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Research article

The relationship between adverse childhood experiences, healthcare utilization, cost of care and medical comorbidities

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ABSTRACT

Background: Prior research suggests that those experiencing adverse childhood experiences (ACEs) may be higher utilizers of the healthcare system. The frequency and financial impact of kept, cancelled and no-showed visits is largely unknown.
Objective: To examine the impact of adverse childhood experiences (ACEs) on healthcare utilization in a sample of US adults.
Participants and Setting: Two thousand thirty-eight adult patients who completed an ACE screening within the behavioral health department of a medium sized, Midwestern healthcare system during 2015–2017 were included.
Methods: Data was extracted retrospectively from 1-year post ACE screen.
Results: Individuals with high ACEs (4+) made more but kept fewer appointments than those with no or moderate (1–3) ACEs ($p < 0.0001$). Individuals with high ACES had more late-cancelled and no-showed appointments compared to those with no ACEs (p's $< .0001$). Relationships were significant even after controlling for age, gender, and insurance type. Those with high ACEs had the greatest impact on potential lost revenue given that they late-cancelled and no-showed more appointments. Those with high ACEs also had more medical comorbidities, medications, and needed care coordinator than those with moderate or no ACEs (p's $< .05$)
Conclusions: Results from this study should be used to inform providers and health care systems on the effects of adversity on patterns of utilization of health care and encourage innovative strategies to better address the needs of these patients.

1. Introduction

It is well understood that experiencing adversity in childhood predicts health problems (Chartier, Walker, & Naimark, 2010; Arnow, 2004; Chartier, Walker, & Naimark, 2007; Felitti & Anda, 1997). Since Felitti and Anda's (Felitti & Anda, 1997) landmark study on Adverse Childhood Experiences (ACEs), research has confirmed the detrimental impacts of toxic stress on health (Bellis et al., 2017; Brown et al., 2009; Kelly-Irving et al., 2013). Recently, research has begun to examine the impact of ACEs on healthcare utilization. Generally, evidence suggests that those with ACEs may be higher utilizers of healthcare, especially specialty emergency services (Arnow et al., 1999; Arnow, Hart, Hayward, Dea, & Barr Taylor, 2000; Arnow, 2004; Bellis et al., 2017; Chartier et al., 2007;

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Finestone et al., 2000; Mercado, Wiltsey-Stirman, & Iverson, 2015; Newman et al., 2000; Schussler-Fiorenza Rose, Xie, & Stineman, 2014; Tang et al., 2006). More recent research has indicated that those with ACEs are less likely to be insured or have had a physician checkup within the last year (Alcala, Valdez-Dadia, & von Ehrenstein, 2017). Some studies have examined the relative cost of ACEs on healthcare utilization, suggesting that those with ACEs have higher healthcare costs (Bonomi et al., 2008; Walker et al., 1999). In 2008 it was estimated that the total economic burden associated with child abuse and neglect, which makes up half of the ACEs screened for, was 124 billion USD or 210,012 USD per victim in 2010 dollars, (Fang, Brown, Florence, & Mercy, 2012) while another estimated the lifetime cost per victim to be 400,533 USD (San Francisco Child Abuse Prevention Center & Haas School of Business at the University of California, 2017).

Despite some emerging trends between ACEs, healthcare utilization and cost, many of the studies are small, (Arnow et al., 1999, 2000; Mercado et al., 2015) limit samples to women (Arnow et al., 1999, 2000; Bonomi et al., 2008; Mercado et al., 2015) or highly specialized populations (e.g., female veterans),(Mercado et al., 2015) utilize self-report data of healthcare use, (Chartier et al., 2007; Tang et al., 2006) and/or were carried out in countries with access to universal/ single payer healthcare (Bellis et al., 2017; Chartier et al., 2007) where those with lower socioeconomic status and/or less education are more likely to access healthcare than in the US (Pylypchuk & Sarpong, 2013).

The current study sought to examine the impact of ACEs on healthcare utilization and cost in a sample of US adults that have been screened for ACEs. The following variables were examined by ACE screening scores: 1) frequency of kept, cancelled, and no-showed visits to primary and specialty care; 2) frequency of urgent care and emergency room visits; and 3) financial impact of cancelled and no-showed visits. Medical comorbidities, medications, and use of a care coordinator by ACE score were examined as secondary analyses to replicate and extend previous literature. It was hypothesized that those with high ACE scores would have more visits to primary and specialty care and ER/UC and would cancel or no-show appointments more often than those with moderate-level ACE scores or no ACEs. It was also hypothesized that a significant financial impact of ACEs would be documented by calculating loss of potential revenue from missed visits.

2. Methods

2.1. Study design

The 10-item ACE screener (Felitti & Anda, 1997) is routinely given to all adults (18+) being seen for new Behavioral Health consultation visits in the study's institution (a medium sized, Midwestern healthcare system). During the study time period (May 12, 2015 through May 6, 2017), 7289 patients were seen for new Behavioral Health consultation visits and thus, were eligible for inclusion in this study. Of those patients, 2038 completed an ACE screener at least 1 year prior to data collection (of visits), while the remaining 5251 patients declined to complete, missed items on the screener, or were not asked to complete due to a breakdown in workflows. Older adults, those with higher BMI, and men were more likely not to complete the ACE screener, but, unfortunately, the reason for their non-completion is unknown. The ACE screener was given either in the waiting room or during provider visits in the office in an outpatient Behavioral Health Department clinic or by Behavioral Health Department staff embedded into other clinical locations (e.g., Internal Medicine). It is expected that these patients presented due to behavioral health symptoms which may or may not be related to childhood adversity experiences. Results should be interpreted with this patient population in mind. Hospital system Institutional Review Board provided approval for the study. See Table 1 for participant demographics.

2.2. Data extraction and measures

Data was extracted retrospectively from 1-year post ACE screen and included demographic information, visits, ACE scores, prescribed medications, medical comorbidities, and use of a care coordinator within the healthcare system. Visits outside of the healthcare system's electronic medical record were not captured. >

The ACE screener (Felitti & Anda, 1997) is a 10-item measure that assesses childhood abuse and household dysfunction. Total exposure is represented by the sum of all questions with a "yes" response. Studies have found a graded relationship between the number of ACE exposures and numerous poor health outcomes and negative health behaviors (Chartier et al., 2010; Anda, Brown, Felitti, Dube, & Giles, 2008; Dube et al., 2009; Felitti & Anda, 1997). Reports of exposure to 4 or more ACEs suggests greater health risks including cancer, ischemic heart disease, lung disease, depression and substance abuse compared to those with no exposure (Felitti & Anda, 1997). For most analyses we categorized patients by their ACE score. "No ACEs" were defined as ACE scores of 0, "Moderate ACESs" as ACE scores of 1–3, and "High ACEs" as ACE scores of 4 + . For regression analyses examining impact of covariates, we used continuous ACE score as the independent variable.

Data was available for visits to the main clinic and hospital as well as surrounding rural clinics within the healthcare system, covering approximately a 150-mile catchment area. Patient visits were categorized by primary Care (PC), specialty care (SC), and urgent care (UC)/ emergency room (ER). SC visits were defined as a scheduled appointment in non-primary care departments within the system (e.g., neurology), excluding behavioral health. Kept appointments were defined as a patient presenting for their scheduled outpatient appointment. Patient cancelled or rescheduled and no-showed appointments were also examined; cancelled/rescheduled visits that occurred with less than 24-hour notice prior to the scheduled appointment were defined as late cancel as they are unlikely to be filled. To examine financial impact of missed visits, we obtained the range of costs from each department within the hospital system and calculated the mean. We then averaged these mean values across all departments to create an aggregate of overall costs as it relates to missed visits.

Table 1
Patient Demographics.

Variable	ACE Score			P Value
	0 (n = 439)	1 to 3 (n = 770)	≥4 (n = 829)	
Age (years, mean ± SD)	43.8 ± 18.5	40.5 ± 16.4	39.1 ± 14.4	< 0.0001
BMI (kg/m^2, mean ± SD)	30.4 ± 8.3	30.2 ± 7.9	31.9 ± 9.3	0.0001
Gender [n (%)]				0.0006
Female	274 (19.7)**	515 (37.0)	602 (43.3)*	
Male	165 (25.5)*	255 (39.4)	227 (35.1)**	
Race [n (%)]				0.0002
White or Caucasian	430 (22.2)*	741 (38.2)	768 (39.6)**	
Other	7 (11.1)**	16 (25.4)**	40 (63.5)*	
Unknown	2 (5.6)**	13 (36.1)	21 (58.3)*	
Marriage Status [n (%)]				< 0.0001
Single	168 (17.7)**	367 (38.6)	416 (43.7)*	
Partnered	203 (27.6)*	280 (38.1)	252 (34.3)**	
Separated	43 (16.8)	87 (34.0)	126 (49.2)*	
Widowed	19 (27.9)	26 (38.2)	23 (33.8)	
Unknown	6 (21.4)	10 (35.7)	12 (42.9)	
Insurance [n (%)]				< 0.0001
State	146 (16.2)**	313 (34.6)**	445 (49.2)*	
Private	254 (29.1)*	359 (41.1)*	260 (29.8)**	
No Insurance	39 (14.9)**	98 (37.6)	124 (47.5)*	
Employment [n (%)]				< 0.0001
Full-Time	197 (22.9)	353 (41.0)**	311 (36.1)*	
Unemployed	66 (14.8)**	143 (32.1)**	237 (53.1)	
Retired	66 (34.9)*	84 (44.4)	39 (20.6)**	
Part-Time	38 (22.6)	60 (35.7)	70 (41.7)	
Disabled	14 (8.3)**	47 (28.0)**	107 (63.7)*	
Student	30 (27.3)	49 (44.6)	31 (28.2)**	
Unknown	28 (29.2)	34 (35.4)	34 (35.4)	
Tobacco Use [n (%)]				< 0.0001
Current User	163 (16.6)**	354 (36.1)	463 (47.2)*	
Never Used	226 (29.9)*	315 (41.7)*	215 (28.4)**	
Unknown	50 (16.6)**	101 (33.4)	151 (50.0)*	

* Observed frequency is significantly greater than expected.
** Observed frequency is significantly less than expected.

Medical comorbidities analyzed included those guided by previous literature on the impact of ACEs on health: chronic obstructive pulmonary disorder (COPD), ischemic heart disease, cancer, obesity, chronic pain, dementia or Alzheimer's and hypertension. Comorbidities were included if a patient had ever been diagnosed with the disease or disorder. Medications were analyzed by drug class and include antidepressants, antipsychotics, benzodiazepines, stimulants, mood stabilizers, opiates 1 (buprenorphine and methadone) and opiates 2 (all other prescription opioids). Medications were included if a patient was ever prescribed a medication of interest. Care coordination was extracted if a patient ever received care from a care coordinator.

2.3. Statistical analysis

All categorical variables, which include demographics, appointment, and ER visit data were analyzed through chi-square. All continuous variables such as age and BMI were analyzed through a *t*-test analysis. For crosstabs that were significant, standardized residuals were calculated to assess how significant each cell is to the chi-square value. A p. value less than 0.05 is considered significant. Linear regression was used to examine ACEs predicting made and missed visits after controlling for age (continuous), gender (men = 1, women = 0), and insurance type (uninsured/state insurance = 1, private insurance = 0). Model 1 consisted of: Step 1: Covariates (age, gender, insurance type), Step 2: ACEs (continuous), Dependent Variable (DV): Total appointments made. Model 2 consisted of: Step 1: Covariates (age, gender, insurance type), Step 2: ACEs (continuous), DV: Missed visits/total appointments made. Logistic regression was used to examine ACEs predicting "high" missed appointments (≥20% of appointments missed; comparable to Coodin, Staley, Cortens, Desrochers, & McLandress, 2004). Model 3 consisted of: Step 1: Covariates (age, gender, insurance type), Step 2: ACEs (continuous), DV: "High" missed appointments.

3. Results

Mean ACE score was 3.1 (± 2.7; "moderate ACEs"); 21.5% (n = 439) had no ACEs, 37.8% (n = 770) had moderate ACEs, and 40.7% (n = 829) had high ACEs. Patients with high ACEs were more likely to be women ($p < 0.001$) and younger ($p < 0.0001$) compared to those with lower ACE scores. Additionally, patients with high ACEs had higher BMIs compared to those with lower ACEs

Table 2
Appointments in the Healthcare System.

Variable [n (%)]	ACE Score			P Value
	0 (n = 439)	1 to 3 (n = 770)	≥4 (n = 829)	
Emergency Services[a]	209 (39.9)**	522 (48.4)**	976 (65.6)*	< 0.0001
All Appointments				
Kept	3138 (67.3)*	5912 (66.3)**	7203 (61.8)**	< 0.0001
Cancelled [b]	1281 (27.5)	2308 (25.9)	3021 (25.9)	0.0892
Late Cancels	449 (9.6)**	943 (10.6)	1385 (11.9)*	< 0.0001
No Shows	241 (5.2)**	695 (7.8)**	1424 (12.2)*	< 0.0001
Primary Care				
Kept	1077 (70.4)*	2009 (69.8)*	2494 (65.8)**	0.0002
Cancelled [b]	361 (23.6)	604 (21.0)	849 (22.4)	0.1248
Late Cancels	129 (8.4)	246 (8.6)**	400 (10.6)*	0.0070
No Shows	93 (6.1)**	264 (9.2)	450 (11.9)*	< 0.0001
Specialty Care				
Kept	2061 (65.9)*	3901 (64.6)*	4709 (60.0)**	< 0.0001
Cancelled [b]	920 (29.4)	1704 (28.2)	2169 (27.6)	0.1722
Late Cancels	320 (10.2)**	697 (11.6)	983 (12.5)*	0.0019
No Shows	148 (4.7)**	431 (7.1)**	974 (12.4)*	< 0.0001

[a] This includes emergency room visits as well as urgent care visits.
[b] Late cancelled are a subset of Cancelled visits. All appointments consist of sum of Kept, Cancelled, and No Show visits.
* Observed frequency is significantly greater than expected.
** Observed frequency is significantly less than expected.

($p < 0.0001$). A greater proportion of individuals with high ACEs had no insurance or state-based insurance, while more individuals with no or moderate ACE scores had private insurance ($p < 0.0001$). Patients with moderate or high ACEs were more likely to be unemployed, be single or separated, and be current smokers than patients with no ACEs (p's < 0.0001). Ninety-five percent of the patients were Caucasian (See Table 1). During the study time-frame, 25,223 outpatient appointments were made in total throughout the hospital system.

3.1. Kept appointments

During the study time-frame, 16,253 outpatient appointments were kept throughout the hospital system. Individuals with high ACEs made more appointments compared to those with moderate or no ACEs. Those with no ACEs made 4660 appointments within the system (10.6 visits per person), while those with moderate ACEs made 8915 appointments (11.6 visits per person), and those with high ACEs made 11,648 appointments (14.1 visits per person). Despite making more appointments, those with high ACEs did not keep as many appointments, compared to those with no or moderate ACES ($p < 0.0001$). When looking at both PC and SC visits, results were similar. See Table 2. Results of linear regression Model 1 indicates that this relationship remained significant even after controlling for age, gender, and insurance type [F (4, 2033) = 42.91, $p < .0001$]. Women ($p < .0001$) and those who were uninsured or who had state-based insurance ($p < .0001$) were more likely to make appointments.

Visits to UC/ ER also differed by ACE score. A greater proportion of individuals with high ACEs visited the UC/ ER compared to those with no or moderate ACEs (p's $< .0001$). See Table 2.

3.2. Missed appointments

Overall, 8970 visits were missed within the healthcare system during data collection; 6610 appointments were cancelled and 2360 were no-showed. Of cancelled visits, 2777 late cancellations occurred. Individuals with high ACEs had more late-cancelled appointments compared to those with no ACEs ($p < 0.0001$), and more no-show appointments compared to those with no or moderate ACEs overall ($p < 0.0001$). Results were similar for PC and SC visits. See Table 2. Results of linear regression Model 2 indicates that, again, this relationship remained significant after controlling for age, gender, and insurance type [F (4, 1832 = 9.87, $p < .0001$]. Those who were uninsured or who had state-based insurance ($p < .05$) were more likely to miss appointments. Results of logistic regression Model 3 suggests that after controlling for age, gender, and insurance type, ACEs significantly predict the likelihood of missing ≥ 20% of appointments [χ^2 (4, 1837) = 8.73, $p < .01$]. As ACE score increases the odds of missing a high number of appointments goes up by 1.06.

3.3. Financial impact

Average visit cost in primary and specialty care was identified by aggregating the total cost of services over 2015, 2016, and 2017 within the specified department areas and deriving a total mean visit cost. Average visit cost in primary care was 268.13 USD and 392.93 USD in specialty care which ranged greatly from 173.72 USD (in nephrology) to 1187.04 USD (in neurosurgery). To calculate

Table 3
. Potential Loss of Revenue for No Shows or Late Cancels.

Variable [n (USD)]	ACE Score			Total Lost Revenue (USD)
	0	1 to 3	≥4	
All Appointments				
Late Cancels	449 (174,349.86)	943 (366,173.54)	1385 (537,805.25)	1,078,328.64
No Shows	241 (93,582.00)	695 (269,873.39)	1424 (552,949.22)	916,404.61
Primary Care				
Late Cancels	129 (34,588.77)	246 (65,959.98)	400 (107,252.00)	207,800.75
No Shows	93 (24,936.09)	264 (70,786.32)	450 (120,658.50)	216,380.46
Specialty Care				
Late Cancels	320 (125,737.35)	697 (273,871.67)	983 (386,249.43)	785,858.46
No Shows	148 (58,153.53)	431 (169,352.50)	974 (382,713.07)	610,219.10

the financial impact of ACEs on visits, the mean number of visits late cancelled and no-showed in primary and specialty care were multiplied by the average visit cost. Those with high ACEs had the greatest impact on potential lost revenue given that they late cancelled and no-showed more appointments. See Table 3.

3.4. Medical comorbidities, medications, care coordination

A greater proportion of individuals with high ACEs had diagnoses of obesity ($p < 0.05$), chronic pain ($p < 0.05$), and COPD ($p < 0.05$), compared to those with no or moderate ACEs. More individuals with high ACES also had a mental health diagnosis ($p < 0.05$) or had treatment for alcohol/drug abuse ($p < 0.0001$). No significant relationship between ACEs and dementia, hypertension, ischemic heart disease, or cancer emerged in this sample. ACE score was related to medications as more individuals with high ACEs were prescribed any type of psychiatric medication including: antidepressants, mood stabilizers, antipsychotics, non-benzodiazepine hypnotics, and stimulants ($p < 0.05$). When drugs were analyzed independently, significantly more patients with high ACEs were prescribed opiates 1 ($p < 0.001$) and 2 ($p < 0.05$), antidepressants, antipsychotics, mood stabilizers, and non-benzo hypnotics significantly more than those with no or moderate ACEs ($p < 0.05$). No significant differences in benzodiazepine prescription emerged between those with different levels of ACEs ($p = 0.28$). Finally, a greater proportion of individuals with high ACEs had a care coordinator compared to those with no or moderate ACEs ($p < .0001$). See Table 4.

Table 4
Comorbidities and related variables.

Variable [n (%)]	ACE Score			P Value
	0 (n = 439)	1 to 3 (n = 770)	≥4 (n = 829)	
Any Comorbidity	197 (44.9)	341 (44.3)	388 (46.8)	0.5793
COPD	6 (1.4)	10 (1.3)	24 (2.9)*	0.0424
Hypertension	102 (23.2)	166 (21.6)	168 (20.3)	0.4666
Cancer	66 (15.0)	96 (12.5)	88 (10.6)	0.0723
Obesity	88 (20.1)	144 (18.7)**	201 (24.3)*	0.0201
Chronic Pain	47 (10.7)	97 (12.6)	132 (15.9)*	0.0222
Dementia	6 (1.4)	4 (0.5)	3 (0.4)	0.1045
Ischemic Heart Disease	20 (4.6)	24 (3.1)	30 (3.6)	0.4371
Mental Health Diagnosis	436 (99.3)**	770 (100)	828 (99.9)	0.0338
Alcohol and Drug Abuse Treatment	43 (9.8)**	124 (16.1)	168 (20.3)*	< 0.0001
Opiates 1[a]	8 (1.8)**	21 (2.73)	47 (5.7)*	0.0005
Opiates 2[b]	292 (66.5)**	537 (69.7)	611 (73.7)*	0.0218
Any Psych Drug[c]	407 (92.7)**	720 (93.5)	793 (95.7)*	0.0581
Antidepressants	358 (81.6)**	644 (83.6)	735 (88.7)*	0.0009
Antipsychotics	70 (16.0)**	150 (19.5)**	263 (31.7)*	< 0.0001
Benzos	304 (69.3)	542 (70.4)	606 (73.1)	0.2834
Mood Stabilizers	50 (11.4)**	111 (14.4)**	194 (23.4)*	< 0.0001
Non-Benzo Hypnotics	105 (23.9)**	220 (28.6)	260 (31.4)*	0.0204
Other Hypnotics	8 (1.8)	9 (1.2)	16 (1.9)	0.4500
Stimulants	54 (12.3)**	124 (16.1)	153 (18.5)*	0.0182
Care Coordinator	20 (4.6)**	69 (9.0)**	149 (18.0)*	< 0.0001

[a] Opiates 1 includes medication used to treat addiction such as buprenorphine and methadone.
[b] Opiates 2 includes medication such as codeine, fentanyl, hydrocodone, meperidine, morphine, and oxycodone.
[c] Any drug other than Opiates 1 and 2.
* Observed frequency is significantly greater than expected.
** Observed frequency is significantly less than expected.

4. Discussion

Results from this study highlight the impact of adversity on healthcare utilization; individuals with high ACEs make more but keep fewer appointments than those with no or moderate ACEs. Understandably, because of these missed visits, the potential loss of revenue for the healthcare system is much higher for those with high ACEs. Results of this study were similar to others in that patients with high ACEs were more likely have no or state-based insurance (Alcala et al., 2017) and presented to the UC/ ER more compared to those with no or moderate ACEs (Arnow, 2004; Bellis et al., 2017). Even after controlling for age, gender, and insurance type, higher ACEs significantly predicted likelihood of making and missing visits in general and specifically for those who miss a high number of appointments (≥ 20%). Finally, results from this study extend previous literature by highlighting the significant impact that ACEs have on likelihood of developing a serious medical condition or mental health/substance use disorder (Arnow, 2004; Felitti & Anda, 1997), of being prescribed psychiatric or opiate medication (Anda et al., 2008), and of needing care coordination to manage complex health comorbidities. Importantly, these results should be viewed with caution to avoid stigmatizing this already at-risk group. The intent of this study is not to encourage biases, unhelpful assumptions, or punitive response plans for those with ACEs, but rather to highlight the great need for providing trauma informed care within healthcare systems.

The underlying mechanisms of how ACEs impact over/under utilization were not directly examined in this study; however, one can hypothesize that because those with high ACEs have more health comorbidities (Felitti & Anda, 1997), they would require a higher number of visits and more medication (e.g., opiates, antidepressants) to treat these conditions. Yet, because of the potential for more mental health concerns (Kessler, Davis, & Kendler, 1997) and/or more life stress without support or adequate coping resources (Manyema, Norris, & Richter, 2018), it may mean they feel less able to come to visits as scheduled. They may instead use the UC/ER as a "go to" for health concerns for several reasons including 1) ease of access 24/7 including evening hours, 2) transportation (e.g., ambulance if needed), 3) health insurance barriers, 4) stigma from healthcare providers (Finkelhor, 2018), and likely others. Results of this study highlight that screening for ACEs is a foundational step that only serves to identify ACE history but does not explain healthcare behaviors. Asking and documenting what patients may need to help keep appointments and/or using more formal psychosocial assessments among high utilizers would likely be helpful. Additionally, understanding personality and systemic mechanisms by which the relationships observed in this study can be more fully explained and or modified should be examined in future research.

This study suggests that better identification of, and communication about ACEs within healthcare is needed. There is a great need for healthcare providers to routinely discuss and provide education around ACEs. Just as car seat education is given to all new parents, so too should education be given around identifying toxic stress, understanding the health impacts, and promoting resilience. Providers may find it helpful to be aware of adversity in their patients in order to anticipate issues regarding follow up, proper use of UC/ ER services and to discuss ways to effectively manage more complex aspects of their care. More routine screening and workflow changes that follow could allow for patients at risk to be identified and provided with better trauma-informed care, which may mean addressing barriers to achieving compliance and follow-up, more frequent visits, automatic addition of a care coordinator, support from a social worker or behavioral health consultant, and/or contact from a health coach/nurse between visits. More research in this area is needed, especially to balance the benefits of intervention with those at risk and the potential harm of identifying and stigmatizing an already at-risk group.

At the systems-level, healthcare organizations could work to incentivize trauma-informed care practices. This could include working with payers to reimburse for services that decrease over/under utilization and improve resiliency (as long as it helps patients get care), advocating at the state/ national level for greater influence on prevention rather than treatment (efforts at addressing ACEs upstream, e.g., obstetrician or well-child visits)(Racine, Plamondon, Madigan, McDonald, & Tough, 2018), and/or partnering with community organizations to build up resources in people's lives, as a buffer to the detrimental effects of trauma on health.

This study is among the first of its kind since the original ACEs study to utilize a large, US based-sample that has been screened using the 10-item ACE questionnaire from the ACEs study (Felitti & Anda, 1997). Also, uniquely, this study collected utilization data across an entire healthcare system. It is also the first to document the complex relationship between ACEs and healthcare utilization whereby individuals with high ACEs both are higher utilizers (more appointments made and more ER/UC visits) and "under" or "mis-utilizers" (more appointments late cancelled and no-showed). Future research to understand the reasons for this pattern of utilization is needed.

Limitations of this study include use of a "high risk" sample of individuals who presumably were experiencing psychological distress within a Behavioral Health Department. Results should be interpreted with this in mind and may not generalize to lower risk populations seen in primary care. This study also included a US-based, homogenous sample of predominantly Caucasian individuals; future research with more diverse samples globally is warranted. Results may vary within other countries and healthcare systems. Moreover, patients may have received care at an outside facility during the year following their ACE screen. These results do not capture any services not documented in the healthcare institution's electronic medical record.

While this study highlights several interesting findings related to ACES, healthcare utilization, cost, and health, perhaps most importantly, this study reiterates the need for future research in primary care related to ACEs, including research that studies systematic changes in care processes. We hope that the information in this study informs providers and health care systems about the effects of adversity on utilization of health care and encourages strategies to better address the needs of patients including trauma informed care.

Declaration of interests

none.

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