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# The role impairment associated with mental disorder risk profiles in the WHO World Mental Health International College Student Initiative

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## Abstract

**Objective:** The objective of this study is to assess the contribution of mental comorbidity to role impairment among college students.

**Methods:** Web-based self-report surveys from 14,348 first-year college students (Response Rate [RR] = 45.5%): 19 universities, eight countries of the World Mental Health International College Student Initiative. We assessed impairment (Sheehan Disability Scales and number of days out of role [DOR] in the past 30 days) and seven 12-month DSM-IV disorders. We defined six multivariate mental disorder classes using latent class analysis (LCA). We simulated population attributable risk proportions (PARPs) of impairment.

**Results:** Highest prevalence of role impairment was highest among the 1.9% of students in the LCA class with very high comorbidity and bipolar disorder (C1): 78.3% of them had severe role impairment (vs. 20.8%, total sample). Impairment was lower in two other comorbid classes (C2 and C3) and successively lower in

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the rest. A similar monotonic pattern was found for DOR. Both LCA classes and some mental disorders (major depression and panic, in particular) were significant predictors of role impairment. PARP analyses suggest that eliminating all mental disorders might reduce severe role impairment by 64.6% and DOR by 44.3%.

**Conclusions:** Comorbid mental disorders account for a substantial part of role impairment in college students.

**KEYWORDS**

college students, disability, role impairment

## 1 | INTRODUCTION

College students are a key group in society in terms of human capital (Abel & Deitz, 2012) as they play a major role in future economic growth and innovation. Most lifetime mental disorders begin in childhood or adolescence (Kessler, Amminger, et al., 2007), and the college years are consequently a peak period for prevalence of recent mental disorders. For instance, a meta-analysis estimated that 30.6% of college students meet criteria for major depression (Ibrahim, Kelly, Adams, & Glazebrook, 2013). Mental disorders have a substantial impact on academic performance (Auerbach et al., 2016; Kessler, Foster, Saunders, & Stang, 1995) and prematriculation onset disorders are strong predictors of college attrition (Auerbach et al., 2016). Mental disorders are also associated with lower employment in adulthood (Mojtabai et al., 2015). Therefore, it is important to detect and treat mental disorders when they exist among college students.

Knowledge about role impairment due to mental disorders among college students is insufficient. We recently reported (Alonso et al., 2018) a high prevalence of severe role impairment in first-year college students in eight countries. We found the highest levels of severe impairment in the domains of close personal relationships and social life and also found high levels of impairment in productive activities. Our results were consistent with previous studies in single countries (Verger, Guagliardo, Gilbert, Rouillon, & Kovess-Masfety, 2010). We also found in that prior report that number of comorbid mental disorders was positively associated with severe role impairment, but the shape of this association was not investigated in detail (Alonso et al., 2018). Taking comorbidity into account is essential given that mental disorders typically do not exist in isolation (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). In addition, for the purposes of intervention, different profiles of comorbidity might call for differentiated intervention services. The association of mental comorbidity with role impairment thus deserves further analysis.

An earlier study in this issue used latent class analysis (LCA) to identify comorbidity patterns (or classes) that are strongly predictive of 12-month suicidality beyond the risks associated with individual disorders, suggesting that there are interactive predictive effects of the disorders in these classes (Auerbach et al., 2018). The analysis found a very small proportion of students (1.9%) in a highly comorbid class associated with high prevalence of bipolar disorder (Class 1), larger proportions of students in two other comorbid classes characterized either by a combination of internalizing and externalizing disorders (Class 2, 5.8%) or mostly internalizing disorders (Class 3, 14.6%), and a final large class of students with pure disorders (16.1%; i.e., each student had only one disorder). Assessing the degree of association of those comorbidity classes with role impairment may help us understand specific care needs of students and facilitate trans-diagnostic interventions (Harrer et al., 2018). Addressing those needs may potentially reduce individual suffering of patients and their families as well as increase the long-term human capital of the societies that today's college students will embody in the future.

The World Health Organization (WHO) World Mental Health International College Student (WMH-ICS) Initiative was developed to obtain accurate longitudinal information about the frequency, correlates, and impact of mental, substance, and behavioral disorders among college students internationally (https://www.hcp.med.harvard.edu/wmh/college_student_survey.php). The aims also included assessing unmet need for treatment, developing a practical method for targeting students in need of outreach, and laying the groundwork for the implementation and evaluation of preventive and clinical interventions.

The objectives of this paper are to estimate among incoming first-year college students in the first wave of the WMH-ICS surveys (a) the prevalence of role impairment (home management/chores, work, close personal relationships and social life, and days out of role) associated with mental comorbidity classes; and (b) the role of comorbid mental disorders in accounting for these role impairments.

## 2 | METHOD

### 2.1 | Sample

The initial round of WMH-ICS surveys was carried out in a convenience sample of 19 colleges and universities (henceforth referred to as colleges) in eight countries (Australia, Belgium, Germany, Mexico, Northern Ireland, South Africa, Spain, and the United States). Details on the participating countries and colleges are provided elsewhere (Alonso et al., 2018) and earlier in this issue of the journal (Auerbach et al., 2016; 2018). Web-based self-report questionnaires were administered to all incoming first-year students between October 2014 and February 2017. To participate in the survey, students had to be enrolled in the first year and fluent in the official language of the country. We excluded all those participants not meeting these inclusion criteria and those who did not provide informed consent. A total of 14,371 eligible questionnaires were completed, with sample sizes ranging from a low of 633 in Australia to a high of 4,580 in Belgium. The weighted (by achieved sample size) mean response rate across all surveys was 45.5%.

### 2.2 | Procedures

All incoming first-year students in the participating colleges were invited to participate in a web-based self-report health survey. The initial mode of contact varied across colleges, with the survey being either part of a health evaluation in some colleges, part of the registration process in others, and implemented as a stand-alone survey delivered via student email addresses in still others. In all cases other than in Mexico (see below), potential respondents were invited to participate and initial nonrespondents were recontacted through a series of personalized reminder emails containing unique electronic links to the survey. Ten colleges implemented conditional incentives in the final stages of refusal conversion (e.g., a raffle for store credit coupons and movie passes). In addition, one site (Spain) used an "end-game strategy" consisting of a random sample of nonrespondents at the end of the normal recruitment period that was offered incentives for participation. The situation was different in Mexico, where students were invited to participate in conjunction with mandatory activities, which varied from college to college (e.g., student health evaluations and tutoring sessions), with time set aside for completing the survey during the sessions. Informed consent was obtained before administering the questionnaires in all countries. Procedures for obtaining informed consent and protecting human participants were approved and monitored for compliance by the institutional review boards of the organizations coordinating the surveys in each country. At the end of the survey, all respondents received a general notification on how to access specialized mental health services at their colleges. Students who reported recent and/or severe suicide thoughts or behaviors additionally received more detailed information about available resources within their college and/or community. Details about ethics approval for the WHO WMH-ICS Initiative countries is available in this link: http://www.hcp.med.harvard.edu/wmh/ftpdir/IRB_EthicsApproval_WMH-ICS.pdf.

### 2.3 | Measures

#### 2.3.1 | Role impairment outcomes

Severity of health-related role impairment in the past 12 months was assessed using an adapted version of the Sheehan Disability Scale (SDS; Leon, Olfson, Portera, Farber, & Sheehan, 1997) that assessed impairment separately in each of four role domains: home management/chores, work roles, close personal relationships, and social life. Impairments in home management were defined as difficulties in such things as "cleaning, shopping, and working around the house, apartment or yard." Impairments in work were defined as difficulties in the "ability to work as well as most of other people." Impairments in close personal relationships were defined as difficulties in "the ability to initiate and maintain close personal relationships." Impairments in social life, finally, were not defined. A 0 to 10 visual analogue scale was used to rate the degree of impairment for each domain. In each of these four cases (Ibrahim et al., 2013), respondents were asked to rate the extent to which problems with their physical or emotional health interfered with their activities in this area on a 0-to-10 scale with labels associated with scale values of *no* (0), *mild* (1–3), *moderate* (4–6), *severe* (7–9), and *very severe* (10) interference. A summary 0–40 scale that combines all four responses has a Cronbach's in the total sample of 0.87. Consistent with prior WMH reports (Kessler & Ustun, 2004; Wittchen, Nelson, & Lachner, 1998), we defined two dichotomies for each of the four SDS role domains as well as for the maximum score across these domains to define respondents who reported any impairment (i.e., scores in the range 1–10 versus 0) and severe interference (i.e., scores in the range 7–10 versus 0–6). In addition, respondents were asked how many days out of 30 in the past month they were totally unable to work or carry out their other normal daily activities because of problems with their physical or mental health or because of problems due to their use of alcohol or drugs.

#### 2.3.2 | Mental disorders

Due to the size and logistical complexities of the surveys, it was impossible to administer an in-depth psychiatric diagnostic interview to each student. Instead, the survey instrument consisted of a series of short validated self-report screening scales for lifetime and 12-month prevalence of seven common DSM-IV disorders. These included four internalizing disorders (major depressive episode, mania/hypomania, generalized anxiety disorder, and panic disorder) and three externalizing disorders (attention deficit hyperactivity disorder [ADHD], alcohol abuse or dependence, and drug abuse or dependence involving either cannabis, cocaine, any other street drug, or a prescription drug either used without a prescription or used more than prescribed to get high, buzzed, or numbed out). This is a larger set of disorders than used in previous college mental health surveys, most of which either focused only on depression (for review, see Ibrahim et al., 2013) or included only screening scales of current anxious and depressive symptoms (Mahmoud, Staten, Hall, & Lennie, 2012). Although a much larger set of disorders is used in the face-to-face WMH (Scott, De Jonge, Stein, & Kessler, 2018), concerns were raised

about administering student surveys that would be long enough to include all those disorders. The seven disorders in the core WMH-ICS surveys were consequently a compromise that included the disorders associated with the highest levels of role impairment among college students in the WMH surveys (Auerbach et al., 2016). As an indication of the coverage of these disorders, 83% of the college students in the WMH surveys who reported suicidal ideation in the 12 months before interview met criteria for one or more of these seven disorders during that same time period.

The assessments of five of the seven disorders were based on the Composite international Diagnostic Interview Screening Scales (Kessler, Calabrese, et al., 2013). The other two disorders were based on the Alcohol Use Disorders Identification Test (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) screen for alcohol use disorder and on the WHO Adult ADHD Self-Report Scale (Kessler et al., 2005) for adult ADHD. The CIDI-SC scales have been shown to have good concordance with blinded clinical diagnoses based on the Structured Clinical interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 1994), with area under the curve (AUC) in the range 0.70–0.78 (Kessler, Santiago, et al., 2013). However, these validation studies have not yet been carried out in samples of college students. The version of the AUDIT we used, which defined alcohol use disorder as either a total score of 16+ or a score of 8–15 with 4+ on the AUDIT dependence questions (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), has been shown to have concordance with clinical diagnoses in the range AUC = 0.78–0.91 (Reinert & Allen, 2002). Additional items taken from the CIDI (Kessler & Ustun, 2004) were used to assess age-of-onset of each disorder and number of lifetime years with symptoms. The DSM-IV version of the ASRS was found to have good concordance with blinded clinical diagnoses based on a standard research diagnostic interview for adult ADHD in two separate clinical studies (Kessler, Adler, et al., 2007; Kessler & Ustun, 2004).

In addition to assessing lifetime prevalence of all the above disorders other than ADHD, brief screening assessments were made for lifetime prevalence of binge-eating disorder, intermittent explosive disorder, and post-traumatic stress disorder, but 12-month evaluation of these disorders was not done in this initial round of the WMH-ICS surveys. This omission has been corrected in the more recent version of the survey that is currently being administered. For purposes of the analyses reported here, these disorders were coded as lifetime, but not 12-month, disorders even though it is almost certainly the case that at least some of these disorders were active in the 12 months before the survey. The inclusion of these disorders in the current analysis accounts for discrepancies in the proportion of students who are estimated to have lifetime disorders compared with the proportion presented in an earlier report (Auerbach et al., 2018).

#### 2.3.3 | Socio-demographics and college-related factors

The following socio-demographic variables were included in the survey: gender, age, parental education, parental marital status, urbanicity of the place the student was raised, religious background, sexual orientation, the extent to which respondents were attracted to men and women, and the gender(s) of people they had sex with (if any) in the past 5 years. Respondents were also asked where they ranked academically compared with other students at the time of their high school graduation, what their most important reason was to go to college, where they were living during the first semester of the academic year, and if they expected to work during the school year. More detailed descriptions of these measures are presented elsewhere (Alonso et al., 2018) and earlier in this issue (Auerbach et al., 2018).

### 2.4 | Analysis methods

#### 2.4.1 | Weighting

The data were weighted to adjust for socio-demographic differences between survey respondents and the population data reported by college administrators. The analyses reported here are based on 14,348 respondents, for whom poststratification weights were computed. Standard methods for poststratification weighting were used for this purpose (Groves & Couper, 1998). Comparisons of these distributions showed that the only meaningful difference was that females had a somewhat higher response rate than males. In Spain, respondents to the end-game interviews were given a weight equal to 1/p, where p represented the proportion of nonrespondents at the end of the normal recruitment period that was included in the end-game, to adjust for the undersampling of these hard-to-recruit respondents. This meant that the data were doubly weighted in the case of the Spanish survey, one to include the end-game weight and then with the poststratification weight applied to those weighted data. For the analyses, each country was given an equal sum of weights, with the total sum of weights across countries set at 14,348.

#### 2.4.2 | Analysis of the associations between latent classes and impairment

As described in more detail in a separate paper in this issue (Auerbach et al., 2018), LCA (Magidson & Vermunt, 2004) was used to examine multivariate profiles among the seven 12-month DSM-IV disorders. LCA is an analysis approach that classifies each person in the analysis into one of a small number of multivariate profiles (referred to as "classes"), in this case defined by the cross-classification of the seven 12-month DSM-IV disorders in such a way as to capture the main patterns of comorbidity among these disorders. Once an optimal number of classes is selected and their characteristics defined, each respondent is assigned to the class with the highest probability of membership for purposes of subsequent analysis.

Once the latent classes were defined, SAS version 9.4 (SAS Institute Inc., 2017) was used to examine associations of LCA classes with role impairment using logistic regression analysis as well as ordinary linear regression for the association of LCA classes with number of days out of role. All models were adjusted by socio-demographic and college-related variables. Logistic regression coefficients and their 95% confidence intervals (CIs) were exponentiated to compute odds ratios (ORs) and associated 95% CIs to facilitate interpretation. All

results were pooled across countries using a fixed effects modeling (FEM) approach by including dummy control variables for country. Due to the variable within-country sample sizes, no attempt was made to search for variation in associations across countries. We chose FEM instead of a multilevel modeling approach to account for the nested structure of the data because our focus is on pooled within-group associations between individual-level predictors and outcomes rather than geographic variation in mean outcome scores. In a situation of this sort, FEM is preferable because it yields estimates of individual-level associations comparable with multilevel analysis without the restrictive, and in our case incorrect, assumption in the latter approach that the aggregate units (i.e., countries and universities within countries) represent random samples from the population of all such units (Goldstein, 2010).

We computed population attributable risk proportions (PARPs) of the impairment outcome measures due to the disorders considered here by using simulation methods. The simulations began by calculating the expected scores on the role impairment outcome measures based on prediction models that included the LCA classes as predictors. We then recalculated these individual-level predicted outcome scores based on the assumption that all respondents were in the class with no lifetime disorders. The difference in mean values of these two scores divided by the mean for the observed data was used to define the proportion of impairment that we might expect to be prevented with complete eradication of the mental disorders considered here. The implicit assumption here is that the coefficients in the prediction models were due to causal effects of disorders on impairments, although the PARP estimates are useful as descriptive measures of association even when this assumption of causality cannot be supported rigorously.

Due to the amount of item-level missing data in the surveys being relatively large (for the most part because not all surveys assessed all constructs), we used the method of multiple imputation by chained equations (Van Buuren, 2012) with 20 imputations per case to adjust for item-missing data. See Auerbach et al. (2018) for details about the missing data patterns. Significance tests were consistently carried out using.05-level two-sided multiple imputation-adjusted tests.

## 3 | RESULTS

### 3.1 | Socio-demographic distribution of the sample

As described in more detail elsewhere in this issue (Auerbach et al., in press), a majority of respondents (54.8%, ranging from 51.4% in Germany to 60.7 in the United States) were female and most others male (44.7%, range = 38.2% to 51.0%), with the small remaining number defining themselves as either transsexual or "other" (0.5%, range = 0.0% to 1.2%). Most respondents were either 16–18 years of age (51.1%), 19 (25.8%), or 20–21 (12.2%). The vast majority (96.5%) were full-time students. The majority of respondents defined themselves as heterosexual with no same-sex attraction (72.4%) and the others as either heterosexual with some same-sex attraction (14.1%), nonheterosexual without same-sex intercourse (8.1%), or nonheterosexual with same-sex intercourse (5.4%).

### 3.2 | Distribution of comorbidity classes/patterns among 12-month mental disorders

A detailed report on 12-month prevalence of mental disorders in this sample is presented elsewhere (Auerbach et al., 2018). In addition, a report on the distribution of multivariate LCA profiles among these disorders is presented separately in this issue (Auerbach et al., 2018). As shown in that report, 38.4% of respondents screened positive for at least one of the 12-month disorders, and clear multivariate profiles among these disorders were detected in LCA. The least common class (C1; 1.9% of students) was made up of students with high comorbidity (four or more disorders, the majority including mania/hypomania). Three other classes consisted of students with combined internalizing-externalizing comorbidity (C2; 5.8%), mostly internalizing comorbidity (C3; 14.6%), and pure disorders (C4; 16.1%; that is, each student in this class had one and only one disorder). Two other classes consisted of students with no 12-month disorders that either did (C5; 29.2%) or did not (C6; 32.4%) have a lifetime history of one or more of the disorders.

### 3.3 | Prevalence of role impairments

About three quarters (74.6%) of students reported at least some health-related role impairment in at least one of the four SDS role domains (i.e., a score in the range 1–10 on at least one of the four 0-to-10 SDS scales; Table 1). Between 45.3% (home) and 61.6% (social) of students reported at least some impairment in each of the four role domains. Severe role impairments were much less common, with 20.8% of respondents reporting severe role impairment in at least one role domain and between 6.7% (home) and 12.4% (social) in individual role domains.

As expected, SDS role impairment scores were significantly associated with number of days out of role (Table 2). Students who reported severe role impairment in at least one SDS domain had a mean of 6.5 days out of role in the past 30 days compared with means of 2.5 days among students with nonsevere role impairment and 0.8 days among students with no role impairment on any SDS domain. The work role domain was most strongly associated with number of days out of role, and the mean number of such days among students who reported severe work role impairment (8.0 days) tended to be higher, although not significantly so in statistical terms, than the

**TABLE 1** Distributions of Sheehan Disability Scale (SDS) impairment in the total sample ($n$ = 14,348)

| | Any | | Severe | | Severe/Any | |
|---|---|---|---|---|---|---|
| | % | (SE) | % | (SE) | % | (SE) |
| Home | 45.3* | (0.7) | 6.7* | (0.4) | 14.9* | (0.8) |
| Work | 58.7* | (0.6) | 9.7* | (0.4) | 16.6* | (0.6) |
| Relationship | 57.3* | (0.6) | 11.4* | (0.4) | 20.0* | (0.7) |
| Social | 61.6* | (0.6) | 12.4* | (0.4) | 20.1* | (0.7) |
| Any | 74.6* | (0.5) | 20.8* | (0.5) | 27.8* | (0.7) |

*Significant at the 0.05 level, two-sided MI-corrected test.

**TABLE 2** Mean number of days out of role associated with Sheehan Disability Scale (SDS) role impairment ($n$ = 14,348)

| | None | | Any | | Nonsevere | | Severe | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | (SE) | Mean | (SE) | Mean | (SE) | Mean | (SE) | $F_2$[a] |
| Home | 1.6 | (0.6) | 4.5 | (1.1) | 3.9 | (0.3) | 7.6 | (2.0) | 408.2* |
| Work | 1.1 | (0.3) | 4.2 | (0.3) | 3.4 | (0.7) | 8.0 | (2.3) | 772.9* |
| Relationship | 1.5 | (0.4) | 4.0 | (0.3) | 3.2 | (0.7) | 6.9 | (1.7) | 422.1* |
| Social | 1.3 | (0.5) | 3.9 | (0.3) | 3.2 | (0.7) | 6.6 | (1.5) | 499.0* |
| Any | 0.8 | (0.4) | 3.6 | (0.3) | 2.5 | (0.5) | 6.5 | (1.1) | 806.1* |

[a]Test of the association between a three-category SDS score (0, 1–6, 7–10) and number of days out of role.

*Significant at the 0.05 level, two-sided MI-corrected test.

means among students who reported severe role impairments in any of the other three role domains (6.6–7.6).

## 3.4 | Associations of comorbidity LCA classes with role impairment outcomes

A generally monotonic association was found between complexity of comorbidity and prevalence of SDS role impairment (Table 3). Class 1 (C1) had by far the highest prevalence of both any impairment (98%) and severe impairment (78.3%). Prevalence of both any impairment and any severe impairment were lower and roughly equal in the two other comorbid classes C2 and C3 (91.7–94.5% any; 43.4–50.0% severe) and successively lower in the pure disorder class (C4), and the classes with no 12-month disorders either in the presence (C5) or absence (C6) of lifetime disorders (81.6–55.6% any; 23.9–6.3% severe). Also, a similar generally monotonic pattern was found between LCA classes and both probability of having any days out of role and mean number of days out of role. The highest probability of any days out of role, as well as of mean number of days out of role in the past 30 days, were in C1 (90.4%; 8.6 days). They were lower, and comparable to each other, in C2 and C3 (73.7–77.8%; 5.4–5.5 days) and successively lower in C4 (58.7%; 3.1 days), C5 (52.2%; 2.4 days), and C6 (35.4%; 1.4 days). A similar pattern is observed in each impairment domain with increasing prevalence of impairment as complexity of comorbidity, according to the defined classes, increased, and similar results are observed in classes C2 and C3.

## 3.5 | The joint associations of LCA classes and disorders with role impairment

We estimated multivariable models in which either LCA classes, the DSM-IV disorders underlying these classes, or both were used to

**TABLE 3** Associations of latent (LCA) classes with role impairment outcomes ($n$ = 14,348)[a]

| | Class 1 $n$ = 174 (1.9%) | | Class 2 $n$ = 676 (5.8%) | | Class 3 $n$ = 1,740 (14.6%) | | Class 4 $n$ = 2,212 (16.1%) | | Class 5 $n$ = 4,525 (29.2%) | | Class 6 $n$ = 5,021 (32.4%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | (SE) | % | (SE) | % | (SE) | % | (SE) | % | (SE) | % | (SE) | $F_5$ |
| I. Any role impairment | | | | | | | | | | | | | |
| Home | 90.5* | (2.8) | 67.2* | (2.9) | 69.1* | (1.6) | 51.1* | (1.9) | 41.1* | (1.3) | 28.9* | (1.1) | 157.5* |
| Work | 93.8* | (2.4) | 83.3* | (2.1) | 84.8* | (1.1) | 66.4* | (1.6) | 57.3* | (1.1) | 38.1* | (1.1) | 270.4* |
| Relationship | 93.2* | (2.5) | 80.5* | (2.2) | 84.1* | (1.1) | 65.8* | (1.6) | 56.1* | (1.2) | 36.0* | (1.1) | 290.6* |
| Social | 95.7* | (1.6) | 83.5* | (2.0) | 88.1* | (1.0) | 70.0* | (1.5) | 60.9* | (1.1) | 40.4* | (1.1) | 270.4* |
| Any | 98.0 | (1.1) | 91.7* | (1.5) | 94.5* | (0.7) | 81.6* | (1.3) | 77.1* | (1.0) | 55.6* | (1.1) | 209.7* |
| II. Severe role impairment | | | | | | | | | | | | | |
| Home | 39.7* | (5.1) | 13.7* | (2.3) | 15.5* | (1.3) | 7.1* | (0.9) | 4.0* | (0.6) | 1.9* | (0.4) | 90.8* |
| Work | 49.5* | (5.2) | 21.9* | (2.6) | 25.4* | (1.5) | 9.8* | (1.0) | 4.5* | (0.5) | 3.0* | (0.4) | 171.9* |
| Relationship | 49.9* | (5.2) | 26.9* | (2.7) | 28.3* | (1.5) | 12.7* | (1.1) | 6.0* | (0.6) | 3.2* | (0.5) | 183.0* |
| Social | 53.0* | (5.2) | 23.7* | (2.6) | 33.1* | (1.6) | 13.3* | (1.2) | 7.1* | (0.7) | 3.2* | (0.4) | 190.7* |
| Any | 78.3* | (4.1) | 43.4* | (3.0) | 50.0* | (1.7) | 23.9* | (1.4) | 12.4* | (0.9) | 6.3* | (0.6) | 314.5* |
| III. Days out of role (maximum of 30)[b] | | | | | | | | | | | | | |
| Any Days | 90.4* | (2.7) | 73.9* | (2.5) | 77.8* | (1.3) | 58.7* | (1.6) | 52.2* | (1.2) | 35.4* | (1.1) | 218.0* |
| Number of Days | 8.6* | (0.7) | 5.4* | (0.4) | 5.5* | (0.2) | 3.1* | (0.2) | 2.4* | (0.1) | 1.4* | (0.1) | 173.6* |

[a]C1: High comorbidity; C2: other internalizing-externalizing comorbidity; C3: primarily internalizing comorbidity; C4: pure disorders; C5: no 12-month disorders with a lifetime history of at least one disorder; C6: no lifetime disorders.

[b]Entries in the Any Days row represent the proportion of students in each class who had any days out of role in the past 30 days. Entries in the Number of Days row represent the mean number of days out of role over that time period.

*Significant at the 0.05 level, two-sided MI-corrected test.

predict SDS role impairments and days out of role controlling for country and socio-demographics. The global significance tests in models that included both sets of predictors ranged from $F_5$ = 9.6–103.5 for classes, and $F_{1-6}$ = 9.0–65.8 for disorders, all of them being statistically significant (see Table S1). We made no attempt to evaluate interactions between classes and disorders based on a prior finding that we lacked the statistical power to do this in predicting other outcomes (Auerbach et al., 2018).

Inspection of the predictive effects of disorders in models that controlled for classes shows that the significant coefficients involving disorders were almost entirely positive (44 out of 46; Tables 4 and 5). The exception was a negative association between alcohol use disorder and social role impairment as well as with any SDS impairment (OR = 0.8, 95% CI [0.6, 0.9] and OR = 0.7, 95% CI [0.6, 0.9], respectively) suggesting the social facilitating effects of alcohol use in a college setting. Major depression was the only disorder that had significant associations with all 12 outcomes. Panic disorder had significant associations with 11 out of the 12 outcomes and ADHD with nine of the 12, followed by drug use disorder (6/12), bipolar disorder (4/12), alcohol use disorder (4/12), and generalized anxiety disorder (0/12).

The LCA classes were also significant as a set in all 12 models, with 93% (56/60) of the associations statistically significant between the five class dummy variables (compared with omitted C6) and the 12 outcomes. The significant associations of the classes with the outcomes were entirely positive, suggesting synergistic effects of comorbidity on impairments. Consistent with this interpretation, the strongest associations involved the comorbid classes (C1–C3). Most strikingly, the high-comorbidity class (C1) was associated with odds ratios of 7.8 in predicting social role impairment, and 7.1 in predicting any work role impairment, 5.1 in predicting severe work role impairment, 10.0 in predicting severe close personal relations role impairment, and 7.1 in predicting severe social role impairment (Table 5). Other significant ORs were in the range 2.2–7.8 and were 15.5–10.3 for C1 predicting the aggregated outcomes of any SDS role impairment and severe role impairment across all role domains.

Associations of socio-demographic and college-related variables predicting role impairment outcomes are presented in Table S2.

## 3.6 | Population attributable risk proportions

We obtained an indication of the extent to which mental disorders influence the role functioning of students by calculating PARP (Table 6). Estimates of the proportion of any SDS role impairment that might be prevented if all students were in C6 (i.e., no lifetime disorders) were 21.4% for any role impairment, 30.1–32.8% for any impairment within SDS role domains, higher for days out of role (30.2% for any and 44.3% for number of days out of role), and much higher for severe impairment (64.6% for any and 65.5%–70.1% within SDS role domains). C3 accounted for the largest proportion of impairment, although other classes were important in absolute terms due to the larger proportions of students in those classes. In relation to the small proportion of students in C1 (1.9%), this class accounted for a higher proportion of all the impairment outcomes (7.0–9.8% of severe impairment within SDS role domains).

**TABLE 4** Associations of 12-month LCA classes and underlying 12-month DSM-IV disorders with role impairment outcomes ($n$ = 14,348)[a]

| | Any SDS role impairment | | Any severe SDS role impairment | | Any days out of role | | Number of days out of role | |
|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | *b* | (SE) |
| I. Classes | | | | | | | | |
| C1 | 15.5* | [5.4, 44.4] | 10.3* | [6.6, 16.0] | 2.7* | [1.4, 5.4] | 1.0 | (1.3) |
| C2 | 5.9* | [4.0, 8.5] | 4.0* | [3.1, 5.3] | 1.8* | [1.2, 2.5] | 0.3 | (0.7) |
| C3 | 8.6* | [6.7, 11.1] | 6.5* | [5.2, 8.0] | 3.4* | [2.8, 4.1] | 1.8* | (0.3) |
| C4 | 3.0* | [2.5, 3.6] | 2.5* | [2.1, 3.1] | 1.7* | [1.4, 2.0] | 0.0 | (0.3) |
| C5 | 2.6* | [2.4, 2.9] | 1.9* | [1.6, 2.3] | 2.0* | [1.8, 2.2] | 0.7* | (0.1) |
| $F_5$ | 103.5* | | 67.5* | | 62.4* | | 16.6* | |
| II. Internalizing disorders | | | | | | | | |
| Major depressive episode | 1.8* | [1.4, 2.1] | 2.2* | [1.9, 2.5] | 1.7* | [1.4, 2.0] | 2.0* | (0.3) |
| Bipolar spectrum disorder | | | | | 1.9* | [1.4, 2.7] | 1.4* | (0.6) |
| Generalized anxiety disorder | | | | | | | | |
| Panic disorder | 2.3* | [1.3, 4.3] | 1.7* | [1.3, 2.3] | 1.9* | [1.4, 2.5] | 1.5* | (0.5) |
| III. Externalizing disorders | | | | | | | | |
| Alcohol use disorder | 0.7* | [0.6, 0.9] | | | 1.4* | [1.2, 1.7] | 0.7 | (0.5) |
| ADHD | | | 1.4* | [1.2, 1.7] | 1.5* | [1.3, 1.8] | 1.2* | (0.3) |
| Drug use disorder | | | | | 1.6* | [1.2, 2.1] | 2.0* | (0.7) |
| $F_v$[b] | 14.7* | | 36.2* | | 10.5* | | 9.0* | |

[a]Based on forward stepwise regression models that included all five latent class analysis (LCA) classes C1–C5 in addition to all individual disorders that stepped in at the 0.05 level of significance using MI-adjusted two-sided tests.

[b]v = the number of mental disorders assessed in Parts II and III of the table.

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

**TABLE 5** Associations of 12-month LCA classes and underlying 12-month DSM-IV disorders with role impairment outcomes ($n$ = 14,348)

| | Home | | Work | | Relationship | | Social | |
|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| I. Any role impairment | | | | | | | | |
| A. Classes | | | | | | | | |
| C1 | 2.2* | [1.0, 4.6] | 7.1* | [3.9, 12.9] | 3.2* | [1.6, 6.5] | 7.8* | [3.8, 19.1] |
| C2 | 1.3 | [0.9, 1.8] | 3.9* | [3.0, 5.1] | 2.4* | [1.8, 3.3] | 3.5* | [2.6, 5.5] |
| C3 | 2.5* | [2.0, 3.0] | 5.2* | [4.4, 6.2] | 4.8* | [4.0, 5.7] | 5.9* | [5.1, 7.7] |
| C4 | 1.4* | [1.2, 1.7] | 2.2* | [1.9, 2.6] | 2.1* | [1.9, 2.4] | 2.4* | [2.1, 3.1] |
| C5 | 1.6* | [1.5, 1.9] | 2.2* | [2.0, 2.4] | 2.2* | [2.0, 2.4] | 2.3* | [2.2, 2.6] |
| $F_5$ | 29.3* | | 90.5* | | 88.9* | | 90.8* | |
| B. Internalizing disorders | | | | | | | | |
| Major depressive episode | 1.7* | [1.5, 2.0] | 1.6* | [1.3, 1.8] | 2.0* | [1.7, 2.3] | 2.0* | [1.6, 2.3] |
| Bipolar spectrum disorder | 1.9* | [1.3, 2.7] | | | 1.6* | [1.1, 2.3] | | |
| Generalized anxiety disorder | | | | | | | | |
| Panic disorder | 1.8* | [1.3, 2.4] | 2.3* | [1.6, 3.3] | 1.9* | [1.4, 2.7] | 2.3* | [1.5, 3.6] |
| C. Externalizing disorders | | | | | | | | |
| Alcohol use disorder | 1.4* | [1.1, 1.7] | | | | | 0.8* | [0.6, 0.9] |
| ADHD | 1.8* | [1.5, 2.1] | 1.5* | [1.2, 1.8] | 1.5* | [1.2, 1.7] | 1.2 | [1.0, 1.5] |
| Drug use disorder | 2.1* | [1.5, 3.1] | | | 1.6* | [1.1, 2.2] | 1.6* | [1.1, 2.3] |
| $F_v$ | 12.0* | | 17.2* | | 15.6* | | 17.9* | |
| II. Severe role impairment | | | | | | | | |
| A. Classes | | | | | | | | |
| C1 | 4.7* | [2.5, 8.9] | 5.1* | [3.3, 7.9] | 10.0* | [6.7, 14.8] | 7.1* | [4.5, 11.2] |
| C2 | 2.2* | [1.4, 3.6] | 2.7* | [1.9, 3.8] | 5.2* | [3.9, 7.0] | 3.4* | [2.4, 4.7] |
| C3 | 3.5* | [2.4, 5.2] | 4.0* | [3.1, 5.2] | 6.4* | [5.0, 8.2] | 6.4* | [4.9, 8.3] |
| C4 | 2.1* | [1.4, 3.1] | 1.8* | [1.4, 2.3] | 2.8* | [2.2, 3.6] | 2.6* | [2.0, 3.4] |
| C5 | 2.0* | [1.4, 2.8] | 1.4* | [1.1, 1.8] | 1.8* | [1.4, 2.3] | 2.2* | [1.7, 2.8] |
| $F_5$ | 9.6* | | 23.2* | | 54.6* | | 40.8* | |
| B. Internalizing disorders | | | | | | | | |
| Major depressive episode | 1.7* | [1.4, 2.2] | 2.2* | [1.9, 2.7] | 2.0* | [1.7, 2.3] | 2.2* | [1.9, 2.6] |
| Bipolar spectrum disorder | | | | | | | | |
| Generalized anxiety disorder | | | | | | | | |
| Panic disorder | 1.6* | [1.2, 2.2] | 1.7* | [1.3, 2.2] | | | 1.3* | [1.0, 1.7] |
| C. Externalizing disorders | | | | | | | | |
| Alcohol use disorder | | | | | | | | |
| ADHD | 1.8* | [1.4, 2.4] | 1.8* | [1.5, 2.1] | | | 1.3* | [1.1, 1.5] |
| Drug use disorder | 1.7* | [1.1, 2.6] | | | | | | |
| $F_v$ | 10.2* | | 37.0* | | 65.8* | | 28.9* | |

Based on forward stepwise regression models that included all five latent class analysis (LCA) classes C1–C5 in addition to all individual disorders that stepped in at the.05 level of significance using MI-adjusted two-sided tests.

bv: the number of mental disorders assessed in Parts II and III of the table.

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

## 4 | DISCUSSION

To the best of our knowledge, this is the first study to report on the associations of multivariate mental disorders comorbid classes with role impairment among college students in a large, cross-national sample. Three major results are worth highlighting. First, role impairment is frequent among students with mental disorders but much more so among the small fraction (1.9%) of students with high comorbidity (C1), more than three quarters of whom report severe role impairment. Moreover, the associations of mental comorbidity with role impairment outcomes follow a generally monotonic pattern. Second, multivariable models found that both LCA classes and some individual mental disorders (most notably, major depression and panic) were significant predictors of all role impairment outcomes. Controlling for disorders, a monotonic association was found between complexity of comorbidity and role impairment. Finally, PARP analyses showed that eliminating all mental disorders could theoretically reduce severe role impairments among college students by almost two thirds, under the assumption that the observed associations are causal (Krysinska & Martin, 2009). These results suggest the need to target students with existing mental disorders for clinical interventions and students at risk of these disorders for preventive interventions.

**TABLE 6** Population attributable risk proportions (PARPs) of role impairment outcomes due to each 12-month LCA class ($n$ = 14,348)[a]

| | Class 1 (%) | Class 2 (%) | Class 3 (%) | Class 4 (%) | Class 5 (%) | Classes 1–5 (%) |
|---|---|---|---|---|---|---|
| I. Any role impairment | | | | | | |
| Home | 2.1 | 4.1 | 11.0 | 6.8 | 6.9 | 30.8 |
| Work | 1.5 | 3.8 | 10.3 | 6.9 | 8.8 | 31.3 |
| Relationship | 1.5 | 3.7 | 10.8 | 7.4 | 9.4 | 32.8 |
| Social | 1.3 | 3.3 | 9.7 | 6.8 | 9.1 | 30.1 |
| Any | 0.8 | 2.1 | 6.3 | 4.8 | 7.5 | 21.4 |
| II. Severe role impairment | | | | | | |
| Home | 9.8 | 9.2 | 27.6 | 11.4 | 8.3 | 66.4 |
| Work | 8.5 | 10.5 | 32.3 | 10.3 | 3.8 | 65.5 |
| Relationship | 7.1 | 11.1 | 30.7 | 12.3 | 6.4 | 67.6 |
| Social | 7.0 | 8.8 | 33.8 | 12.1 | 8.4 | 70.1 |
| Any | 5.9 | 9.5 | 29.1 | 12.4 | 7.6 | 64.6 |
| III. Days out of role (maximum of 30)[b] | | | | | | |
| Any days | 1.8 | 3.7 | 10.1 | 6.4 | 8.3 | 30.2 |
| Number of days | 4.1 | 6.8 | 18.2 | 7.9 | 7.2 | 44.3 |

[a]PARPs were calculated across all 20 multiply imputed data sets combined and should be interpreted as average values across these datasets. The models used to calculate PARPs controlled for country and socio-demographics.

[b]The percentages represent the expected reductions in numbers of days out of role as a percentage of total number of currently observed days out of role in the full sample.

In a previous study, we reported a strong association between mental disorders and role impairment (Alonso et al., 2018). This association was strongest for social life, close personal relationships, and work domains, and in particular in the case of major depressive episode and generalized anxiety disorder. In that study, the number of comorbid mental disorders was associated with a higher likelihood of role impairment, but in multivariable models, the relationship between comorbidity and impairment was subadditive; that is, for a person within a given mental disorder, a comorbid disorder would add impairment but less so than it would be expected if the latter disorder happened alone. Results presented here show that the association of comorbidity classes with role impairments is also monotonic, with the class characterized by highest comorbidity showing the highest level of impairment, the other comorbid classes (either predominantly internalizing or mixed internalizing and externalizing) having intermediate levels of impairment, the class characterized by pure disorders having lower impairments, and the classes with no disorders having the lowest impairments. These results, coupled with the finding reported by Auerbach et al. (2018) of comparable associations of disorder classes with suicidal ideation and behaviors, suggest that LCA class membership would be a useful marker of risk to use in targeting clinical interventions for students.

It is also important to note that several disorders were associated with variation in role impairment net of the effects of class. Impairments were most consistently associated with major depression, panic disorder, and ADHD after adjusting for class membership. This association is consistent with evidence for the special importance of these disorders in previous surveys among students (Verger et al., 2010) as well as in the general population (Comer et al., 2011; Edlund et al., 2018). However, the LCA showed that substantial proportions of the students with these disorders also had other diagnoses, making it important to consider the use of trans-diagnostic approaches in treating these students (Barlow et al., 2017). The high prevalence of students with multiple mental disorders creates a challenge for delivery of these or other treatments. As discussed in a number of the other papers in this special issue, the existence of inexpensive evidence-based online interventions with proven effectiveness could help address this problem (Cuijpers, Kleiboer, Karyotaki, & Riper, 2017; Ebert et al., 2018). This approach could be of special value among college students, who have ready access to, and familiarity with, computers and given their low levels of use of conventional mental health services (Bruffaerts et al., under review; Thorley, 2017).

## 4.1 | Strengths and limitations

An important strength of our study is that it was based on a large sample that included students across eight different countries. Pooling across these different countries was facilitated by using a consistent methodology as well as highly standardized data management and analysis procedures. Nevertheless, our findings should be considered in light of several limitations.

First, the response rates were low in several sites, although these response rates compare favorably to those achieved in other large-scale college student surveys (39–44%; Eisenberg, Hunt, & Speer, 2013; Paul, Tsypes, Eidlitz, Ernhout, & Whitlock, 2015). Although it has been shown that the empirical relationship between response rate and nonresponse bias is weak (Groves, 2006), recent findings warn of potential overestimation of mental disorders when response rates are low (Mortier et al., 2018). In addition, the colleges and universities we surveyed were convenience samples rather than nationally representative samples of incoming first-year students, which may limit the representativeness of the data.

Second, data are not available on the validity of diagnostic assessments even though, as noted in Section 2.3, diagnoses of 12-month prevalence of the seven core disorders based on screening scales have

shown good concordance with diagnoses based on blinded semistructured clinical interviews in other populations. In addition, the very brief screens for lifetime binge-eating disorder, intermittent explosive disorder, and post-traumatic stress disorder have never been validated. Our assumption that none of these lifetime disorders was active in the 12 months before the survey is almost certainly inaccurate, leading to some misclassification of comorbidity classes. This also accounts for discrepancies in the proportion of students estimated to have lifetime disorders here compared with those in an earlier report (Auerbach et al., 2018). This omission has been corrected in the more recent version of the survey that is currently being administered, and we should be able to estimate if misclassification bias in our analyses is of any importance.

Third, we used an adapted version of the SDS. The original scale was targeted for individuals with mental disorders and asked specifically about the impairment caused by such conditions (Klemenc-Ketis, Kersnik, Eder, & Colaric, 2011). The modified scale used in our study did not differentiate between physical and mental health. This may have led us to attribute impairment related to physical health to the presence of mental disorders. However, bias should be small given that impairment of mental disorders as measured by the SDS tends to be considerably higher than that of physical conditions (Ormel et al., 2008). Nonetheless, additional analyses taking into account the presence of physical disorders could help better estimate those effects.

Finally, the LCA was based on the assumption that true underlying classes exist that lead the disorders to be conditionally independent within classes. If this assumption is incorrect, it might be that other methods would yield more useful characterizations of the multivariate profiles among disorders. This possibility needs to be investigated in future analyses of the WMH-ICS data.

## 5 | CONCLUSIONS

This online survey of first-year college students in eight countries revealed strong associations of mental disorders with role impairment outcomes, especially severe impairment, with magnitudes in terms of population attributable risk that were very comparable for all four role domains we considered. The LCA results showed that comorbidity had special importance in predicting severe role impairment, suggesting that the classes defined by the existence of comorbidity might be useful as markers of need for treatment. The high prevalence of comorbid mental disorders among college students creates a challenge for treatment. Innovative e-therapies are available that might be useful in diminishing role impairment among university college students.

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### CONFLICTS OF INTEREST

In the past 3 years, Dr. Kessler received support for his epidemiological studies from Sanofi Aventis; was a consultant for Johnson & Johnson Wellness and Prevention, Sage Pharmaceuticals, Shire, Takeda; and served on an advisory board for the Johnson & Johnson Services Inc. Lake Nona Life Project. Kessler is a co-owner of DataStat, Inc., a market research firm that carries out healthcare research.

Dr. Ebert reports to have received consultancy fees/served in the scientific advisory board from several companies such as Minddistrict, Lantern, Schoen Kliniken, and German health insurance companies (BARMER, Techniker Krankenkasse). He is also stakeholder of the Institute for Health Training Online (GET.ON), which aims to implement scientific findings related to digital health interventions into routine care.

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## SUPPORTING INFORMATION

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

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