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Military Medical Academy, Institute of Pathology and Forensic Medicine, Belgrade² *Stručni članak*

University of Novi Sad, Faculty of Medicine Novi Sad³

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Special Hospital for Rheumatic Diseases, Novi Sad⁴

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Clinical Center of Serbia, Department of Pathology, Belgrade⁵

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Clinical Center of Serbia, Center for Anesthesiology and Reanimatology, Belgrade⁶

MENTAL HEALTH OF PATIENTS WITH CHRONIC DISEASES DURING THE CORONAVIRUS DISEASE 2019 PANDEMIC IN SERBIA – A CROSS-SECTIONAL STUDY

MENTALNO ZDRAVLJE LJUDI SA HRONIČNIM BOLESTIMA TOKOM COVID-19 PANDEMIJE U SRBIJI – STUDIJA PRESEKA

Darko MIKIĆ^{1,2}, Jelena ZVEKIĆ SVORCAN^{3,4}, Ljubiša JOVANOVIĆ⁵ and Vera R. VUČIĆEVIĆ⁶

Summary

Introduction. Since the coronavirus disease 2019 outbreak was declared a pandemic by the World Health Organization on March 11, 2020, it has become the greatest public health threat worldwide. People with chronic diseases were identified as the group at risk for fatal outcome. The purpose of this research is to estimate the mental health of patients with chronic diseases during the coronavirus disease 2019 pandemic. **Material and Methods.** A total of 463 individuals (50.8% female), with the average age of 46.63 years (SD = 14.29, ranging from 20 to 75 years of age) participated in the research. The subjects were divided into two groups, based on the existence of at least one chronic disease. The Depression, Anxiety and Stress Scale-21 was used to assess the mental health of the participants. The research was conducted in August 2020. The impact of chronic illness on depression, anxiety, and stress levels was assessed using linear regression models. **Results.** The prevalence of chronic diseases among the participants was 44.3%. The participants with chronic diseases presented with higher levels of depression ($p < 0.05$), anxiety ($p < 0.001$), and stress ($p < 0.001$) compared to healthy participants. The presence of chronic illness remains a significant predictor of all the dependent variables, even after the inclusion of multiple variables in the final regression model: depression (Beta [β] 0.37; 95% confidence interval: 2.67 – 4.42; $p < 0.01$), anxiety (Beta [β] 0.19; 95% confidence interval: 0.80 – 2.55; $p < 0.01$), and stress (Beta [β] 0.09; 95% confidence interval: 0.01 – 2.13; $p < 0.05$). **Conclusion.** About five months after the coronavirus disease 2019 pandemic was declared, the investigation of mental health of chronically ill adults in Serbia shows an increased amount of stress, anxiety, and depression in this subpopulation.

Key words: Mental Health; Chronic Disease; Pandemics; Coronavirus Infections; Depression; Anxiety; Stress, Psychological; Surveys and Questionnaires

Sažetak

Uvod. Od kada je 11. marta 2020. godine Svetska zdravstvena organizacija proglasila COVID-19 pandemiju, ona je postala najveća pretnja globalnom javnom zdravlju. Kao rizična grupa za nastanak smrtnog ishoda identifikovane su osobe sa hroničnim bolestima. Cilj ovog istraživanja bio je procena mentalnog zdravlja ljudi sa hroničnim bolestima tokom pandemije COVID-19. **Materijali i metode.** U istraživanju je učestvovalo 463 ispitanika (50,8% ženskog pola), prosečne starosti 46,63 godina (SD = 14,29, raspon od 20 do 75 godina). Ispitanici su podeljeni u dve grupe na osnovu postojanja makar jedne hronične bolesti. Skala 21 depresivnosti, anksioznosti i stresa korišćena je za procenu mentalnog zdravlja odraslog stanovništva u Srbiji. Istraživanje je sprovedeno tokom avgusta 2020. Kroz niz linearnih regresionih modela procenjen je uticaj hroničnih bolesti na nivo depresivnosti, anksioznosti i stresa. **Rezultati.** Učestalost hroničnih bolesti u uzorku iznosi 44,3%. Kod ispitanika sa hroničnim bolestima beleže se viši nivoi depresije ($p < 0,05$), anksioznosti ($p < 0,001$) i stresa ($p < 0,001$) u odnosu na zdrave ispitanike. Prisustvo hroničnih bolesti ostalo je značajan prediktor svih zavisnih varijabli i nakon uključivanja više varijabli u konačan regresioni model: depresivnost (beta [β] 0,37; 95% interval pouzdanosti: 2,67 – 4,42; $p < 0,01$), anksioznost (beta [β] 0,19; 95% interval pouzdanosti: 0,80 – 2,55; $p < 0,01$) i stres (beta [β] 0,09; 95% interval pouzdanosti: 0,01 – 2,13; $p < 0,05$). **Zaključak.** Približno pet meseci od proglašenja COVID-19 pandemije, istraživanje mentalnog zdravlja u Srbiji na odraslim osobama sa hroničnim bolestima pokazuje povećanu količinu stresa, anksioznosti i depresije kod ove subpopulacije.

Ključne reči: mentalno zdravlje; hronično oboljenje; pandemija; koronavirus infekcija; depresija; anksioznost; stres; istraživanja i upitnici

Introduction

The psychological reality of physical illness is the patient's subjective construction. For any life-long illness, the question of its impact on the per-

son's mental health inevitably gets raised. Can the disabled, or those who live with a death threat every day, be expected to respond to the stress of a pandemic unfolding around them with the same resilience as healthy persons?

Abbreviations

COVID-19	– coronavirus disease 2019
DASS-21	– Depression, Anxiety and Stress Scale-21
CVD	– cardiovascular disease
DM	– diabetes mellitus
CI	– confidence interval

Chronic noncommunicable diseases are globally the leading cause of death with 41 million deaths per year [1]. Over 70% of all premature deaths worldwide are caused by cardiovascular disease (CVD) (17.9 million deaths per year), malignant diseases (9 million deaths per year), respiratory diseases (3.9 million deaths per year), and diabetes mellitus (DM) (1.6 million deaths per year) [1].

In December 2019, an outbreak of the new coronavirus pneumonia appeared in Wuhan, Hubei Province, China [2] and it quickly spread becoming a global menace. The coronavirus disease 2019 (COVID-19) outbreak was declared a pandemic by the World Health Organization on March 11, 2020. Approximately 25,602,665 confirmed cases of the COVID-19 have been reported worldwide, including 852,758 deaths [3]. Studies have been conducted to examine the impact of COVID-19 on chronically ill persons. Analysis of 72,314 cases in China established the case fatality ratio (CFR) to be 10.5% for CVD, 7.3% for DM, 6.3% for chronic respiratory syndrome, and 6% for hypertension, while the CFR for the general population was 2.3% [4]. A study conducted in Italy also shows that the presence of comorbidities may raise the risk of death in COVID-19 cases [5]. The elderly suffering from chronic diseases such as DM, CVD, hypertension, asthma, or stroke were found to be at highest risk [5].

Numerous studies have shown that living with a chronic disease affects the person's mental health. For example, in cerebrovascular diseases, there is permanent damage to the brain tissue caused by a somatic disorder; coronary heart disease affects the severity of depressive symptoms in surviving apoplexy [6], and the removal of the vascular pathology substrate often leads to improved cognitive function and reduced depression [7]; depression often develops as part of type-2 DM and has been identified as one of the factors that accelerates the onset of advanced degenerative changes to small blood vessels. Patients on hemodialysis face a number of difficulties brought on by the nature of the disease. This contributes significantly to the onset of depression which is the most common psychological disorder afflicting these individuals [8]. Depression and depressive disorders are often associated with numerous socio-demographic factors. A study conducted by Vučurević et al. found an association between depression and marital status, employment, previous contact with mental health services, but above all with chronic illness [9]. Anxiety is experienced by all dialysis patients examined in a study conducted by Novaković et al. in 2007 [10].

Generally speaking, psychological reactions to a somatic disease can be manifested through the following [11]:

Anxiety (concern over disease prognosis - uncertainty can be harder to cope than the worst prognosis);

Regression (dependence on others - at the level of a child, with attachment to the mother; passivity - receptive personality structure - the position of a child);

Depression (people in whom the super-ego is rigid and who function on the principle of perfection);

Aggression (anger at and rage against the environment - projection of feelings of dissatisfaction onto others)

Retroflexion - self-aggression, increased risk of suicide.

The advent of the COVID-19 has dramatically changed the lives of people worldwide. Measures such as quarantine, self-isolation, ban on movement, traffic suspension, and working from home, have become our new daily routine. Disasters, such as a pandemic, can and do undermine people's feelings of security, reminding them of their own and the mortality of their loved ones, adversely affecting their mental health. No answers are in sight to questions raised as humanity faces the ongoing COVID-19 pandemic, such as when it will end, or what the consequences for society will be; effective treatment methods remain lacking; people are constantly exposed to controversial, even contradictory information; social relations are impaired, and drastic measures, such as quarantine, introduced - all this can potentially be detrimental to the mental health of individuals. Symptoms such as anxiety, depression, fear, stress, and sleep problems tend to become more pronounced during pandemics, but the effects of this particular pandemic on the mental health of the chronically ill are in need of further research.

The purpose of this study is to evaluate the levels of depression, anxiety and stress in the chronically ill in Serbia at the time of the pandemic wave, in the summer of 2020. We also wish to determine the state of the mental health of certain socioeconomic groups during the COVID-19 pandemic.

The main objective of this paper is to investigate distress, anxiety, and depression levels of adults with chronic diseases at the time of the COVID-19 pandemic in Serbia, and the differences in these parameters between healthy individuals and those chronically ill.

It is important to investigate the pandemic's psychological impact on particular groups in order to develop strategies toward mitigating both mental and physical ailments of individuals during this time. We expect that the chronically ill individuals will experience higher levels of stress, anxiety, and depression. We also expect that vulnerable groups, such as women, seniors, single parents, and persons of low income, will all have higher levels of the above-mentioned symptoms.

Several studies have investigated the impact of COVID-19 on the mental health of the chronically ill, such as Özdin et al. [12], Louvardi et al. [13], and Ozamiz-Etxebarria et al. [14], and they all came to similar conclusions – persons suffering from chronic diseases have more pronounced mental health issues during the pandemic.

Table 1. Sample characteristics in regard to health status**Tabela 1.** Karakteristike uzorka s obzirom na zdravstveni status ispitanika

	Chronically ill respondents <i>Ispitanici sa hroničnim bolestima</i> (n=205)	Healthy respondents <i>Zdravi ispitanici</i> (n=258)	p <i>p</i>	All respondents <i>Svi ispitanici</i> (n=463)
Gender/ <i>Pol</i> , n (%)				
Male/ <i>Muški</i>	87 (42.4%)	141 (54.7%)	0.009 ^a	228 (49.2%)
Female/ <i>Ženski</i>	118 (57.6%)	117 (45.3%)		235 (50.8%)
Age, M ± SD (Min – Max) <i>Starost, prosek ± SD (Min. – Maks.)</i>	54.32±12.36 (20-75)	40.53 ±12.71 (20-74)	0.000 ^b	46.63± 14.29 (20-75)
Age category (years)/ <i>Starosne kategorije (godine)</i> , n (%)				
20 – 44	45 (22.0%)	167 (64.7%)	0.000 ^a	212 (45.8%)
45 – 64	119 (58.0%)	79 (30.6%)		198 (42.8%)
≥ 65	41 (20.0%)	12 (4.7%)		53 (11.4%)
Education (years)/ <i>Obrazovanje (godine)</i> , n (%)				
≤ 8	31 (16.0%)	13 (5.2%)	0.001 ^a	44 (9.9%)
8 – 12	108 (55.7%)	146 (58.6%)		254 (57.4%)
≥ 12	55 (28.3%)	90 (36.2%)		145 (32.7%)
Employment status/ <i>Radni status</i> , n (%)				
Student/ <i>Student</i>	5 (2.5%)	18 (7.0%)	0.000 ^a	23 (5.0%)
Unemployed/ <i>Nezaposlen/a</i>	14 (6.9%)	49 (19.1%)		63 (13.7%)
Employed in private sector <i>Zaposlen/a u privatnom sektoru</i>	60 (29.7%)	88 (34.2%)		148 (32.2%)
Employed in public sector <i>Zaposlen/a u državnom sektoru</i>	21 (10.4%)	62 (24.1%)		83 (18.1%)
Farmer/homemaker/ <i>Poljoprivrednik/domaćica</i>	17 (8.4%)	19 (7.4%)		36 (7.8%)
Retired/ <i>Penzioner/ka</i>	85 (42.1%)	21 (8.2%)		106 (23.2%)
Family material status/ <i>Imovinsko stanje porodice</i> , n (%)				
Below average/ <i>Ispod proseka</i>	20 (14.1%)	7 (4.5%)	0.004 ^a	27 (9.1%)
Average/ <i>U proseku</i>	107 (75.4%)	117 (76.0%)		224 (75.7%)
Above average/ <i>Iznad proseka</i>	15 (10.5%)	30 (19.5%)		45 (15.2%)
Marital status/ <i>Bračni status</i> , n (%)				
Married/ <i>Oženjen/udata</i>	136 (68.3%)	163 (64.9%)	0.000 ^a	299 (66.4%)
Single/ <i>Neoženjen/neudata</i>	24 (12.1%)	64 (25.5%)		88 (19.6%)
Divorced/ <i>Razveden/a</i>	13 (6.5%)	15 (6.0%)		28 (6.2%)
Widowed/ <i>Udovac/udovica</i>	26 (13.1%)	9 (3.6%)		35 (7.8%)
Type of current residence/ <i>Mesto stanovanja</i> , n (%)				
Urban/ <i>Grad</i>	104 (50.7%)	141 (54.7%)	0.401 ^a	245 (52.9%)
Rural/ <i>Manje mesto/selo</i>	101 (49.3%)	117 (45.3%)		218 (47.1%)
Types of diseases/ <i>Vrsta hronične bolesti</i> , n (%)				
CVD/ <i>Kardiovaskularne bolesti</i>	151 (73.7%)	/	/	151 (32.6%)
Musculoskeletal disorders/ <i>Muskuloskeletne bolesti</i>	49 (23.9%)	/		49 (10.6%)
Respiratory disorders/ <i>Respiratorne bolesti</i>	38 (18.5%)	/		38 (8.2%)
DM/ <i>Dijabetes melitus</i>	24 (11.7%)	/		24 (5.2%)
Others/ <i>Druge hronične nezarazne bolesti</i>	27 (13.2%)	/		27 (5.8%)
Number of chronic diseases/ <i>Broj hroničnih bolesti</i> , n (%)				
0	0 (0.0%)	258 (100%)	/	258 (55.7%)
1	133 (64.8%)	0 (0.0%)		133 (28.7%)
2	61 (29.8%)	0 (0.0%)		61 (13.2%)
≥ 3	11 (5.4%)	0 (0.0%)		11 (2.4%)

Legend: ^a Chi-square test (χ^2); ^b Independent Samples T-Test; M±SD (Min – Max) - Mean±Std. Deviation (Minimum – Maximum); p - Statistical significance; n - Number of respondents;

Legenda: ^a Hi kvadrat test (χ^2); ^b T-test za velike nezavisne uzorke; M ± SD (Min. – Maks.) – aritmetička sredina ± standardna devijacija (minimum – maksimum); p – statistička značajnost; n – broj ispitanika

Material and Methods

This cross-sectional study aimed to assess the mental health of the general adult population in Serbia at the time of the COVID-19 epidemic and also to examine whether people with chronic diseases are in a disadvantaged position. The study was conducted via an online panel, where the participants anonymously filled out a questionnaire over a period of five days (August 10 – 15, 2020). The participants were asked to fill out a questionnaire, the beginning of which disclosed the title and purpose of the research, as well as the time necessary to complete it. Filling out the questionnaire took about ten minutes. A total of 463 individuals participated in the study, with a confidence level of 95% and confidence interval (CI) of 4, the calculated sample size being 435 persons. The calculations were done using the G*Power software. The participants were all twenty years of age or older (exclusion criteria: < 20 years of age).

The online questionnaire covered several areas: (a) general data, (b) chronic disease data, and (c) Depression, Anxiety and Stress Scale-21 (DASS-21).

The general data referred to socio-demographic variables: gender (male/female), age (open question), education level (≤ 8 years/8 – 12 years/ ≥ 12 years), employment status (student/unemployed/employed in the private sector/employed in the public sector/farmer/homemaker/retired), family material status (below average/average/above average), marital status (married/single/divorced/widowed), and type of current residence (urban/rural).

The chronic illness data were given by the participants themselves. The question was: "In the last 12 months, did you have one of the following diseases or conditions?" A list of chronic diseases was provided for the participants to select from, in case they suffered from any of the listed. Data collection on the prevalence of chronic illness was conducted in accordance with the European Health Interview Survey recommendations [15]. The diseases were subsequently separated into five categories: CVD, respiratory disorders, musculoskeletal disorders, DM, and others. The respondents were also subsequently divided into two groups - chronically ill individuals (those with at least one chronic disease) and healthy individuals (those without chronic diseases).

The DASS-21 was used to estimate the mental condition of the adult population of Serbia at the time of the COVID-19 pandemic. It consists of three self-report scales that measure depression, anxiety, and stress. All subscales are rated on a four-point Likert scale ranging from 0 (never) to 3 (almost always). The DASS-21 is translated and adapted for the Serbian population [16]. In this study, the reliability of the depression, anxiety, and stress subscales was 0.84, 0.79, and 0.82, respectively. It has been used in other studies in the COVID-19 pandemic period, showing good reliability [17, 18].

Descriptive analysis was performed on the socio-demographic characteristics, health status, and DASS-21 subscales. The obtained results were pre-

sented using frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. We assessed the difference using the Independent samples t-test. Analysis of variance (ANOVA) was used for comparison of more than two independent samples. The chi-square test was used to assess the differences between categorical variables. To examine the impact of chronic illness on the DASS-21 subscale, we performed a series of linear regression models based on potential confounding effects of the other observed variables. The DASS-21 subscales, depression, anxiety, and stress, were used as dependent variables. Three regression models were used for all three dependent variables. The first model, Chronic Illness Model, is a univariate linear regression model. In the Basic Model, age and gender were added as covariates. In the Full Model, we included level of education, employment status, family material status, marital status, and type of current residence as covariates. The effect estimates were presented as Beta coefficients, with a corresponding 95% CI. The probability level of $p \leq 0.05$ was considered statistically significant. Statistical analysis was carried out using the Statistical package for the social sciences (SPSS) for Windows, ver. 24.0 (IBM Corp., Armonk, NY, USA).

Results

Table 1 shows the socio-demographic characteristics of the two subsamples. As per their own testimony, 205 (44.3%) adult respondents over the age of 20 had at least one chronic illness. Cardiovascular diseases were the most common, followed by musculoskeletal diseases, respiratory diseases, and DM, at 32.6%, 10.6%, 8.2%, and 5.2%, respectively. Of the total number of respondents with chronic illness, 64.9% reported having one chronic illness, 29.8% reported having two, while three or more chronic diseases were reported by 5.4% of the respondents.

The average values of the three DASS-21 subscales of the questionnaire for both the chronically ill and healthy respondents are shown in **Graph 1**. Depression is more pronounced in chronically ill respondents than in the healthy (7.03 [SD = 5.15] vs. 3.29 [SD = 3.51]; $p < 0.05$). Anxiety was also higher in the chronically ill (4.81 [SD = 4.75] vs. 3.30 [SD = 3.78]; $p < 0.001$), as was stress (7.29 [SD = 5.39] vs. 6.03 [SD = 5.33]; $p < 0.001$).

The average values of depression, anxiety, and stress in the socio-demographic groups of respondents are also presented (**Table 2**). Higher subscale values of depression were reported by women, elderly respondents, those with elementary education, low income respondents, and widowers. Depression was also more pronounced in those with all types of chronic diseases. Higher anxiety was reported by women, the unemployed, and those with CVD and musculoskeletal diseases. During the COVID-19 pandemic, higher levels of stress were experienced by women, the unemployed, married, as well as by those with respiratory and musculoskeletal diseases.

Table 2. Mean scores on the DASS-21 scales among the socio-demographic groups**Tabela 2.** Prosečne vrednosti na Skali 21 depresivnosti, anksioznosti i stresa kod ispitanika sa različitim socio-demografskim karakteristikama

	Depression <i>Depresija</i>	p	Anxiety <i>Anksioznost</i>	p	Stress <i>Stres</i>	p
Gender/ <i>Pol</i> , n (%)						
Male/ <i>Muški</i>	3.73±3.99	0.000 ^a	3.08±3.76	0.000 ^a	4.61±5	0.000 ^a
Female/ <i>Ženski</i>	6.13±5.03		4.84±4.62		8.51±5.06	
Age category (years)/ <i>Starosne kategorije (godine)</i> , n (%)						
20 – 44	4.17±4.47	0.002 ^b	3.88±4.2	0.336 ^b	6.19±5.24	0.341 ^b
45 – 64	5.41±4.52		3.85±4.25		6.96±5.53	
≥ 65	6.34±5.66		4.79±4.87		6.79±5.42	
Education (years)/ <i>Obrazovanje (godine)</i> , n (%)						
≤ 8	7.23±6.63	0.002 ^b	4.86±4.93	0.341 ^b	6.89±5.62	0.433 ^b
8 – 12	4.9±4.7		3.87±4.16		6.77±5.32	
≥ 12	4.37±3.97		3.84±4.4		6.08±5.43	
Employment status/ <i>Radni status</i> , n (%)						
Student/ <i>Student</i>	2±2.89	0.000 ^b	2.65±2.71	0.000 ^b	4.57±4.44	0.002 ^b
Unemployed/ <i>Nezaposlen/a</i>	6.25±5.86		6.29±4.58		8.76±5.41	
Employed in private sector/ <i>Zaposlen/a u privatnom sektoru</i>	4.37±3.85		3.05±3.83		5.91±5.32	
Employed in public sector/ <i>Zaposlen/a u državnom sektoru</i>	4.11±4.28		3.14±3.65		6±5.31	
Farmer/homemaker/ <i>Poljoprivrednik/domaćica</i>	4.31±3.5		3.83±3.75		5.86±5.02	
Retired/ <i>Penzioner/ka</i>	6.42±5.28		4.84±4.94		7.28±5.45	
Family material status/ <i>Imovinsko stanje porodice</i> , n (%)						
Below average/ <i>Ispod proseka</i>	9.7±6.98	0.000 ^b	5.11±4.73	0.062 ^b	7.7±6.7	0.064 ^b
Average/ <i>U proseku</i>	4.74±4.27		3.67±4.4		6.58±5.6	
Above average/ <i>Iznad proseka</i>	3.62±3.9		2.64±3.36		4.78±4.45	
Marital status/ <i>Bračni status</i> , n (%)						
Married/ <i>Oženjen/udata</i>	4.9±4.45	0.000 ^b	4±4.31	0.248 ^b	7.09±5.43	0.015 ^b
Single/ <i>Neoženjen/neudata</i>	3.76±4.26		3.39±3.91		4.98±5.05	
Divorced/ <i>Razveden/a</i>	4.79±4.26		3.96±4.57		6.68±5.5	
Widowed/ <i>Udovac/udovica</i>	8.17±6.49		5.11±4.74		6.54±5.5	
Type of current residence/ <i>Mesto stanovanja</i> , n (%)						
Urban/ <i>Grad</i>	4.77±4.67	0.380 ^a	3.96±4.24	0.929 ^a	6.83±5.33	0.312 ^a
Rural/ <i>Manje mesto/selo</i>	5.15±4.73		3.99±4.39		6.32±5.45	
CVD/ <i>Kardiovaskularne bolesti</i>						
No/ <i>Ne</i>	3.96±4.11	0.000 ^a	3.62±3.97	0.010 ^a	6.40±5.38	0.279 ^a
Yes/ <i>Da</i>	7.00±5.17		4.70±4.85		6.98±5.42	
DM/ <i>Dijabetes</i>						
No/ <i>Ne</i>	4.83±4.63	0.000 ^a	3.94±4.28	0.446 ^a	6.60±5.39	0.841 ^a
Yes/ <i>Da</i>	7.17±5.41		4.63±4.81		6.38±5.44	
Respiratory disorders/ <i>Respiratorne bolesti</i>						
No/ <i>Ne</i>	4.75±4.61	0.000 ^a	3.96±4.27	0.842 ^a	6.40±5.33	0.012 ^a
Yes/ <i>Da</i>	7.18±5.11		4.11±4.72		8.68±5.67	
Musculoskeletal disorders/ <i>Muskuloskeletne bolesti</i>						
No/ <i>Ne</i>	4.68±4.63	0.000 ^a	3.76±4.13	0.002 ^a	6.39±5.35	0.020 ^a
Yes/ <i>Da</i>	7.20±4.71		5.80±5.26		8.29±5.45	
Others/ <i>Druge hronične nezarazne bolesti</i>						
No/ <i>Ne</i>	4.81±4.65	0.000 ^a	3.90±4.28	0.170 ^a	6.60±5.48	0.857 ^a
Yes/ <i>Da</i>	7.22±4.95		5.07±4.67		6.41±3.61	
Number of chronic illnesses/ <i>Broj hroničnih bolesti</i> , n (%)						
1	6.89±5.32	0.821 ^b	4.82±4.69	0.998 ^b	7.22±5.43	0.915 ^b
2	7.38±4.88		4.82±4.57		7.51±5.51	
≥ 3	6.82±4.96		4.73±6.75		6.91±4.68	

Legend: ^aIndependent Samples T-Test; ^bOne-way analysis of variance (ANOVA); p - Statistical significance; n - Number of respondents;
 Note: Mean ± Std. Deviations are shown in the table

Legenda: ^a T-test za velike nezavisne uzorke; ^bJednofaktorska analiza varijanse (ANOVA); p – statistička značajnost; n – broj ispitanika;
 Napomena: u Tabeli je prikazana aritmetička sredina ± standardna devijacija

Table 3 shows the linear regression models with the DASS-21 subscale of depression as the dependent variable. In all models, the presence of chronic illness was significantly associated with worsened depression. In the univariate linear regression model, chronic illness was significantly associated with worsened depression (Beta [β] 0.39; 95% CI: 2.94 – 4.52; $p < 0.01$). After adjustment for gender and age in the Basic Model, the presence of chronic illness remained associated with worsened depression (Beta [β] 0.36; 95% CI: 2.55 – 4.33; $p < 0.01$). Adjusting for multiple confounding factors in the Full Model, chronic illness was still found to be associated with worsened depression (Beta [β] 0.37; 95% CI: 2.67 – 4.42; $p < 0.01$).

Similar results were obtained using the regression models when anxiety was the dependent variable. When all the variables were included as confounding factors in the Full Model, chronic illness remained a statistically significant predictor of anxiety (Beta [β] 0.19; 95% CI: 0.80 – 2.55; $p < 0.01$) (**Table 4**).

The presence of chronic illness was also found to be significantly associated with worsened stress levels in all regression models. After adjusting for all variables in the Full Model, chronic illness was still found to be significantly related to higher levels of stress (Beta [β] 0.09; 95% CI: 0.01 – 2.13; $p < 0.05$) (**Table 5**).

Discussion

The prevalence of chronic disease in the adult population of Serbia in our sample was 44.3%. Among the chronically ill participants, CVD were most common, followed by musculoskeletal diseases, respiratory diseases, DM, and others: 73.7%, 23.9%, 18.5%, 11.7%, 13.2%, respectively. Many respondents (35.2%) reported more than one illness. As per their own testimony, more than half (53.5%) of the people over the age of 15 living in Serbia in 2003 had at least one chronic illness [19].

The average values of depression, anxiety, and stress were all higher to a statistically significant extent in the group of chronically ill participants (7.03 [SD = 5.15], 4.81 [SD=4.75] and 7.29 [SD = 5.39], respectively) than in the healthy group (3.29 [SD = 3.51], 3.30 [SD = 3.78] and 6.03 [SD = 5.33], respectively). In a study including 1,374 students in Serbia prior to the COVID-19 pandemic, the average level of depression was 3.14 (SD = 3.90), anxiety 3.37 (SD = 3.82), and stress 6.70 (SD = 11.01) [16]. Mental health is thus worse in the group of chronically ill participants. In all of the regression models, chronic illness proved a statistically significant predictor of a higher level of depression, anxiety, and

Table 3. Linear regression models of the association between health status and depression
Tabela 3. Linearni regresioni modeli povezanosti zdravstvenog statusa ispitanika i depresije

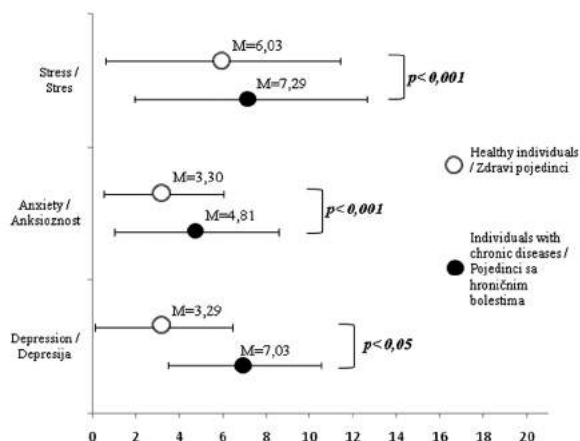
	Chronic illnesses model <i>Model sa hroničnim bolestima</i>	Basic model <i>Osnovni model</i>	Full model <i>Kompletan model</i>
Presence of chronic diseases (ref.: no diseases)/ <i>Prisustvo hroničnih bolesti (ref.: bez prisustva bolesti)</i>			
Yes/ <i>Da</i>	0.39 (2.94 - 4.52)**	0.36 (2.55 - 4.33)**	0.37 (2.67 - 4.42)**
Gender (ref.: males)/ <i>Pol (ref.: muški pol)</i>			
Females/ <i>Žene</i>		0.21 (1.20 - 2.75)**	0.20 (1.13 - 2.66)**
Age/ <i>Starost</i>		0.01 (-0.02 - 0.03)	0.02 (-0.03 - 0.05)
Education (ref.: ≥ 12 years)/ <i>Obrazovanje (ref.: ≥ 12 godina)</i>			
≤ 8			0.06 (-0.39 - 2.57)
8 – 12			0.01 (-0.70 - 0.97)
Employment status (ref.: student)/ <i>Radni status (ref.: student)</i>			
Unemployed/ <i>Nezaposlen/a</i>			0.26 (1.61 - 5.53)**
Employed in private sector <i>Zaposlen/a u privatnom sektoru</i>			0.12 (-0.78 - 3.22)
Employed in public sector <i>Zaposlen/a u državnom sektoru</i>			0.12 (-0.57 - 3.60)
Farmer/homemaker/ <i>Poljoprivrednik/domaćica</i>			0.02 (-1.83 - 2.72)
Retired/ <i>Penzioner/ka</i>			0.03 (-2.00 - 2.86)
Family material status (ref.: above average)/ <i>Imovinsko stanje porodice (ref.: iznad proseka)</i>			
Below average/ <i>Ispod proseka</i>			0.16 (1.46 - 5.04)**
Average/ <i>Prosečno</i>			0.01 (-0.80 - 1.02)
Marital status (ref.: widowed)/ <i>Bračni status (ref.: udovac/udovica)</i>			
Married/ <i>Oženjen/udata</i>			-0.12 (-2.53 - 0.11)
Single/ <i>Neoženjen/neudata</i>			-0.12 (-3.24 - 0.17)
Divorced/ <i>Razveden/a</i>			-0.03 (-2.63 - 1.32)
Type of current residence (ref.: rural)/ <i>Mesto stanovanja (ref.: manje mesto/selo)</i>			
Urban/ <i>Grad</i>			-0.01 (-0.93 - 0.59)

Note: Values represent Beta coefficients with corresponding 95% confidence intervals; * $p < 0.05$; ** $p < 0.01$

*Napomena: Vrednosti predstavljaju beta koeficijente sa 95% intervalom poverenja; * $p < 0.05$; ** $p < 0.01$*

stress. A study conducted in Greece from March to May 2020, including 943 healthy persons and 163 chronically ill persons, shows that the chronically ill had significantly higher levels of distress ($p = 0.001$), but there was no significant difference in anxiety ($p = 0.098$) or depression ($p = 0.052$) [13]. A more recent Chinese study shows that the chronically ill have higher levels of stress [18].

Higher levels of depression were reported by respondents with CVD, DM, respiratory diseases, musculoskeletal diseases, and other chronic diseases compared to healthy respondents. Compared to healthy participants, higher anxiety was reported by those with cardiovascular and musculoskeletal diseases, while respondents with respiratory and musculoskeletal diseases reported more pronounced levels of stress. The estimate of stress prevalence among diabetics was 49.2%, 1.47 times higher than in the healthy controls, according to a study conducted in Bangladesh during the COVID-19 pandemic [20]. The same study shows that participants with asthma, diabetes, cardiovascular symptoms, or any combination of these diseases had greater odds of experiencing stress, anxiety, and depression than healthy individuals [20].



Graph 1. Mean scores on the DASS-21 scales among the healthy and chronically ill

Grafikon 1. Prosečne vrednosti na DASS-21 skali kod zdravih i ispitanika sa hroničnim bolestima

Legend: M - Mean; p - Statistical significance; Note: Independent Samples T-Test was performed

Legenda: M – aritmetička sredina; p – statistička značajnost; Napomena: primenjen je T-test za velike nezavisne uzorke

Table 4. Linear regression models of the association between health status and anxiety

Tabela 4. Linearni regresioni modeli povezanosti zdravstvenog statusa ispitanika i anksioznosti

	Chronic illnesses model/Model sa hroničnim bolestima	Basic model Osnovni model	Full model Kompletan model
Presence of chronic diseases (ref.: no diseases)/Prisustvo hroničnih bolesti (ref.: bez prisustva bolesti)			
Yes/Da	0.17 (0.73 - 2.29) **	0.18 (0.68 - 2.44) **	0.19 (0.80 - 2.55) **
Gender (ref.: males)/Pol (ref.: muški pol)			
Females/Žene		0.18 (0.83 - 2.36) **	0.16 (0.63 - 2.17) **
Age/Starost		-0.06 (-0.04 - 0.01)	-0.14 (-0.08 - 0.00)
Education (ref.: ≥12 years)/Obrazovanje (ref.: ≥12 godina)			
≤ 8			0.02 (-1.13 - 1.84)
8 – 12			-0.04 (-1.23 - 0.44)
Employment status (ref.: student)/Radni status (ref.: student)			
Unemployed/Nezaposlen/a			0.27 (1.49 - 5.42) **
Employed in private sector Zaposlen/a u privatnom sektoru			0.00 (-1.93 - 2.08)
Employed in public sector Zaposlen/a u državnom sektoru			0.02 (-1.79 - 2.40)
Farmer/homemaker/Poljoprivrednik/domaćica			0.03 (-1.66 - 2.90)
Retired/Penzioner/ka			0.15 (-0.87 - 4.00)
Family material status (ref.: above average)/Imovinsko stanje porodice (ref.: iznad proseka)			
Below average/Ispod proseka			-0.03 (-1.84 - 1.74)
Average/Prosečno			0.01 (-0.82 - 1.01)
Marital status (ref.: widowed)/Bračni status (ref.: udovac/udovica)			
Married/Oženjen/udata			-0.04 (-1.70 - 0.94)
Single/Neoženjen/neudata			-0.11 (-2.93 - 0.48)
Divorced/Razveden/a			-0.05 (-2.06 - 1.89)
Type of current residence (ref.: rural)/Mesto stanovanja (ref.: manje mesto/selo)			
Urban/Grad			0.07 (-0.70 - 0.82)

Note: Values represent Beta coefficients with corresponding 95% confidence intervals; * $p < 0.05$; ** $p < 0.01$

Napomena: Vrednosti predstavljaju beta koeficijente sa 95% intervalom poverenja; * $p < 0.05$; ** $p < 0.01$

Table 5. Linear regression models of the association between health status and stress**Tabela 5.** Linearni regresioni modeli povezanosti zdravstvenog statusa ispitanika i stresa

	Chronic illnesses model/ <i>Model sa hroničnim bolestima</i>	Basic model <i>Osnovni model</i>	Full model <i>Kompletan model</i>
Presence of chronic diseases (ref.: no diseases)/ <i>Prisustvo hroničnih bolesti (ref.: bez prisustva bolesti)</i>			
Yes/ <i>Da</i>	0.11 (0.26 - 2.23)*	0.10 (0.24 - 2.20)*	0.09 (0.01 - 2.13)*
Gender (ref.: males)/ <i>Pol (ref.: muški pol)</i>			
Females/ <i>Žene</i>		0.35 (2.88 - 4.73) **	0.34 (2.77 - 4.64)**
Age/ <i>Starost</i>		-0.03 (-0.03 - 0.03)	0.34 (2.77 - 4.64)**
Education (ref.: ≥12 years)/ <i>Obrazovanje (ref.: ≥ 12 godina)</i>			
≤ 8			0.03 (-1.17 - 2.43)
8 - 12			0.01 (-0.81 - 1.21)
Employment status (ref.: student)/ <i>Radni status (ref.: student)</i>			
Unemployed/ <i>Nezaposlen/a</i>			0.15 (0.10 - 4.87)*
Employed in private sector/ <i>Zaposlen/a u privatnom sektoru</i>			-0.07 (-3.30 - 1.56)
Employed in public sector/ <i>Zaposlen/a u državnom sektoru</i>			-0.04 (-3.14 - 1.94)
Farmer/homemaker/ <i>Poljoprivrednik/domaćica</i>			-0.05 (-3.93 - 1.60)
Retired/ <i>Penzioner/ka</i>			-0.05 (-3.64 - 2.27)
Family material status (ref.: above average)/ <i>Imovinsko stanje porodice (ref.: iznad proseka)</i>			
Below average/ <i>Ispod proseka</i>			0.02 (-1.61 - 2.73)
Average/ <i>Prosečno</i>			0.05 (-0.50 - 1.72)
Marital status (ref.: widowed)/ <i>Bračni status (ref.: udovac/udovica)</i>			
Married/ <i>Oženjen/udata</i>			0.12 (-0.25 - 2.96)
Single/ <i>Neoženjen/neudata</i>			-0.07 (-3.04 - 1.11)
Divorced/ <i>Razveden/a</i>			0.06 (-0.85 - 3.95)
Type of current residence (ref.: rural)/ <i>Mesto stanovanja (ref.: manje mesto/selo)</i>			
Urban/ <i>Grad</i>			0.04 (-0.48 - 1.37)

Note: Values represent Beta coefficients with corresponding 95% confidence intervals; * $p < 0.05$; ** $p < 0.01$;

*Napomena: Vrednosti predstavljaju beta koeficijente sa 95% intervalom poverenja; * $p < 0.05$; ** $p < 0.01$;*

Conclusion

The present study examined the mental health of chronically ill adults at the time of the coronavirus disease 2019 pandemic in Serbia. The study was conducted approximately five months after the pandemic was pronounced. One of the causes of high mortality risk in the chronically ill population is their undermined mental health. The findings indicate that the existence of a chronic illness is associated with raised levels of depression, anxiety, and stress.

A limiting factor for the scope of this study is the lack of data regarding pre-pandemic levels of

depression, anxiety, and stress. Because of this, before-and-after analysis could not be carried out. However, longitudinal studies that may well be conducted would contribute to a clearer understanding of the population's mental health, focusing in particular on the most vulnerable groups.

Considering that our findings suggest that the mental health of the chronically ill during the coronavirus disease 2019 pandemic is damaged, it is necessary to address this issue with timely social and health measures. We believe that this kind of research may contribute to the development of social and health strategies in order to mitigate the psycho-social effects of the pandemic.

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