# Prevalence of adolescent mental disorders in Kenya, Indonesia, and Viet Nam measured by the National Adolescent Mental Health Surveys (NAMHS): a multi-national cross-sectional study

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## Summary

**Background** Mental disorders are the leading global cause of health burden among adolescents. However, prevalence data for mental disorders among adolescents in low-income and middle-income countries are scarce with often limited generalisability. This study aimed to generate nationally representative prevalence estimates for mental disorders in adolescents in Kenya, Indonesia, and Viet Nam.

**Methods** As part of the National Adolescent Mental Health Surveys (NAMHS), a multinational cross-sectional study, nationally representative household surveys were conducted in Kenya, Indonesia, and Viet Nam between March and December, 2021. Adolescents aged 10–17 years and their primary caregiver were interviewed from households selected randomly according to sampling frames specifically designed to elicit nationally representative results. Six mental disorders (social phobia, generalised anxiety disorder, major depressive disorder, post-traumatic stress disorder, conduct disorder, and attention-deficit hyperactivity disorder) were assessed with the Diagnostic Interview Schedule for Children, Version 5. Suicidal behaviours and self-harm in the past 12 months were also assessed. Prevalence in the past 12 months and past 4 weeks was calculated for each mental disorder and collectively for any mental disorder (ie, of the six mental disorders assessed). Prevalence of suicidal behaviours (ie, ideation, planning, and attempt) and self-harm in the past 12 months was calculated, along with adjusted odds ratios (aORs) to show the association with prevalence of any mental disorder in the past 12 months. Inverse probability weighting was applied to generate national estimates with corresponding 95% CIs.

**Findings** Final samples consisted of 5155 households (ie, adolescent and primary caregiver pairs) from Kenya, 5664 households from Indonesia, and 5996 households from Viet Nam. In Kenya, 2416 (46·9%) adolescents were male and 2739 (53·1%) were female; in Indonesia, 2803 (49·5%) adolescents were male and 2861 (50·5%) were female; and in Viet Nam, 3151 (52·5%) were male and 2845 (47·4%) were female. Prevalence of any mental disorder in the past 12 months was 12·1% (95% CI 10·9–13·5) in Kenya, 5·5% (4·3–6·9) in Indonesia, and 3·3% (2·7–4·1) in Viet Nam. Prevalence in the past 4 weeks was 9·4% (8·3–10·6) in Kenya, 4·4% (3·4–5·6) in Indonesia, and 2·7% (2·2–3·3) in Viet Nam. The prevalence of suicidal behaviours in the past 12 months was low in all three countries, with suicide ideation ranging from 1·4% in Indonesia (1·0–2·0) and Viet Nam (1·0–1·9) to 4·6% (3·9–5·3) in Kenya, suicide planning ranging from 0·4% in Indonesia (0·3–0·8) and Viet Nam (0·2–0·6) to 2·4% (1·9–2·9) in Kenya, and suicide attempts ranging from 0·2% in Indonesia (0·1–0·4) and Viet Nam (0·1–0·3) to 1·0% (0·7–1·4) in Kenya. The prevalence of self-harm in the past 12 months was also low in all three countries, ranging from 0·9% (0·6–1·3) in Indonesia to 1·2% (0·9–1·7) in Kenya. However, the prevalence of suicidal behaviours and self-harm in the past 12 months was significantly higher among those with any mental disorder in the past 12 months than those without (eg, aORs for suicidal ideation ranged from 7·1 [3·1–15·9] in Indonesia to 14·7 [7·5–28·6] in Viet Nam).

**Interpretation** NAMHS provides the first national adolescent mental disorders prevalence estimates for Kenya, Indonesia, and Viet Nam. These data can inform mental health and broader health policies in low-income and middle-income countries.

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## Research in context

**Evidence before this study**

The evidence available before the National Adolescent Mental Health Surveys (NAMHS) was determined on the basis of previous research conducted by the lead author (HEE), published in 2016, which analysed the prevalence data used to generate relevant Global Burden of Disease Study (GBD) 2013 estimates. Despite the majority of the world's adolescents living in low-income and middle-income countries (LMICs), few studies had examined the prevalence of mental disorders in young people living in these regions. Data that reached the threshold for inclusion in GBD 2013 represented only 6·7% of the child and adolescent population aged 10–17 years. The proportion was even lower in LMICs (4·5%) compared with high-income countries (26·4%). Further review of the mental disorder prevalence studies informing the GBD 2019 estimates (GBD 2019 Mental Disorders Collaborators, 2022) showed little to no progress in data availability to improve representation for adolescents in LMICs, inclusive of Kenya, Indonesia, and Viet Nam. Prevalence estimates of adolescent mental disorders are essential for informing policies to address the health needs of young people. Such estimates also enable cross-national comparisons, provide evidence for the funding of health services, and assist in evaluating the effectiveness of universal interventions to improve the mental health of adolescents living in LMICs.

**Added value of this study**

The NAMHS were conducted in Kenya, Indonesia, and Viet Nam to specifically address this evidence gap in these countries, their surrounding regions, and in LMICs more broadly, by providing the first nationally representative prevalence estimates for mental disorders among adolescents in these countries. The rationale for the choice of these countries in addition to the scarcity of available data is detailed in the published study protocol. NAMHS showed that the prevalence of any mental disorder in the past 12 months differed significantly between the three countries. Given the scarcity of prevalence studies of mental disorders among adolescents living in Kenya, Indonesia, and Viet Nam and the near absence of data derived from diagnostic instruments, the data from NAMHS provide crucial information on the mental health of adolescents for the governments of the participating countries, as well as international aid and development agencies, and increase the representativeness of prevalence data for adolescent mental disorders (inclusive of internalising and externalising disorders) from LMICs. These data are essential for informing the actions and priorities of policy makers, stakeholders, and relevant domestic and international organisations in relation to adolescent mental health. Further, the methods of NAMHS, collaboratively developed by organisations from five different countries (Kenya, Indonesia, Viet Nam, Australia, and the USA), were designed specifically with the potential to be adapted to other low-resource settings in future surveys.

**Implications of all the available evidence**

The findings of NAMHS show the magnitude and distribution of mental disorders among adolescents in Kenya, Indonesia, and Viet Nam. Although the estimates inform our understanding of the mental health of adolescents in LMICs more broadly, they also point towards a clear need for national prevalence data from individual countries to inform in-country mental health policy and planning, rather than relying on inference from studies, if available, from geographically proximal or culturally similar countries. Local data are crucial in forming the evidence base for prioritising adolescent mental health in existing and future health policies. Further, the findings raise some important questions for global mental health, specifically about the applicability of instruments based on diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, and the best balance between cultural adaptation and conceptual consistency. The data generated by NAMHS provide an opportunity to investigate these questions further, informing both our understanding of mental disorders among adolescents in LMICs and future survey methods and measures.

## Introduction

Mental disorders are the leading cause of health burden among adolescents across the world.[1,2] Evidence shows that poor mental health during this crucial developmental period can have adverse effects on health and wellbeing, education, employment, and family and social life across the lifespan.[3,4] However, prevalence data for adolescent mental disorders in low-income and middle-income countries (LMICs), where most of the world's young people live, are scarce.[5] A 2017 study found that only 6·7% of the global child and adolescent population was represented by mental disorder surveys utilising diagnostic tools, with an evident disparity in the availability of prevalence data between high-income countries (HICs; 26·4%) and LMICs (4·5%).[5] Little to no progress has since been made to increase the number of available prevalence studies of adolescent mental disorders in LMICs.[1,6] Further, prevalence surveys that allow meaningful cross-national comparison to inform the setting of global priorities are virtually non-existent despite evidence from the World Mental Health Surveys, which include a wide group of LMICs, showing that most adult mental disorders have onset in childhood or adolescence.[7] Given that the proportion of the globe's adolescents living in LMICs is projected to increase over the coming decades,[8] data pertaining to their mental health are crucial for current and future health policy and service provision, both at a national and international level.

Existing prevalence studies on adolescent mental health in LMICs have some common limitations, restricting their ability to be generalised more broadly to inform national and global population-level change. Data from health services are often used as a starting point to gauge the prevalence of mental disorders in a population. Although important, these data only represent those who chose to or were able to access services within areas where services were available. In low-resource settings in particular, such data are often incomplete because of the absence of existing systems to capture and accurately record this information. Further, such data are typically skewed towards the most severe presentations of a disorder, which are more likely to be treated, or over-represent serious mental disorders with externalising symptoms, which are of concern to caregivers and educators.[9] The consideration of these limitations is particularly important for adolescents, whose access to and use of services is generally controlled or at least influenced by their caregivers.[10–12]

Epidemiological studies of adolescent mental disorders that do exist within LMICs tend to be conducted in urban centres with existing research infrastructure, confined to locations where specific exposures are present or have occurred (eg, natural disasters and conflict), or recruit participants exclusively from schools. Additionally, most focus on a single disorder. Further, most existing prevalence surveys in LMICs use brief symptom measures of general mental health, rather than instruments that can generate a diagnosis of specific mental disorders according to internationally recognised and established diagnostic criteria.[5] Results of these studies cannot be generalised to the national level and nationally representative data are required to accurately inform country-wide mental health policy and service provision for adolescents. In addition, data based on established diagnostic instruments more readily support cross-national comparisons, allowing for differences to be more accurately explored. Further, diagnostic data can be included in international research efforts, such as the Global Burden of Disease (GBD) study that quantifies the burden of mental disorders in comparison with other health conditions and is used by governments and other health agencies to set health-related priorities.[1]

As such, one of the great challenges for the epidemiological measurement of adolescent mental disorders in LMICs is establishing methods that: (1) utilise a diagnostic measure of mental disorders that adheres to internationally recognised diagnostic criteria while allowing for necessary cultural adaptation; (2) use a household-based sampling design, which can be conducted on a national scale in the face of varying geographical, cultural, and logistical challenges; and (3) have the potential to be adapted for use in other LMICs. High-quality data generated from studies using such methods are an important starting point for good policy and programmatic decisions. Without such data, adolescent mental disorders in LMICs remain a largely unrecognised and unaddressed health issue.

The National Adolescent Mental Health Surveys (NAMHS) measured the prevalence of six mental disorders in adolescents aged 10–17 years by conducting nationally representative surveys in three LMICs: Kenya, Indonesia, and Viet Nam. The choice of Kenya, Indonesia, and Viet Nam was informed by little to no data being available for these countries and their respective region, in parallel to evidence of each country's prioritisation of adolescent mental health and their broader status as a priority for international agencies, and the presence of an in-country organisation with relevant experience able to conduct NAMHS and to further build adolescent mental health into their ongoing research agenda (further detail is available in the appendix [p 2]).[13] Further, the methods and measures used in NAMHS were specifically designed to produce data that meet criteria for inclusion in GBD. Increased precision of GBD burden estimates resulting from the inclusion of data from NAMHS is not only reflected in Kenya, Indonesia, and Viet Nam, but also in their respective regions because GBD relies on countries with data to directly inform estimates for countries with little to no data that sit within the same region.[1] As such, the data generated by NAMHS improve burden estimates for many other countries within two major regions of the world.

See Online for appendix

High-quality survey methods (ie, able to produce data meeting criteria for inclusion in GBD burden estimation[1]) were developed collaboratively for NAMHS by organisations from five countries and implemented to allow for both cross-national comparison and use by future surveys in other low-resource settings.[13,14] This Article aimed to describe the prevalence of mental disorders in adolescents in Kenya, Indonesia, and Viet Nam, and report findings by disorder, age, sex, urbanicity, and household wealth. Findings for suicidal behaviours and self-harm are also reported, as are the key demographic characteristics of the survey samples in each country.

## Methods

### Study design and participants

In this multinational, cross-sectional study, nationally representative household surveys were conducted to measure the prevalence of mental disorders in adolescents aged 10–17 years in Kenya, Indonesia, and Viet Nam. NAMHS was approved by the University of Queensland Human Research Ethics Committee (approval number 2019001268), with further in-country ethics approvals received from the relevant ethical bodies (appendix p 2). This study follows the STROBE guidelines for cross-sectional studies (appendix p 17). The methods of NAMHS are detailed in the appendix (p 2) and are broadly described in a published protocol.[13]

Participants were adolescents and their primary caregiver living in randomly selected households. In each country, a stratified multistage clustered random sample design was employed to generate a nationally representative sample of adolescents (appendix p 3). For each country, the sample size was determined with standard survey methodology and incorporated available prevalence estimates, response rates of previous large-scale surveys, relevant design effects, and a margin of error (appendix p 3). The estimated response rates incorporated into the sampling frames were 90·0% for Kenya, 80·0% for Indonesia, and 79·0% for Viet Nam. The required sample sizes estimated for each country were 5290 for Kenya, 6580 for Indonesia, and 7599 for Viet Nam. In households with more than one such adolescent, the reference adolescent was selected at random by the survey software (SurveyCTO, Dobility). Adolescents eligible to participate were those who were currently living at the home most of the time and were not currently away (eg, at boarding school). To participate in the survey, both the primary caregiver and the adolescent had to speak the language of the survey in their respective country. The full list of eligibility criteria is detailed in the appendix (p 9). Written consent from the primary caregiver and written assent from the adolescent were required for the household to participate, and privacy was a requirement for the interviews to proceed (ie, only the interviewer and the participant were permitted to be present during the interview). Only households with complete data from both the adolescent and the primary caregiver were included in the final sample for each country.

## Procedures

Participants were interviewed by a trained lay interviewer, with the survey answers recorded on a smartphone or tablet. A series of measures were administered to participants, including mental health, risk and protective factors, service use, and other relevant information. These are detailed in the appendix (p 9) and are broadly described in a published protocol.[13] Data collection occurred in Kenya from March 24 to July 28, 2021, in Indonesia from March 8 to Nov 30, 2021, and in Viet Nam from Sept 21 to Dec 16, 2021, after delays of 12–18 months in each country because of the COVID-19 pandemic. During data collection, regular data monitoring and quality checking reports were generated centrally and then reviewed in parallel to in-field management procedures overseen by the in-country lead organisations.

### *Mental disorders*

Mental disorders were assessed with the Diagnostic Interview Schedule for Children, Version 5 (DISC-5).[15,16] The DISC-5 is a structured diagnostic instrument that applies criteria established in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5),[17] and is designed to be administered by trained lay interviewers. Six diagnostic modules were included in NAMHS to measure the prevalence of six mental disorders: social phobia, generalised anxiety disorder, major depressive disorder, post-traumatic stress disorder, attention-deficit hyperactivity disorder (ADHD), and conduct disorder. These disorders were selected on the basis of their prevalence in adolescents and the associated burden of disease.[2] All modules were administered to the adolescent, except for ADHD, which was administered to the primary caregiver. The DISC-5 modules included in NAMHS underwent substantial preparation in 2019 and 2020, including translation and back-translation with comparison with the original versions to check for conceptual consistency, reviews by in-country clinicians and researchers, reviews by the DISC developer (PWF), testing via a pilot study in each country, and further ongoing revision informed by all five organisations involved in NAMHS.[13]

### *Suicidal behaviour and self-harm*

All adolescents were asked questions related to suicidal behaviour and self-harm, regardless of mental disorder status. Questions were partly adapted from previous surveys,[18] revised on the basis of expert advice, and finalised in consultation with the in-country lead organisations. The questions related to suicidal behaviours in the DISC-5 major depressive disorder module were expanded to capture ideation, planning, and attempts in the past 12 months and attempts over the lifetime. These questions were administered to the whole sample. For suicidal behaviours in the past 12 months, only those who reported suicidal ideation were then asked about suicide planning, and only those who reported planning were then asked about suicide attempts in the past 12 months. The self-harm questions asked about self-harm in the past 12 months and over the lifetime and were administered to the whole sample. All participants were read short definitions of suicide and self-harm before answering the relevant questions. The prevalence of suicidal behaviours and self-harm in the past 12 months is reported in this Article.

### *Demographic factors*

Drawing from previous studies,[18,19] a demographic module was developed and adapted for NAMHS to balance consistency across all three countries with relevance within country. Demographic information collected pertained to the adolescent, primary caregiver, and household, and was either reported by the primary caregiver (eg, the age of the adolescent) or collected by the interviewer (eg, geographical information). The sex of the adolescent was reported by the primary caregiver, with the response options of male, female, and other. Urbanicity was determined based on the household's location according to classification established by the relevant in-country statistical agencies (appendix p 8).

The primary outcomes of this study were the prevalence of mental disorders in the past 12 months and the past 4 weeks. The prevalence of suicidal behaviours and

| | Method | Kenya | Indonesia | Viet Nam |
|---|---|---|---|---|
| Response rate | Households that were eligible and agreed to participate divided by households approached after subtracting households that were ineligible to participate | 5160/5270 (97·9%) | 5760/6245 (92·2%) | 6048/7461 (81·1%) |
| Completion rate | Households with complete data (ie, completed interviews from both primary caregiver and adolescent) divided by households that were eligible and agreed to participate | 5155/5160 (99·9%) | 5664/5760 (98·3%) | 5996/6048 (99·1%) |

*Table 1:* **Response and completion rates in Kenya, Indonesia, and Viet Nam**

self-harm in the past 12 months was also calculated, along with adjusted odds ratios (aORs) showing the association with the past 12-month prevalence of any mental disorder.

## Statistical analysis

All estimates are presented as weighted prevalence or proportions unless otherwise specified, with associated 95% CIs provided when applicable. Details related to the inverse probability weighting (ie, population weights) applied to the analyses are available in the appendix (p 16). Household wealth quintiles were generated with principal component analysis of items from the wealth index[20] included in NAMHS, which largely measured household assets (appendix p 18). Significant differences were determined through the assessment of 95% CIs. All analyses were conducted in Stata 17.

The prevalence of each individual mental disorder, and the prevalence of any mental disorder (ie, of the six mental disorders assessed with DISC-5), in the past 12 months and the past 4 weeks was calculated. DSM-5 requires the presence of impairment attributable to the disorder's symptoms to meet diagnostic criteria for the mental disorder. The DISC-5 offers four different algorithms for calculating impairment, with six questions included in each diagnostic module. Algorithm A (ie, moderate impairment evident in at least one domain) was selected to balance fidelity to DSM-5 diagnostic criteria while recognising that different manifestations of impairment might occur in different cultures. The effect of the choice of algorithm on the prevalence of any mental disorder in the past 12 months is presented in the appendix (p 19).

The persistence of mental disorders was also calculated with the method previously established by Kessler and colleagues.[21] The DISC-5 assesses prevalence in both the past 12 months and past 4 weeks, which further allows for the persistence of mental disorders to be calculated by dividing the number of adolescents who met criteria for a mental disorder both in the past 12 months and in the past 4 weeks by the number of adolescents who met criteria for a mental disorder in the past 12 months.[21,22]

The prevalence of suicidal behaviours and self-harm in the past 12 months was calculated. The association between suicidal behaviours and self-harm in the past 12 months with any mental disorder in the past 12 months was assessed with logistic regression to produce aORs. Multivariate analyses adjusted the model for demographic variables including adolescent age (as a categorical variable: 10–14 years or 15–17 years), adolescent sex, household wealth quintile, and urbanicity. Separate regression models were applied to each country.

| | Kenya (N=5155*) | Indonesia (N=5664*) | Viet Nam (N=5996*) |
|---|---|---|---|
| Oversampled populations*† | 572 (urban slum) | 630 (Palu); 680 (Purworejo) | NA |
| Adolescent | | | |
| Sex | | | |
| Male | 50·1% | 50·9% | 52·0% |
| Female | 49·9% | 49·1% | 48·0% |
| Age | | | |
| Mean (SD), years | 13·3 (2·3) | 13·4 (2·2) | 13·3 (2·3) |
| 10–14 years | 66·9% | 65·5% | 65·2% |
| 15–17 years | 33·1% | 34·5% | 34·8% |
| Education and employment | | | |
| Currently attending school | 97·6% | 95·9% | 91·4% |
| Currently employed | 1·1% | 3·6% | 4·1% |
| Primary caregiver | | | |
| Mean (SD) age, years | 41·3 (11·0) | 42·7 (7·9) | 43·8 (9·8) |
| Mother | 70·3% | 74·5% | 62·6% |
| Completed high school or higher level of education | 37·8% | 48·0% | 36·0% |
| Employed | 59·1% | 57·6% | 86·7% |
| Married | 77·2% | 90·5% | 90·1% |
| Head of household | 47·8% | 31·0% | 51·9% |
| Household urbanicity | | | |
| Urban | 37·0% | 69·1% | 32·6% |
| Rural | 63·0% | 30·9% | 67·4% |

All findings presented as weighted proportions (%) unless otherwise specified. Unweighted numbers are available in the appendix (p 21). NA=not applicable. *Unweighted numbers (N) refer to the number of households (with one adolescent and one primary caregiver interviewed per household). †Kenya and Indonesia oversampled specific populations of interest to allow for mental disorder prevalence to be estimated for these populations; this oversampling was accounted for in the respective population weights.

*Table 2:* **Key information about study samples in Kenya, Indonesia, and Viet Nam**

## Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

| | Kenya | Indonesia | Viet Nam |
|---|---|---|---|
| **Prevalence in past 12 months** | | | |
| Any mental disorder | 12·1% (10·9–13·5) | 5·5% (4·3–6·9) | 3·3% (2·7–4·1) |
| Anxiety disorders | 5·6% (4·9–6·5)* | 3·7% (2·8–4·9)* | 2·3% (1·8–2·9) |
| Social phobia | 3·9% (3·3–4·7) | 2·8% (2·1–3·6) | 0·9% (0·6–1·4) |
| Generalised anxiety disorder | 2·4% (2·0–2·9) | 1·6% (1·1–2·4) | 1·7% (1·3–2·2) |
| Major depressive disorder | 2·0% (1·6–2·5) | 1·0% (0·7–1·5) | 0·8% (0·6–1·2) |
| Post-traumatic stress disorder | 1·3% (0·9–1·8) | 0·5% (0·3–0·8) | 0·3% (0·2–0·5) |
| ADHD | 3·5% (2·9–4·3) | 0·5% (0·3–1·0) | 0·5% (0·3–0·8) |
| Conduct disorder | 2·8% (2·2–3·4) | 0·8% (0·5–1·3) | 0·2% (0·1–0·5) |
| Comorbidity | 2·4% (2·0–3·1) | 1·0% (0·6–1·4) | 0·6% (0·4–0·9) |
| **Prevalence in past 4 weeks** | | | |
| Any mental disorder | 9·4% (8·3–10·6) | 4·4% (3·4–5·6) | 2·7% (2·2–3·3) |
| Anxiety disorders | 3·4% (2·8–4·2) | 2·8% (2·1–3·8) | 1·8% (1·4–2·3) |
| Social phobia | 2·4% (2·0–2·9) | 1·9% (1·4–2·6) | 0·7% (0·4–1·1) |
| Generalised anxiety disorder | 1·5% (1·1–2·0) | 1·2% (0·8–1·9) | 1·3% (0·9–1·8) |
| Major depressive disorder | 1·5% (1·2–2·0) | 0·9% (0·6–1·3) | 0·7% (0·5–1·1) |
| Post-traumatic stress disorder | 0·9% (0·6–1·3) | 0·2% (0·1–0·4) | 0·2% (0·1–0·3) |
| ADHD | 3·3% (2·7–4·0) | 0·5% (0·2–0·9) | 0·4% (0·3–0·7) |
| Conduct disorder† | 2·8% (2·2–3·4) | 0·8% (0·5–1·3) | 0·2% (0·1–0·5) |
| Comorbidity | 1·9% (1·5–2·5) | 0·7% (0·4–1·1) | 0·6% (0·4–0·9) |
| **Persistence‡** | | | |
| Any mental disorder | 77·5% (73·1–81·4) | 80·5% (73·3–86·2) | 80·2% (72·4–86·2) |
| Anxiety disorders | 61·1% (53·6–68·1) | 75·3% (66·1–82·7) | 79·0% (69·3–86·2) |
| Social phobia | 60·0% (52·1–67·5) | 69·6% (58·7–78·6) | 72·9% (58·4–83·8) |
| Generalised anxiety disorder | 62·6% (51·9–72·2) | 76·9% (63·3–86·6) | 77·0% (64·8–85·9) |
| Major depressive disorder | 75·3% (64·2–83·7) | 85·2% (66·8–94·3) | 87·0% (71·9–94·6) |
| Post-traumatic stress disorder | 66·1% (54·0–76·4) | 35·2% (14·6–63·2) | 55·9% (18·1–87·9) |
| ADHD | 93·0% (88·0–96·0) | 85·3% (61·7–95·4) | 92·5% (67·6–98·7) |
| Conduct disorder§ | .. | .. | .. |

Percentages represent the weighted prevalence (95% CI). Statistically significant differences were identified by non-overlapping 95% CIs. Unweighted numbers are available in the appendix (p 22). Comorbidity was defined as two or more mental disorders during the relevant time period, noting that comorbidity was considered out of a possible five disorders given that social phobia and generalised anxiety disorder were grouped as anxiety disorders for this analysis. ADHD=attention-deficit hyperactivity disorder. *Significant difference because 95% CIs do not overlap before rounding. †Prevalence of conduct disorder in the past 4 weeks is equivalent to that in the past 12 months, as measured by the Diagnostic Interview Schedule for Children (DISC), Version 5, given that prevalence is determined by the presence of one required behaviour in the past 6 months (also true of previous studies using earlier versions of the DISC[22]). ‡Persistence is calculated by dividing the number of adolescents who met criteria for a mental disorder both in the past 12 months and in the past 4 weeks by the number of adolescents who met criteria for a mental disorder in the past 12 months. §Persistence of conduct disorder is 100% given that the prevalence in the past 12 months and past 4 weeks is the same.

*Table 3:* **Prevalence of mental disorders in the past 12 months and past 4 weeks in adolescents aged 10–17 years in Kenya, Indonesia, and Viet Nam**

## Results

The final sample sizes consisted of 5155 pairs of adolescents and primary caregivers in Kenya (97·9% response rate), 5664 in Indonesia (92·2%), and 5996 in Viet Nam (81·1%; table 1). The observed response rates for all countries were greater than the estimated response rates incorporated into the sampling frames.

Key information about the study samples in Kenya, Indonesia, and Viet Nam is summarised (table 2). The samples were generally representative of the age and sex distribution of the general adolescent population in each country before weighting. In Kenya, 2416 (46·9%) adolescents were male versus 2739 (53·1%) female; in Indonesia, 2803 (49·5%) were male versus 2861 (50·5%) female; and in Viet Nam, 3151 (52·5%) were male versus 2845 (47·4%) female (appendix p 20). Most adolescents were currently attending school and the primary caregiver was usually the adolescent's mother, biological or otherwise.

The prevalence of any mental disorder in the past 12 months varied by country, with Kenya showing the highest prevalence of 12·1% (95% CI 10·9–13·5), followed by Indonesia (5·5%, 4·3–6·9) and Viet Nam (3·3%, 2·7–4·1; table 3). Across all three countries, anxiety disorders had the highest prevalence (Kenya 5·6% [95% CI 4·9–6·5]; Indonesia 3·7% [2·8–4·9]; Viet Nam 2·3% [1·8–2·9]). Comorbidity (ie, having two or more mental disorders) in the past 12 months was relatively low (Kenya 2·4% [95% CI 2·0–3·1]; Indonesia 1·0% [0·6–1·4]; Viet Nam 0·6% [0·4–0·9]).

The prevalence of any mental disorder in the past 4 weeks also varied by country (Kenya 9·4% [95% CI 8·3–10·6]; Indonesia 4·4% [3·4–5·6]; Viet Nam 2·7% [2·2–3·3]; table 3). Patterns of prevalence in the past 4 weeks among the different mental disorders largely followed that of the past 12 months. Among adolescents with any mental disorder in the past 12 months, approximately 80% had also met diagnostic criteria in the past 4 weeks in all three countries (Kenya 77·5% [95% CI 73·1–81·4]; Indonesia 80·5% [73·3–86·2]; Viet Nam 80·2% [72·4–86·2]).

The prevalence of any mental disorder in the past 12 months did not significantly differ by sex, age, or urbanicity in any of the three countries (table 4). However, some significant differences were seen between household wealth quintiles. In Kenya, the prevalence of mental disorders was significantly higher in the second highest quintile compared with the lowest quintile. In contrast, the opposite relationship was found in Indonesia whereby the prevalence of mental disorders was significantly higher among the two lowest household wealth quintiles compared with the highest quintile. No statistically significant differences were seen in Viet Nam between any household wealth quintiles.

Adolescents in Kenya had significantly higher prevalence of suicidal behaviours in the past 12 months compared with those in Indonesia and Viet Nam (table 5). No significant difference was seen in the prevalence of self-harm in the past 12 months between any country. For all three countries, adolescents with any mental disorder in the past 12 months had significantly higher odds of any suicidal behaviour than those without any mental disorder. Similarly, compared with adolescents who did not have a mental disorder, those with any mental disorder in the past 12 months had significantly higher odds of self-harm, ranging between 7·2 (Kenya [95% CI 3·6–14·4]) and 13·3 (Viet Nam [6·0–29·5]). No significant differences in odds ratios were seen between countries despite the differences in prevalence, although only small numbers of adolescents reported suicidal behaviours and self-harm, leading to wide confidence intervals (table 5).

## Discussion

NAMHS presents the first national prevalence estimates of adolescent mental disorders for Kenya, Indonesia, and Viet Nam, with 12·1% of adolescents aged 10–17 years in Kenya, 5·5% in Indonesia, and 3·3% in Viet Nam meeting DSM-5 criteria for any mental disorder in the past 12 months. Of the sociodemographic characteristics analysed, the prevalence of any mental disorder in the past 12 months only differed by household wealth, with Kenya and Indonesia showing opposing patterns. Additionally, although differences were seen in the prevalence of suicidal behaviours in the past 12 months (Kenya 4·6%, Indonesia 1·4%, and Viet Nam 1·4%), all countries showed significantly increased odds of suicidal behaviours and self-harm among adolescents with mental disorders compared with those who did not have a mental disorder in the past 12 months.

The prevalence of adolescent mental disorders in Kenya (12·1%, 95% CI 10·9–13·5) is consistent with that of previous studies of adolescent mental disorders in other countries. For example, a national Australian study that used the DISC-IV to measure a similar group of mental disorders found that the prevalence of any mental disorder in the past 12 months was 14·4% (95% CI 12·9–15·9) among adolescents aged 12–17 years.[22] Further, a systematic review and meta-analysis of 48 studies from 27 HICs and LMICs that used diagnostic instruments to measure the prevalence of child and adolescent mental disorders found an overall pooled mental disorder prevalence of 13·4% (95% CI 11·3–15·9).[23] In this systematic review, geographical location was not a significant moderator of prevalence in the final multivariate model. This finding contrasts with NAMHS, in which the prevalence of any mental disorder in the past 12 months was significantly lower in Indonesia (5·5%) and Viet Nam (3·3%) than in Kenya (12·1%). Further, although prevalence differed between the three countries, persistence was similar, with most adolescents who had any mental disorder in the past 12 months continuing to meet diagnostic criteria in the past 4 weeks (Kenya: 77·5%; Indonesia: 80·5%; Viet Nam: 80·2%). These results differ from those of the national Australian study, in which the persistence of any mental disorder was significantly lower than in our study, at 67% (95% CI 63–70).[22] The low proportion of adolescents whose mental disorders remitted might be explained by a higher proportion having more severe illness than participants in the Australian study, a lack of services, or the adverse effect of stigma on seeking mental health treatment or support from others regarding distress.

| | Kenya | Indonesia | Viet Nam |
|---|---|---|---|
| **Sex** | | | |
| Male | 13·1% (11·6–14·8) | 5·8% (4·4–7·6) | 3·3% (2·4–4·6) |
| Female | 11·2% (9·5–13·1) | 5·1% (3·7–7·1) | 3·3% (2·6–4·3) |
| **Age** | | | |
| 10–14 years | 11·6% (10·3–13·0) | 4·9% (3·7–6·4) | 3·2% (2·5–4·0) |
| 15–17 years | 13·3% (11·2–15·7) | 6·6% (5·0–8·5) | 3·6% (2·6–5·0) |
| **Urbanicity** | | | |
| Urban | 13·7% (11·9–15·7) | 4·7% (3·5–6·3) | 2·9% (2·0–4·1) |
| Rural | 11·2% (9·6–13·0) | 7·1% (4·8–10·3) | 3·5% (2·7–4·6) |
| **Household wealth quintile** | | | |
| 1st (least wealth) | 8·6% (6·1–12·0) | 7·1% (5·1–9·9) | 4·2% (2·7–6·3) |
| 2nd | 11·9% (9·5–14·8) | 8·5% (6·2–11·7)* | 2·8% (1·8–4·5) |
| 3rd | 11·6% (9·3–14·5) | 4·6% (3·0–6·8) | 3·9% (2·8–5·3) |
| 4th | 15·3% (13·2–17·6) | 4·0% (2·6–6·2)* | 2·9% (1·7–4·7) |
| 5th (most wealth) | 13·3% (11·4–15·4) | 2·9% (1·7–4·9) | 2·6% (1·5–4·6) |

Percentages represent the weighted prevalence (95% CI) of any mental disorder in the past 12 months. Unweighted numbers are available in the appendix (p 23). Statistically significant differences were identified by non-overlapping 95% CIs. *Significant difference because 95% CIs do not overlap before rounding.

*Table 4:* **Prevalence of any mental disorder in the past 12 months in adolescents aged 10–17 years by sex, age, urbanicity, and household wealth quintile in Kenya, Indonesia, and Viet Nam**

| | Kenya | Indonesia | Viet Nam |
|---|---|---|---|
| **Prevalence in past 12 months*** | | | |
| Suicidal behaviour | | | |
| Ideation | 4·6% (3·9–5·3) | 1·4% (1·0–2·0) | 1·4% (1·0–1·9) |
| Planning | 2·4% (1·9–2·9) | 0·4% (0·3–0·8) | 0·4% (0·2–0·6) |
| Attempt | 1·0% (0·7–1·4) | 0·2% (0·1–0·4) | 0·2% (0·1–0·3) |
| Self-harm | 1·2% (0·9–1·7) | 0·9% (0·6–1·3) | 1·1% (0·8–1·5) |
| **aOR (95% CI)†** | | | |
| Suicidal behaviour | | | |
| Ideation | 8·0 (6·1–10·6) | 7·1 (3·1–15·9) | 14·7 (7·5–28·6) |
| Planning | 10·9 (7·4–15·9) | 10·4 (3·8–28·9) | 26·9 (10·8–66·9) |
| Attempt | 9·7 (5·8–16·3) | 14·4 (2·2–95·3) | 53·7 (18·1–158·8) |
| Self-harm | 7·2 (3·6–14·4) | 10·8 (4·5–26·2) | 13·3 (6·0–29·5) |

Percentages represent weighted prevalence (95% CI). Unweighted numbers are available in the appendix (p 24). aOR=adjusted odds ratio. Statistically significant differences were identified by non-overlapping 95% CIs. *In the whole sample. †aORs calculated for suicidal behaviours and self-harm in the past 12 months among adolescents with any mental disorder in the past 12 months (vs adolescents without any mental disorder in the past 12 months); adjusted for age, sex, urbanicity, and household wealth quintile.

*Table 5:* **Prevalence of suicidal behaviours and self-harm in the past 12 months in adolescents aged 10–17 years in Kenya, Indonesia, and Viet Nam**

Explaining the differences in prevalence between the three countries is complex. A previous systematic review and meta-analysis of common mental disorders (ie, mood disorders, anxiety disorders, and alcohol use disorders) in adults found that surveys in the World Bank's East Asia and Pacific LMIC region, which includes Indonesia and Viet Nam, had a lower prevalence of mental disorders in the past 12 months compared with the pooled prevalence for all LMICs.[24] Similarly, the WHO World Health Surveys found a substantially lower prevalence of depression in adults in Viet Nam than adults in Kenya according to the International Classification of Diseases 10th revision diagnostic criteria.[25,26] Examining similar patterns among adolescents is difficult due to few to no available diagnostic studies of mental disorders, but the existing adult studies indicate that the differences between countries seen in NAMHS are not completely unexpected.

The difference in the prevalence of any mental disorder in the past 12 months between Kenya and the two southeast Asian countries was partly driven by the externalising disorders: ADHD and conduct disorder. The prevalence of ADHD in Kenya was 3·5% versus 0·5% in both Indonesia and Viet Nam, and the prevalence of conduct disorder was also higher in Kenya (2·8%) compared with Indonesia (0·8%) and Viet Nam (0·2%). Although differences in the prevalence of other disorders were also seen between countries, the magnitude was smaller. The externalising disorders are based on a behaviour-driven diagnosis, in which behaviours that indicate different aspects of psychopathology (eg, breaching of societal norms or what is considered age-appropriate behaviour) are assessed to make a diagnosis. However, DSM-5 diagnoses are largely reflective of North American societal norms and expectations. Therefore, there is a possibility that other behaviours or expressions of distress in southeast Asian countries are not adequately accounted for when determining a diagnosis.

The findings for externalising disorders reflect a key limitation of NAMHS: the broad challenge of adapting instruments based on DSM-5 diagnostic criteria to best suit a given cultural context while still maintaining consistency to allow for cross-national and future comparison. For example, the question content and structure of the DISC-5, and the scoring algorithms subsequently applied to form a diagnosis, are specifically designed to assess mental disorders according to DSM-5 criteria. The applicability of DSM diagnostic criteria and the cultural relevance of the operational definition of mental disorders in LMICs have been questioned, including its applicability to young people.[27] There is a possibility that culturally relevant symptoms and expressions of mental illness in cultures that are distinct from those of North America are omitted or underweighted by DSM, resulting in the low prevalence of mental disorders reported by NAMHS. Further, the use of diagnoses rather than symptom measures results in categorisation of mental illness, which some have argued would be better measured on a continuum, particularly in relation to adolescents for whom a fluidity of mental disorder symptomology is particularly apparent. At the same time, an adherence to internationally recognised criteria is necessary to allow meaningful cross-national comparisons. The data collected in NAMHS allow for future analyses examining subthreshold mental disorders and the effect of evidence-based cultural adjustments to scoring algorithms.

The low prevalence, particularly of suicidal behaviours and self-harm, might also partly reflect another limitation of NAMHS in relation to the interviewer-administered design of the study. All questions related to mental disorders, suicidal behaviours, and self-harm were interviewer-administered. Previous studies have shown that the reported prevalence of sensitive behaviours, such as sexual behaviours, tends to be lower among interviewer-administered surveys compared with self-administered surveys.[28,29] These findings suggest that stigma or apprehension (eg, about potential legal ramifications) could have potentially affected the reporting of these behaviours in NAMHS. Efforts were made to minimise these potential effects by assuring participants of the confidentiality and anonymity of their data, which was incorporated into consent and assent processes, requiring privacy for interviews to proceed and ensuring comprehensive interviewer training on the concepts being surveyed. Further, concerns about interviewer administration did not appear to be reflected in either the response rates or completion rates in any country. Finally, NAMHS was conducted when the world was still substantially impacted by COVID-19. Although future analyses of the COVID-19-related effects measured by NAMHS might enable us to better understand the effect of the global pandemic on mental disorders, the extent and nature of any effect on the reported prevalence estimates is currently unclear.

Despite these limitations, NAMHS represents an important and timely contribution to the understanding of adolescent mental health globally, both in terms of data on the prevalence of mental disorders in Kenya, Indonesia, and Viet Nam, and collaboratively developed methods[13,14] that can be implemented on a national scale in low-resource settings to generate high-quality data. Before NAMHS, very little, if any, existing diagnostic prevalence data for mental disorders among adolescents living in Kenya, Indonesia, and Viet Nam were available. These data are crucial for informing countrywide mental health policies and planning, forming the evidence base and the impetus for policy makers to give adolescent mental health specific consideration in existing and future health policies. Measurement of adolescent mental disorders has been identified as a priority for improving global adolescent health to support the 2030 Sustainable Development Agenda.[30] Further, NAMHS provides comprehensive data to support in-depth examination of the prevalence estimates presented in this study, including culturally informed adjustments to diagnostic algorithms, further analysis of functional impairment as measured by the DISC-5 and other measures, service use among adolescents with diagnostic and subthreshold mental disorders and comprehensive assessment of unmet need and barriers to care, and the association between mental disorders and a range of risk and protective factors as a means of identifying potential targets for interventions and further explaining variations in mental disorder prevalence between countries. As such, the prevalence estimates presented in this study provide the foundation for ongoing work that will enrich our understanding of adolescent mental disorders in LMICs.

**Contributors**

HEE, HAW, and JGS originally conceptualised NAMHS. HEE, MEE, JS, SJB, HAW, JGS, RWB, SLF, ML, and AR developed the methods of NAMHS collaboratively with authors from the in-country organisations responsible for the survey in their respective country (Kenya-National Adolescent Mental Health Survey [K-NAMHS]: YDW, FMW, SAO, and CWK of the African Population and Health Research Center [APHRC]; Indonesia-National Adolescent Mental Health Survey [I-NAMHS]: AEW, AS, YPA, RR, and SAW of Universitas Gadjah Mada; and Viet Nam Adolescent Mental Health Survey [V-NAMHS]: VML and NDV of the Institute of Sociology [IOS], Vietnam Academy of Social Sciences [VASS]). PWF provided permission to use the DISC-5 and provided ongoing support and advice regarding adaptation and implementation. DL provided guidance in relation to the choice and adaptation of survey measures and provided ongoing support throughout the project. YDW, FMW, SAO, CWK, AEW, AS, YPA, RR, SAW, VML, DTKH, and NDV supervised data collection within their respective countries. ML, JS, CM, and KW provided technical and analytical support. HEE, SJB, and HAW maintained oversight of the project during data collection. ML conducted data cleaning and initial data analysis, supported by CM and KW, under the guidance of HEE, and with input from YDW, SAO, CWK, AN, AEW, AS, YPA, RR, VML, DTKH, and NDV. All authors were permitted to access the raw data. HEE, JCM, YDW, AEW, VML, SLF, ML, AR, FMW, SAO, AN, AS, YPA, RR, DTKH, DL, NDV, SAW, CWK, RWB, and JGS accessed and verified the underlying data. JCM conducted all analyses for the manuscript. HEE and JGS reviewed all analyses. HEE, JCM, and JGS wrote the original draft of the manuscript. All authors reviewed and approved the final manuscript and accept responsibility to submit for publication.

**Declaration of interests**

HEE and HAW receive core funding from the Queensland Department of Health in Australia. JCM is supported by the Centre of Research Excellence in Adolescent Health (APP1171981), which receives funding from the National Health and Medical Research Council in Australia. All other authors declare no competing interests.

**Data sharing**

The NAMHS datasets are co-owned by the University of Queensland (QLD, Australia) and each respective in-country lead organisation (APHRC in Kenya, Universitas Gadjah Mada in Indonesia, and IOS, VASS, in Viet Nam). 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 work includes the development of accompanying metadata, inclusive of a codebook, technical manual, and analysis files. The expected launch date for these public use datasets and accompanying metadata is 2024, with hosting mechanisms currently under development in line with country legislation and ethical requirements.

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