Severe Role Impairment Associated with Mental Disorders: Results of the WHO World Mental Health Surveys International College Student Project

Jordi Alonso, M.D., Ph.D.[1],[*], **Philippe Mortier, Ph.D.**[2], **Randy P. Auerbach, Ph.D.**[3], **Ronny Bruffaerts, Ph.D.**[2], **Gemma Vilagut, Ph.D.**[1], **Pim Cuijpers, Ph.D.**[4], **Koen Demyttenaere, Ph.D.**[2], **David D. Ebert, Ph.D.**[5], **Edel Ennis, Ph.D.**[6], **Raul A. Gutiérrez-García, Ph.D.**[7], **Jennifer Greif Green, Ph.D.**[8], **Penelope Hasking, Ph.D.**[9], **Christine Lochner, M.A., Ph.D.**[10], **Matthew K. Nock, Ph.D.**[11], **Stephanie Pinder-Amaker, Ph.D.**[3], **Nancy A. Sampson, B.A.**[12], **Alan M. Zaslavsky, Ph.D.**[12], **Ronald C. Kessler, Ph.D.**[12], and **on behalf of the WHO WMH-ICS Collaborators**

[1]Health Services Research Group, IMIM (Hospital del Mar Medical Research Institute), Barcelona, Spain; Pompeu Fabra University (UPF), Barcelona, Spain; CIBER en Epidemiología y Salud Pública (CIBERESP), Madrid, Spain [2]Universitair Psychiatrisch Centrum - Katholieke Universiteit Leuven (UPC-KUL), Campus Gasthuisberg, Leuven, Belgium [3]Department of Psychiatry, Harvard Medical School, Boston, Massachusetts, USA; Center for Depression,

Conflict of Interest

Anxiety and Stress Research, McLean Hospital, Belmont, Massachusetts, USA [4]Department of Clinical, Neuro and Developmental Psychology, Amsterdam Public Health Research Institute, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands [5]Department for Psychology, Clinical Psychology and Psychotherapy Friedrich-Alexander University Erlangen Nuremberg, Erlangen, Germany [6]School of Psychology, Ulster University, Londonderry, United Kingdom [7]De La Salle Bajio University, Campus Salamanca, Guanajuato, Mexico [8]School of Education, Boston University, Boston, Massachusetts, USA [9]School of Psychology & Speech Pathology, Curtin University, Perth, Australia [10]SAMRC/UCT/SU Unit on Risk & Resilience in Mental Disorders, Department of Psychiatry, Stellenbosch University, South Africa [11]Department of Psychology, Harvard University, Cambridge, Massachusetts, USA [12]Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts, USA

Abstract

Background—College entrance is a stressful period with a high prevalence of mental disorders.

Aims—To assess the role impairment associated with 12-month mental disorders among incoming first-year college students within a large cross-national sample.

Methods—Web-based self-report surveys assessing the prevalence of DSM-IV mental disorders and health-related role impairment (Sheehan Disability Scale) were obtained and analysed from 13,984 incoming first-year college students (Response= 45.5%), across 19 universities in 8 countries. Impairment was assessed in the following domains: home management, work (e.g., college-related problems), close personal relationships, and social life.

Results—Mean age of the sample was 19.3 (SD=0.59) and 54.4% were female. Findings showed that 20.4% of students reported any severe role impairment (10% of those without a mental disorder vs. 42.9% of those with at least one disorder, $p < 0.01$). In bivariate analyses, panic disorder and mania were associated most frequently with severe impairment (60.6% and 57.5%, respectively). Students reporting 3 or more mental disorders had almost five-fold more frequently severe impairment relative to those without mental disorders. Multiple logistic regression showed that major depression (OR= 4.0; 95% CI 3.3, 4.8), generalized anxiety (OR=3.9; 95% CI 3.1, 4.8), and panic disorder (OR=2.9; 95% CI 2.4, 4.2) were associated with the highest odds of severe impairment. Only minimal deviations from these overall associations were found across countries.

Conclusion—Mental disorders among first-year college students are associated with substantial role impairment. Providing preventative interventions targeting mental disorders and associated impairments is a critical need for institutions to address.

Keywords

INTRODUCTION

College students are a key group in society in terms of human capital (Abel & Deitz, 2012) as they will drive future economic growth and innovation. They are an increasingly higher proportion of the population younger than 25 in developed countries (OECD, 2016). College is a peak period for mental disorders (Auerbach et al., 2016; Blanco et al., 2008; Cho et al., 2015; Eisenberg, Golberstein, & Gollust, 2007; Ibrahim, Kelly, Adams, & Glazebrook, 2013; Kendler, Myers, & Dick, 2015; Mojtabai et al., 2015; Vazquez, Torres, Otero, & Diaz, 2011), particularly mood, anxiety, and substance use disorders. A recent metaanalysis reported that an average of 30.6% of the students suffered from depression (Ibrahim et al, 2013). This high prevalence is significant for both the distress it causes and its associated impairment in academic performance (Auerbach et al., 2016; Auerbach et al., 2018; Bruffaerts et al., 2018; Bruffaerts et al., 2012; Skidmore, Kaufman, & Crowell, 2016) as well as suicidal thoughts and behaviors (Mortier, Auerbach, et al., 2018; Mortier, Cuijpers, et al., 2018). However, research is needed to clarify how mental disorders may affect important functioning across key life domains.

Mental disorders are a significant contributor to disability in the general population (Ormel et al., 2008; Verger, Guagliardo, Gilbert, Rouillon, & Kovess-Masfetty, 2010). Among students, mental disorders have a substantial impact on academic performance (Auerbach et al., 2016; Kessler, Foster, Saunders, & Stang, 1995), and pre-matriculation onset disorders are strong predictors of college attrition (Auerbach et al., 2016). More broadly, mental disorders are associated with lower employment in adulthood (Mojtabai et al., 2015). Nevertheless, impairment in other domains, including home management/chores, work, close personal relationships and social life remains poorly understood. An enhanced understanding of the mental disorder-related role impairment is critical, as this may inform specific care needs of students. Addressing those needs may potentially reduce individual suffering of patients and their families as well as increase human capital of our societies. A French study reported that the presence of any 12-month mental disorder was associated with a 10-fold likelihood of "marked" or "extreme" impairment in the Sheehan Disability Scale (Verger et al., 2010). Nevertheless, the amount and type of disability associated with mental disorders among university students has been assessed only in a few, single country studies (Klemenc-Ketis, Kersnik, Eder, & Colaric, 2011; Verger et al., 2010).The WHO World Mental Health Surveys International College Student Project (WMH-ICS) was developed to obtain accurate longitudinal information about the prevalence, correlates and impact of mental, substance, and behavioral disorders among college students throughout the world [https://www.hcp.med.harvard.edu/wmh/college_student_survey.php]. The aims in doing this were to assess unmet need for treatment, to develop a practical method of targeting students in need of outreach, and to lay the groundwork for the implementation and evaluation of preventive and clinical interventions. The initial phase of the initiative, which is the focus of the current report, involves carrying out surveys with representative samples in a total of 19 colleges of 8 countries of incoming college students to estimate prevalence of mental disorders, associated impairments, adverse social and academic consequences, and patterns of help-seeking.

The objectives of this paper are to estimate among incoming first-year college students: (a) the prevalence of role impairment (home management/chores, college-related work, close relationships and social life) associated with mental disorders; and (b) the modification of this association by comorbid mental disorders. A secondary aim was to test whether there was between-country variation in role impairment associated with mental disorders.

METHOD

Study design

Cross-sectional baseline data from surveys of participants at the WMH-ICS project in a total of 19 colleges of 8 countries were used for this study. Most participating sites are following first-year students every 12 months (e.g., from the first to final year of studies). However, data collection remains ongoing, and thus, follow-up data are beyond the scope of the current manuscript.

Participants

The initial round of WMH-ICS surveys were carried out in 8 countries (Australia, Belgium, Germany, Mexico, Northern-Ireland, South-Africa, Spain, and the United States). Details on the participating countries and college surveys are provided in Table 1. Web-based self-report questionnaires were administered to all incoming first-year students from 19 participating universities across these countries (7 private, 12 public) between October 2014 and February 2017. Inclusion criteria for participating in the survey were the same in all countries: a) university students 18+ years-old; b) enrolled in the first year and for the first time in the participating universities; and c) fluent in the official language of the country. We excluded all those participants not complying with all the inclusion criteria and those who refused to provide their informed consent. A total of 14,371 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%. An overview of the participating sample and invitation procedures carried out in each country is provided in online data supplement 1. The sample for the analyses reported here was restricted to students identifying themselves as male or female who were full-time students (n = 13,984).

Sociodemographic differences between respondents and non-respondents were assessed when constructing the nonresponse survey weights. Females were overrepresented in the survey. Data were weighted to adjust for differences between survey respondents and non-respondents on whatever socio-demographic information was made available about the student body by University officials using post-stratification weights (Groves & Couper, 1998).

Procedures

All incoming first-year students in the participating universities were invited to participate in a web-based self-report health survey. The initial mode of contact varied across universities, with the survey being either a part of a health evaluation in some universities, a part of the registration process in others, or implemented as a stand-alone survey administered to

students via their student email addresses in still others. In all cases, other than in Mexico, potential respondents were invited to participate, and initial non-respondents were re-contacted through a series of personalized reminder emails containing unique electronic links to the survey. Ten universities implemented conditional incentives in the final stages of refusal conversion (e.g., a raffle for store credit coupons, movie passes). In addition, one site (Spain) used an "end-game strategy" consisting of a random sample of non-respondents at the end of the normal recruitment period that was offered incentives for participation. Respondents to these end-game interviews were given a weight equal to 1/p, where p represented the proportion of non-respondents at the end of the normal recruitment period that was included in the end-game, to adjust for the under-sampling of these hard-to-recruit respondents. The situation was different in Mexico, where students were invited to participate in conjunction with mandatory activities, which varied from school to school (e.g., student health evaluations; 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 which provides information on how to access specialized mental health services if they considered it necessary for them. Students endorsing recent and/or severe suicide thoughts and behaviors received information about available resources within their school and/or community.

Measures

Role impairment—Severity of health-related role impairment during the past 12 months was assessed using an adapted version of the Sheehan Disability Scale (Leon, Olfson, Portera, Farber, & Sheehan, 1997; Ormel et al., 2008). This was completed for four role domains home management/chores, college-related and other work, close personal relationships, and social life. Home management specified the activities "cleaning, shopping, and working around the house, apartment or yard). College-related and other work specified "ability to work as well as most of other people". Close personal relationships were specified as "the ability to initiate and maintain close personal relationships," whereas social life was asked without further specification. A 0 to 10 visual analogue scale was used to rate the degree of impairment for each domain. The scale was labeled as no interference (0), mild (1-3), moderate (4-6), severe (7-9), and very severe (10) interference. Severe self-reported role impairment was defined as having a 7 to 10 rating (Kessler & Ustun, 2004; Wittchen, Nelson, & Lachner, 1998). In our study Cronbach's alpha for the overall SDS scale was 0.876.

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 broad range of short validated self-report screening scales. These included the Composite International Diagnostic Interview Screening Scales (CIDI-SC) (Kessler et al., 2013; Kessler & Ustun, 2004) for major depressive episode, mania/hypomania (broad mania), generalized anxiety disorder (GAD), panic disorder (PD), and drug use disorder (abuse or dependence either on cannabis,

cocaine, or any other street drug, or on a prescription drug either used without a prescription or with used more than prescribed to get high, buzzed, or numbed out); and the AUDIT screening scale for alcohol use disorder (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The CIDI-SC scales have concordance with blinded clinical diagnoses in the range AUC = 0.70-0.78 (16). In line with recommendation (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), we defined alcohol use disorder (abuse or dependence) in the AUDIT as having a total score of 8+ and a score of 4+ on the AUDIT dependence score. This version of AUDIT scoring has concordance with clinical diagnosis 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 months with symptoms in the past year. Participants with a positive response for lifetime disorder were assessed for the number of months in the past year that they experienced symptoms. All respondents indicating that they experienced symptoms for one month or more in the past year were coded positive for past year disorder. A detailed report of the prevalence of mental disorders in this sample is under review (Auerbach et al., 2018). Students endorsing recent and/or severe suicide thoughts and behaviors received information about available resources within their school and/or community.

Sociodemographic factors—Questions on socio-demographic characteristics were administered at the beginning of the survey in order to promote the warming up of the respondent. Sociodemographic factors examined in the survey included: gender, age, parental education, parental marital status, urbanicity, religious background, and sexual orientation. Gender was assessed by asking respondents whether they identified themselves as male, female, transgender (male-to-female/female-to-male), or "other".

Respondent age was categorized into three categories (18 years/19 year/20 or more years old). Parental educational level was assessed for father and mother separately (none/elementary school/secondary school/some post-secondary education/university graduate/doctoral degree), and was categorized into high (university graduate or more), medium (some post-secondary education), and low (secondary school or less) based on the highest-of-both parents' educational level. Parental marital status was dichotomized into "parents not married or parent(s) deceased" versus "parents married and both alive". Respondents were asked about the level of urbanicity of the place they were raised (small city/large city/town or village/suburbs/rural area), and their religious background (categorized into Christian/Other religion/No religion). Students were asked whether they identified themselves as heterosexual, gay or lesbian, bisexual, asexual, not sure, and other. *Those indicating "other" were presented an open text item "How would you describe your sexual orientation?" All free text responses were inspected in the data cleaning process, and, if applicable, recoded to one of the five other response options.* Additional questions were asked about the extent to which respondents reported being attracted to men and women and the gender(s) of people they had sex with (if any) in the past 5 years. To create the final sexual orientation variables, respondents were categorized into the following categories: heterosexual with no same-sex attraction, heterosexual with same-sex attraction, non-heterosexual without same-sex sexual intercourse, and non-heterosexual with same-sex sexual intercourse.

College-related factors—The college-related factors examined in the survey included: high school performance, the most important reason to go to university, and residence during first semester. Respondents were asked where they ranked academically compared to other students at the time of their high school graduation (from top 5% to bottom 10%; categorized into quartiles). They were also asked, out of nine possible reasons, what their most important reason was to go to university. Based on the results of a tetrachoric factor analysis (details available on request), the most important reason to go to university was categorized into extrinsic reasons (i.e., family wanted me to/my friends were going/teachers advised me to/did not want to get a job right away) versus intrinsic reasons (to achieve a degree/I enjoy learning and studying/to study a subject that really interests me/to improve job prospects generally/to train for specific type of job). Finally, respondents were also asked where they were living during the first semester of the academic year (parents', other relative's, or own home/university or college hall of residence/shared house, apartment, or flat/private hall of residence/other), and if they already worked or expected to work on a student job.

Analysis

All analyses were conducted with SAS version 9.4(Inc., 2010). In addition, multiple imputation (MI) by chained equations(Van Buuren, 2012) was used to adjust for within-survey item non-response, random internal subsampling of survey sections, and missing data due to skip logic errors that occurred in a few surveys. Cross-tabulations were used to estimate the prevalence of severe role impairment among those with 12-month mental disorder, and are reported as weighted within-country proportions, with associated MI-adjusted standard errors obtained through the Taylor series linearization method. To obtain pooled estimates of prevalence across countries, each country was given an equal sum of weights.

Logistic regression analyses were used to identify 12-month mental disorders as predictors for any severe role impairment, and in each separate role domain of severe role impairment. Regression coefficients and their MI-based standard errors were exponentiated to generate odds ratios (OR) and associated 95% confidence intervals (CI). A series of five models was evaluated: (M1) type only, i.e., model including a separate dummy variables for each of the six types of mental disorder; (M2) continuous number only, i.e., one variable indicating number of disorders ranging from zero to six; (M3) categorical number of disorders only, i.e., a series of dummy variables indicating exactly one, exactly two, and three or more disorders; (M4) both type and continuous number of comorbid disorders and (M5) both type and categorical number, excluding the dummy indicating exactly one mental disorder. This series of models was conducted to evaluate whether it is the joint effect of specific types of disorder and/or the interactions between disorders that explains the data best (Kessler et al., 2010; Nock, Borges, & Ono, 2012). Model 1 implicitly assumed that the joint effect of the multiple disorders is the product of the odds-ratios (ORs). The assumptions in Models 2 and 3 were that the disorder is unimportant once number of disorders is known, and the main effect coefficients for the various component disorders are assumed to be the same. Additionally, model 3, with dummy variables for number of predictor disorders, implicitly allows for interactions in the sense that the coefficients associated with having exactly two

or exactly three or exactly n disorders can be significantly different from the product of the coefficient associated with having exactly one disorder. The model that includes terms for both type and number of predictor disorders, in comparison, allows both for differences in effects of the different disorders and for interactions. Specifically, the coefficients associated with types of disorders can be interpreted as the coefficients of the outcome among individuals who had one and only one specific mental disorder compared to respondents with none of the disorders, while the coefficients associated with number of disorders are multipliers of the combination of coefficients associated with the component disorders. All models were adjusted for sociodemographic and college-related variables, and country membership. Akaike's information criterion was used to select the best model. Based on this model, population attributable risk proportions (PARP) were calculated to estimate the potential reduction in severe role impairment if we were able to eliminate the six 12-month mental disorders under study from the population, assuming a full causal relationship between disorder and role impairment (Krysinska & Martin, 2009). We then examined between-country variation in associations by including predictor-by-country interactions and an adjusted interaction dummy coding scheme that kept the product of all country-specific ORs equal to one. The latter method allowed us to detect significant between-country variation by evaluating the statistical significance of deviation of within-country coefficients from the median 1.0 value. Statistical significance in all analyses was evaluated using two-sided MI-based tests with significance level α set at 0.05.

RESULTS

Sample Description

The final sample included in this study is of 13,984 students, representing a weighted by achieved sample size mean response rate of 45.5% (Table 1). Mean age of the participants was 19.33 (SD=0.59), and 54.4% were female. The characteristics of the sample are presented in the Online Data Supplement Table 1."

Prevalence of mental disorders and severe role impairment

As shown in Table 2 (**first column**), twelve-month prevalence of any mental disorder was 31.4%, and ranged from **3% for drug use disorder to 18.5% for major depression"** A detail account of the prevalence of mental disorders in this sample has been reported elsewhere (Auerbach et al., 2018). A 20.4% of the sample reported any severe role impairment (Table 2, **6th column**), 10% for those with no mental disorder and 42.9% of those with any mental disorder (p<.0.001). Students with panic disorder and broad mania showed the highest proportion with severe impairment (60.6 and 57.5%, respectively). Results suggest a dose-dependent effect whereby the higher the number of disorders, the greater the impairment (almost 69% among students reporting three or more mental disorders). The highest level of impairment was observed for social life and close relationships.

The frequency of any severe role impairment across the different participating sites is summarized in Table 3. As expected, severe role impairment is much higher among students with than without mental disorders across all sites. However, there is considerable variation

in the prevalence of any severe impairment, from the lowest in Mexico and Belgium (8.9 and 10.6%, respectively) to the highest in Australia and Germany (38.7 and 27.4%, respectively). These site differences in prevalence of severe impairment persist among students with any and those with no mental disorder.

Mental disorders as predictors of severe role impairment

The results of the logistic regression models predicting any severe impairment adjusted by all our sociodemographic and college related factors, as well as by country, are presented in Table 4. Model 1 shows that all disorders were significantly associated with the reporting of severe role impairment, major depression and GAD being those disorders with the highest odds of severe impairment (OR=3.2 and OR=3.0, respectively).

Models 2 and 3 include only the number of disorders, either considered as a continuous count (Model 2) or a 3-level categorical count (Model 3). Model 2 shows a significant OR=2.5 of severe role impairment for each additional mental disorder, and Model 3 shows additive different effect for each of the categories considered (exactly one, exactly two, and three or more disorders), ORs ranging from 3.3 to 14.9. The joint effects corresponding to more than one disorder according to this model are sub-additive.

Models 4 and 5 assess the association of 12-month mental disorders with any severe role impairment taking into account the number of disorders using a continuous (Model 4) and categorical (Model 5) approach. Both Models 4 and 5 show that estimates for individual disorders are even higher, when the disorder count is included, than they were in Model 1. In contrast with Models 2 and 3, once the presence a specific mental disorders is considered, additional disorders are associated with a sub-additive effect (with OR significantly smaller than 1). Model AUCs were similar, ranging from 0.781 (Model 2) to 0.785 (Models 1 and 5) suggesting similar model performance. Model 5 was selected as the best fitting model.

The association of 12-month mental disorders with specific types of severe impairment when using a final logistic regression (Model 5 in Table 3) is presented in Table 5. All mental disorders are significantly associated with severe impairment in all four domains (with only two exceptions among 24 estimates). Major Depressive episode is associated with the highest impairment (with ORs ranging from 4.4 for close relationships, to 2.2 for home management), closely followed by GAD (ORs ranging from 3.7 to 2.3). Social life and in close relationships were the domains consistently with the highest association with 12-month mental disorders, and home management, the domain with lowest but still high and significant ORs.

Table 5 also provides the population attributable risk proportion (PARP), estimated for severe impairment in each role domain. This can be interpreted as the theoretical proportion of impairment that could be avoided if there was no 12-month disorder. Overall, almost half (45.2%) of any severe role impairment (last column) could be avoided, with PARPs over 50% for social life, close relationship and work impairment. AUCs indicated a similarly good performance for all models, with a range from 0.757 (work) to 0.803 (close relationships).

The association of 12-month mental disorders with any severe role impairment by country is presented in Table 6. For each row in the table, a separate model was built to determine the country-specific effects. All the models (and all the ORs shown) are also adjusted for sociodemographic and college-related variables, country membership, and variables-by-country interaction dummies. The first column shows the overall effects for the pooled sample, while each country column represents deviation for this particular country sample, once adjusted by all sociodemographic and college-related factors. The vast majority of country specific estimates were non-significantly different from one (i.e., no country effect); however, significant differences were found for Belgium (MDE, GAD, broad mania, and for three or more disorders), Australia (GAD and for exactly 2 disorders), and Spain (panic disorder) (the odds ratios of country differences ranging from 1.4 to 2.4).

Analyses of the association of sociodemographic and college-related variables with impairment, adjusting for 12-month mental disorders are presented in Online Data Supplement Table 2. Results show that age, religion, sexual orientation, and country are associated with the likelihood of reporting any severe impairment adjusting by mental disorders. As shown in Online Data Supplement Table 2, adjusting by a large number of variables, including mental disorders, a significant association with the likelihood of reporting sever role impairment was found for country. Spain and Australia students consistently showed a lower likelihood while Northern Ireland in particular, but also South Africa and Germany showed a higher likelihood of severe role impairment, adjusting by mental disorders and other sociodemographic variables.

DISCUSSION

To the best of our knowledge, this is the first study to report on the association between mental disorders and severe role impairment in first-year university students in a large, cross-national sample. Results indicate that severe role impairment is common among students with mental disorders and it encompasses broad domains of life, including social life, close personal relationships and work domains. Notably, PARP analyses indicated that if mental disorders were eliminated, nearly half of the reported severe role impairment in this population would be avoided, assuming that the observed association is causal (Krysinska & Martin, 2009). When adjusting for sociodemographic and college-related factors as well as country membership, major depressive episode and GAD are most strongly associated with role impairment. Additionally, while comorbidity is linearly related to severe role impairment, after controlling for individual existing disorders, additional disorders show a sub-additive association with impairment. Finally, we found that while there are cross-national differences in the frequency of severe role impairment, the association of mental disorders on severe role impairment is relatively similar across all the countries studied.

The finding that social life, close relationships, and college-related and other work domains are very frequently impaired among students with mental disorders is consistent with results of a previous study carried out in French universities (n = 1,025) (Verger et al., 2010). That study indicated comparable rates of impairment in the context of mental disorders. Our results are also in line with studies of adults in the general population, where individuals

with mental disorders reported severe role impairment more frequently than those with physical conditions, due to a higher association with social and personal relationships (Ormel et al., 2008). The high frequency of impairment among college students with mental disorders suggests that screening for impairment may be critical to substantively improve health and associated academic functioning. Since role impairment mediates the impact of mental disorders on perceived health outcomes (Alonso et al., 2013), it is quite likely that diminishing or avoiding impairment on social, relationships may improve students' health perceptions. It is nevertheless important to bear in mind that the data analyzed here are cross-sectional, precluding an interpretation of the directionality of the association between mental disorders and role impairment. Severe role impairment may have an effect on the incidence of new mental disorders, their impact and help-seeking behavior.

In our study, major depressive episode and GAD, the two most prevalent conditions, showed the strongest association with role impairment. Similar high prevalence of these two disorders have been previously reported (Auerbach et al., 2016; Farrer, Gulliver, Bennett, Fassnacht, & Griffiths, 2016; Ibrahim et al., 2013; Storrie, Ahern, & Tuckett, 2010; Vazquez et al., 2011). The combination of a high prevalence and high impact makes them a major source of role impairment among first year university students (Ormel et al., 2008; Verger et al., 2010). Major depression has been associated with a higher degree of attrition of university failure (Auerbach et al., 2016). Screening for these two mental disorders among university students, in particular major depression, may diminish their burden. On-line screening and intervention programs have been evaluated and shown to be feasible and effective for reducing symptoms (Andersson & Cuijpers, 2009; Spek et al., 2008) and prevent onset of full mental disorders (Buntrock et al., 2016). The impact of such strategies on academic outcomes should also be assessed.

We observed a monotonic relationship between number of mental disorders and frequency of severe role impairment in the bivariate analyses. However, a sub-additive interaction between number of disorders and impairment was found in a more complex model that included terms for both the type and the number of comorbid conditions. That is, in a person with a given mental disorder, a comorbid disorder adds impairment but less so than it would be expected for the latter disorder if it happened alone. This general pattern has been replicated in other studies (Alonso et al., 2011; Bruffaerts et al., 2012). An important theoretical implication is that interventions that successfully treat only one disorder in a highly comorbidity set are unlikely to be successful in fully reducing the impairments associated with these disorders. The entire set of disorders needs to be targeted. The feasibility of the latter is increased by the fact that many comorbid mental disorders share similar symptoms and pathological pathways (34). Recognition of this fact and of the high prevalence of comorbidity among mental disorders has led to the development of trans-diagnostic treatment approaches (Norton & Roberge, 2017). It has to be noted, that the sub-additive interaction documented here is based on a logistic regression model. In such a model, a sub-additive effect means that the joint effect of two conditions is lower than the product rather than the sum of their individual effects. Synergistic effects may still exist. And they might be important for prevention, since they might require innovative interventions beyond those directed to combat one particular disorder (Evans & Frank, 2004; Kessler et al., 2012; Lewinsohn, Rohde, & Seeley, 1995; Rothman, 2002; Scott et al., 2009).

A comparative evaluation of interventions targeted to specific disorders versus those targeted to more general manifestations is therefore necessary.

Differences across international sites were found for both the prevalence of mental disorders (Auerbach et al., 2018) and for the frequency of severe role impairment. But the association of mental disorder with severe role impairment was remarkably similar across sites (as shown in table 6). This is consistent with reports about role impairment in the adult general population (Alonso et al., 2011), and suggests the generalizability of the impact of mental disorders. Additional analyses adjusting by many variables (Online Supplement Table 2) do suggest that university students in Australia and Spain would show a somewhat lower risk of impairment than average, while Northern Ireland shows a higher risk. No clear hypotheses emerge from our data. In future longitudinal analyses, we should test whether these differences persist. We also will assess the extent to which mental disorders are associated with academic outcomes internationally.

The findings reported here should be interpreted under the consideration of several limitations of our study. First, the response rates were low in several sites. However, these response rates compare favourably to those achieved in other large-scale prospective college student surveys (39-44%) (Eisenberg, Hunt, & Speer, 2013; Paul, Tsypes, Eidlitz, Ernhout, & Whitlock, 2015). While 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, Cuijpers, et al., 2018). In addition, convenience samples rather than nationally representative samples of incoming first-year students were included in our study, which may limit the representativeness of the data. Second, 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 et al., 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. But bias should be small given that impairment of mental disorders as measured by the SDS tends to be 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. Third, the assessment of mental disorders is based on self-report surveys as opposed to in-depth clinical interviews. While the survey uses well-validated screening scales, with good concordance with blinded clinical diagnoses (in the range AUC = 0.70-0.78 for mental disorders(Kessler et al., 2013) and 0.78-0.91 for alcohol use disorder (Reinert & Allen, 2002), this is not a substitute for diagnostic interviews, and replication of results using full standard diagnostic measures is needed. Fourth, we were limited to the use of cross-sectional data, and analyses only adjusted for a limited range of variables. We plan to undergo longitudinal analyses when data are gathered in our study to assess the extent to which we replicate our findings. Finally, monetary incentives were offered in our study. This might have augmented participation and therefore the representativity of the study samples. But, because the research on the use of incentives in web surveys is limited, the possibility of an associated bias cannot be ruled out.

In summary, this large on-line survey of first-year university students in eight countries has revealed that role impairment associated with mental disorders is very high, affecting social life, close personal relationships, and work domains. Major depressive episode and GAD are the disorders with the highest impact on role impairment. The combination of their high prevalence and substantial functional impairment should call for interventions that diminish their potential impact on academic achievement and future mental health decrements. Implementation of interventions addressed to major depression and GAD, specifically, should be strongly considered. The combination of high prevalence and substantial functional impairment should call for careful consideration of the potential benefit of screening for mental disorders in the university student population. Also, the implementation of interventions addressed to major depression and GAD, specifically, should be evaluated. There is evidence that online interventions are effective for the prevention and treatment of depression and anxiety disorders (Ebert, Cuijpers, Munoz, & Baumeister, 2017; Sander, Rausch, & Baumeister, 2016), but more research is needed to determine the potential of such approaches among university students, for example with regard to the reduction of role impairment and academic functioning. Also interventions targeted to the most frequent impairments associated with these disorders (i.e., social life, close personal relationships and work) seem necessary.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

Abel JR, Deitz R. Do colleges and universities increase their region's human capital? J Econ Geogr. 2012; 12(3):667–691.

Alonso J, Petukhova M, Vilagut G, Chatterji S, Heeringa S, Ustun TB, Kessler RC. Days out of role due to common physical and mental conditions: results from the WHO World Mental Health surveys. Mol Psychiatry. 2011; 16(12):1234–1246. DOI: 10.1038/mp.2010.101 [PubMed: 20938433]

Alonso J, Vilagut G, Adroher ND, Chatterji S, He Y, Andrade LH, Kessler RC. Disability mediates the impact of common conditions on perceived health. PLoS One. 2013; 8(6):e65858.doi: 10.1371/journal.pone.0065858 [PubMed: 23762442]

Andersson G, Cuijpers P. Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. Cogn Behav Ther. 2009; 38(4):196–205. DOI: 10.1080/16506070903318960 [PubMed: 20183695]

Auerbach RP, Alonso J, Axinn WG, Cuijpers P, Ebert DD, Green JG, Bruffaerts R. Mental disorders among college students in the World Health Organization World Mental Health Surveys. Psychol Med. 2016; 46(14):2955–2970. DOI: 10.1017/S0033291716001665 [PubMed: 27484622]

Auerbach RP, Mortier P, Bruffaerts R, Alonso J, Benjet C, Cuijpers P. WHO World Mental Health Surveys International College Student Project: Prevalence and Distribution of Mental Disorders. J Abnormal Psychol. 2018 Under review.

Babor T, Higgins-Biddle J, Saunders J, Monteiro M. The Alcohol Use Disorders Identification Test. Guidelines for Use in Primary Care. 2001 Retrieved from.

Blanco C, Okuda M, Wright C, Hasin DS, Grant BF, Liu SM, Olfson M. 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. 2008; 65(12):1429–1437. DOI: 10.1001/archpsyc.65.12.1429 [PubMed: 19047530]

Bruffaerts R, Mortier P, Kiekens G, Auerbach RP, Cuijpers P, Demyttenaere K, Kessler RC. Mental health problems in college freshmen: Prevalence and academic functioning. J Affect Disord. 2018; 225:97–103. DOI: 10.1016/j.jad.2017.07.044 [PubMed: 28802728]

Bruffaerts R, Vilagut G, Demyttenaere K, Alonso J, Alhamzawi A, Andrade LH, Kessler RC. Role of common mental and physical disorders in partial disability around the world. Br J Psychiatry. 2012; 200(6):454–461. DOI: 10.1192/bjp.bp.111.097519 [PubMed: 22539779]

Buntrock C, Ebert DD, Lehr D, Smit F, Riper H, Berking M, Cuijpers P. Effect of a web-based guided self-help intervention for prevention of major depression in adults with sub-threshold depression: A randomized clinical trial. Journal of the American Medical Association. 2016; 315(17):1854–1863. [PubMed: 27139058]

Cho SB, Llaneza DC, Adkins AE, Cooke M, Kendler KS, Clark SL, Dick DM. Patterns of Substance Use Across the First Year of College and Associated Risk Factors. Front Psychiatry. 2015; 6:152.doi: 10.3389/fpsyt.2015.00152 [PubMed: 26578984]

Ebert DD, Cuijpers P, Munoz RF, Baumeister H. Prevention of Mental Health Disorders Using Internet- and Mobile-Based Interventions: A Narrative Review and Recommendations for Future Research. Front Psychiatry. 2017; 8:116.doi: 10.3389/fpsyt.2017.00116 [PubMed: 28848454]

Eisenberg D, Golberstein E, Gollust SE. Help-seeking and access to mental health care in a university student population. Med Care. 2007; 45(7):594–601. DOI: 10.1097/MLR.0b013e31803bb4c1 [PubMed: 17571007]

Eisenberg D, Hunt J, Speer N. Mental health in American colleges and universities: variation across student subgroups and across campuses. J Nerv Ment Dis. 2013; 201(1):60–67. DOI: 10.1097/NMD.0b013e31827ab077 [PubMed: 23274298]

Evans AS, Frank SJ. Adolescent depression and externalizing problems: testing two models of comorbidity in an inpatient sample. Adolescence. 2004; 39(153):1–18. [PubMed: 15230062]

Farrer LM, Gulliver A, Bennett K, Fassnacht DB, Griffiths KM. Demographic and psychosocial predictors of major depression and generalised anxiety disorder in Australian university students. BMC Psychiatry. 2016; 16:241.doi: 10.1186/s12888-016-0961-z [PubMed: 27422284]

Groves RM. Nonresponse rates and nonresponse bias in household surveys. Public Opin Q. 2006; 70(5):646–675.

Groves RM, Couper MP. Nonresponse in Household Interview Surveys. New York: Wiley; 1998.

Ibrahim AK, Kelly SJ, Adams CE, Glazebrook C. A systematic review of studies of depression prevalence in university students. J Psychiatr Res. 2013; 47(3):391–400. DOI: 10.1016/j.jpsychires.2012.11.015 [PubMed: 23260171]

Inc., S.I. SAS/STATR Software. Cary, NC: SAS Institute Inc; 2010.

Kendler KS, Myers J, Dick D. The stability and predictors of peer group deviance in university students. Soc Psychiatry Psychiatr Epidemiol. 2015; 50(9):1463–1470. DOI: 10.1007/s00127-015-1031-4 [PubMed: 25702166]

Kessler RC, Avenevoli S, Costello J, Green JG, Gruber MJ, McLaughlin KA, Merikangas KR. Severity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication Adolescent Supplement. Arch Gen Psychiatry. 2012; 69(4):381–389. DOI: 10.1001/archgenpsychiatry. 2011.1603 [PubMed: 22474106]

Kessler RC, Foster CL, Saunders WB, Stang PE. Social consequences of psychiatric disorders, I: Educational attainment. Am J Psychiatry. 1995; 152(7):1026–1032. [PubMed: 7793438]

Kessler RC, McLaughlin KA, Green JG, Gruber MJ, Sampson NA, Zaslavsky AM, Williams DR. Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. Br J Psychiatry. 2010; 197:378–385. [PubMed: 21037215]

Kessler RC, Santiago PN, Colpe LJ, Dempsey CL, First MB, Heeringa SG, Ursano RJ. Clinical reappraisal of the Composite International Diagnostic Interview Screening Scales (CIDI-SC) in the Army Study to Assess Risk and Resilience in Service members (army STARRS). International Journal of Methods in Psychiatric Research. 2013; 22(4):303–321. [PubMed: 24318219]

Kessler RC, Ustun TB. The World Mental Health (WMH) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). Int J Methods Psychiatr Res. 2004; 13(2):93–121. [PubMed: 15297906]

Klemenc-Ketis Z, Kersnik J, Eder K, Colaric D. Factors associated with health-related quality of life among university students. Srp Arh Celok Lek. 2011; 139(3–4):197–202. [PubMed: 21618866]

Krysinska K, Martin G. The struggle to prevent and evaluate: application of population attributable risk and preventive fraction to suicide prevention research. Suicide Life Threat Behav. 2009; 39(5):548–557. DOI: 10.1521/suli.2009.39.5.548 [PubMed: 19929154]

Leon AC, Olfson M, Portera L, Farber L, Sheehan DV. Assessing psychiatric impairment in primary care with the Sheehan Disability Scale. Int J Psychiatry Med. 1997; 27(2):93–105. [PubMed: 9565717]

Lewinsohn PM, Rohde P, Seeley JR. Adolescent psychopathology: III. The clinical consequences of comorbidity. J Am Acad Child Adolesc Psychiatry. 1995; 34(4):510–519. [PubMed: 7751265]

Mojtabai R, Stuart EA, Hwang I, Eaton WW, Sampson N, Kessler RC. Long-term effects of mental disorders on educational attainment in the National Comorbidity Survey ten-year follow-up. Soc Psychiatry Psychiatr Epidemiol. 2015; 50(10):1577–1591. DOI: 10.1007/s00127-015-1083-5 [PubMed: 26082040]

Mortier P, Auerbach RP, Alonso J, Bantjes J, Benjet C, Cuijpers P, Collaborators W.W.-I. Suicidal Thoughts and Behaviors Among First-Year College Students: Results From the WMH-ICS Project. J Am Acad Child Adolesc Psychiatry. 2018; 57(4):263–273 e0261. DOI: 10.1016/j.jaac. 2018.01.018 [PubMed: 29588052]

Mortier P, Cuijpers P, Kiekens G, Auerbach RP, Demyttenaere K, Green JG, Bruffaerts R. The prevalence of suicidal thoughts and behaviours among college students: a meta-analysis. Psychol Med. 2018; 48(4):554–565. DOI: 10.1017/S0033291717002215 [PubMed: 28805169]

Nock MK, Borges G, Ono Y. Suicide: Global Perspective from the WHO World Mental Health Surveys. New York: Cambridge University Press; 2012.

Norton PJ, Roberge P. Transdiagnostic Therapy. Psychiatr Clin North Am. 2017; 40(4):675–687. DOI: 10.1016/j.psc.2017.08.003 [PubMed: 29080593]

OECD. Stat Education and Training > Education at a Glance > Educational attainment and labor-force status > Educational attainment of 25-64 year-olds. 2016 Accessed February 23, 2018.

Ormel J, Petukhova M, Chatterji S, Aguilar-Gaxiola S, Alonso J, Angermeyer MC, Kessler RC. Disability and treatment of specific mental and physical disorders across the world. Br J Psychiatry. 2008; 192:368–375. [PubMed: 18450663]

Paul E, Tsypes A, Eidlitz L, Ernhout C, Whitlock J. Frequency and functions of non-suicidal self-injury: associations with suicidal thoughts and behaviors. Psychiatry Res. 2015; 225(3):276–282. DOI: 10.1016/j.psychres.2014.12.026 [PubMed: 25592979]

Reinert DF, Allen JP. The Alcohol Use Disorders Identification Test (AUDIT): a review of recent research. Alcohol Clin Exp Res. 2002; 26(2):272–279. [PubMed: 11964568]

Rothman KJ. Epidemiology: An Introduction. New York: Oxford University Press; 2002.

Sander L, Rausch L, Baumeister H. Effectiveness of Internet-Based Interventions for the Prevention of Mental Disorders: A Systematic Review and Meta-Analysis. JMIR Ment Health. 2016; 3(3):e38.doi: 10.2196/mental.6061 [PubMed: 27535468]

Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detecton of Persons with Harmful Alcohol Consumption–II. Addiction. 1993; 88(6):791–804. [PubMed: 8329970]

Scott KM, Von Korff M, Alonso J, Angermeyer MC, Bromet E, Fayyad J, Williams D. Mental-physical co-morbidity and its relationship with disability: results from the World Mental Health Surveys. Psychol Med. 2009; 39(1):33–43. DOI: 10.1017/S0033291708003188 [PubMed: 18366819]

Skidmore CR, Kaufman EA, Crowell SE. Substance Use Among College Students. Child Adolesc Psychiatr Clin N Am. 2016; 25(4):735–753. DOI: 10.1016/j.chc.2016.06.004 [PubMed: 27613349]

Spek V, Cuijpers P, Nyklicek I, Smits N, Riper H, Keyzer J, Pop V. One-year follor-up results of a randomized conrolled clinical trial on internet-based cognitive behavioural therapy for subthreshold depression in people over 50 years. Psychological Medicine. 2008; 38(5):635–639. [PubMed: 18205965]

Storrie K, Ahern K, Tuckett A. A systematic review: Students with mental health problems–a growing problem. Int J Nurs Pract. 2010; 16(1):1–6. DOI: 10.1111/j.1440-172X.2009.01813.x [PubMed: 20158541]

Van Buuren S. Flexible Imputation of Missing Data. Boca Raton: CRC Press(Taylor & Francis Group); 2012.

Vazquez FL, Torres A, Otero P, Diaz O. Prevalence, comorbidity, and correlates of DSM-IV axis I mental disorders among female university students. J Nerv Ment Dis. 2011; 199(6):379–383. DOI: 10.1097/NMD.0b013e31821cd29c [PubMed: 21629015]

Verger P, Guagliardo V, Gilbert F, Rouillon F, Kovess-Masfetty V. Psychiatric disorders in students in six French universities: 12-month prevalence, comorbidity, impairment and help-seeking. Social Psychiatry and Psychiatric Epidemiology. 2010; 45(2):189–199. [PubMed: 19381424]

Wittchen HU, Nelson CB, Lachner G. Prevalence of mental disorders and psychosocial impairments in adolescents and young adults. Psychol Med. 1998; 28(1):109–126. [PubMed: 9483687]

Table 1

WMH-ICS sample characteristics.

Country	Number of participating universities	Total size of the universities	Number of first-year students eligible	Number of first-year students participated	Response Rate	Survey Field Dates	Sampling & procedures
Australia	one public	~ 45,000	9,042	633	7.0%	2016	All first-year students were invited to participate through e-mail. Five reminder emails were sent with personalized links to the survey. Conditional incentives were applied (movie passes).
Belgium	one public	~ 40,000	8,530	4,580	53.7%	2014-16	All first-year students were invited for a psycho-medical check-up in the student mental health center. Surveys were completed in the waiting room. Students who did not show up for the psycho-medical check-up received up to eight reminder emails. Conditional incentives were applied (store credit coupons).
Germany	one public	~ 40,000	5,064	677	13.4%	2016-17	All first-year students were invited to participate through e-mail. Six reminder emails were sent with personalized links to the survey. Conditional incentives were applied (store credit coupons).
Mexico	four private/two public	~ 28,000	5,293	4,199	79.3%	2016	All first-year students were eligible for the survey. Initial contact differed by university: survey included in an obligatory health evaluation (1 university), as part of obligatory group tutoring sessions (1 university), or as part of required classes (2 universities) or teacher evaluations (2 universities). Two universities sent reminder emails (tutors sent out emails to their tutees; in a required class of personal development, reminders were sent out by faculty). No incentives were applied.
Northern-Ireland	one public	~ 25,000	4,359	739	17.0%	2015	All first-year students due to register were invited to participate. Following registration, ID numbers and links to the survey were provided. Five reminder emails/text messages were sent with personalized links to the survey. A 6th reminder involved a researcher telephoning non-responders. All responders were entered into a number of draws to win an iPad.
South-Africa	one public	~ 30,000	5,338	686	12.9%	2015	All first-year students were invited to participate through e-mail. Eight reminder emails and one text message were sent with personalized links to the survey. Conditional incentives were applied (5× R1000 draw).
Spain	five public	~ 96,000	16,332	2,118	13.0%	2014-15	All first-year students were eligible for the survey. Initial contact differed by university (information stands, information sessions in classrooms, through the university's website). Four reminder emails were sent with personalized links to the survey. Conditional monetary incentives were applied. Additionally, an end-game strategy was

Country	Number of participating universities	Total size of the universities	Number of first-year students eligible	Number of first-year students participated	Response Rate	Survey Field Dates	Sampling & procedures
							implemented by selecting a random proportion of non-respondents and offering all of them a monetary incentive.
United States	three private	~ 21,800	4,382	739	16.9%	2015-16	All first-year students were invited to participate through e-mail. Three reminder emails were sent with personalized links to the survey. Conditional incentives were applied (gift cards).
Total	12 public/7 private	~ 326,000	58,340	14,371	45.5% [*]	2014-17	

[*]
weighted by achieved sample size

Table 2

Severe role impairment by 12-month mental disorder in the WMH-ICS surveys.

	% (SE)	Any severe role impairment % (SE)	Home management % (SE)	College-related work % (SE)	Close relationships % (SE)	Social life % (SE)	Exactly 1 severe role impairment % (SE)	Exactly 2 severe role impairments % SE	3 or more severe role impairments % (SE)
Full sample (n = 13,984)	100 (0.0)	20.4 (0.6)	6.6 (0.4)	9.6 (0.4)	11.1 (0.4)	12.1 (0.5)	8.9 (0.4)	5.8 (0.3)	5.7 (0.3)
No mental disorder	68.6 (0.6)	10.0 (0.5)	3.3 (0.3)	4.1 (0.3)	4.8 (0.4)	5.4 (0.4)	5.4 (0.4)	2.4 (0.2)	2.2 (0.3)
Any mental disorder	31.4 (0.6)	42.9 (1.2)	13.7 (0.9)	21.7 (1.0)	24.8 (1.0)	26.8 (1.1)	16.4 (0.9)	13.0 (0.8)	13.5 (0.9)
Type of disorder									
Major depressive episode	18.5 (0.5)	51.2 (1.5)	16.7 (1.3)	27.4 (1.4)	30.9 (1.5)	33.3 (1.5)	17.7 (1.2)	15.6 (1.1)	17.9 (1.3)
Generalized anxiety disorder	16.7 (0.5)	53.1 (1.6)	18.1 (1.4)	27.8 (1.5)	30.6 (1.5)	34.8 (1.6)	19.1 (1.4)	15.5 (1.2)	18.5 (1.3)
Panic disorder	4.5 (0.3)	60.6 (3.4)	24.4 (3.0)	35.2 (3.3)	32.4 (3.3)	37.6 (3.4)	21.6 (3.1)	16.9 (2.6)	22.1 (3.0)
Broad mania	3.1 (0.2)	57.5 (3.8)	24.5 (3.7)	32.9 (3.6)	35.7 (3.7)	35.3 (3.7)	19.9 (3.4)	14.3 (2.7)	23.3 (3.4)
Alcohol abuse or dependence	6.3 (0.3)	34.2 (2.8)	13.0 (2.1)	15.7 (2.1)	19.4 (2.3)	21.4 (2.4)	13.8 (2.1)	9.5 (1.7)	10.9 (1.9)
Drug abuse or dependence	3.0 (0.2)	48.4 (4.2)	22.3 (3.8)	25.8 (3.7)	31.5 (3.9)	23.9 (3.6)	20.8 (3.7)	8.7 (2.5)	18.9 (3.3)
Number of disorders									
Exactly one mental disorder	17.2 (0.5)	30.2 (1.5)	7.6 (0.9)	13.7 (1.1)	16.4 (1.2)	17.5 (1.3)	13.1 (1.2)	10.6 (1.0)	6.5 (0.8)
Exactly two mental disorders	9.4 (0.4)	52.9 (2.2)	16.7 (1.8)	26.9 (2.0)	32.0 (2.1)	35.0 (2.1)	18.5 (1.8)	16.2 (1.7)	18.2 (1.8)
Three or more mental disorders	4.8 (0.3)	68.8 (3.0)	29.4 (3.2)	40.1 (3.3)	40.7 (3.2)	43.8 (3.3)	24.3 (3.1)	15.5 (2.4)	29.0 (3.0)

Note: to obtain pooled estimates of prevalence, each country was given an equal sum of weights. SE = standard error.

Table 3

Any severe role impairment by 12-month mental disorder in the WMH-ICS surveys, by country.

	Australia % (SE)	Belgium % (SE)	Germany % (SE)	Mexico % (SE)	Northern-Ireland % (SE)	South-Africa % (SE)	Spain % (SE)	USA % (SE)	F(ndf, ddf) [p-value][a]
Full sample	38.7 (2.3)	10.6 (0.5)	27.4 (1.9)	8.9 (0.5)	22.2 (1.6)	20.9 (1.8)	17.3 (1.3)	17.0 (1.5)	65.24(7,88432)[<0.01]*
No mental disorder	16.9 (2.4)	5.6 (0.4)	15.1 (2.1)	5.4 (0.4)	9.8 (1.4)	11.2 (1.8)	9.7 (1.3)	9.3 (1.4)	14.35(7,5920)[<0.01]*
Any mental disorder	67.2 (3.4)	31.9 (1.6)	48.9 (3.3)	20.0 (1.5)	43.4 (3.1)	41.3 (3.8)	32.6 (2.7)	37.8 (3.5)	28.09(7,179424)[<0.01]*
Type of disorder									
Major depressive episode	75.4 (4.0)	41.6 (2.2)	51.6 (3.9)	27.5 (2.5)	52.0 (4.0)	48.6 (5.0)	38.8 (3.5)	50.6 (5.2)	14.51(7,971377)[<0.01]*
Generalized anxiety disorder	78.1 (3.7)	43.8 (2.7)	58.7 (4.9)	29.0 (2.5)	52.5 (4.0)	47.6 (5.1)	39.9 (3.9)	43.7 (4.9)	15.25(7,1274302)[<0.01]*
Panic disorder	75.1 (6.2)	37.9 (5.0)	65.5 (8.9)	28.6 (5.8)	62.5 (10.1)	57.7 (12.9)	71.4 (7.6)	46.0 (9.6)	6.25(7,281)[<0.01]*
Broad mania	79.5 (7.5)	59.1 (7.2)	55.2 (11.9)	27.5 (3.7)	49.3 (12.0)	44.6 (15.4)	57.8 (7.4)	62.1 (13.8)	6.14(7,471872)[<0.01]*
Alcohol abuse or dependence	69.5 (8.1)	17.7 (3.0)	48.9 (10.6)	15.2 (2.3)	33.4 (6.0)	34.6 (7.9)	26.8 (7.0)	12.9 (6.8)	7.96(7,207551)[<0.01]*
Drug abuse or dependence	68.8 (9.6)	26.8 (9.6)	66.3 (10.5)	27.5 (5.7)	55.8 (15.2)	43.9 (10.1)	37.4 (10.1)	21.6 (8.7)	3.33(7,1465)[<0.01]*
Number of disorders									
Exactly one mental disorder	44.6 (5.6)	22.3 (1.9)	38.0 (4.3)	12.3 (1.5)	29.9 (4.3)	32.7 (5.1)	22.5 (3.2)	33.6 (4.5)	11.20(7,10032)[<0.01]*
Exactly two mental disorders	81.6 (4.7)	44.1 (3.5)	62.2 (6.2)	29.4 (3.9)	51.4 (6.1)	47.5 (7.1)	41.3 (4.6)	38.0 (6.5)	8.28(7,660)[<0.01]*
Three or more mental disorders	83.8 (5.1)	70.5 (6.1)	68.6 (8.4)	41.0 (6.0)	67.6 (8.0)	56.6 (10.4)	61.6 (9.9)	69.0 (10.9)	3.15(7,256)[<0.01]*

[a] F-test to evaluate significant between-country difference in prevalence estimates. ndf = numerator degrees of freedom; ddf = denominator degrees of freedom.

Table 4

Twelve-month mental disorders as predictors for any severe role impairment in the WMH-ICS surveys.

	Model 1	Model 2	Model 3	Model 4	Model 5
	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)
Type of mental disorder					
Major depressive episode	3.2 (2.8-3.8)*			4.1 (3.4-4.9)*	4.0 (3.3-4.8)*
Generalized anxiety disorder	3.0 (2.6-3.6)*			4.1 (3.3-5.0)*	3.9 (3.1-4.8)*
Panic disorder	2.1 (1.5-2.9)*			2.8 (2.0-4.0)*	2.9 (2.1-4.2)*
Broad mania	1.9 (1.4-2.6)*			2.6 (1.9-3.7)*	2.7 (1.9-3.8)*
Alcohol abuse or dependence	1.4 (1.1-1.7)*			1.7 (1.3-2.2)*	1.7 (1.3-2.2)*
Drug abuse or dependence	1.6 (1.1-2.2)*			2.1 (1.5-3.1)*	2.1 (1.4-3.0)*
Number of disorders (continuous)		2.5 (2.4-2.7)*		0.8 (0.7-0.9)*	
Number of disorders (categorical)					
None			(ref)		(ref)
Exactly one mental disorder			3.3 (2.8-3.8)*		
Exactly two mental disorders			8.2 (6.9-9.8)*		0.7 (0.5-0.9)*
Three or more mental disorders			14.9 (11.4-19.5)*		0.4 (0.2-0.6)*
F(ndf, ddf)[p-value][a]			272.76(3,2615)[<0.01]*		7.73(2,1992)[<0.01]*
Model fit					
Akaike information criterion	9416.8	9498.2	9474.4	9399.9	9398.2
Area under the Curve	0.784	0.781	0.782	0.785	0.785

Note: Model 1 includes all the type of mental disorders; Model 2 includes the number of mental disorders (as a continuous variable); Model 3 Includes the number of mental disorders (as categorical variables); Model 4 includes all the types of mental disorders plus he number of disorders (continuous); and Model 5 includes all the types of mental disorders plus the number of disorders (categorical). All models are adjusted for sociodemographic (gender, age, parental educational level, parental marital status, place raised, religion, sexual orientation, and current living situation), college-related predictors (expected to work on a student job, academic performance in high school, most important reason to go to university), the predictors shown in the rows, and country membership. Significant findings are indicated in bold and marked with an asterisk *; α = 0.05.

aOR = adjusted odds ratio; CI = confidence interval.

[a]F-test to evaluate joint significance of categorical predictor levels. ndf = numerator degrees of freedom; ddf = denominator degrees of freedom.

Table 5

Twelve-month mental disorders as predictors for types of severe role impairment in the WMH-ICS surveys, final model.

	Any severe role impairment	Home management	College-related work	Close relationships	Social life
	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)
Type of disorder					
Major depressive episode	**4.0 (3.3-4.8)***	**2.2 (1.6-3.0)***	**3.6 (2.8-4.6)***	**4.4 (3.4-5.5)***	**4.3 (3.4-5.4)***
Generalized anxiety disorder	**3.9 (3.1-4.8)***	**2.3 (1.6-3.2)***	**3.5 (2.7-4.7)***	**3.1 (2.3-4.2)***	**3.7 (2.9-4.8)***
Panic disorder	**2.9 (2.1-4.2)***	**1.9 (1.1-3.3)***	**3.0 (2.0-4.4)***	**2.4 (1.6-3.6)***	**2.5 (1.7-3.7)***
Broad mania	**2.7 (1.9-3.8)***	**1.9 (1.1-3.2)***	**2.3 (1.6-3.4)***	**2.4 (1.6-3.6)***	**2.4 (1.6-3.5)***
Alcohol abuse or dependence	**1.7 (1.3-2.2)***	**1.5 (1.0-2.3)***	1.4 (1.0-1.9)	**1.6 (1.1-2.2)***	**1.7 (1.3-2.4)***
Drug abuse or dependence	**2.1 (1.4-3.0)***	**1.7 (1.0-3.0)***	**2.3 (1.5-3.5)***	**2.4 (1.6-3.6)***	1.5 (1.0-2.3)
Number of disorders					
None or exactly one disorder					
Exactly two mental disorders	**0.7 (0.5-0.9)***	1.0 (0.6-1.6)	0.7 (0.5-1.0)	0.7 (0.5-1.0)	**0.6 (0.4-0.9)***
Three or more mental disorders	**0.4 (0.2-0.6)***	0.8 (0.3-2.0)	**0.4 (0.2-0.7)***	**0.3 (0.2-0.6)***	**0.3 (0.2-0.6)***
F(ndf, ddf)[p-value][a]	7.73(2,1992)[<0.01]*	0.21(2,7336)[0.81]	5.31(2,946)[<0.01]*	6.14(2,690)[<0.01]*	6.95(2,751)[<0.01]*
PARP % (SE)	45.2 (1.8)	40.7 (3.2)	50.4 (2.2)	50.7 (1.9)	50.7 (1.6)
Area under the Curve	0.785	0.757	0.775	0.803	0.798

Note: all models are adjusted for sociodemographic (gender, age, parental educational level, parental marital status, place raised, religion, sexual orientation, and current living situation), college-related predictors (expected to work on a student job, academic performance in high school, most important reason to go to university), the predictors shown in the rows, and country membership. Significant findings are indicated in bold and marked with an asterisk *; α = 0.05.

aOR = adjusted odds ratio; CI = confidence interval

[a] F-test to evaluate joint significance of categorical predictor levels. ndf = numerator degrees of freedom; ddf = denominator degrees of freedom.

Table 6

Twelve-month mental disorders as predictors for any severe role impairment in the WMH-ICS surveys, country effect *vs.* overall effect.

	Overall Effect	Australia	Belgium	Germany	Mexico	Northern-Ireland	South-Africa	Spain	USA
	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)
Type of disorder									
Major depressive episode	**3.8 (3.2-4.6)***	1.2 (0.8-1.9)	**1.5 (1.2-2.0)***	0.8 (0.5-1.1)	0.8 (0.6-1.0)	1.0 (0.7-1.5)	0.8 (0.5-1.2)	0.8 (0.6-1.1)	1.4 (0.9-2.1)
Generalized anxiety disorder	**3.9 (3.2-4.8)***	**1.8 (1.1-2.8)***	**1.4 (1.0-1.8)***	0.8 (0.5-1.3)	0.8 (0.6-1.1)	1.0 (0.7-1.4)	0.9 (0.5-1.4)	0.8 (0.6-1.1)	0.9 (0.6-1.4)
Panic disorder	**3.1 (2.2-4.5)***	0.9 (0.4-1.7)	0.8 (0.5-1.4)	1.1 (0.5-2.6)	0.7 (0.4-1.3)	1.0 (0.4-2.6)	0.9 (0.3-3.0)	**2.4 (1.2-4.8)***	0.8 (0.3-1.8)
Broad mania	**2.6 (1.8-3.9)***	1.2 (0.5-2.8)	**2.4 (1.2-4.6)***	0.8 (0.3-1.9)	0.7 (0.4-1.2)	0.5 (0.2-1.3)	0.4 (0.1-1.7)	1.4 (0.8-2.7)	2.3 (0.7-7.3)
Alcohol abuse or dependence	**1.7 (1.3-2.3)***	1.5 (0.7-3.2)	1.0 (0.6-1.5)	1.7 (0.8-3.5)	0.9 (0.6-1.4)	1.0 (0.6-1.8)	1.1 (0.5-2.2)	0.9 (0.6-1.5)	0.4 (0.1-1.2)
Drug abuse or dependence	**2.1 (1.4-3.0)***	1.1 (0.5-2.5)	1.1 (0.4-2.8)	1.7 (0.7-4.0)	1.1 (0.6-2.1)	0.9 (0.3-2.8)	1.0 (0.4-2.4)	0.8 (0.4-1.8)	0.6 (0.2-1.5)
Number of disorders									
None or exactly one disorder	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Exactly two mental disorders	**0.7 (0.5-0.9)***	**2.2 (1.2-3.9)***	1.2 (0.9-1.7)	0.9 (0.6-1.6)	1.0 (0.7-1.4)	0.9 (0.6-1.6)	0.8 (0.5-1.5)	0.8 (0.6-1.1)	0.6 (0.4-1.1)
Three or more mental disorders	**0.3 (0.2-0.6)***	1.0 (0.5-2.0)	**1.9 (1.0-3.4)***	0.9 (0.4-1.8)	0.7 (0.4-1.3)	1.0 (0.4-2.1)	0.7 (0.3-1.6)	1.2 (0.7-2.0)	1.1 (0.4-3.0)

Note: For each row in the table, a separate model was built to determine the country-specific effects. All the models (and all the ORs shown) are also adjusted for all other predictor variables, sociodemographic and college-related predictors, country membership, and predictor-by-country interaction dummies. The second column shows the overall adjusted predictor variable effect; the country columns show to what extent the country-specific adjusted predictor variable effect deviates from the overall adjusted predictor variable effect. For example, the country-specific effect for "Generalized anxiety disorder" in Australia can be obtained by multiplying aOR = 3.9 (the overall effect) by aOR = 1.8 (the country-specific deviation), i.e., aOR = 7.0. Significant findings are indicated in bold and marked with an asterisk *; α = 0.05. aOR = adjusted odds ratio; CI = confidence interval; SE = standard error.