Society of Medical Education & Research

Establishing a Threshold for ACE Scores: Adverse Childhood Experiences and Their Association with Chronic Diseases

Mateusz Piotr Krukowski[1]*, Jakub Pawel Lewandowski[1], Kamil Tomasz Mazur[1]

[1]Department of Management, Poznan University of Economics and Business, Poznan, Poland.

*E-mail ✉ m.krukowski90@gmail.com

Abstract

Adverse Childhood Experiences (ACEs) are linked to numerous detrimental effects on physical, mental, and behavioral well-being. Nevertheless, no definitive threshold for ACE scores in relation to health consequences has been firmly established. This lack of clarity has resulted in the application of varying thresholds to classify elevated scores. The objective of this investigation is to determine a threshold at which ACEs demonstrate a notable connection to adverse long-term health conditions. To achieve this goal, a secondary examination was performed using information from a cross-sectional survey. Data were gathered employing the Adverse Childhood Experiences-International Questionnaire (ACE-IQ). Analyses involving descriptive statistics, nonparametric regression, and logistic regression were carried out on a cohort of 10,047 adults. Information encompassing demographics and self-reported health indicators was incorporated. Findings indicated that a threshold of four or more ACEs was markedly linked to higher incidences of chronic illnesses. Individuals reporting at least one chronic condition were nearly three times more likely (OR = 2.8) to fall into the elevated ACE category. Establishing a uniform threshold for ACE scores will support forthcoming studies exploring the influence of substantial ACEs across diverse cultures in assessing how early-life experiences affect health.

Keywords: Chronic disease, Adverse childhood experiences, Childhood trauma, Cut-point

Introduction

The term "Adverse Childhood Experiences" (ACEs) encompasses a broad spectrum of stressful events encountered during childhood [1]. These include various forms of abuse (emotional, psychological, physical, and sexual) as well as family challenges (such as substance abuse, mental health issues among household members, intimate partner violence, and criminal activity) [2, 3]. Additional categories involve emotional and physical neglect [3]; observing verbal, physical, or sexual abuse directed at other family members [4]; exposure to violence in the community [5]; and incarceration of a family member [6]. ACEs are defined as occurrences before age 18 that may recur, persist over time, and differ in severity [6, 7]. Such experiences are associated with a range of harmful outcomes affecting physical, mental, and behavioral health [8]. Despite this, a clear threshold indicating when ACEs substantially elevate the risk for chronic conditions has yet to be confirmed.

Various instruments for assessing ACEs exist, ranging from 10 [9] to 31 questions [1], covering topics like abuse, neglect, household issues, and community violence. In this research, the focus was on identifying a numerical threshold for ACEs that correlates with health effects, independent of the instrument's total question count. It was posited that a specific threshold exists where the link between ACEs and chronic illness differs markedly above and below that level. Defining such a threshold would aid investigators by offering an

51

J Med Sci Interdiscip Res, 2024, 4(1):50-56   **Krukowski** *et al*.

empirically supported benchmark for designating elevated ACE levels.

Studies have demonstrated a strong connection between ACEs, brain development, and enduring health issues [10, 11]. The ongoing stress from childhood adversities can contribute to allostatic overload, leading to impairments in cardiovascular, hormonal, and immune functions [12–14]. Over recent decades, investigations into ACEs have linked them to conditions such as diabetes [15], depression [16], anxiety [17], psychiatric disorders [18], and obesity [19].

Following the landmark ACE study in the United States [9], professionals in fields like nursing, public health, medicine, social work, and criminal justice have explored the ties between ACEs and health [15], extending these inquiries internationally [20]. Yet, a standardized threshold for the number of ACEs needed to indicate a meaningful impact on adverse health results remains undefined. While a threshold of 4 ACEs is commonly applied [21], other studies have employed different levels, including 2 ACEs [22], 3 ACEs [23], 5 ACEs [24], or even several thresholds in a single investigation [25] to signify sufficient adversity for health effects. This inconsistency creates challenges and limitations in ACE assessment, underscoring the importance of defining a threshold [26]. Accordingly, this study seeks to pinpoint a threshold for "high" ACE exposure—the level at which ACEs show a significant association with unfavorable chronic health conditions.

Materials and Methods

Study design
This investigation involved a secondary review of a nationwide dataset from Saudi Arabia. The primary research employed a cross-sectional approach to gather data from residents of Saudi Arabia regarding ACEs and particular health results.

Participants
The dataset utilized here originated from the National Family Safety Program (NFSP) in Saudi Arabia. In 2013, NFSP personnel gathered ACE-related data through an international partnership involving multiple countries and the World Health Organization (WHO). Details on ACEs and chronic illnesses were obtained from adult men and women aged 18 and older across various nations, including Saudi Arabia.

Data collection
Information was gathered across the 13 regions of Saudi Arabia; 182 sites within these regions were chosen randomly based on the nation's geographic divisions. The goal was to include at least one major and one minor city per region to ensure a representative cross-section of the population. Teams set up stations in public venues like malls, parks, and primary health centers for participant recruitment. Those who qualified, met criteria, and consented in writing received questionnaires, completed them privately, and deposited them in sealed containers [27, 28]. The initial dataset comprised 10,156 individuals; 109 non-Saudi participants were removed for this analysis, yielding a final sample of 10,047. Overall, the sample reflects the Saudi populace, as all 13 regions were included with attention to geographic, cultural, and societal differences.

Measurement
Data collection relied on a modified form of the Adverse Childhood Experiences-International Questionnaire (ACE-IQ). The ACE-IQ was created through collaboration between experts from the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and other international specialists in the area [1]. This self-administered tool targets individuals aged 18 and above. The questionnaire consists of 29 questions covering various forms of adverse experiences during childhood, such as items related to household dynamics; emotional, physical, or sexual mistreatment; violence from peers; observing violence in the community; and contact with collective or war-related violence. As noted earlier, the present investigation represents a secondary examination of an existing dataset [5]. In that original work, the category concerning collective violence was omitted because it did not align with Saudi cultural context [5]. A comparable exclusion of this category occurred in a study from South Korea for similar cultural reasons [29]. Consequently, the analysis incorporated the remaining 25 questions grouped into 12 domains. Scores on this adapted ACE-IQ could range from 0 to 25.

The ACE-IQ has demonstrated acceptable reliability and validity across multiple nations, including China ($r = 0.29$; [30]) and Nigeria ($r = 0.72$; [31]). In the Saudi context, the instrument underwent initial testing with 200 individuals to evaluate its suitability in terms of culture, society, and ease of understanding [5]. It was translated into Arabic, back-translated into English, adjusted for

cultural relevance where necessary, and confirmed for validity by Almuneef and colleagues (2014) in their Saudi-based study [5].

Variables examined in this research encompassed demographic factors (including gender, age, educational attainment, employment status, marital status, and urban/rural residence), the overall ACE-IQ score, and the count of self-reported chronic conditions (encompassing diabetes, hypertension, coronary heart disease, chronic respiratory disorders, liver conditions, obesity, and depression).

Ethical consideration

The original study's protocol received approval from an ethics review committee in Saudi Arabia. For the current secondary analysis, the dataset was acquired from the lead investigator of the primary research. All participant responses remained anonymous and were utilized solely for research objectives. Furthermore, no personally identifiable health details from respondents were included in the findings.

Data analysis

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 28. Descriptive statistics were computed for demographic details, ACE prevalence, and rates of chronic conditions, yielding frequencies and percentages. Nonparametric regression was applied to detect any threshold in the association between ACE levels and chronic disease occurrence. Subsequently, logistic regression was employed to assess the association between dichotomized ACE groups (low versus high) and the probability of having chronic diseases. Covariates in the logistic model included various demographics (gender, age, marital status, education, and employment). Given that employment was a nominal variable with three categories (unemployed/retired, employed, student), it was recoded into two dummy variables (employed versus others, and student versus others).

Results and Discussion

Sample characteristics

Most participants in the sample of 10,047 (64%) fell within the 18–37 age range (mean = 34.3; SD = 11.3). Males comprised 52% of the respondents, and the vast majority (86.8%) resided in urban areas. Slightly more than half (58.6%) had completed high school or less

education, approximately half (51.6%) were in employment, and 58.7% were married **(Table 1)**.

Table 1. Demographic information (N = 10,047).

Variables	N	% *
Age (Mean = 34.3)	10,029	
18–27 years old		34.0
28–37 years old		30.0
38–47 years old		20.0
48–57 years old		13.8
58 years old or older		2.2
Gender	10,028	
Female		47.6
Male		52.4
Geographical setting	10,047	
Urban		86.8
Non-urban		13.2
Education	9938	
High school or below		58.6
College or above		41.4
Occupation	9808	
Unemployed		28.8
Employed		51.6
Students		16.3
Retired		3.4
Marital status	9942	
Married		58.7
Not married		41.3

* Total equals 100.1% due to rounding.

Prevalence of ACEs and chronic diseases

In the study cohort, participants reported an average of 5.8 ACEs (SD = 5.0, range = 0–25), with 87.6% indicating exposure to at least one ACE. The highest 10% of respondents experienced thirteen or more ACEs, while the top 5 percent had fifteen or more; two individuals endorsed all 25 ACEs. Further details on the distribution of ACE frequencies within the sample are presented in **Table 2**. Close to 40% of participants indicated a diagnosis of at least one chronic condition, and around 20% reported two or more such diagnoses. The most commonly reported chronic illnesses were hypertension and diabetes (20 percent and 17.1 percent, respectively).

Table 2. Prevalence of ACEs and CD (N = 10,047).

Variables	%	Mean	Std. Dev.
ACEs total score (25 items)		5.77	4.97
0 ACEs	12.4		

1 ACE	10.0	
2 ACEs	10.8	
3 ACEs	8.9	
4 + ACEs	57.9	
Chronic diseases total number (7 diseases)	0.77	1.29
No chronic diseases	60.7	
1 chronic disease	19.7	
2 chronic diseases	11.1	
3 chronic diseases	4.4	
4 + chronic diseases	4.1	
Chronic diseases		
Diabetes	17.1	
Hypertension	20.0	
Coronary heart disease	5.9	
Chronic respiratory disease	12.3	
Liver disease	5.2	
Obesity	4.2	
Depression	12.3	

Identification of a cut-point for a high ACE level
Nonparametric regression was conducted to detect any threshold in the relationship between the overall ACE count and the occurrence of chronic conditions **(Figure 1)**. Examination of the smoothed regression curve reveals no noticeable link between ACEs and chronic disease until reaching a total of four or more ACEs. At 4 ACEs and beyond, the curve rises steadily in a linear pattern without any further plateaus. This trend confirms a threshold of 4 ACEs in the association between ACE exposure and chronic disease rates within this cohort.
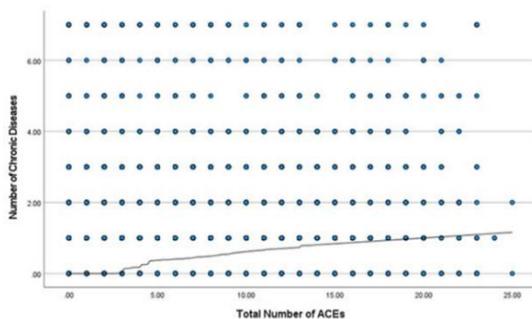

Figure 1. Frequency of chronic diseases by ACE exposure

Link between ACEs and chronic disease
To explore how ACEs relate to chronic disease, a logistic regression was conducted comparing participants with fewer than 4 ACEs to those with 4 or more. The analysis accounted for demographic factors such as age, sex, education level, employment, residential setting, and marital status. The model was statistically significant, $\chi^2(8) = 1098.6$, $p < 0.001$, and explained 14.6% of the variation in chronic disease prevalence. Individuals reporting at least one chronic illness were nearly three times as likely (OR = 2.8) to be in the high ACE category. Age and gender also significantly influenced outcomes: older participants had a slightly higher likelihood (1.1 times per age group) of chronic disease, whereas men were 31.7 percent less likely than women to have a chronic condition in this cohort **(Table 3)**.

Table 3. Relationship between ACEs and chronic disease.

Variable	B	S.E.	p	Exp (B)
Geographical setting	0.05	0.066	0.427	1.054
Gender	−0.38	0.051	<0.001	0.683
Age	0.05	0.002	<0.001	1.047
Marital status	−0.08	0.054	0.120	0.919
Education	−0.09	0.048	0.071	0.918
Employed vs other	−0.07	0.058	0.199	0.928
Student vs other	0.04	0.083	0.644	1.039
ACEs group (< 4, ≥ 4)	1.04	0.047	<0.001	2.832

Variability in threshold values for ACE scores across research has resulted in the application of diverse thresholds in various investigations. In this investigation, we effectively established a threshold for ACEs concerning the occurrence of chronic illnesses. Findings indicate that an ACE score of ≥4 is markedly linked to an elevated likelihood of developing chronic conditions. We additionally suggest that this threshold may be applied independently of the specific ACE assessment tool employed. Accordingly, a score of four or higher ACEs represents a threshold associated with adverse health consequences.

Distinctively, this research explored the existence of a threshold for ACEs with respect to particular chronic illnesses. Our advancement in the field of ACEs and health involves pinpointing a level where ACE scores demonstrate a notable connection to unfavorable long-term health issues. Until now, investigators have employed inconsistent threshold values for ACEs lacking empirical rationale. Via this research, we pinpointed four ACEs as the level at which a notable link emerged between ACEs and ongoing health problems. The link between ACEs and chronic illnesses became evident

starting at four ACEs and escalated steadily as ACE counts rose above that point. These findings endorse adopting four ACEs as a threshold to distinguish elevated ACE levels in studies exploring ACEs and chronic illness.

The typical ACE count (mean = 5.8) among the research participants aligns with earlier findings from additional emerging nations, including China [32], the Philippines [33], and Brazil [34]. Among those involved in this research, hypertension and diabetes emerged as the predominant chronic conditions reported. Obesity, diabetes, and hypertension rank among the primary five health threats in Saudi Arabia [35]. Roughly one-third of adult Saudis experience several ongoing health issues [36], even though the overall disease impact declined from 1990 to 2017 [35]. Chronic illnesses indeed constitute a key concern for public health in Saudi Arabia [37]. Limited access to healthcare services in early adulthood could play a role in the elevated rates and impact of risk elements, encompassing chronic conditions, within the Saudi populace [35, 38].

Findings from this research reinforce employing an ACE score of ≥4 in evaluations of the connection between ACEs and chronic illnesses. Specifically, individuals with chronic conditions showed almost triple the likelihood of belonging to the group with >4 ACEs. This pattern aligns with investigations conducted globally. For instance, in a sample from Iraq, household dysfunction correlated with a 98% rise in chronic physical conditions, while abuse correlated with an 81% rise [39]. In U.S. samples, ACEs served as indicators for conditions like heart disease, stroke, and chronic obstructive pulmonary disease [40]. ACEs are thought to trigger enduring biological and psychological alterations that contribute to poor health results [40–43], offering a potential mechanism for the strong association observed between ACEs and chronic illnesses.

Limitations and strengths
Several constraints apply to this research. Initially, as a re-analysis of pre-existing dataset, it is constrained by the health variables, instruments, and participant groups from the primary investigation [44]. Next, ACE data were gathered retrospectively, potentially introducing recall inaccuracies and misreporting, a common drawback of self-reported data [45]. Moreover, Saudi Arabia possesses distinct societal, cultural, and faith-based standards influencing child development and upbringing, similar to other nations. This investigation

enhances the worldwide understanding of ACEs and health. The inclusion of a substantial, nationally representative participant pool represents an additional asset.

Conclusion

This research pinpointed a standardized ACE threshold deemed adequate to influence health outcomes. The established threshold of ≥4 ACEs offers direction for subsequent investigations on ACEs. Validation of this elevated ACE threshold is recommended in upcoming research involving varied groups and medical issues. Data on the occurrence of ACEs and chronic illnesses in Saudi Arabia have likewise been documented. Health systems ought to prioritize creating and implementing initiatives and interventions aimed at timely identification and mitigation of ACEs to improve overall well-being worldwide. Incorporating ACE screening into routine healthcare represents an initial measure to detect individuals vulnerable to ACE-related health effects, succeeded by initiatives for preventing chronic illnesses to alleviate the impact of chronic conditions in Saudi Arabia.

References

1. World Health Organization. Adverse Childhood Experiences International Questionnaire (ACE-IQ). Available online: https://www.who.int/publications/m/item/adverse-childhood-experiences-international-questionnaire-(ace-iq) (accessed on 20 March 2022).

2. Anda, R.; Tietjen, G.; Schulman, E.; Felitti, V.; Croft, J. Adverse childhood experiences and frequent headaches in adults: October 2010. Headache J. Head Face Pain 2010, 50, 1473–1481.

3. Dube, S.R.; Felitti, V.J.; Dong, M.; Chapman, D.P.; Giles, W.H.; Anda, R.F. Childhood abuse, neglect, and household dysfunction and the risk of illicit drug use: The adverse childhood experiences study. Pediatrics 2003, 111, 564–572.

55

J Med Sci Interdiscip Res, 2024, 4(1):50-56   **Krukowski** *et al*.

4. Hamdullahpur, K.; Jacobs, K.J.; Gill, K.J. Mental health among help-seeking urban women: The relationships between adverse childhood experiences, sexual abuse, and suicidality. Violence Against Women 2018, 24, 1967–1981.

5. Almuneef, M.; Qayad, M.; Aleissa, M.; Albuhairan, F. Adverse childhood experiences, chronic diseases, and risky health behaviors in Saudi Arabian Adults: A pilot study. Child Abus. Negl. 2014, 38, 1787–1793.

6. Cronholm, P.F.; Forke, C.M.; Wade, R.; Bair-Merritt, M.H.; Davis, M.; Harkins-Schwarz, M.; Pachter, L.M.; Fein, J.A. Adverse childhood experiences. Am. J. Prev. Med. 2015, 49, 354–361.

7. Kalmakis, K.A.; Chandler, G.E. Adverse childhood experiences: Towards a clear conceptual meaning. J. Adv. Nurs. 2014, 70, 1489–1501.

8. Kalmakis, K.A.; Chandler, G.E. Health consequences of adverse childhood experiences: A systematic review. J. Am. Assoc. Nurse Pract. 2015, 27, 457–465.

9. Felitti, V.J.; Anda, R.F.; Nordenberg, D.; Williamson, D.F.; Spitz, A.M.; Edwards, V.; Koss, M.P.; Marks, J.S. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. Am. J. Prev. Med. 1998, 14, 245–258.

10. Armstrong, F.D. Neurodevelopment and chronic illness: Mechanisms of disease and treatment. Ment. Retard. Dev. Disabil. Res. Rev. 2006, 12, 168–173.

11. Edwards, V.J.; Holden, G.W.; Felitti, V.J.; Anda, R.F. Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: Results from the adverse childhood experiences study. AJP 2003, 160, 1453–1460.

12. Danese, A.; McEwen, B.S. Adverse childhood experiences, allostasis, allostatic load, and age-related disease. Physiol. Behav. 2012, 106, 29–39.

13. Pechtel, P.; Pizzagalli, D.A. Effects of early life stress on cognitive and affective function: An integrated review of human literature. Psychopharmacology 2011, 214, 55–70.

14. Shonkoff, J.P.; Boyce, W.T.; McEwen, B.S. Neuroscience, molecular biology, and the childhood roots of health disparities: Building a new framework for health promotion and disease prevention. JAMA 2009, 301, 2252–2259.

15. Lynch, L.; Waite, R.; Davey, M.P. Adverse childhood experiences and diabetes in adulthood: Support for a collaborative approach to primary care. Contemp. Fam. Ther. 2013, 35, 639–655.

16. Danese, A.; Moffitt, T.E.; Harrington, H.; Milne, B.J.; Polanczyk, G.; Pariante, C.M.; Poulton, R.; Caspi, A. Adverse childhood experiences and adult risk factors for age-related disease: Depression, inflammation, and clustering of metabolic risk markers. Arch. Pediatr. Adolesc. Med. 2009, 163, 1135–1143.

17. Tran, Q.A.; Dunne, M.P.; Vo, T.V.; Luu, N.H. Adverse childhood experiences and the health of university students in eight provinces of Vietnam. Asia Pac. J. Public Health 2015, 27, 26S–32S.

18. Choi, N.G.; DiNitto, D.M.; Marti, C.N.; Choi, B.Y. Association of adverse childhood experiences with lifetime mental and substance use disorders among men and women aged 50+ years. Int. Psychogeriatr. 2017, 29, 359–372.

19. Iniguez, K.C.; Stankowski, R.V. Adverse childhood experiences and health in adulthood in a rural population-based sample. Clin. Med. Res. 2016, 14, 126–137.

20. Alhowaymel, F.; Kalmakis, K.; Jacelon, C. Developing the concept of adverse childhood experiences: A global perspective. J. Pediatr. Nurs. 2021, 56, 18–23.

21. Hughes, K.; Bellis, M.A.; Hardcastle, K.A.; Sethi, D.; Butchart, A.; Mikton, C.; Jones, L.; Dunne, M.P. The effect of multiple adverse childhood experiences on health: A systematic review and meta-analysis. Lancet Public Health 2017, 2, e356–e366.

22. Kelly-Irving, M.; Lepage, B.; Dedieu, D.; Bartley, M.; Blane, D.; Grosclaude, P.; Lang, T.; Delpierre, C. Adverse childhood experiences and premature all-cause mortality. Eur. J. Epidemiol. 2013, 28, 721–734.

23. Marryat, L.; Frank, J. Factors associated with adverse childhood experiences in scottish children: A prospective cohort study. BMJPO 2019, 3, e000340.

24. Daníelsdóttir, H.B.; Aspelund, T.; Thordardottir, E.B.; Fall, K.; Fang, F.; Tómasson, G.; Rúnarsdóttir, H.; Yang, Q.; Choi, K.W.; Kennedy, B.; et al. Adverse childhood experiences and resilience among adult women: A population-based study. eLife 2022, 11, e71770.

25. Gilbert, L.K.; Breiding, M.J.; Merrick, M.T.; Thompson, W.W.; Ford, D.C.; Dhingra, S.S.; Parks, S.E. Childhood adversity and adult chronic disease. Am. J. Prev. Med. 2015, 48, 345–349.

26. Negriff, S. Expanding our understanding of intergenerational exposure to adversity. Child. Youth Serv. Rev. 2020, 118, 105369.

27. Almuneef, M.; Hollinshead, D.; Saleheen, H.; AlMadani, S.; Derkash, B.; AlBuhairan, F.; Al-Eissa, M.; Fluke, J. Adverse childhood experiences and association with health, mental health, and risky behavior in the Kingdom of Saudi Arabia. Child Abus. Negl. 2016, 60, 10–17.

28. Almuneef, M.; ElChoueiry, N.; Saleheen, H.N.; Al-Eissa, M. Gender-based disparities in the impact of adverse childhood experiences on adult health: Findings from a national study in the Kingdom of Saudi Arabia. Int. J. Equity Health 2017, 16, 90.

29. Kim, Y.H. Associations of adverse childhood experiences with depression and alcohol abuse among Korean college students. Child Abus. Negl. 2017, 67, 338–348.

30. Chen, W.; Yu, Z.; Wang, L.; Gross, D. Examining childhood adversities in chinese health science students using the simplified Chinese version of the Adverse Childhood Experiences-International Questionnaire (SC-ACE-IQ). Adv. Res. Sci. 2022, 3, 335–346.

31. Kazeem, O.T. A validation of the adverse childhood experiences scale in Nigeria. Res. Humanit. Soc. Sci. 2015, 5, 18–23.

32. Ho, G.W.K.; Chan, A.C.Y.; Chien, W.-T.; Bressington, D.T.; Karatzias, T. Examining patterns of adversity in Chinese young adults using the Adverse Childhood Experiences—International Questionnaire (ACE-IQ). Child Abus. Negl. 2019, 88, 179–188.

33. Ramiro, L.S.; Madrid, B.J.; Brown, D.W. Adverse Childhood Experiences (ACE) and health-risk behaviors among adults in a developing country setting. Child Abus. Negl. 2010, 34, 842–855.

34. Soares, A.L.G.; Howe, L.D.; Matijasevich, A.; Wehrmeister, F.C.; Menezes, A.M.B.; Gonçalves, H. Adverse childhood experiences: Prevalence and related factors in adolescents of a Brazilian birth cohort. Child Abus. Negl. 2016, 51, 21–30.

35. Tyrovolas, S.; El Bcheraoui, C.; Alghnam, S.A.; Alhabib, K.F.; Almadi, M.A.H.; Al-Raddadi, R.M.; Bedi, N.; El Tantawi, M.; Krish, V.S.; Memish, Z.A.; et al. The burden of disease in Saudi Arabia 1990–2017: Results from the global burden of disease study 2017. Lancet Planet. Health 2020, 4, e195–e208.

36. Hajat, C.; Stein, E. The global burden of multiple chronic conditions: A narrative review. Prev. Med. Rep. 2018, 12, 284–293.

37. Memish, Z.A.; Jaber, S.; Mokdad, A.H.; AlMazroa, M.A.; Murray, C.J.L.; Al Rabeeah, A.A.; The Saudi Burden of Disease Collaborators. Burden of disease, injuries, and risk factors in the Kingdom of Saudi Arabia, 1990–2010. Prev. Chronic Dis. 2014, 11, 140176.

38. El Bcheraoui, C.; Tuffaha, M.; Daoud, F.; Kravitz, H.; AlMazroa, M.A.; Al Saeedi, M.; Memish, Z.A.; Basulaiman, M.; Al Rabeeah, A.A.; Mokdad, A.H. Access and barriers to healthcare in the Kingdom of Saudi Arabia, 2013: Findings from a National Multistage Survey. BMJ Open 2015, 5, e007801.

39. Al-Shawi, A.; Lafta, R. Effect of adverse childhood experiences on physical health in adulthood: Results of a study conducted in Baghdad City. J. Fam. Community Med. 2015, 22, 78.

40. Downey, J.C.; Gudmunson, C.G.; Pang, Y.C.; Lee, K. Adverse childhood experiences affect health risk behaviors and chronic health of Iowans. J. Fam. Viol. 2017, 32, 557–564.

41. Chang, X.; Jiang, X.; Mkandarwire, T.; Shen, M. Associations between adverse childhood experiences and health outcomes in adults aged 18–59 years. PLoS ONE 2019, 14, e0211850.

42. Salinas-Miranda, A.A.; Salemi, J.L.; King, L.M.; Baldwin, J.A.; Berry, E.; Austin, D.A.; Scarborough, K.; Spooner, K.K.; Zoorob, R.J.; Salihu, H.M. Adverse childhood experiences and health-related quality of life in adulthood: Revelations from a community needs assessment. Health Qual. Life Outcomes 2015, 13, 123.

43. Bellis, M.A.; Hughes, K.; Leckenby, N.; Hardcastle, K.A.; Perkins, C.; Lowey, H. Measuring mortality and the burden of adult disease associated with adverse childhood experiences in England: A national survey. J. Public Health 2015, 37, 445–454.

44. Wickham, R.J. Secondary analysis research. JADPRO 2019, 10, 394–400.

45. Talari, K.; Goyal, M. Retrospective studies—Utility and caveats. J. R. Coll. Physicians Edinb. 2020, 50, 398–402.