

## ARTERIJSKA HIPERTENZIJA KOD RUDARA JAMSKOG KOPA

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### SAŽETAK

**Uvod/Cilj:** Arterijska hipertenzija je česta kako u opštoj populaciji, tako i kod proizvodnih radnika, naročito onih koji rade na poslovima u specijalnim uslovima rada. Cilj ovog rada je da se analizira učestalost javljanja i karakteristike arterijske hipertenzije kod rudara jamskog kopa u odnosu na fizičke radnike.

**Metode:** U studiju preseka uključeno je 321 rudar Rudnika „Lece“ (Srbija) i 150 fizičkih radnika koji nikada nisu radili u jamskom kopu. Dobijeni rezultati su analizirani u odnosu na vrstu i težinu arterijske hipertenzije i godine starosti ispitanika. U cilju postavljanja dijagnoze hipertenzije urađen je klinički pregled. U statističkoj analizi podataka korišćen je hi kvadrat test.

**Rezultati:** Arterijska hipertenzija je značajno ( $p < 0,001$ ) češće bila prisutna kod rudara (35,2%) nego fizičkih radnika (14,5%). Najmanje 95% ispitanika obe ispitivane grupe je imalo primarnu hipertenziju. Učestalost hipertenzije raste sa godinama starosti kod obe ispitivane grupe i bila je najveća u uzrastu 46-55 godina. Nije bilo značajne razlike između ispitivanih grupa u odnosu na učestalost hipertenzije po uzrasnim grupama, mada su rudari u najstarijem uzrastu češće imali umerenu (31,5%) i tešku hipertenziju (13,0%) nego fizički radnici (28,6% i 7,1%).

**Zaključak:** Češće javljanje hipertenzije, kao i predominacija umerene i teške hipertenzije, kod rudara u odnosu na fizičke radnike, upućuje na mogućnost da radni uslovi utiču na nastanak ovog oboljenja.

**Gljučne reči:** arterijska hipertenzija, uzrast, rudari, jamski kop, fizički radnici.

### Uvod

Arterijska hipertenzija je široko rasprostranjena bolest koja se javlja kod oko 50% svih oboljelih od kardiovaskularnih bolesti i najčešći je uzrok smrti kod  $\frac{1}{4}$  do  $\frac{1}{2}$  oboljelih. Kardiovaskularne bolesti su vodeći uzrok obolevanja i umiranja u svetu (1). Prema podacima Svetske zdravstvene organizacije, procenjuje se da u svetu 46% odraslih uzrasta od 30-79 godina ne zna da ima hipertenziju, a samo je kod 42% dijagnostikovana i lečena (1). Hipertenzija se javlja kod radno aktivnog stanovništva na pojedinim poslovima, sa akcentom na teškim i stresnim poslovima (2).

Cilj ovog rada je da se analizira učestalost javljanja i karakteristike arterijske hipertenzije kod rudara jamskog kopa u odnosu na fizičke radnike.

### Metode

Ovom studijom preseka bio je obuhvaćen 321 rudar „Rudnika Lece“ i 150 fizičkih radnika „Rudnika Lece“ (Srbija) koji uopšte nisu radili u jami. Svi ispitanici su muškog pola. Ispitanici su pregledani u prostorijama rudnika. Studija je urađena u prvoj polovini 2019. godine. Od svih ispitanika dobijeni su podaci o uzrastu, vrsti posla, postojanju hipertenzije i težini hipertenzije. Nijedan testirani rudar nije bio stariji od 55 godina što je posledica činjenice da rudari odlaze u penziju ranije zbog beneficiranog radnog staža. Upravo iz tog razloga u studiju smo uključili rudare i fizičke radnike uzrasta 26-55 godina.

Svim ispitanicima je izmeren krvni pritisak, prema uslovima preporučenim u Smernicama za tretiranje arterijske hipertenzije Evropskog društ-

## ARTERIAL HYPERTENSION IN MINE PIT MINERS

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### SUMMARY

**Introduction/Aim:** Arterial hypertension is common both in the general population and in production workers, especially those who work in jobs with special working conditions. The aim of this work is to analyze the frequency of occurrence and characteristics of arterial hypertension in pit miners in relation to physical workers.

**Methods:** The cross-sectional study included 321 miners of the "Lece" Mine (Serbia) and 150 manual workers who had never worked in the pit. The obtained results were analyzed in relation to the type and severity of arterial hypertension and the age of subjects. In order to diagnose hypertension, a clinical examination was performed. The chi-square test was used in the statistical analysis of data.

**Results:** Arterial hypertension was significantly ( $p < 0.001$ ) more often present in miners (35.2%) than manual workers (14.5%). At least 95% of the subjects of both investigated groups had primary hypertension. The frequency of hypertension increased with age in both studied groups and was highest in the age group of 46-55 years. There was no significant difference between the treated groups in relation to the frequency of hypertension by age group, although miners in the oldest age group had moderate (31.5%) and severe hypertension (13.0%) more often than manual workers (28.6% and 7.1%).

**Conclusion:** The more frequent occurrence of hypertension, as well as the predominance of moderate and severe hypertension, in miners compared to physical workers, points to the possibility that working conditions influence the onset of this disease.

**Key words:** arterial hypertension, age, miners, pit, manual workers.

### Introduction

Arterial hypertension is a widespread disease that accounts for about 50% of all cardiovascular patients and it is the most common cause of death in  $\frac{1}{4}$  to  $\frac{1}{2}$  of patients. Cardiovascular diseases are the leading cause of morbidity and mortality in the world (1). According to the official World Health Organization data, it is estimated that in the world 46% of adults aged 30-79 do not know that they have hypertension, and only 42% have it diagnosed and treated (1). Hypertension occurs in the working population in some jobs, with an accent placed on difficult and stressful jobs (2).

The aim of this work is to analyze the frequency of occurrence and characteristics of arterial

hypertension in pit miners in relation to physical workers.

### Methods

This cross-sectional study included 321 miners of the "Lece Mine" and 150 manual workers of the "Lece Mine" (Serbia) who did not work in the pit at all. All respondents were male. The respondents were examined on the mine premises. The study was done in the first half of 2019. Data on age, type of work, presence of hypertension, and severity of hypertension were obtained from all respondents. No miner tested was older than 55 years old, which is a consequence of the fact that

va za kardiologiju i Evropskog društva za hipertenziju iz 2018. godine (3). Ispitanici su udobno sedeli u tihom okruženju 5 minuta pre početka merenja krvnog pritiska. Dva puta je meren krvni pritisak, u razmaku od 1-2 minuta, a dodatna merenja su obavljena samo ako su se prva dva očitavanja razlikovala za >10 mmHg. Krvni pritisak je zabeležen kao prosek poslednja dva očitavanja krvnog pritiska. Za klasifikaciju hipertenzije korišćene su iste Smernice za tretiranje arterijske hipertenzije (4).

U statističkoj analizi podataka korišćen je hi kvadrat test.

## Rezultati

Kao što je prikazano u Tabeli 1, od 321 rudara, 113 (35,2%) imalo je arterijsku hipertenziju, dok od 138 fizičkih radnika 20 (14,5%). Ova razlika je bila značajna ( $p < 0,001$ ). Prema težini hipertenzije, rudari su značajno češće imali povišeni normalni, blagu, umerenu i tešku hipertenziju u odnosu na fizičke radnike. Između ispitivanih grupa nije bilo značajne razlike u odnosu na vrstu hipertenzije. Primarna hipertenzija konstatovana je kod 96,5% rudara i 95,0% fizičkih radnika. Rudari sa hipertenzijom su bili češće stariji (81,4%) u poređenju sa fizičkim radnicima (70,0%).

Umerena i teška arterijska hipertenzija češće se javljala kod rudara u uzrastu 36-45 i 46-55 godine, a kod fizičkih radnika blaga u uzrastu 36-45 godina i 46-55 godina (tabela 2). U uzrastu 26-35 godina, kod obe ispitivane grupe, bila je prisutna samo blaga hipertenzija.

## Diskusija

U našoj studiji prevalencija hipertenzije je bila značajno veća kod rudara jamskog kopa (35,2%) nego fizičkih radnika (14,5%). Takođe, rudari jamskog kopa su češće imali teži oblik hipertenzije (umerenu i tešku) nego fizički radnici. Mnoge studije navode da rad u rudnicima povećava rizik od kardiovaskularnih bolesti zbog uticaja brojnih faktora: silicijum dioksid, vibracije, buka, ugljen monoksid, visoka temperatura i smenski rad (5-8). Pored profesionalnih faktora odgovorni su i brojni drugi počevši od gojaznosti, nasleđa, sagorevanja na poslu, stresa itd. (9). Rudari u jamskim kopovima izloženi su lošijim uslovima rada i većem radnom riziku što može uzrokovati stres i dovesti do hipertenzije (10,11). Istraživanje Wang-a i Shang-a, kojim je obuhvaćeno 1736 rudara koji su radili u podzemnom kopu i 825 koji su radili u površinskom kopu, je pokazalo da je prevalencija hiperten-

**Tabela 1.** Distribucija rudara i fizičkih radnika prema demografskim karakteristikama, vrsti i težini arterijske hipertenzije

Karakteristike	Rudari Broj (%)	Fizički radnici Broj (%)	p vrednost*
<b>Arterijska hipertenzija (sistolni <math>\geq 140</math> mmHg i/ ili dijastolni <math>\geq 90</math> mmHg)</b>			
Da	113 (35,2)	20 (14,5)	<0,001
Ne	208 (64,8)	118 (85,5)	
Ukupno	321 (100,0)	138 (100,0)	
<b>Težina arterijske hipertenzije</b>			
Normalna (sistolni 120-129 i/ili dijastolni 80-84 mmHg)	198 (61,7)	115 (83,3)	<0,001
Povišeni normalni (sistolni 130-139 i/ili dijastolni 85-89 mmHg)	10 (3,1)	3 (2,2)	
Blaga hipertenzija (sistolni 140-159 i/ili dijastolni 90-99 mmHg)	63 (19,6)	13 (9,4)	
Umerena hipertenzija (160-179 i/ili 100-109 mmHg)	38 (11,8)	6 (4,3)	
Teška hipertenzija ( $\geq 180$ i/ili $\geq 110$ mmHg)	12 (3,7)	1 (0,7)	
Ukupno	321 (100,0)	138 (100,0)	
<b>Vrsta hipertenzije</b>			
Primarna (esencijalna)	109 (96,5)	19 (95,0)	0,752
Sekundarna	4 (3,5)	1 (5,0)	
Ukupno	113 (100,0)	20 (100,0)	
<b>Uzrast (godine) lica sa hipertenzijom</b>			
26-35	4 (3,5)	1 (5,0)	0,498
36-45	17 (15,0)	5 (25,0)	
46-55	92 (81,4)	14 (70,0)	
Ukupno	113 (100,0)	20 (100,0)	

p vrednost za  $\chi^2$  test

miners retire earlier due to beneficial working years. It is for this reason that we included miners and manual workers aged 26-55 in the study.

Each respondent's blood pressure was measured under the conditions recommended in the 2018 ESC/ESH Guidelines for the management of arterial hypertension (3). Patients were seated comfortably in a quiet environment for 5 min before the beginning of blood pressure (BP) measurements. Two BP measurements were recorded, 1-2 min apart, and additional measurements were recorded only if the first two readings differed by >10 mmHg. BP was recorded as the average of the last two BP readings. The same 2018 ESC/ESH Guidelines for the management of arterial hypertension were used for the hypertension classification (4).

The chi-square test was used in the statistical analysis of data.

## Results

As shown in Table 1, out of 321 miners, 113 (35.2%) had arterial hypertension, while out of 138 manual workers 20 (14.5%). This difference was significant ( $p < 0.001$ ). According to the severity of hypertension, miners had elevated normal, mild,

moderate, and severe hypertension significantly more often than manual workers. There was no significant difference between the examined groups in relation to the type of hypertension. Primary hypertension was found in 96.5% of miners and 95.0% of manual workers. Miners with hypertension were more often older (81.4%) compared to manual workers (70.0%).

Moderate and severe arterial hypertension occurred more often in miners aged 36-45 and 46-55 years, and in manual labourers aged 36-45 and 46-55 years (Table 2). At the age of 26-35, in both investigated groups, only mild hypertension was present.

## Discussion

In our study, the prevalence of hypertension was significantly higher in pit miners (35.2%) than in manual workers (14.5%). Also, pit miners had a more severe form of hypertension (moderate and severe) than manual workers. Many studies report that working in mines increases the risk of cardiovascular diseases due to the influence of numerous factors: silica, vibration, noise, carbon monoxide, high temperature, and shift work (5-8).

**Table 1.** Distribution of miners and manual workers according to demographic characteristics, type and severity of arterial hypertension

Characteristics	Miners Number (%)	Manual workers Number (%)	p value*
<b>Arterial hypertension (systolic <math>\geq 140</math> mmHg and/ or diastolic <math>\geq 90</math> mmHg)</b>			
Yes	113 (35.2)	20 (14.5)	<0.001
No	208 (64.8)	118 (85.5)	
Total	321 (100.0)	138 (100.0)	
<b>Severity of arterial hypertension</b>			
Normal (systolic 120-129 and/or diastolic 80-84 mmHg)	198 (61.7)	115 (83.3)	<0.001
Elevated normal (systolic 130-139 and/or diastolic 85-89 mmHg)	10 (3.1)	3 (2.2)	
Mild hypertension (systolic 140-159 and/or diastolic 90-99 mmHg)	63 (19.6)	13 (9.4)	
Moderate hypertension (160-179 and/or 100-109 mmHg)	38 (11.8)	6 (4.3)	
Severe hypertension ( $\geq 180$ and/or $\geq 110$ mmHg)	12 (3.7)	1 (0.7)	
Total	321 (100.0)	138 (100.0)	
<b>Type of hypertension</b>			
Primary	109 (96.5)	19 (95.0)	0.752
Secondary	4 (3.5)	1 (5.0)	
Total	113 (100.0)	20 (100.0)	
<b>Age (years) of the person with hypertension</b>			
26-35	4 (3.5)	1 (5.0)	0.498
36-45	17 (15.0)	5 (25.0)	
46-55	92 (81.4)	14 (70.0)	
Total	113 (100.0)	20 (100.0)	

p value for  $\chi^2$  test

**Tabela 2.** Distribucija rudara i fizičkih radnika sa hipertenzijom prema uzrastu i težini arterijske hipertenzije

Karakteristike	Rudari							
	Blaga AH		Umerena AH		Teška AH		Ukupno	
	N	(%)	N	(%)	N	(%)	N	(%)
<b>Uzrast (godine) lica sa hipertenzijom</b>								
26-35	4	100	0	0,0	0	0,0	4	100,0
36-45	8	47,0	9	53,0	0	0,0	17	100,0
46-55	51	55,4	19	31,5	12	13,0	92	100,0
Karakteristike	Fizički radnici							
	Blaga AH		Umerena AH		Teška AH		Ukupno	
	N	(%)	N	(%)	N	(%)	N	(%)
<b>Uzrast (godine) lica sa hipertenzijom</b>								
26-35	1	100,0	0	0,0	0	0,0	1	100,0
36-45	3	60,0	2	40,0	0	0,0	5	100,0
46-55	9	64,3	4	28,6	1	7,1	14	100,0

AH- arterijska hipertenzija

zije rudara jamskog kopa 23,9% i da je značajno veća od prevalencije za rudare površinskog kopa 15,5% (12). Dužina rada pod zemljom, takođe, značajno je korelirala sa prevalencijom hipertenzije. Studija sprovedena u Americi je pokazala da je prevalencija hipertenzije među rudarima 31%, kao i da je veća od one zabeležene u odrasloj populaciji, što je zahtevalo intervencije za borbu protiv kardiovaskularnih bolesti (13).

U nacionalnoj studiji Grujić i saradnika, sprovedenoj 2006. godine u R. Srbiji na 14.204 odraslih uzrasta 20 godina i više, uočeno je da 47% odrasle populacije ima hipertenziju (stadijum 1, kada je sistolni krvni pritisak 140-159 mm Hg ili dijastolni krvni pritisak 90-99 mm Hg, - 25,3%; stadijum 2, kada je sistolni krvni pritisak 160 i više mm Hg ili dijastolni krvni pritisak 100 i više mm Hg, - 18,1%) (14). Tek sva druga osoba znala je da ima hipertenziju, a lečilo se samo 60,4% ispitanika (14). Podaci za svet pokazuju da hipertenziju, prema potvrdi ispitanika da im je dijagnostikovana hipertenzija, ima 59% žena i 49% muškaraca u 2019. godini, kao i da se leči tek svaka druga žena i svaki treći muškarac (15).

Kod naših ispitanika, kako rudara jamskog kopa, tako i fizičkih radnika, češće je bila zastupljena primarna hipertenzija (oko 95%) što se može objasniti prethodnim rigoroznim kontrolnim pregledima koji isključuju da osobe sa oboljenjima obavljaju ovaj težak posao.

U našoj studiji, učestalost javljanja arterijske hipertenzije raste sa godinama starosti, a umerena i teška forma bolesti arterijske hipertenzije su češće kod starijih rudara jamskog kopa nego fizičkih radnika. Rezultati o uticaju starenja na hipertenziju su u skladu sa rezultatima drugih autora (15-19).

Glavni nedostatak ove studije je što nisu analizirani i drugi faktori rizika koji mogu da se dovedu do nastanka hipertenzije kod rudara (npr. dužina radnog staža, stepen uhranjenosti, stres, depresija, sagorevanje na poslu, itd.). S druge strane ogroman je doprinos ove studije, jer ukazuje na često javljanje hipertenzije i otvara mogućnost za preventivni rad (rano otkrivanje hipertenzije, redukcija ili eliminacija faktora rizika – npr. gojaznosti) što bi doprinelo sprečavanju nastanka infarkta miokarda, moždanog udara i drugih kardiovaskularnih događaja. Sve navedeno ukazuje na važnost očuvanja fizičkog i mentalnog zdravlja rudara, odnosno obezbeđivanja adekvatnog kvalitet života osobama ove profesije.

## Zaključak

Arterijska hipertenzija se češće registruje kod rudara (35,2%) nego kod fizičkih radnika (14,5%), sa dominantnom umerenom i teškom hipertenzijom, što ukazuje na mogućnost da uslovi rada utiču na pojavu ove bolesti. Prevalencija arterijske hipertenzije raste sa uzrastom ispitanika.

**Table 2.** Distribution of miners and manual workers with hypertension according to age and severity of arterial hypertension

Arterial hypertension	Mine workers						Total	
	Mild		Moderate		Severe		N	(%)
	N	(%)	N	(%)	N	(%)	N	(%)
<b>Age (years) of miners with hypertension</b>								
26-35	4	100	0	0.0	0	0.0	4	100.0
36-45	8	47.0	9	53.0	0	0.0	17	100.0
46-55	51	55.4	19	31.5	12	13.0	92	100.0
Arterial hypertension	Manual workers						Total	
	Mild		Moderate		Severe		N	(%)
	N	(%)	N	(%)	N	(%)	N	(%)
<b>Age (years) of workers with hypertension</b>								
26-35	1	100.0	0	0.0	0	0.0	1	100.0
36-45	3	60.0	2	40.0	0	0.0	5	100.0
46-55	9	64.3	4	28.6	1	7.1	14	100.0

In addition to occupational factors, many other factors are responsible, including obesity, heredity, burnout at work, stress, etc. (9). Pit miners are exposed to poorer working conditions and greater occupational risk, which can cause stress and lead to hypertension (10,11). A study by Wang and Shang, which included 1736 underground miners and 825 open pit miners, showed that the prevalence of hypertension in pit miners was 23.9% and was significantly higher than the prevalence for open pit miners 15.5% (12). The length of work underground also significantly correlated with the prevalence of hypertension. A study conducted in America showed that the prevalence of hypertension among miners was 31% and that it was higher than that recorded in the adult population, which required interventions to combat cardiovascular diseases (13).

In a national study by Grujić and associates, conducted in 2006 in the Republic of Serbia on 14,204 adults aged 20 and over, it was observed that 47% of adult population had hypertension (stage 1, when systolic blood pressure is 140-159 mm Hg or diastolic blood pressure 90-99 mm Hg, - 25.3%; stage 2, when systolic blood pressure is 160 and more mm Hg or diastolic blood pressure 100 and more mm Hg, - 18.1%) (14). Only every second person knew that they had hypertension, and only 60.4% of respondents were treated (14). Data for the world show that 59% of women and 49% of men had hypertension, according to respondents'

confirmation that they were diagnosed with hypertension in 2019, and that only every second woman and every third man were treated (15).

In our respondents, both pit miners and manual workers, primary hypertension was more common (about 95%), which can be explained by previous rigorous control examinations that exclude people with diseases from performing this difficult work.

In our study, the incidence of arterial hypertension increases with age, and moderate and severe forms of arterial hypertension are more common in older pit miners than manual workers. The results on the effect of aging on hypertension are consistent with the results of other authors (16-20).

The main shortcoming of this study is that other risk factors that may lead to the development of hypertension in miners were not analyzed (e.g. length of work experience, level of nutrition, stress, depression, burnout at work, etc.). On the other hand, the contribution of this study is huge, because it indicates the frequent occurrence of hypertension and opens the possibility for preventive work (early detection of hypertension, reduction or elimination of risk factors – e.g. obesity) which would contribute to the prevention of myocardial infarction, stroke and other cardiovascular events. All of the above points to the importance of preserving the physical and mental health of miners, that is, ensuring an adequate quality of life for people in this profession.

Neophodna su dalja ispitivanja faktora rizika za nastanak hipertenzije kod rudara koji rade u jamskim i površinskim kopovima.

## Konflikt interesa

Autori su izjavili da nema konflikta interesa.

## Reference

1. World Health Organization. Fact sheets on hypertension. Accessed on 16 March 2023. Available at: <https://www.who.int/news-room/fact-sheets/detail/hypertension#:~:text=An%20estimated%201.28%20billion%20adults%20aged%2030-79%20years,adults%20%2842%25%29%20with%20hypertension%20are%20diagnosed%20and%20treated>
2. Kulić Lj, Mihajlović G, Jovanović M, Đurović M, Mihajlović I. Pathomorphologic analysis of the remyocardial infarction localisation, 8th International Congress on Coronary Artery Disease From Prevention to Intervention, EACCME, European Union of Medical Specialists (UEMS). International Congress on Coronary Artery Disease (ICCAD), EBAC, ICCAD 2009, designated for 15 ECMESs, Prague, 2009.
3. European Society of Cardiology (ESC) & European Society of Hypertension (ESH), 2018 ESC/ESH Guidelines for the management of arterial hypertension. *European Heart Journal* 2018;39:3021–3104. doi:10.1093/eurheartj/ehy339
4. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. *Hypertension* 2020;75(6):1334-1357. Available at: <https://doi.org/10.1161/HYPERTENSIONAHA.120.15026>
5. Kalay N, Ozdogru I, Cetinkaya Y, Eryol NK, Dogan A, Gul I, et al. Cardiovascular effects of carbon monoxide poisoning. *Am J Cardiol* 2007;99(3):322–4.
6. Skogstad M, Johannessen HA, Tynes T, Mehlum IS, Nordby KC, Lie A. Systematic review of the cardiovascular effects of occupational noise. *Occup Med (Lond)* 2016;66(1): 10–6.
7. Kaski JC, Crea F, Meran D, Rodriguez L, Araujo L, Chierchia S, et al. Local coronary supersensitivity to diverse vasoconstrictive stimuli in patients with variant angina. *Circulation* 1986;74(6):1255–65.
8. Park S, Nam J, Lee JK, Oh SS, Kang HT, Koh SB. Association between night work and cardiovascular diseases: analysis of the 3rd Korean working conditions survey. *Ann Occup Environ Med* 2015;27:15.
9. Lee DJ, Davila E, LeBlanc WG, Caban-Martinez AJ, Fleming LE, Christ S, et al. Morbidity and disability among workers 18 years and older in the mining sector, 1997–2007. National Institute for Occupational Safety and Health. Centers for Disease Control and Prevention. U.S. Department of Health and Human Services; Oct, 2012. Publication No. 2012–155.
10. Hou CL, Li LJ, Zhang Y, Li WH, Li ZX, Yang JL, Li GY. [Prevalence and risk factors for posttraumatic stress disorder among survivors from a coal mining accident after 2 and 10 months]. *Zhong Nan Da Xue Xue Bao Yi Xue Ban* 2008;33:279-83.
11. Yu HM, Ren XW, Chen Q, Zhao JY, Zhu TJ, Guo ZX. Quality of life of coal dust workers without pneumoconiosis in mainland China. *J Occup Health* 2008;50:505-11.
12. Wang MX, Shang YX. [The relationship between mine environment and hypertension in coal miners]. *Zhonghua Nei Ke Za Zhi* 2008;47(8): 661-3.
13. Casey ML, Fedan KB, Edwards N, Blackley DJ, Halldin CN, Wolfe AL, Laney AS. Evaluation of high blood pressure and obesity among US coal miners participating in the Enhanced Coal Workers' Health Surveillance Program. *J Am Soc Hypertens* 2017;11(8):541-545. doi: 10.1016/j.jash.2017.06.007.
14. Grujić V, Dragnić N, Kvrđić S, Sušnjević S, Grujić J, Travar S. Epidemiology of hypertension in Serbia: results of a National Survey. *J Epidemiol* 2012;22(3):261-6. doi: 10.2188/jea.je20110077.
15. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet* 2021;398(10304):957-980.
16. Kulić S, Janić L, Kostić J, Kulić M, Stanković S, Kulić Lj, et al. Representation of hipertension in the geriatric population in our country and in the world, the representation of arterial hypertension in the geriatric population in our country and the world. *Zdravstvena Zaštita* 2014; 43(6):32-42
17. Kulić Lj, Kulić S, Arsić-Komljenović G, Anđelski H, Jovanović M, Šijan-Gobeljić M. Impact on the risk factors and prevention of hypertension in the geriatric population, the impact on risk factors and prevention of hypertension in the geriatric population, 10th Asian-Pacific Congress of hypertension, Philippines, 2014.
18. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol* 2020;16(4):223-237. doi: 10.1038/s41581-019-0244-2.
19. Ostchega Y, Fryar CD, Nwankwo T, Nguyen DT. Hypertension prevalence among adults aged 18 and over: United States, 2017–2018. NCHS Data Brief, no 364. Hyattsville, MD: National Center for Health Statistics, 2020.

## Conclusion

Arterial hypertension was more often registered in the miners (35.2%) than in manual workers (14.5%), with dominant moderate and severe hypertension, suggesting the possibility that working conditions affect the occurrence of this disease. The prevalence of arterial hypertension increases with the age of respondents. Further studies of risk factors for the development of hypertension in miners working in pit and surface mines are necessary.

## Competing interests

The authors declared no competing interests.

## References

- World Health Organization. Fact sheets on hypertension. Accessed on 16 March 2023. Available at: <https://www.who.int/news-room/fact-sheets/detail/hypertension#:~:text=An%20estimated%201.28%20billion%20adults%20aged%2030-79%20years,adults%20%284%25%29%20with%20hypertension%20are%20diagnosed%20and%20treated>
- Kulić Lj, Mihajlović G, Jovanović M, Đurović M, Mihajlović I. Pathomorphologic analysis of the remyocardial infarction localisation, 8th International Congress on Coronary Artery Disease From Prevention to Intervention, EACCME, European Union of Medical Specialists (UEMS). International Congress on Coronary Artery Disease (ICCAD), EBAC, ICCAD 2009, designated for 15 ECMESs, Prague, 2009.
- European Society of Cardiology (ESC) & European Society of Hypertension (ESH), 2018 ESC/ESH Guidelines for the management of arterial hypertension. *European Heart Journal* 2018;39:3021–3104. doi:10.1093/eurheartj/ehy339
- Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. *Hypertension* 2020;75(6):1334-1357. Available at: <https://doi.org/10.1161/HYPERTENSIONAHA.120.15026>
- Kalay N, Ozdogru I, Cetinkaya Y, Eryol NK, Dogan A, Gul I, et al. Cardiovascular effects of carbon monoxide poisoning. *Am J Cardiol* 2007;99(3):322–4.
- Skogstad M, Johannessen HA, Tynes T, Mehlum IS, Nordby KC, Lie A. Systematic review of the cardiovascular effects of occupational noise. *Occup Med (Lond)* 2016;66(1): 10–6.
- Kaski JC, Crea F, Meran D, Rodriguez L, Araujo L, Chierchia S, et al. Local coronary supersensitivity to diverse vasoconstrictive stimuli in patients with variant angina. *Circulation* 1986;74(6):1255–65.
- Park S, Nam J, Lee JK, Oh SS, Kang HT, Koh SB. Association between night work and cardiovascular diseases: analysis of the 3rd Korean working conditions survey. *Ann Occup Environ Med* 2015;27:15.
- Lee DJ, Davila E, LeBlanc WG, Caban-Martinez AJ, Fleming LE, Christ S, et al. Morbidity and disability among workers 18 years and older in the mining sector, 1997–2007. National Institute for Occupational Safety and Health. Centers for Disease Control and Prevention. U.S. Department of Health and Human Services; Oct, 2012. Publication No. 2012–155.
- Hou CL, Li LJ, Zhang Y, Li WH, Li ZX, Yang JL, Li GY. [Prevalence and risk factors for posttraumatic stress disorder among survivors from a coal mining accident after 2 and 10 months]. *Zhong Nan Da Xue Xue Bao Yi Xue Ban* 2008;33:279-83.
- Yu HM, Ren XW, Chen Q, Zhao JY, Zhu TJ, Guo ZX. Quality of life of coal dust workers without pneumoconiosis in mainland China. *J Occup Health* 2008;50:505-11.
- Wang MX, Shang YX. [The relationship between mine environment and hypertension in coal miners]. *Zhonghua Nei Ke Za Zhi* 2008;47(8): 661-3.
- Casey ML, Fedan KB, Edwards N, Blackley DJ, Halldin CN, Wolfe AL, Laney AS. Evaluation of high blood pressure and obesity among US coal miners participating in the Enhanced Coal Workers' Health Surveillance Program. *J Am Soc Hypertens* 2017;11(8):541-545. doi: 10.1016/j.jash.2017.06.007.
- Grujić V, Dragnić N, Kvrđić S, Sušnjević S, Grujić J, Travar S. Epidemiology of hypertension in Serbia: results of a National Survey. *J Epidemiol* 2012;22(3):261-6. doi: 10.2188/jea.je20110077.
- NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet* 2021;398(10304):957-980.
- Kulić S, Janić L, Kostić J, Kulić M, Stanković S, Kulić Lj, et al. Representation of hypertension in the geriatric population in our country and in the world, the representation of arterial hypertension in the geriatric population in our country and the world. *Zdravstvena Zaštita* 2014; 43(6):32-42
- Kulić Lj, Kulić S, Arsić-Komljenović G, Anđelski H, Jovanović M, Šijan-Gobeljić M. Impact on the risk factors and prevention of hypertension in the geriatric population, the impact on risk factors and prevention of hypertension in the geriatric population, 10th Asian-Pacific Congress of hypertension, Philippines, 2014.
- Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol* 2020;16(4):223-237. doi: 10.1038/s41581-019-0244-2.
- Ostchega Y, Fryar CD, Nwankwo T, Nguyen DT. Hypertension prevalence among adults aged 18 and over: United States, 2017–2018. NCHS Data Brief, no 364. Hyattsville, MD: National Center for Health Statistics, 2020.





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