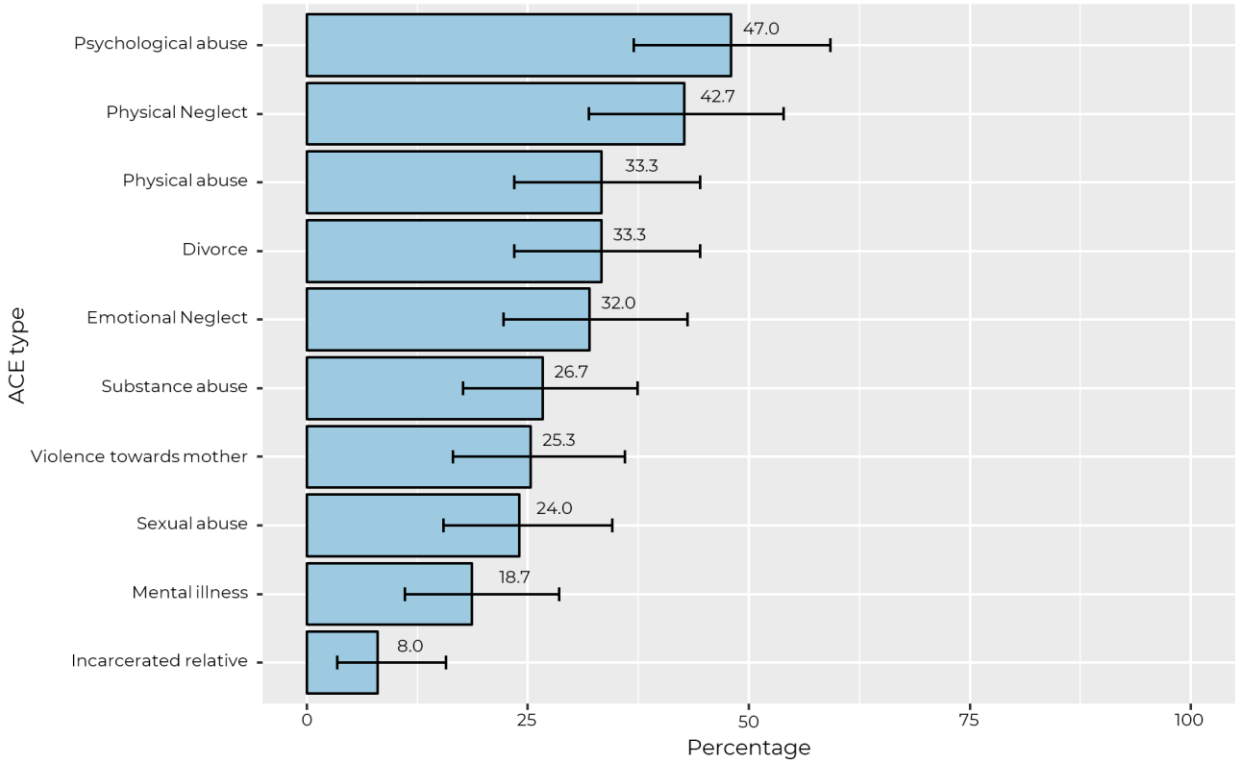
Relationship of ACE with Development of One or More Chronic Disease

The unadjusted analysis in Table 2 shows that patients with ACE score 3-4 had 2.63 [95% confidence interval 1.24, 7.79] times risk (p=0.03) of having more than one type of chronic disease compared to patients who reported no ACEs. Patients with ACE score ≥5 had 2.39 [1.12, 7.14] times risk (p=0.05) of having more than one type of chronic disease compared to patients who did not have any ACEs (p for trend= 0.002, Figure 3). After controlling for age, gender, and race, patients with ACE scores 3-4 and patients with ACE score ≥5 showed 2 times [0.92, 4.36] (p=0.08) and 1.69 times [0.74, 3.82] (p=0.21) risk, respectively, of having more than one chronic disease compared to patients who did not have any ACEs. Table 3 shows the univariate and multivariate analyses for each ACE exposure and having more than one chronic disease. Patients with any one of the ACE exposures showed increased risk of having more than one type of chronic disease (versus having only one chronic disease). Patients who reported physical abuse showed 55% higher risk of having more than one chronic disease compared to patients who never experienced physical abuse after controlling for age, gender, and race relative risk: 1.55 [1.03, 2.33], p=0.03.

Relationship of ACE with Development of Specific Chronic Disease

Table 4 shows the association between ACEs and each specific chronic disease. ACE score ≥5 was associated with increased risk of having depression compared to patients who did not have ACEs in an unadjusted analysis (p=0.04). Figure 4 shows the prevalence of ACEs by different chronic diseases. Patients who had depression, diabetes, and chronic headache had a higher prevalence of ACEs.

Figure 1. Prevalence of ACE (score ≥1) by characteristics of study population



NH: Non-Hispanic; ACE: Adverse Childhood Experience. The Jeffreys interval was calculated for binomial proportions. Some patients had multiple types of ACE.

Figure 2. ACE prevalence by ACE type

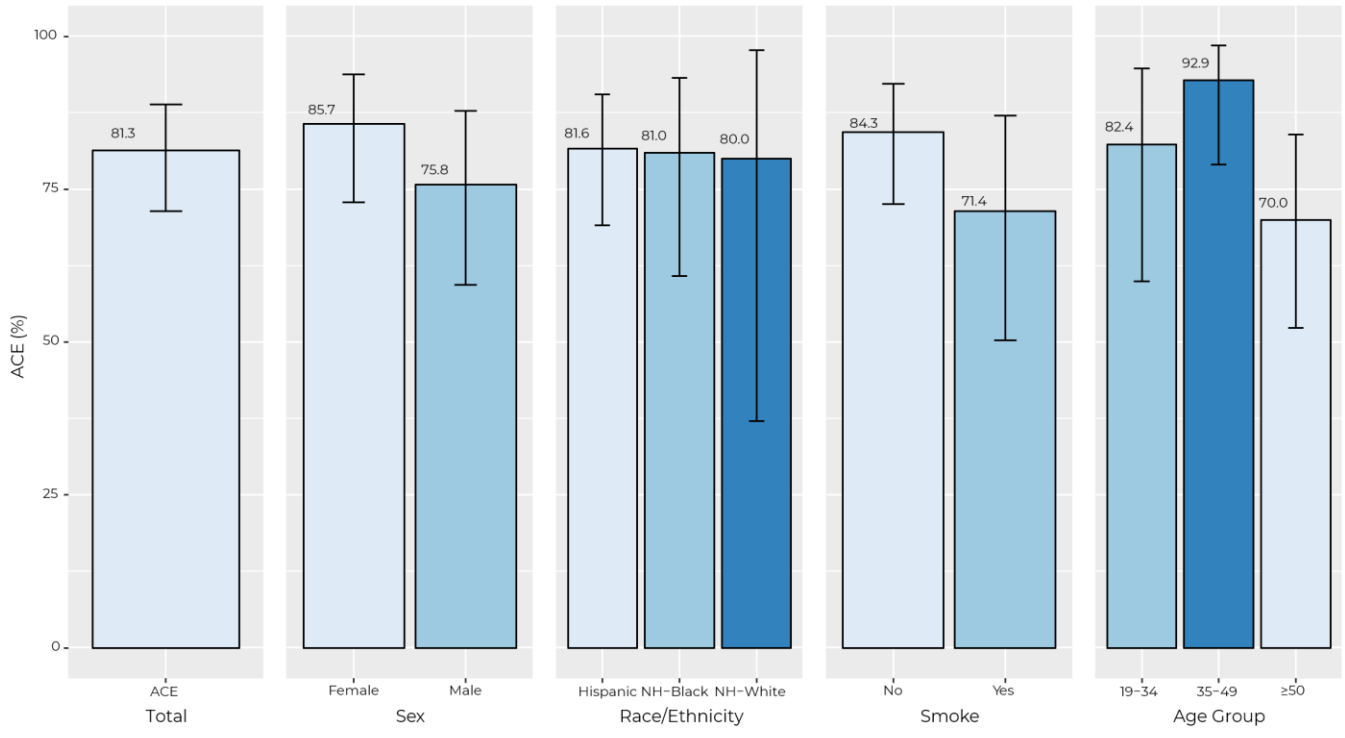
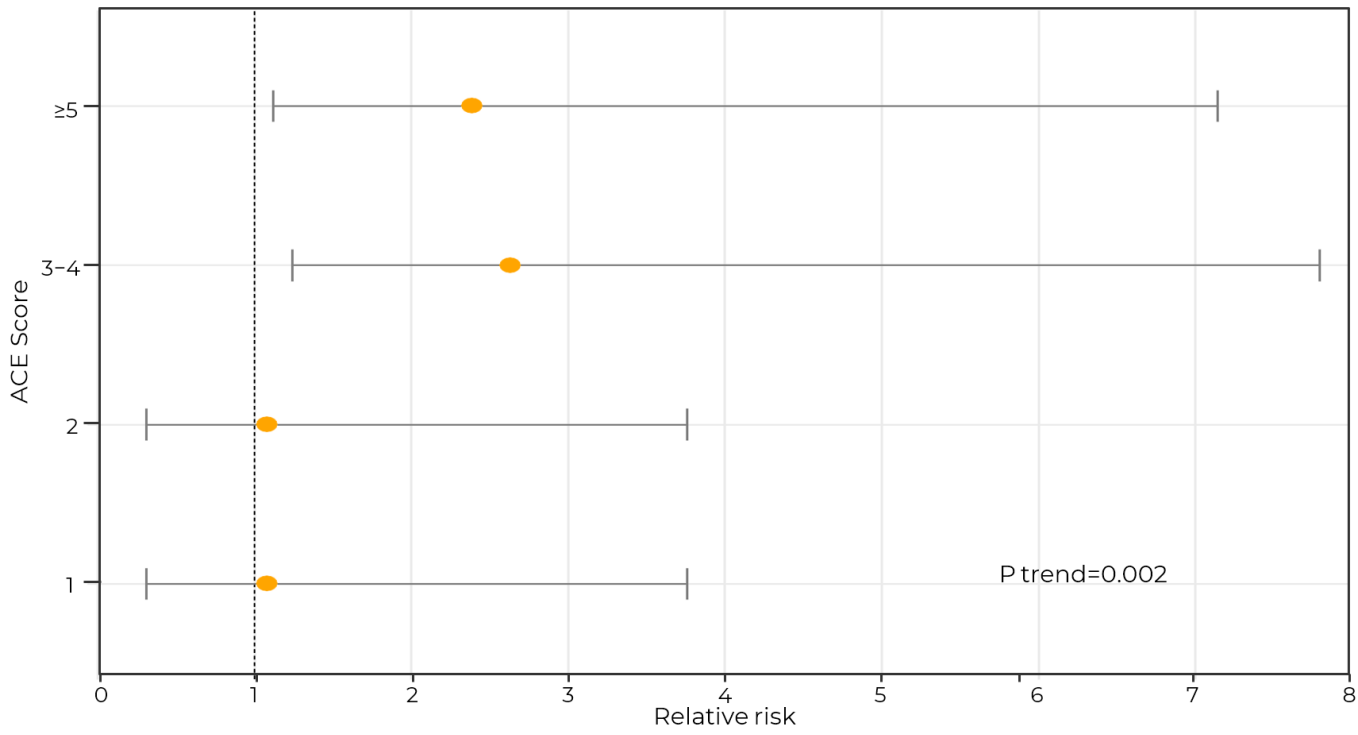


Table 2. Univariate and multivariate analyses for ACE and having more than one chronic disease

		Having more than one chronic disease versus one chronic disease				
ACE	**N=75**	**%**	**Unadjusted RR (95% CI)**	**p**	**Adjusted RR (95% CI)***	**p**
Overall†						
No	14	28.6	1.00 (referent)		1.00 (referent)	
Yes	61	54.1	1.89 (0.94, 5.58)	0.15	1.67 (0.7, 3.99)	0.25
Score				0.002		
0	14	10.8	1.00 (referent)		1.00 (referent)	
1	13	30.8	1.08 (0.31, 3.76)	0.90	0.92 (0.34, 2.52)	0.88
2	13	30.8	1.08 (0.31, 3.76)	0.90	1.07 (0.42, 2.70)	0.89
3-4	16	32.4	2.63 (1.24, 7.79)	0.03‡	2.00 (0.92, 4.36)	0.08
≥5	19	35.1	2.39 (1.12, 7.14)	0.05	1.69 (0.74, 3.82)	0.21

ACE: Adverse Childhood Experience; RR: Relative Risk; CI: Confidential Interval
**Adjusted for age, gender, and race*
†ACE score ≥1 is defined as having ACE
‡p<0.05

Figure 3. Association between ACE score and >1 Chronic Disease



ACE: Adverse Childhood Experience
Cochran–Armitage test for trend was used to generate p-value for the trend.

Table 3. Univariate and multivariate analyses for ACE category and having more than one chronic disease

ACE	Unadjusted RR (95% CI)	p	Adjusted RR (95% CI)*	p
Psychological abuse	1.59 (1.00, 2.65)	0.06	1.41 (0.83, 2.41)	0.21
Physical abuse	1.89 (1.23, 2.98)	0.004†	1.55 (1.03, 2.33)	0.03†
Sexual abuse	1.52 (0.93, 2.33)	0.06	2.09 (0.98, 4.48)	0.06
Emotional Neglect	1.29 (0.79, 2.02)	0.27	1.26 (0.80, 1.99)	0.32
Physical Neglect	1.14 (0.71, 1.82)	0.57	1.17 (0.72, 1.89)	0.53
Any household dysfunction‡	2.07 (1.21, 3.55)	0.008†	1.65 (0.91, 2.97)	0.10
Divorce	1.22 (0.74, 1.91)	0.40	1.12 (0.62, 2.02)	0.71
Violence towards mother	1.60 (1.00, 2.44)	0.03†	1.34 (0.86, 2.07)	0.19
Substance abuse	2.10 (1.39, 3.20)	0.0003†	1.62 (0.90, 2.93)	0.11
Mental illness	1.40 (0.79, 2.16)	0.17	1.22 (0.69, 2.16)	0.49
Incarcerated relative	1.39 (0.57, 2.23)	0.29	1.14 (0.53, 2.45)	0.73

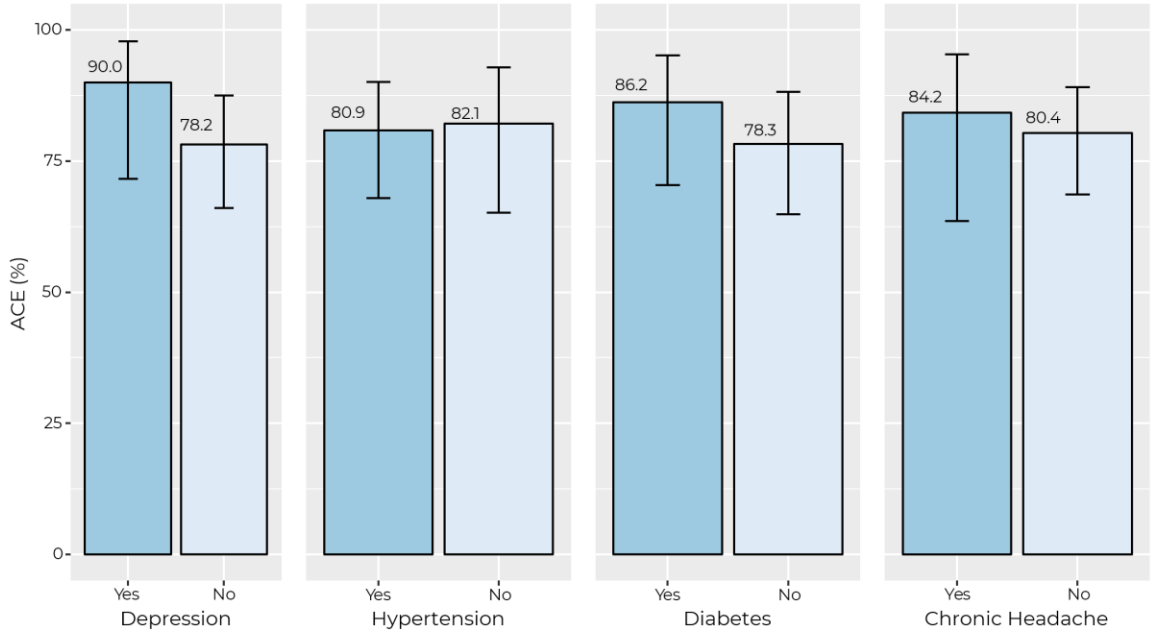
ACE: Adverse Childhood Experience; RR: Relative Risk; CI: Confidential Interval
**Adjusted for age, gender, and race*
†p<0.05
‡Household dysfunction includes any one or more events including divorce, violence towards mother, substance abuse, mental illness, and incarcerated relative.

Table 4. Univariate and multivariate analyses for ACE and specific chronic disease

	Depression (N=20)	p	Hypertension (N=47)	p	Diabetes (N=29)	p	Chronic Headaches (N=19)	p
Unadjusted RR (95% CI)								
ACE								
No	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
Yes	2.07 (0.54, 7.89)	0.29	0.97 (0.63, 1.50)	0.89	1.43 (0.59, 3.46)	0.42	1.22 (0.41, 3.63)	0.72
ACE score		0.003*		0.72		1.00		0.05
0	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
1	0.54 (0.06, 5.26)	0.59	0.96 (0.54, 1.71)	0.88	1.88 (0.72, 4.97)	0.20	0.34 (0.04, 3.03)	0.35
2	1.62 (0.32, 8.18)	0.56	0.96 (0.54, 1.71)	0.88	1.08 (0.34, 3.44)	0.90	0.72 (0.14, 3.62)	0.69
3-4	1.31 (0.25, 6.76)	0.75	1.17 (0.72, 1.89)	0.53	1.75 (0.67, 4.58)	0.25	1.46 (0.42, 5.03)	0.55
≥5	4.05 (1.06, 15.46)	0.04*	0.82 (0.46, 1.46)	0.50	1.11 (0.38, 3.19)	0.85	1.96 (0.63, 6.10)	0.24
Adjusted RR† (95% CI)								
ACE								
No	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
Yes	1.98 (0.54, 7.29)	0.30	0.97 (0.61, 1.54)	0.90	1.57 (0.65, 3.79)	0.32	0.96 (0.37, 2.49)	0.94
ACE score								
0	1.00 (referent)		1.00 (referent)		1.00 (referent)		1.00 (referent)	
1	0.68 (0.12, 3.71)	0.65	0.90 (0.50, 1.60)	0.71	2.34 (0.89, 6.16)	0.09	0.32 (0.04, 2.63)	0.29
2	1.45 (0.35, 6.07)	0.61	1.00 (0.50, 1.99)	1.00	1.02 (0.32, 3.29)	0.97	0.70 (0.15, 3.32)	0.65
3-4	1.21 (0.28, 5.18)	0.80	1.27 (0.70, 2.30)	0.43	1.77 (0.67, 4.67)	0.25	1.13 (0.35, 3.69)	0.84
≥5	2.87 (0.86, 9.61)	0.09	0.91 (0.50, 1.65)	0.76	1.31 (0.45, 3.77)	0.62	1.51 (0.51, 4.49)	0.46

ACE: Adverse Childhood Experience; RR: Relative Risk; CI: Confidential Interval
**p<0.05*
†Adjusted for age, gender, race; for chronic headaches, adjusted for age and gender only due to small sample size

Figure 4. Prevalence of ACE (score ≥1) by specific chronic disease



The ACE prevalence was defined as the proportion of participants who had ACE score ≥1 among participants who had the specific chronic disease. The Jeffreys interval was calculated for each binomial proportion. Some patients who had one chronic disease also had other type of chronic diseases.

Discussion

Summary

ACEs have been shown to be associated with higher rates of comorbidities, poor health outcomes, and early death.[2,3] Certain demographics are more heavily burdened with elevated ACE scores, in particular women, minority groups, and those with a lower socioeconomic status.[5] The 12th Street HWC in Little Rock, Arkansas is an SRFC whose patient population reflects the underserved and minority groups who may be more burdened by high ACEs and thus higher comorbidities. Our research sought to understand the effect ACEs may have on this vulnerable population.

Population Characteristics

Based on the data, ACEs were found to be more prevalent in the 12th St HWC patient population (81.0%) than the general population (61.5%). The highest ACE prevalence was noticed in the 35-49 year-old age group, and lowest in the >50 age group. This could possibly be explained because chronic disease, independent of ACE score, may be more common in older aged patients who qualified for inclusion into the study. Additionally, ACEs were more prevalent in women than men, which was anticipated based upon national trends as shown in BRFSS.[5] This difference may be due to higher reported rates of childhood abuse (sexual and physical) in women.[24,25] There was no difference in ACE prevalence between racial/ethnic groups. This was unexpected, as national trends demonstrate a higher prevalence in minority populations.[25]

ACEs Dose-Response Relationship

As expected, based upon current literature, the unadjusted data demonstrated a dose-response relationship between ACE score and chronic disease. This supports the hypothesis that the greater the number of ACEs someone faced in development, the more likely they are to have multiple chronic diseases in adulthood. When the data is adjusted for demographic information, the trend is no longer significant, but there is nonetheless still an almost two-fold increase in risk. The loss of significance after adjustment could have been due to the small patient

population. It was not expected that adjusted data would no longer show a significantly higher risk for chronic diseases with higher ACE scores because the dose-response relationship is a well-established trend reported in current ACE literature.

ACEs Exposure and Risk of Chronic Diseases & Health Risk Factors

An ACE score of ≥1 with exposure to any ACE had an increased risk of having more than one chronic disease. Patients reporting physical abuse showed the highest risk of having more than one chronic disease, regardless of demographic. This is consistent with previous literature showing an increased incidence of chronic disease in patients who reported physical abuse as an ACE.[26,27] However, in literature analysis, inconsistencies were found for the definition of chronic disease. Some articles report chronic disease as primarily metabolic (obesity, diabetes, cardiovascular disease) with mental illness (depression) as a separate measurement.[26-28] Thus, it is unknown whether the definition used in this study for chronic disease influenced the association it had with physical abuse. In order to clarify this relationship, future studies would benefit from comparing individual ACE categories with each chronic disease.

In unadjusted analyses, a significant trend was found between exposure to ACEs and the risk for depression, but not the other chosen chronic diseases. It was not expected to see a difference between the risk for chronic diseases as there is no consensus in current literature that ACEs are associated with a greater risk for any one chronic disease more than others. This difference may be due to how the comparison group was structured, since patients with one chronic disease were compared to patients with more than one chronic disease. Additionally, it was found that non-smokers had a higher prevalence of ACEs than smokers. This finding was unexpected as studies consistently report on increased risky health behaviors (smoking) in patients with higher ACE scores.[29,30] Smoking status was recorded from the clinic's EMR, which denotes smoking history as "current smoker," and does not include patients who are former smokers. Therefore, patients allocated as non-smokers may have a history of smoking.

Limitations

One limitation is that, due to the small sample size, there is no comparison group of participants with individual chronic diseases to ACE score. For example, there is no comparison group of patients who only have hypertension to compare to ACE score. This prevented examination of the relationship between individual chronic diseases to determine if any are more strongly associated with a high ACE score. Additionally, since the ACE survey is self-reported, patients may alter results by underreporting ACEs due to stigma associated with their traumatic experiences.

Future Studies

Surveys should be offered to all patients regardless of their chronic disease status. This would allow for an improved comparison group. Additionally, more demographic and social information should be obtained, such as education level, income, and illicit drug/alcohol use. This would allow observation of ACE effects on health risk factors, since additional confounders could be controlled for. By adopting ACE surveys at 12th Street HWC, student teams could screen at-risk patients and conduct secondary prevention techniques for offsetting the negative effects of ACEs. In particular, the Center for Health Care Strategies (CHCS) identifies protocols for providing trauma-informed care for patients with ACEs, in order to improve healthcare counseling and outcomes.[31]

Conclusions

As this was novel research into ACEs at the 12th Street HWC, these findings establish an initial profile of ACEs in the clinic's patient population. The findings support the hypothesis that an increased prevalence of ACEs would be found in this SRFC. Additionally, a dose-response relationship was identified between ACEs and the prevalence of chronic diseases. This project reflects the need for ACE screening and early intervention in order to offset the effect ACEs have on health later in life.[32] This is particularly true at SRFCs, since they historically care for populations of people who are vulnerable to having a history of ACEs.

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Disclosures

The authors have no conflicts of interest to disclose.

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