Title: Epidemiology of depression with psychotic experiences and its association with chronic physical conditions in 47 low- and middle-income countries

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Figure 1

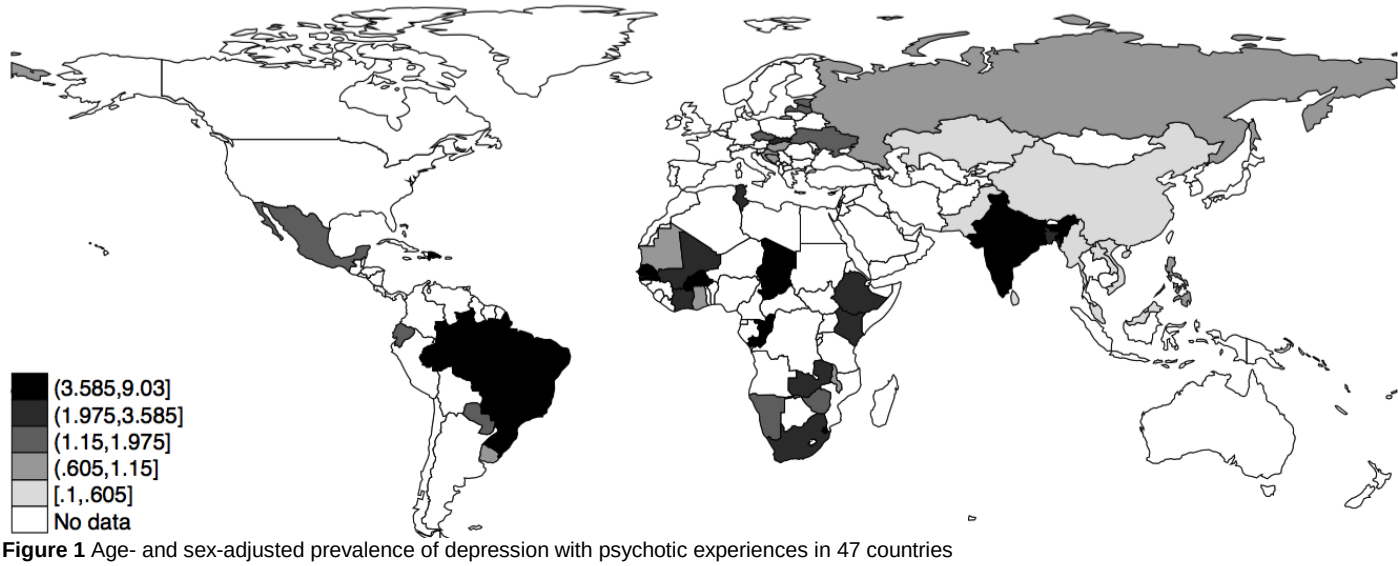

Figure 1 Age- and sex-adjusted prevalence of depression with psychotic experiences in 47 countries
All age- and sex-adjusted estimates were calculated using the United Nations population pyramids for the year 2010.

Figure 2

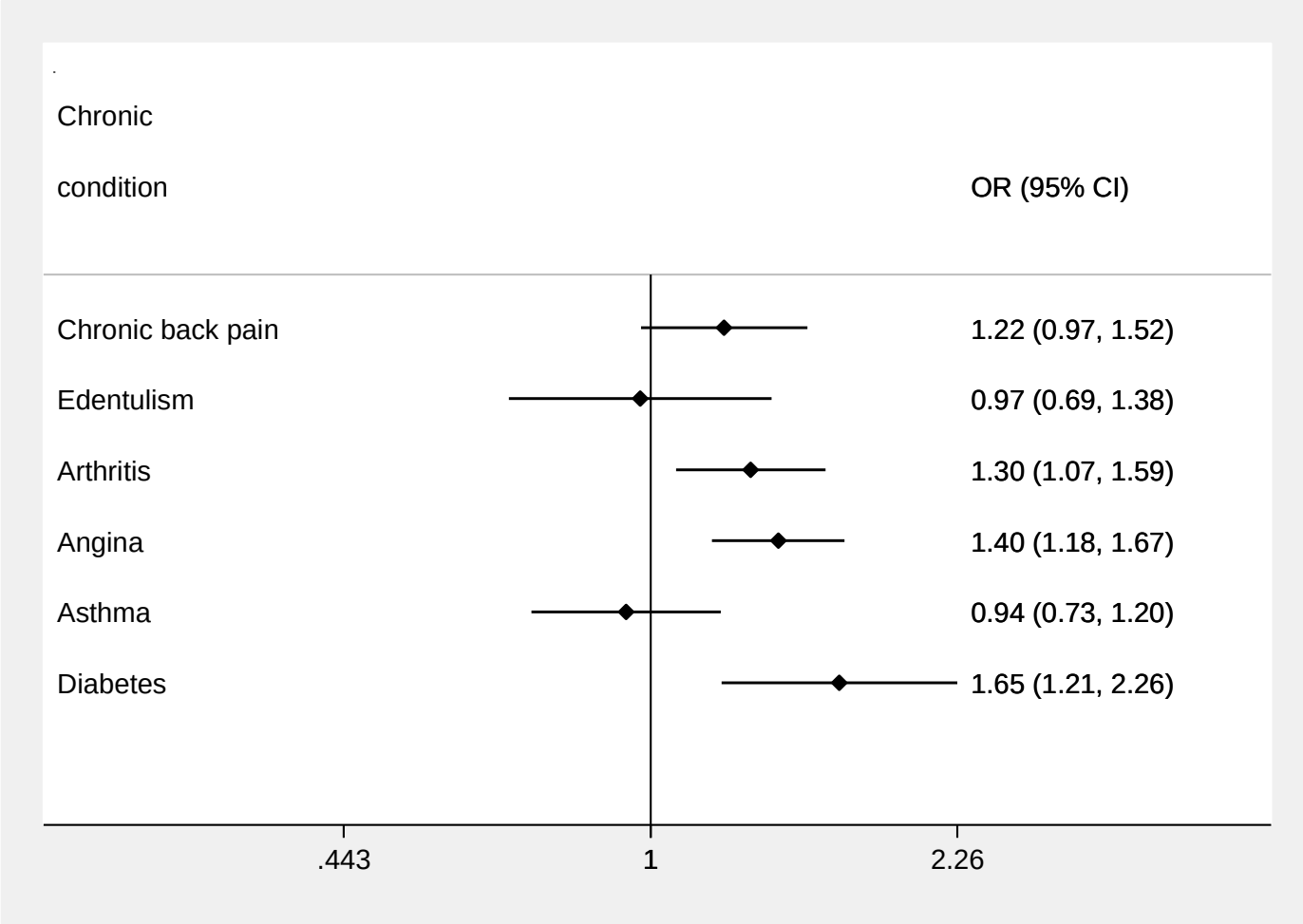

Figure 2 Associations between physical health conditions and comorbid depression and psychotic experiences (vs. depression alone) estimated by multivariable logistic regression
Abbreviation: OR odds ratio; CI confidence interval
Models are adjusted for age, sex, setting, marital status, education, wealth, anxiety, and country.

Abstract

Background: The coexistence of depression and psychotic experiences (PEs) is associated with more pronounced adverse health outcomes compared to depression alone. However, data on its prevalence and correlates are lacking in the general adult population, and there is no published data on its association with chronic physical conditions.

Methods: Cross-sectional, community-based data from 201,337 adults aged ≥18 years from 47 low- and middle-income countries from the World Health Survey were analyzed. The presence of past-12 month PE and DSM-IV depression was assessed with the Composite International Diagnostic Interview (CIDI). Information on six chronic medical conditions (chronic back pain, edentulism, arthritis, angina, asthma, diabetes) were obtained by self-report. Multivariable logistic regression analysis was performed.

Results: The crude overall prevalence of comorbid depression/PE was 2.5% (95%CI=2.3%-2.7%), with the age- and sex-adjusted prevalence ranging from 0.1% (Sri Lanka, Vietnam) to 9.03% (Brazil). Younger age, urban setting, current smoking, alcohol consumption, and anxiety were significant correlates of co-existing depression/PE. Co-occurring depression/PE was associated with significantly higher odds for arthritis, angina, and diabetes beyond that of depression alone after adjusting for sociodemographics, anxiety, and country, with ORs (depression/PE vs. depression only) being: arthritis 1.30 (95%CI=1.07-1.59; p=0.0086); angina 1.40 (95%CI=1.18-1.67; p=0.0002); diabetes 1.65 (95%CI=1.21-2.26; p=0.0017).

Conclusions: The prevalence of co-existing depression/PE was non-negligible in most countries. Our study suggests that when depression/PE or a chronic condition (e.g., arthritis, angina, diabetes) is detected, screening for the other may be important to improve clinical outcomes.

Key words: Psychotic experience, depression, chronic conditions, community-based, low- and middle-income countries

Introduction

Depression is a pervasive and prevalent mental disorder, affecting approximately 350 million people, with major depressive disorder accounting for 8.2% of the total worldwide years lived with disability (YLDs) (Ferrari *et al.* 2013). Researchers have extensively explored the prevalence, correlates, and clinical outcomes of depression and its subtypes, but have conducted far less research on depression with psychotic experiences in the general population. Psychotic experiences are attenuated forms of psychotic symptoms which do not reach the clinical threshold for a psychosis diagnosis. This condition is common in the general population (prevalence 7.2% according to a systematic review) (Linscott & van Os, 2013), and may present an underlying susceptibility for psychotic disorders such as schizophrenia (Werbeloff *et al.* 2012). Depression and psychotic experiences may co-occur due to shared genetic factors (Varghese *et al.* 2011a), underlying social factors such as childhood adversities (Varghese *et al.* 2011b), or impaired cognitive, social and emotional functioning (Weiser *et al.* 2005). Furthermore, depression and psychotic experiences may mutually influence each other leading to the maintenance and/or exacerbation of both conditions. For example, depression may increase the likelihood of having a more negative appraisal of psychotic experiences, which in turn may further aggravate depression or increase levels of stress and anxiety (Yung *et al.* 2007). This may lead to biological alterations resulting in exacerbation and persistence of psychotic experiences (Yung *et al.* 2007).

Recent studies have shown that comorbid depression and psychotic experiences in the general population is associated with a myriad of adverse health outcomes when compared to depression alone. Specifically, among adolescents and young adults in Munich, Germany, depression (and anxiety) with psychotic experiences was associated with higher odds for poorer course of mental illness and substance use as well as greater health service use, when

compared to anxiety/depression without psychotic experiences (Wigman *et al.* 2012). Furthermore, our previous community-based study using data on adults aged ≥18 years from 44 low- and middle-income countries (LMICs) showed that comorbid depression and psychotic experiences is related to significant declines in health status in the domains of cognition, interpersonal activities, and sleep/energy, compared to depression alone (Koyanagi *et al.* 2016a).

An abundance of literature has demonstrated that both depression (Thase, 2016) and psychotic experiences (Moreno *et al.* 2013; Oh & DeVylder, 2015; Saha *et al.* 2011a) are associated with considerable chronic physical health burden. The interest in chronic physical health conditions is critical, as these may be the leading contributors to the premature mortality in individuals with depression (Walker *et al.* 2015) and psychotic experiences (Sharifi *et al.* 2015). However, surprisingly, a paucity of literature has considered the chronic physical health comorbidity among people with co-existing depression and psychotic experiences. Although one large multi-country study examined the association between psychotic experiences and chronic physical conditions, it only adjusted for age, sex, country-income level, and country, and did not take other non-psychotic mental disorders into account (Moreno *et al.* 2013). Furthermore, while single-country studies from Western settings on psychotic experiences and physical health conditions did adjust for non-psychotic mental disorders, estimates of risks specific to individuals with comorbid depression and psychotic experiences were not provided (Oh & DeVylder, 2015; Saha *et al.* 2011a).

Given the scarcity of studies on the risk for adverse health outcomes of comorbid depression and psychotic experiences (especially physical health conditions), the lack of data on the prevalence and correlates of co-existing depression and psychotic experiences at the national level, and the large disease burden attributable to mental disorders as well as the rapid increase in non-communicable diseases in LMICs (Beaglehole *et al.* 2011; Murray *et al.*

2012), the aims of the current study were: (a) to assess the prevalence and correlates of comorbid depression and psychotic experiences among adults aged ≥18 year in 47 LMICs using predominantly nationally-representative data from more than 200,000 individuals; and (b) to examine its association with chronic physical conditions (chronic back pain, edentulism, arthritis, angina, asthma, diabetes).

Methods

The survey

The World Health Survey (WHS) was a cross-sectional survey carried out in 70 countries in 2002-2004 with the aim of strengthening national capacity to monitor health outcomes. Survey details are available elsewhere (http://www.who.int/healthinfo/survey/en/). Briefly, single-stage random sampling and stratified multi-stage random cluster sampling was conducted in 10 and 60 countries respectively. Eligible participants were those with a valid home address and aged ≥18 years. One individual was randomly chosen from the household with the use of Kish tables. The questionnaire was subject to standard translation procedures to ensure comparability between countries. Face-to-face interviews and telephone interviews were conducted by trained interviewers. The individual response rate (ratio of completed interviews among selected respondents after excluding ineligible respondents from the denominator) ranged from 63% (Israel) to 99% (Philippines) (Moussavi *et al.* 2007), with the overall individual response rate being 98.5% (Nuevo *et al.* 2012). To adjust for non-response, sampling weights were generated using the population distribution as reported by the United Nations Statistical Division. Ethical approval for the survey was provided by ethical boards at each study site. All participants gave their informed consent.

Variables

Chronic medical conditions

A total of six chronic medical conditions were assessed. The diagnosis of arthritis, asthma, and diabetes was based solely on self-reported lifetime diagnosis. Those who had either or both a self-reported diagnosis of angina or a symptom-based angina diagnosis based on the Rose questionnaire (Rose, 1962) were considered to have angina. Chronic back pain referred to a back pain (including disc problems) occurring everyday during the last 30 days. Those who had lost all their natural teeth based on self-report were considered to have edentulism.

Depression

Past 12-month depression was based on the presence, duration, and persistence of depressive symptoms. Algorithms based on the DSM-IV (American Psychiatric Association, 1994) used in previous WHS publications were employed (Cifuentes *et al.* 2008; Loerbroks *et al.* 2012). Respondents were first asked if they experienced any of the following five depressive symptoms over the past 12 months: (a) A period lasting several days when you felt sad, empty or depressed? (b) A period lasting several days when you lost interest in most things you usually enjoy such as hobbies, personal relationships or work? (c) A period lasting several days when you have been feeling your energy level decreased or that you were tired all the time? (d) Did you lose your appetite? (e) Did you notice any slowing down in your thinking?' Those who answered 'Yes' to at least four of the questions were considered to have possible depression. Among those with possible depression, individuals who further responded 'Yes' to both of the following questions were classified as having depression: (a) Was this period for more than 2 weeks? (b) Was this period most of the day, nearly every day?

Psychotic experiences

Positive psychotic symptoms were measured using items from the CIDI 3.0 (Kessler & Ustun, 2004). This psychosis module has been validated with clinician ratings (Cooper *et al.* 1998). The hallucinations question excluded experiences that took place in the context of sleep or substance use. Specifically, respondents could respond 'yes' or 'no' to the following questions:

During the last 12 months, have you experienced:

(a) 'A feeling something strange and unexplainable was going on that other people would find hard to believe?' (delusional mood)

(b) 'A feeling that people were too interested in you or there was a plot to harm you?' (delusions of reference and persecution)

(c) 'A feeling that your thoughts were being directly interfered or controlled by another person, or your mind was being taken over by strange forces?' (delusions of control)

(d) 'An experience of seeing visions or hearing voices that others could not see or hear when you were not half asleep, dreaming or under the influence of alcohol or drugs?' (hallucinations)

Individuals who endorsed at least one of the four aforementioned psychotic symptoms were considered to have psychotic experiences.

Smoking and alcohol consumption

Smoking was assessed using the question: 'Do you currently smoke any tobacco products such as cigarettes, cigars, or pipes?' with the answer options being 'daily', 'yes, but not daily', or 'no, not at all'. This variable was dichotomized into those who smoked regardless of frequency (i.e., daily or not daily) (current smokers) and those who do not smoke. Alcohol consumption was assessed by first asking the question 'Have you ever consumed a drink that contains alcohol (such as beer, wine, etc)?' Respondents who replied 'no' were considered

lifetime abstainers. Respondents who replied affirmatively were asked how many standard drinks of any alcoholic beverage they had on each day of the past seven days. Females who reported consuming at least four drinks, and males who reported consuming at least five drinks, on one or two days in the past seven days were considered infrequent heavy drinkers, and respondents who drank these amounts at least three days in the past seven days were considered frequent heavy drinkers. All other respondents, apart from lifetime abstainers, were considered non-heavy drinkers (Hosseinpoor *et al.* 2012; World Health Organization, 2002).

Anxiety

The question 'Overall in the past 30 days, how much of a problem did you have with worry or anxiety' was used to assess anxiety. The answer options were none, mild, moderate, severe, and extreme. In accordance with previous WHS publications, those who answered severe and extreme were considered to have anxiety (Koyanagi *et al.* 2016a; Wong *et al.* 2013).

Sociodemographic variables

Information on age, sex, setting (rural or urban), marital status (married/cohabiting, never married, separated/divorced/widowed), education (no formal education, primary education, secondary or high school completed, or tertiary education completed), and wealth were assessed. Principal component analysis based on 15-20 assets was conducted to establish country-wise wealth quintiles.

Statistical analysis

Publically available data of the WHS included 69 countries. The data were nationally-representative for all countries with the exception of China, Comoros, the Republic of Congo,

Ivory Coast, India, and Russia. We excluded 10 countries (Austria, Belgium, Denmark, Germany, Greece, Guatemala, Italy, Netherlands, Slovenia, UK) as they lacked sampling information. A further nine countries (Finland, France, Ireland, Israel, Luxembourg, Norway, Portugal, Sweden, Turkey) were deleted as no information on psychotic symptoms was available. Moreover, the remaining two high-income countries (Spain and United Arab Emirates) were also deleted, as the focus of this study was on LMICs, while Morocco was also omitted due to lack of information on anxiety. Thus, a total of 47 countries, of which 21 and 26 were low-income and middle-income countries respectively at the time of the survey (2003) according to the World Bank, were included in the final sample.

The statistical analysis was performed with Stata 14.1 (Stata Corp LP, College station, Texas). For all analyses, individuals with a self-reported lifetime diagnosis of psychotic disorder such as schizophrenia (n=2395) were omitted so that the estimates obtained are not confounded by psychotic disorders (Koyanagi *et al.* 2016a; Wigman *et al.* 2012). We calculated the country-wise age- and sex-adjusted prevalence of depression with at least one psychotic symptom (delusional mood, delusions of reference and persecution, delusions of control, or hallucinations) among 201,337 individuals for whom data was available. The United Nations population pyramid for the year 2010 was used to calculate the age- and sex-adjusted estimates. In line with previous publications on comorbid depression and psychotic experiences (Koyanagi *et al.* 2016a; Wigman *et al.* 2012), we further characterized the study sample by a three category variable: (a) no depression and no psychotic experiences (control) (n=170,237); (b) depression without psychotic experiences (n=6991); and (c) depression with psychotic experiences (n=4313). Individuals with psychotic experiences only (n= 19,796) were omitted from this analysis to specifically focus on the significance of psychotic experiences in the context of depression. Chi-squared tests and oneway ANOVA (or student's *t*-tests) were used to test the difference in sample characteristics for categorical and

continuous (age) variables respectively. In order to assess the association between depression alone or depression with psychotic experiences (exposure variable), and the six chronic conditions (outcome variables), we conducted multivariable logistic regression analysis while adjusting for age (continuous variable), sex, setting, marital status, education, wealth, anxiety, and country. Adjustment for country was done by including dummy variables in the models, as in previous WHS publications (Moreno *et al.* 2013; Nuevo *et al.* 2012). We did not adjust for smoking and alcohol consumption for this analysis as they may be mediators in the association between depression/psychotic experiences and physical health conditions. The sample weighting and the complex study design were taken into account in all analyses. Results from the logistic regression models are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at $P<0.05$.

Results

The mean age of the overall sample (i.e., including individuals with psychotic experiences alone) was 38.3 (16.0) years with 50.8% being female, while the crude past 12-month prevalence (95%CI) of psychotic experiences, depression, and comorbid depression/psychotic experiences were 13.7% (13.2%-14.2%), 6.4% (6.1%-6.7%), and 2.5% (2.3%-2.7%) respectively. The age- and sex- adjusted past 12-month prevalence of depression with psychotic experiences ranged from 0.1% (Sri Lanka, Vietnam) to 9.03% (Brazil) with prevalence of >4% also being observed in Nepal (6.76%), Congo (4.64%), India (4.54%), and Burkina Faso (4.12%) (**Table 1, Figure 1**). The sample characteristics by different combinations of depression and psychotic experiences are illustrated in **Table 2**. Compared with those with depression alone, individuals with depression and psychotic experiences were significantly more likely to be younger, urban residents, have primary education (vs. no formal), engage in current smoking and alcohol consumption, and suffer

from anxiety, chronic back pain, edentulism, angina, and diabetes, as well as a higher number of physical health conditions. The association between depression/psychotic experiences groups and physical health conditions estimated by multivariable logistic regression is shown in **Table 3**. Compared to those with no depression or psychotic experiences, significantly elevated odds for all chronic physical conditions were observed for depression alone [edentulism (OR 1.43; 95%CI=1.09-1.89) to angina (OR 2.46; 95%CI=2.19-2.77)] and comorbid depression/psychotic experiences [edentulism (OR 1.39; 95%CI=1.11-1.76) to angina (OR 3.45; 95%CI=2.97-4.02)]. The OR was higher for comorbid depression/psychotic experiences compared to depression alone for chronic back pain, arthritis, angina, and diabetes. In order to assess whether this difference is statistically significant, we also conducted the same analysis but changing the reference category to depression alone. The ORs (comorbid depression/psychotic experiences vs. depression only) obtained were: chronic back pain 1.22 (95%CI=0.97-1.52; p=0.0830); edentulism 0.97 (95%CI=0.69-1.38; p=0.8781); arthritis 1.30 (95%CI=1.07-1.59; p=0.0086); angina 1.40 (95%CI=1.18-1.67; p=0.0002); asthma 0.94 (95%CI=0.73-1.20; p=0.6131); and diabetes 1.65 (95%CI=1.21-2.26; p=0.0017) (**Figure 2**).

Discussion

Main findings

Our study showed that the overall crude prevalence of past-12 month comorbid depression/psychotic experiences in 47 LMICs is notable (2.5%) with the highest age- and sex-adjusted prevalence being observed in Brazil (9.0%), Nepal (6.8%), Congo (4.6%), India (4.5%), and Burkina Faso (4.1%). Compared to those with depression alone, younger age, urban residency, current smoking, alcohol consumption, and anxiety were more common in comorbid depression/psychotic experiences. Although depression, regardless of the presence

of psychotic experiences, was associated with higher odds for all chronic physical conditions, the odds were significantly higher for comorbid depression/psychotic experiences than depression alone for arthritis, angina, and diabetes. Our results reinforce the notion that comorbid depression/psychotic experiences is associated with adverse health outcomes.

Prevalence of co-existing depression/psychotic experiences

In our study, the overall prevalence of co-existing depression/psychotic experiences in the past 12 months was 2.5%. The lowest rates were observed in mostly Asian countries [e.g., Sri Lanka (0.10%), Vietnam (0.10%), Myanmar (0.18%), China (0.29%), Kazakhstan (0.45%), Laos (0.45%), Georgia (0.50%)], while the highest rates were observed in Brazil (9.03%), Nepal (6.76%), Congo (4.64%), India (4.54%), and Burkina Faso (4.12%). While there are no previous studies which are totally comparable, the prevalence of depression with psychotic "features" was reported to be between 0.2%-0.6% in the general adult population in Western settings (Johnson *et al.* 1991; Ohayon & Schatzberg, 2002). However, since psychotic "features" refer to DSM diagnosable symptoms, in contrast to psychotic symptoms which include the broader continuum of self-reported psychosis-like phenomena, the lower overall prevalence observed in these studies is probably a reflection of the greater psychotic symptom severity.

Correlates of comorbid depression/psychotic experiences

In our study, younger age, urban residency, education, anxiety, smoking, and alcohol consumption were significantly associated with comorbid depression/psychotic experiences compared to depression alone with no significant differences for sex, marital status, and wealth. Some of these findings concur with previous community-based studies of similar nature but not all. For example, among adolescents and young adults in Germany, younger

age and male sex were associated with comorbid depression/psychotic experiences while urbanicity was not (Wigman *et al.* 2012). Furthermore, depression with psychotic "features" was associated with female sex, younger age, and marital status (separated/divorced) in the European adult population (Ohayon & Schatzberg, 2002), while in the adult population in the US, depression with psychotic "features" was related with female sex, lower socioeconomic status, and comorbid mental health conditions (obsessive-compulsive disorder, somatization disorder, simple phobia) with no significant differences for marital status, age, and alcohol or drug abuse and dependence (Johnson *et al.* 1991). These varying findings between studies may have been due to differences in settings, age groups, and severity of psychotic symptoms. The finding that urbanicity was associated with comorbid depression/psychotic experiences in adults is novel, and may reflect the increased risk for schizophrenia onset reported to be associated with urban upbringing (Padhy *et al.* 2014) and affective disturbance with psychotic experiences (Krabbendam *et al.* 2005).

Association of comorbid depression/psychotic experiences with chronic physical conditions

In our study, co-occurring depression/psychotic experiences was associated with significantly higher odds for arthritis, angina, and diabetes beyond that of depression alone. The reason why only these three conditions were more likely to be associated with comorbid depression/psychotic experiences than others is unknown but particularly for angina and diabetes, this may be related to unhealthy health behaviors (Kouidrat *et al.* 2014). For example, in our study, smoking and alcohol consumption were more common among those with comorbid depression/psychotic experiences than depression alone. Furthermore, disordered eating has been related to psychotic experiences even after adjustment for non-psychotic mental disorders (including depression) (Koyanagi *et al.* 2016b). Alternatively, psychotic symptoms have been associated with psychological distress regardless of

depression (Saha *et al.* 2011b), and this may be an important factor in the associations observed. Compared to other conditions, there are some reasons to believe that arthritis, angina, and diabetes may cause more distress. For example, while arthritis and chronic back pain are both painful conditions, arthritis was based on a lifetime diagnosis whereas chronic back pain was based on self-reported pain in the past 30 days with no information on severity. In settings where access to medical facilities is limited, diagnoses based solely on self-report such as arthritis may represent particularly severe cases as people may not seek medical help until the condition is critical. Furthermore, given that asthma is a condition that often remits, the fact that our definition for asthma was based on a lifetime diagnosis may mean that symptoms are were not currently present for some individuals. In contrast, arthritis, angina, and diabetes usually do not remit and may cause substantial disability and distress due to their chronic nature and symptoms, which may be aggravated especially in LMICs given that treatment options may be limited. The US study reported increased risks for medical hospitalizations in the past year in depression with psychotic "features" but not outpatients visits (Johnson *et al.* 1991). This may be mirroring our findings where only severe medical conditions might be associated with depression with psychotic "features" or psychotic experiences, possibly due to increased risk for psychological distress. Next, given that trauma has been linked to comorbid depression/psychotic experiences (Wigman *et al.* 2012), and that stress can lead to impaired hypothalamic-pituitary-adrenal (HPA) axis functioning, which in turn has been associated with increased risk for psychotic experiences (Thompson *et al.* 2007) as well as diabetes, cardiovascular diseases (Rosmond & Bjorntorp, 2000), and arthritis (Muscatell & Eisenberger, 2012), this may be a shared underlying factor. Furthermore, in our previous study, co-existing depression/psychotic experiences was associated with interviewer-rated or observable mental health problems (Koyanagi *et al.* 2016a). Given that there may be a particularly high level of stigma attached to mental illnesses in LMICs

(Alonso *et al.* 2008), inequality in access to health care [resulting in under-detection of risk factors (e.g., hypercholesterolemia, hypertension) of more serious health conditions, and/or suboptimal treatment for the physical health conditions] for those with comorbid depression/psychotic experiences may also underlie our findings (De Hert *et al.* 2011a, 2011b). Next, sleep problems, which have been associated with comorbid depression/psychotic experiences, may also be implicated (Koyanagi *et al.* 2014, 2016a). Finally, it is also possible that psychotic experiences in the context of depression are a reflection of more severe psychopathology. For example, previous studies have shown that higher numbers of mental disorder subtypes (i.e., depressive disorder, anxiety disorder, PTSD, substance use disorder) are associated with psychotic experiences in a dose-dependent fashion (DeVylder *et al.* 2014), while depression/psychotic experiences may also be a marker of more severe depression (Koyanagi *et al.* 2016a; Saha *et al.* 2012). As more severe psychopathology has also been associated with higher risks for chronic physical conditions (Scott *et al.* 2016), this may also explain the link between depression/psychotic experiences and chronic physical conditions observed in our study.

Strengths and limitations

To the best of our knowledge, our study is the first study to provide information on the prevalence and correlates of co-existing depression and psychotic experiences at the national level, while it is also the first study to assess the excess risk for chronic physical conditions associated with this condition. The strength of the study is the large sample size including predominantly nationally-representative data from diverse settings. The results should nevertheless be interpreted in the light of several potential limitations. First, since the data used in our study were based on self-report, reporting bias may have influenced responses (e.g., social desirability, recall). For example, social desirability may, at least partially,

account for the differences in the prevalence of some variables used in this study [e.g., psychotic experiences (DeVylder & Hilimire, 2015)]. Furthermore, medical conditions based solely on self-reported diagnosis (arthritis, asthma, diabetes) may be under-diagnosed where access to health care facilities is limited. Second, we did not have information on all types of psychotic symptoms or details on the exact nature of the psychotic experiences. In particular, it would have been desirable to have information on the latter as it is possible that some questions on psychotic experiences were misinterpreted by the respondent, or that they were reflections of "normal" experiences in some circumstances or cultures. Third, institutionalized individuals were not included in the survey, limiting generalizability. Next, the WHS countries were not randomly selected to represent all LMICs. Thus, the results of our studies may not be generalizable to all LMICs. Finally, causality cannot be inferred due to the cross-sectional nature of the data.

Conclusion

In conclusion, the prevalence of comorbid depression and psychotic experiences might not be negligible in many LMICs. Although depression was associated with higher odds for chronic back pain, edentulism, arthritis, angina, asthma, and diabetes, the co-existence of depression and psychotic experiences was associated with a higher odds beyond that of depression alone only for angina, arthritis, and diabetes. Given the increasing evidence that depression with psychotic experiences maybe a depression subtype associated with adverse health outcomes, while psychotic experiences and depression may mutually act to sustain and aggravate each other, our study suggests that when depression/psychotic experiences or a chronic condition (e.g., arthritis, angina, diabetes) is detected, screening for the other may be important. Future studies examining the reasons for the increased risk for comorbid depression/psychotic

experiences for some chronic conditions but not others may shed light on the significance and etiology of co-existing depression/psychotic experiences.

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Conflict of interest

None.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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Table 1 Age- and sex-adjusted prevalence of depression with psychotic experiences by country

Country	N	% (SE)	Country	N	% (SE)
Africa			**Asia**		
Burkina Faso	4,948	4.12 (0.66)	Bangladesh	5,942	2.87 (0.37)
Chad	4,870	3.94 (0.67)	China	3,994	0.29 (0.14)
Comoros	1,836	2.62 (0.48)	Georgia	2,950	0.50 (0.13)
Congo	3,075	4.64 (1.11)	India	10,687	4.54 (0.43)
Ethiopia	5,089	2.59 (0.30)	Kazakhstan	4,499	0.45 (0.13)
Ghana	4,165	0.70 (0.16)	Laos	4,988	0.45 (0.11)
Ivory Coast	3,251	2.07 (0.42)	Malaysia	6,145	0.60 (0.14)
Kenya	4,640	3.28 (0.47)	Myanmar	6,045	0.18 (0.07)
Malawi	5,551	0.65 (0.15)	Nepal	8,820	6.76 (0.37)
Mali	4,886	2.70 (0.36)	Pakistan	6,501	0.51 (0.10)
Mauritania	3,902	1.01 (0.24)	Philippines	10,083	0.86 (0.13)
Mauritius	3,968	2.37 (0.32)	Sri Lanka	6,805	0.10 (0.05)
Namibia	4,379	1.63 (0.31)	Vietnam	4,174	0.10 (0.07)
Senegal	3,461	3.72 (0.63)	**Europe**		
South Africa	2,629	1.99 (0.52)	Bosnia Herzegovina	1,031	1.10 (0.42)
Swaziland	3,117	3.77 (0.66)	Croatia	993	0.61 (0.22)
Tunisia	5,202	3.42 (0.44)	Czech Republic	949	1.23 (0.54)
Zambia	4,165	3.45 (0.56)	Estonia	1,020	1.91 (0.44)
Zimbabwe	4,290	1.20 (0.40)	Hungary	1,419	0.69 (0.23)
Americas			Latvia	929	1.74 (0.49)
Brazil	5,000	9.03 (0.55)	Russia	4,427	0.62 (0.14)
Dominican Republic	5,027	3.72 (0.47)	Slovakia	2,535	2.33 (1.23)
Ecuador	5,675	1.96 (0.37)	Ukraine	2,860	1.35 (0.29)
Mexico	38,746	1.77 (0.15)			
Paraguay	5,288	1.40 (0.21)			
Uruguay	2,996	0.92 (0.19)			

Abbreviation: SE standard error

Dare are unweighted N and weighted %.

The N is the total sample size including individuals with a psychosis diagnosis.

Psychotic experiences referred to either one of: delusional mood, delusions of reference and persecution, delusions of control, or hallucinations.

All age- and sex-adjusted estimates were calculated using the United Nations population pyramids for the year 2010.

Table 2 Sample characteristics by different combinations of depression and psychotic experiences

Characteristic	(a) No depression or psychotic experiences	(b) Depression without psychotic experiences	(c) Depression with psychotic experiences	P-value[a]	P-value[b] (b) vs. (c)
Age Mean (SD)	37.9 (15.9)	45.1 (15.9)	42.0 (15.1)	<0.0001	0.0001
Sex					
Male	50.6	33.8	37.5	<0.0001	0.1760
Female	49.4	66.2	62.5		
Setting					
Rural	58.0	61.1	53.1	0.0042	0.0008
Urban	42.0	38.9	46.9		
Marital status					
Married/cohabiting	66.3	67.2	67.4	<0.0001	0.4825
Never married	24.3	12.7	14.2		
Separated/divorced/widowed	9.4	20.0	18.5		
Education					
No formal	25.4	41.5	31.2	<0.0001	0.0345
Primary	30.7	29.4	38.6		
Secondary completed	33.9	22.8	23.4		
Tertiary completed	10.0	6.2	6.9		
Wealth					
Poorest	19.9	24.0	23.3	<0.0001	0.3628
Poorer	19.7	21.4	22.7		
Middle	19.8	20.7	20.5		
Richer	20.1	17.7	20.2		
Richest	20.5	16.2	13.3		
Current smoker					
No	74.0	72.4	68.0	0.0002	0.0172
Yes	26.0	27.6	32.0		
Alcohol consumption					
Lifetime abstainer	68.2	71.6	57.7	<0.0001	<0.0001
Non-heavy	27.3	25.8	36.3		
Infrequent heavy	3.5	2.1	4.5		
Frequent heavy	1.0	0.5	1.5		
Anxiety	7.5	33.2	50.4	<0.0001	<0.0001
Chronic conditions					
Chronic back pain	4.8	19.4	23.0	<0.0001	<0.0001
Edentulism	5.1	10.4	10.9	<0.0001	0.0295
Arthritis	11.4	24.5	26.6	<0.0001	0.7506
Angina	12.0	32.8	36.8	<0.0001	0.0261
Asthma	4.1	10.8	13.0	<0.0001	0.0733
Diabetes	2.4	5.9	8.5	<0.0001	0.0070
Number of chronic conditions					
0	71.9	38.9	34.6	<0.0001	0.0144
1	19.5	32.1	32.4		
2	6.5	18.9	19.1		
≥3	2.2	10.1	13.9		

Abbreviation: SD standard deviation

Estimates are based on weighted sample.

[a] Difference in sample characteristics by the three groups of different combinations of depression and psychotic experiences. One-way ANOVA and Chi-squared tests were used for continuous and categorical variables respectively.

[b] Pairwise comparison among those with depression with and without psychotic experiences. Student's *t*-tests and Chi-squared tests were used for continuous and categorical variables respectively.

Table 3 Associations between depression/psychotic experiences groups and physical health conditions estimated by multivariable logistic regression

Characteristics	Chronic back pain		Edentulism		Arthritis		Angina		Asthma		Diabetes	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Depression/psychotic experiences groups												
No depression/ No psychotic experiences	1.00		1.00		1.00		1.00		1.00		1.00	
Depression alone	2.29***	[1.93,2.72]	1.43*	[1.09,1.89]	1.63***	[1.42,1.87]	2.46***	[2.19,2.77]	2.02***	[1.68,2.43]	1.57***	[1.21,2.03]
Depression and psychotic experiences	2.79***	[2.32,3.35]	1.39**	[1.11,1.76]	2.12***	[1.80,2.49]	3.45***	[2.97,4.02]	1.89***	[1.53,2.34]	2.59***	[1.95,3.43]
Age (years)	1.03***	[1.03,1.03]	1.07***	[1.07,1.08]	1.05***	[1.04,1.05]	1.03***	[1.03,1.03]	1.02***	[1.02,1.02]	1.06***	[1.05,1.07]
Sex												
Male	1.00		1.00		1.00		1.00		1.00		1.00	
Female	1.76***	[1.57,1.97]	1.34***	[1.21,1.48]	1.51***	[1.40,1.62]	1.54***	[1.44,1.64]	1.09	[0.99,1.21]	1.30***	[1.13,1.49]
Setting												
Rural	1.00		1.00		1.00		1.00		1.00		1.00	
Urban	0.97	[0.86,1.10]	1.17*	[1.02,1.34]	0.98	[0.86,1.12]	0.97	[0.88,1.06]	1.00	[0.89,1.13]	1.48***	[1.24,1.76]
Marital status												
Married/cohabiting	1.00		1.00		1.00		1.00		1.00		1.00	
Never married	0.51***	[0.41,0.62]	1.20	[0.99,1.45]	0.75***	[0.65,0.86]	0.82***	[0.75,0.91]	1.17*	[1.00,1.36]	0.61**	[0.45,0.82]
Separated/divorced/widowed	0.86*	[0.74,0.99]	1.03	[0.91,1.17]	0.89*	[0.80,0.98]	0.95	[0.85,1.05]	1.01	[0.87,1.17]	0.78*	[0.62,0.98]
Education												
No formal	1.00		1.00		1.00		1.00		1.00		1.00	
Primary	0.77***	[0.68,0.89]	1.02	[0.88,1.19]	1.10*	[1.00,1.22]	1.04	[0.95,1.14]	0.93	[0.78,1.11]	2.01***	[1.55,2.59]
Secondary completed	0.66***	[0.55,0.79]	0.79*	[0.66,0.95]	0.90	[0.79,1.02]	1.02	[0.90,1.16]	0.98	[0.81,1.18]	1.55**	[1.16,2.07]
Tertiary completed	0.47***	[0.37,0.59]	0.52***	[0.41,0.65]	0.88	[0.74,1.05]	0.85	[0.71,1.00]	0.95	[0.70,1.28]	1.78***	[1.27,2.51]
Wealth												
Poorest	1.00		1.00		1.00		1.00		1.00		1.00	
Poorer	0.99	[0.85,1.15]	1.09	[0.95,1.26]	1.08	[0.97,1.20]	0.97	[0.88,1.07]	1.03	[0.89,1.20]	1.24*	[1.00,1.54]
Middle	1.05	[0.90,1.22]	0.97	[0.82,1.14]	0.97	[0.87,1.08]	0.84***	[0.76,0.92]	1.00	[0.87,1.16]	1.30*	[1.04,1.64]
Richer	0.99	[0.85,1.16]	1.03	[0.88,1.22]	0.97	[0.85,1.10]	0.76***	[0.69,0.85]	1.14	[0.98,1.33]	1.57***	[1.25,1.97]
Richest	1.12	[0.93,1.34]	0.98	[0.82,1.17]	0.91	[0.78,1.05]	0.73***	[0.64,0.82]	1.15	[0.98,1.35]	2.21***	[1.72,2.84]
Anxiety	2.02***	[1.77,2.31]	0.94	[0.81,1.10]	1.33***	[1.19,1.49]	1.70***	[1.53,1.89]	1.46***	[1.25,1.72]	1.51**	[1.18,1.94]

Abbreviation: OR odds ratio; CI confidence interval

Models are adjusted for all variables in the respective column and country.

* p<0.05, ** p<0.01, *** p<0.001