Association between adverse childhood experiences and mental disorders among adolescents in Kenya, Indonesia, and Vietnam: Evidence from National Adolescent Mental Health Surveys.

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Abstract

Background: Few studies have examined the prevalence of adverse childhood experiences (ACEs) among adolescents living in low- and middle-income countries, and fewer assessed the association with mental disorders.

Methods: We used data from nationally representative household surveys of mental disorders among adolescents aged 10-17 years conducted in Kenya, Indonesia, and Vietnam. The lifetime experience of 13 ACEs was measured using a self-administered questionnaire. Mental disorders were measured using a diagnostic instrument. The proportion of adolescents who endorsed each individual ACE, as well as those who endorsed one or more and four or more ACEs, was calculated. Multivariable logistic regression was used to examine the associations between the number of ACEs endorsed and any mental disorder in the past 12 months, after adjusting for demographic characteristics and primary caregiver mental health.

Results: The prevalence of experiencing at least one ACE was evident among adolescents in all three countries, with Kenya (65.8%, 95% CI: 64.2 – 67.3) demonstrating significantly higher prevalence than Indonesia (40.1%, 95% CI: 38.4 – 41.9) and Vietnam (36.9%, 95% CI: 35.2 – 38.6). Significant differences were seen between all countries in the prevalence of adolescents who experienced four or more ACEs (Kenya: 19.2%, 95% CI: 18.0 – 20.6; Indonesia: 7.6%, 95% CI: 6.7 – 8.6; Vietnam: 5.2%, 95% CI: 4.4 – 6.1). The odds of experiencing a mental disorder in the past 12 months increased as the number of ACEs increased in all three countries. This was most apparent among those experiencing four or more ACEs, who had the highest odds of any mental disorder in the past 12 months as compared to those reporting no ACEs (Kenya: aOR 4.60, 95% CI: 3.43 – 6.17; Indonesia: aOR 10.80, 95% CI: 6.46 – 18.10; Vietnam: aOR 10.75, 95% CI: 6.06 – 19.07).

Conclusion: The current study demonstrated that ACEs are common among adolescents in Kenya, Indonesia, and Vietnam, and are significantly associated with mental disorders in all three countries. The prevention of ACEs may be a key avenue for reducing the risk of mental disorders in adolescence.

Keywords: adverse childhood experiences, adolescents, mental disorders, Kenya, Indonesia, Vietnam

Background

Mental disorders are a major contributor to the burden of disease among adolescents globally (1), accounting for approximately 13% of the disease burden in young people aged 10–19 years (2). The prevalence, persistence, and severity of mental disorders, both during adolescence and later in life, are influenced by social, economic, environmental, and genetic factors (3,4). Research has highlighted how early exposure to adversity is associated with higher prevalence of mental disorders in adolescence, which may further persist into adulthood (3,5,6). When occurring early in life, exposures to adverse events are referred to as adverse childhood experiences (ACEs). ACEs include sexual, physical, or emotional abuse, childhood neglect, household dysfunction (such as living in a household with a person with a drinking problem), deprivations and poverty, and other traumatic events (such as death of a parent) (3,7).

The available literature reporting the prevalence of ACEs, as well as their association with mental health, comes largely from high-income countries (HICs). Studies from HICs have found that ACEs are common, with prevalence estimates ranging from 40% to 65% for those experiencing one or more ACEs and 8% to 20% for those experiencing four or more ACEs (5-7). However, many studies are based on retrospective reports of ACEs among adults, with far fewer studies researching ACEs reported by adolescents (8). A systematic review of studies from mostly HICs assessing ACEs among school-aged youth (younger than 18 years) found that the prevalence of one or more ACEs varied widely from 41% to 97% (9). Prevalence studies of ACEs in adolescent populations in HICs vary greatly in terms of ACEs measured and are often limited to school-based samples. As such, methodological differences between studies generally impedes direct comparisons (9,10). Like prevalence studies of ACEs, many of the studies of associated health outcomes are based on adults' retrospective reports of ACEs, and little is known about the impact of ACEs during adolescence.

Few studies have examined the prevalence of adverse childhood experiences (ACEs) among adolescents living in low- and middle-income countries. A study from Indonesia among university students aged 18-20 years reported that more than 45% had experienced at least one ACE before they were 18 years (11). In Kenya, a cross-sectional study among adolescents aged 12-19 years in the informal settlements of Nairobi found that 54% had experienced at least one ACE, while 18% reported three or more ACEs (12). In Vietnam, a study conducted among high school students in two provinces found that approximately 74% of students reported experiencing at least one ACE, and more than 25% reported experiencing three or more ACEs (13). The few available studies from LMICs reporting the prevalence of ACEs have similar limitations as studies from HICs. Most of the available studies are not representative of the broader population e.g., are either based on school or health facility samples, or cover smaller geographic units (11,12,14).

In addition to evidence reporting the prevalence of ACEs, research shows exposure to multiple ACEs increases the risk of mental disorders (6,15–17). A systematic review and meta-analysis of the effects of multiple ACEs on health showed that individuals who had experienced four or more ACEs had a three- to six-fold increase in the risk of mental illness and problematic alcohol use, as compared with individuals reporting no ACEs (6). A prospective study in the United States found that ACEs were significantly associated with incident depressive symptoms, substance use, and antisocial behavior after two year follow-up (18). These findings are supported by evidence from systematic reviews of studies from HICs (19–21).

The few studies from LMICs reporting the association between ACEs and mental health outcomes have found similar results to that of evidence from HICs. For example, a study by Blum and colleagues examined the association between cumulative ACEs and depressive symptoms in 14 urban communities in LMICs using data from the Global Early Adolescent Study (7). This study found that adolescents (age 10-14) who experienced one or more ACEs were at 88% more likely to have more than three depressive symptoms (7). A study of adolescents from Nairobi slums found that childhood

adversity was positively and significantly associated with delinquency (12). However, many studies from LMICs are small scale, not nationally representative, and are narrow in focus, for example limiting their examination to the association between ACEs and a single mental disorder (7,11,12). In addition, previous studies of ACEs in LMICs and HICs have largely used symptom scales and not diagnostic instruments to assess mental health outcomes.

More research is required to shed light on the prevalence of ACEs and their associations with mental disorders in LMICs, where the majority of the world's adolescents live. Given that the prevalence and profile of ACEs may differ from HICs (3,6), this information is necessary for policymakers, programmers, and researchers in LMICs to develop effective prevention programs to reduce exposure to ACEs and promote adolescent mental health and wellbeing.

In this study, we utilize data from the National Adolescent Mental Health Surveys (NAMHS) (22) to examine the prevalence of ACEs experienced by adolescents aged 10-17 years in Kenya, Indonesia, and Vietnam. Further, data from these nationally representative surveys are used to analyze the association between ACEs and mental disorders among adolescents in these three countries.

Methods

Sample

NAMHS employed a multi-stage stratified sampling design to generate a nationally representative sample of adolescents aged 10-17 years in Kenya, Indonesia, and Vietnam. Data were collected in 2021 by trained lay interviewers who interviewed the adolescent and their primary caregiver. Final sample sizes (and response rates) were 5,155 (98%) in Kenya, 5,664 (82%) in Indonesia, and 5,996 (95%) in Vietnam. Detailed information on the study design, sample size, and sampling procedures have been published elsewhere (22,23).

Measures

Adverse childhood experiences

The measure of ACEs utilized in NAMHS was adapted from the WHO ACEs International questionnaire (24). The ACEs measure contained 13 questions, with seven questions focused on child maltreatment (physical abuse, emotional abuse, physical neglect, emotional neglect [2 items], and sexual abuse [2 items]) and six questions related to household level challenges (i.e., parental substance abuse, parental emotional distress, domestic violence, parental incarceration, and household instability [2 items]). The recall period for these questions was lifetime (i.e., 'ever'). In NAMHS, the ACEs questions were answered by the adolescent who self-administered these questions (i.e., answering questions on the tablet/smartphone) rather than being asked by an interviewer. This approach was informed by previous literature which found differences in responses to sensitive questions between interviewer- and self-administered methods (25,26). For each question, adolescents answered 'Yes', 'No', 'Don't know', or 'Prefer not to say'. A small proportion of adolescents gave a non-meaningful response ('Don't Know' or 'Prefer not to say') for each of the questions, and were classified as missing and not included in the analysis. The proportions of adolescents who gave non-meaningful responses for the different ACEs questions, and were excluded from the denominator of the analysis are provided in supplementary Table 1 (see additional file 1).

Mental disorders

Mental disorders were defined according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (27) measured by the Diagnostic Interview Schedule for Children, Version 5 (DISC-5) (28). The DISC-5 is a standardized diagnostic instrument designed to be administered by trained 'lay' interviewers—individuals who do not have any clinical training but who are trained on the DISC-5. NAMHS measured the prevalence of six mental disorders in adolescents: social phobia, generalized anxiety disorder, major depressive disorder, conduct disorder, posttraumatic stress disorder, and attention-deficit/hyperactivity disorder (ADHD).

In NAMHS, all DISC-5 modules (i.e., measures of individual disorders) were administered to the adolescent except for ADHD (which was asked of the primary caregiver). The DISC-5 assessed for the presence of the selected mental disorders during the past 12 months. For the purpose of this study, mental disorders were grouped into a single category of any mental disorder in the past 12 months.

Demographics

Demographic information pertaining to both the adolescent and the primary caregiver was collected. All demographic information was reported by the primary caregiver except for urbanicity, which was determined based on household location. This included the age and sex of the adolescent, household wealth, and parental mental health (23). Household wealth was measured by the wealth index which was analyzed according to standardized methodology published elsewhere (23). The Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7) questionnaire were administered to the primary caregiver to assess for depressive symptoms and anxiety symptoms, respectively. The PHQ-9 and GAD-7 scores were generated and categorized based on established thresholds (29,30).

Statistical approach

Data were analyzed using Stata version 17 (31). For ACEs that were assessed by two questions (e.g., sexual abuse), endorsement of one or both questions counted as only one ACE. The 13 questions were grouped into ten categories according to the ACE domains. The proportion of adolescents who endorsed one or more ACEs and four or more ACEs was also calculated. The number of ACEs endorsed were then categorized into five groups: no ACEs, one ACE, two ACEs, three ACEs, and four or more ACEs. For each country, results are presented as weighted proportions with associated 95% confidence intervals (CIs). Sampling weights applied in each country were generated using inverse probability weighting which considered NAMHS complex sampling design (23).

Bivariate analyses were conducted to examine the prevalence of four or more ACEs by selected demographic characteristics (age, sex, urbanicity, and wealth quintile). The prevalence of any mental

disorder in the past 12 months was calculated within each of the five mutually exclusive categories of ACEs endorsement i.e., none, one, two, three, four or more. Multivariable logistic regression analysis was used to examine associations between the five categories of ACEs and any mental disorder in the past 12 months after adjusting for demographic characteristics – age (10-14 years, 15-17 years), sex (male, female), urbanicity (urban, rural), and household wealth (as wealth index quintiles).

Results

Prevalence of ACEs

Table 1 shows the prevalence of each type of ACE, as well as the prevalence of adolescents experiencing one or more, and four or more ACEs, for Kenya, Indonesia, and Vietnam. The type of ACEs experienced varied between the countries. In Kenya, household instability (39.7%, 95%CI: 38.1-41.3), emotional abuse (24.6%,95%CI:23.3-26.1), and emotional neglect (21.1%, 95% CI: 19.8-22.4) were the most prevalent ACEs reported by adolescents. In Indonesia, emotional neglect (18.5%, 95% CI: 17.2-19.9), and emotional abuse (15.9%, 95%CI: 14.6-17.3) were the most prevalent ACEs. Similarly, in Vietnam, emotional abuse (14.9%, 95%CI: 13.6-16.2) and emotional neglect (14.3%, 95%CI: 13.1-15.5) were the most commonly endorsed ACEs by adolescents (Table 1).

Kenya had significantly higher prevalence of adolescents who had experienced one or more ACEs (65.8%, 95% CI: 64.2-67.3) than Indonesia (40.1%, 95% CI: 38.4- 41.9) and Vietnam (36.9%, 95% CI: 35.2-38.6). Among those reporting four or more ACEs, statistically significant differences were seen between all countries with Kenya again having the highest prevalence (19.2%, 95% CI: 18.0 - 20.6) followed by Indonesia (7.6%, 95% CI: 6.7 - 8.6) and Vietnam (5.2%, 95% CI: 4.4- 6.1) (Table 1).

Table 1: Prevalence of adverse childhood experiences among adolescents in Kenya, Indonesia, and Vietnam

ACEs question	**Kenya % (95% CI)**	**Indonesia % (95% CI)**	**Vietnam % (95% CI)**
Physical abuse Ever scared that your parents/other adults were going to hurt you badly	11.9 (10.9-13.0)	12.3 (11.2-13.5)	7.3 (6.4- 8.3)
Emotional abuse Ever scared/felt really bad because grown-ups called you names	24.6 (23.3-26.1)	15.9 (14.6-17.3)	14.9 (13.6-16.2)
Neglect Ever been a time in your life when you were totally on your own	18.8 (17.5-20.1)	9.2 (8.2-10.4)	8.4 (7.5 -9.5)
Emotional neglect* Ever felt like you are not loved or cared about Ever felt like you have no one that protects you	21.1 (19.8-22.4)	18.5 (17.2-19.9)	14.3 (13.1-15.5)
Sexual abuse* Ever touched by an adult in your private parts except when bathing Ever had an adult attempt to or forced you to have sexual intercourse	11.0 (10.0-12.0)	5.8 (5.1-6.7)	2.0 (1.5-2.5)
Parental substance use? Ever had parents who drank too much alcohol/used drugs and were abusive	6.4 (5.7- 7.2)	1.5 (1.1- 2.0)	2.4 (1.8- 3.1)
Parental mental health Ever saw mother/father so sad that they couldn't take care of you	17.5 (16.3-18.8)	7.7 (6.8-8.8)	8.6 (7.6-9.7)
Domestic violence Ever saw your mother being hit, beaten, or threatened	14.8 (13.7-16.0)	3.7 (3.1-4.5)	5.5 (4.7-6.4)
Parental incarceration Ever had either of parents be in prison/jail	7.9 (7.1-8.8)	0.6 (0.4-1.0)	1.1 (0.7-1.5)
Household instability* Ever had family forced to leave home Ever time when family did not have enough food because of money	39.7 (38.1- 41.3)	12.1 (10.9-13.3)	8.3 (7.3-9.4)
One or more ACEs	65.8 (64.2-67.3)	40.1 (38.4-41.9)	36.9 (35.2-38.6)
Four or more ACEs	19.2 (18.0-20.6)	7.6 (6.7-8.6)	5.2 (4.4-6.1)

*For ACEs measured by two questions, endorsement of one or both questions was counted as a single ACE when calculating the proportion of adolescents endorsing one or more ACEs, and four or more ACEs.

As shown in Table 2, the prevalence of adolescents reporting four or more ACEs in Kenya was significantly higher among older (15-17 years) adolescents compared to younger (10-14 years)

adolescents. However, there was no statistically significant difference in ACEs prevalence by age for Indonesia and Vietnam. Similarly, no significant differences in ACEs were observed by sex and urbanicity, although ACEs prevalence varied by household wealth in Indonesia and Kenya (Table 2). In Indonesia, the prevalence of four or more ACEs decreased as the wealth increased. In Kenya, an inverse-U shaped association was seen whereby the prevalence of four or more ACEs was significantly higher in the middle (3) wealth quintile compared to the lowest and highest wealth quintiles (Table 2).

Table 2: Prevalence of four or more ACEs among adolescents by demographic characteristics in Kenya, Indonesia, and Vietnam.

Demographic characteristic	**Kenya, % (95% CI)**	**Indonesia, % (95% CI)**	**Vietnam, % (95% CI)**
Age group			
10-14	16.7 (15.2-18.2)	7.0 (6.0-8.3)	4.5 (3.7-5.6)
15-17	24.4 (22.1-26.9)	8.6 (7.1-10.5)	6.4 (5.0-8.1)
Sex			
Male	19.3 (17.5-21.2)	6.9 (5.6-8.3)	5.2 (4.1-6.6)
Female	19.2 (17.5-21.0)	8.3 (7.0-9.9)	5.1 (4.2-6.3)
Residence			
Urban	20.5 (18.5-22.7)	7.6 (6.5-8.9)	6.0 (4.7-7.7)
Rural	18.5 (16.9-20.1)	7.5 (6.0-9.4)	4.8 (3.9-5.9)
Wealth quintile			
1 (Least)	16.6 (14.1-19.6)	12.7 (10.2-15.7)	5.8 (3.9-8.5)
2	21.0 (18.1-24.2)	6.9 (5.18-9.1)	4.2 (2.8-6.3)
3	22.9 (20.1-25.9)	7.7 (5.98-10.1)	6.4 (4.8-8.3)
4	21.7 (18.9-24.8)	6.4 (4.7-8.6)	5.8 (4.2-8.0)
5 (Most)	13.9 (11.6-16.6)	3.3 (2.1-5.3)	3.4 (2.3-5.1)

Association between ACEs and mental disorders

Table 3 shows the prevalence of any mental disorder in the past 12 months among those experiencing none, one, two, three, and four or more ACEs. Across all three countries, the prevalence of any mental disorder in the past 12 months increased as the number of ACEs increased. In Kenya, there was a four-

fold difference in the prevalence of any mental disorder between those who had not experienced any ACEs (6.0%, 95%CI: 4.9-7.4) and those who had experienced four or more ACEs (25.9%, 95%CI: 22.7-29.3). In Indonesia, a nine-fold difference was seen between the same groups (none: 2.4%, 95%CI: 1.8-3.3; four or more ACEs: 22.3%, 95%CI: 17.3-28.3) with the same magnitude differences also seen in Vietnam (none: 1.8%, 95%CI: 1.3-2.5; four or more ACEs: 17.0%, 95%CI: 11.7-24.1).

Table 3: Prevalence of any mental disorder in the past 12 months among adolescents by number of ACEs in Kenya, Indonesia, and Vietnam.

Number of ACEs	Any mental disorder in the past 12 months		
	Kenya, % (95% CI)	**Indonesia, % (95% CI)**	**Vietnam, % (95% CI)**
None	6.0 (4.9-7.4)	2.4 (1.8-3.3)	1.8 (1.3-2.5)
1	9.5 (7.7-11.7)	5.3 (3.7-7.6)	1.9 (1.1-3.2)
2	11.4 (8.9-14.5)	10.2 (7.3-14.0)	7.1 (4.7-10.7)
3	13.9 (10.9-17.6)	7.9 (4.8-12.8)	7.5 (4.7-11.9)
4 or more	25.9 (22.7-29.3)	22.3 (17.3-28.3)	17.0 (11.7-24.1)

Table 4 shows the adjusted odds ratios (aORs) for the association between the number of ACEs and any mental disorder in the past 12 months among adolescents. The odds of having a mental disorder increased as the number of ACEs increased in all three countries (Table 4). In Kenya, compared to those reporting no ACEs, the aORs increased from 1.53 (95% CI: 1.12-2.10) among those who experienced one ACE to 4.60 (95% CI: 3.43-6.17) among those who reported four or more ACEs. Similarly, the odds of experiencing any mental disorder in the past 12 months increased as the number of ACEs reported increased in Indonesia (one ACE: 2.02, 95%CI: 1.18-3.46; four or more ACEs: 10.8, 95%CI: 6.48-18.1) and Vietnam (one ACE: 0.98, 95%CI: 0.51-1.88; four or more ACEs: 10.75, 95%CI: 6.06-19.07) (Table 4).

Table 4. Unadjusted and adjusted odds ratios for the association between number of ACEs and any mental disorder in the past 12 months among adolescents in Kenya, Indonesia, and Vietnam.

Number of ACEs	Kenya		Indonesia		Vietnam	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
None	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
2	**1.64 (1.19 - 2.26)**	**1.53 (1.12 - 2.10)**	**2.26 (1.38 - 3.72)**	**2.02 (1.18 - 3.46)**	1.05 (0.56 - 1.96)	0.98 (0.51 - 1.88)
2	**2.00 (1.41 - 2.85)**	**1.68 (1.16 - 2.44)**	**4.57 (2.82 - 7.39)**	**4.41 (2.62 - 7.42)**	**4.15 (2.38 - 7.22)**	**3.47 (2.03 - 5.95)**
3	**2.53 (1.78 - 3.59)**	**2.19 (1.53 - 3.12)**	**3.46 (1.85 - 6.46)**	**3.02 (1.55 - 5.89)**	**4.41 (2.40 - 8.10)**	**4.19 (2.13 - 8.26)**
4 or more	**5.45 (4.14 - 7.19)**	**4.60 (3.43 - 6.17)**	**11.56 (7.37 - 18.16)**	**10.8 (6.46 - 18.1)**	**11.09 (6.38 - 19.28)**	**10.75 (6.06 - 19.07)**

Note: Adjusted for adolescent age, adolescent sex, urbanicity, household wealth and primary caregiver mental health
OR = Unadjusted odds ratio; AOR = adjusted odds ratio
Bold estimates indicate statistical significance at $p<0.05$.

Discussion

This study used nationally representative surveys of adolescents aged 10-17 years from Kenya, Indonesia, and Vietnam to report the prevalence of ACEs and their association with mental disorders. The prevalence of adolescents endorsing at least one or more ACEs was high in all three countries, with 65.8% in Kenya, 40.1% in Indonesia and 36.9% in Vietnam. In Kenya, nearly one in five adolescents (19.2%) reported experiencing four or more ACEs compared to less than one in ten adolescents in Indonesia (7.6%) and Vietnam (5.2%). The NAMHS also showed that the 12-month prevalence of any mental disorder among adolescents was 12.1%, 5.5% and 3.3% in Kenya, Indonesia and Vietnam respectively (23).

Although comparison with previous studies is difficult due to different methods for measuring ACEs, these rates are consistent with studies from HICs (9,12,18). The prevalence of one or more ACEs in Kenya (65.8%) falls in the range reported in a systematic review of studies (ranging from 41% to 97%) among school-aged youth that also included studies from LMICs (9). The equivalent proportion of adolescents in Indonesia and Vietnam is slightly less than previously reported (9). Although most

previous studies from LMICs report higher prevalence, these were focused on specific population groups or small geographic areas and are generally not comparable with the current study because they are not representative of the general population. The few studies from Kenya sampled the informal settlements and reported higher prevalence of ACEs among adolescents and adults (12,32,33). Moreover, most of the studies from Indonesia and Vietnam were university- or school-based and reported higher prevalence of ACEs than the current study (11,13,34). Nonetheless, the current study shows that a significant proportion of adolescents in LMICs have exposure to ACEs, albeit with substantial variation between the three countries.

The type of ACEs experienced by adolescents varied cross-nationally. Emotional abuse and neglect were among the most common ACEs reported in all three countries. Previous studies have shown that emotional abuse is particularly harmful to mental health across the lifespan (17,35). For instance, a national study in Australia found that emotional abuse was consistently and independently associated with increased odds of mental disorders (17). The high rates of emotional abuse observed cross nationally in the current study provides an opportunity for public health interventions that might reduce mental disorder prevalence. Additionally, household instability, such as food insecurity, was reported by a high proportion of adolescents in Kenya (39.7%). The reported level of household challenges reflects the high level of poverty and food insecurity in Kenya. This demonstrates how factors beyond the health system such as social inequalities may influence health outcomes. The findings also suggest that poverty-related childhood adversity should be considered in designing interventions to improve mental health.

In general, exposure to ACEs did not vary significantly by sex, urbanicity, or household wealth, which suggests that the vulnerability of adolescents to ACEs cuts across demographic and socioeconomic lines. While several previous studies have reported differences by sex (7,36,37), with females being more vulnerable to certain ACEs such as sexual abuse, no difference in the prevalence of four or more ACEs was seen between the sexes. The relationship between household wealth and ACEs varied across

the countries. Some studies have found that both low socio-economic status and ACEs independently increase the risk of mental disorders in children (38,39), while other studies have suggested that ACEs may mediate the relationship between socio-economic status and later life health outcomes (40). The disparity in findings related to ACEs and household wealth in the current study further demonstrate the likely complexity of this relationship.

Consistent with previous studies from HICs and LMICs (6,7,41), the present study found that exposure to multiple ACEs is significantly associated with mental disorders among adolescents. Across all three countries, the prevalence of mental disorders increased as the number of ACEs experienced increased, indicating a dose-response relationship. The mechanisms by which ACEs contribute to mental disorders is less clear but may include activation of the body's stress response with sensitization of neurobiological systems, making an individual more vulnerable to mental illness (42). Additionally, ACEs can lead to psychological changes in children such as distrust of others and biased emotional processing, which impact on learning and formation of stable friendships and other relationships (43). These and other pathways are purported to underpin a causal relationship between ACEs and mental disorders.

There are certain limitations that must be considered when interpreting the findings of the current study. For example, given NAMHS is a cross-sectional survey, the directionality of the association between ACEs and mental disorders cannot be explored or confirmed—it is possible that the initial onset of the mental disorder preceded any exposure to ACEs. While this is a limitation, the reported findings are in line with longitudinal studies that have found associations between ACEs and poor mental health (39). In addition, the ACEs questionnaire utilized in NAMHS is only a relatively brief screener and does not delve into the frequency, severity, or duration of these experiences. This may be vital information for policymakers and stakeholders when looking to develop targeted interventions, particularly as the association with mental disorders may vary as a result. Further, the ACEs questions themselves are limited to specific examples of broad experiences, for example, specific

types of sexual abuse perpetrated by adults, yet evidence from HICs has found that sexual abuse perpetrated by other adolescents is becoming more prevalent in recent generations (44). However, the ACEs questions utilised in NAMHS have been widely used in other studies, allowing for further comparisons beyond just NAMHS while providing an important initial evidence base for Kenya, Indonesia, and Vietnam.

Conclusion

Overall, the findings of the current study demonstrate that ACEs are common among adolescents in Kenya, Indonesia, and Vietnam, albeit with significant differences in prevalence between all three countries. Further, these findings show that despite differences in prevalence, ACEs are associated with increased odds of mental disorders in all three countries. As such, prevention or minimization of the number of ACEs experienced by an individual may be an effective approach for reducing the risk of mental disorders in adolescence. Further, these data provide baseline prevalence estimates by which governments and stakeholders can assess the impact of any population-level efforts to reduce the prevalence of ACEs.

List of abbreviations

ACEs: adverse childhood experiences

ADHD: attention-deficit/hyperactivity disorder

aOR: adjusted odds ratio

CIs: confidence intervals

DISC-5: Diagnostic Interview Schedule for Children, Version 5

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, 5th Edition

GAD-7: Generalized Anxiety Disorder *7*

HICs: high income countries

I-NAMHS: Indonesia – National Adolescent Mental Health Survey

JHSPH: John Hopkins Bloomberg School of Public Health

K-NAMHS: Kenya – National Adolescent Mental Health Survey

LMICs: low- and middle-income countries

NAMHS: National Adolescent Mental Health Surveys

PHQ-9: Patent Health Questionnaire -9

UQ: University of Queensland

V-NAMHS: Viet Nam Adolescent Mental Health Survey

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval for the National Adolescent Mental Health Surveys (NAMHS) was granted by the University of Queensland (UQ) Human Research Ethics Committee (approval no. 2019001268). Additionally, each in-country NAMHS team sought and was granted approval from their relevant in-country ethics committee or institutional review board for their respective survey. K-NAMHS received approval from the AMREF Health Africa's Ethics and Scientific Review Committee (approval no. P654/2019). Further, the National Commission for Science, Technology and Innovation (NASCOSTI) granted the research permit for conducting K-NAMHS in Kenya (license no. NACOSTI/P/19/837). I-NAMHS received approval from the Medical and Health Research Ethics Committee at Universitas Gadjah Mada (UGM) (approval no. KE/FK/1212/EC/2019), along with approval to conduct a national population-based household survey from the Ministry of Home Affairs, Indonesia (approval no. 440.04/835/Polpum). V-NAMHS received approval from the Ethical Review Board for Biomedical Research at Hanoi University of Public Health (approval no. 499/2019/YTCC-HD3). The UQ NAMHS team and each in-country NAMHS team worked collaboratively to ensure that the content and principles of the in-country ethical approvals were consistent with the overarching ethical approval.

Consent for publication

Not applicable.

Availability of data and materials

The NAMHS datasets are co-owned by the University of Queensland and each respective in-country lead organization (K-NAMHS: APHRC and UQ; I-NAMHS: UGM and UQ; V-NAMHS: IOS and UQ). Currently, these datasets or analysis of these datasets are available for collaborative work on request to the relevant data owners following an established protocol. Work is currently underway to convert the NAMHS datasets into public use datasets, allowing for wide use of these datasets while ensuring protection of participant privacy, adherence to country-specific legislation, and appropriate use of data. This includes development of accompanying meta-data, inclusive of a codebook, technical manual, and analysis files. The expected launch date for these public use datasets and accompanying meta-data is 2024, with hosting mechanisms currently under development in line with country legislation and ethical requirements.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

YDW wrote the first draft of the manuscript. AN and IA conducted the statistical analyses. SO, AEW, SLF, AR, ML, VML, JCM, JGS, HEE and CWK provided comprehensive feedback on the statistical analysis and manuscript drafts. All authors read and approved the final manuscript.

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572

573 **Additional files**

574 Title of data: Table S1: Distribution of non-meaningful responses to each ACE questions in
575 Kenya, Indonesia, and Vietnam

576

577 Description of data: Table showing numbers and percentages of adolescents who provided

578 non-meaningful responses to each of the ACEs questions in Kenya, Indonesia and Vietnam

579