



Research paper

Mental disorders & self-injurious thoughts and behaviors predict high risk of role impairment among university students - results from the world mental health international college student initiative



Jordi Alonso <sup>a,b,c,\*</sup>, Maria V. Petukhova <sup>d</sup>, Sue Lee <sup>d</sup>, Nancy A. Sampson <sup>d</sup>, Yasmin A. Altwaijri <sup>e</sup>, Ahmad N. AlHadi <sup>f,g</sup>, Nouf K. Al-Saud <sup>e</sup>, Claes Andersson <sup>h</sup>, Randy P. Auerbach <sup>i</sup>, Laura Ballester <sup>a,b</sup>, Jason Bantjes <sup>j,k,l</sup>, Marcus Bendtsen <sup>m</sup>, Corina Benjet <sup>n</sup>, Anne H. Berman <sup>o</sup>, Paula Carrasco <sup>b,p,q</sup>, Silver C.N. Chan <sup>r</sup>, Irina Cohut <sup>s</sup>, Marcelo A. Crockett <sup>t</sup>, Pim Cuijpers <sup>u,v</sup>, Oana A. David <sup>w</sup>, Dong Dong <sup>x</sup>, Jorge Gaete <sup>t,y</sup>, Mireia Felez-Nobrega <sup>z</sup>, Carlos García Forero <sup>aa</sup>, Margalida Gili <sup>ab</sup>, Raúl A. Gutiérrez-García <sup>ac</sup>, Josep Maria Haro <sup>z,ad</sup>, Xanthe Hunt <sup>j,ae</sup>, Álvaro I. Langer <sup>t,af</sup>, Irene Léniz <sup>ag</sup>, Yan Liu <sup>ah</sup>, Scarlett Mac-Ginty <sup>t,ai</sup>, Vania Martínez <sup>t,aj</sup>, Andre Mason <sup>ak</sup>, Andrea Miranda-Mendizabal <sup>ad,al</sup>, Daniel Núñez <sup>am,an</sup>, Claudiu C. Papasteri <sup>ao</sup>, José A. Piqueras <sup>ap</sup>, Codruta A. Popescu <sup>aq</sup>, Charlene Rapsey <sup>ar</sup>, Tiscar Rodriguez-Jimenez <sup>as</sup>, Wylene Saal <sup>at</sup>, Oi-ling Siu <sup>au</sup>, Dan J. Stein <sup>av</sup>, Sascha Y. Struijs <sup>u</sup>, Cristina T. Tomoiga <sup>w</sup>, Samuel Y.S. Wong <sup>x</sup>, Gemma Vilagut <sup>a,b</sup>, Ronald C. Kessler <sup>d</sup>, World Mental Health International College Student collaborators <sup>1</sup>

<sup>a</sup> Health Services Research Group, Hospital del Mar Research Institute, Carrer del Doctor Aiguader, 88 08003, Barcelona, Spain

<sup>b</sup> Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública, Instituto de Salud Carlos III (CIBERESP, ISCIII), Av. Monforte de Lemos, 3-5. Pabellón 11. Planta 0, 28029, Madrid, Spain.

<sup>c</sup> Department of Medicine and Life Sciences, Pompeu Fabra University (UPF), Barcelona, Spain

<sup>d</sup> Department of Health Care Policy, Harvard Medical School, Boston, MA, USA

<sup>e</sup> Biostatistics, Epidemiology and Scientific Computing Department, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

<sup>f</sup> Department of Psychiatry, College of Medicine, King Saud University, Riyadh, Saudi Arabia

<sup>g</sup> SABIC Psychological Health Research & Applications Chair (SPHRAC), Department of Psychiatry, College of Medicine, King Saud University, Riyadh, Saudi Arabia

<sup>h</sup> Department of Criminology, Malmö University, Malmö, Sweden

<sup>i</sup> Department of Psychiatry, Columbia University, New York, NY, USA

<sup>j</sup> Mental Health, Alcohol, Substance Use and Tobacco Research Unit, South African Medical Research Council, Cape Town, South Africa

<sup>k</sup> Department of Psychiatry and Mental Health, University of Cape Town, South Africa

<sup>l</sup> Institute for Life Course Health Research, Global Health, Stellenbosch University, South Africa

<sup>m</sup> Department of Health, Medicine and Caring Sciences, Linköping University, Linköping, Sweden

<sup>n</sup> Center for Global Mental Health Research, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Mexico City, Mexico

<sup>o</sup> Department of Psychology, Uppsala University, Uppsala, Sweden

<sup>p</sup> Department of Medicine, Universitat Jaume I, Castellón de la Plana, Spain

<sup>q</sup> Epidemiology and Environmental Health Joint Research Unit, FISABIO-Universitat Jaume I-Universitat de València, Valencia, Spain

<sup>r</sup> The Hong Kong University of Science and Technology, Hong Kong

<sup>s</sup> Career Counseling and Guidance Center, Technical University of Cluj-Napoca, Romania

<sup>t</sup> Nucleus to Improve the Mental Health of Adolescents and Youths (Imhay), Santiago, Chile

<sup>u</sup> Faculty of Behavioural and Movement Science, Department of Clinical, Neuro- and Developmental Psychology, Vrije Universiteit Amsterdam, the Netherlands

<sup>v</sup> Department of Clinical Psychology and Psychotherapy, Babes-Bolyai University, Cluj-Napoca, Romania

<sup>w</sup> DATA Lab, International Institute for Advanced Studies in Psychotherapy and Applied Mental Health, Babeş-Bolyai University, Cluj-Napoca, Romania

<sup>x</sup> The Jockey Club School of Public Health and Primary Care, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong

<sup>y</sup> Centro de Investigación en Salud Mental Estudiantil (ISME), Facultad de Ciencias Sociales, Universidad de los Andes, Santiago, Chile

<sup>z</sup> Parc Sanitari Sant Joan de Deu, Institut de Recerca Sant Joan de Deu (IRSJD), Sant Boi de Llobregat, Barcelona, Spain

<sup>aa</sup> Departamento de Medicina, Universitat Internacional de Catalunya (UIC), Barcelona, Spain

<sup>ab</sup> Department of Psychology, University of the Balearic Islands (UIB), Palma, Mallorca, Spain

\* Corresponding author at: Pompeu Fabra University, Hospital del Mar Research Institute, CIBERESP/ISCIII, PRBB Building, Carrer del Doctor Aiguader 88, 08003, Barcelona, Spain.

E-mail address: [jordi.alonso@upf.edu](mailto:jordi.alonso@upf.edu) (J. Alonso).

<sup>ac</sup> Faculty of Higher Education Universidad La Salle Bajío, campus Salamanca, Mexico  
<sup>ad</sup> Centro de investigación Biomédica en Red en Salud Mental (CIBERSAM), ISCIII, Madrid, Spain  
<sup>ae</sup> Africa Health Research Institute (AHRJ), Durban, South Africa  
<sup>af</sup> Facultad de Psicología y Humanidades, Universidad San Sebastián, Santiago, Chile  
<sup>ag</sup> Dirección de Salud Mental, Universidad de O'Higgins, Rancagua, Chile.  
<sup>ab</sup> School of Public Health, Jining Medical University, Jining, 272067, Shandong Province, PR China.  
<sup>ai</sup> Department of Health Service & Population Research, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK  
<sup>aj</sup> Centro de Medicina Reproductiva y Desarrollo Integral del Adolescente (Cemera), Facultad de Medicina, Universidad de Chile, Santiago, Chile  
<sup>ak</sup> School of Psychological and Social Sciences, University of Waikato, Hamilton, New Zealand  
<sup>al</sup> Sant Joan de Déu Research Institute, Carrer de Santa Rosa, 39-57, 08950, Esplugues del Llobregat, Spain  
<sup>an</sup> Nucleus Imhay, Santiago, Chile  
<sup>ar</sup> Facultad de Psicología, Universidad de Talca, Talca, Chile  
<sup>ac</sup> Department of Psychology and Cognitive Sciences, University of Bucharest, Romania  
<sup>ap</sup> Department of Health Psychology, Universidad Miguel Hernández de Elche (UMH), Alicante, Spain  
<sup>ad</sup> Department of Human Sciences, 'Iuliu Hatieganu' University of Medicine and Pharmacy, Cluj-Napoca, Romania  
<sup>ar</sup> Department of Psychological Medicine, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand  
<sup>as</sup> Department of Psychology and Sociology, Universidad de Zaragoza (UNIZAR), Zaragoza, Spain  
<sup>at</sup> Department of Social Sciences, Sol Plaatje University, South Africa.  
<sup>au</sup> Department of Psychology, Lingnan University, Hong Kong  
<sup>av</sup> SAMRC Unit on Risk & Resilience in Mental Disorders, Dept of Psychiatry & Neuroscience Institute, University of Cape Town, South Africa

## ARTICLE INFO

**Keywords:**  
 role impairment  
 university students  
 mental disorders  
 self-injurious thoughts and behaviors  
 risk prediction  
 risk concentration  
 targeted interventions

## ABSTRACT

**Objective:** We examined psychopathological conditions accounting for the highest risk of role impairment among university students.

**Method:** Cross-sectional online survey of first-year students (60 universities, 10 countries) assessing role impairment due to emotional problems in previous 30 days with the 3-item emotional subscale of the VR-36. Cross-tabulations and Poisson regression examined associations between 12 psychopathological conditions (8 probable mental disorders and 4 SITB) and socio-demographics with "significant role impairment" ("most"/"all of the time" in 2+ VR-36 items). We used machine learning methods to predict probabilities (risk) of significant role impairment based on the 12 psychopathological conditions. Observed prevalence of significant role impairment was examined within and across the 20 population ventiles to assess risk concentration using sensitivity (SN) and positive predictive value (PPV).

**Results:** 43,990 students responded to the survey (median age = 19, IQR = 18–23). 27.1 % had significant role impairment due to emotional problems and 65.8 % had at least one psychopathological condition. Students with one or more of these conditions were more likely to have significant impairment than those without (RR = 3.9; 95 %CI: 3.6–4.2). In multivariable analyses, probable Depression and Bipolar disorders were the strongest correlates of significant impairment. Most (69.6 %) of the observed significant role impairment occurred among the roughly 35 % of respondents with highest predicted risk (PPV = 53.2 %).

**Conclusion:** Significant role impairment due to emotional problems is highly prevalent among university students. High risk of significant role impairment concentrates in one third of the students, those with several psychopathological conditions. Assessing these conditions should help identifying highest role impairment risk university students.

## 1. Introduction

University students represent an increasingly large segment of the young adult population (OECD, 2019 <https://www.oecd.org/education-at-a-glance>), and they are positioned to become future leaders and influential contributors to societal progress (Abel and Deitz, 2012; Astin, 1993; Eisenberg et al., 2025). The university experience is characterized by numerous personal and contextual transitions,

including intensified academic pressures, evolving social relationships, and potential separation from familial support networks, all of which contribute to high perceived stress levels and can adversely affect mental health.

Mental disorders are highly prevalent among university students—including anxiety, depression, and substance-related disorders (Ahmed et al., 2023; Auerbach et al., 2018; Ibrahim et al., 2013; Jenkins et al., 2021; Mason et al., 2025) and are strongly associated with role impairment, adversely affecting academic performance, social interactions, and overall daily functioning (Beiter et al., 2015; Blanco et al., 2008; King et al., 2021). Of particular concern is the high prevalence of non-suicidal self-injury (NSSI) and suicidality, which not only indicate severe psychological distress but also further exacerbate impairment in both academic and social realms (Garlow et al., 2008). Vulnerability to mental disorders among university students has been exacerbated by the COVID-19 pandemic (Browning et al., 2021; King et al., 2023; Zarowski et al., 2024).

Evidence reveals that a considerable proportion of university students experience health-related role impairment, with prevalence estimates ranging from 20 % to 33 % across various studies (Alonso et al., 2018; Eisenberg et al., 2009). While impairment is associated with both physical and mental disorders (Wilks et al., 2020) but mental disorders and, in particular, comorbid mental disorders, are especially important (Alonso et al., 2019). Role impairment among university students is

<sup>1</sup> The WMH-ICS collaborators are: Yesica Albor, Patricia M. Báez-Mansur, Lukoye Atwoli, Caroline Ayuya Muaka, Harald Baumeister, Marilisa Bozzo, Guilherme Borges, Elsie Breet, Ronny Bruffaerts, Paula Cristóbal-Narvaez, Sergio Cruz-Hernández, David D. Ebert, Nadia Garnefski, Penelope Hasking, Praxedis Cristina Hernández Uribe, Kristen Hudec, Petra Hurks, Mathilde M. Husky, Karen Jacobs, Florence Jaguga, Leontien Jansen, Ana Lucía Jiménez-Pérez, Fanny Kähkle, Elisabeth F. Klinkenberg, Vivian Kraaij, Ann-Marie Küchler, Irene Léniz, Rodrigo Antunes Lima, Christine Lochner, Francisca Ongecha Owuor, Muthoni Mathai, Margaret McLafferty, Maria Elena Medina-Mora, Iris Ruby Monroy-Velasco, Tiana Mori, Lonna Munro, Richard J. Munthali, Elaine K. Murray, Catherine M. Musyoka, Catalin Nedelcea, Jessica Nooj, Siobhan M. O'Neill, Maria Abigail Paz-Peréz, Ana Paula Prescivalli, Marisa Rebagliato, Danielle Remmerswaal, Kealagh Robinson, Miquel Roca, Elske Salemink, Claudia van der Heijde, Eunice Vargas-Contreras, Shelby Vereecke, Daniel V. Vigo, Wouter Voorspoels, Angel Y. Wang, Reinout W. Wiers

associated with academic challenges—such as declining performance and increased dropout rates (Eisenberg et al., 2009; Misra and McKean, 2000). Predicting risk of role impairment among university students could facilitate preventive actions and avoid poor academic outcomes.

Here we present data on the prevalence and correlates of role impairment associated with emotional problems among university students in 60 universities across 10 countries covering 4 broad world regions who participated in the World Mental Health International College Student (WMH-ICS) surveys. We then examine the extent to which specific psychopathological conditions predict the highest risk of this impairment.

## 2. Methods

### 2.1. Participant and procedures

This is a cross-sectional study of online surveys carried out between 2020 and 2023 in a convenience sample of 60 universities across 10 countries (Chile, China, Mexico, Netherlands, New Zealand, Romania, Saudi Arabia, South Africa, Spain, and Sweden). The same measures and procedures were used in all universities. While some specific recruitment strategies varied by institution (e.g., number of email reminders, additional classrooms information, see *Supplementary Table 1*), attempts were generally made to recruit 100 % of first-year undergraduate students via emails provided by participating universities. The emails requested participation in a confidential online survey of student mental health. Participants were provided with a study description, an informed consent script, and a university phone number or e-mail address for questions. Incentives, which differed across countries (e.g., raffles for store credit coupons, cash), were offered in 5 of the 10 countries to encourage survey completion (*Supplementary Table 1*). Informed consent was required before administering the survey. Reminder emails were used to increase response rates. Response rates ranged from 5.1 % to 34.7 % (mean = 14.8 %). Within-country sample sizes ranged from  $n = 399$  in Mexico to  $n = 14,475$  in South Africa. Ethics approval details are posted at [https://www.hcp.med.harvard.edu/wmh/ftpdir/IRB\\_EthicsApproval\\_WMH-ICS\\_DSM-5.pdf](https://www.hcp.med.harvard.edu/wmh/ftpdir/IRB_EthicsApproval_WMH-ICS_DSM-5.pdf).

### 2.2. Measures

The self-report questionnaire ([https://www.hcp.med.harvard.edu/wmh/ftpdir/WMH-ICS\\_Baseline\\_survey\\_V3.2\\_FINAL\\_20220228.pdf](https://www.hcp.med.harvard.edu/wmh/ftpdir/WMH-ICS_Baseline_survey_V3.2_FINAL_20220228.pdf)) was developed in English and translated into local languages using a consistent translation, back-translation, and harmonization protocol designed to maximize cross-national equivalence and building on the standard World Health Organization (WHO) protocol (Harkness et al., 2008). The links to the study ethical approvals and questionnaire are available also in the *Supplementary Material*.

#### 2.2.1. Role impairment

We used the three items of the emotional functioning subscale of the Veterans RAND-36-item Health Survey (VR-36) (Kazis et al., 2004a) which asked respondents how often in the past 30 days they had *any of the following problems with your work or other regular activities as a result of any emotional problems*. These were: *accomplished less than you would like; did work or activities less carefully than usual; and cut down on the amount of time you spent on work or other activities*. This version of the VR-36 differs from the widely used SF-36 (Ware and Sherbourne, 1992) in changing dichotomous response options to five-item response options (*none of the time to all of the time*), leading to a reduction in floor and ceiling effects and increasing the reliability and validity of the assessment (Kazis et al., 2004b). The response options were *none, a little, some, most, and all or almost all of the time*. Cronbach's alpha was 0.88. Participants were coded as having “significant role impairment” if they responded either *most or all or almost all* to two or more of the three items. This threshold was selected to capture substantial and consistent

impairment while maintaining comparability with previous epidemiological surveys (Kessler et al., 2003; The ESEMeD/MHEDEA Alonso, 2000 investigators et al., 2004).

#### 2.2.2. Probable mental disorders

Screening scales were used to assess recent prevalence of eight DSM-5 mental disorders (MDx). Probable generalized anxiety disorder (GAD), major depressive disorder (MDD), and panic disorder (PD) in the past 12 months were assessed with the Composite International Diagnostic Interview Screening Scales, (CIDI-SC) Version 3.2). Diagnoses based on CIDI-SC have been shown to have good concordance with diagnoses based on blinded clinical reappraisal interviews (Kessler et al., 2013).

Twelve-month prevalence of probable bipolar I/II disorder (BP) and drug use disorder (DUD) were assessed with the Composite International Diagnostic Interview for DSM-5 (CIDI-5) modified for self-report administration. Although only one clinical reappraisal study has assessed CIDI-5 so far, concordance of diagnoses with diagnoses based on blinded clinical reappraisal interviews was consistently good (AU-ROC = 0.67–0.75) (Khaled et al., 2024).

The three remaining probable mental disorders were post-traumatic stress disorder (PTSD), attention-deficit/hyperactivity disorder (ADHD), and alcohol use disorder (AUD), each assessed with a brief specialized dimensional screening scale. Twelve-month prevalence of PTSD was assessed with the 4-Item Short-Form of the PTSD Checklist for DSM-5 (PCL-5; (Weathers et al., 2013; Zuromski et al., 2019), a widely used and validated screening scale (Georgescu et al., 2024; Hansen et al., 2023; Kramer et al., 2023). We established probable disorder by using a cut-point of 5+ on the 4-Item Short-Form PCL-5 (each item scored in the range 0–4 for a total score of 0–16). This cut-point has been shown in previous research to have good concordance with DSM-5 diagnoses in the full PCL-5 (AU-ROC = 0.98) (Zuromski et al., 2019).

Six-month prevalence of attention-deficit/hyperactivity disorder (ADHD) was assessed with the Adult Self-Report Scale-V1.1 (ASRS-V1.1) Screener (Kessler et al., 2007), a widely used and validated 6-item screening scale of adult ADHD (each item scored in the range 0–4 for a total score of 0–24) (Zuromski et al., 2019). We established probable diagnose by using a cut-point of 14+, which has been shown to have good concordance with blinded clinical diagnoses in multiple clinical reappraisal studies (Kessler et al., 2007; Kessler et al., 2005).

Twelve-month prevalence of probable AUD was assessed with the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 1992), a widely used and validated 10-question screening scale for AUD (each item scored in the range 0–4 for a total score of 0–40). We used the standard AUDIT scoring rules for possible dependence (either a score of 16 or more on the 0–40 total AUDIT or a score of 8–15 on the total AUDIT in conjunction with a score of 4+ on the AUDIT dependence subscale), which has had high concordance with blinded clinical diagnoses of AUD in prior research (AU-ROC = 0.91) (Toner et al., 2019). However, as more recent studies suggest that a lower threshold might be preferable for university students, we also included AUDIT scores for likely abuse (8+ on the total AUDIT) (Villarosa-Hurlocker et al., 2020).

#### 2.2.3. Self-injurious thoughts and behaviors

12-month non-suicidal self-injury (NSSI) was assessed with a question from the self-report version of the Self-Injurious Thoughts and Behaviors Interview (SITBI; (Nock et al., 2007) about whether the respondent ever did *something to purposely hurt yourself, without wanting to die*. Positive responses to this question were followed by questions about frequency and recency. Responses to these questions have been consistently found to have excellent test-retest reliability (Fox et al., 2020; Latimer et al., 2013; Nock et al., 2007). We used the proposed DSM-5 criterion of engaging in NSSI five or more times in the last 12 months (American Psychiatric Association, 2022) as the cut-point for defining recent NSSI.

The survey also asked about lifetime and recent suicide ideation, suicide plans, and suicide attempts (STB) using questions adapted from

the Columbia-Suicide Severity Rating Scale (Posner et al., 2011). Two questions were asked about ideation (*Did you ever wish you were dead or would go to sleep and never wake up?* and *Did you ever have thoughts of killing yourself?*), one about plans (*Did you ever think about how you might kill yourself or work out a plan of how to kill yourself?*), and one about attempts (*Did you ever purposefully hurt yourself with at least some intent to die?*). Participants who responded positively to each question were then asked whether the experience occurred in the past 12 months. Collectively, the eight probable mental disorders (MDx) and the four indicators of Self-Injurious thoughts and behaviors (SITB) are called “psychopathological conditions” throughout the text.

#### 2.2.4. Socio-demographics

We considered respondent age (dichotomized into less than 20 versus 20+ years old, given the sample median age of 19 years), sex at birth (male versus female), gender identity (dichotomized into same versus different from sex at birth), sexual orientation (dichotomized into heterosexual/straight versus other), and parent education (highest education of either parent dichotomized into college degree versus less than college degree). As neither gender identity nor sexual orientation was assessed in Saudi Arabia, gender identity was set equal to sex at birth and sexual orientation was set equal to heterosexual in that survey.

#### 2.3. Data analysis

Post-stratification weights were used to adjust for nonresponse bias with respect to socio-demographic variables within universities to have the same distributions as the total student body at their university on the cross-classification of age and sex. 30-iteration multiple imputation (MI) by chained equations (Van Buuren, 2012) was then used to adjust for within-survey item non-response, missing data due to skip logic errors that occurred occasionally in individual surveys (between <1 % and 3 %), and random internal subsampling of survey sections (between 13.1 % for bipolar disorder and 21.5 % for alcohol use disorder). The latter was used as a variation of the split questionnaire design proposed by Raghunathan and Grizzle (Raghunathan and Grizzle, 1995) to allow surveys to be shortened while still obtaining some information about all constructs from all respondents by subsampling question administration and then imputing random missing values to full samples using MI methods. We did this in universities where concerns were raised about survey length by administering diagnostic stem questions for four diagnoses – PD, BD, PTSD, and AUD – to all respondents and then administered full diagnostic sections only to a probability subsample of 40 % of the respondents who endorsed the stems. Given the high comorbidities that exist among common mental disorders (McGrath et al., 2020), access to full diagnostic data for more than 60 % of respondents (i.e., 100 % of those in the surveys that did not use subsamples plus a random 40 % in surveys that used subsampling, where each of the four subsampled diagnoses had a 40 % chance of being assessed in full versus only with diagnostic stem questions) allowed us to generate appropriate estimates for these screening disorders.

Simple cross-tabulations were used to estimate the overall significant role impairment due to emotional problems in daily life. Both univariable and multivariable Poisson regression models were then used to examine associations between socio-demographics and the 12 psychopathological conditions with significant role impairment. They were estimated with log link, robust standard errors, and the correction for multiple imputation. Exponentiated Poisson regression coefficients are reported here as risk ratios (RRs) with 95 % confidence intervals adjusting for sociodemographic data, country, year of survey completion, and whether students were surveyed in the first three months of the academic year.

We also used machine learning (ML) methods to generate predicted probabilities of significant role impairment from the presence of the 12 psychopathological conditions. We considered three models: a simple lasso penalized regression model (Tibshirani, 1996); a random forests

model that allowed for interactions among the dichotomous predictors (Breiman, 2001) and a super learner ensemble model (Van Der Laan et al., 2007).

Each respondent in the sample was assigned a 10-fold cross-validated predicted probability of significant role impairment based on the best ML model, which was defined as the model with the lowest cross-validated mean-squared error of prediction. Respondents were then divided into ventiles (20 equal-sized population segments) based on the rank ordering of these predicted values (1 the highest, 20 the lowest). Observed prevalence of significant role impairment was then examined within and across each of these ventiles to assess concentration of risk by calculating sensitivity (SN; the proportion of observed role impairment within each ventile and cumulatively across ventiles) and positive predictive value (PPV; the prevalence of significant role impairment within individual ventiles and cumulatively across ventiles). The calibration plot of the ML model is presented in *Supplementary Figure*.

Finally, population attributable risk proportions (PARPs) were calculated to estimate the proportion of significant role impairment associated with the psychopathological conditions assessed here. This was done by calculating the predicted probability of significant role impairment for each respondent twice, both predictions based on the model coefficients in the final multivariable model, but in the first case with all respondents assumed not to have any of the conditions while in the second case with the observed values of all predictors being used (Greenland and Drescher, 1993). The ratio of the mean predicted prevalence of significant role impairment in the two models defines the proportion of outcome cases that would be expected to remain if we were able to remove all the psychopathological conditions successfully based on the assumption that the RR estimates represent unconfounded causal effects. 1 minus this ratio then defines PARP; that is, the proportion of observed significant role impairment that is due to the 12 psychopathological conditions.

As observations were weighted to make post-stratification adjustments and were clustered within universities, design-based standard errors of prevalence estimates were obtained using weighted frequency analyses with stratification by university and modified multivariable Poisson models with robust standard errors were estimated in STATA (StataCorp LLC, 2024) to adjust for the effects of the data being weighted and geographically clustered (Tabatabai et al., 2014).

These analyses had not been pre-registered.

### 3. Results

#### 3.1. Sample characteristics

The total of 43,990 student respondents had a median age of 19 years (IQR = 18–23; Table 1). Participants from universities in the Middle East/Africa were slightly older with a median age of 22 (IQR = 19–27) relative to Europe (median = 19, IQR = 18–21), and the Americas and Asia/Pacific (median = 18, IQR = 18–19) regions. A majority of the sample was female at birth (total sample = 60.1 %) with similar estimates across regions. The great majority in the total sample were cis-gender (98.1 %), with estimates ranging from 96.9 % in the Americas to 99.7 % in the Middle East/Africa region. The majority of the total sample was also heterosexual (76.0 %), with estimates ranging from 67.2 % in the Americas to 86.2 % in the Middle East/Africa region. Close to half of respondents had at least one parent with a college degree (44.8 %), with estimates ranging from 30.1 % in the Middle East/Africa region to 57.5 % in the Europe region.

Over one out of every four respondents in the total sample (27.1 %) had significant role impairment due to emotional problems. The highest prevalence was in the Americas (34.2 %) and lowest in the Middle East/Africa region (19.7 %). The distribution of responses for each impairment item in the total sample are displayed in *Supplementary Table 2*.

**Table 1**Distribution of socio-demographics characteristics and of significant role impairment due to emotional problems, overall and by region<sup>a</sup>.

	Total Sample		The Americas		Europe		Middle East/ Africa		Asia/ Pacific	
	Est	(SE)	Est	(SE)	Est	(SE)	Est	(SE)	Est	(SE)
<b>I. Socio-demographics</b>										
Age										
20+ (%)	52.3	(0.2)	22.6	(0.5)	55.3	(0.4)	71.4	(0.3)	16.5	(0.8)
Median	19	–	18	–	19	–	22	–	18	–
IQR	18–23		18–19		18–21		19–27		18–19	
Sex, gender modality, sexual orientation										
Female sex at birth (%)	60.1	(0.3)	55.3	(0.6)	60.3	(0.4)	62.4	(0.4)	59.3	(1.0)
Transgender <sup>b</sup> (%)	1.9	(0.1)	3.1	(0.2)	2.8	(0.1)	0.3	(0.0)	2.4	(0.3)
Not heterosexual <sup>c</sup> (%)	24.0	(0.2)	32.8	(0.5)	29.6	(0.4)	13.8	(0.3)	23.2	(0.8)
Parental education										
College graduate (%)	44.8	(0.2)	42.6	(0.6)	57.5	(0.4)	30.1	(0.4)	53.6	(0.9)
II. Significant role impairment <sup>d</sup> (%)	27.1	(0.2)	34.2	(0.6)	30.9	(0.4)	19.7	(0.3)	26.1	(0.8)
(n)	(43,990)		(7624)		(17,158)		(15,705)		(3503)	

Abbreviations: Est estimate; SE standard error of Est; IQR interquartile range (25th–75th percentiles of the age distribution).

<sup>a</sup> Data were multiply imputed,  $m = 30$ .<sup>b</sup> Defined as self-reported male assigned sex at birth and identifying as female or another gender or female assigned sex at birth and male or another gender identity.<sup>c</sup> Self-reported sexual orientation was gay or lesbian, bisexual, asexual, not sure, or other.<sup>d</sup> The respondent reported that they either “most of the time” or “all of the time” experienced two or more of the three health-related role impairments assessed in the survey.

### 3.2. Associations of the 12 psychopathological conditions with significant role impairment

Previous WMH-ICS reports presented information about the prevalence and correlates of mental disorders (Mason et al., 2025) and measures of NSSI and STB (Husky et al., 2024; Mortier et al., 2025) assessed in these surveys. Here, the univariable and multivariable associations of the 12 psychopathological conditions with role impairment are presented in Table 2. About two-thirds (65.8 %) of the total sample had at least one psychopathological condition (a probable mental disorder or SITB). The most prevalent mental disorder was PTSD (33.8 %) followed by MDD (25.9 %) and AUD (23.3 %). Suicidal ideation was also very common (35.6 %). Prevalence of psychopathological conditions by region are reported in *Supplementary Table 3*. Nearly three-quarters (71.6 %) of the European region had at least one psychopathological condition, while the Middle East/Africa region had the lowest prevalence across regions (56.9 %).

As shown in Table 2, univariable models (2nd column) showed a positive statistically significant association between each of the 12 psychopathological conditions and significant role impairment at the  $p < 0.05$  level. Respondents with any psychopathological condition were 3.9 times more likely than those without any psychopathological condition to have significant role impairment due to emotional problems. MDD, GAD, suicidal ideation, and PTSD had the strongest individual-level associations with role impairment (RRs = 2.3–2.9). The majority of these associations remained statistically significant in the multivariable model (3rd column), with the interquartile range (IQR) of RRs ranging from 1.0 to 1.4 and the strongest individual-level associations involving MDD and BP (RR = 2.3 and 2.2, respectively;  $F_{12} = 559.5$ ,  $p < 0.001$ ). Comparable multivariable associations by region are reported in *Supplementary Table 4* ( $F_{12} = 43.6$ –211.1,  $p < 0.001$ ). These associations did not differ significantly across regions ( $F_{36} = 1.0$ ,  $p = 0.47$ ).

### 3.3. Concentration of risk

Table 3 displays the median number of psychopathological conditions (2nd column) in each of 20 ventiles of predicted role impairment risk in the total sample. Predicted risk was estimated by an optimal machine learning model (defined as the model with the minimum cross-validated mean-squared error), made up of all the 12 psychopathological conditions. Notably, this optimal model was the lasso penalized regression model, which assumed that the joint associations of

the different psychopathological conditions with significant role impairment were additive on the log-odds scale (AUC = 0.799) (*Supplementary fig. 1*). The median number of psychopathological conditions for those in the top 5 % of risk (i.e., ventile 1) was 6.2 (IQR = 5.3–7.2), followed by a median of 4.6 (IQR = 3.8–5.3) in the next ventile (i.e., ventile 2), etc. The Sensitivity (SN; prevalence of role impairment) for the first ventile was 14.3 %, followed by 12.1 % for the second ventile, for a cumulative sensitivity of 26.4 % among the 10 % of respondents with highest predicted risk. The 4th column of the table shows that at the 7th ventile (which represents roughly the 35 % of the sample with highest predicted probabilities based on the lasso model) the cumulative SN was 69.6 %. That is, more than two-thirds or true cases of significant role impairment were found to exist in this 35 % of the sample. The cumulative PPV (last column) at ventile 7 was 53.2 %.

The median number of psychopathological conditions and Sensitivity estimates by region are presented in *Supplementary Table 5*. As shown, the concentration of risk and PPV for high-risk students were generally quite similar across regions. Prevalence estimates for each psychopathological condition by concentration of risk are presented in *Supplementary Table 6*.

### 3.4. Multivariable association of socio-demographics with significant role impairment

Table 4 displays multivariable associations between socio-demographic characteristics and significant role impairment in two parallel models. The first model (Model 1) estimated these associations without controlling for psychopathological conditions. Female sex at birth, transgender, and not being heterosexual were associated with significant increased risk of significant role impairment (RR = 1.2–1.6), while older students (20+ years of age) had a significantly lower prevalence of significant role impairment than younger students (RR = 0.9). Parent education was not statistically significant ( $p = 0.25$ ). In the model that controlled by psychopathological conditions (Model 2), only age (RR = 0.9) and sexual orientation (RR = 1.1) remained statistically significant at the  $p = 0.001$  level. However, the 12 psychopathological conditions explained most of the effect of sexual orientation as the magnitude of the RR decreased. In addition, controlling for psychopathological conditions explained the effect of sex and gender identity, as these socio-demographics were no longer statistically significant ( $p = 0.75$  and 0.39, respectively).

Table 5 presents the estimated population attributable risk

**Table 2**

Univariable and multivariable associations of the 12 psychopathological conditions with significant role impairment due to emotional problems in the t ( $n = 43,990$ )<sup>a</sup>.

	12-month prevalence		Univariable		Multivariable <sup>b</sup>	
	%	(SE)	RR	(95 % CI)	RR	(95 % CI)
<b>I. Probable Mental Disorders</b>						
Major depressive disorder	25.9	(0.2)	2.9*	(2.8–3.0)	2.3*	(2.2–2.4)
Bipolar I/II disorder	4.2	(0.1)	2.0*	(1.9–2.1)	2.2*	(2.0–2.3)
Generalized anxiety disorder	14.6	(0.2)	2.6*	(2.5–2.7)	1.3*	(1.3–1.3)
Panic disorder	9.1	(0.2)	1.9*	(1.8–2.0)	1.0	(1.0–1.1)
Post-traumatic stress disorder	33.8	(0.3)	2.3*	(2.2–2.4)	1.4*	(1.3–1.4)
Attention deficit/hyperactivity disorder	6.7	(0.1)	1.9*	(1.9–2.0)	1.3*	(1.2–1.3)
Alcohol use disorder	23.3	(0.3)	1.3*	(1.2–1.4)	1.1*	(1.0–1.1)
Drug use disorder	7.6	(0.1)	1.7*	(1.6–1.8)	1.1*	(1.1–1.2)
<b>II. Self-Injurious Thoughts and Behaviors</b>						
NSSI	4.0	(0.2)	2.1*	(2.0–2.2)	1.0	(1.0–1.1)
Suicide ideation	35.6	(0.7)	2.4*	(2.3–2.5)	1.4*	(1.4–1.5)
Suicide plan	15.7	(0.5)	2.1*	(2.0–2.2)	1.0	(1.0–1.1)
Suicide attempt	2.9	(0.4)	1.9*	(1.8–2.1)	1.0	(0.9–1.1)
<b>III. Any psychopathological condition</b>						
Any	65.8	(0.4)	3.9*	(3.6–4.2)	–	–
F <sub>12</sub>	–	–	–	–	559.5*	–

Abbreviations: % prevalence of the psychopathological conditions; SE design-based standard error of %; RR relative-risk of the association between the risk factor and persistent role impairment; 95 % CI design-based 95 % confidence interval of RR; NSSI non-suicidal Self-Injurious.

<sup>a</sup> Data were multiply imputed,  $m = 30$ . RR and 95 % CIs were obtained from modified log Poisson regression models with robust standard errors. All models controlled for country, survey year, a dummy variable for whether the survey was administered during the first 3 months of the academic year, and socio-demographics. A separate univariable model was estimated for the risk factor in each row of the table, while a single multivariable model was estimated for all 12 conditions combined.

<sup>b</sup> Multivariable associations did not differ significantly across regions,  $F_{36} = 1.0$ ,  $p = 0.47$ .

\* Significant at the  $p = 0.05$  level, two-sided design-based test.

proportions (PARPs) of persistent role impairment attributable to the 12 psychopathological conditions considered. Overall, 68.0 % of role impairment could be avoided if those 12 conditions were eliminated, ranging from 60.6 % in Middle East/Africa to 72 % in Asia/Pacific.

#### 4. Discussion

Previous studies have revealed that a considerable proportion of university students experience role impairment and that it is associated with mental disorders (Alonso et al., 2019; Alonso et al., 2018). Building on previous work of the World Mental Health International College Surveys (WMH-ICS), this study evaluated students from 60 universities in ten countries across four world regions and identified a number of relevant results. First, one out of every four university students report substantial and sustained role impairment due to emotional problems. Second, as expected, probable mental disorders and self-injurious thoughts and behaviors are highly associated with such persistent role impairment. Our results extend current knowledge by showing that this level of association is similar in all the study regions, and by estimating that over two thirds (68 %) of the sustained role impairment could be potentially avoided if the 12 psychopathological conditions studied

could be prevented or eliminated. Importantly, the majority of risk of significant role impairment (i.e., 69.6 %) is concentrated in a minority of students (about 35 %) with the highest predicted risk. These students have at least two or more psychopathological conditions. Finally, the only factor associated with role impairment other than psychopathology that we observed is non-heterosexual orientation. Collectively, these findings considerably extend previous knowledge about the risk of role impairment among university students, and suggest the importance of identifying students at highest risk who could benefit from indicated prevention.

Some limitations of our study deserve discussion. First, our measure of psychopathological conditions was incomplete, as several impairing mental disorders were not studied. As a consequence, we might have underestimated the association between psychopathology and role impairment. Second, although we assessed psychopathological conditions with good sensitivity and specificity (Ballester et al., 2019), their positive predictive value (PPV) is modest. Thus, they are not suitable for establishing individual-level clinical diagnosis (Hu et al., 2023; Siu et al., 2016; Thombs et al., 2018). The misclassification of mental disorders might have led us to further underestimate the association between psychopathological conditions and significant impairment. Another important limitation is that diagnoses were assessed with screening scales that, although validated, might have different thresholds among student than in the general population, resulting in the high prevalence estimates found here. The existence of high comorbidity, with some students classified as meeting criteria for many disorders, could also be a partial artifact of the screening scales used here. However, it is noteworthy that substantial overlap exists in the symptom criteria of the DSM-5 disorders considered here, resulting in high levels of comorbidity even when diagnoses are based on gold standard clinical diagnostic interviews (Newson et al., 2021). Third, our study is based on a convenience selection of universities and response rates were sub-optimal, which may have biased prevalence estimates (Cheung et al., 2017; Groves, 2006; Office for National Statistics. Internet users. Office for National Statistics., 2018). However, we used an online closed recruitment approach, which is associated with fewer response biases (Hewson, 2016). Importantly, we applied analytical weighing to ensure that the results were representative of the overall target student population, thus minimizing bias in prevalence estimations (Miller, 2020). Finally, while our study provides estimates of concentration of risk of role impairment among university students, it does not assess the accuracy of screening in this population.

Our study also has several strengths. It is based on a large international sample of university students (about 44,000) covering different regions worldwide. Also, we assessed role impairment that was attributed by respondents to “emotional problems”, thus increasing the specificity of its association with probable mental disorders and self-injurious thoughts and behaviors. In addition, our assessment of role impairment was based in key relevant dimensions (from partial difficulties to complete loss of performance) and we used a high-level cutoff (2 out of the three dimensions should be affected “most or all of the time”). By assessing substantial and persistent role impairment, we enhance the potential relevance of our results.

##### 4.1. Comparison with previous research

Our results are consistent with previous research showing high levels of role impairment associated with emotional problems among university students (Alonso et al., 2019; Alonso et al., 2018; Eisenberg et al., 2009; Jenkins et al., 2021; King et al., 2021). Also aligned with previous reports is our observation of a higher risk of significant role impairment among students with probable mental disorders, in particular Major Depression Episode (RR = 2.9), GAD (R = 2.6), Suicidal Ideation (RR = 2.4), and PTSD (RR = 2.3). In general, associations were substantially attenuated in multivariable models that adjusted for all other psychopathological risk factors, except for probable MDE (OR = 2.3) and

**Table 3**

Distribution of 12 psychopathological conditions according to ordered ventile of predicted probability of significant role impairment, within-ventile Sensitivity (SN) and Positive Predictive Value (PPV) of the lasso model in the 10-fold cross-validated total sample<sup>a</sup>.

Ventile <sup>b</sup>	%	(SE)	Median and IQR number of 12-month psychopathological conditions		Sensitivity		Cumulative Sensitivity		Positive Predicted Value		Cumulative Positive Predicted Value	
			Median	(Q1-Q3)	SN	(SE)	SN	(SE)	PPV	(SE)	PPV	(SE)
1	5.1	(0.1)	6.2	(5.3-7.2)	14.3	(0.3)	14.3	(0.3)	76.5	(1.0)	76.5	(1.0)
2	5.0	(0.1)	4.6	(3.9-5.3)	12.1	(0.3)	26.4	(0.4)	65.9	(1.1)	71.3	(0.7)
3	5.2	(0.1)	3.7	(3.2-4.4)	11.2	(0.3)	37.5	(0.5)	58.4	(1.1)	66.9	(0.6)
4	4.9	(0.1)	2.8	(2.4-3.5)	9.6	(0.3)	47.1	(0.5)	52.9	(1.2)	63.5	(0.6)
5	5.4	(0.1)	2.2	(2.0-2.8)	9.5	(0.3)	56.7	(0.5)	48.3	(1.1)	60.2	(0.5)
6	5.1	(0.1)	1.5	(1.0-2.5)	7.5	(0.3)	64.1	(0.5)	39.9	(1.1)	56.8	(0.5)
7	4.9	(0.1)	2.1	(1.0-2.8)	5.5	(0.2)	69.6	(0.5)	30.4	(1.1)	53.2	(0.4)
8	4.7	(0.1)	1.6	(1.2-2.2)	4.5	(0.2)	74.1	(0.4)	26.3	(1.1)	50.0	(0.4)
9	5.5	(0.1)	1.5	(1.2-1.9)	4.3	(0.2)	78.4	(0.4)	21.3	(0.9)	46.6	(0.4)
10	5.8	(0.1)	1.0	(1.0-1.0)	3.6	(0.2)	82.0	(0.4)	17.0	(0.8)	43.2	(0.4)
11	5.5	(0.1)	1.0	(1.0-1.0)	3.7	(0.2)	85.7	(0.4)	18.4	(0.9)	40.8	(0.3)
12	7.7	(0.1)	1.0	(1.0-1.0)	3.2	(0.2)	89.0	(0.3)	12.1	(0.8)	37.3	(0.3)
13	0.9	(0.0)	1.0	(1.0-1.0)	0.4	(0.1)	89.4	(0.3)	10.3	(1.8)	37.0	(0.3)
14–20	34.5	(0.2)	0.0	(0.0-0.0)	10.6	(0.3)	100.0	–	8.3	(0.2)	27.1	(0.2)

Abbreviations: SE design-based standard error or SN; SN sensitivity (i.e. the proportion of all observed respondents with persistent role impairment in each of ventiles 1–13 and averaged across ventiles 14–20); PPV positive predicted value.

<sup>a</sup> The lasso model was estimated with 10-fold cross-validation in the total sample using stratification across regions. Cross-validated AU-ROC was 0.80. We also trained a random forest model with default hyper-parameter values (Wright & Ziegler, 2017) and a super-learner with an ensemble that included a series of random forest models with different hyper-parameter values along with a series of elastic net regularized regression models with different hyper-parameter values (Friedman et al., 2010). Both these models had cross-validated AU-ROC very similar to that of lasso (i.e., 0.80), documenting that the joint associations of the 12 psychopathological conditions considered here predicting persistent impairment are additive on a logistic scale.

<sup>b</sup> Ventiles were defined separately in the total sample and each region.

**Table 4**

The effect of controlling psychopathological conditions on the multivariable associations of socio-demographics with significant role impairment<sup>a</sup>.

	M1		M2	
	RR	(95 % CI)	RR	(95 % CI)
Age 20+	0.9*	(0.9-1.0)	0.9*	(0.9-0.9)
Female sex at birth	1.2*	(1.1-1.2)	1.0	(1.0-1.0)
Transgender <sup>b</sup>	1.4*	(1.3-1.5)	1.0	(0.9-1.0)
Not heterosexual <sup>c</sup>	1.6*	(1.5-1.6)	1.1*	(1.1-1.2)
Parent college graduate	1.0	(1.0-1.1)	1.0	(1.0-1.0)
Standardized psychopathological risk	–	–	1.8*	(1.8-1.8)

Abbreviations: M1 model 1 estimated multivariable associations of socio-demographics with persistent role impairment without controlling for psychopathological conditions; M2 model 2 estimated multivariable associations of socio-demographics with persistent role impairment with a control for a standardized (to a mean of 0 and variance of 1) measure of psychopathological risk created by assigning each respondent the cross-validated predicted probability of persistent role impairment based on the lasso model in Table 3; RR relative risk; 95 % CI 95 % design-based confidence interval of RR.

<sup>a</sup> Data were multiply imputed,  $m = 30$ . RR and 95 % CIs were obtained from modified log Poisson regression models with robust standard errors. Both M1 and M2 controlled for country, survey year, and a dummy variable for whether the survey was administered during the first 3 months of the academic year.

<sup>b</sup> Defined as either (i) self-reported male assigned sex at birth and currently identifying as anything other than male; or (ii) self-reported female assigned at birth and currently identifying as anything other than female.

<sup>c</sup> Self-reported sexual orientation gay, lesbian, bisexual, asexual, not sure, or other.

\* Significant at the  $p = 0.05$  level, two-sided design-based test.

Bipolar disorder (OR = 2.2), which remained robust in the case of Probable PTSD, ADHD and GAD, as well as Suicidal Ideation were still significantly associated with significant role impairment but to a considerably lesser extent. Of notice, across the four world regions studied here, over two-thirds of the significant role impairment due to emotional problems could be avoided if those 12 conditions were eliminated.

We also observed significant associations of some sociodemographic characteristics with significant role impairment, which are consistent

with previous studies: a higher risk of impairment for the youngest, female sex at birth, transgender, and non-heterosexual students. But after adjusting for a standardized psychological risk score, only the youngest and non-heterosexual students were at a statistically significant increased risk. Our results suggest that the presence of substantive psychopathological symptoms is very likely to lead to role impairment, which increases the risk of academic failure and/or dropout (Eisenberg et al., 2009; King et al., 2021; Misra and McKean, 2000).

#### 4.2. International similarities and differences

An interesting finding in our study is that despite the considerable international diversity of the sample studied, differences across countries were relatively minor for prevalence and, particularly, for association estimates. The largest variation was found for the prevalence of significant role impairment, which ranged from 34 % among students in the Americas to 20 % for Middle East/Africa students. Also, the prevalence of any probable mental disorder varied, ranging from the highest (72 %) in Europe to the lowest (57 %) in the Middle East/Africa. On the other hand, associations between psychological conditions and significant role impairment were very similar across countries. The consistent associations found in our study support their external relevance and reinforce the need to prevent mental disorders and self-destructive behaviors among university students worldwide and to include population approaches for their early identification and treatment.

#### 4.3. Concentration of risk of role impairment

We used machine learning techniques to predict the probability of persistent role impairment for each student, and compared predicted with observed role impairment status (in ventile groups). This allowed us to observe a very high concentration of cases in the first 7 highest ventiles of predicted impairment risk (about 35 % of the sample). These ventiles, collectively, accounted for about 70 % of the observed persistent role impairment cases, with a cumulative positive predicted value over 53 %. Our approach contributes methodological innovation, providing more granular risk stratification that can enhance the scalability of student mental health screening. This is particularly important given the increasing burden on university counseling centers (Lipson

**Table 5**Estimated population attributable risk proportions of significant role impairment due to 12 psychopathological conditions based on simulated intervention scenario<sup>a</sup>.

	Total sample	The Americas	Europe	Middle East/ Africa	Asia/ Pacific					
	%	(SE)	%	(SE)	%	(SE)	%	(SE)		
Scenario: Removing all psychopathological conditions PARP	68.0	(0.8)	70.9	(1.6)	70.3	(2.0)	60.6	(1.4)	72.0	(4.5)

Abbreviations: Est, estimate; SE, standard error.

<sup>a</sup> Based on Model 2 in Table 4. Scenario assumed that all 12 psychopathological conditions assessed were removed. Standard errors were estimated using the jackknife repeated replications method with replicates defined by countries.

et al., 2019). The similarity of results among universities of the four different world regions studied suggests that the underlying risks structure for role impairment among university students may be globally stable, despite of cultural and institutional variations.

#### 4.4. Conclusions and implications

This study shows that there is a high prevalence of role impairment due to emotional problems among university students which is closely associated with psychopathological conditions. It also reveals that the high risk of role impairment concentrates in just over one third of the students. Overall, these results underscore the importance of assessing mental health symptoms, not only to gauge their prevalence but also to identify individuals at greatest risk of role impairment. By focusing on preventive and supportive interventions on students with psychopathological symptoms, universities can mitigate the adverse academic, personal, and societal consequences of role impairment. Economic evaluations indicate that universal and, in particular, indicated mental health promotion and prevention programs in higher education settings are cost-effective (Eisenberg et al., 2025, p. 202).

Our results have implications for university officials and counseling services. To maximize the academic achievement and well-being of their students, academic institutions should invest in mental health promotion and early identification of students at high risk of role impairment and ensure timely access to appropriate support and care services. Overburdened university counseling services could benefit from integrating online screening tools and surveys to efficiently triage students based on levels of psychological distress and need. From a research perspective, our findings highlight the need to improve the precision of predicting role impairment risk among university students. This could be achieved by incorporating a broader array of psychopathological conditions, more detailed sociodemographic characteristics, and other distal influences such as early-life adversity, social support, and academic environment—factors that have been consistently associated with mental health outcomes in student populations.

#### CRediT authorship contribution statement

**Jordi Alonso:** Writing – review & editing, Validation, Supervision, Investigation, Funding acquisition, Data curation, Conceptualization. **Maria V. Petukhova:** Writing – review & editing, Formal analysis. **Sue Lee:** Writing – review & editing, Validation, Data curation. **Nancy A. Sampson:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Data curation. **Yasmin A. Altwaijri:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Ahmad N. AlHadi:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Nouf K. Al-Saud:** Writing – review & editing, Data curation. **Claes Andersson:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Randy P. Auerbach:** Writing – review & editing, Resources, Funding acquisition, Data curation. **Laura Ballester:** Writing – review & editing, Data curation. **Jason Bantjes:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Marcus Bendtsen:** Writing – review & editing, Investigation, Funding acquisition, Data curation. **Corina Benjet:** Writing – review & editing,

Resources, Investigation, Funding acquisition, Data curation. **Anne H. Berman:** Writing – review & editing, Resources, Funding acquisition, Data curation. **Paula Carrasco:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Silver C.N. Chan:** Writing – review & editing, Data curation. **Irina Cohut:** Writing – review & editing, Data curation. **Marcelo A. Crockett:** Writing – review & editing, Data curation. **Pim Cuijpers:** Writing – review & editing, Investigation, Funding acquisition, Data curation. **Oana A. David:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Dong Dong:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Jorge Gaete:** Writing – review & editing, Data curation. **Mireia Felez-Nobrega:** Writing – review & editing, Data curation. **Carlos García Forero:** Writing – review & editing, Data curation. **Margalida Gili:** Writing – review & editing, Data curation. **Raúl A. Gutiérrez-García:** Writing – review & editing, Data curation. **Josep Maria Haro:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Xanthe Hunt:** Writing – review & editing, Data curation. **Álvaro I. Langer:** Writing – review & editing, Data curation. **Irene Léniz:** Writing – review & editing, Data curation. **Yan Liu:** Writing – review & editing, Data curation. **Scarlett Mac-Ginty:** Writing – review & editing, Data curation. **Vania Martínez:** Writing – review & editing, Investigation, Funding acquisition, Data curation. **Andre Mason:** Writing – review & editing, Investigation, Data curation. **Andrea Miranda-Mendizabal:** Writing – review & editing, Data curation. **Daniel Núñez:** Writing – review & editing, Data curation. **Claudiu C. Papasteri:** Writing – review & editing, Investigation. **José A. Piqueras:** Writing – review & editing, Data curation. **Codruta A. Popescu:** Writing – review & editing, Data curation. **Charlene Rapsey:** Writing – review & editing, Resources, Funding acquisition, Data curation. **Tiscar Rodriguez-Jimenez:** Writing – review & editing, Data curation. **Wylene Saal:** Writing – review & editing, Data curation. **Oi-ling Siu:** Writing – review & editing, Data curation. **Dan J. Stein:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Sascha Y. Struijs:** Writing – review & editing, Investigation, Data curation. **Cristina T. Tomoigao:** Writing – review & editing, Data curation. **Samuel Y.S. Wong:** Writing – review & editing, Resources, Investigation, Funding acquisition, Data curation. **Gemma Vilagut:** Writing – review & editing, Data curation, Conceptualization. **Ronald C. Kessler:** Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

#### Funding acknowledgments

Funding to support this initiative was received from the National Institute of Mental Health (NIMH) R56MH109566 (RPA), and the content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or NIMH.

Local funding for surveys in each country is listed below:

Chile: MAC, VM, JG, and ÁIL, received funding from ANID/Millennium Science Initiative Program-NCS2021\_081 and ANID/FONDECYT REGULAR-N°1,221,230.

SM-G received funding from ANID/Millennium Science Initiative Program-NCS2021\_081 and ANID/PFCHA/DOCTORADO EN EL

## EXTRANJERO BECAS CHILE/2019-72,200,092.

China: Shandong Taishan Scholar Young Expert Project (tsqn201909145), awarded to Yan Liu.

Mexico: Consejo Nacional de Ciencia y Tecnología (Mexican National Council of Science and Technology). Grant CONACYT 285548 awarded to institution (National Institute of Psychiatry Ramon de la Fuente Muñiz) with CB as PI.

The Netherlands: ZonMw (Netherlands Organization for Health Research and Development; grant number 636110005) and the PFGV (PFGV; Protestants Fonds voor de Geestelijke Volksgezondheid) in support of the student survey project.

New Zealand: The WMH-ICS NZ surveys were supported by a Rutherford Discovery Fellowship and a James Hume Bequest Grant.

Romania: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-IV-P1-PCE-2023-1854, within PNCDI IV.

Saudi Arabia: The Saudi University Mental Health Survey is conducted by the King Salman Center for Disability Research; funded by Saudi Basic Industries Corporation, King Abdulaziz City for Science and Technology, Ministry of Health (Saudi Arabia) and King Saud University. Funding in-kind was provided by King Faisal Specialist Hospital & Research Center, and Ministry of Economy & Planning, General Authority for Statistics, Riyadh.

South Africa: The work reported herein was made possible through funding by the South African Medical Research Council (SAMRC) through its Division of Research Capacity Development under the MCSP (awarded to JB and XH).

Spain: The PROMES-U study is supported by Instituto de Salud Carlos III (ISCIII) and cofunded by the European Union, grant number PI20/00006; the Departament de Recerca i Universitats of the Generalitat de Catalunya (AGAUR 2021 SGR 00624); and CIBER -Consorcio Centro de Investigación Biomédica en Red- (CB06/02/0046), Instituto de Salud Carlos III, Ministerio de Ciencia e Innovación and Unión Europea. For surveys directed by Parc Sanitari Sant Joan de Déu, funding was provided by Fundació Sant Joan de Déu. AMM reports grant funding - Sara Borrell grant (CD23/00010) ISC-III.

Sweden: CA, MB and AHB received funding for this work from the Swedish Research Council (ID 2019-01127) as well as from a Public Health Agency in Sweden (ID 04252-2021-2.3.2). Both grants were awarded to AHB.

Mexico: National Institute of Psychiatry Ramon de la Fuente Muñiz.

Saudi Arabia: King Faisal Specialist Hospital & Research Center, and Ministry of Economy & Planning, General Authority for Statistics, Riyadh.

The World Mental Health International College Student (WMH-ICS) initiative is carried out as part of the World Mental Health (WMH) Survey Initiative. The WMH survey is supported by the National Institute of Mental Health NIMH R01MH070884, the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R03-TW006481), the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical, GlaxoSmithKline, and Bristol-Myers Squibb (RCK).

## Role of the funding source

None of the funders had any role in the design, analysis, interpretation of results, decision to publish or preparation of this paper.

A complete list of all within-country and cross-national WMH-ICS publications can be found at [http://www.hcp.med.harvard.edu/wmh/college\\_student\\_survey.php](http://www.hcp.med.harvard.edu/wmh/college_student_survey.php)

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Randy P. Auerbach reports a relationship with Get Sonar Inc that includes: consulting or advisory. Randy P. Auerbach reports a relationship with RPA Health Consulting, Inc. that includes: consulting or advisory. Randy P. Auerbach reports a relationship with Covington & Burling LLP that includes: consulting or advisory. Dan J Stein reports a relationship with Discovery Vitality that includes: consulting or advisory. Dan J Stein reports a relationship with Lundbeck that includes: consulting or advisory. Dan J Stein reports a relationship with Orion that includes: consulting or advisory. Dan J Stein reports a relationship with Servier that includes: consulting or advisory. Dan J Stein reports a relationship with Seaport Therapeutics Inc that includes: consulting or advisory. Dan J Stein reports a relationship with Takeda that includes: consulting or advisory. Dan J Stein reports a relationship with Wellcome that includes: consulting or advisory. Dan J Stein reports a relationship with L'Oréal SA that includes: consulting or advisory. Dan J Stein has received consultancy honoraria from Kanna. Ronald C Kessler reports a relationship with Cambridge Health Alliance that includes: consulting or advisory. Ronald C Kessler reports a relationship with Canandaigua VA Medical Center that includes: consulting or advisory. Ronald C Kessler reports a relationship with Child Mind Institute Inc that includes: consulting or advisory. Ronald C Kessler reports a relationship with Holmusk USA Inc that includes: consulting or advisory. Ronald C Kessler reports a relationship with Massachusetts General Hospital that includes: consulting or advisory. Ronald C Kessler reports a relationship with Partners HealthCare that includes: consulting or advisory. Ronald C Kessler reports a relationship with Rallypoint Networks, Inc that includes: consulting or advisory. Ronald C Kessler reports a relationship with SAGE Therapeutics Inc that includes: consulting or advisory. Ronald C Kessler reports a relationship with The University of North Carolina at Chapel Hill that includes: consulting or advisory. Ronald C Kessler reports a relationship with Cerebral Inc that includes: consulting or advisory. Ronald C Kessler reports a relationship with Mirah that includes: consulting or advisory. Ronald C Kessler reports a relationship with Prepare Your Mind that includes: consulting or advisory. Ronald C Kessler reports a relationship with Roga Sciences that includes: consulting or advisory. Ronald C Kessler reports a relationship with Verisense Health that includes: consulting or advisory. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2025.120847>.

## Data availability

The data analyzed in this study is subject to the following licenses/restrictions: The WMH-ICS data sharing agreement limits access of this data to members of the consortium. The participant data and statistical analysis plan used for this study are available upon reasonable request from the corresponding author (Jordi Alonso) as long as the main objective of the data sharing request is replicating the analysis and findings as reported in this paper.

## References

Abel, J.R., Deitz, R., 2012. Do colleges and universities increase their region's human capital? *J. Econ. Geogr.* 12, 667-691. <https://doi.org/10.1093/jeg/lbr020>.

Ahmed, I., Hazell, C.M., Edwards, B., Glazebrook, C., Davies, E.B., 2023. A systematic review and meta-analysis of studies exploring prevalence of non-specific anxiety in undergraduate university students. *BMC Psychiatry* 23, 240. <https://doi.org/10.1186/s12888-023-04645-8>.

The ESEMeD/MHEDEA 2000 investigators, Alonso, J., Angermeyer, M.C., Bernert, S., Bruffaerts, R., Brugha, T.S., Bryson, H., De Girolamo, G., De Graaf, R., Demeyteneare, K., Gasquet, I., Haro, J.M., Katz, S.J., Kessler, R.C., Kovess, V., Lépine, J.P., Ormel, J., Polidori, G., Russo, L.J., Vilagut, G., Almansa, J., Arbabzadeh-Bouchez, S., Autonell,

J., Bernal, M., Buist-Bouwman, M.A., Codony, M., Domingo-Salvany, A., Ferrer, M., Joo, S.S., Martínez-Alonso, M., Matschinger, H., Mazzi, F., Morgan, Z., Morosini, P., Palacín, C., Romera, B., Taub, N., Vollebergh, W.A.M., 2004. Disability and quality of life impact of mental disorders in Europe: results from the European study of the epidemiology of mental disorders (ESEMeD) project. *Acta Psychiatr. Scand.* 109, 38–46. doi:<https://doi.org/10.1111/j.1600-0047.2004.00329.x>.

Alonso, J., Mortier, P., Auerbach, R.P., Bruffaerts, R., Vilagut, G., Cuijpers, P., Demetyteneare, K., Ebert, D.D., Ennis, E., Gutiérrez-García, R.A., Green, J.G., Hasking, P., Lochner, C., Nock, M.K., Pinder-Amaker, S., Sampson, N.A., Zaslavsky, A.M., Kessler, R.C., Collaborators, WHO WMH-ICS, 2018. Severe role impairment associated with mental disorders: Results of the WHO World Mental Health Surveys International College Student Project. *Depress. Anxiety* 35, 802–814. doi:<https://doi.org/10.1002/da.22778>.

Alonso, J., Vilagut, G., Mortier, P., Auerbach, R.P., Bruffaerts, R., Cuijpers, P., Demetyteneare, K., Ebert, D.D., Ennis, E., Gutiérrez-García, R.A., Green, J.G., Hasking, P., Lee, S., Bantjes, J., Nock, M.K., Pinder-Amaker, S., Sampson, N.A., Zaslavsky, A.M., Kessler, R.C., on behalf of the WHO WMH-ICS Collaborators, 2019. The role impairment associated with mental disorder risk profiles in the WHO World Mental Health International College Student Initiative. *Int. J. Methods Psychiatr. Res.* 28, e1750. doi:<https://doi.org/10.1002/mpr.1750>.

American Psychiatric Association (Ed.), 2022. Diagnostic and Statistical Manual of Mental Disorders, DSM-5-TR. American Psychiatric Association Publishing. doi:<https://doi.org/10.1176/appi.books.9780890425787>.

Astin, A.W., 1993. What matters in college? Four critical years revisited. *Jossey-Bass/Wiley*.

Auerbach, R.P., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., Demetyteneare, K., Ebert, D.D., Green, J.G., Hasking, P., Murray, E., Nock, M.K., Pinder-Amaker, S., Sampson, N.A., Stein, D.J., Vilagut, G., Zaslavsky, A.M., Kessler, R.C., Collaborators, WHO WMH-ICS, 2018. WHO World Mental Health Surveys International College Student Project: Prevalence and distribution of mental disorders. *J. Abnorm. Psychol.* 127, 623–638. doi:<https://doi.org/10.1037/abn0000362>.

Babor, T.H., de la Fuente, J.R., Saunders, J., Grant, M., 1992. AUDIT The Alcohol Use Disorders Identification Test: Guidelines for use in Primary Health Care. World Health Organization. doi:<https://auditscreen.org/cmsb/uploads/1992-audit-the-alcohol-use-disorders-identification-test-guidelines-for-use-in-primary-health-care-global-audit-organization-1992.pdf>.

Ballester, L., Alayo, I., Vilagut, G., Almenara, J., Cebrià, A.I., Echeburúa, E., Gabilondo, A., Gili, M., Lagares, C., Piqueras, J.A., Roca, M., Soto-Sanz, V., Blasco, M.J., Castellví, P., Forero, C.G., Bruffaerts, R., Mortier, P., Auerbach, R.P., Nock, M.K., Sampson, N., Kessler, R.C., Alonso, J., on behalf of the UNIVERSAL study group, 2019. Accuracy of online survey assessment of mental disorders and suicidal thoughts and behaviors in Spanish university students. Results of the WHO world mental health-international college student initiative. *PLoS One* 14, e0221529. doi:<https://doi.org/10.1371/journal.pone.0221529>.

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., Sammut, S., 2015. The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect. Disord.* 173, 90–96. doi:<https://doi.org/10.1016/j.jad.2014.10.054>.

Blanco, C., Okuda, M., Wright, C., Hasin, D.S., Grant, B.F., Liu, S.-M., Olfsen, M., 2008. Mental Health of College Students and Their Non-College-Attending Peers: Results From the National Epidemiologic Study on Alcohol and Related Conditions. *Arch. Gen. Psychiatry* 65, 1429. doi:<https://doi.org/10.1001/archpsyc.65.12.1429>.

Breiman, L., 2001. Random forests. *Mach. Learn.* 45, 5–32. doi:<https://doi.org/10.1023/A:1010933404324>.

Browning, M.H.E.M., Larson, L.R., Sharaevska, I., Rigolon, A., McAnirlin, O., Mullenbach, L., Cloutier, S., Vu, T.M., Thomsen, J., Reignier, N., Metcalf, E.C., D'Antonio, A., Helbich, M., Bratman, G.N., Alvarez, H.O., 2021. Psychological impacts from COVID-19 among university students: Risk factors across seven states in the United States. *PLoS One* 16, e0245327. doi:<https://doi.org/10.1371/journal.pone.0245327>.

Cheung, K.L., Ten Klooster, P.M., Smit, C., De Vries, H., Pieters, M.E., 2017. The impact of non-response bias due to sampling in public health studies: A comparison of voluntary versus mandatory recruitment in a Dutch national survey on adolescent health. *BMC Public Health* 17, 276. doi:<https://doi.org/10.1186/s12889-017-4189-8>.

Eisenberg, D., Abelson, S., Lipson, S.K., 2025. The Economic Case for Investing in Student Mental Health Services and Programs. In: Benjet, C., Bruffaerts, R., Cuijpers, P., Kessler, R.C. (Eds.), *The Mental Health of University Students: Global Perspectives on Prevalence and Innovations in Treatment from the World Mental Health International University Student Initiative*. Cambridge University Press, New York.

Eisenberg, D., Downs, M.F., Golberstein, E., Zivin, K., 2009. Stigma and Help Seeking for Mental Health Among College Students. *Med. Care Res.* 66, 522–541. doi:<https://doi.org/10.1177/107755870935173>.

Fox, K.R., Harris, J.A., Wang, S.B., Millner, A.J., Deming, C.A., Nock, M.K., 2020. Self-Injurious Thoughts and Behaviors Interview—Revised: Development, reliability, and validity. *Psychol. Assess.* 32, 677–689. doi:<https://doi.org/10.1037/pas0000819>.

Garlow, S.J., Rosenberg, J., Moore, J.D., Haas, A.P., Koestner, B., Hendif, H., Nemerooff, C.B., 2008. Depression, desperation, and suicidal ideation in college students: results from the American Foundation for Suicide Prevention College Screening Project at Emory University. *Depress. Anxiety* 25, 482–488. doi:<https://doi.org/10.1002/da.20321>.

Georgescu, T., Nedelcea, C., Gorbănescu, A., Papasteri, C., Cosmoiu, A.M., Vasile, D.L., Letzner, R.D., 2024. Psychometric evaluation of the PCL-5: assessing validity, diagnostic utility, and bifactor structures. *Eur. J. Psychotraumatol.* 15, 2333222. doi:<https://doi.org/10.1080/20008066.2024.2333222>.

Greenland, S., Drescher, K., 1993. Maximum likelihood estimation of the attributable fraction from logistic models. *Biometrics* 49, 865–872.

Groves, R.M., 2006. Nonresponse Rates and Nonresponse Bias in Household Surveys. *Public Opin. Q.* 70, 646–675. doi:<https://doi.org/10.1093/poq/nfl033>.

Hansen, M., Vaegter, H.B., Ravn, S.L., Andersen, T.E., 2023. Validation of the Danish PTSD Checklist for DSM-5 in trauma-exposed chronic pain patients using the Clinician-Administered PTSD Scale for DSM-5. *Eur. J. Psychotraumatol.* 14, 2179801. doi:<https://doi.org/10.1080/20008066.2023.2179801>.

Harkness, J., Pennell, B.E., Villar, A., Gebler, N., Aguilar-Gaxiola, S., B., I., 2008. Translation procedures and translation assessment in the world mental health survey initiative. In: Kessler, R.C., Ustun, T.B. (Eds.), *The WHO World Mental Health Surveys: Global Perspectives on the Epidemiology of Mental Disorders*. Cambridge University Press, pp. 91–113.

Hewson, C., 2016. Conducting research on the internet. *Psychologist*. 290–293.

Hu, B., Yang, X., Tuo, X., 2023. The prevalence of post-traumatic stress disorder in college students by continents and national income during the COVID-19 pandemic: a meta-analysis. *Front. Psychol.* 14. doi:<https://doi.org/10.3389/fpsyg.2023.1129782>.

Husky, M.M., Pic, O., Callahan, S., Navarro-Mateu, F., 2024. Twelve-month suicidal ideation, incidence and persistence among college students pre-pandemic and during the pandemic: A longitudinal study. *Psychiatry Res.* 331, 115669. doi:<https://doi.org/10.1016/j.psychres.2023.115669>.

Ibrahim, A.K., Kelly, S.J., Adams, C.E., Glazebrook, C., 2013. A systematic review of studies of depression prevalence in university students. *J. Psychiatr. Res.* 47, 391–400. doi:<https://doi.org/10.1016/j.jpsychires.2012.11.015>.

Jenkins, P.E., Ducker, I., Gooding, R., James, M., Rutter-Eley, E., 2021. Anxiety and depression in a sample of UK college students: a study of prevalence, comorbidity, and quality of life. *J. Am. Coll. Heal.* 69, 813–819. doi:<https://doi.org/10.1080/07448481.2019.1709474>.

Kazis, L.E., Lee, A., Spiro, A., Rogers, W., Ren, X.S., Miller, D.R., Selim, A., Hamed, A., Haffer, S.C., 2004a. Measurement comparisons of the medical outcomes study and veterans SF-36 health survey. *Health Care Financ. Rev.* 25, 43–58.

Kazis, L.E., Miller, D.R., Clark, J.A., Skinner, K.M., Lee, A., Ren, X.S., Spiro, A., Rogers, W.H., Ware, J.E., 2004b. Improving the response choices on the veterans SF-36 health survey role functioning scales: results from the Veterans Health Study. *J. Ambul. Care Manage.* 27, 263–280. doi:<https://doi.org/10.1097/0004479-200407000-00010>.

Kessler, R.C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M.J., Jin, R., Secnik, K., Spencer, T., Ustun, T.B., Walters, E.E., 2005. The World Health Organization adult ADHD self-report scale (ASRS): a short screening scale for use in the general population. *Psychol. Med.* 35, 245–256. doi:<https://doi.org/10.1017/S033291704002892>.

Kessler, R.C., Adler, L.A., Gruber, M.J., Sarawate, C.A., Spencer, T., Van Brunt, D.L., 2007. Validity of the World Health Organization Adult ADHD Self-Report Scale (ASRS) Screener in a representative sample of health plan members. *Int. J. Methods Psychiatr. Res.* 16, 52–65. doi:<https://doi.org/10.1002/mpr.208>.

Kessler, R.C., Berglund, P., Demler, O., Jin, R., Koretz, D., Merikangas, K.R., Rush, A.J., Walters, E.E., Wang, P.S., 2003. The Epidemiology of Major Depressive Disorder: Results From the National Comorbidity Survey Replication (NCS-R). *JAMA* 289, 3095. doi:<https://doi.org/10.1001/jama.289.23.3095>.

Kessler, R.C., Santiago, P.N., Colpe, L.J., Dempsey, C.L., First, M.B., Heeringa, S.G., Stein, M.B., Fullerton, C.S., Gruber, M.J., Naifeh, J.A., Nock, M.K., Sampson, N.A., Schoenbaum, M., Zaslavsky, A.M., Ursano, R.J., 2013. Clinical reappraisal of the Composite International Diagnostic Interview Screening Scales (CIDI-SC) in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARSS). *Int. J. Methods Psychiatr. Res.* 22, 303–321. doi:<https://doi.org/10.1002/mpr.1398>.

Khaled, S.M., Al-Thani, S.M., Sampson, N.A., Kessler, R.C., Woodruff, P.W., Alabdulla, M., 2024. Twelve-month prevalence, persistence, severity, and treatment of mood and anxiety disorders in Qatar's national mental health study. *Int. J. Methods Psychiatr. Res.* 33, e2012. doi:<https://doi.org/10.1002/mpr.2012>.

King, N., Pickett, W., McNevin, S.H., Bowie, C.R., Rivera, D., Keown-Stoneman, C., Harkness, K., Cunningham, S., Milanovic, M., Saunders, K.E.A., Goedday, S., Duffy, A., U-Flourish Student Well-Being and Academic Success Research Group, 2021. Mental health need of students at entry to university: Baseline findings from the U-Flourish student well-being and academic success study. *Early Interv. Psychiatry* 15, 286–295. doi:<https://doi.org/10.1111/eip.12939>.

King, N., Pickett, W., Rivera, D., Byun, J., Li, M., Cunningham, S., Duffy, A., 2023. The Impact of the COVID-19 Pandemic on the Mental Health of First-Year Undergraduate Students Studying at a Major Canadian University: A Successive Cohort Study. *Can. J. Psychiatr.* 68, 499–509. doi:<https://doi.org/10.1177/07067437221094549>.

Kramer, L.B., Whiteman, S.E., Petri, J.M., Spitzer, E.G., Weathers, F.W., 2023. Self-Rated Versus Clinician-Rated Assessment of Posttraumatic Stress Disorder: An Evaluation of Discrepancies Between the PTSD Checklist for DSM-5 and the Clinician-Administered PTSD Scale for DSM-5. *Assessment* 30, 1590–1605. doi:<https://doi.org/10.1177/1073191122113571>.

Latimer, S., Meade, T., Tennant, A., 2013. Measuring engagement in deliberate self-harm behaviours: psychometric evaluation of six scales. *BMC Psychiatry* 13, 4. doi:<https://doi.org/10.1186/1471-244X-13-4>.

Lipson, S.K., Lattie, E.G., Eisenberg, D., 2019. Increased Rates of Mental Health Service Utilization by U.S. College Students: 10-Year Population-Level Trends (2007–2017). *PS* 70, 60–63. doi:<https://doi.org/10.1176/appi.ps.201800332>.

Mason, A., Rapsey, C., Sampson, N., Lee, S., Albor, Y., Al-Hadi, A.N., Alonso, J., Al-Saud, N., Altwajiri, Y., Andersson, C., Atwoli, L., Auerbach, R.P., Ayuya, C., Baez-Mansur, P.M., Ballester, L., Bantjes, J., Baumeister, H., Bendtsen, M., Benjet, C., Berman, A.H., Bootsma, E., Chan, S.C.N., Cohut, I., Covarrubias Díaz Couder, M.A., Cuijpers, P., David, O., Dong, D., Ebert, D.D., Nobrega, M.F., Gaete, J., Forero, C.G., Gili, M., Gutiérrez-García, R., Haro, J.M., Hasking, P., Hudec, K., Hunt, X., Hurks, P.,

Husky, M., Jaguga, F., Jansen, L., Kählke, F., Klinkenberg, E., Küchler, A.-M., Langer, A.I., Léniz, I., Liu, Y., Mac-Ginty, S., Martínez, V., Mathai, M., McLafferty, M., Miranda-Mendizabal, A., Murray, E., Musyoka, C.M., Nedelcea, C., Ngai, C.H., Núñez, D., O'Neill, S., Piqueras, J.A., Popescu, C.A., Robinson, K., Rodriguez-Jimenez, T., Scarf, D., Siu, O.L., Stein, D.J., Struijs, S.Y., Tomoaga, C., Valdés-García, K.P., Van Luenen, S., Vigo, D.V., Wang, A.Y., Wiers, R., Wong, S.Y.S., Kessler, R.C., Bruffaerts, R., Lima, R.A., Breet, E., Garnefski, N., Jacobs, K., Kraaij, V., Munro, L., Munthali, R.J., Prescivalli, A.P., Rebagliato, M., Roca, M., Saleminck, E., Van Der Heijde, C., 2025. Prevalence, age-of-onset, and course of mental disorders among 72,288 first-year university students from 18 countries in the World Mental Health International College Student (WMH-ICS) initiative. *J. Psychiatr. Res.* 183, 225–236. <https://doi.org/10.1016/j.jpsychires.2025.02.016>.

McGrath, J.J., Lim, C.C.W., Plana-Ripoll, O., Holtz, Y., Agerbo, E., Momen, N.C., Mortensen, P.B., Pedersen, C.B., Abdulmalik, J., Aguilar-Gaxiola, S., Al-Hamzawi, A., Alonso, J., Bromet, E.J., Bruffaerts, R., Bunting, B., De Almeida, J.M.C., De Girolamo, G., De Vries, Y.A., Florescu, S., Gureje, O., Haro, J.M., Harris, M.G., Hu, C., Karam, E.G., Kawakami, N., Kiejean, A., Kovess-Masfety, V., Lee, S., Mneimneh, Z., Navarro-Mateu, F., Orozco, R., Posada-Villa, J., Roest, A.M., Saha, S., Scott, K.M., Stagnaro, J.C., Stein, D.J., Torres, Y., Viana, M.C., Ziv, Y., Kessler, R.C., De Jonge, P., 2020. Comorbidity within mental disorders: a comprehensive analysis based on 145 990 survey respondents from 27 countries. *Epidemiol. Psychiatr. Sci.* 29, e153. <https://doi.org/10.1017/S2045796020000633>.

Miller, P., 2020. A systematic review of nonresponse bias studies in federally sponsored surveys.

Misra, R., McLean, M., 2000. College Students' Academic Stress and Its Relation to Their Anxiety, Time Management, and Leisure Satisfaction. *Am. J. Health Stud.* 16, 41–51.

Mortier, P., Yang, X., Altwaijri, Y.A., Holdcraft, J.A., Lee, S., Sampson, N.A., Albor, Y., Alhadji, A.N., Alonso, J., Al-Saud, N.K., Andersson, C., Atwoli, L., Auerbach, R.P., Muaka, C.A., Báez-Mansur, P.M., Ballester, L., Bantjes, J., Baumeister, H., Bendtsen, M., Benjet, C., Berman, A.H., Bruffaerts, R., Carrasco, P., Chan, S.C.N., Cohut, I., Couder, M.A.C.D., Crockett, M.A., Cuijpers, P., David, O.A., Dong, D., Ebert, D.D., Gaete, J., Felez-Nobrega, M., Forero, C.G., Gili, M., Gutiérrez-García, R.A., Haro, J.M., Hasking, P., Hunt, X., Husky, M.M., Jaguga, F., Jansen, L., Langer, Á.I., Liu, Y., Mac-Ginty, S., Martínez, V., Mason, A., Mathai, M., McLafferty, M., Miranda-Mendizabal, A., Murray, E.K., Musyoka, C.M., O'Neill, S.M., Papasteri, C.C., Piqueras, J.A., Popescu, C.A., Rapsey, C., Robinson, K., Rodriguez-Jimenez, T., Scarf, D., Siu, O., Stein, D.J., Struijs, S.Y., Tomoaga, C.T., Valdés-García, K.P., Vereecke, S., Vigo, D.V., Wang, A.Y., Wong, S.Y.S., Kessler, R.C., 2025. The associations of childhood adversities and mental disorders with suicidal thoughts and behaviors - results from the World Mental Health International College Student Initiative. *Psychiatry Res.*, 116555 <https://doi.org/10.1016/j.psychres.2025.116555>.

Newson, J.J., Pastukh, V., Thiagarajan, T.C., 2021. Poor Separation of Clinical Symptom Profiles by DSM-5 Disorder Criteria. *Front. Psychol.* 12, 775762. <https://doi.org/10.3389/fpsyg.2021.775762>.

Nock, M.K., Holmberg, E.B., Photos, V.I., Michel, B.D., 2007. Self-Injurious Thoughts and Behaviors Interview: Development, reliability, and validity in an adolescent sample. *Psychol. Assess.* 19, 309–317. <https://doi.org/10.1037/1040-3590.19.3.309>.

OECD, 2019. Education at a Glance 2019: OECD Indicators. OECD Publishing, Paris. <https://doi.org/10.1787/f8d7880d-en>.

Office for National Statistics. Internet users. Office for National Statistics, 2018.

Posner, K., Brown, G.K., Stanley, B., Brent, D.A., Yershova, K.V., Oquendo, M.A., Currier, G.W., Melvin, G.A., Greenhill, L., Shen, S., Mann, J.J., 2011. The Columbia-Suicide Severity Rating Scale: initial validity and internal consistency findings from three multisite studies with adolescents and adults. *AJP* 168, 1266–1277. <https://doi.org/10.1176/appi.ajp.2011.10111704>.

Raghunathan, T.E., Grizzle, J.E., 1995. A Split Questionnaire Survey Design. *J. Am. Stat. Assoc.* 90, 54–63. <https://doi.org/10.1080/01621459.1995.10476488>.

Siu, A.L., and the US Preventive Services Task Force (USPSTF), Bibbins-Domingo, K., Grossman, D.C., Baumann, L.C., Davidson, K.W., Ebell, M., García, F.A.R., Gillman, M., Herzstein, J., Kemper, A.R., Krist, A.H., Kurth, A.E., Owens, D.K., Phillips, W.R., Phipps, M.G., Pignone, M.P., 2016. Screening for depression in adults: US preventive services task force recommendation statement. *JAMA* 315, 380. doi:<https://doi.org/10.1001/jama.2015.18392>.

StataCorp LLC, 2024. <https://www.stata.com/company/>.

Tabatabai, M.A., Li, H., Eby, W.M., Kengwoung-Keumo, J.J., Manne, U., Bae, S., Fouad, M., Singh, K.P., 2014. Robust Logistic and Probit Methods for Binary and Multinomial Regression. *J. Biom Biostat* 5, 202. <https://doi.org/10.4172/2155-6180.1000202>.

Thombs, B.D., Kwakkenbos, L., Levis, A.W., Benedetti, A., 2018. Addressing overestimation of the prevalence of depression based on self-report screening questionnaires. *CMAJ* 190, E44–E49. <https://doi.org/10.1503/cmaj.170691>.

Tibshirani, R., 1996. Regression Shrinkage and Selection Via the Lasso. *J. R. Stat. Soc. Ser. B Stat Methodol.* 58, 267–288. <https://doi.org/10.1111/j.2517-6161.1996.tb02080.x>.

Toner, P., Böhnke, J.R., Andersen, P., McCambridge, J., 2019. Alcohol screening and assessment measures for young people: A systematic review and meta-analysis of validation studies. *Drug Alcohol Depend.* 202, 39–49. <https://doi.org/10.1016/j.drugalcdep.2019.01.030>.

Van Buuren, S., 2012. Flexible Imputation of Missing Data, 0 ed. Chapman and Hall/CRC. doi:<https://doi.org/10.1201/b11826>.

Van Der Laan, M.J., Polley, E.C., Hubbard, A.E., 2007. Super Learner. *Stat. Appl. Genet. Mol. Biol.* 6. <https://doi.org/10.2202/1544-6115.1309>.

Villarosa-Hurlocker, M.C., Schutts, J.W., Madson, M.B., Jordan, H.R., Whitley, R.B., Mohn, R.C., 2020. Screening for alcohol use disorders in college student drinkers with the AUDIT and the USAUDIT: a receiver operating characteristic curve analysis. *Am. J. Drug Alcohol Abuse* 46, 531–545. <https://doi.org/10.1080/00952990.2020.1712410>.

Ware, J.E., Sherbourne, C.D., 1992. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med. Care* 30, 473–483.

Weathers, F.W., Litz, B.T., Keane, T.M., Palmieri, P.A., Marx, B.P., Schnurr, P.P., 2013. The PTSD Checklist for DSM-5 (PCL-5).

Wilks, C.R., Auerbach, R.P., Alonso, J., Benjet, C., Bruffaerts, R., Cuijpers, P., Ebert, D.D., Green, J.G., Mellins, C.A., Mortier, P., Sadikova, E., Sampson, N.A., Kessler, R.C., 2020. The importance of physical and mental health in explaining health-related academic role impairment among college students. *J. Psychiatr. Res.* 123, 54–61. <https://doi.org/10.1016/j.jpsychires.2020.01.009>.

Zarowski, B., Giokaris, D., Green, O., 2024. Effects of the COVID-19 Pandemic on University Students' Mental Health: A Literature Review. *Cureus*. <https://doi.org/10.7759/cureus.54032>.

Zuromski, K.L., Ustun, B., Hwang, I., Keane, T.M., Marx, B.P., Stein, M.B., Ursano, R.J., Kessler, R.C., 2019. Developing an optimal short-form of the PTSD Checklist for DSM-5 (PCL-5). *Depress. Anxiety* 36, 790–800. <https://doi.org/10.1002/da.22942>.