Mental Health Among Hypertensive People and its Associated Factors: Findings From RISKESDAS 2018 Data

Rozana Ika Agustiya[1]*, Siti Isfandari[1], Indri Yunita Suryaputri[1], Rofingatul Mubasyiroh[1], Lely Indrawati[1], and Julianty Pradono[2]

[1] National Research and Innovation Agency, Indonesia
[2] University Malahayati, Indonesia
* Rozana Ika Agustiya, corresponding author. Email: rozanaika@gmail.com; roza003@brin.go.id
Submitted: 28 July 2023. Accepted: 27 March 2024. Published: 10 May 2024
Volume 32, 2024. pp. 813–828. http://doi.org/10.25133/JPSSv322024.047

Abstract

This study aims to investigate the complex relationship between general mental health issues, specifically depression, and hypertension, and to identify associated factors among individuals affected by these conditions in Indonesia. Using data from the Indonesia National Basic Health Research (RISKESDAS) in 2018, the study included a large sample of 88,590 individuals aged 30−59 with hypertension from various provinces and districts across Indonesia. The findings show that 11.5% of hypertensive individuals in the 30−59 age range in Indonesia experience general mental health problems, including common mental disorders, while 7.0% exhibit symptoms of depression. Importantly, individuals with multiple coexisting health conditions are more susceptible to mental health issues. Furthermore, factors such as female gender, lower educational attainment, unmarried status, unemployment, physician-diagnosed hypertension, and the presence of other concurrent health conditions are identified as contributors to an increased likelihood of experiencing general mental health problems and depression. Finally, this study emphasizes the importance of addressing mental health concerns among individuals dealing with hypertension and other non-communicable diseases in Indonesia, with a particular focus on those with lower educational levels, unmarried status, and unemployment.

Keywords

Depression; general mental health problems; hypertension; mental health

Introduction

High blood pressure is a significant risk factor for cardiovascular disease (CVD), which is a leading cause of death globally, including in Indonesia (Fuchs & Whelton, 2020; Kjeldsen, 2018). According to the Indonesia National Basic Health Research (Riskesdas), the prevalence of hypertension in Indonesia has risen to over 8% since 2013, as of 2018 (Ministry of Health [Indonesia], 2013, 2018). This increase in hypertension rates is concerning and requires immediate attention and comprehensive interventions.

The relationship between physical and mental health in individuals has been widely recognized (Ohrnberger et al., 2017). A comprehensive study found that individuals with hypertension are more susceptible to depression, with a clinically diagnosed prevalence of 21.3% and 29.8%, as determined through screening tools (Li et al., 2015). The Indonesia Family Life Survey also supports a connection between depression and hypertension among the Indonesian population (Peltzer & Pengpid, 2018). Furthermore, an earlier study based on 2013 data identified a significant correlation between psychological distress and hypertension (Idaiani & Wahyuni, 2016). Additionally, existing research highlights that various socio-demographic factors, such as gender, age, education, employment status, and socioeconomic standing, influence the complex relationship between depression and hypertension (Mahmood et al., 2017). Research in Asia, particularly in Indonesia, has revealed a noticeable association between hypertension and mental health challenges in adults (Turana et al., 2021).

The complex relationship between depression and blood pressure presents a multifaceted challenge. Previous research has provided a comprehensive overview of the bidirectional interplay between hypertension and mental health concerns (Scalco et al., 2005). Depression has been identified as a contributing factor to the increased incidence of hypertension, as shown by a global survey conducted in 19 countries as part of the World Mental Health Survey (WMHS) (Stein et al., 2014). Conversely, individuals dealing with depression, especially those with melancholic symptoms, are more susceptible to hypertension (Nakagawara et al., 1987). The impact of comorbid conditions involving hypertension and mental health goes beyond their coexistence. Low compliance with hypertension treatment has been observed, leading to uncontrolled blood pressure levels and contributing to premature mortality (Endomba et al., 2020). It is crucial to understand the relationship between depression and hypertension, as it has significant implications for both mental and cardiovascular health.

Indonesia has a large population, and as of 2021, over one-third of its people are aged between 30 and 59, totaling over 87.7 million individuals (BPS-Statistics Indonesia, 2021). With increasing rates of hypertension, it is vital to recognize and address mental health issues in hypertensive individuals to prevent further complications. Due to the lack of extensive studies on the psychological well-being of adults with hypertension, there is a need to investigate the factors contributing to general mental health problems in hypertensive individuals in Indonesia. This study aims to examine the prevalence of depression in hypertensive patients through a community health survey and identify the factors associated with mental health problems in this population.

Methods

Study design

The research used a cross-sectional design, covering all households in 34 provinces and 514 districts and cities in Indonesia. The household sample was taken from the 2018 National Socio-Economic Survey (Susenas) sample frame database conducted in March 2018 (Agency of Health Research and Development, 2019). The Probability Proportional to Size (PPS) method ensured representative sampling, with 30,000 census blocks selected. Ten households were then systematically sampled from each selected census block. Stratification was based on the highest education level completed by the head of the household in each census block. The research team collected comprehensive individual-level data for all members within each household.

Sample and data collection

In 2018, the Ministry of Health of the Republic of Indonesia conducted Riskesdas, which covered 514 districts and cities, and surveyed 282,654 households, gathering information from just over 1 million individuals of all age groups (Agency of Health Research and Development, 2019). Our specific sample included 387,542 respondents aged 30−59 years. While Riskesdas aimed to measure blood pressure for all selected household members aged 15 and older within the 30−59 age range, only 372,542 individuals underwent blood pressure assessments. Of these, 129,716 were identified as having hypertension. After excluding 40,998 respondents using the jump questionnaire system, 88,718 respondents were classified as either hypertensive or non-hypertensive. The SRQ-20 and MINI depression variables contained missing data for 128 cases, resulting in a dataset of 88,590 individual records. Our study included individuals aged 30−59 years with diastolic and systolic blood pressure measurements exceeding 140/90 mmHg at the time of data collection who consented to be interviewed. Respondents who could not independently complete the SRQ-20 questionnaire and MINI tests were excluded from the study.

Measurement

Abdominal circumference

Abdominal circumference measurements were taken for all adult household members except pregnant women. The procedure involved using a measuring tape directly on the exposed skin of the abdomen, without any clothing. The measuring point was the midpoint between the lowest rib and the hip bone arch. This was done by drawing a parallel and horizontal line across the waist and abdomen.

Blood pressure

Respondents had their blood pressure measured using an AND brand digital sphygmomanometer, model UA-1020. Each respondent was measured twice, with a 1−2 minute interval between measurements. If the difference between the first and second

measurements exceeded 10 mmHg, a third measurement was taken after the respondent had rested for 10 minutes (Ministry of Health [Indonesia], 2018).

The blood pressure of the participants was measured on the upper arm (brachial side). The average of two measurements (first and second) was calculated. If there was a difference of 10 mmHg or more for systolic or diastolic pressure, a third measurement was taken after a 15-minute rest interval. The results of the third measurement were compared with the first or second measurement, and the closest number (with less than a 10 mmHg difference for systolic or diastolic pressure) was selected for averaging. Respondents taking antihypertensive medication with blood pressure below 140/90 mmHg were not categorized as having hypertension.

This study specifically focused on participants who were diagnosed with hypertension at the time of data collection. Hypertension was defined as an average of two blood pressure readings differing by 10 mmHg, with the systolic limit being ≥ 140 mmHg and/or the diastolic limit being ≥ 90 mmHg (James et al., 2014; Unger et al., 2020).

Study variables

Dependent variables

The study's dependent variables include general mental health problems, which were assessed using the Self-Reporting Questionnaire 20 items (SRQ-20), and depression, which was determined by the Mini International Neuropsychiatric Interview-Depression (MINI-Depression). The SRQ-20 is a screening instrument for general mental health problems, including depression, anxiety-related disorders, somatoform disorders, other neurotic disorders, and neurasthenia. It is important to note that the SRQ-20 is not intended as a substitute for clinical diagnosis (Beusenberg et al., 1994; Lund et al., 2010). The SRQ-20 questions are designed to screen for diagnostic categories as indicated by ICD-11 or DSM-5.

The general mental health status in the past month was assessed through interviews with respondents using the SRQ-20 instrument. The SRQ-20 has been tested for internal validity and has a high Cronbach's alpha value ($\alpha > 0.80$) (Patel et al., 2008). This World Health Organization tool screens for general mental health problems such as anxiety, depression, somatoform, and neurasthenia in the community. Each question requires a yes/no response, with "1" for "yes" and "0" for "no," and the total score determines general mental health problems. Respondents were considered to have general mental health problems if the total score was above 5, with a positive predictive value of 70% and a negative predictive value of 92% (Ganihartono, 1996).

Symptoms of depression in the past two weeks were evaluated using the MINI-Depression. This brief interview tool takes about 15 minutes to complete and is considered reliable for clinical trials and epidemiological studies. After a short training course, physicians could administer the MINI instrument, while non-physician interviewers required extensive training (Sheehan et al., 1998). The MINI instrument consists of 10 questions, with a score of "0" for each "no" answer and "1" for each "yes" answer. Respondents were classified as "depressed" if they had at least two "yes" answers to questions 1–3 and at least two "yes" answers to questions 4–10. The MINI instrument has also been validated for the Indonesian population (Idaiani et al., 2019).

Independent variables

This study included various demographic and health-related variables, such as gender (categorized as male and female), age groups (30−39 years, 40−49 years, and 50−59 years), educational attainment (categorized as low if lacking a high school certificate and high if possessing at least a high school certificate or higher), marital status (classified as single and married), employment status (distinguished between employed and unemployed individuals), residential area (divided into urban and rural), central obesity status (determined as non-obese or obese), and non-communicable diseases (NCDs).

The study included individuals with a medical history of heart disease, diabetes, stroke, asthma, arthritis, and cancer, all confirmed by a physician's diagnosis. Central obesity was determined based on respondents' abdominal/waist circumference measurements, with individuals exceeding 80 cm for women and 90 cm for men classified as obese according to World Health Organization (2011) guidelines.

Respondents were asked about their history of NCDs diagnosed by a physician, including questions such as "Have you ever been diagnosed with diabetes mellitus by a physician?" "Have you ever been diagnosed with heart disease by a physician?" and "Have you ever been diagnosed with stroke by a physician?" Additionally, the variable of a physician-diagnosed history of hypertension was assessed with the question, "Have you ever been diagnosed with hypertension by a physician?".

Data collection procedure

The Riskesdas research team took extensive measures to ensure the reliability and validity of the survey questionnaire before initiating data collection. Thorough training sessions were conducted for interviewers and data collectors, all with a background in health education, to standardize procedures and minimize potential biases. Sociodemographic variables, including gender, age, education, occupation, marital status, and residential area, were obtained through direct interviews and cross-validated using government-issued family identity cards. Disease conditions, including comorbidities, multimorbidities, and the diagnosis of hypertension, were gathered through direct interviews utilizing questionnaires and tested guidelines. Comorbidity was defined as hypertensive respondents with only one disease condition (e.g., heart disease, diabetes, or stroke), while multimorbidities were characterized by hypertensive respondents having at least two diseases. In this study, cancer, asthma, and arthritis were classified as multimorbidities in the data analysis.

Data analysis

The characteristics of the sample were analyzed by examining the distribution of both dependent and independent variables. A bivariate chi-square analysis was used to compare the distribution patterns of the dependent variables in relation to the independent variables. Multiple logistic regression models were then used to investigate the associations between general mental health problems and the independent variables. The results were presented as odds ratio [OR] with corresponding 95% confidence intervals, and statistical significance was determined by p values, with values less than .05 considered significant. These statistical analyses were performed using SPSS Version 15.

Table 1: Distribution of Mental Health Problems with Independent Variables Among Hypertensive People

Characteristics	All respondent	General mental health problem			Depression		
		No	Yes		No	Yes	
	N (%)	*n* (%)	*n* (%)	*p*	*n* (%)	*n* (%)	*p*
Gender				< .001			< .001
Male	31,324 (37.4)	28,852 (92)	2,472 (8)		29,869 (95.2)	1,455 (4.8)	
Female	57,266 (62.6)	49,472 (86.5)	7,794 (13.5)		52,501 (91.6)	4,765 (8.4)	
Age (years)				< .001			
30−39	19,546 (24.0)	17,583 (89.5)	1,963 (10.5)		18,355 (93.5)	1,191 (6.5)	.042
40−49	33,807 (37.7)	29,900 (88.7)	3,907 (11.3)		31,376 (92.9)	2,431 (7.1)	
50−59	35,237 (38.3)	30,841 (87.8)	4,396 (12.2)		32,639 (92.7)	2,598 (7.3)	
Educational level				< .001			< .001
High	30,513 (34.8)	28,398 (92.7)	2,115 (7.3)		29,190 (95.4)	1,323 (4.6)	
Low	58,077 (65.2)	49,926 (86.3)	8,151 (13.7)		53,180 (91.6)	4,897 (8.4)	
Marital status				< .001			< .001
Single	10,836 (11.4)	9,122 (85.1)	1,714 (14.9)		9,730 (90.3)	1,106 (9.7)	
Married	77,754 (88.6)	69,202 (89.0)	8,552 (11.0)		7,2640 (93.3)	5,114 (6.7)	
Working status				< .001			< .001
Working	61,219 (67.3)	54,942 (90.1)	6,277 (9.9)		57,475 (94.1)	3,744 (5.9)	
Not working	27,371 (32.7)	23,382 (85.3)	3,989 (14.7)		24,895 (90.7)	2,476 (9.3)	
Living area				< .001			.066
Urban	41,836 (58.8)	37,677 (89.2)	4,159 (10.8)		39,193 (93.2)	2,643 (6.8)	
Rural	46,754 (41.2)	40,647 (87.6)	6,107 (12.4)		43,177 (92.7)	3,577 (7.3)	
Diagnosis of hypertension				< .001			< .001
No	26,432 (29.4)	56,050 (90.4)	6,108 (9.8)		58,488 (94.2)	3,670 (5.8)	
Yes	62,158 (70.6)	22,274 (84.0)	4,158 (16.0)		23,882 (90.0)	2,550 (10.0)	
Central obesity				.032			.070
No	34,412 (39.1)	30,525 (89.0)	3,887 (11.0)		32,059 (93.2)	2,353 (6.8)	
Yes	54,178 (60.9)	47,799 (88.3)	6,379 (11.7)		50,311 (92.8)	3,867 (7.2)	

Characteristics	All respondent	General mental health problem			Depression		
		No	Yes		No	Yes	
	N (%)	*n* (%)	*n* (%)	*p*	*n* (%)	*n* (%)	*p*
Comorbidities				< .001			< .001
None	69,041 (78.1)	62,474 (90.6)	6,567 (9.4)		65,182 (94.4)	3,859 (5.6)	
Two or more illness	2,454 (2.7)	1,724 (69.6)	730 (30.4)		1,963 (80.0)	491 (20.0)	
Only diabetes	2,871 (3.4)	2,473 (85.7)	398 (14.3)		2,601 (90.6)	270 (9.4)	
Heart disease	1,575 (1.9)	1,315 (83.2)	260 (16.8)		1,416 (89.9)	159 (10.1)	
Stroke	1,245 (1.4)	982 (78.8)	263 (21.2)		1,061 (85.2)	184 (14.8)	
Cancer, asthma, arthritis	11,404 (12.5)	9,356 (82.7)	2,048 (17.3)		10,147 (89.0)	1,257 (11.0)	
Total		78,324 (88.5)	10,266 (11.5)		82,370 (93.0)	6,220 (7.0)	

Results

This study included 88,590 individuals aged 30−59, all of whom had hypertension. The characteristics of the participants are summarized in Table 1. Most participants were female, had lower educational qualifications, and were employed. A quarter of the participants were in the young adult age bracket (30−39 years). However, only one-third of these individuals with hypertension were aware of their condition through a physician's diagnosis.

More than half of the respondents exhibited central obesity. Additionally, 3.4% of those with hypertension had diabetes, 1.9% had heart disease, 1.4% had experienced a stroke, and 2.7% had multiple health conditions. Furthermore, 11.5% of individuals with hypertension faced general mental health issues, as indicated by an SRQ-20 score exceeding 5, while 7.0% reported experiencing depression.

As shown in Table 1, the bivariate analysis revealed a strong association between the prevalence of general mental health problems and all independent variables. Among hypertensive individuals, general mental health problems were more prevalent among women, those with lower levels of education, the unemployed, individuals residing in rural areas, and those aware of their hypertension diagnosis. Additionally, the prevalence of general mental health problems increased with age and in patients with multiple health conditions.

On the other hand, no significant association was found between depression and living area or central obesity. However, depression was more prevalent among hypertensive women, individuals with lower education levels, and the unemployed, particularly those aware of their hypertension diagnosis. Moreover, depression showed an increased prevalence with age and in individuals with multiple health conditions.

The multivariate analysis in Table 2 demonstrated that general mental health problems maintained a significant relationship with all variables except age and residential area. Specifically, stronger associations with general mental health problems were identified among women, individuals with lower education levels, those who were not married, the unemployed, individuals aware of their hypertension status, those without central obesity, and individuals with multiple health conditions. Similarly, depression exhibited associations with being female, belonging to younger age groups, having lower education levels, being unmarried, unemployed, aware of hypertension status, not having central obesity, and having multiple health conditions.

In summary, the multivariate analysis revealed that general mental health problems and depression were significantly associated with various demographic and health-related factors, highlighting the need for targeted interventions to address mental health issues in hypertensive individuals.

Table 2: Odds Ratios for Mental Health Issues: Sociodemographic and Health Factors

Characteristics	General mental health problems			Depression		
	Adj. OR	95% CI	*p*	Adj. OR	95% CI	*p*
Gender			< .001			< .001
Male	Ref			Ref		
Female	1.42	(1.31, 1.55)		1.46	(1.32, 1.62)	
Age			< .001			< .001
30−39	Ref			Ref		
40−49	0.96	(0.88, 1.05)		0.98	(0.88, 1.10)	
50−59	0.91	(0.83, 1.00)		0.86	(0.77, 0.97)	
Education level			< .001			< .001
High	Ref			Ref		
Low	1.75	(1.61, 1.90)		1.66	(1.50, 1.84)	
Marital status			< .001			< .001
Single	Ref			Ref		
Married	0.74	(0.68, 0.82)		0.70	(0.63, 0.79)	
Employment status			< .001			< .001
Employed	Ref			Ref		
Unemployed	1.26	(1.17, 1.35)		1.29	(1.18, 1.41)	
Residential area			.142			.001
Urban	Ref			Ref		
Rural	1.04	(0.97, 1.14)		0.97	(0.89, 1.06)	
Hypertension diagnosis			< .001			< .001
No	Ref			Ref		
Yes	1.61	(1.51, 1.73)		1.61	(1.48, 1.75)	
Central obesity			.005			< .001
No	Ref			Ref		
Yes	0.89	(0.83, 0.96)		0.88	(0.81, 0.95)	
Comorbidities			< .001			< .001
None	Ref			Ref		
Two or more illnesses	3.74	(3.26, 4.30)		3.85	(3.28, 4.51)	
Diabetes only	1.54	(1.31, 1.80)		1.67	(1.39, 2.01)	
Heart disease	1.82	(1.47, 2.26)		1.90	(1.47, 2.47)	
Stroke	2.23	(1.81, 2.76)		2.23	(1.78, 2.81)	
Cancer, asthma, and arthritis	1.85	(1.69, 2.02)		1.94	(1.74, 2.17)	

Discussion

The prevalence of general mental health problems and depression among Indonesian adults aged 30−59 years with hypertension is 11.5% and 7%, respectively. These statistics highlight the significant overlap between mental health issues and hypertension in this demographic. Research has revealed the physiological connections between depression, general mental health issues, and blood pressure, primarily through the involvement of the sympathetic nervous system (Jones-Webb et al., 1996; Townsend et al., 1998). Empirical evidence supports the idea that depression leads to changes in autonomic control of the body, shifting the autonomic balance towards increased sympathetic tone (Singla et al., 2020). This shift in

autonomic balance may contribute to the worsening of hypertension and associated health complications in affected individuals.

Additionally, the connection between mental health problems and hypertension can be explained through the mechanism of chronic stress. Chronic stress can impact blood pressure regulation and endocrine-metabolic function by influencing the limbic-hypothalamic center, ultimately contributing to arterial hypertension. Preclinical and animal studies support this complex interplay, highlighting the profound relationship between stress and arterial hypertension (Nenezić et al., 2021). This mechanistic perspective contributes to a comprehensive understanding of the intricate physiological pathways linking mental health and blood pressure, informing potential therapeutic interventions.

In this study, general mental health problems were more prevalent in women with lower education, unmarried status, unemployment, physician-diagnosed hypertension, and comorbidities (diabetes, heart disease, stroke, or other conditions like cancer, arthritis, and asthma). Participants with multimorbidities had a stronger association with mental health issues compared to those with a single comorbid condition. The factors associated with general mental health problems and depression were similar.

Our analysis revealed a higher prevalence of general mental health problems and depression in women, which is consistent with a study indicating that women are nearly twice as likely as men to experience mental illness, even in the presence of cardiovascular issues (Bucciarelli-Ducci et al., 2020). Specifically, interpersonal stress reactivity and internalizing coping methods in women are associated with an increased risk of cardiovascular disease (CVD) and/or depression through specific behavioral and pathophysiological processes, including anomalies in the hypothalamic-pituitary-adrenal (HPA) axis and autonomic nervous system (Möller-Leimkühler, 2010). However, findings from other research studies vary, as psychological factors have been linked to incident ischemic heart disease (IHD) in both men and women, with no discernible differences between the sexes (Smaardijk et al., 2019).

Additionally, our analysis of research data revealed a significant correlation between lower educational attainment and higher instances of depression and general mental health challenges among hypertensive adults in Indonesia. This observation aligns with numerous studies highlighting the notable association between lower educational levels and increased anxiety and depression (Bjelland et al., 2008).

The study found that higher levels of education serve as a protective factor against anxiety and depression, providing lifelong benefits. Increased educational attainment leads to better job opportunities and higher income and correlates with improved quality of life and enhanced emotional and psychological well-being. On the other hand, individuals with lower levels of education often have more limited prospects. However, a study discovered that individuals with low to moderate educational levels had a lower risk of psychological distress compared to those with higher educational levels (Molarius & Granström, 2018).

Additionally, the research observed that individuals with a single marital status, including those who were single, separated, or divorced, were more likely to experience general mental health problems and depression compared to their married counterparts. Existing literature supports the idea that relationships are a fundamental aspect of human functioning and that universal protective factors are significantly linked to mental health (Braithwaite & Holt-Lunstad, 2017). Those with relationships are presumed to benefit from enhanced emotional,

social, and financial support, distinguishing them from individuals without such connections (Ross, 1995; Wilmoth & Koso, 2002).

The investigation revealed a significant link between employment status and depression among individuals with hypertension, with a higher prevalence observed among the unemployed respondents. It is well established that health issues related to hypertension can hinder an individual's ability to work, subsequently increasing healthcare costs (Wu et al., 2021). This situation can lead to emotional distress, as supported by established associations between employment status and psychological distress (Norström et al., 2019; Zuelke et al., 2018).

In contrast to some international studies, our research found no apparent differences in the prevalence of general mental health problems and depression between Indonesian adults with central obesity and those without. This contradicts findings in the United States, where abdominal obesity was closely linked to several depression symptoms (Zhao et al., 2011). Similarly, studies in the United Kingdom involving middle-aged populations (41–61 years) demonstrated an association between central obesity and depression (Akbaraly et al., 2009). On the other hand, a study conducted in Indonesia found that individuals with higher body weights were perceived as happier, symbolizing health, status, and success (Sohn, 2017).

This research underscores the fact that adults who are aware of their hypertension status are more likely to experience general mental health problems and depression compared to those who are unaware of their hypertension status. This finding is consistent with a study suggesting that labeling individuals as hypertensive, rather than just having elevated blood pressure, may lead to higher levels of distress among individuals undergoing hypertension treatment. Additionally, it has been observed that even in the absence of other health conditions, hypertensive individuals often exhibit signs of depression (Rantanen et al., 2018). Another study found that the risk of psychological distress in patients who were aware of their hypertension status was 1.57 times higher (95% CI [1.41, 1.74]) compared to those who were unaware (0.91 times) (95% CI [0.78, 1.07]) (Hamer et al., 2010).

The analysis also revealed a stronger association between individuals with comorbidities or multimorbidities, general mental health problems, and depression. Patients with chronic diseases often experience prolonged illness trajectories, leading to high costs for public health services, including the use of pharmacological treatments, and presenting challenges in terms of management (Daar et al., 2007; Kankeu et al., 2013). Consequently, chronic diseases, as a form of negative mental stimulation, impose severe psychological pressure on patients, adversely affecting their mental health (Liu et al., 2018).

Inflammatory responses linked to both acute and chronic physical diseases have been shown to impact the availability of neurotransmitter precursor amino acids, and these changes are associated with mental health (Hüfner et al., 2019). The observed psychological impact of individuals with diabetes is consistent with findings in 2,818 older subjects (Azam et al., 2021). Additionally, higher depression scores were found to increase the risk of coronary heart disease in Dutch adults aged 60 to 85 (de Hartog-Keyzer et al., 2022).

Strengths and limitations

Our study has several notable strengths. First, it includes a large sample of nationally representative respondents. Second, we used specific mental health measures that are not commonly used but are highly effective in identifying mental health problems within the community. Third, we collected data by measuring and recording respondents' hypertension levels on the spot.

However, the study also has limitations. Firstly, using a cross-sectional approach means we cannot establish causal relationships. Secondly, we did not include certain independent variables, such as family history of hypertension, dietary habits, and physical activity, in the analysis. Thirdly, we did not account for respondents on antihypertensive medications whose blood pressure falls below 140/90 mmHg, classifying them as normotensive. Additionally, individuals taking medication but exhibiting normotensive readings during the assessment were excluded, which means we may have missed detecting white-coat hypertension, as blood pressure was measured only once.

Fourthly, it is essential to acknowledge the potential for underreporting of physician-diagnosed hypertension due to memory limitations or a tendency to provide socially desirable responses. Fifthly, variations in the interpretation of psychiatric notions, regardless of the use of SRQ-20 or MINI depression assessments, could arise from cultural and language disparities. To address these limitations, the Riskesdas team implemented several measures. These included providing stringent instructions to interviewers, prohibiting deviations from the questionnaire, and offering comprehensive training to ensure uniformity in questioning. Additionally, efforts were made to counteract subjective questioning by interviewers with diverse backgrounds through intensive training conducted by psychiatrists serving as master trainers and individuals with a health professional background acting as trainers and enumerators.

Conclusion

This research highlights the high prevalence of mental health issues among individuals with non-communicable diseases (NCDs) in Indonesia, especially those diagnosed with high blood pressure. The study found that these individuals often have low educational attainment, are unmarried, unemployed, and have been diagnosed with hypertension by a physician. The findings emphasize the importance of addressing mental health concerns in people dealing with hypertension and other NCDs. Further research is needed to understand the complex relationship between mental disorders and hypertension, especially considering the influence of other coexisting NCDs.

References

Agency of Health Research and Development. (2018). *Pedoman Pengisian Kuesioner Riskesdas 2018 [Guidelines for filling in the 2018 Riskesdas Questionnaire].* https://repository.badankebijakan.kemkes.go.id/id/eprint/4606/

Agency of Health Research and Development. (2019*). Laporan Nasional Riskesdas 2018 [Riskesdas National Report 2018].* https://repository.badankebijakan.kemkes.go.id/id/eprint/3514

Akbaraly, T. N., Kivim¨aki, M. K., Brunner, E. J., Chandola, T., Marmot, M. G., Singh-Manoux, A., & Ferrie, J. E. (2009). Association between metabolic syndrome and depressive symptoms in middle-aged adults. *Cardiovascular and Metabolic Risk*, *32*(3), 499–504. https://doi.org/10.2337/dc08

Azam, M., Sulistiana, R., Fibriana, A. I., Savitri, S., & Aljunid, S. M. (2021). Prevalence of mental health disorders among elderly diabetics and associated risk factors in Indonesia. *International Journal of Environmental Research and Public Health*, *18*(19), Article 10301. https://doi.org/10.3390/ijerph181910301

Beusenberg, M., Orley, J. H., & World Health Organization. *Division of Mental Health. (1994). A user's guide to the self reporting questionnaire (SRQ)*. World Health Organization. https://iris.who.int/handle/10665/6111

Bjelland, I., Krokstad, S., Mykletun, A., Dahl, A. A., Tell, G. S., & Tambs, K. (2008). Does a higher educational level protect against anxiety and depression? The HUNT study. *Social Science and Medicine*, *66*(6), 1334–1345. https://doi.org/10.1016/j.socscimed.2007.12.019

BPS-Statistics Indonesia. (2021, February 26). *Statistical Yearbook of Indonesia 2021*. https://www.bps.go.id/en/publication/2021/02/26/938316574c78772f27e9b477/statistik-indonesia-2021.html

Braithwaite, S., & Holt-Lunstad, J. (2017). Romantic relationships and mental health. *Current Opinion in Psychology*, *13*, 120–125. https://doi.org/10.1016/j.copsyc.2016.04.001

Bucciarelli-Ducci, C., Ostenfeld, E., Baldassarre, L. A., Ferreira, V. M., Frank, L., Kallianos, K., Raman, S. V., Srichai, M. B., McAlindon, E., Mavrogeni, S., Ntusi, N. A. B., Schulz-Menger, J., Valente, A. M., & Ordovas, K. G. (2020). Cardiovascular disease in women: Insights from magnetic resonance imaging. *Journal of Cardiovascular Magnetic Resonance*, *22*(1), Article 71. https://doi.org/10.1186/s12968-020-00666-4

Daar, A. S., Singer, P. A., Persad, D. L., Pramming, S. K., Matthew, D. R., Beaglehole, R., Bernstein, A., Borysiewicz, L. K., Colagiuri, S., Ganguly, N., Glass, R. I., Finegood, D. T., Koplan, J., Nabel, E. G., Sarna, G., Sarrafzadegan, N., Smith, R., Yach, D., & Bell, J. (2007). Grand challenges in chronic non-communicable diseases. *Nature*, *450*, 494–496. https://doi.org/https://doi.org/10.1038/450494a

de Hartog-Keyzer, J. M. L., Pedersen, S. S., El Messaoudi, S., Nijveldt, R., & Pop, V. J. M. (2022). Psychological distress is independently related to new coronary events at 8 years' follow-up in elderly primary care patients with hypertension. *Journal of Psychosomatic Research*, *160*, Article 110980. https://doi.org/10.1016/j.jpsychores.2022.110980

Endomba, F. T., Mazou, T. N., & Bigna, J. J. (2020). Epidemiology of depressive disorders in people living with hypertension in Africa: A systematic review and meta-analysis. *BMJ Open*, *10*(12), Article e037975. https://doi.org/10.1136/bmjopen-2020-037975

Fuchs, F. D., & Whelton, P. K. (2020). High blood pressure and cardiovascular disease. *Hypertension*, *75*(2), 285–292. https://doi.org/10.1161/HYPERTENSIONAHA.119.14240

Ganihartono, I. (1996). Psychiatric morbidity among patients attending the Bangetayu Community Health Centre in Indonesia. *Buletin Penelitian Kesehatan*, *24*(4), 42–51. https://repository.badankebijakan.kemkes.go.id/id/eprint/1028/1/333-527-1-PB.pdf

Hamer, M., Batty, G. D., Stamatakis, E., & Kivimaki, M. (2010). Hypertension awareness and psychological distress. *Hypertension*, *56*(3), 547–550. https://doi.org/10.1161/HYPERTENSIONAHA.110.153775

Hüfner, K., Fuchs, D., Blauth, M., & Sperner-Unterweger, B. (2019). How acute and chronic physical disease may influence mental health – An Analysis of neurotransmitter precursor amino acid levels. *Psychoneuroendocrinology*, *106*, 95–101. https://doi.org/10.1016/j.psyneuen.2019.03.028

Idaiani, S., Mubasyiroh, R., & Isfandari, S. (2019). Validity and reliability of depression, anxiety and psychosis questionnaire of Mini International Neuropsychiatric Interview (MINI) in Indonesia. *ASEAN Journal of Psychiatry*, *20*(2). https://www.aseanjournalofpsychiatry.org/abstract/validity-and-reliability-of-depression-anxiety-and-psychosis-questionnaire-of-mini-international-neuropsychiatric-interv-53675.html

Idaiani, S., & Wahyuni, H. S. (2016). Hubungan gangguan mental emosional dengan hipertensi pada penduduk Indonesia [The relationship between emotional mental disorders and hypertension in the Indonesian population]. *Media Penelitian dan Pengembangan Kesehatan*, *26*(3), 137–144.

https://www.neliti.com/publications/179235/hubungan-gangguan-mental-emosional-dengan-hipertensi-pada-penduduk-indonesia

James, P. A., Oparil, S., Carter, B. L., Cushman, W. C., Dennison-Himmelfarb, C., Handler, J., Lackland, D. T., LeFevre, M. L., MacKenzie, T. D., Ogedegbe, O., Smith, S. C., Jr., Svetkey, L. P., Taler, S. J., Townsend, R. R., Wright, J. T., Jr., Narva, A. S., & Ortiz, E. (2014). 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults: Report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*, *311*(5), 507–520. https://doi.org/10.1001/jama.2013.284427

Jones-Webb, R., Jacobs, D. R., Jr, Flack, J. M., & Liu, K. (1996). Relationships between depressive symptoms, anxiety, alcohol consumption, and blood pressure: Results from the CARDIA study. *Alcoholism, Clinical and Experimental Research*, *20*(3), 420–427. https://doi.org/10.1111/j.1530-0277.1996.tb01069.x

Kankeu, H. T., Saksena, P., Xu, K., & Evans, D. B. (2013). The financial burden from non-communicable diseases in low- and middle-income countries: A literature review. *Health Research Policy and Systems*, *11*, Article 31. https://doi.org/10.1186/1478-4505-11-31

Kjeldsen, S. E. (2018). Hypertension and cardiovascular risk: General aspects. *Pharmacological Research*, *129*, 95–99. https://doi.org/10.1016/j.phrs.2017.11.003

Li, Z., Li, Y., Chen, L., Chen, P., & Hu, Y. (2015). Prevalence of depression in patients with hypertension: A systematic review and meta-analysis. *Medicine*, *94*(31), Article e1317. https://doi.org/10.1097/MD.0000000000001317

Liu, Q., Cai, H., Yang, L. H., Xiang, Y.-B., Yang, G., Li, H., Gao, Y.-T., Zheng, W., Susser, E., & Shu, X.-O. (2018). Depressive symptoms and their association with social determinants and chronic diseases in middle-aged and elderly Chinese people. *Scientific Reports*, *8*(1), Article 3841. https://doi.org/10.1038/s41598-018-22175-2

Lund, C., Breen, A., Flisher, A. J., Kakuma, R., Corrigall, J., Joska, J. A., Swartz, L., & Patel, V. (2010). Poverty and common mental disorders in low and middle income countries: A systematic review. *Social Science and Medicine*, *71*(3), 517–528. https://doi.org/10.1016/j.socscimed.2010.04.027

Mahmood, S., Hassan, S. Z., Tabraze, M., Khan, M. O., Javed, I., Ahmed, A., Siddiqui, O. M., Narmeen, M., Ahmed, M. J., Tariq, A., Patel, M. S., & Fatima, K. (2017). Prevalence and predictors of depression amongst hypertensive individuals in Karachi, Pakistan. *Cureus*, *9*(6), Article e1397. https://doi.org/10.7759/cureus.1397

Ministry of Health of Republic of Indonesia. (2013). *Basic Health Research: RISKESDAS 2013*. https://repository.badankebijakan.kemkes.go.id/id/eprint/4519/1/Basic_Health_Research_Riskesdas.pdf

Molarius, A., & Granström, F. (2018). Educational differences in psychological distress? Results from a population-based sample of men and women in Sweden in 2012. *BMJ Open*, *8*(4), Article e021007. https://doi.org/10.1136/bmjopen-2017-021007

Möller-Leimkühler, A. M. (2010). Higher comorbidity of depression and cardiovascular disease in women: A biopsychosocial perspective. *The World Journal of Biological Psychiatry*, *11*(8), 922–933. https://doi.org/10.3109/15622975.2010.523481

Nakagawara, M., Witzke, W., & Matussek, N. (1987). Hypertension in depression. *Psychiatry Research*, *21*(1), 85–86). https://doi.org/https://doi.org/10.1016/0165-1781(87)90065-5

Nenezić, N., Matunović, R., Gudelj, O., Đurić, I., Jančić, J., & Samardžić, J. (2021). Stress and arterial hypertension – from pathophysiology to pharmacology. *Srpski Arhiv Za Celokupno Lekarstvo*, *149*(11–12), 737–740. https://doi.org/10.2298/SARH210323066N

Norström, F., Waenerlund, A.-K., Lindholm, L., Nygren, R., Sahlén, K.-G., & Brydsten, A. (2019). Does unemployment contribute to poorer health-related quality of life among Swedish adults? *BMC Public Health, 19*, Article 457. https://doi.org/10.1186/s12889-019-6825-y

Ohrnberger, J., Fichera, E., & Sutton, M. (2017). The relationship between physical and mental health: A mediation analysis. *Social Science and Medicine*, *195*, 42–49. https://doi.org/10.1016/j.socscimed.2017.11.008

Patel, V., Araya, R., Chowdhary, N., King, M., Kirkwood, B., Nayak, S., Simon, G., & Weiss, H. A. (2008). Detecting common mental disorders in primary care in India: A comparison of five screening questionnaires. *Psychological Medicine*, *38*(2), 221–228. https://doi.org/10.1017/S0033291707002334

Peltzer, K., & Pengpid, S. (2018). High prevalence of depressive symptoms in a national sample of adults in Indonesia: Childhood adversity, sociodemographic factors and health risk behaviour. *Asian Journal of Psychiatry*, *33*, 52–59. https://doi.org/10.1016/j.ajp.2018.03.017

Rantanen, A. T., Korkeila, J. J. A., Löyttyniemi, E. S., Saxén, U. K. M., & Korhonen, P. E. (2018). Awareness of hypertension and depressive symptoms: A cross-sectional study in a primary care population. *Scandinavian Journal of Primary Health Care*, *36*(3), 323–328. https://doi.org/10.1080/02813432.2018.1499588

Ross, C. E. (1995). Reconceptualizing marital status as a continuum of social attachment. *Source: Journal of Marriage and Family*, *57*(1), 129–140. https://doi.org/https://doi.org/10.2307/353822

Scalco, A. Z., Scalco, M. Z., Batista, J., Azul, S., & Neto, F. L. (2005). Review hypertension and depression. *Clinics*, *60*(3), 241–250. https://doi.org/10.1590/s1807-59322005000300010

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., & Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *The Journal of Clinical Psychiatry*, *59 Suppl 20*, 22–57. https://www.psychiatrist.com/jcp/mini-international-neuropsychiatric-interview-mini/

Singla, S., Jhamb, S., Singh, K. D., & Kumar, A. (2020). Depression affects autonomic system of the body? Yes, it does! *Journal of Education and Health Promotion*, *9*, Article 217. https://doi.org/10.4103/jehp.jehp_627_19

Smaardijk, V. R., Lodder, P., Kop, W. J., van Gennep, B., Maas, A. H. E. M., & Mommersteeg, P. M. C. (2019). Sex- and gender-stratified risks of psychological factors for incident ischemic heart disease: Systematic review and meta-analysis. *Journal of the American Heart Association*, *8*(9), Article e010859. https://doi.org/10.1161/JAHA.118.010859

Sohn, K. (2017). The fatter are happier in Indonesia. *Quality of Life Research*, *26*(2), 393–402. https://doi.org/10.1007/s11136-016-1403-6

Stein, D. J., Aguilar-Gaxiola, S., Alonso, J., Bruffaerts, R., De Jonge, P., Liu, Z., Miguel Caldas-de-Almeida, J., O'Neill, S., Viana, M. C., Al-Hamzawi, A. O., Angermeyer, M. C., Benjet, C., De Graaf, R., Ferry, F., Kovess-Masfety, V., Levinson, D., De Girolamo, G., Florescu, S., Hu, C., … Scott, K. M. (2014). Associations between mental disorders and subsequent onset of hypertension. *General Hospital Psychiatry*, *36*(2), 142–149. https://doi.org/10.1016/j.genhosppsych.2013.11.002

Townsend, M. H., Bologna, N. B., & Barbee, J. G. (1998). Heart rate and blood pressure in panic disorder, major depression, and comorbid panic disorder with major depression. *Psychiatry Research*, *79*, 187–190. https://doi.org/https://doi.org/10.1016/s0165-1781(98)00036-5

Turana, Y., Tengkawan, J., Chia, Y. C., Shin, J., Chen, C. H., Park, S., Tsoi, K., Buranakitjaroen, P., Soenarta, A. A., Siddique, S., Cheng, H. M., Tay, J. C., Teo, B. W., Wang, T. D., & Kario, K. (2021). Mental health problems and hypertension in the elderly: Review from the HOPE Asia Network. *Journal of Clinical Hypertension*, *23*(3), 504–512. https://doi.org/10.1111/jch.14121

Unger, T., Borghi, C., Charchar, F., Khan, N. A., Poulter, N. R., Prabhakaran, D., Ramirez, A., Schlaich, M., Stergiou, G. S., Tomaszewski, M., Wainford, R. D., Williams, B., & Schutte, A. E. (2020). 2020 International Society of Hypertension Global Hypertension Practice Guidelines. *Hypertension*, *75*(6), 1334–1357. https://doi.org/10.1161/HYPERTENSIONAHA.120.15026

Wilmoth, J., & Koso, G. (2002). Does marital history matter? Marital status and wealth outcomes among preretirement adults. *Journal of Marriage and Family*, *64*, 254–268. https://doi.org/https://doi.org/10.1111/j.1741-3737.2002.00254.x

World Health Organization. (2011, May 16). *Waist circumference and waist-hip ratio: Report of a WHO expert consultation, Geneva, 8-11 December 2008*. https://www.who.int/publications/i/item/9789241501491

Wu, Y., Zhao, D., Guo, J., Lai, Y., Chen, L., Jin, S., & Huang, Y. (2021). Economic burden of depressive symptoms conditions among middle-aged and elderly people with hypertension in China. *International Journal of Environmental Research and Public Health*, *18*(19), Article 10009. https://doi.org/10.3390/ijerph181910009

Zhao, G., Ford, E. S., Li, C., Tsai, J., Dhingra, S., & Balluz, L. S. (2011). Waist circumference, abdominal obesity, and depression among overweight and obese U.S. adults: National Health and Nutrition Examination Survey 2005-2006. *BMC Psychiatry*, *11*, Article 130. https://doi.org/10.1186/1471-244X-11-130

Zuelke, A. E., Luck, T., Schroeter, M. L., Witte, A. V., Hinz, A., Engel, C., Enzenbach, C., Zachariae, S., Loeffler, M., Thiery, J., Villringer, A., & Riedel-Heller, S. G. (2018). The association between unemployment and depression–Results from the population-based LIFE-adult-study. *Journal of Affective Disorders*, *235*, 399–406. https://doi.org/10.1016/j.jad.2018.04.073