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# Lifetime prevalence and age-of-onset distributions of mental disorders in the Saudi National Mental Health Survey

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## Abstract

**Objectives:** To estimate lifetime prevalence of mental disorders in the Saudi National Mental Health Survey (SNMHS).

**Methods:** The SNMHS is a face-to-face community epidemiological survey in a nationally representative household sample of citizens ages 15–65 in the Kingdom of Saudi Arabia (KSA) (n = 4,004). The World Health Organization (WHO) Composite International Diagnostic Interview (CIDI) was used to estimate lifetime prevalence of common DSM-IV mental disorders.

**Results:** Estimated lifetime prevalence of any DSM-IV/CIDI disorder is 34.2% and lifetime morbid risk is 38.0%. Anxiety disorders are by far the most prevalent (23.2%) followed by disruptive behavior (11.2%), mood (9.3%), eating (6.1%), and substance use (4.0%) disorders. Synthetic estimates of cohort effects suggest that prevalence of many disorders has increased in recent cohorts. Onsets typically occur in childhood for a number of anxiety and disruptive behavior disorders and in adolescence or early adulthood for most other disorders, although age-of-onset distributions for drug abuse is much later (median age of 31) than in CIDI surveys carried out in other high-income countries.

**Conclusions:** Lifetime mental disorders are highly prevalent in Saudi Arabia and typically have early ages-of-onset.

KEYWORDS

Composite International Diagnostic Interview (CIDI), mental disorders, prevalence, Saudi National Mental Health Survey (SNMHS), World Mental Health (WMH) Survey Initiative

## 1 | INTRODUCTION

Epidemiological data show clearly that mental disorders are highly prevalent and seriously impairing in all parts of the world (Alonso, Chatterji, & He, 2013; Kessler & Üstün, 2008; Scott, de Jonge, Stein, & Kessler, 2018). Indeed, the Global Burden of Disease (GBD) Study concluded that mental and substance disorders are the leading cause of years lived with disability worldwide (Whiteford et al., 2013).

This is because common mental disorders are both highly prevalent and highly impairing (Kessler et al., 2009; Murray & Lopez, 1996).

The GBD has estimated disease burden for different classes of disorders for each country in the world. The most recent GBD estimates for the Kingdom of Saudi Arabia (KSA), the focus of the current report, suggest that drug use disorders, depressive disorders, and anxiety disorders are the third, fourth, and sixth leading causes of disability (Institute for Health Metrics and Evaluation, 2019). Yet no large-scale epidemiological surveys were carried out in KSA to support these estimates. The estimates were instead based on extrapolations using indirect information from epidemiological surveys carried out in other countries in the region (GBD 2015 Eastern Mediterranean Region Mental Health Collaborators, 2018). Given the major policy implications of these estimates, more direct data are needed by policy planners to assess the societal burden of mental disorders, unmet need for treatment, and barriers to treatment.

The Saudi National Mental Health Survey (SNMHS) was launched to provide these data. The SNMHS was carried out as part of the World Health Organization (WHO) World Mental Health (WMH) Survey Initiative (Alonso et al., 2013; Scott et al., 2018; Kessler & Üstün, 2008). WMH carries out coordinated psychiatric epidemiological surveys of common mental disorders in representative general population samples of countries throughout the world. Standardized WMH methods are used to provide valid data for policy planning purposes to estimate the distribution of mental disorders around the globe in countries from different regions with varying degrees of development and to determine service needs and guide regional and global public health policy (Harkness et al., 2008; Heeringa et al., 2008; Pennell et al., 2008).

Prior to launching the SNMHS, Lebanon and Iraq were the only countries from the WHO Eastern Mediterranean Region that participated in WMH. In Lebanon, lifetime prevalence of any WMH mental disorder was estimated to be 25.8%, with a median (inter-quartile range [IQR]) age-of-onset (AOO) of 19 (15–25), where the IQR refers to the 25th–75th percentiles of the AOO distribution (Karam et al., 2008). The projected morbid risk through age 75 given the AOO distribution was 32.9%, where the morbid risk refers to the lifetime prevalence expected in the current population once all people in the population reach a target age given the estimates of age-specific and cumulative lifetime risk in the AOO distribution.

In Iraq, lifetime prevalence of any mental disorder assessed in the WMH survey was estimated to be 18.8%, with a median (IQR) AOO of 29 (14–54), and the projected morbid risk through age 75 was 40.8% (Alhasnawi et al., 2009). It is important to note, though, that the Iraq WMH survey was carried out among people remaining in Iraq during the years 2007–2008, shortly before U.S. forces began withdrawing from the country after the end of the Iraq War. This excluded the roughly 20% of the pre-war population that was displaced by the war as of the time of the survey. This exclusion doubtlessly led to substantial under-estimation of the prevalence of the war-related mental disorders that are known to exist in the larger Iraqi population (Levy & Sidel, 2013; Slewa-Younan, Uribe Guajardo, Heriseanu, & Hasan, 2015).

The profile of KSA is quite different. Whereas Iraq and Lebanon are middle-income countries with struggling economies, KSA has a vibrant economy and the 13th highest per capita gross national income in the world (World Bank, 2019). Furthermore, although KSA has been involved in recent years in political conflict affecting 2 of the 13 regions in the country (Jazan, Najran), KSA has neither been involved in a major war or experienced major internal sectarian violence in the lifetimes of its inhabitants. The two regions involved in border conflicts at the time were excluded from the SNMHS survey. Based on these differences, it was felt that the rates of mental disorders in KSA were likely to be quite different from those in Iraq and Lebanon, further supporting the decision to carry out the SNMHS.

The current report presents estimates of lifetime prevalence, AOO distributions, morbid risk up to age 65 (the 97th percentile of the KSA age distribution), and basic sociodemographic correlates of the mental disorders assessed in the SNMHS. The main groups of disorders assessed were anxiety disorders, mood disorders, eating disorders, disruptive behavior disorders, and substance use disorders. Although recent prevalence is of more importance than lifetime prevalence from a short-term policy perspective, current prevalence is a joint function of lifetime prevalence and course of illness, either or both of which can be the focus of preventive interventions aimed at reducing recent prevalence. We consequently begin with a focus on lifetime perspective in the current paper and then turn in a subsequent companion paper to recent prevalence (Altwaijri et al., n.d.).

## 2 | METHODS

### 2.1 | Sample

As detailed elsewhere in this issue (Mneimneh, Heeringa, Lin, Altwaijri, & Nishimura, n.d.), the SNMHS was based on a nationally representative multistage clustered area probability sampling design that focused on citizens aged 15–65 living in the household population exclusive of the Jazan and Najran administrative areas. As noted in an earlier paper in this issue (Al-Subaie, Al-Habeeb, & Altwaijri, n.d.), the great majority of Saudi citizens are 65 years of age or younger. Jazan and Najran were excluded because of political conflicts along the Saudi Yemeni border with these areas. A stratified multistage cluster area probability sample of 4,302 households was selected as the first-stage sampling units in the remaining 11 administrative areas. The household screening rate was 84% and the conditional interview response rate in screened households was 73%, for an estimated individual-level response rate of 61% using the American Association of Public Opinion Research RR2 definition (American Association for Public Opinion Research, 2016). (The individual-level response rate was "estimated" because we had to estimate resident eligibility data for households in which we were not able to obtain a listing. We assumed that the eligibility rate in these households was comparable to that of households in the same area in which we were

able to obtain a household listing for purposes of calculating the estimated response rate.) A total of 4,004 interviews were completed. We attempted to interview one randomly selected male and one randomly selected female in households that contained both males and females in the age range 15–65 and only one randomly selected respondent in households in which eligible residents were either all male or all female.

As in other WMH surveys, we used a two-part case–control sampling design to reduce the interview burden on respondents who did not meet criteria for any of the core mental disorders assessed in the survey. All respondents completed Part I of the interview, which assessed core disorders. All Part I respondents who met lifetime criteria for any of these disorders plus a probability sub-sample of other Part I respondents were then administered Part II, which assessed disorders of secondary interest and a wide range of correlates. A total of $n$ = 1,981 respondents were administered the Part II interview, whereas the remaining $n$ = 2,023 (i.e., 4,004–1,981) Part I respondents were terminated after completing Part I. The Part I sample was weighted to adjust for differential probabilities of selection within and between households and to match sample distributions to population distributions on the cross-classification of key sociodemographic and geographic data. The Part II sample was then additionally weighted for the under-sampling of Part I respondents without core disorders, resulting in the prevalence estimates of core disorders in the weighted Part II sample being identical to those in the Part I sample.

## 3 | MEASURES

### 3.1.1. | Field procedures

All interviews were carried out face-to-face by trained lay interviewers. The interview schedule and all training materials were translated and adapted using a standardized WHO translation protocol (Harkness et al., 2008; Shahab et al., 2019). Interviewer training procedures and field quality control procedures were used consistent with those in other WMH surveys (Heeringa et al., 2008; Pennell et al., 2008). Interviewers followed a strict fieldwork protocol to guarantee data quality. Details of these quality assurance and quality control procedures are described elsewhere (Hyder et al., 2017). Study procedures conformed to the international standards set by the Declaration of Helsinki. Written informed consent was obtained from respondents prior to beginning each interview. These consent procedures were approved by the Institutional Review Board at the King Faisal Hospital and Research Center.

### 3.1.2. | Mental disorders

Diagnoses were based on the WHO Composite International Diagnostic Interview Version 3.0 (CIDI 3.0; Kessler & Üstün, 2004), the same diagnostic interview schedule used in all other WMH surveys. The CIDI is a fully structured interview that is designed to be used by trained lay interviewers and that generates both ICD-10 (World Health Organization, 1991) and DSM-IV (American Psychiatric Association, 2000) diagnoses. DSM-IV criteria are used here to facilitate comparison with previous WMH epidemiological surveys. Diagnoses based on the CIDI have been shown to have good concordance with diagnoses based on blinded clinician interviews in previous WMH surveys (Haro et al., 2006). However, we modified the diagnostic thresholds for three disorders thought to be of special relevance to KSA based on considerations discussed elsewhere in this issue (Kessler et al., n.d.): obsessive–compulsive disorder, separation anxiety disorder, and social phobia. Prevalence estimates of these disorders are likely to be conservative in the SNMHS. As a result, subthreshold manifestations of these disorders will be the focus of separate attention in subsequent analyses that will be reported as results become available.

The 19 disorders considered in the SNMHS were examined separately and also grouped into broad categories of anxiety disorders (i.e., panic disorder, agoraphobia without panic disorder, social phobia, generalized anxiety disorder, post-traumatic stress disorder, obsessive–compulsive disorder, and separation anxiety disorder), mood disorders (i.e., major depressive disorder, bipolar I–II disorders [BPD]), eating disorders (i.e., anorexia nervosa, bulimia nervosa, binge-eating disorder), disruptive behavior disorders (i.e., attention-deficit/hyperactivity disorder, conduct disorder, oppositional-defiant disorder, intermittent explosive disorder), and substance use disorders (i.e., alcohol and drug abuse and dependence).

Organic exclusion rules and hierarchy rules were used to make all diagnoses other than the diagnoses of substance use disorders. The latter were diagnosed without hierarchy in recognition that abuse is often a stage in the progression to dependence. However, we also coded disorders so that they could be analyzed without using diagnostic hierarchy rules for purposes of studying various types of comorbidity that are of special interest.

Retrospective AOO reports play an important part in generating estimates of projected lifetime morbid risk. A question series was used to avoid the implausible response patterns obtained in using the standard AOO questions in previous psychiatric epidemiological surveys (Simon & VonKorff, 1995). Experimental research shows that this question sequence yields responses with a much more plausible AOO distribution than the standard AOO questions (Knäuper, Cannell, Schwarz, Bruce, & Kessler, 1999). AOO questions were asked about full syndromes as well as about important symptoms (e.g., first lifetime panic attack).

Sociodemographic correlates: The socio-demographic correlates considered here include age-at-interview, gender, education, and marital status. All these variables other than gender were treated as time-varying covariates in survival analyses described below in the section on analysis methods. Education was coded to distinguish between the years when each respondent was a student (based on reports of years of education) and years after the completion of education assuming no repeat of grades. Years after completing education were then treated as time-invariant and divided into the four

categories of low (0–6 years of education), low-average (7–9 years of education), high-average (10–15 years of education), and high (16 + years of education). The upper end of the low education category represents completion of primary school (6 years in KSA). The upper end of the low-average category represents completion of secondary school (3 years in KSA). And the high-average category includes high school (3 years in KSA) and the first 3 years of college. The high education category includes people who graduated from college. Marital status was coded either as never married (up to the year before age of first marriage), married (beginning the year of first marriage and ending the year before age of first marital termination due to either separation, divorce, or widowhood), or previously married (beginning the year of first marital termination). Age-at-interview was divided into rough quartiles to define cohorts (15–24, 25–34, 35–49, and 50–65).

### 3.1 | Analysis methods

The data were weighted to adjust for differences in within-household and between-household probabilities of selection as well as for discrepancies between sample and population distribution due to random error and differential response across segments of the population defined by census variables known for the population. Lifetime prevalence was then estimated in these weighted data in the conventional fashion, as the proportion of respondents who ever had a given disorder up to their age-at-interview. AOO and projected lifetime morbid risk as of age 65 were estimated using the two-part actuarial method implemented in SAS 8.2 (SAS Institute, 2001). The actuarial method differs from the more familiar Kaplan–Meier method (Kaplan & Meier, 1958) in using a more accurate way of estimating the timing of onsets within a given year (Halli, 1992), but, like the Kaplan–Meier method, assuming constant conditional risk of onset at a given year of life across cohorts.

Predictors of lifetime prevalence were examined using discrete-time survival analysis with a logistic link function and person-year treated as the unit of analysis (Efron, 1988). As noted above in the description of sociodemographic correlates, all these variables other than gender were coded as time-varying variables so as to estimate the associations of these variables with the subsequent first onset of each disorder. We did this separately for each of the disorders assessed in the SNMHS and we then pooled results across individual disorders to estimate five composite prediction equations for anxiety, mood, eating, disruptive behavior, and substance use disorders. The pooled models were based on a combination of the separate person-year datasets created for each separate disorder in a given category into a single stacked dataset that included dummy predictor variables to distinguish the component datasets for the individual disorders and then estimated pooled within-disorder associations of the sociodemographic variables with the outcomes (i.e., first onset of a given disorder) across disorders based on the simplifying assumption that the ORs are constant across disorders. Significance tests were carried out to evaluate the accuracy of that assumption so as to know when it is important to look at disorder-specific ORs rather than summary ORs pooled across all disorders in the class.

Standard errors of prevalence estimates and logits were obtained using the Taylor series linearization method (Wolter, 1985) implemented in the SUDAAN software system (Research Triangle Institute, 2002). Standard errors of projected lifetime risk estimates were obtained using the jackknife repeated replication method (Kish & Frankel, 1974) implemented in a SAS macro (SAS Institute, 2001). Logits and logits +/−2 standard errors were exponentiated to produce odds-ratios (ORs) and 95% confidence intervals (95% CIs). Multivariate significance tests of predictor sets (including interactions between sociodemographics and type of disorder in models pooled across all disorders in a class) were made with Wald $\chi^2$ tests using Taylor series design-based coefficient variance–covariance matrices. Statistical significance was evaluated consistently at the .05 level with two-sided tests.

## 4 | RESULTS

### 4.1 | Lifetime prevalence

Lifetime prevalence of at least one of the 19 DSM-IV disorders assessed in the survey was 34.2% (Table 1). Anxiety disorders were by far the most common class of disorders (23.2%, which represents about two-thirds of all people with any lifetime mental disorder), followed by disruptive behavior disorders (11.2%, about one-third of all people with any lifetime mental disorder) and mood disorders (9.3%, a little more than one-fourth of all people with any lifetime mental disorder). Least common were eating disorders (6.1%, about one-sixth of all people with any lifetime mental disorder) and substance use disorders (4.0%, about one-eighth of all people with any lifetime mental disorder). The most common individual disorders were separation anxiety disorder (11.9%), attention-deficit/hyperactivity disorder (8.0%), major depressive disorder (6.0%), and social phobia (5.6%).

The sum of the component prevalence estimates far exceeds the proportion of the overall sample that meets criteria for at least one disorder. This means that at least some Saudis have a lifetime history of multiple mental disorders. As shown in the last rows of Table 1, this kind of comorbidity characterizes about 44% of all respondents with a history of at least one disorder (i.e., 15.0%/34.2%). Furthermore, about half of those with two or more lifetime disorders have at least three (i.e., 7.5%/15.0%) and about half of those with three or more have at least four (i.e., 3.9%/7.5%).

Four significant gender differences were found in disorder-specific prevalence, all of them involving higher prevalence among women than men. These include three anxiety disorders—agoraphobia (3.2% vs. 1.4%, $\chi^2_1 = 5.2$, $p = .024$), social phobia (7.0% vs. 4.3%, $\chi^2_1 = 6.4$, $p = .012$), and generalized anxiety disorder (2.9% vs. 0.9%, $\chi^2_1 = 6.4$, $p = .012$)—and major depressive disorder (8.9% vs. 3.1%, $\chi^2_1 = 5.2$, $p < .001$). Despite these differences, though, there was no significant gender difference in overall prevalence of having at

**TABLE 1** Lifetime prevalence of DSM-IV/CIDI disorders, overall and stratified by gender and age in the Saudi National Mental Health Survey

| | Total | | Gender | | | | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Female | | Male | | | 15–24 | | 25–34 | | 35–49 | | 50+ | | |
| | % | (SE) | % | (SE) | % | (SE) | $\chi^2_1$ | % | (SE) | % | (SE) | % | (SE) | % | (SE) | $\chi^2_3$ |
| Anxiety disorders | | | | | | | | | | | | | | | | |
| Panic disorder | 1.6 | (0.3) | 1.9 | (0.3) | 1.3 | (0.5) | 1.6 | 1.1 | (0.3) | 1.7 | (0.5) | 2.3 | (0.8) | 1.4 | (0.5) | 1.0 |
| Agoraphobia | 2.3 | (0.3) | 3.2 | (0.6) | 1.4 | (0.4) | 5.2* | 2.3 | (0.7) | 2.6 | (0.7) | 2.6 | (0.6) | 1.0 | (0.5) | 1.9 |
| Social phobia | 5.6 | (0.6) | 7.0 | (0.8) | 4.3 | (0.8) | 6.4* | 8.0 | (1.3) | 5.7 | (0.9) | 4.7 | (1.0) | 1.3 | (0.5) | 10.4* |
| Generalized anxiety disorder | 1.9 | (0.4) | 2.9 | (0.7) | 0.9 | (0.3) | 6.4* | 1.5 | (0.7) | 1.8 | (0.5) | 2.4 | (0.9) | 2.2 | (0.7) | 0.3 |
| Post-traumatic stress disorder[a] | 3.3 | (0.5) | 3.9 | (0.5) | 2.8 | (0.7) | 1.6 | 1.6 | (0.4) | 5.2 | (1.1) | 3.8 | (0.9) | 3.7 | (1.8) | 3.7* |
| Obsessive–compulsive disorder[a] | 4.1 | (0.7) | 4.9 | (0.8) | 3.4 | (0.9) | 2.0 | 4.3 | (0.9) | 5.8 | (1.7) | 4.2 | (1.3) | 0.7 | (0.4) | 4.5* |
| Separation anxiety disorder[a] | 11.9 | (1.4) | 13.0 | (1.5) | 11.0 | (2.1) | 0.5 | 12.0 | (2.3) | 17.0 | (3.3) | 9.8 | (2.1) | 5.8 | (1.7) | 2.1 |
| Any[a] | 23.2 | (1.7) | 26.0 | (2.0) | 20.0 | (2.7) | 3.6 | 25.0 | (3.0) | 30.0 | (3.6) | 20.0 | (2.8) | 13.0 | (2.8) | 2.8* |
| Mood disorders | | | | | | | | | | | | | | | | |
| Major depressive disorder | 6.0 | (0.5) | 8.9 | (1.0) | 3.1 | (0.4) | 5.2* | 5.9 | (0.9) | 6.7 | (1.1) | 5.9 | (1.1) | 4.7 | (1.0) | 0.6 |
| Bipolar I–II disorders | 3.3 | (0.5) | 2.7 | (0.5) | 4.0 | (0.8) | 2.5 | 4.6 | (1.0) | 3.7 | (1.1) | 3.0 | (1.1) | 0.1 | (0.1) | 8.8* |
| Any | 9.3 | (0.7) | 12.0 | (1.1) | 7.0 | (0.8) | 13.3* | 10.0 | (1.3) | 10.0 | (1.5) | 8.9 | (1.4) | 4.9 | (1.0) | 4.1* |
| Eating disorders | | | | | | | | | | | | | | | | |
| Anorexia nervosa[a,b] | – | | – | | – | | – | – | | – | | – | | – | | – |
| Bulimia nervosa[a] | 2.9 | (0.5) | 2.6 | (0.6) | 3.1 | (0.8) | 0.3 | 3.2 | (1.0) | 4.7 | (1.5) | 2.2 | (0.8) | 0.2 | (0.2) | 5.8* |
| Binge-eating disorder[a] | 3.2 | (0.5) | 3.8 | (0.8) | 2.7 | (0.6) | 1.4 | 2.4 | (0.7) | 5.2 | (1.2) | 3.1 | (1.2) | 1.9 | (0.9) | 1.8 |
| Any | 6.1 | (0.9) | 5.9 | (0.9) | 6.3 | (1.3) | 0.1 | 6.8 | (1.7) | 9.1 | (1.9) | 4.5 | (1.3) | 2.1 | (1.0) | 4.4* |
| Disruptive behavior disorders | | | | | | | | | | | | | | | | |
| Conduct disorder | 1.7 | (0.3) | 1.5 | (0.4) | 1.9 | (0.4) | 0.6 | 2.1 | (0.7) | 2.5 | (0.8) | 0.9 | (0.4) | 1.2 | (0.6) | 1.7 |
| Attention-deficit/hyperactivity disorder[a] | 8.0 | (1.1) | 6.0 | (0.9) | 10.0 | (1.9) | 3.8 | 12.0 | (2.1) | 9.2 | (1.9) | 4.5 | (0.9) | 2.8 | (1.9) | 4.5* |
| Intermittent explosive disorder[a,c] | 3.4 | (0.5) | 2.9 | (0.8) | 3.8 | (0.7) | 0.8 | 5.1 | (1.1) | 4.5 | (1.2) | 1.7 | (0.5) | 0.0 | – | 6.1* |
| Any[a] | 11.2 | (1.2) | 9.8 | (1.2) | 13.0 | (1.9) | 1.5 | 16.0 | (2.2) | 14.0 | (2.2) | 6.2 | (1.1) | 3.9 | (2.0) | 8.2* |
| Substance disorders | | | | | | | | | | | | | | | | |
| Alcohol abuse[a,c] | 0.6 | (0.2) | 0.0 | (0.0) | 1.3 | (0.4) | 8.6* | 0.4 | (0.3) | 1.3 | (0.9) | 0.6 | (0.2) | – | | 0.5 |
| Alcohol dependence[a,b] | – | | – | | – | | – | – | | – | | – | | – | | – |
| Drug abuse[a] | 2.7 | (0.5) | 2.4 | (0.6) | 2.9 | (0.9) | 0.2 | 3.3 | (1.2) | 2.0 | (0.7) | 3.0 | (1.1) | 1.5 | (0.9) | 0.7 |
| Drug dependence[a] | 0.8 | (0.2) | 0.8 | (0.3) | 0.9 | (0.3) | 0.1 | 0.5 | (0.3) | 1.1 | (0.4) | 1.3 | (0.5) | 0.2 | (0.2) | 2.1 |
| Any | 4.0 | (0.6) | 3.2 | (0.7) | 4.9 | (0.8) | 2.6 | 4.2 | (1.2) | 4.4 | (1.2) | 4.7 | (1.2) | 1.7 | (0.9) | 1.5 |

(Continues)

**TABLE 1** (Continued)

| | Total | | Female | | Male | | Gender $\chi^2_1$ | 15–24 | | Age 25–34 | | 35–49 | | 50+ | | $\chi^2_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | (SE) | % | (SE) | % | (SE) | | % | (SE) | % | (SE) | % | (SE) | % | (SE) | |
| Total | | | | | | | | | | | | | | | | |
| Any disorder[a] | 34.2 | (2.1) | 36.0 | (2.6) | 33.0 | (2.9) | 0.8 | 40.0 | (3.1) | 40.0 | (4.5) | 29.0 | (3.3) | 19.0 | (3.4) | 4.9* |
| Two or more disorders[a] | 15.0 | (1.1) | 18.0 | (1.7) | 12.0 | (1.4) | 7.3* | 16.0 | (2.0) | 21.0 | (2.6) | 13.0 | (2.0) | 5.9 | (1.4) | 8.9* |
| Three or more disorders[a] | 7.5 | (0.7) | 8.9 | (1.2) | 6.2 | (0.8) | 5.2* | 7.9 | (1.3) | 11.0 | (1.8) | 6.3 | (1.3) | 2.6 | (1.0) | 6.3* |
| Four or more disorders[a] | 3.9 | (0.6) | 3.8 | (0.7) | 4.1 | (0.7) | 0.1 | 4.0 | (0.8) | 6.9 | (1.6) | 2.8 | (0.9) | 0.9 | (0.4) | 6.6* |

*Note:* Part I sample size $n$ = 4,004; Part II sample size $n$ = 1,981.
Abbreviations: CIDI, Composite International Diagnostic Interview; SE, standard error.
[a]Disorders that were only assessed in the Part II sample.
[b]Disorders with $n$ < 20 respondents were not reported.
[c]$\chi^2$ test statistic evaluated age differences with 2 degrees of freedom since there were no observed lifetime cases in the age range 50+.
*Significant at the .05 level, two-sided test.

least one lifetime disorder (36.0% vs. 33.0%, $\chi^2_1$ = 0.78, $p$ = .38). Instead, significantly higher proportions of women than men met criteria for 2+ (18.0% vs. 12.0%, $\chi^2_1$ = 7.3, $p$ = .008) and 3+ (8.9% vs. 6.2%, $\chi^2_1$ = 5.3, $p$ = .023) disorders.

Lifetime prevalence varied significantly with respondent age-at-interview for seven of the 19 disorders ($\chi^2_3$ = 3.7–10.4, $p$ = .000–.013). These included three anxiety disorders (social phobia, post-traumatic stress disorder, obsessive–compulsive disorder), BPD, bulimia nervosa, and two disruptive behavior disorders (attention-deficit/hyperactivity disorder, intermittent explosive disorder). Four of these seven disorders were inversely associated with age (social phobia, BPD, attention-deficit/hyperactivity disorder, intermittent explosive disorder). One was much less common among the youngest (15–24) than older respondents (post-traumatic stress disorder). And the remaining two disorders were much less common among the oldest (50–65) than younger respondents (obsessive–compulsive disorder and bulimia nervosa).

## 4.2 | Projected lifetime morbid risk

Projected lifetime morbid risk of any disorder as of age 65 was 38.0%. This is not much higher than the 34.2% observed lifetime prevalence, indicating that most Saudis who will ever have a mental disorder as of age 65 already experienced at least one such disorder as of the time of interview. (Table 2) The reason for this is that median AOO of mental disorders in KSA is 13 years of age. However, the AOO distribution varies widely across disorders. Earlier AOO distributions are found for two disruptive behavior disorders, conduct disorder and attention-deficit/hyperactivity disorder, both of which have median AOOs in childhood (ages 7–11, IQRs 6–13). Seven other disorders had median AOOs during the teenage years, including four anxiety disorders (agoraphobia, social phobia, post-traumatic stress disorder, and separation anxiety disorder [ages 13–19, IQRs 11–26]), BPD (age 19, IQR 16–24), intermittent explosive disorder (age 19, IQR 16–21), and drug dependence (age 16, IQR 8–30). Four other disorders (obsessive–compulsive disorder, major depressive disorder, bulimia nervosa and binge-eating disorder) had median AOOs in the early 20s (ages 20–21, IQRs 14–34). Two other disorders, both of them anxiety disorders (panic disorder and generalized anxiety disorder), had median AOOs in the late 20s (26–28, IQRs 17–51). Drug abuse had the latest median AOO (age 31, IQR 20–46). Several other disorders assessed were so uncommon that their AOO distributions could not be estimated (anorexia nervosa and alcohol dependence).

## 4.3 | Cohort effects

The term "cohort effect" in lifetime risk of a disorder refers to variation in the odds of a given disorder occurring for the first time at a given age as a function of historical time of birth. Although longitudinal tracking studies are required to monitor cohort effects directly, indirect estimates can be made in cross-sectional studies

**TABLE 2** Projected lifetime risk of DSM-IV/CIDI disorders at age 65 and ages at selected probabilities of age at onset distributions in the Saudi National Mental Health Survey

| | Projected LT risk age 65 | | Ages at selected age-of-onset percentiles (years) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | (SE) | 5 | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Anxiety disorders | | | | | | | | | | |
| Panic disorder | 2.6 | (0.5) | 9 | 13 | 17 | 28 | 40 | 43 | 46 | 46 |
| Agoraphobia | 2.8 | (0.4) | 6 | 7 | 11 | 16 | 26 | 31 | 31 | 31 |
| Social phobia | 6.1 | (0.7) | 7 | 7 | 11 | 14 | 19 | 21 | 36 | 36 |
| Generalized anxiety disorder | 3.8 | (0.7) | 18 | 20 | 22 | 26 | 51 | 55 | 55 | 55 |
| Post-traumatic stress disorder[a] | 5.2 | (0.7) | 9 | 9 | 13 | 19 | 26 | 31 | 31 | 31 |
| Obsessive–compulsive disorder[a] | 5.1 | (1.0) | 13 | 13 | 14 | 21 | 34 | 34 | 34 | 34 |
| Separation anxiety disorder[a] | 14.1 | (1.6) | 5 | 5 | 8 | 13 | 25 | 30 | 31 | 31 |
| Any[a] | 28.2 | (2.0) | 5 | 7 | 10 | 15 | 25 | 31 | 34 | 34 |
| Mood disorders | | | | | | | | | | |
| Major depressive disorder | 8.7 | (0.8) | 12 | 14 | 17 | 20 | 25 | 31 | 43 | 46 |
| Bipolar I–II disorders | 4.1 | (0.6) | 13 | 13 | 16 | 19 | 24 | 27 | 31 | 31 |
| Any | 12.7 | (1.0) | 12 | 13 | 16 | 19 | 25 | 31 | 36 | 46 |
| Eating disorders | | | | | | | | | | |
| Anorexia nervosa[a,b] | – | | – | – | – | – | – | – | – | – |
| Bulimia nervosa[a] | 3.6 | (0.7) | 14 | 16 | 20 | 21 | 24 | 25 | 25 | 25 |
| Binge-eating disorder[a] | 5.0 | (0.9) | 13 | 15 | 18 | 21 | 28 | 31 | 33 | 33 |
| Any | 8.2 | (1.2) | 13 | 15 | 16 | 20 | 23 | 25 | 30 | 33 |
| Disruptive behavior disorders | | | | | | | | | | |
| Conduct disorder | 1.7 | (0.3) | 5 | 6 | 6 | 7 | 11 | 19 | 19 | 19 |
| Attention-deficit/hyperactivity disorder[a] | 8.2 | (1.1) | 5 | 5 | 8 | 11 | 13 | 17 | 24 | 31 |
| Intermittent explosive disorder[a] | 3.9 | (0.7) | 13 | 14 | 16 | 19 | 21 | 31 | 31 | 31 |
| Any[a] | 11.7 | (1.3) | 5 | 6 | 8 | 13 | 17 | 24 | 31 | 31 |
| Substance disorders | | | | | | | | | | |
| Alcohol abuse[a] | 0.9 | (0.3) | 19 | 19 | 21 | 21 | 21 | 31 | 31 | 31 |
| Alcohol dependence[a,b] | – | | – | – | – | – | – | – | – | – |
| Drug abuse[a] | 4.3 | (1.0) | 16 | 16 | 20 | 31 | 46 | 46 | 46 | 46 |
| Drug dependence[a] | 1.1 | (0.3) | 8 | 8 | 8 | 16 | 30 | 30 | 30 | 30 |
| Any | 6.0 | (1.2) | 8 | 16 | 20 | 30 | 46 | 46 | 46 | 46 |
| Total | | | | | | | | | | |
| Any disorder[a] | 38.0 | (2.3) | 5 | 6 | 8 | 13 | 19 | 30 | 31 | 34 |

*Note:* Part I sample size = 4,004; Part II sample size = 1,981.

Abbreviations: CIDI, Composite International Diagnostic Interview; LT, lifetime; SE, standard error.

[a]Disorders that were only assessed in the Part II sample ($n$ = 1,981).

[b]Disorders with $n$ < 20 respondents were not reported.

like the SNMHS by using retrospective AOO reports to estimate odds of onset at given ages for respondents that differ in age-at-interview. The median year of birth of respondents who were in the four age groups we considered was 1995 for the generation of respondents who were ages 15–24 at interview, 1985 for the generation of respondents who were 25–34 at interview, 1972 for the generation of respondents who were ages 35–49 at interview, and 1957 for the generation of respondents who were ages 50–65 at interview.

Analyses investigating inter-cohort differences in previous WMH surveys found indirect evidence for significant cohort effects involving lifetime risk of many different mental disorders (Kessler et al., 2007). The SNMHS data are broadly consistent with those earlier surveys in finding significant evidence for cohort effects involving nine disorders ($\chi^2_3$ = 3.4–14.8, $p$ = .000–.019; Table 3). The general pattern is for relative-odds of disorder onset to be inversely related to age-at-interview. The highest ORs are generally found in the youngest respondents (ages 15–24 at interview) compared to the oldest

**TABLE 3** Cohort (age-at-interview) as a predictor of lifetime risk of DSM-IV/CIDI disorders in the Saudi National Mental Health Survey

| | Younger cohorts (age-at-interview) compared to respondents aged 50–65 | | | | | | |
|---|---|---|---|---|---|---|---|
| | 15–24 | | 25–34 | | 35–49 | | |
| | OR | (95% CI) | OR | (95% CI) | OR | (95% CI) | $\chi^2_3$ |
| Anxiety disorders | | | | | | | |
| Panic disorder | 2.8* | (1.0–7.8) | 2.3 | (0.8–6.6) | 2.2 | (0.8–5.8) | 1.3 |
| Agoraphobia | 4.5* | (1.4–13.8) | 3.3* | (1.1-10.4) | 2.7 | (0.8–8.9) | 2.6 |
| Social phobia | 8.4* | (3.6–19.8) | 4.8* | (2.2–10.5) | 3.7* | (1.6–8.8) | 8.7* |
| Generalized anxiety disorder | 6.2* | (1.7–22.8) | 2.3 | (0.9–5.9) | 1.8 | (0.7–4.6) | 2.6 |
| Post-traumatic stress disorder[a] | 1.3 | (0.4–4.5) | 2.4 | (0.6–9.3) | 1.3 | (0.4–4.6) | 1.5 |
| Obsessive–compulsive disorder[a] | 12.9* | (3.6–46.8) | 11.1* | (3.3–38.1) | 6.1* | (1.9–20.0) | 6.4* |
| Separation anxiety disorder[a] | 3.9* | (1.8–8.5) | 4.1* | (1.8–9.6) | 1.9 | (0.9–4.0) | 4.7* |
| Any[a] | 4.0* | (2.2–7.2) | 3.5* | (1.9–6.5) | 1.9* | (1.1–3.3) | 8.9* |
| Mood disorders | | | | | | | |
| Major depressive disorder | 4.2* | (2.2–7.8) | 2.4* | (1.4–4.1) | 1.6 | (0.9–2.6) | 6.9* |
| Bipolar I–II disorders | 102.9* | (25.8–409.8) | 46.6* | (10.3–210.8) | 29.6* | (6.0–146.3) | 14.8* |
| Any | 7.0* | (4.0–12.4) | 3.6* | (2.1–6.1) | 2.3* | (1.3–3.9) | 15.1* |
| Eating disorders | | | | | | | |
| Anorexia nervosa[a,b] | – | | – | | – | | – |
| Bulimia nervosa[a] | 56.2* | (7.5–421.4) | 37.5* | (4.7–297.1) | 14.8* | (1.7–126.7) | 7.3* |
| Binge-eating disorder[a] | 4.9* | (1.2–20.4) | 5.2* | (1.4–18.8) | 2.2 | (0.5–9.0) | 2.4 |
| Any | 10.3* | (3.1–34.2) | 7.2* | (2.3–22.6) | 2.8 | (0.8–9.9) | 6.8* |
| Disruptive behavior disorders | | | | | | | |
| Conduct disorder | 1.8 | (0.5–6.3) | 2.2 | (0.7–6.7) | 0.8 | (0.2–2.8) | 1.7 |
| Attention-deficit/hyperactivity disorder[a] | 4.8* | (1.1–21.3) | 3.5 | (0.8–14.6) | 1.7 | (0.4–7.0) | 6.4* |
| Intermittent explosive disorder[a,c] | 9.7* | (4.1–22.9) | 5.3* | (2.5–11.2) | – | | 14.4* |
| Any[a] | 5.1* | (1.7–15.6) | 4.1* | (1.3–12.4) | 1.6 | (0.5–4.9) | 11.0* |
| Substance disorders | | | | | | | |
| Alcohol abuse[a,c] | 2.9 | (0.5–15.6) | 3.7 | (0.8–17.6) | – | | 2.0 |
| Alcohol dependence[a,b] | – | | – | | – | | – |
| Drug abuse[a] | 10.7* | (1.6–72.2) | 3.3* | (0.5–23.4) | 2.6* | (0.4–15.7) | 3.4* |
| Drug dependence[a] | 6.6 | (0.6–76.4) | 8.8 | (1.0–79.3) | 8.8 | (1.0–79.3) | 1.4 |
| Any | 10.0* | (2.2–45.5) | 5.2* | (0.9–31.7) | 3.6* | (0.8–16.6) | 4.3* |
| Total | | | | | | | |
| Any disorder[a] | 4.2* | (2.6–6.8) | 3.2* | (1.9–5.4) | 1.8* | (1.2–2.8) | 13.7* |

*Note:* Results reflect weighted person-year level data. Models include time intervals as controls. Testing for global inter-cohort differences (2 degrees of freedom).

Abbreviations: CI, confidence interval; CIDI, Composite International Diagnostic Interview; OR, odds ratio.

[a]Disorders that were only assessed in the Part II sample ($n$ = 1,981).

[b]Disorders with $n$ < 20 respondents were not reported.

[c]The reference category was changed to 35+ because there were no respondents in the age cohort 50+ with an onset of IED or alcohol abuse.

*Significant at the .05 level, two-sided test.

(i.e., ages 50–65 at interview). The only exceptions are somewhat higher ORs in the 24–35 age group than in the 15–24 age group for several disorders (post-traumatic stress disorder, separation anxiety disorder, binge-eating disorder, conduct disorder, drug dependence). However, in all these cases the ORs for respondents ages 15–24 and 25–34 are significantly elevated relative to those for the oldest respondents. The ORs for respondents ages 35–49 are also elevated compared to the oldest respondents but somewhat lower in magnitude than among respondents ages 25–34. The only notable exception to this general pattern is the OR for drug dependence among respondents ages 35–49 that is equal to the OR among respondents ages 24–34.

It is noteworthy that the foregoing evaluation of cohort effects assumed implicitly that differences across cohorts are constant across the full AOO range. This might not be the case. In an effort to investigate this issue, we replicated the cohort analysis by focusing

**TABLE 4** Variation in the effects of cohort (age-at-interview) in predicting lifetime risk of DSM-IV/CIDI disorders in the Saudi National Mental Health Survey

| | | Early | | Middle | | Late | |
|---|---|---|---|---|---|---|---|
| | Age cohort | OR | (95% CI) | OR | (95% CI) | OR | (95% CI) |
| Anxiety disorders | | | | | | | |
| Panic disorder[a,b] | 15–24 | 2.8 | (0.8–10.0) | – | | – | |
| | 25–34 | 2.2 | (0.7–7.0) | 4.7 | (0.3–69.2) | – | |
| | 35–49 | 2.1 | (0.6–7.6) | 5.7* | (1.0–31.8) | – | |
| | 50+ | 1.0 | – | 1.0 | – | – | |
| | $\chi^2_{3,2}$ | 0.9 | | 2.0 | | | |
| Agoraphobia | 15–24 | 3.2* | (1.5–6.5) | 1.4 | (0.4–4.3) | 2.0 | (0.5–8.3) |
| | 25–34 | 2.1* | (1.1–4.0) | 2.0 | (0.6–6.4) | 1.3 | (0.4–4.5) |
| | 35–49 | 1.5 | (0.7–3.5) | 1.0 | – | 1.0 | – |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |
| | $\chi^2_{3,2,2}$ | 4.6* | | 0.6 | | 0.8 | |
| Social phobia | 15–24 | 3.8* | (2.2–6.6) | 4.0* | (1.5–10.4) | 8.3* | (2.1–33.2) |
| | 25–34 | 1.9* | (1.2–3.2) | 3.2* | (1.2–8.4) | 3.9* | (1.1–13.4) |
| | 35–49 | 2.0 | (1.0–4.2) | 1.0 | – | 2.2 | (0.7–7.1) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |
| | $\chi^2_{3,2,2}$ | 8.2* | | 4.5* | | 3.2* | |
| Generalized anxiety disorder[a,c] | 15–24 | 7.9* | (1.6–39.9) | – | – | – | |
| | 25–34 | 2.4 | (0.6–9.4) | 2.6 | (0.5–14.4) | – | |
| | 35–49 | 2.0 | (0.3–12.1) | 2.3 | (0.5–11.1) | 1.5 | (0.5–4.7) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |
| | $\chi^2_{3,2,1}$ | 2.5 | | 0.6 | | 0.5 | |
| Post-traumatic stress disorder[d,e] | 15–24 | 0.6 | (0.1–3.1) | 2.7 | (1.0–7.7) | – | |
| | 25–34 | 1.4 | (0.2–9.6) | 2.6* | (1.1–6.2) | 3.3* | (1.1–9.6) |
| | 35–49 | 0.7 | (0.1–4.6) | 1.0 | – | 2.3 | (0.8–6.8) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | |
| | $\chi^2_{3,2,2}$ | 1.2 | | 2.6 | | 2.4 | |
| Obsessive–compulsive disorder[d,e] | 15–24 | 7.2* | (1.6–33.6) | 4.6* | (1.5–13.7) | – | |
| | 25–34 | 5.0 | (0.9–27.1) | 4.5* | (1.5–13.5) | 27.8* | (4.8–159.7) |
| | 35–49 | 4.6 | (1.0–20.4) | 1.0 | – | 14.0* | (2.1–92.0) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | |
| | $\chi^2_{3,2,2}$ | 2.2 | | 4.6* | | 7.0* | |
| Separation anxiety disorder[b,d] | 15–24 | 2.3* | (1.2–4.5) | 8.9* | (2.4–33.3) | – | |
| | 25–34 | 2.6* | (1.2–5.8) | 5.6* | (1.6–18.9) | – | |
| | 35–49 | 1.5 | (0.8–2.8) | 1.6 | (0.4–6.1) | – | |
| | 50+ | 1.0 | – | 1.0 | – | – | |
| | $\chi^2_{3,3}$ | 2.5 | | 6.3* | | | |
| Mood disorders | | | | | | | |
| Major depressive disorder[2] | 15–24 | 3.7* | (1.8–7.4) | 5.6* | (1.3–24.2) | – | |
| | 25–34 | 1.7 | (0.8–3.6) | 4.0 | (0.8–21.9) | 2.6* | (1.3–5.3) |
| | 35–49 | 1.7 | (0.8–3.9) | 1.6 | (0.3–8.6) | 1.4 | (0.8–2.6) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |
| | $\chi^2_{3,3,2}$ | 5.7* | | 5.0* | | 3.8* | |
| Bipolar I–II disorders[e] | 15–24 | 5.2* | (1.4–18.2) | 4.7* | (1.1–20.2) | – | |
| | 25–34 | 2.4 | (0.6–10.6) | 1.2 | (0.2–6.5) | 29.2* | (6.3–135.7) |
| | 35–49 | 1.0 | – | 1.0 | – | 9.8* | (2.3–41.3) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |

(Continues)

**TABLE 4** (Continued)

| | | Early | | Middle | | Late | |
|---|---|---|---|---|---|---|---|
| | Age cohort | OR | (95% CI) | OR | (95% CI) | OR | (95% CI) |
| $\chi^2_{2,2,2}$ | | 3.6* | | 2.5 | | 9.4* | |
| Eating disorders | | | | | | | |
| Bulimia nervosa[d,e] | 15–24 | 5.6* | (1.8–16.9) | 2.8 | (0.6–12.4) | – | |
| | 25–34 | 2.9 | (0.8–10.4) | 4.6* | (1.8–11.9) | 1.0 | (0.3–3.5) |
| | 35–49 | 1.0 | – | 1.0 | – | 1.0 | – |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |
| $\chi^2_{2,2,1}$ | | 4.7* | | 5.1* | | 0.0 | |
| Binge-eating disorder[d,e] | 15–24 | 2.2 | (0.8–6.3) | 3.4 | (0.0–132.5) | – | – |
| | 25–34 | 2.5 | (0.9–7.2) | 2.6 | (0.0–503.7) | 12.3* | (3.0–51.1) |
| | 35–49 | 0.6 | (0.2–1.7) | 3.0 | (0.0–1,042.3) | 4.0* | (1.0–15.4) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | |
| $\chi^2_{3,3,2}$ | | 12.4* | | 0.1 | | 6.0* | |
| Substance disorders | | | | | | | |
| Any[c,f] | 15–24 | 4.1* | (1.0–16.6) | 2.6 | (0.6–11.9) | – | |
| | 25–34 | 1.9 | (0.4–9.2) | 2.6 | (1.1–6.2) | – | |
| | 35–49 | 1.5 | (0.3–6.9) | 1.0 | – | 11.0 | (0.4–274.8) |
| | 50+ | 1.0 | – | 1.0 | – | 1.0 | – |
| $\chi^2_{3,2,1}$ | | 2.7* | | 2.6 | | 2.2 | |

Abbreviations: CI, confidence interval; CIDI, Composite International Diagnostic Interview; OR; odds ratio.

*Note:* Results reflect weighted person-year level data. Disruptive behavior disorders were not included because most of these disorders begin in a short period of time before age 18. Models include time intervals as controls. Categorization of person-years into early, middle, and late subsamples was based on age cut-points at the projected 33rd and 67th percentile of onset risk for each mental disorder (panic: 28/39; agoraphobia: 13/19; social phobia: 13/16; generalized anxiety disorder: 25/33; PTSD: 18/24; obsessive–compulsive disorder: 14/24; separation anxiety disorder: 12/25; major depressive disorder: 19/24; bipolar I–II: 17/23; bulimia: 20/24; binge disorder: 18/21; any substance: 22/35).

[a]There were no person-years from the 15–24 age cohort with a middle onset of panic or generalized anxiety disorders, so these person-years were excluded from the analysis.

[b]There were no person-years from the 15–24, 25–34, or 35–49 age cohorts with a late onset of panic or separation anxiety disorders, so models measuring late onsets could not be evaluated for these two disorders.

[c]There were no person-years from the 15–24 or 25–34 age cohorts with a late onset of generalized anxiety or any substance disorders, so these person-years were excluded from the analysis.

[d]Disorders that were only assessed in the Part II sample ($n$ = 1,981).

[e]There were no person-years from the 15–24 age cohort with a late onset of PTSD, OCD, bulimia, binge, major depression, or bipolar disorders, so these person-years were excluded from the analysis.

[f]There were no person-years from the 50+ age cohort with a middle onset of PTSD, bulimia, or any substance disorders, so these person-years were combined with person-years from the 35–49 age cohort as the reference category.

*Significant at the .05 level, two-sided test.

separately on early-onset cases (defined as cases with onsets up through the 33rd percentile in the AOO distribution for the disorder), middle-onset cases (34th-67th percentiles), and late-onset cases (68th + percentiles; Table 4). Results were less stable than in the total sample because they were based on only subsamples of person-years. Nonetheless, the broad pattern can be seen of increasing prevalence in more recent cohorts within each of the subsamples of early-onset, middle-onset, and late-onset case.

## 4.4 | Sociodemographic correlates

Sociodemographic distributions are reported in Appendix Table S1. We focus here on sociodemographic differences in broad disorder categories. More detailed disorder-specific patterns are reported in Appendix Table S2a-c. Saudi women have significantly higher lifetime risk than men of anxiety disorders (OR = 1.5, 95% CI = 1.2–2.0) and mood disorders (OR = 1.7, 95% CI = 1.2–2.2), but there are no significant gender differences in either eating, disruptive behavior, or substance use disorders ($\chi^2_1$ = 0.0–2.1, $p$ = .15–.98; Table 5). Education is significantly related to lifetime risk of all disorders ($\chi^2_4$ = 6.5–8.4, $p$ < .001) other than substance use disorder ($\chi^2_4$ = 2.0, $p$ = .10). This is due to students and nonstudents with the highest education (college graduates) consistently having the highest ORs and nonstudents with the lowest educations consistently having the lowest ORs. Respondents with high-average education are comparable to those with high education in odds of anxiety, mood, and disruptive behavior disorders and comparable to those with low education in odds of eating

**TABLE 5** Time-varying sociodemographic predictors of lifetime risk of DSM-IV/CIDI disorders in the Saudi National Mental Health Survey

| | Any anxiety[a] | | Any mood | | Any eating disorder[a] | | Any disruptive behavior[a] | | Any substance[a] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OR | (95% CI) | OR | (95% CI) | OR | (95% CI) | OR | (95% CI) | OR | (95% CI) |
| Gender | | | | | | | | | | |
| Female | 1.5* | (1.2–2.0) | 1.7* | (1.2–2.2) | 1.0 | (0.6–1.6) | 0.8 | (0.5–1.1) | 0.7 | (0.4–1.3) |
| Male | 1.0 | – | 1.0 | – | 1.0 | – | 1.0 | – | 1.0 | – |
| $\chi^2_1$ | 8.7* | | 11.9* | | 0.0 | | 2.1 | | 1.2 | |
| Education, time varying | | | | | | | | | | |
| Student | 1.6 | (0.8–3.2) | 2.2* | (1.0–4.7) | 1.0 | (0.3–2.8) | 1.4 | (0.2–8.0) | 1.1 | (0.2–5.2) |
| Low | 0.4* | (0.2–0.7) | 0.4* | (0.2–0.8) | 0.1* | (0.0–0.3) | 0.3 | (0.1–1.7) | 1.1 | (0.2–5.5) |
| Low-average | 0.8 | (0.4–1.6) | 1.1 | (0.6–2.1) | 0.4 | (0.1–1.2) | 0.2 | (0.0–1.2) | 3.6 | (0.9–14.4) |
| High-average | 1.0 | (0.5–1.8) | 0.8 | (0.4–1.5) | 0.4* | (0.1–0.9) | 0.9 | (0.2–4.6) | 3.6* | (1.1–12.1) |
| High | 1.0 | – | 1.0 | – | 1.0 | – | 1.0 | – | 1.0 | – |
| $\chi^2_4$ | 8.4* | | 7.0* | | 6.9* | | 6.5* | | 2.0 | |
| Marital status, time varying | | | | | | | | | | |
| Previously married | 2.0* | (1.1–3.6) | 3.3* | (1.5–7.4) | 1.1 | (0.4–3.3) | 5.6 | (0.7–44.1) | 2.3 | (0.4–12.4) |
| Never married | 0.6* | (0.4–0.9) | 0.7 | (0.4–1.3) | 0.7 | (0.3–1.9) | 1.5 | (0.3–7.9) | 2.1 | (0.8–5.6) |
| Currently married | 1.0 | – | 1.0 | – | 1.0 | – | 1.0 | – | 1.0 | – |
| $\chi^2_2$ | 6.3* | | 4.4* | | 0.4 | | 1.9 | | 1.2 | |

Abbreviations: CI, confidence interval; CIDI, Composite International Diagnostic Interview; OR; odds ratio.

*Note:* Results reflect weighted person-year level data. Models include time intervals and data stacks as controls. To avoid prediction of the first onset of any individual mental disorder within each of the five subgroups, the analysis sample for each subgroup was created by "stacking" the person-year sample for each mental disorder within each subgroup on top of each other (see Table 1), for a total of seven data stacks measuring any anxiety, two data stacks for any mood, three data stacks for any eating disorder, three data stacks for any impulse-control, and four data stacks for any substance. Dummy variables for $n - 1$ stacks were included as controls in each model.

[a]Disorders that were only assessed in the Part II sample ($n$ = 1,981).

*Significant at the .05 level, two-sided test.

disorder. Respondents with low-average education are comparable to those with high education in odds of anxiety and mood disorders and comparable to those with low education in odds of eating disorder and disruptive behavior disorder.

Marital status, finally, is significantly associated with anxiety and mood disorders ($\chi^2_2$ = 4.4–6.3, $p$ = .002–.013) but not with any of the other disorders ($\chi^2_2$ = 0.4–1.9, $p$ = .15–.70). This is due to previously married people having the highest odds of both anxiety disorders (OR = 2.0, 95% CI = 1.1–3.6) and mood disorders (OR = 3.3, 95% CI = 1.5–7.4), whereas never married people have significantly reduced odds of anxiety disorder (OR = 0.6, 95% CI = 04–0.9) and nonsignificantly reduced odds of mood disorders (OR = 0.7, 95% CI = 0.4–1.3) relative to the currently married. It is noteworthy, though, that these results are net of the other predictors in the model given that about two-thirds of all the person-years in the model when respondents were not married corresponded to years when they were students. The generally elevated ORs for student status and the low ORs for the never married are consequently striking. More detailed modeling that disaggregates anxiety and mood disorders separately by the cross-classification of age, education, including current student status, and marital status will be needed to tease apart these relative effects in future analyses of the SNMHS data.

## 5 | DISCUSSION

Four possible biases need to be noted in interpreting the estimates presented here. First, people with mental disorders might have been less likely than others to participate in the survey because of sample frame exclusions (e.g., excluding people not living in households), differential mortality, or greater reluctance of mentally ill people to participate. Such biases have been documented in the past (Allgulander, 1989). Second, lifetime disorders might have been under-reported by survey participants because of reluctance to report embarrassing behaviors. Again, such biases have long been known to exist (Cannell, Marquis, & Laurent, 1977). Bias of this type might be especially likely among less well educated and older people, among whom stigma about mental disorders is highest in many countries (Alonso et al., 2008). We asked about stigma in the SNMHS and we will investigate this issue in future analyses but for now, we merely note it as a possible source of downward bias in prevalence estimates. Third, the method used to estimate projected lifetime morbid risk was based on the simplified assumption of constant conditional risk of first onset in a particular year of life across cohorts. But we know that prevalence is higher in more recent cohorts, which means that this simplifying assumption is incorrect. As a result, estimates of lifetime morbid risk

should be considered only suggestive. Finally, it is likely that AOO was recalled with more error the longer ago the disorders began, which could produce the pattern found here that we interpreted as indirect evidence for a cohort effect (Giuffra & Risch, 1994). Evidence for age-related bias has been documented in previous epidemiological research (Simon & VonKorff, 1995), although the novel probing strategy used in the WMH surveys has been shown to reduce this problem (Knäuper et al., 1999).

Based on these considerations, the estimates of lifetime disorder prevalence in the SNMHS are likely to be conservative, as the biases described above would all be expected to result in under-estimation. Within the context of these limitations, the SNMHS prevalence estimates are within the range found in previous WMH surveys. The estimate that 34.2% of the KSA population experienced at least one DSM-IV/CIDI disorder at some time in their life is similar to estimates in WMH surveys in such high-income countries as Belgium (29.1%), the Netherlands (31.7%), France (37.9%), and New Zealand (39.3%), but considerably lower than in the United States (47.4%) and higher than in some other high-income countries (18.0–25.2% in Italy, Japan, and Spain; Kessler, Angermeyer, et al., 2007). It is noteworthy, though, that the SNMHS did not assess specific phobia, which is the most common anxiety disorder in virtually all WMH surveys (Wardenaar et al., 2017). This omission presumably reduced the overall disorder prevalence estimate relative to other WMH surveys.

Despite not assessing specific phobia, anxiety disorders were the most prevalent lifetime disorders in the SNMHS (23.3%). And this prevalence estimate is considerably higher than estimates in most prior WMH surveys (13.8%, IQR 9.9–15.9%; Kessler, Angermeyer, et al., 2007). The high prevalence of anxiety disorders overall is due largely to the much higher prevalence of separation anxiety disorder (both childhood-onset and adult-onset) in KSA (11.9%) than in other WMH surveys (4.7%, IQR 1.4–5.1%; Silove et al., 2015). The estimated lifetime prevalence of major depressive disorder, in comparison, is considerably lower in the SNMHS (6.0%) than in most other WMH surveys (14.6%, IQR 12.3–17.9%; Fayyad et al., 2017; Kessler & Bromet, 2013). Other notable differences are a much higher prevalence of attention-deficit/hyperactivity disorder in the SNMHS (8.0%) than in WMH surveys in other high-income countries (3.3%, IQR 1.8–3.3%) other than the United States (Fayyad et al., 2017), a lower prevalence of drug use disorders in the SNMHS (3.5%) than in WMH surveys in other high-income countries (4.8%, IQR 3.5–5.5%; Degenhardt et al., 2019a), and vanishingly small prevalence estimates of alcohol use disorders in the SNMHS compared to 2.6–7.7% in WMH surveys in other high-income countries (Glantz et al., 2020).

Another important issue involving prevalence is that we found substantial comorbidity among lifetime mental disorders in the SNMHS. Indeed, nearly half of all survey respondents with a history of at least one disorder had at least two, about half of those with at least two disorders had at least three, and about half of those with three or more disorders had at least four. Although beyond the scope of this first report, it is worth noting that previous WMH studies in other countries have shown that the small proportion of people in the population with this kind of high comorbidity, which is often referred to as multimorbidity (National Guideline Centre, 2016), sometimes account for the majority of all the serious mental illness in the population (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). This has important implications for prevention in that the earliest disorders in these multimorbid profiles typically are relatively mild when they begin, which means that they might be comparatively easy to treat but seldom come to clinical attention because they are so mild. Interventions designed to detect and successfully treat these mild primary disorders might be effective in preventing progression to more serious comorbidity (de Girolamo, McGorry, & Sartorius, 2019; Kessler & Price, 1993). This possibility will be the focus of a future SNMHS report.

The AOO distributions reported here are consistent with those found in other WMH surveys (Kessler et al., 2007) and elsewhere (de Girolamo, Dagani, Purcell, Cocchi, & McGorry, 2012). Indeed, the median AOO of 13 years of age for a first lifetime mental disorder in the SNMHS is identical to the median AOO found across all WMH surveys combined. Also similar to other WMH surveys, the SNMHS found that social phobia, separation anxiety disorder, conduct disorder, and attention-deficit/hyperactivity disorder typically have onsets in childhood, that most other anxiety disorders along with mood disorders, eating disorders, and substance disorders typically have onsets in late adolescence or early adulthood, and that the onset ages of panic disorder and generalized anxiety disorder are later than those of the other anxiety disorders. The only striking discrepancy between the AOO distributions in KSA and other countries is the very late median onset of drug abuse in KSA of 31 (IQR 20–46) compared to medians in early adolescence in other WMH surveys (17, IQR 15–19; Degenhardt et al., 2019b). This finding suggests that there is something very different about the nature of drug dependence in KSA than most other countries, an issue we are in the process of investigating and that will be reported in the future.

The early AOO distributions of mental disorders have important policy implications because they mean that these disorders might have repercussions for educational attainment (Mojtabai et al., 2015a), entry into the labor force (Mojtabai et al., 2015b), and interpersonal relationships established in adolescence or early adulthood (Breslau et al., 2011). The potential for such effects, in turn, means that early detection and timely intervention are needed during the school years to target children and adolescents with emerging disorders. The programs and human resources needed to implement such interventions are insufficient in most countries of the world (World Health Organization, 2005) and KSA is no exception in this regard. Saudi health policymakers should take these findings into consideration in determining the costs and potential benefits of programs aimed at investing in the mental health of youth.

The sociodemographic correlates found in the SNMHS are like those found in prior WMH surveys in showing that women have significantly higher odds than men of both anxiety and mood disorders. However, we also typically find that eating disorders are significantly more common among women than men (Kessler et al., 2013) and that both disruptive behavior disorders (Fayyad et al., 2017; Nock, Kazdin,

Hiripi, & Kessler, 2007; Scott et al., 2016) and drug use disorders (Degenhardt et al., 2019a) are more common among men than women, but none of these associations was significant in the SNMHS. The most striking correlate documented here is cohort, as this has the potential to be a key issue in assessing societal burden if lifetime prevalence is truly increasing in recent cohorts. But is lifetime prevalence truly increasing? Or is the indirect evidence for a cohort effect a methodological artifact? We cannot adjudicate this issue with the SNMHS data. The possibility that lifetime prevalence of mental disorders is higher in more recent cohorts is a distinct possibility, though, as KSA has undergone enormous changes in the half century separating the ages of the youngest and oldest respondents in the survey. An alternative possibility, though, is that prevalence is stable but underestimated due to biased reporting or under-representation of older respondents with a history of mental illness due either to differential mortality or differential willingness to participate in the survey. A more definitive evaluation would require longitudinal trend data. Even in the absence of such data, though, we can see clearly from the cross-sectional data that lifetime prevalence of mental disorders is highly prevalent in recent generations of Saudi adults. The public health implications of this fact need to be considered by policymakers.

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## DECLARATION OF INTEREST STATEMENT

In the past 3 years, Dr. Kessler received support for his epidemiological studies from Sanofi Aventis; was a consultant for Datastat, Inc., Sage Pharmaceuticals, and Takeda. The other authors declare no conflicts of interest.

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## REFERENCES

Al-Subaie, A. S., Al-Habeeb, A., & Altwaijri, Y. (n.d.). Overview of the Saudi National Mental Health Survey (SNMHS). *International Journal of Methods in Psychiatric Research*. (In press).

Alhasnawi, S., Sadik, S., Rasheed, M., Baban, A., Al-Alak, M. M., Othman, A. Y., … Kessler, R. C. (2009). The prevalence and correlates of DSM-IV disorders in the Iraq Mental Health Survey (IMHS). *World Psychiatry*, *8*, 97–109.

Allgulander, C. (1989). Psychoactive drug use in a general population sample, Sweden: Correlates with percieved health, psychiatric diagnoses, and mortality in an automated record-linkage study. *American Journal of Public Health*, *79*, 1006–1010. https://doi.org/10.2105/ajph.79.8.1006

Alonso, J., Buron, A., Bruffaerts, R., He, Y., Posada-Villa, J., Levine, J.-P., … World Mental Health Consortium. (2008). Association of percieved stigma and mood and anxiety disorders: Results from the World Mental Health Surveys. *Acta Psychiatrica Scandinavica*, *118*, 305–314. https://doi.org/10.1111/j.1600-0447.2008.01241.x

Alonso, J., Chatterji, S., & He, Y. (Eds.). (2013). *The burdens of mental disorders: Global perspectives from the WHO World Mental Health Surveys*. Cambridge, UK: Cambridge University Press.

Altwaijri, Y., Al-Habeeb, A., Al-Subaie, A. S., Bilal, L., Al-Desouki, M., Shahab, M., … Kessler, R. C. (n.d.). Twelve-month prevalence and severity of mental disorders in the Saudi National Mental Health Survey. *International Journal of Methods in Psychiatric Research*. (In press).

American Association for Public Opinion Research. (2016). Standard definitions. Retrieved from https://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders: DSM-IV-TR* (4th ed.). Washington, DC: American Psychiatric Association.

Breslau, J., Miller, E., Jin, R., Sampson, N. A., Alonso, J., Andrade, L. H., … Kessler, R. C. (2011). A multinational study of mental disorders, marriage, and divorce. *Acta Psychiatrica Scandinavica*, *124*, 474–486. https://doi.org/10.1111/j.1600-0447.2011.01712.x

Cannell, C. F., Marquis, K. H., & Laurent, A. A. (1977). *A summary of studies of interviewing methodology: 1959–1970. Vital Health and Statistics 2*. Rockville, MD: National Center for Health Statistics.

de Girolamo, G., Dagani, J., Purcell, R., Cocchi, A., & McGorry, P. D. (2012). Age of onset of mental disorders and use of mental health services: Needs, opportunities and obstacles. *Epidemiology and Psychiatric Sciences*, *21*, 47–57. https://doi.org/10.1017/s2045796011000746

de Girolamo, G., McGorry, P. D., & Sartorius, N. (2019). Introduction: Relevance of the age of onset of meantal disorders to research in psychiatry and to the organization of services for people with mental illness. In G. de Girolamo, P. D. McGorry, & N. Sartorius (Eds.), *Age of onset of mental disorders: Etiopathogenetic and treatment implications*. Springer Nature: Cham, Switzerland.

Degenhardt, L., Bharat, C., Glantz, M. D., Sampson, N. A., Scott, K., Lim, C. C. W., … Kessler, R. C. (2019a). The epidemiology of drug use disorders cross-nationally: Findings from the WHO's World Mental Health Surveys. *The International Journal on Drug Policy*, *71*, 103–112. https://doi.org/10.1016/j.drugpo.2019.03.002

Degenhardt, L., Bharat, C., Glantz, M. D., Sampson, N. A., Al-Hamzawi, A., Alonso, J., … Kessler, R. C. (2019b). Association of cohort and individual substance use with risk of transitioning to drug use, drug use disorder, and remission from disorder: Findings from the World Mental Health Surveys. *JAMA Psychiatry*, *76*, 708–720. https://doi.org/10.1001/jamapsychiatry.2019.0163

Efron, B. (1988). Logistic regression, survival analysis, and the Kaplan-Meier curve. *Journal of the American Statistical Association*, *83*, 414–425. https://doi.org/10.1080/01621459.1988.10478612

Fayyad, J., Sampson, N. A., Hwang, I., Adamowski, T., Aguilar-Gaxiola, S., Al-Hamzawi, A., … Kessler, R. C. (2017). The descriptive epidemiology of DSM-IV Adult ADHD in the World Health Organization World Mental Health Surveys. *Attention Deficit and Hyperactivity Disorders*, *9* (1), 47–65. https://doi.org/10.1007/s12402-016-0208-3

GBD 2015 Eastern Mediterranean Region Mental Health Collaborators. (2018). The burden of mental disorders in the Eastern Mediterranean region, 1990-2015: Findings from the Global Burden of Disease 2015 Study. *International Journal of Public Health*, *63*(Suppl 1), 25–37. https://doi.org/10.1007/s00038-017-1006-1

Giuffra, L. A., & Risch, N. (1994). Diminished recall and the cohort effect of major depression: A simulation study. *Psychological Medicine*, *24*, 375–383. https://doi.org/10.1017/s0033291700027355

Glantz, M. D., Bharat, C., Degenhardt, L., Sampson, N. A., Scott, K. M., Lim, C. C. W., … WHO World Mental Health Survey Collaborators. (2020). The epidemiology of alcohol use disorders cross-nationally: Findings from the World Mental Health Surveys. *Addictive Behaviors*, *102*, 106128. https://doi.org/10.1016/j.addbeh.2019.106128

Halli, S. S. (1992). *Advanced techniques of population analysis*. New York, NY: Plenum Press.

Harkness, J., Pennell, B. E., Villar, A., Gebler, N., Aguilar-Gaxiola, S., & Bilgen, I. (2008). Translation procedures and translation assessment in the World Mental Health Survey Initiative. In R. C. Kessler & T. B. Üstün (Eds.), *The WHO World Mental Health Surveys: Global perspectives on the epidemiology of mental disorders*. Cambridge, UK: Cambridge University Press.

Haro, J. M., Arbabzadeh-Bouchez, S., Brugha, T. S., de Girolamo, G., Guyer, M. E., Jin, R., … Kessler, R. C. (2006). Concordance of the Composite International Diagnostic Interview Version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health surveys. *International Journal of Methods in Psychiatric Research*, *15*, 167–180. https://doi.org/10.1002/mpr.196

Heeringa, S. G., Wells, J. E., Hubbard, F., Mneimneh, Z. N., Chiu, W. T., Sampson, N. A., & Berglund, P. A. (2008). Sample designs and sampling procedures. In R. C. Kessler & T. B. Üstün (Eds.), *The WHO World Mental Health Surveys: Global perspectives on the epidemiology of mental disorders*. Cambridge, UK: Cambridge University Press.

Hyder, S., Bilal, L., Akkad, L., Lin, Y. C., Al-Habeeb, A., Al-Subaie, A. S., … Altwaijri, Y. (2017). Evidence-based guideline implementation of quality assurance and quality control procedures in the Saudi National Mental Health Survey. *International Journal of Mental Health Systems*, *11*, 60. https://doi.org/10.1186/s13033-017-0164-0

Institute for Health Metrics and Evaluation. (2019). Saudi Arabia. Retrieved from http://www.healthdata.org/saudi-arabia

Kaplan, E. L., & Meier, P. (1958). Nonparametric estimation from incomplete observations. *Journal of the American Statistical Association*, *53*, 457–481. https://doi.org/10.1080/01621459.1958.10501452

Karam, E. G., Mneimneh, Z. N., Dimassi, H., Fayyad, J. A., Karam, A. N., Nasser, S. C., … Kessler, R. C. (2008). Lifetime prevalence of mental disorders in Lebanon: First onset, treatment, and exposure to war. *PLoS Medicine*, *5*, e61. https://doi.org/10.1371/journal.pmed.0050061

Kessler, R. C., Aguilar-Gaxiola, S., Alonso, J., Chatterji, S., Lee, S., Ormel, J., … Wang, P. S. (2009). The global burden of mental disorders: An update from the WHO World Mental Health (WMH) surveys. *Epidemiology and Psychiatric Sciences*, *18*, 23–33. https://doi.org/10.1017/s1121189x00001421

Kessler, R. C., Al-Desouki, M., King, A. J., Sampson, N. A., Al-Subaie, A. S., Al-Habeeb, A., … Altwaijri, Y. A. (n.d.). Clinical reappraisal of the Composite International Diagnostic Interview Version 3.0 in the Saudi National Mental Health Survey. *International Journal of Methods in Psychiatric Research*. (In press).

Kessler, R. C., Angermeyer, M., Anthony, J. C., De Graaf, R., Demyttenaere, K., Gasquet, I., … Üstün, T. B. (2007). Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's World Mental Health Survey Initiative. *World Psychiatry*, *6*, 168–176.

Kessler, R. C., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., & Üstün, T. B. (2007). Age of onset of mental disorders: A review of recent literature. *Current Opinion in Psychiatry*, *20*, 359–364. https://doi.org/10.1097/YCO.0b013e32816ebc8c

Kessler, R. C., Berglund, P. A., Chiu, W. T., Deitz, A. C., Hudson, J. I., Shahly, V., … Xavier, M. (2013). The prevalence and correlates of binge eating disorder in the World Health Organization World Mental Health Surveys. *Biological Psychiatry*, *73*, 904–914. https://doi.org/10.1016/j.biopsych.2012.11.020

Kessler, R. C., & Bromet, E. J. (2013). The epidemiology of depression across cultures. *Annual Review of Public Health*, *34*, 119–138. https://doi.org/10.1146/annurev-publhealth-031912-114409

Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*, 617–627. https://doi.org/10.1001/archpsyc.62.6.617

Kessler, R. C., & Price, R. H. (1993). Primary prevention of secondary disorders: A proposal and agenda. *American Journal of Community Psychology*, *21*, 607–633. https://doi.org/10.1007/bf00942174

Kessler, R. C., & Üstün, T. B. (2004). The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research*, *13*, 93–121. https://doi.org/10.1002/mpr.168

Kessler, R. C., & Üstün, T. B. (Eds.). (2008). *The WHO World Mental Health Surveys: Global perspectives on the epidemiology of mental disorders*. Cambridge, UK: Cambridge University Press.

Kish, L., & Frankel, M. R. (1974). Inference from complex samples. *Journal of the Royal Statistical Society: Series B (Methodological)*, *36*, 1–22. https://doi.org/10.1111/j.2517-6161.1974.tb00981.x

Knäuper, B., Cannell, C. F., Schwarz, N., Bruce, M. L., & Kessler, R. C. (1999). Improving accuracy of major depression age-of-onset reports in the US National Comorbidity Survey. *International Journal of Methods in Psychiatric Research*, *8*, 39–48. https://doi.org/10.1002/mpr.55

Levy, B. S., & Sidel, V. W. (2013). Adverse health consequences of the Iraq war. *Lancet*, *381*, 949–958. https://doi.org/10.1016/S0140-6736(13)60254-8

Mneimneh, Z., Heeringa, S. G., Lin, Y.-C., Altwaijri, Y., & Nishimura, R. (n.d.). The Saudi National Mental Health Survey: Sample design and weight development. *International Journal of Methods in Psychiatric Research*. (In press).

Mojtabai, R., Stuart, E. A., Hwang, I., Eaton, W. W., Sampson, N. A., & Kessler, R. C. (2015a). Long-term effects of mental disorders on educational attainment in the National Comorbidity Survey ten-year follow-up. *Social Psychiatry and Psychiatric Epidemiology*, *50*, 1577–1591. https://doi.org/10.1007/s00127-015-1083-5

Mojtabai, R., Stuart, E. A., Hwang, I., Susukida, R., Eaton, W. W., Sampson, N. A., & Kessler, R. C. (2015b). Long-term effects of mental disorders on employment in the National Comorbidity Survey ten-year follow-up. *Social Psychiatry and Psychiatric Epidemiology*, *50*, 1657–1668. https://doi.org/10.1007/s00127-015-1097-z

Murray, C. J. L., & Lopez, A. D. (1996). *The global burden of disease: A comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020*. Cambridge, MA: Harvard School of Public Health on behalf of the World Health Oranization and World Bank.

National Guideline Centre. (2016). *Multimorbidity: Assessment, prioritisation and management of care for people with commonly occurring*

*multimorbidity*. London, UK: National Institute for Health and Care Excellence.

Nock, M. K., Kazdin, A. E., Hiripi, E., & Kessler, R. C. (2007). Lifetime prevalence, correlates, and persistence of oppositional defiant disorder: Results from the National Comorbidity Survey Replication. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *48*, 703–713. https://doi.org/10.1111/j.1469-7610.2007.01733.x

Pennell, B. E., Mneimneh, Z. N., Bowers, A., Chardoul, S., Wells, J. E., Viana, M. C., … Saiz, G. V. (2008). Implementation of the World Mental Health Surveys. In R. C. Kessler & T. B. Üstün (Eds.), *The WHO World Mental Health Surveys: Global perspectives on the epidemiology of mental disorders*. Cambridge, UK: Cambridge University Press.

Research Triangle Institute. (2002). *SUDAAN: Professional software for survey data analysis (version 8.01)*. Research Triangle Park, NC: Research Triangle Park.

SAS Institute. (2001). *SAS/STAT software: Changes and enhancements, release 8.2*. Cary, NC: SAS Publishing.

Scott, K. M., de Jonge, P., Stein, D. J., & Kessler, R. C. (Eds.). (2018). *Mental disorders around the world: Facts and figures from the WHO World Mental Health surveys*. Cambridge, UK: Cambridge University Press.

Scott, K. M., Lim, C. C. W., Hwang, I., Adamowski, T., Al-Hamzawi, A., Bromet, E., … Kessler, R. C. (2016). The cross-national epidemiology of DSM-IV intermittent explosive disorder. *Psychological Medicine*, *46*, 3161–3172. https://doi.org/10.1017/S0033291716001859

Shahab, M., Al-Tuwaijri, F., Kattan, N., Bilal, L., Hyder, S., Mneimneh, Z., … Altwaijri, Y. (2019). Implementing the TRAPD model for the Saudi adaptation of the World Mental Health Composite International Diagnostic Interview 3.0. *International Journal of Mental Health Systems*, *13* (1), 12. https://doi.org/10.1186/s13033-019-0267-x

Silove, D., Alonso, J., Bromet, E., Gruber, M., Sampson, N. A., Scott, K. M., … Kessler, R. C. (2015). Pediatric-onset and adult-onset separation anxiety disorder across countries in the World Mental Health Survey. *The American Journal of Psychiatry*, *172*, 647–656. https://doi.org/10.1176/appi.ajp.2015.14091185

Simon, G. E., & VonKorff, M. (1995). Recall of psychiatric history in cross-sectional surveys: Implications for epidemiologic research. *Epidemiologic Reviews*, *17*, 221–227. https://doi.org/10.1093/oxfordjournals.epirev.a036180

Slewa-Younan, S., Uribe Guajardo, M. G., Heriseanu, A., & Hasan, T. (2015). A systematic review of post-traumatic stress disorder and depression amongst Iraqi refugees located in western countries. *Journal of Immigrant and Minority Health*, *17*, 1231–1239. https://doi.org/10.1007/s10903-014-0046-3

Wardenaar, K. J., Lim, C. C. W., Al-Hamzawi, A. O., Alonso, J., Andrade, L. H., Benjet, C., … de Jonge, P. (2017). The cross-national epidemiology of specific phobia in the World Mental Health Surveys. *Psychological Medicine*, *47*, 1744–1760. https://doi.org/10.1017/S0033291717000174

Whiteford, H. A., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., Erskine, H. E., … Vos, T. (2013). Global burden of disease attributable to mental and substance use disorders: Findings from the Global Burden of Disease Study 2010. *Lancet*, *382*, 1575–1586. https://doi.org/10.1016/S0140-6736(13)61611-6

Wolter, K. M. (1985). *Introduction to variance estimation*. New York: Springer-Verlag.

World Bank. (2019). GNI per capita, PPP (current international $). Retrieved from https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD?year_high_desc=true

World Health Organization. (1991). *International classification of diseases (ICD-10)*. Geneva, Switzerland: World Health Organization.

World Health Organization. (2005). *Atlas: Child and adolescent mental health resources*. Geneva, Switzerland: World Health Organization.

## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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