

Latent Class Analysis of Adverse Childhood Experiences and Their Co-Occurrence in University Students in Islamabad (Pakistan)

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Abstract

Adverse childhood experiences (ACEs) have lasting impacts on both mental and physical health, making them a significant public health concern. This study aimed to examine the latent class structure, patterns of co-occurrence, and prevalence of ACEs among university students in Islamabad, Pakistan. After obtaining informed consent, participants were randomly selected from various institutions, and data were collected using the online WHO Adverse Childhood Experiences International Questionnaire (ACE-IQ). Statistical analyses included descriptive statistics, chi-square tests, Cramér's V, and latent class analysis (LCA). The results revealed a high overall prevalence of ACEs, with the most frequently reported experiences being physical abuse (65.2%) and exposure to peer or community violence (82.9%). The LCA identified three distinct latent classes: Class 1—High/Multiple ACEs (21.38%), Class 2—Low ACEs (39.26%), and Class 3—ACE patterns characterized by neglect, physical abuse, and exposure to violence (39.36%). These findings underscore the importance of trauma-informed interventions and early prevention strategies within university settings, highlighting the clustering of adverse experiences during childhood.

Keywords: Adverse Childhood Experiences, Co-occurrence, Latent Class Analysis, Pakistani Youth.

Introduction

Adverse Childhood Experiences (ACEs), or stressful events experienced early in life, have profound and lasting effects on an individual's physical, mental, and social well-being (Maul et al., 2019). These experiences encompass a wide range of traumas, including exposure to dysfunctional family environments such as parental separation, domestic violence, substance abuse, mental illness, or incarceration of a household member, as well as direct experiences of emotional, physical, or sexual abuse (Petrucelli et al., 2019; Crouch et al., 2019). Due to their enduring impact on both personal health and societal welfare, ACEs are recognized as a significant public health concern (Flores-Torres et al., 2020).

Research consistently demonstrates a graded relationship between the number of ACEs and adverse health outcomes in adulthood. Individuals with multiple ACEs are at higher risk of developing chronic conditions such as obesity, diabetes, cardiovascular disease, depression, anxiety, substance abuse, and sleep disturbances (Chang et al., 2019; Giano et al., 2020; Ikram et al., 2022). For instance, Dong et al. reported a dose-response relationship between

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cumulative ACE exposure and the future risk of ischemic heart disease (Dong et al., 2004). Neurological studies suggest that early life stress can trigger toxic stress, disrupting brain development and emotional regulation in children and adolescents (Karatekin & Ahluwalia, 2020; Herzog & Schmahl, 2018).

Although ACEs are present across all cultural and socioeconomic groups globally, they are more prevalent in low- and middle-income countries, where limited access to healthcare, poverty, and weak protective systems exacerbate vulnerability (Walsh et al., 2019). UNICEF data indicate that 59% of children in the United States and 46% in the United Kingdom experience at least one ACE. In Mexico, 63% of children reported experiencing physical or psychological violence in the past year (Flores-Torres et al., 2020). Beyond the health consequences, ACEs contribute to substantial economic costs; for example, non-fatal child abuse can incur nearly \$200,000 per victim over a lifetime (Koball et al., 2019).

In Pakistan, data on ACEs remain limited. Estimates suggest that roughly half of children and adolescents may experience at least one adverse event, although nationally representative statistics are lacking (Abbas & Jabeen, 2020; LeMasters et al., 2021). Several factors—such as a large youth population exceeding 70 million, poverty, hunger, child labor, homelessness, and insufficient child protection systems—create a high-risk environment for ACEs. Cultural norms, including taboos surrounding discussions of abuse and the widespread use of corporal punishment, further hinder recognition and intervention (Maul et al., 2019).

Most research in Pakistan has focused on individual forms of childhood adversity, with limited attention to patterns or clustering of multiple ACEs. This study aims to address this gap by using Latent Class Analysis (LCA) to investigate the prevalence and latent patterns of ACEs among university students in Islamabad. Understanding how different adversities co-occur in the Pakistani context can guide the development of targeted interventions, raise awareness, and inform the creation of trauma-informed policies.

Materials and Methods

This study was conducted across three randomly selected universities in Islamabad, Pakistan, using a computer-generated randomization process. The selected institutions were: (1) University of Islamabad, (2) University of Central Punjab, and (3) Health Services Academy, Islamabad.

An online version of the Adverse Childhood Experiences International Questionnaire (ACE-IQ) was distributed digitally through departmental mailing lists and academic networks within these universities. The use of an online survey format was chosen to ensure participant anonymity and to provide a culturally sensitive approach, given the personal nature of the subject matter.

A stratified random sampling technique was employed to capture a representative sample of students across various educational levels (undergraduate and postgraduate). Within each academic level, students were randomly selected to participate in the survey, ensuring diverse representation.

Before participation, all respondents were required to read and electronically agree to an informed consent statement embedded at the beginning of the questionnaire. Only those who provided explicit consent were allowed to proceed, and their responses were included in the final dataset. Participation was entirely voluntary, and all responses were kept anonymous and confidential.

Ethical considerations were prioritized throughout the study design and data collection process. The online administration of the ACE-IQ not only ensured confidentiality but also allowed students to respond at their convenience, minimizing discomfort and encouraging honest disclosure.

Study Design and Sample Size

The frequency and trends of adverse childhood experiences (ACEs) among college students in Islamabad, Pakistan, were evaluated using a cross-sectional approach. For assessing prevalence in a large population, this strategy was thought to be the most appropriate [1]. More than 100,000 students enrolled in different universities around Islamabad made up the target group. With a 95% confidence level and a 5% margin of error, 289 individuals were determined to be the bare minimum needed for the study. The final sample size was raised to 309 pupils in order to account for any non-response or inconsistent data.

Data Collection Instrument

Data was gathered using the *Adverse Childhood Experiences International Questionnaire* (ACE-IQ) developed by the World Health Organization (Ho et al., 2019). The 41 items in this standardized instrument cover a wide range of topics, such as demographic data, family dynamics, parent–child interactions, and direct or indirect exposure to different types of violence, abuse, and neglect. The ACE-IQ offers a thorough understanding of childhood adversity and has been verified for use in a variety of cultural contexts.

Data Collection Procedure

Students from Islamabad's public and private institutions were given self-administered questionnaires to complete in order to gather data. Students were informed of the study's goals and methods before participation, and their signed agreement was acquired. Anonymity was protected at all times, and participation was entirely voluntary. Under the direction of the lead investigator, skilled research assistants collected data over the course of a month.

Statistical Analysis

Each ACE category's total prevalence was determined using descriptive statistics. The WHO-recommended method (Ho et al., 2019) was used for the scoring and analysis of ACE-IQ responses, with cumulative ACE scores calculated by counting each positive response. Chi-square tests and cross-tabulations were used to look at relationships between specific ACEs. R statistical software version 4.2.3 was used to conduct latent class analysis (LCA) in order to find unique patterns of ACE co-occurrence. The model encompassed important ACE factors such as bullying, parental separation, death, incarceration, peer/community violence, exposure to marital violence, physical and sexual abuse, emotional and physical neglect, and mental illness or drug misuse in the home. The degree of correlation between categorical variables was also assessed using Cramér's V. The LCA model ultimately identified three latent classes based on the clustering of ACEs.

Ethical Considerations

The Health Services Academy in Islamabad's Institutional Review Board granted the study ethical approval (Ref No. D/42/HSA). Every procedure that included human subjects was carried out in compliance with institutional policies and the Declaration of Helsinki's ethical principles. Participants were limited to adults who were fully aware of the purpose and nature of the study. Before the start of data Collection, each participant gave their informed consent.

Results

The study assessed how everyday adverse childhood experiences (ACEs) were among Pakistani university students in Islamabad. Following a frequency analysis of the responses, the percentage values for each domain of unpleasant childhood events were computed, and between 30% and 85% of people reported having these experiences. The highest rate of exposure to community/peer violence was 82.9%, whereas 65.2% of individuals reported

experiencing physical abuse. Interestingly, 80.3% of participants reported having at least three ACEs, 93.5% reported having at least two, and 97.7% reported having at least one. Of the individuals, 69.6% (95% CI) reported having four or more ACEs. Additionally, frequency estimation was used to examine the participant demographics.

Table 1: Demographics of Study Participants

No.	Characteristic	Frequency	Percentage
1	Gender		
	Female	184	61%
	Male	122	38%
	Prefer not to say	3	1%
2	Employment Status		
	Government employee	4	1.3%
	Non-government employee	36	11.7%
	Self-employed	30	9.7%
	Student only	237	76.5%
	Missing value	2	0.8%
3	Marital Status		
	Married	30	9.7%
	Never married	278	90.3%
	Missing	1	0%

Table 2: Prevalence of Subcategories of Adverse Childhood Experiences in the Study Population

No.	Adverse Experience	Frequency	Percentage
1	Physical Neglect	94	30.3%
2	Emotional Neglect	189	61.2%
3	Sexual Abuse	89	28.8%
4	Emotional Abuse	167	54.2%
5	Divorce/Separation of Parents	21	6.8%
6	Death of Either Parent	41	13.3%
7	Witnessing Domestic Violence	208	67.1%
8	Exposure to Substance Abuse at Home	14	4.5%
9	Mental Illness at Home	53	17.2%
10	Having a Family Member Incarcerated	19	6.1%
11	Physical Abuse	202	65.2%
12	Bullying	177	57.1%
13	Community/Peer Violence	257	82.9%
14	Exposure to War or Terrorism	63	20.3%

Co-occurrence of Adverse Childhood Experiences

The likelihood of different childhood adversities co-occurring in our study population was analyzed using the chi-square test. The strength of the association between various adversities, including physical abuse, sexual abuse, bullying, peer violence, emotional neglect, physical neglect, witnessing domestic violence, and mental illness at home, was assessed using the Cramer-V test. The results are summarized in Tables 3 and 4.

Table 3: Likelihood of Co-occurrence Between Different Adverse Childhood Experiences

Independent Adversities	Dependent Adversities	Physical Abuse	Sexual Abuse	Bullying	Peer/Community Violence	Emotional Neglect
Physical Neglect	Yes/No	73/129 (23.6%/41.7%)	21/86 (6.8%/27.8%)	39/49 (12.6%/15.9%)	55/165 (17.8%/53.4%)	59/118 (19.1%/38.2%)
Witnessed Domestic Violence	Yes/No	167/35 (54%/11.3%)	41/66 (13.3%/21.4%)	68/20 (22%/6.5%)	140/80 (45.3%/36.4%)	131/46 (42.4%/14.9%)
Mental Illness at Home	Yes/No	45/157 (14.6%/50.8%)	8/99 (2.6%/32%)	29/59 (9.4%/19.1%)	24/196 (7.8%/63.4%)	37/140 (12%/45.3%)

Table 4: Results of the Cramer-V Test for Association Between Selected Experiences

Adversity Pair	Cramer-V Test Value
Physical Abuse & Emotional Neglect	0.313
Physical Abuse & Physical Neglect	0.171
Physical Abuse & Witnessed Domestic Violence	0.45
Physical Abuse & Mental Illness at Home	0.187
Sexual Abuse & Emotional Neglect	0.120
Sexual Abuse & Physical Neglect	0.191
Sexual Abuse & Witnessed Domestic Violence	0.134
Sexual Abuse & Mental Illness at Home	0.265

Latent Class Analysis

To further examine the co-occurrence of ACEs, Latent Class Analysis (LCA) was performed. The results divided the participants into three distinct groups (classes) based on their experiences with ACEs, as summarized in Table 5. The population distribution across these classes was as follows: Class 1 (21.4%) included individuals with multiple ACEs, Class 2 (39.3%) had low ACEs, and Class 3 (39.4%) experienced ACEs related to neglect, physical abuse, and violence.

Table 5: Results of Latent Class Analysis (LCA)

Variable	Class 1 (High ACEs)	Class 2 (Low ACEs)	Class 3 (Neglect & Abuse)
Emotional Neglect	0.80	0.34	0.77
Physical Neglect	0.45	0.18	0.33
Substance Abuse at Home	0.17	0.01	0.004
Mental Illness at Home	0.51	0.02	0.12
Incarcerated Family Member	0.26	0.00	0.01
Divorce/Separation of Parents	0.26	0.00	0.02
Death of Either Parent	0.22	0.19	0.02
Witnessing Domestic Violence	0.80	0.37	0.89
Physical Abuse	0.84	0.20	1.00
Sexual Abuse	0.68	0.09	0.25
Bullying	0.69	0.41	0.66
Community Violence	0.83	0.76	0.89
Exposure to War	0.41	0.13	0.15

Discussion

The direct, proven causes of illnesses have been the primary focus of human health research for many years. The knowledge of more distant and indirect variables that can contribute to the emergence of chronic illnesses in later life stages has, nonetheless, changed throughout time (Petruccelli et al., 2019; Crouch et al., 2019; Flores-Torres et al., 2020). Adverse childhood experiences (ACEs) are one such element that has received a lot of attention lately. A child's exposure to a variety of harmful experiences during childhood, such as physical abuse, sexual abuse, emotional neglect, family substance abuse, mental illness in the home, parental separation, and exposure to violence or community-based trauma, is what the Centers for Disease Control and Prevention (CDC) defines as an adverse childhood experience (ACE) (Lee et al., 2020). A rising number of physical, mental, and social health problems in adulthood are being associated with these experiences.

Emerging evidence suggests that ACEs serve as significant predisposing factors for numerous chronic diseases, including cardiovascular diseases, respiratory issues, gastrointestinal disorders, mental health problems, and social health challenges that manifest early in life. Research across different ethnicities and regions supports these findings, highlighting the global relevance of ACEs (Mersky et al., 2021). However, there remains a considerable gap in research regarding ACEs in South Asia, particularly in Pakistan. While some studies have explored the impact of ACEs, most have been limited to female populations (LeMasters et al., 2021). Our study, in contrast, focused on university students, a demographic that is representative of the broader youth population and capable of providing meaningful self-reported data. Globally, studies on ACEs among university students have shown a high prevalence of these experiences, reinforcing the need for further attention to this group (Abbas & Jabeen, 2020; Ho et al., 2019; Merians et al., 2019).

We discovered a remarkably high frequency of ACEs in our survey, which included male and female students from three prominent Islamabad institutions. Three or more ACEs were indicated by over 80% of the individuals; this threshold is linked to a markedly increased risk of physical and behavioral health problems later in life (Alhowaymel et al., 2023). Physical abuse (65.2%) and exposure to peer or community violence (82.9%) were the most common types of ACEs. These results imply that ACEs impact many facets of young people's lives and are not only common but also varied in their appearance.

A key strength of our study was its examination of the co-occurrence of different ACEs, an area that has been minimally explored in existing research (Bussemakers et al., 2019; Liu et al., 2020; Brown et al., 2019). Our results revealed a moderately positive correlation between emotional neglect, witnessing domestic violence, physical abuse, and sexual abuse. Additionally, physical neglect showed a mild positive correlation with physical abuse, sexual abuse, and exposure to peer/community violence. These findings align with the broader understanding that inevitable childhood adversities tend to co-occur due to shared underlying factors, such as family dysfunction or socioeconomic stress. For example, witnessing domestic violence was positively correlated with both physical abuse and exposure to bullying or community violence, suggesting a compounding effect of multiple stressors in early life.

Latent class analysis (LCA) revealed three distinct classes of ACEs within our dataset: high/multiple ACEs, low ACEs, and neglect- and violence-related ACEs. These findings are consistent with international studies that have categorized individuals based on the extent and types of ACEs they experienced (Merians et al., 2019; Lew & Xian, 2019; Ziobrowski et al., 2020). The identification of these classes underscores the heterogeneous nature of ACEs, providing a nuanced understanding of how different adversities can combine to affect individuals in varying degrees.

Conclusion

Our study concludes by highlighting the startlingly high incidence of ACEs among Islamabad university students, as well as the strong relationships between various adversities that raise the possibility that they may occur together. These results highlight how crucial it is to treat ACEs at an early age in order to lessen their long-term consequences on health and well-being. Future studies should look into these connections in more detail and find practical preventative measures to lessen the incidence and effects of ACEs in Pakistan and other comparable settings throughout the world.

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