BMC Public Health

RESEARCH

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The association of cardiometabolic multimorbidity with depression and length of hospitalization: a population-based cross-sectional study among adults in Turkey

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Abstract

Background Recent developments suggest a strong association between cardiometabolic multimorbidity, depression, and hospitalization. The aim of this study was to investigate the association of cardiometabolic multimorbidity with depression and the length of hospitalization among individuals aged 40 and older.

Methods This study is based on the secondary analysis of data obtained from the 2022 Turkey Health Survey conducted by the Turkish Statistical Institute (TUIK). A weighted sample of 31,425,252 individuals aged 40 and over was analyzed. The dependent variables of the study are depression and hospitalization, while the independent variable is cardiometabolic multimorbidity. Other covariates include gender, age, education level, physical activity, body mass index, tobacco use, and alcohol use. The weights from the database provided by TUIK were used in the data analysis. The relationship between cardiometabolic multimorbidity and depression was investigated using univariate and multivariate logistic regression analysis.

Result Of the included participants, 51.2% were female and 35.5% were between the ages of 40–49. In Model 1, individuals with five cardiometabolic diseases had a 10-fold higher risk of developing depression compared to those with no diseases (OR: 10.0; 95% CI: 9.82–10.23). In Model 2, the risk of depression was 5.1 times higher in individuals with three diseases (OR: 5.1; 95% CI: 5.08–5.14), 5.83 times higher in those with four diseases (OR: 5.3; 95% CI: 5.78–5.88), and 14.6 times higher in individuals with five diseases (OR: 14.6; 95% CI: 14.36–14.99). Furthermore, as the number of cardiometabolic diseases increases, a significant increase in the length of hospitalization was observed ($p < 0.001$).

Conclusions The findings of this study revealed that cardiometabolic multimorbidity may increase the risk of depression and the length of hospitalization in adults. These results may provide guidance for developing disease prevention and control strategies regarding cardiometabolic multimorbidity and associated factors in adults.

Keywords Cardiometabolic diseases, Depression, Hospitalization, Population-based, Cardiometabolic Multimorbidity

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Introduction

Cardiometabolic diseases such as stroke, diabetes, coronary artery disease, and hypertension are increasingly prevalent both globally and in Turkey, creating a significant burden on healthcare systems [1]. Cardiovascular diseases account for 85% of deaths worldwide, primarily due to myocardial infarction and stroke [2]. Circulatory system diseases are the leading cause of death in Turkey, accounting for 34% of all deaths [3].

Cardiometabolic multimorbidity refers to the presence of two or more cardiometabolic conditions in an individual [4]. The prevalence of cardiometabolic multimorbidity is expected to rise in the coming years due to factors such as demographic and epidemiological transitions, social inequalities, rapid urbanization, globalization, and unhealthy lifestyle habits [5]. Cardiometabolic diseases like coronary heart disease, stroke, diabetes, and hypertension often share common risk factors, similar etiological mechanisms, and reciprocal interactions [6]. For instance, hypertension can lead to the development of diabetes, while diabetes can also increase the likelihood of developing hypertension [6].

Beyond increasing mortality risk, cardiometabolic multimorbidity is strongly associated with reduced quality of life, higher healthcare utilization, and escalating healthcare costs [7]. There are studies indicating that as the number of cardiometabolic diseases in an individual increases, the frequency of outpatient visits and the length of hospital stays also increase [8, 9]. According to the International Classification of Diseases, 11th Revision (ICD-11) by the World Health Organization, a depressive episode is defined as a period of at least two weeks during which an individual experiences a depressed mood or a marked loss of interest or pleasure in activities, accompanied by other symptoms such as diminished energy, changes in sleep or appetite, feelings of worthlessness or excessive guilt, difficulty concentrating, or recurrent thoughts of death or suicide [10]. It is a common condition that negatively affects social and occupational functioning, reducing quality of life [11]. Highly prevalent among individuals with cardiometabolic diseases, it occurs more frequently compared to healthy individuals [12]. Moreover, it is an important factor that negatively affects the progression of coronary artery disease (CAD). Numerous studies have shown that it increases the risk of developing CAD and also elevates morbidity and mortality in individuals with existing heart disease [12–14]. There is a bidirectional and complex relationship between depression and cardiovascular diseases [12]. Depression increases the risk of cardiovascular diseases through both behavioral and biological mechanisms [13, 14]. Individuals with depression are more likely to exhibit lifestyle-related risk factors such as physical inactivity, unhealthy diet, smoking, and poor medication adherence, all of which contribute to the development and progression of cardiovascular conditions [13, 14]. Conversely, cardiometabolic diseases are also significant triggers for the onset of depression. Living with such chronic conditions can lead to functional impairment, the need to cope with persistent symptoms, and increased social isolation, thereby elevating the risk of depression [13, 14]. This bidirectional interaction has important implications both for individuals and for the healthcare system [13].

However, studies investigating the relationship between cardiometabolic diseases and depression in Turkey are quite limited. Existing research typically focuses on the relationship between depression and a single cardiometabolic condition [15]. Similarly, studies assessing the association between cardiometabolic multimorbidity and hospitalizations are also scarce [15]. The aim of this population-based study is to examine the relationship between cardiometabolic multimorbidity, depression, and the length of hospitalization among individuals aged 40 years and older.

Methods

This cross-sectional study is based on a secondary analysis of data obtained from the 2022 Turkey Health Survey conducted by the Turkish Statistical Institute (TUIK) [16]. The Turkey Health Survey is carried out every two to three years and provides information on health and health-related behaviors for the adult population aged 15 and above. The survey excludes institutionalized populations such as those in military facilities, dormitories, prisons, hospitals, and nursing homes. In the study, a stratified two-stage cluster sampling method was used. The external stratification criterion was based on the urban-rural distinction. (Settlements with a population of 20,000 or fewer were classified as rural, and settlements with a population of 20,001 or more were classified as urban). In the first stage, the sampling unit consisted of blocks, each containing an average of 100 household addresses, selected randomly through proportional allocation based on size. In the second stage, the sampling unit consisted of systematically selected household addresses from each selected cluster. For the 2022 Turkey Health Survey, a total of 11,170 household addresses were selected from 1,117 sampled blocks (10 households from each block), and a survey was conducted with 29,762 individuals aged 15 and over. In this study, data from 12,613 individuals aged 40 and over were analyzed [16]. (Fig. 1).

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of the Dokuz Eylul University Faculty of Medicine Non-Interventional Research Ethics Committee, with decision number 2025/05–09 on 12/02/2025. This study is based on anonymized data provided by the

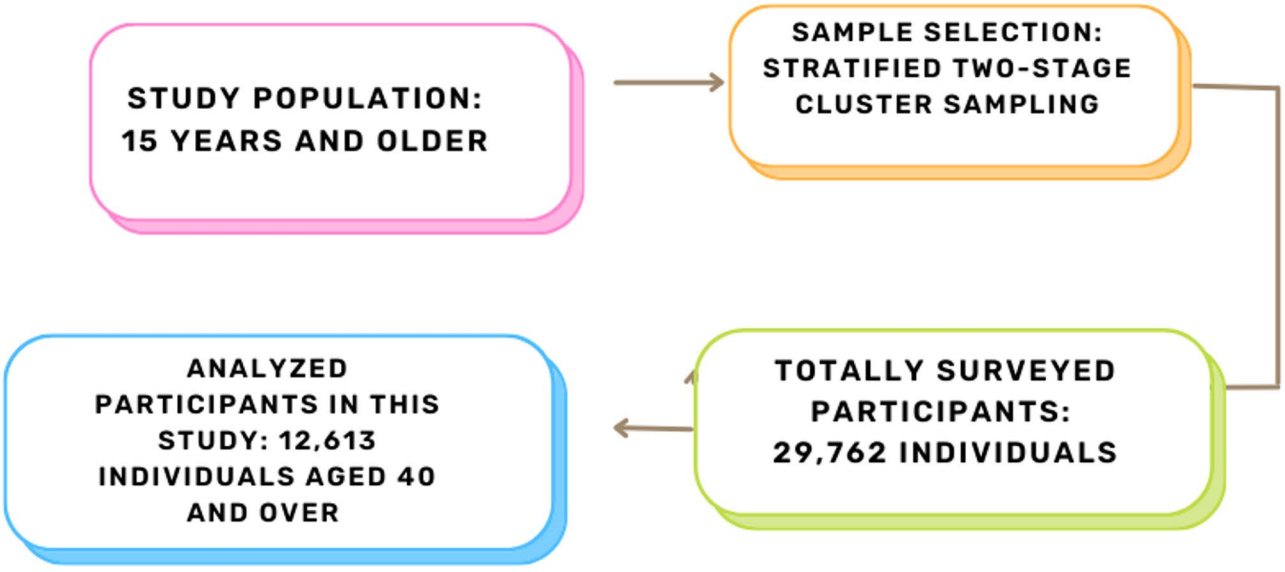


Fig. 1 Sampling and participant selection process of the research

Turkish Statistical Institute (TUIK). Informed consent was obtained from all participants before the study by TUIK. The use of TUIK data complies with ethical guidelines and institutional regulations.

Variables of the study

The dependent variables of the study are the presence of depression and the length of hospitalization, while the primary independent variable is cardiometabolic multimorbidity. Gender, age, education level, physical activity, body mass index, tobacco use, and alcohol consumption were regarded as covariates. In the study, dependent and independent variables were collected based on the participants' self-reports. Participants were asked, "In the past 12 months, have you been diagnosed with depression by a doctor?" regarding depression. Regarding hospitalization, they were asked, "In the past 12 months, have you spent at least one night in the hospital?" For those answering "yes" to the latter, they were further asked, "Considering all inpatient services, how many nights in total have you spent in the hospital?" These questions, derived from the Turkey Health Survey (THS), refer to hospitalizations due to any cause; reasons for hospitalization were not specifically classified. Having at least two of the following five diseases was considered as "having cardiometabolic multimorbidity": Hypertension, coronary heart disease, stroke, diabetes mellitus, and hyperlipidemia. For chronic diseases, participants were asked, "In the past 12 months, have you been diagnosed with [disease name] by a doctor?" for each disease.

Age was divided into four groups based on decades: 40–49, 50–59, 60–69, and 70+. Participants were classified into three education levels: low, medium, and high. Those who did not complete formal education, were illiterate, or attended only primary school, general secondary school, or vocational/technical secondary school were categorized as having low education. Participants with high school or vocational high school education were assigned to the medium education level, and those with associate degrees, bachelor's degrees, or postgraduate education were classified as having a high education level.

The physical activity levels of the participants were determined based on their physical activities in daily life. Participants were asked, "Considering a normal day, which of the following best describes your situation?" and were presented with three options: "Mostly sitting or standing (e.g., desk jobs, traveling)," "Mostly walking or performing moderately physical tasks (e.g., shopping, household chores)," and "Mostly performing heavy or physically demanding tasks (e.g., construction work, manual labor)." These responses were later categorized into three main groups in the analysis: low physical activity (mostly sitting or standing tasks), moderate physical activity (mostly walking or moderately physically demanding tasks), and high physical activity (mostly heavy or physically demanding tasks). BMI was calculated by dividing body weight (kg) by the square of height (m) (BMI = kg/m^2). Based on World Health Organization criteria, individuals with a BMI below 18.5 kg/m^2 were categorized as "underweight," those with a BMI between 18.5 and 24.9 kg/m^2 as "normal," those with a BMI between 25 and 29.9 kg/m^2 as "overweight," and those with a BMI over 30 kg/m^2 as "obese." Participants were asked the question, 'Do you use tobacco products (cigarettes, hand-rolled cigarettes, cigars, hookah, heated tobacco products, hookah, etc.)?' for tobacco use, and 'Do you use alcohol?' for alcohol use. Smoking status was

classified into three categories: Current smoker, former smoker, and never smoked. Alcohol use was simply categorized as yes or no.

Statistical analysis

In the data analysis, the weights from the database provided by TUIK were used. During the analyses, the weighting procedure was carried out using the weighting coefficient variable "FERTFAKTOR (INDIVIDUALFACTOR)". The weighting process in the study was carried out to ensure that the dataset obtained from the sample more accurately represents the target population. The weighting variable, FERTFAKTOR, was calculated in three stages [16]. First, the base weights, which are inversely proportional to the final selection probabilities for each sample unit, were determined. In this stage, cluster and household selection probabilities were calculated, and base weights were assigned at both the household and individual levels. In the second stage, base weights were adjusted to compensate for sample loss due to nonresponse. In the final stage, iterative adjustments were made using the Integrated Calibration method, which utilizes projected population ratios. Through the final adjustment coefficient, estimates were aligned with the projected population (excluding the institutionalized population) and the total number of households across Turkey. Descriptive statistics were presented as numbers, percentages, means, and standard deviations (SD) where appropriate. For group comparisons, the chi-square test was utilized for categorical variables. The relationship between cardiometabolic multimorbidity and depression was evaluated using univariate and multivariate logistic regression analysis, and the odds ratios (ORs) and their corresponding 95% confidence intervals (CIs) were calculated. Subsequently, the relationship between cardiometabolic multimorbidity and hospitalization was examined using multiple linear regression analysis. A two-tailed p-value of <0.05 was deemed statistically significant in all tests performed. All statistical analyses were executed using SPSS version 30.0 (IBM Corp., Armonk, NY, USA) software.

Results

Basic characteristics of the participants

In this study, weighted data from 31,425,252 individuals aged 40 and above were analyzed. The socio-demographic characteristics, health behaviors, and disease conditions of the participants are presented in Table 1. The participants were 51.2% female, 35.5% aged 40–49, 72.1% had a low education level, 53.0% had low physical activity, 42.3% were overweight, 31.0% were smokers, and 16.8% were alcohol consumers. Additionally, 18% of the participants had cardiometabolic multimorbidity, and 9% had depression (Table 1).

Statistically significant differences were found in the prevalence of cardiometabolic multimorbidity across gender, age groups, education level, physical activity level, smoking and alcohol consumption, and body mass index ($p<0.001$) (Table 1). Cardiometabolic multimorbidity was more common among women, individuals aged 60 and above. As age and body mass index increase, the prevalence of cardiometabolic multimorbidity also increases. However, as education level and physical activity level increase, the prevalence decreases. (Table 1).

Statistically significant differences were found in depression presence across gender, age, education level, physical activity level, smoking and alcohol consumption, body mass index, and cardiometabolic multimorbidity groups ($p<0.001$) (Table 2). Depression was found to be more common among women, smokers, alcohol consumers, and underweight individuals. As seen in Table 2, while depression prevalence increased with age, it decreased as education and physical activity levels increased.

In the unadjusted model (Model 1), the risk of developing depression significantly increased as the number of cardiometabolic diseases in an individual rose. Specifically, individuals with five diseases had a 10-fold higher risk of developing depression compared to those without any diseases (OR: 10.02; 95% CI: 9.82–10.23) (Table 3). In the adjusted model (Model 2), the risk of depression showed a notable increase, particularly in individuals with three or more cardiometabolic diseases. Compared to those without any diseases, the risk of depression was 5.11 times higher in individuals with three diseases (OR: 5.11; 95% CI: 5.08–5.14), 5.83 times higher in those with four diseases (OR: 5.83; 95% CI: 5.78–5.88), and 14.67 times higher in individuals with five diseases (OR: 14.67; 95% CI: 14.36–14.99) (Table 3).

As the number of cardiometabolic diseases increases, the prevalence of hospitalization significantly rises ($p<0.001$). As presented in Table 4, the prevalence of hospitalization is particularly notable in individuals with three or more diseases. The prevalence was found to be 36.6% in those with three diseases, 43.1% in those with four diseases, and 42.9% in those with five diseases (Table 4).

As the number of cardiometabolic diseases increases, the length of hospital stay significantly extends (ANOVA $p<0.001$). Compared to individuals without any diseases, the hospital stay is 2.35 days longer (95% CI: 2.32–2.38) for individuals with one disease, 1.83 days longer (95% CI: 1.80–1.87) for those with two diseases, and 2.05 days longer (95% CI: 2.00-2.08) for those with three diseases. The duration is notably higher for individuals with four or five diseases; it is 4.80 days longer (95% CI: 4.73–4.75) for those with four diseases and 4.05 days longer (95% CI: 3.87–4.22) for those with five diseases (Table 5).

Table 1 General characteristics of the participants and the distribution of cardiometabolic Multimorbidity across sociodemographic and clinical variables

Variables			Cardiometabolic multimorbidity				*p*-value*
	Total		Yes		No		
	n	%	n	%	n	%	
Gender							< 0.001
Male	15,328,298	48,8	2,103,870	13.7	13,224,427	86.3	
Female	16,096,955	51,2	3,491,203	21.7	12,605,752	78.3	
Age Groups							< 0.001
40–49	11,154,014	35,5	590,158	5.3	10,563,856	94.7	
50–59	8,939,999	28,4	1,318,817	14.8	7,621,182	85.2	
60–69	6,600,677	21	1,840,909	27.9	4,759,769	72.1	
70 and above	4,730,562	15,1	1,845,190	39.0	2,885,372	61.0	
Education Level							< 0.001
Low	22,667,490	72,1	4,803,899	21.2	17,863,591	78.8	
Medium	4,854,125	15,4	465,558	9.6	4,388,567	90.4	
High	3,903,638	12,4	325,617	8.3	3,578,021	91.7	
Physical Activity							< 0.001
Low	16,646,050	53	4,055,891	24.4	12,590,159	75.6	
Moderate	13,289,242	42,3	1,466,968	11.0	11,822,274	89.0	
High	1,489,961	4,7	72,215	4.8	1,417,746	95.20	
Smoking Status							< 0.001
Never	17,346,988	55,2	3,197,476	18.3	14,232,561	81.7	
Former	4,331,925	13,8	755,649	17.1	3,671,128	82.9	
Current	9,746,339	31	1,641,949	17.2	7,926,490	82.8	
Alcohol Use							< 0.001
Yes	5,288,575	16,8	671,783	12.7	4,616,792	87.3	
No	26,136,678	83,2	4,923,290	18.8	21,213,387	81.2	
Body Mass Index							< 0.001
Underweight	278,51	0,9	46,470	16.7	232,039	83.3	
Normal	8,718,407	27,7	1,060,470	12.2	7,657,937	87.8	
Overweight	13,294,630	42,3	2,180,797	16.4	11,113,833	83.6	
Obese	9,133,706	29,1	2,307,336	25.30	6,826,371	74.7	

*Chi-square ($\chi 2$) test

Discussion

In this study, using a nationally representative sample from Turkey, the relationship between cardiometabolic multimorbidity, depression, and hospitalization was evaluated in detail. The majority of the study participants were women, individuals aged 40–49, and those with low educational attainment. The prevalence of depression was found to be 8.70%, while the prevalence of cardiometabolic multimorbidity was determined to be 18%. In the adjusted models, an increase in the number of cardiometabolic diseases in an individual was found to significantly increase the risk of depression and the length of hospitalization. In parallel with our study, various studies in the literature have also shown that an increase in the number of cardiometabolic diseases is associated with a higher risk of depression [17, 18]. There are various explanations in the literature regarding the relationship between cardiometabolic multimorbidity and depression. An increase in the number of cardiometabolic diseases requires individuals to take more responsibility in disease management [19, 20]. In particular, situations that require continuous monitoring, such as regular medication use and tracking blood pressure and blood glucose levels, may impose an additional psychological burden on individuals [19, 20]. Additionally, adopting healthy eating habits, increasing physical activity, and avoiding harmful habits are also important components of disease management [19].

However, in individuals who do not adopt lifestyle changes, the severity of physical symptoms is more frequently observed [19, 20]. For example, not exercising regularly, unhealthy eating habits, and inability to cope with stress can worsen the symptoms of cardiometabolic diseases [19]. These increased physical symptoms may negatively affect individuals' overall health and lead to the emergence of psychological problems such as stress, anxiety, and depression [19, 20]. This resulting vicious cycle can cause profound deterioration in both physical and psychological health [19]. Furthermore, an excessive sensitivity to or avoidance of lifestyle changes may

Table 2 Comparison between groups based on depression presence

Depression					
	Yes		**No**		
	n	**%**	**n**	**%**	***p*-value***
Gender					
Male	838,06	5.5	14,490,234	94.5	<0.001
Female	1,896,250	11.8	14,200,704	88.2	
Age Groups					
40–49	895,27	8.0	10,258,748	92.0	
50–59	803,71	9.0	8,136,292	91.0	
60–69	647,84	9.8	5,952,840	90.2	
70 and above	387,50	8.2	4,343,059	91.8	<0.001
Education Level					
Low	2,105,132	9.3	20,562,358	90.7	
Medium	392,18	8.1	4,461,947	91.9	
High	237,00	6.1	3,666,633	93.9	<0.001
Physical Activity					
Low	1,615,064	9.7	15,030,986	90.3	
Moderate	1,026,912	7.7	12,262,330	92.3	
High	92,339	6.2	1,397,622	93.8	<0.001
Smoking Status					
Never	1,396,220	8.0	15,950,769	92.0	
Former	408,87	9.4	3,923,059	90.6	
Current	929,23	9.5	8,817,111	90.5	<0.001
Alcohol Use					
Yes	494,29	9.3	4,794,284	90.7	
No	2,240,023	8.6	23,896,655	91.4	<0.001
Body Mass Index					
Underweight	41,241	14.8	237,268	85.2	
Normal	621,95	7.1	8,096,455	92.9	
Overweight	1,108,051	8.3	12,186,579	91.7	
Obese	963,07	10.5	8,170,637	89.5	<0.001
Cardiometabolic Multimorbidity					
No diseases	1,034,052	5.6	17,533,750	94.4	
One disease	805,42	11.1	6,456,953	88.9	
Two diseases	559,72	14.1	3,420,276	85.9	
Three diseases	242,35	19.9	976,82	80.1	
Four diseases	78,094	21.9	278,318	78.1	
Five diseases	14,677	37.2	24,822	62.8	<0.001

*Chi-square (χ2) test

Table 3 The effect of cardiometabolic Multimorbidity on the development of depression

	Model 1*			**Model 2****		
	OR	**(95% CI)**	***p*-value**	**OR**	**(95%CI)**	***p*-value**
Cardiometabolic multimorbidity						
No diseases	Ref.			Ref.		
One disease	2.11	(2.10–2.12)	< 0.001	2.26	(2.26–2.27)	< 0.001
Two diseases	2.77	(2.76–2.78)	< 0.001	3.03	(3.02–3.04)	< 0.001
Three diseases	4.20	(4.18–4.22)	< 0.001	5.11	(5.08–5.14)	< 0.001
Four diseases	4.78	(4.72–4.80)	< 0.001	5.83	(5.78–5.88)	< 0.001
Five diseases	10.02	(9.82–10.23)	< 0.001	14.67	(14.36–14.99)	< 0.001

*Model 1 is unadjusted. **Model 2 is adjusted for age, gender, education level, physical activity, body mass index, alcohol, and smoking use

Table 4 Comparison of hospitalization status among cardiometabolic Multimorbidity groups: a chi-square analysis

Hospitalization					
	Yes		No		*p*-value
	n	%	n	%	
Cardiometabolic Multimorbidity					
No diseases	1,330,300	7.2	17,237,503	92.8	
One disease	914,108	12.6	6,348,269	87.4	
Two diseases	797,33	20.0	3,182,668	80.0	
Three diseases	446,684	36.6	772,482	63.4	< 0.001*
Four diseases	153,656	43.1	202,756	56.9	
Five diseases	16,963	42.9	22,536	57.1	
Total	3,659,041	11.6	27,766,214	88.4	

*Chi-square (χ2) for trend

Table 5 The impact of cardiometabolic Multimorbidity on length of hospital stay: a multiple linear regression analysis

Independent Variable	Regression coefficient (β)	Standardized regression coefficient (β)	t	*p*	%95 CI
One disease	2.35	0.09	144.85	<0.001	2.32–2.38
Two diseases	1.83	0.02	105.81	<0.001	1.80–1.87
Three diseases	2.05	0.02	96.50	<0.001	2.00-2.08
Four diseases	4.80	0.03	149.79	<0.001	4.73–4.75
Five diseases	4.05	0.09	45.46	<0.001	3.87–4.22

R^2=0.05 ANOVA $P < 0.001$. Those without any diseases were taken as the reference group. Model is adjusted for age, gender, education level, physical activity, body mass index, alcohol, and smoking use. β: beta

increase anxiety levels and lead to the development of negative thought patterns in the individual [19].

Cardiometabolic diseases and obesity share common risk factors [21]. Elements such as obesity, smoking, sedentary lifestyle, and insufficient physical activity are considered important risk factors for both cardiometabolic diseases and depression [21]. These factors may negatively affect individuals' physical and psychological health, thereby creating a basis for the development of depression in addition to cardiometabolic diseases [13, 21]. In particular, obesity and a sedentary lifestyle can contribute to the onset of depression by affecting both metabolism and brain chemistry [21]. Moreover, the relationship between cardiometabolic diseases and depression is not limited to behavioral factors. These two conditions also share similar biological mechanisms [22]. For instance, increased inflammatory markers stand out as a common feature of both cardiometabolic diseases and depression; these biomarkers may trigger either condition or worsen existing symptoms [22].

Disability in patients who have experienced a stroke is considered a significant risk factor for depression [23]. After a stroke, individuals may face difficulties in mobility, speech, or other daily functions [23]. Such functional impairments can increase psychological pressure and facilitate the development of mental health problems such as depression [23]. Additionally, structural damage in certain brain regions following a stroke may lead to neurochemical changes. In particular, imbalances in neurotransmitters such as dopamine, serotonin, and norepinephrine may increase the risk of depression [24]. In other words, damage to brain cells resulting from a stroke can disrupt the release and effects of these chemical substances, adversely affecting the individual's mood and emotional regulation capacity [24].

Similar to our findings, studies in the literature have shown that an increase in the number of cardiometabolic diseases leads to greater healthcare utilization and longer hospital stays [25, 26]. In individuals with cardiometabolic diseases, hypertensive crises, hypoglycemic and hyperglycemic episodes, drug-drug interactions due to polypharmacy, inadequate self-management, and poor treatment adherence significantly increase the risk of hospitalization. Particularly in elderly individuals, geriatric syndromes, functional impairments, and cognitive disorders may prolong hospital stays [27–31].

To prevent depression and hospitalization in individuals with cardiometabolic multimorbidity, it is essential for patients to take an active role in managing their own health conditions [32]. In this regard, improving health literacy levels and developing self-management skills are of great importance [32]. Additionally, minimizing unnecessary medication use is crucial to preventing polypharmacy and reducing drug-drug interactions [33]. Strengthening primary healthcare services to ensure the regular follow-up of individuals with chronic diseases is a critical necessity [34]. Furthermore, specialists dealing with cardiometabolic diseases should not overlook patients' mental health and should collaborate with

mental health professionals to ensure a holistic approach to patient management [35].

A key strength of this study is its utilization of data from a comprehensive national survey conducted by the country's statistical agency, which provides representative statistics on chronic diseases, lifestyle factors, and sociodemographic characteristics for the general population of Turkey. This study has several limitations. Firstly, a participant-reported method was used during the data collection process. The information provided by participants regarding their medical history is based on recall, which carries the risk of recall bias. In particular, the accuracy of information such as disease diagnoses, hospitalization history, and treatment history depends on the participants' individual memories. This can lead to some information being reported inaccurately or incompletely, which may limit the accuracy and reliability of the results obtained. Another limitation concerns potential biases in disease reporting. Particularly for socially sensitive health conditions such as depression, participants may report them incompletely or inaccurately. Reporting bias may occur when participants fail to report their conditions accurately due to fear of social stigma or judgment. This could lead to an underestimation of the true prevalence of depression. In addition, participants were only asked a general question about their hospitalization status, and no detailed information was collected regarding the reasons for their hospital stays. Moreover, Length of hospitalization was based on all-cause admissions, rather than hospitalizations specifically due to cardiometabolic conditions. This may limit the ability to directly attribute hospital stays to cardiometabolic multimorbidity.

Finally, this study has a cross-sectional design, meaning data were collected at a single point in time. This makes it impossible to determine causal relationships. The direction of the relationship between depression and cardiometabolic diseases is not clearly established. Therefore, this study can only examine the relationship between these two conditions, but it is not possible to draw causal inferences. Of note, another important limitation of this study was that although our multivariable models adjusted for a comprehensive set of sociodemographic and clinical covariates, we did not formally assess collinearity among included predictors. Future analyses should examine variance inflation factors or condition indices to ensure multicollinearity does not influence effect estimates.

Conclusions

In this population-based study, the relationship between cardiometabolic multimorbidity, the length of hospitalization, and depression was investigated using data from a national survey conducted in Turkey. The findings of this study highlight the strong association between cardiometabolic multimorbidity, depression, and the length of hospitalization. Given this relationship, screening for depression in individuals with cardiometabolic multimorbidity and integrating mental health support into routine healthcare services could be beneficial. Additionally, the increasing health needs of the population should be addressed to improve disease management and reduce hospitalizations. These results may provide guidance in developing effective disease prevention and control strategies in this area.

Abbreviations

CI	Confidence interval
CMM	Cardiometabolic multimorbidity
SD	Standart deviation
TUIK	Turkish Statistical Institute
BMI	Body Mass Index
THS	Turkey Health Survey

Acknowledgements

I would like to express my endless thanks to TUIK for sharing the TUIK Health Survey data.

Author contributions

A.K., M.E.A., H.S.: Conceptualization, Methodology, Software, Writing-Original draft preparation, Writing-Reviewing and Editing, Critical Review. AK and MEA: Data analysis. A.K., M.E.A., H.S.: Writing-Original draft preparation, Writing-Reviewing and Editing, Critical Review. The final manuscript was reviewed and approved by A.K., M.E.A. and H.S..

Funding

None.

Data availability

The data used in this study were obtained from the Turkish Statistical Institute (TUIK) and are not publicly available due to legal and ethical restrictions. Access to the dataset requires permission from TUIK. However, aggregated or anonymized data can be shared upon reasonable request from the TUIK.

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of the Dokuz Eylul University Faculty of Medicine Non-Interventional Research Ethics Committee, with decision number 2025/05–09 on 12/02/2025. This study is based on anonymized data provided by the Turkish Statistical Institute (TUIK). Informed consent was obtained from all participants before the study by TUIK. The use of TUIK data complies with ethical guidelines and institutional regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 8 March 2025 / Accepted: 23 May 2025
Published online: 31 May 2025

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