

The Effects of Adverse Childhood Experiences on Developing Diabetes Using Path Analysis
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Abstract

Introduction: Childhood trauma is an ongoing problem that has many debilitating consequences, including poor outcomes of both mental and physical health. Trauma can result in chronic stress which impairs the neuroendocrine and immune systems. This stress often leads to an abundance of cortisol in the body which can have detrimental effects on the body, specifically a higher risk of developing chronic illnesses. Due to the implications of chronic stress on the body, childhood trauma should be assessed when appropriate to assist in possibly preventing long-term health effects. The following path analysis was conducted to assess whether certain types of traumatic experiences in childhood could predict the development of diabetes. We hypothesized that (I) one or more ACE's will predict the development of diabetes and (II) various types of ACE's will yield different effect sizes in predicting the development of diabetes.

Methods: Archival data was obtained from the 2017 National Survey of Child Health, which included parent/caregiver self-reports concerning 21,599 children, ages 0-18. Demographic (age, gender), clinical (diabetes diagnosis), and ACE variables were reported at one time point. A path analysis was used to examine this data and evaluate the predictive relationship of adverse childhood experiences on diabetes.

Results: Results showed that the only significant direct effect on the presence of diabetes was experiencing low income ($B = 0.305$, $p = .001$). Cohen's d for this relationship was 0.0465, which is a small effect size.

Conclusion: These findings show the importance of assessing for adverse childhood experiences in primary healthcare settings so that brief interventions can be provided to help in the prevention of development of chronic illnesses. It is important to further evaluate potential moderators between this relationship.

Introduction

Childhood trauma is an ongoing problem that has many debilitating short- and long-term consequences. An estimated 2-3 million children have experienced maltreatment with an estimate of 5 million children who experience a traumatic event every year in the United States (Fratto, 2016). Not only can childhood trauma influence the development of mental disorders, but a plethora of research has shown that it influences the development of physical illness and poor health (Felitti et al., 1998; Forkey & Szilagyi, 2014). Trauma can result in chronic stress, which impairs the neuroendocrine and immune systems. This toxic stress often causes a prolonged activation of the HPA axis response leading to abnormal patterns of cortisol in the body (Forkey & Conn, 2018). Additionally, toxic stress can cause issues with immune responses, gene expression, and neurodevelopment of the brain (Forkey & Szilagyi, 2014; Merrick & Latzman, 2014). Specifically, these physiological responses may result in poorer physical health (Brown, Fang, & Florence, 2011). These consequences can be apparent in childhood, adolescence, or adulthood (Merrick & Latzman, 2014; Hillis, Mercy, & Saul, 2017).

Childhood trauma can influence physical health in general, but also can cause increased risk of developing chronic illnesses (Collins, 2016). Not only does this personally affect the health of people who have experienced the trauma, but it also is a public health concern due to increased hospital visits, longer hospital stays, and higher mortality rates among this population (Friedman, Sheppard, & Freidman, 2012).

Adverse childhood experiences also known as ACEs are traumatic events that occur during childhood that have long-lasting effects on a person's biopsychosocial development over the course of the lifespan (Bryan, 2019). Commonly agreed categories of childhood maltreatment that fall into the term of ACE's include physical, emotional, and sexual abuse; physical and

emotional neglect; witnessing domestic violence; having a family member affected by mental illness, substance abuse, or incarceration; and losing a parent to separation or divorce (Bryan, 2019). ACEs can have effects on many aspects of a person's development including acute physical injuries, health-risk behaviors, social repercussions and long term physical and mental health issues (Bryan, 2019; Ford et al., 2019; Figure A). The most common types of chronic illness associated with ACES found in the review were asthma, eczema, allergies, gastric difficulties, migraines, HIV, chronic pain, obesity, cardiac disease and issues, and STIs.

A systematic review of the literature found a strong relationship between ACEs and chronic illness. Studies found that participants with a history of childhood trauma impacted the release of cortisol when under stress compared to a normative group which impacts many long-term physical issues (Merrick & Latzman, 2014). Articles evaluated whether complex trauma impacted the development of chronic illnesses more than single trauma experiences. Overall, the literature indicates that there is a dose-response relationship between these two factors and that the number of adverse trauma experiences is more predictive of poor health than trauma type (Jacobs et al., 2012; Khrapatina & Berman, 2017).

Not every child who has had ACEs will develop a chronic illness or poor health during their lifetime. Mediators were evaluated throughout this review and several factors were found to have a possible impact. Factors found that could possibly impact the relationship between childhood trauma and chronic illnesses were lack of access to healthcare, a non-supportive family, level of resiliency, and disease-provoking behaviors (Collins 2016; Klassen et al., 2016; Jackson & Deye, 2015; Figure A).

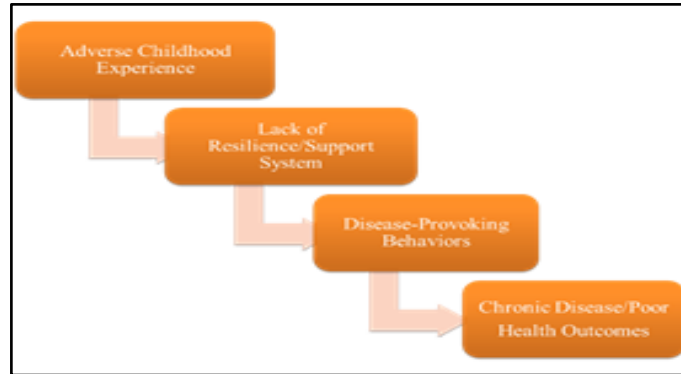


Figure A. The proposed model of the relationship between ACEs and chronic illness.

Overall, the majority of the literature found that childhood trauma had a significant influence on the development of chronic illness, and that there was a positive correlation between number of traumas and poor health, including chronic illness (Fratto, 2016). The relationship between childhood trauma and chronic illness is highly apparent according to the literature; however, these results have not been evaluated in a specific manner of whether certain ACEs have a stronger predictability of developing chronic illnesses. The aim of this study was to draw causal inferences on specific types of ACEs in predicting a diagnosis of diabetes. Our hypothesis was two-fold: (I) one or more ACE's will predict the development of diabetes and (II) various types of ACE's will yield different effect sizes in predicting the development of diabetes.

Methods

Archival data was utilized from the 2017 National Child Health Survey accessed by the Data Resource Center for Child & Adolescent Health. Participants included the parents/caregivers of 21, 599 children and data was collected during the time period of August 2017 to February 2018. The self-report survey was filled out by the parents/caregivers and evaluated the child's demographic information, health and functional status, early childhood experiences including ACEs, family functioning, and healthcare utilization. ACE variables

included in this survey included: hard to get by on family's income (hard to cover basics like food or housing); parent/guardians divorced or separated; parent/guardian died; parent/guardian served time in jail, saw or heard parents or adults slap, hit, kick, punch one another in the home; victim/witness of neighborhood violence; lived with anyone who was mentally ill, suicidal, or severely depressed; lived with anyone who had a problem with alcohol or drugs; and treated or judged because of race or ethnic group. The survey was administered through the mail and online to all 50 states based on demographics and census information. Path analysis was performed to provide an advanced regression and determine the predictability of different types of ACEs on a diagnosis of diabetes for children ages 0-18.

Results

Descriptive analyses showed that participants included 11,067 males and 10,532 females, with 91 participants having a current diagnosis of diabetes. ACE-Income was endorsed by 4,123 participants, ACE-Divorce was endorsed by 4,657 participants, ACE-Death was endorsed by 659 participants, ACE-Jail was endorsed by 1,299 participants, ACE-Domestic Violence was endorsed by 1,029 participants, ACE-Neighborhood Violence was endorsed by 783 participants, ACE-Mental Health was endorsed by 1,733 participants, ACE-Drug was endorsed by 1,896 participants, and ACE-Discrimination was endorsed by 621 participants.

Standardized beta scores and Cohen's *d* were calculated for each of the ACE variables (Table 1). The only ACE variable that produced a significant beta was ACE-Income ($B = .305$, $p = .001$) which was described as hard to get by on family's income (hard to cover basics like food or housing). In addition, the Cohen's *d* for ACE-Income was 0.0465 which was a small effect size. Cohen's *d* for the other ACE variables were between -0.0227 and 0.016.

ACE Variable	Cohen's <i>d</i>	Standardized Beta
Income	0.0465*	0.305, p = 0.001
Divorce	-0.0051	-0.039
Death	-0.0227	-5.404
Jail	-0.003	-.023
Domestic Violence	-0.0015	-.012
Neighborhood Violence	0.0023	.062
Mental Health	-0.0087	-.176
Drug	-0.0036	-.003
Discrimination	0.016	0.493

Table 1. Cohen's *d* effect size with ACE variables on developing diabetes.

Discussion

This study aimed to determine (I) if one or more ACEs predict development of diabetes and (II) if various types of ACE's will yield different effect sizes in predicting the development of diabetes. Results indicate that the presence of one or more ACEs accounts for a very small piece of prediction, and only one ACE was significant in predicting development of diabetes (ACE-Income, standardized beta = .305; p = .001). This shows that children who have experienced low income levels, including making it difficult to cover basics such as food or housing, increases the

likelihood of developing diabetes. Cohen's d was also calculated for ACE-Income and diabetes diagnosis; however, the results showed an extremely small effect size (Cohen's $d = .05$). This causal relationship between low income status in childhood and the development of diabetes is consistent with the literature (Slack, 2017) and may be explained by stress experienced around low income, ability to access healthcare, and availability of healthy foods. Hypothesis (I) concerning one or more ACEs predicting development of diabetes was supported with the relationship between low income and development of diabetes. Hypothesis (II) was also supported, in that other variables concerning ACE categories of divorce, death, jail, domestic violence, neighborhood violence, mental health, drug, and discrimination were not significantly related to the development of diabetes.

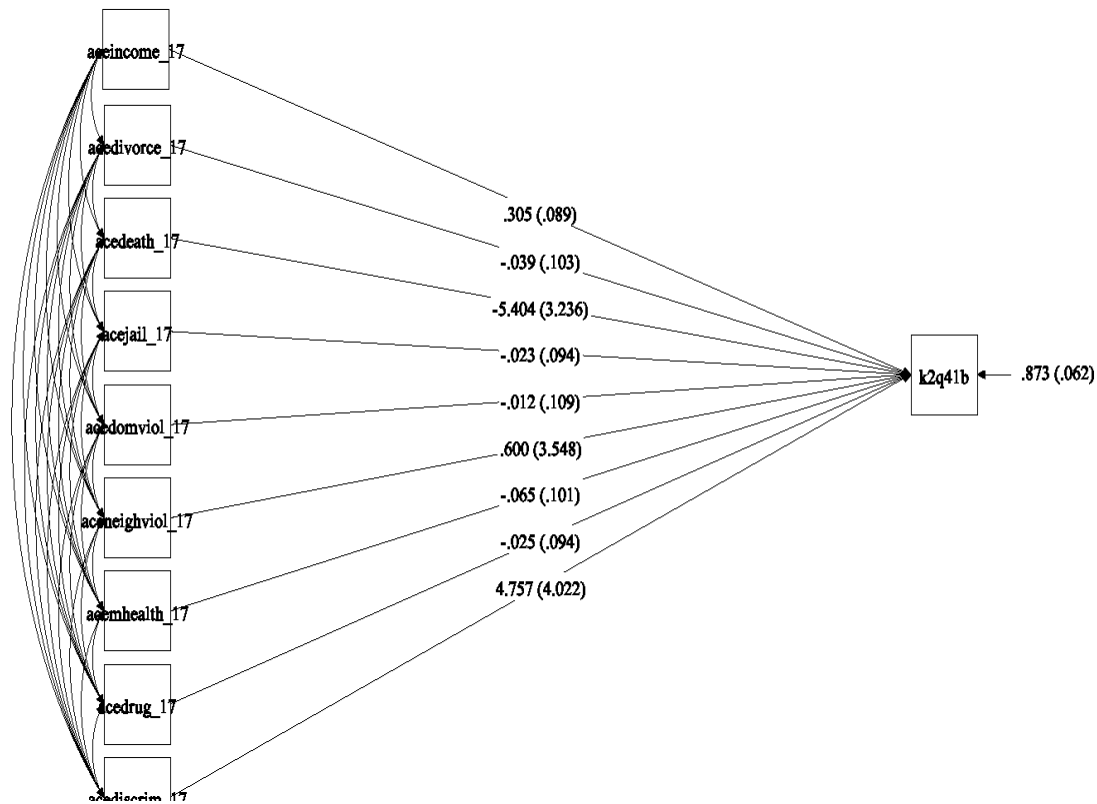


Figure B. Path Analysis of ACE Variables on Diabetes Diagnosis

There were several limitations in this study. First, data was only collected from parent self-reports and not by the participants themselves. This could limit the accuracy of the information gathered, specifically about adverse childhood experiences. Additionally, participants' long-term health information was not obtained since data was only collected while participants were within the age range of 0-18. Since the literature shows that ACEs highly correlate with developing chronic illnesses later in life, looking past the ages of childhood could provide useful information (Bryan, 2019). Future studies may consider collecting longitudinal data over many time points for additional information, since this study only had one point of data collection. Another important factor that should be addressed in future research is possible moderators and mediators of the relationship between ACEs and developing diabetes. Factors such as resiliency, social support, and family support could affect the relationship.

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