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# The Long Shadow of Adverse Childhood Experiences (ACEs): 1. Mental Health Outcomes in a Community Sample

**Keith Stephen Dobson***, **Lauren Allan, Gina Marandola, Dennis Pusch**
*Department of Psychology, University of Calgary 2500 University, Drive NW Calgary, Alberta, Canada*

## ABSTRACT

**Background:** Research has consistently linked adverse childhood experiences (ACEs) to negative mental and physical health outcomes later in life. The present study replicated the landmark ACE study in the United States, but within a Canadian adult primary care population (N=3,924).

**Methods:** Participants completed an Adverse Childhood Experiences Questionnaire and a self-report measure for the diagnoses of a variety of mental health problems. Using age and socioeconomic status as covariates, odds ratios were calculated with multivariate logistic regression separately for males and females.

**Results:** Approximately 30.3% of the sample had an ACE score of 0, while the scores for 1, 2, 3 and 4+ACEs were 23.1%, 16.4%, 10.5% and 12.9%, respectively. As the number of ACEs increased, the odds of either a previous or current mental health problem generally also increased in a dose-response manner. This relationship was particularly strong for the DSM-V categories of depressive disorders, anxiety disorders, obsessive-compulsive disorders, bipolar and related disorders, substance-related and addictive disorders, and neurodevelopmental disorders. Similar patterns of results were observed for both males and females.

**Conclusion:** This research replicates results from population-based studies that have examined relationships between ACEs and mental health problems. A better understanding of the factors that underlie the risk for mental disorders is critical to develop prevention and early intervention models. The implications for ACEs screening and intervention within primary care populations are discussed.

## Introduction

Adverse childhood experiences (ACEs) are defined as exposure to emotional, physical, and/ or sexual abuse; emotional and physical neglect; and household dysfunction prior to 18 years of age [1,2]. Research has consistently demonstrated that ACEs have long-term effects on child and adult development, and that they need to be incorporated into models of risk and resilience for adult physical, mental, and social health problems [1].

The original and landmark ACE study involved a large-scale evaluation of adult members of the Kaiser Permanente's San Diego Health Appraisal Clinic [2]. The study assessed the relationship among various forms of self-reported childhood adversity on a broad range of health behaviors and outcomes in adulthood. The authors found that although the

outpatient sample of over 17,000 participants was predominantly middle class and fairly affluent, the occurrence of ACEs were quite common. For example, approximately two-thirds of the sample reported exposure to at least one ACE, while 12% reported having experienced four or more [1]. Similar patterns of reporting have been observed outside of the United States. For example, Ramiro and colleagues found that 75% of respondents in an urban Philippines sample reported exposure to at least one ACE, and 9% reported four or more ACEs [3]. Similar patterns of results also have emerged in countries such as Mexico and China [4,5]. In addition to being widely reported, ACEs also appear to be interrelated. Dong et al reported that the presence of one ACE significantly increased the likelihood of reporting additional ACEs [6].

A consistent association between ACEs and adult

**Coressponding Author:** Keith Stephen Dobson ✉ ksdobson@ucalgary.ca 🖾 Department of Psychology, University of Calgary 2500 University, Drive NW Calgary, Alberta, Canada.

mental health problems has been reported, and notably in the context of adult depression [7-9]. Individuals with depression who have experienced childhood adversity are at greater risk for recurrent or persistent depressive episodes, are less responsive to treatment, and experience a generally less favorable course of illness than those who have not had these experiences [8]. Similarly, the associations between ACEs and anxiety disorders has been consistently demonstrated, as have the associations between ACEs and substance use, psychological distress, and suicide attempts and ideation [10,11]. Notably, the relationships between ACEs and mental health outcomes in later life generally follow a dose-response pattern, wherein mental health concerns rise in concordance with increased exposure to ACEs.

Most ACE studies have employed a cumulative score as a measure of the exposure to childhood adversity. This score captures the sum of the ACE categories for which an individual reports exposure, although it fails to distinguish the number of exposures to each type of category, or the severity of each type of experience [1,11-13]. Nonetheless, research has shown the cumulative impact of multiple types of ACEs on mental health. For example, the original ACE study found that individuals who experienced four or more categories of childhood adversity demonstrated a 4-12 fold increase in depression, alcoholism, and substance abuse compared to individuals who had experienced none [2]. Similar strong dose-response relationships have been demonstrated between ACEs and depression [7,9,14]. For example, Chapman et al. showed that women who reported five or more ACEs had approximately 4-fold increased odds of reporting lifetime and recent depressive disorders compared to those reporting no ACEs [7].

While there is substantial ACE research, no other large-scale replications of the original ACE study exist [2]. There is also wide variability in the methodologies that have been used to measure childhood adversity and its relationship with mental health. For example, some studies have explored the relationship between ACEs and mental health outcomes using phone surveys [13,15]. Additionally, there are few studies where an ACE questionnaire has been used for screening adults in primary care clinics [16]. Given the association between ACEs and a range of mental health outcomes in adulthood, primary care settings are an important venue in which to identify and potentially treat individuals who have experienced childhood adversity. It is well recognized that the first point of contact within the health care system for individuals developing mental and/or physical health problems is a primary care physician [17]. Thus, while research has demonstrated an association between ACEs and negative health outcomes, these associations have rarely been explored within primary care clinics.

## Hypotheses

The current study utilized a similar cross-sectional methodology to the original Kaiser-Permanente study to evaluate the hypothesis of an association between ACEs and mental health disorders within the context of a large sample of adult primary care patients. It was hypothesized that there would be a significant association between ACE scores and a range of mental health symptoms, including neurodevelopmental disorders, bipolar and related disorders, depressive disorders, anxiety disorders, obsessive-compulsive disorder, dissociative disorders, feeding and eating disorders, and substance-related and addictive disorders. The study design permitted a detailed analysis of the degree of association and the computation of odds ratios for various disorders, given differential ACE histories.

## Methods

### Participants

The current study was part of a large-scale multi-phase research program, entitled the embrACE program, which investigated the relationships among ACEs and physical and mental health outcomes among adult primary care patients in Calgary, Alberta, Canada. This specific study was approved by the University of Calgary's Conjoint Health Research Ethics Board (Certificate REB16-2159). Data was collected from a convenience sample of 4,006 primary care patients aged 18 years and older. Participants were recruited from 11 clinics in Calgary and the surrounding area, and recruitment took place from October 2014 to July 2015.

### Procedure

Primary care physicians at clinics in the Calgary area were invited to participate in the embrACE study. Each clinic was offered a $1,000 honorarium in order to compensate for staff time and potential clinic disruption. On average, time spent recruiting at each clinic was roughly six weeks. Recruitment took place at the primary care clinics. Clinics posted a sign on the dates that when data collection was taking place, and patients who were willing to be approached about the study took a card when they checked in for their appointment to so indicate. Trained research assistants approached these patients in the clinic waiting rooms, as they waited to be

seen by their physician. Following a brief description of the embrACE study and the importance of understanding the determinants of adult health, interested participants were asked to provide written informed consent and their contact information. Each participant was assigned a unique participant identification number and was offered the option to complete the questionnaire package online or in paper format. There was no exclusionary criterion to the study, other than the ability to compete the questionnaires unaided. Individuals who chose to online format (n=2,737) were given a card with instructions and the link to the online questionnaire. Individuals who chose the paper format (n=1,269) were given the questionnaire package and a pre-addressed and pre-stamped envelope to return the completed package to the researchers. Each participant received a $20.00 gift card following completion of the questionnaire package.

## Measures

### Demographic information

Participants provided information about their age, gender, and ethnicity, place of birth, education, employment status, annual household income, and marital status. For use as covariates, all nominal and ordinal values (e.g., gender, income, marital status) were dummy coded.

### Adverse Childhood Experiences (ACEs)

ACEs were measured using the Adverse Childhood Experiences (ACE) Questionnaire, a 28-item scale that was adapted from a variety of published questionnaires, including the Conflict Tactics Scale, The Child Trauma Questionnaire, and the Wyatt questions on sexual abuse [18-20]. The scale assessed the 10 most commonly evaluated types of ACEs: emotional, physical, and sexual abuse (3 items), emotional and physical neglect (2 items), and household dysfunction (inter-parental violence, household substance use, parental separation or divorce, mental illness in household, and crime in household; 5 items). Participants were asked to indicate the degree to which they might have experienced the listed events before the age of 18 years old. Response options were "Never", "Once or twice", "Sometimes", "Often", or "Very often". Each ACE was then coded as a binary variable using an algorithm, where "did not occur" was coded as 0 and "occurred" was coded as 1. The sum of this binary coding represented a participant's ACE score, which could range from 0 to 10. In the following analyses, ACE categories were assigned as 0, 1, 2, 3 and 4+, given the decreasing frequency of scores at the higher levels (see below).

An earlier study within the embrACE study demonstrated that this questionnaire is valid for use with the current sample [21]. The measure previously demonstrated excellent internal consistency (α=.95) and construct validity (correlated significantly with both the Child Abuse and Trauma Scale (CATS; r=.94) and the Childhood Trauma Questionnaire (CTQ; r=.95). Previous researchers have also reported substantial reliability of the ACE Questionnaire (κ=.64) [22].

### Mental health conditions

Participants were presented with a list of 20 commonly diagnosed mental health conditions, with titles consistent with The Diagnostic and Statistical Manual of Mental Disorders, 5th edition [23]. This list was generated by a group of clinicians who work in primary care settings. Participants indicated "Yes" (dummy coded as 1) or "No" (dummy coded as 0) to the following question: "Please check "yes" if you have had, or currently have, any of the listed mental health conditions. The condition must have been diagnosed by a health care professional. Check "no" if you have not been diagnoses with the condition". Participants were also given the opportunity to report whether they have ever had any other diagnosed mental health condition.

### Statistical Analyses

### Data screening and management

While 4,006 participants provided informed consent and agreed to complete the questionnaire, 3,932 participants completed it. Additionally, participants who listed "other" as their gender were removed from the analysis given their small representation in the sample (n=8). Thus, all subsequent analyses were conducted with 3,924 participants (97.9%) of the full sample.

Variables were created for each diagnostic category and dummy coded as "1" if any listed diagnosis was ever received or "0" if none of the listed diagnoses were ever received. For those participants who specified "other mental health diagnosis", that diagnosis was included in the respective diagnostic category.

### Main analyses

Analyses were performed using IBM SPSS version 24. Two tailed odds ratios were calculated by performing logistic regressions, with ACEs category as the independent variable and the odds of each type of diagnosis as the dependent variable [24]. As age and family income are often associated with mental health diagnoses, these variables were used as covariates in the analysis to rule

out the possibility that the effects were explained by these factors. All analyses were conducted separately for males and females as different rates of ACEs are reported between males and females, and the genders also demonstrate important differences in rates on some mental health disorders.

## Results

### Participant characteristics

Participants ranged in age from 18 to 92 (M=44.13, SD=17.01), and 68% were women (Table 1). Approximately 82.5% were Caucasian, 7.2% were Asian, 1% were African American or Black, 0.9% First Nation, and 7.9% identified as "other ethnicity". In terms of education, 20.4% of the sample had completed high school or less, 69.3% had completed all or some college or university, while 10.1% had completed graduate studies. The sample reported a high current annual household income, as 48% had an income of over $80,000 CAD per year. The majority of participants (63.8%) were married or cohabitating.

**Table 1.** Demographic characteristics of the sample (N=3,556).

| Variable | n | - | Males (n=1241) | | Females (n=2673) | |
|---|---|---|---|---|---|---|
| - | - | %/M (SD) | *n* | %/M (SD) | *n* | %/M (SD) |
| Age | - | 44.13 (17.01) | | 46.13 (17.16) | | 46.13 (17.16) |
| **Education** | | | | | | |
| Less than high school | 199 | 5.10% | 74 | 6.00% | 125 | 4.70% |
| High school or equiv. | 602 | 15.30% | 203 | 16.40% | 398 | 14.90% |
| Some post-second-ary | 876 | 22.30% | 271 | 21.80% | 600 | 22.40% |
| Post-second-ary | 1845 | 47.00% | 549 | 44.20% | 1291 | 48.40% |
| Graduate degree | 399 | 10.10% | 142 | 11.40% | 255 | 9.50% |
| **Household Income** | | | | | | |
| Less than 20,000 | 387 | 9.80% | 95 | 7.70% | 287 | 10.70% |
| 20,000-39,999 | 473 | 12.00% | 138 | 11.10% | 335 | 12.50% |
| 40,000-59,999 | 565 | 14.40% | 162 | 13.10% | 401 | 15.00% |
| 60,000-79,999 | 537 | 13.70% | 184 | 14.80% | 352 | 13.20% |
| Greater than 80,000 | 1888 | 48.00% | 651 | 52.50% | 1232 | 46.10% |
| **Marital Status** | | | | | | |
| Married/Co-habitating | 2509 | 63.80% | 834 | 67.20% | 1672 | 62.50% |
| Never married | 900 | 22.90% | 297 | 23.90% | 594 | 22.20% |
| Widowed | 107 | 2.70% | 13 | 1.00% | 94 | 3.50% |
| Separated/Divorced | 402 | 10.30% | 92 | 7.50% | 308 | 11.50% |

| Employment | | | | | | |
|---|---|---|---|---|---|---|
| Full-time | 1826 | 46.40% | 751 | 60.50% | 1070 | 40.00% |
| Part-time | 836 | 21.30% | 137 | 11.00% | 694 | 26.00% |
| Unemployed | 607 | 15.40% | 131 | 10.60% | 472 | 17.70% |
| Retired | 647 | 16.50% | 218 | 17.60% | 429 | 16.00% |
| **Ethnicity** | | | | | | |
| Caucasian | 3243 | 82.50% | 984 | 79.30% | 2251 | 84.20% |
| Black/African | 38 | 1.00% | 20 | 1.60% | 18 | 0.70% |
| Asian | 285 | 7.20% | 100 | 8.10% | 184 | 6.90% |
| First Nations | 36 | 0.90% | 12 | 1.00% | 22 | 0.80% |
| Other | 313 | 7.90% | 122 | 6.30% | 189 | 7.10% |
| **ACEs** | | | | | | |
| 0 | 1192 | 30.30% | 420 | 33.80% | 771 | 28.80% |
| 1 | 907 | 23.10% | 309 | 24.90% | 594 | 22.20% |
| 2 | 643 | 16.40% | 198 | 16.00% | 442 | 16.50% |
| 3 | 411 | 10.50% | 129 | 10.40% | 278 | 10.40% |
| 4+ | 711 | 12.90% | 160 | 12.90% | 546 | 20.50% |

Table 2 provides information about the rates of ACEs in the current sample, categorized as 0, 1, 2, 3 and 4 or more. The decision to make this categorization system was in part because this was a replication study, and in part because higher ACE scores are relatively uncommon, and so was grouped to provide a sufficient sample size for analyses. As shown there, approximately 30.3% of the sample had an ACE score of 0, while the scores for 1, 2, 3 and 4+ACEs were 23.1%, 16.4%, 10.5% and 12.9%, respectively. That table also provides information about the types of ACEs experienced by the sample, divided by gender.

**Table 2.** Adjusted odds ratios for DSM-5 diagnoses by gender, controlling for age and household income

| DSM-5 Diagnostic Category/ ACE score | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Adjusted odds ratio | CI | p | Adjusted odds ratio | CI | p |
| **Neurodevelopmental Disorders** | | | | | | |
| | 1.75 | 0.83-3.66 | 0.139 | 1.25 | 0.66-2.39 | 0.001*** |
| | 2.16 | 0.97-4.81 | 0.06 | 1.81 | 0.96-3.39 | 0.002** |
| | 3.54 | 1.98-8.46 | 0.002** | 1.98 | 0.98-3.99 | 0.068 |
| | 3.61 | 1.68-7.73 | 0.001*** | 3.64 | 2.13-6.23 | <.001*** |
| **Bipolar and Related Disorders** | | | | | | |
| 1 | 7.92 | 0.99-69.27 | 0.056 | 0.77 | 0.18-3.24 | 0.721 |
| 2 | 9.08 | 0.98-83.64 | 0.052 | 2.92 | 0.95-9.09 | 0.064 |
| 3 | 19.48 | 2.30-165.32 | 0.006** | 2.28 | 0.60-8.60 | 0.224 |
| 4+ | 15.54 | 1.87-129.44 | 0.011* | 4.42 | 1.61-12.11 | 0.004** |
| **Depressive Disorders** | | | | | | |
| 1 | 3.08 | 1.53-6.21 | 0.002** | 1.64 | 1.13-2.40 | 0.009** |
| 2 | 3.49 | 1.65-7.40 | 0.001*** | 3.09 | 2.14-4.46 | <.001*** |

| | OR | CI | p | OR | CI | p |
|---|---|---|---|---|---|---|
| 3 | 5.77 | 2.68-12.41 | <.001*** | 3.87 | 2.60-5.76 | <.001*** |
| 4+ | 6.88 | 3.38-14.01 | <.001*** | 5.2 | 3.72-7.26 | <.001*** |
| **Anxiety Disorders** | | | | | | |
| 1 | 4.1 | 1.89-8.89 | <.001*** | 1.88 | 1.31-2.70 | 0.001*** |
| 2 | 6.73 | 3.07-14.75 | <.001*** | 3.28 | 2.29-4.70 | <.001*** |
| 3 | 8.79 | 3.89-18.98 | <.001*** | 3.36 | 2.25-5.01 | <.001*** |
| 4+ | 9.87 | 4.53-21.51 | <.001*** | 4.04 | 2.90-5.64 | <.001*** |
| **Obsessive-Compulsive Disorders** | | | | | | |
| 1 | 2.35 | 0.85-6.45 | 0.098 | 1.82 | 0.99-3.32 | 0.53 |
| 2 | 3.02 | 1.05-8.69 | 0.040* | 2.74 | 1.50-4.98 | 0.001*** |
| 3 | 5.08 | 1.79-14.41 | 0.002** | 3.77 | 2.02-7.02 | <.001*** |
| 4+ | 10.29 | 4.00-26.48 | <.001*** | 6.17 | 3.67-10.38 | <.001*** |
| **Dissociative Disorders** | | | | | | |
| 1 | - | - | - | 0.59 | 0.04-4.16 | 0.672 |
| 2 | - | - | - | 0.89 | 0.08-9.96 | 0.927 |
| 3 | - | - | - | 4.1 | 0.68-24.87 | 0.125 |
| 4+ | - | - | - | 3.96 | 0.81-19.34 | 0.089 |
| **Feeding and Eating Disorders** | | | | | | |
| 1 | - | - | - | 1.97 | 1.03-3.76 | 0.039* |
| 2 | - | - | - | 1.16 | 0.53-2.54 | 0.705 |
| 3 | - | - | - | 0.67 | 0.22-2.03 | 0.478 |
| 4+ | - | - | - | 2.52 | 1.95-6.37 | <.001*** |
| **Substance-Related and Addictive Disorders** | | | | | | |
| 1 | 1.78 | 0.82-3.84 | 0.142 | 2.82 | 1.06-7.48 | .038* |
| 2 | 1.98 | 0.84-4.65 | 0.117 | 4.75 | 1.82-12.41 | 0.001*** |
| 3 | 4.2 | 1.84-9.55 | 0.001*** | 8.36 | 3.24-21.58 | <.001*** |
| 4+ | 8.02 | 3.94-16.32 | <.001*** | 14.66 | 6.26-34.30 | <.001*** |

**Note:** Diagnostic Categories with fewer than 15 participants are not reported. These disorders include Schizophrenia Spectrum and Other Psychotic Disorders; Somatic Symptoms and Related Disorders; Disruptive, Impulse-Control, and Conduct Disorders; Personality Disorders; Dissociative Disorders and Feeding and Eating Disorders for males)
*p < .05. **p <.01. ***p <.001.

Relationships among ACEs and diagnosed mental health conditions

Adjusted odds ratios (OR) and confidence intervals (CI) were computed for diagnostic categories that had a minimum of 15 participants. These odds ratios all used 0 ACEs as the reference condition. In general, for those categories of disorders for which there were enough cases, increased ACE scores conferred an increased risk for a wide range of mental disorders.

Among males, participants with an ACE score of 1 or more had a significantly increased risk of a lifetime diagnosis of depressive and anxiety disorders, and the risk generally increased with a higher number of ACEs. Similarly, an ACE score of 2 or more increased the risk of a lifetime diagnosis of an obsessive-compulsive disorder, while an ACE score of 3 or more had an increased risk of a lifetime diagnosis of a neurodevelopmental disorder, a bipolar or related disorder, and a substance-related and addictive disorder. Indeed, the risk for males who reported 3 or 4 ACEs had a 19-fold and 15-fold increased risk, respectively, for bipolar and related disorders. When comparing male participants with 4+ACEs and those with 0 ACEs, risk increased most for obsessive-

compulsive disorders (over 10-fold), anxiety disorders (over 9-fold), and substance-related and addictive disorders (over 8-fold).

A similar profile of risk to that seen in males was observed in females. An ACE score of 1 or more increased the risk of a lifetime diagnosis of a depressive, anxiety, or substance-related and addictive disorder, while an ACE score of 2 or more increased the risk of a lifetime diagnosis of an obsessive-compulsive disorder. Only an ACE score of 4 or more increased the risk of a lifetime diagnosis of a bipolar and related disorders and feeding/eating disorder. Overall, when comparing the odds ratios for female participants with 4 or more ACEs, as compared to the base of participants with 0 ACEs, risk increased most for substance-related and addictive disorders (over 14-fold), obsessive-compulsive disorders (over 6-fold), and depressive disorders (over 5-fold).

## Discussion

This study examined the relationships between self-reported adverse childhood experiences (ACEs) and adult mental health diagnoses and sought to replicate the results of the landmark ACEs study in a Canadian primary care population [1,2]. The risk of having a lifetime diagnosis of a mental health disorder, including depressive, anxiety, obsessive-compulsive, and substance-related and addictive disorders, generally increased in a dose-response pattern for both males and females. A similar increased risk was also found for neurodevelopmental disorders, bipolar and related disorders, and feeding/eating disorders (for females only), particularly for those participants who experienced three or more ACEs.

The current results generally indicated dose-response relationships among ACEs and a range of mental health outcomes within a large adult primary care population. This relationship was evident for both men and women. Over two-thirds (69.7%) of participants reported a history of at least one ACE and about 13% reported exposure to four or more types of childhood adversity. These rates are consistent with the original ACE study (Felitti et al, 1998), in spite of the relatively younger mean age of the current sample (44 years vs 56 years). Findings were also similar with two other more recent population-based studies [12,13]. As in previous research, more women than men reported having experienced four or more ACEs (20.5% vs. 12.9%) [7]. Collectively, these findings demonstrate that a history of childhood adversity is extremely common among adult Canadian primary care patients, that ACEs are associated

with mental health impairment into adulthood, and that exposure to multiple ACEs appears to have a dose-response effect on mental health outcomes. We note that this was a cross-sectional study, as is the case for most research in this field, and so the directionality of these associations cannot be stated categorically.

We note that although the current research further bolsters an association between the number of ACEs in childhood and adult mental health problems, it does not elucidate the possible typologies or patterns of ACEs that are most or least associated with such outcomes. Recent research has begun to examine ACE typologies and their differential relationships with health outcomes in veteran and prison samples, and similar research is recommended in primary care settings [25,26].

## Strengths and Limitations

Strength of this research was the use of a relatively large primary care sample, likely providing a more accurate estimate of the prevalence of ACEs within these settings than can be obtained through studies of patients with specific clinical diagnoses. In addition, a broad range of mental health problems were included in this study, and participants were asked only to endorse problems that were previously diagnosed, likely increasing accuracy of their self-reported information. The current study also used a version of the ACE questionnaire that was well-validated in a previous phase of the research and included multiple types of childhood adversity [19].

The current results must be considered in light of several limitations. While the current sample was similar to the original ACE study, in that participants were generally well-educated and the majority were employed, ethnic diversity was limited (82.5% Caucasian) and therefore the findings may not generalize to individuals of non-Caucasian background. It was the case in the current study that potential participants had the option to take part or not, as the study was voluntary, and so some self-selection likely occurred. Previous studies have shown that cultural differences exist with respect to the relationship between ACEs and substance use and future research with a more diverse sample would provide valuable insights into these differences [27].

While some researchers have begun to explore specific associations between types of maltreatment (e.g., emotional vs. sexual abuse) and mental health outcomes, this issue was not examined in this study [25,26]. Rather, a cumulative ACE score was used in order to be consistent with many previous studies in this area. The study also did not explore severity or duration of adverse events, and it

was based on retrospective self-reports of mental health diagnoses and adverse childhood events, so the accuracy of those reports could not be verified [28]. Future studies to examine ACEs may benefit from collecting mental health data using physician billing codes and mental health diagnoses recorded in patient medical records. For some categories of problems, such as dissociative and eating disorders, the number of participants who had endorsed a diagnosis was low. A larger sample size may elucidate the relationship between ACEs and these diagnostic categories. In addition, the more significant relationships between ACEs and some diagnostic categories may also be partly explained by the larger numbers of participants who had endorsed these mental health concerns. Indeed, prevalence rates for problems such as anxiety and depressive disorders tend to be particularly high in primary care populations compared to other diagnostic categories. The terms used to describe mental health problems on the checklist used were likely open to some subjective interpretation by participants, as the study used a non-standardized method to have respondent's self-report on past diagnoses. A final limitation of the study was that participants were simply asked to self-identify if they had received diagnoses from a health professional, and no independent interviews or evaluations were conducted to cross-validate these diagnoses. It is possible that some participants mis-remembered their diagnoses, or that some diagnoses are more difficult to self-recognize. As such, although such research would be challenging to do and expensive, future research could use a more thorough interview method to ensure that diagnoses are validated.

## Clinical Implications

The current study is consistent with previous reports that over one third of adults' have a history of at least one type of ACE, and that such a history is associated with increased risk for mental health concerns in adulthood. These results suggest that consideration of exposure to childhood adversity may be beneficial within primary care settings. ACE assessment in primary care can provide information about a patient's biopsychosocial context and can assist care providers in understanding how childhood adversity may be related to an individual's past and current mental health symptoms or diagnoses. Additionally, this information may be especially important not only for physicians, but for collaborative or interdisciplinary healthcare teams who may also provide patient services. The information gathered through ACE screening, in combination with a patient's physical and mental health history of symptoms, can provide clarification and context regarding a patient

and his or her treatment needs. It has been suggested, however, that widespread screening for ACEs in primary care may be premature until effective interventions and responses have been designed for patients who screen positively for ACEs [29].

Adults with a history of ACEs have been shown to have greater utilization of health care services and increased health care costs than those who do not [30,31]. They may seek the assistance of mental health professionals, but more often first present to their primary care provider with associated mental health concerns. As such, interventions delivered within a primary care setting that target the sequelae of childhood adversity are greatly needed. Research by Poole and colleagues and Campbell-Sills and Stein suggests that resilience moderates the relationship between ACEs and that the association between depression symptoms and ACEs is stronger in those with low resilience than those with high resilience [14,32]. In addition, Poole et al found that emotion regulation moderated the association between ACE scores and anxiety symptoms [24]. Future interventions may benefit from focusing on the development of factors such as resilience and emotional regulation. The development and evaluation of treatment protocols that address the long-term and cumulative effects of ACEs is an important direction for further research [33-44].

## Conclusion

The current study contributes to a large body of knowledge regarding the association between cumulative ACE scores and an array of adverse mental health outcomes in adulthood. Specifically, it adds to our understanding of these issues within an urban Canadian primary care setting. Additional research is needed to better elucidate the mechanisms by which ACEs contribute to later life mental health outcomes. In turn, such results will inform both the prevention and treatment of the negative physical and mental health problems related to ACE exposure. A better understanding of patients' ACE experiences in primary care settings holds potential for improved service delivery for affected individuals.

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