

The Influence of Different Risk Factors on COVID-19 Outcomes in Adult Patients - An Observational-Descriptive Study

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Abstract

Objective. The aim of our study was to investigate the predictors of morbidity (age, gender, smoking habits, obesity and the presence of chronic diseases) and COVID-19 outcomes. **Subjects and Methods.** The research was an observational descriptive study, conducted at The Family Medicine Education Center, The Primary Health Care Center, Banja Luka, in the period from 26th June to 31st December 2020. During the research period, seven family medicine teams followed their patients with COVID-19, and recorded possible predictors for morbidity and their influence on the disease outcome. **Results.** The study included 934 patients, 46.90% of whom were male. The majority of subjects were non-smokers and overweight. Diabetes was found in 5.57% patients, hypertension in 29.44%, chronic respiratory diseases in 5.25%, cancer in 4.39% patients. In the observed sample, 29.23% subjects contracted pneumonia, 18.52% were hospitalized, while 19 (2.03%) patients with severe clinical features had a fatal outcome. Multivariable regression analysis showed a high risk of pneumonia in male patients [OR=2.45, 95% CI (1.73-3.46)], elderly [OR= 1.07, 95% CI (1.06-1.09)] and obese patients with Body Mass Index ≥ 30.0 kg/m² [OR=2.55, 95% CI (1.73-3.77)]. Male gender [OR=2.19, 95% CI (1.11-4.31)], older age [OR=1.08, 95% CI (1.05-1.11)] and hypertension [OR=2.51, 95% CI (1.06-5.91)] were the most important predictors for the development of severe clinical features in COVID 19. The statistically significant predictors of mortality were male gender [OR=7.16, 95% CI (1.56-32.86)] and older age [OR=1.12, 95% CI (1.06-1.18)]. **Conclusion.** Being familiar with the predictors of morbidity and poor outcome in COVID-19 is helpful for carrying out preventive measures, early diagnosis and treatment of risk groups of patients.

Key Words: COVID-19 ■ Risk Factors ■ Comorbidity.

Introduction

The pandemic caused by Severe Acute Respiratory Syndrome Coronavirus -2 (SarsCoV-2 virus) started in December 2019 in the Chinese city Wuhan, and gradually spread to countries around the world (1). This new coronavirus causes the disease Corona Virus Disease 2019 (COVID-19) (2). The World Health Organization (WHO) declared this outbreak a global pandemic on 11th March 2020 due to the rapid increase in the number of cases all around the world (3). The symptoms are mild in the majority of infected persons but a small number of infected persons can develop severe clinical

features, with severe pneumonia, or potentially Acute Respiratory Distress Syndrome (ARDS), or other organ failure can occur, and the disease can have a fatal outcome (4).

At the beginning of the pandemic it was not known what the potential risk groups for COVID-19 were, nor what risk groups of patients would develop severe or potentially life threatening forms of the disease. As the pandemic spread, researchers worldwide identified the persons at higher risk for the infection and for developing severe or potentially life threatening forms of the disease. For instance, Alqahtani at al. reported that patients with chronic obstructive pulmonary

disease (COPD) were at higher risk of developing severe clinical features and a high mortality rate compared to patients without COPD (5). Also smokers and former smokers were at higher risk of developing COVID-19 complications and had a higher mortality rate (5).

A meta-analysis that investigated the prevalence and risk factors associated with COVID-19 mortality reported a significant correlation between mortality and older age (> 65 years), male gender, patients treated in Intensive Care Units (ICU), obesity, hypertension, diabetes, cardiovascular diseases and cancer (6). Diabetic patients with COVID-19 pneumonia had worse treatment outcomes that manifest as increased mortality, severe clinical features, more frequent occurrence of ARDS, and disease progression (7). Patients with hypertension and COVID-19 pneumonia have worse treatment outcomes overall. Pranata et al. found in their research that patients with hypertension had a higher mortality rate, severe forms of COVID-19, more frequent ICU admission, and more frequent disease progression (8). The presence of cardiovascular and cerebrovascular diseases is also related to worse COVID-19 outcome (9).

The studies reported that patients with cancer were more likely to contract COVID 19, and had more severe forms of the disease and higher mortality (10). The results of a large number of studies showed a strong correlation between morbidity and poor treatment outcome in overweight or obese persons that contracted COVID-19 (11, 12).

The aim of our study was to investigate the influence of age, gender, smoking habits, obesity and the presence of chronic diseases (diabetes, hypertension, chronic respiratory diseases, cancer) in adult patients, on the severity of COVID-19 clinical features and outcomes.

Subjects and Methods

The research was an observational descriptive study, conducted at The Family Medicine Education Center, The Primary Health Care Center, Banja Luka. The patients were included in the period from 26th June to 30st November 2020 and all

patients were followed up for one month. During the follow-up, data on disease severity, pneumonia and death were collected. During the research period, seven family medicine teams followed their patients with COVID-19. Each physician registered patients infected with virus SarsCoV-2. For further follow-up and analysis, only patients with COVID-19 confirmed by PCR (polymerase chain reaction) were taken into account. PCR test was administrated to almost all symptomatic patients. Laboratory testing was performed in two microbiological laboratories: at the Clinical Centre of the Republic of Srpska or in the Public Health Institute of the Republic of Srpska.

Subjects

The study included 934 patients with COVID-19. All the subjects were examined for the first time at The Outpatient Department for Acute Respiratory Diseases, The Primary Health Care Center, Banja Luka. The data from those examinations were recorded in electronic medical records, so that they are available to the subjects' family physicians. On the basis of all the available data for each subject, the severity of clinical features was estimated (mild, moderate and severe). The estimation of the severity of clinical features was performed according to the recommendations from "The Manual for Treating the Infection Caused by the Novel Coronavirus", published by The Faculty of Medicine in Banja Luka.

According to the severity of clinical features, the subjects were classified into three groups using the following criteria:

- Mild cases: They have mild clinical features of uncomplicated infection. Possible symptoms are mild fever, headache, nasal congestion, malaise, loss of smell and taste, and myalgia.
- Moderate cases: Symptoms such as high or long-term fever, weakness, malaise, shortness of breath, cough, chest x-ray showing signs of incipient pneumonia. The patient does not need supplemental oxygen therapy.
- Severe cases: The patients have bilateral pneumonia with at least one of the following signs: severe dyspnea, tachypnea with respiration rate

>30/minute, respiratory failure or the necessity for supplemental oxygen therapy (SaO₂ on room air is <90%), or other organ failure (13).

The majority of patients with pneumonia included in the study, had bilateral pneumonia, confirmed by lung X-ray or low-dose chest CT findings. All our patients with fatal outcome, died in hospital. Family doctors had discharge from the hospital in which the first diagnosis was COVID-19, as a cause of death.

Measuring

For the purpose of the study, the following data from electronic medical records were used:

- Data about confirmed diagnosis of pneumonia, hospitalization and fatal outcome (all-cause mortality)
- Additional parameters: age, gender, Body Mass Index (BMI), smoking status and the presence of chronic diseases (diabetes mellitus, chronic respiratory diseases, hypertension, cancer).

In estimating the severity of clinical features, other medical documentation was also used: specialist medical reports, hospital discharge summaries, low-dose chest CT findings, laboratory findings.

In relation to the BMI levels, all the patients were divided into three groups: patients with BMI < 25.0 kg/m² i.e. patients with ideal body weight; patients with BMI from 25.0 to 29.9 kg/m² i.e. the group of pre-obese patients; and patients with BMI ≥30.0 kg/m² i.e. the group of obese persons.

In relation to smoking status, patients were divided into groups of smokers, non-smokers and ex-smokers. Smokers are defined as persons who consume tobacco or tobacco products every day. Ex-smokers are defined as people who have not smoked for at least 6 months or longer (6). In statistical data processing, ex-smokers and non-smokers were classified into one group and viewed as non-smokers compared to current smokers.

Ethical Statement

The written consent of the director and the Ethics Committee of the Primary Health Care Cen-

ter (Number: 01-592-1, 18.06.2020.), Banja Luka was obtained for conducting this research. The research was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) Version 25. Descriptive statistics were presented as the mean plus standard deviation, or median plus interquartile range, based on the distribution determined by the Kolmogorov-Smirnov test. The difference in means was evaluated by the Student t-test and ANOVA in the case of normal distribution, or by the Mann Whitney U test in the case of non-normal distribution. The independent predictors of the severity of clinical features and mortality were identified using univariable and multivariable logistic regression analysis. In the analytical methods applied, the level of significance was P<0.05.

Results

Out of the total of 934 patients with COVID-19 included in this study, 46.90% were male. The average age of patients with mild clinical features was 40.22±15.23 years, while the average age of patients with severe clinical features was 65.40±11.82 years. The majority of patients included in our study, 675 (72.27%), were non-smokers. In relation to BMI, the smallest number of patients (18.95%) were obese with BMI ≥30.0 kg/m². In our group of subjects, 133 patients were health care professionals, and they mostly had mild clinical features. Among our subjects, in relation to the comorbidities present, there were 5.57% patients with diabetes, 29.44% patients with hypertension, 5.25% patients with chronic respiratory diseases (asthma, chronic obstructive lung disease), and 4.39% patients with cancer.

In the observed sample of patients, 29.23% subjects contracted pneumonia, 18.52% subjects were hospitalized, while 19 (2.03%) subjects with severe clinical features had fatal outcomes (Table 1).

Table 1. The Characteristics of Patients with COVID 19

Variable	Clinical features			P [†]	Total N (%)
	Mild N (%)	Moderate N (%)	Severe N (%)		
Gender					
Male	250 (38.94)	151 (62.92)	37 (71.15)	<0.001	438 (46.90)
Female	392 (61.06)	89 (37.08)	15 (28.85)		496 (53.10)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Age ($\bar{x} \pm SD$)	40.22±15.23	54.90±13.48	65.40±11.82	<0.001	-
Smoking status					
Smoker	128 (19.94)	31 (12.92)	8 (15.39)	0.001	167 (17.88)
Non-smoker	463 (72.12)	180 (75.00)	32 (61.53)		675 (72.27)
Former smoker	51 (7.94)	29 (12.08)	12 (23.08)		92 (9.85)
Total	642 (100)	240 (100)	52 (100)		934 (100)
BMI [‡]					
<25	314 (48.91)	44 (18.33)	8 (15.38)	<0.001	366 (39.19)
25-30	253 (39.41)	116 (48.33)	22 (42.31)		391 (41.86)
≥30	75 (11.68)	80 (33.34)	22 (42.31)		177 (18.95)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Healthcare professionals					
Yes	106 (16.51)	26 (10.83)	1 (1.92)	0.003	133 (14.24)
No	536 (83.49)	214 (89.17)	51 (98.08)		801 (85.76)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Diabetes					
Yes	17 (26.48)	27 (11.25)	8 (15.39)	<0.001	52 (5.57)
No	625 (73.52)	213 (88.75)	44 (84.61)		882 (94.43)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Hypertension					
Yes	120 (18.69)	113 (47.08)	42 (80.77)	<0.001	275 (29.44)
No	522 (81.31)	127 (52.92)	10 (19.23)		659 (70.56)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Asthma, COPD[§]					
Yes	27 (4.21)	17 (7.08)	5 (9.62)	0.081	49 (5.25)
No	615 (95.79)	223 (92.92)	47 (90.38)		885 (94.75)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Cancer					
Yes	25 (38.94)	10 (4.17)	6 (11.54)	0.034	41 (4.39)
No	617 (61.06)	230 (95.83)	46 (88.46)		893 (95.61)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Pneumonia					
Yes	6 (0.94)	215 (89.58)	52 (100)	<0.001	273 (29.23)
No	636 (99.06)	25 (10.42)	0 (0)		661 (70.77)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Hospitalization					
Yes	7 (1.09)	114 (47.50)	52 (100)	<0.001	173 (18.52)
No	635 (98.91)	126 (52.50)	0 (0)		761 (81.48)
Total	642 (100)	240 (100)	52 (100)		934 (100)
Fatal outcome					
Yes	0 (0)	0 (0)	19 (36.54)	<0.001	19 (2.03)
No	642 (100)	240 (100)	33 (63.46)		915 (97.97)
Total	642 (100)	240 (100)	52 (100)		934 (100)

[†]One-Way ANOVA; [‡]Body Mass Index; [§]Chronic Obstructive Pulmonary Disease.

Table 2. The Predictors for Pneumonia Onset in COVID 19 Patients

Variable	Logistic regression			
	Univariable		Multivariable	
	OR (95% CI)*	P†	OR (95% CI)*	P†
Male vs. Female	2.70 (2.02-3.62)	<0.001	2.45 (1.73-3.46)	<0.001
Age (years)	1.08 (1.06-1.10)	<0.001	1.07 (1.06-1.09)	<0.001
Smoker vs. Former smoker + Never smoker	0.64 (0.43-0.95)	0.027	0.69 (0.44-1.08)	0.101
BMI‡ ≥30 vs. BMI<30	4.13 (2.93-5.80)	<0.001	2.55 (1.73-3.77)	<0.001
Health care workers vs. Non-health care workers	0.46 (0.29-0.74)	0.001	0.72 (0.43-1.23)	0.230
Diabetes (Yes vs. No)	3.59 (2.03-6.34)	<0.001	0.81 (0.41-1.60)	0.550
Hypertension (Yes vs. No)	4.86 (3.58-6.60)	<0.001	1.02 (0.67-1.55)	0.937
Asthma, COPD§ (Yes vs. No)	1.88 (1.05-3.38)	0.034	1.39 (0.68-2.87)	0.371
Cancer (Yes vs. No)	1.42 (0.74-2.73)	0.292	-	-

*Odds ratio (95% Confidence interval); †Statistically significant at P<0.05; ‡Body Mass Index; §Chronic Obstructive Pulmonary Disease.

In our study, the factors that contributed to the onset of pneumonia in patients with COVID-19 were analyzed. Therefore, the univariable regression analysis showed that male gender [OR=2.70, 95% CI (2.02-3.62)], older age [OR=1.08, 95% CI (1.06-1.10)], non-smokers [OR=0.64, 95% CI (0.43-0.95)], obesity with BMI ≥30.0 kg/m² [OR=4.13, 95% CI (2.93-5.80)], non-health care profession [OR=0.46, 95% CI (0.29-0.74)], diabetes [OR=3.59, 95% CI (2.03-6.34)], hypertension [OR=4.86, 95% CI (3.58-6.60)] and pulmonary diseases [OR=1.88, 95% CI (1.05-3.38)] were risk factors for the occurrence of pneumonia in COVID-19 (Table 2). The multivariable regression analysis showed that male patients [OR=2.45, 95% CI (1.73-3.46)], older patients [OR=1.07, 95% CI (1.06-1.09)] and obese patients with BMI ≥30.0 kg/m² [OR=2.55, 95% CI (1.73-3.77)] (Table 2) had a high risk for pneumonia.

In our sample of 934 patients with COVID-19, the predictors of the development of severe clinical features were analyzed (Table 3). The univariable regression analysis showed that the predictors of severe clinical features of COVID-19 were male gender [OR=2.96, 95% CI (1.60-5.47)], older age [OR=1.10, 95% CI (1.07-1.13)], obesity with BMI ≥30.0 kg/m² [OR= 3.44, 95% CI (1.93-6.12)], non-health care profession [OR=0.11, 95% CI (0.06-0.81)], presence of diabetes [OR=3.46, 95%

CI (1.54-7.80)], hypertension [OR=11.69, 95% CI (5.77-23.69)] and cancer [OR=3.16, 95% CI (1.26-7.89)]. The predictors of severe clinical features were analyzed using multivariable regression analysis which showed that male gender [OR=2.19, 95% CI (1.11-4.31)], older age [OR=1.08, 95% CI (1.05-1.11)] and hypertension [OR=2.51, 95% CI (1.06-5.91)] were the most important predictors of the development of severe clinical features in COVID-19 in our group of subjects (Table 3).

Out of the 934 patients included, 19 (2.03%) had fatal outcomes. The predictors of all-cause mortality were analyzed using univariable and multivariable logistic regression analysis (Table 4). The univariable regression analysis showed that the statistically significant predictors of all-cause mortality were: male gender [OR=9.97, 95% CI (2.29-43.42)], older age [OR=1.15, 95% CI (1.10-1.20)], the presence of hypertension [OR=46.09, 95% CI (6.12-347.01)] and cancer [OR=4.33, 95% CI (1.21-15.49)]. The multivariable logistic regression analysis showed that the statistically significant predictors of all-cause mortality were male gender [OR=7.16, 95% CI (1.56-32.86)] and older age [OR=1.12, 95% CI (1.06-1.18)] (Table 4).

No multicollinearity was found in Tables 1 to 3, in which a tolerance score ranged from 0.630 to 0.967 and a variance inflation factor ranged from 1.034 to 1.607.

Table 3. The Predictors of Severe Clinical Features

Variable	Logistic regression			
	Univariable		Multivariable	
	OR (95% CI)*	P†	OR (95% CI)*	P†
Male vs. Female	2.96 (1.60-5.47)	0.001	2.19 (1.11-4.31)	0.023
Age (years)	1.10 (1.07-1.13)	<0.001	1.08 (1.05-1.11)	<0.001
Smoker vs. Former smoker + Never smoker	0.83 (0.38-1.79)	0.629	-	-
BMI‡ ≥30 vs. BMI‡ <30	3.44 (1.93-6.12)	<0.001	1.85 (0.97-3.52)	0.062
Health care workers vs. Non-health care workers	0.11 (0.06-0.81)	0.030	0.25 (0.03-1.88)	0.177
Diabetes (Yes vs. No)	3.46 (1.54-7.80)	0.003	0.72 (0.29-1.78)	0.477
Hypertension (Yes vs. No)	11.69 (5.77-23.69)	<0.001	2.51 (1.06-5.91)	0.036
Asthma, COPD§ (Yes vs. No)	2.03 (0.77-5.35)	0.154	-	-
Cancer (Yes vs. No)	3.16 (1.26-7.89)	0.014	1.45 (0.51-4.11)	0.487

*Odds ratio (95% Confidence interval); †Statistically significant at P<0.05; ‡Body Mass Index; §Chronic Obstructive Pulmonary Disease.

Table 4. The Predictors of Mortality in COVID 19 Patients

Variable	Logistic regression			
	Univariable		Multivariable	
	OR (95% CI)*	P†	OR (95% CI)*	P†
Male vs. Female	9.97 (2.29-43.42)	0.002	7.16 (1.56-32.86)	0.011
Age (years)	1.15 (1.10-1.20)	<0.001	1.12 (1.06-1.18)	<0.001
Smoker vs. Former smoker + Never smoker	1.23 (0.40-3.76)	0.716	-	-
BMI‡ ≥30 vs. BMI‡ <30	1.14 (0.38-3.49)	0.813	-	-
Health care workers vs. Non-health care workers	0.02 (0.00)	0.989	-	-
Diabetes (Yes vs. No)	3.31 (0.93-11.76)	0.064	0.48 (0.12-1.97)	0.309
Hypertension (Yes vs. No)	46.09 (6.12-347.01)	<0.001	6.43 (0.77-54.01)	0.087
Asthma, COPD§ (Yes vs. No)	1.00 (0.13-7.67)	0.997	-	-
Cancer (Yes vs. No)	4.33 (1.21-15.49)	0.024	1.94 (0.45-8.33)	0.374

*Odds ratio (95% Confidence interval); †Statistically significant at P<0.05; ‡Body Mass Index; §Chronic Obstructive Pulmonary Disease.

Discussion

The results of our study showed that the majority of patients with COVID-19 were female, non-smokers and overweight patients. The severity of clinical features increased with age, therefore the majority of patients with severe clinical features were older than 65 years. The multivariable regression analysis identified male gender, older age and obesity (with BMI ≥30.0 kg/m²) as the main predictors for pneumonia onset; male gender, older age and comorbidity hypertension as the main predictors for severe clinical features onset, while

the most important predictors of all-cause mortality were male gender and older age.

Regarding gender, the results of other studies have shown that both genders can develop the disease almost equally, however, the clinical features and outcome of the disease were worse in male patients (14). Although our study showed that in the sample of subjects with more female patients, the male patients had more severe clinical features and higher mortality rate compared to the female patients. The authors explain the differences in the severity of the clinical features and mortality between the male and female patients by the differ-

ences in the expression of angiotensin-converting enzyme-2 and increased immune responses (15).

SarsCov-2 virus infection has a considerably greater health impact on the elderly (>65 years). The elderly have worse disease prognosis, and the outcome of the disease is worse in patients with more comorbidities (16). The results of our study were similar to those published in other studies (17). Therefore, our older subjects also had statistically significantly more pneumonia present, severe clinical features and high all-cause mortality compared to younger subjects. Although the majority of authors have reported that smoking is a considerable risk factor for severe clinical features in COVID-19, the data from different studies are contradictory. Some authors found that smoking has a considerable impact on the development of the severe clinical features and poor outcomes of COVID-19 (18, 19). In our study, the majority of patients were non-smokers, and no statistically significant influence of smoking on the onset of severe clinical features and pneumonia, or increased mortality in active smokers was verified. Özdemir et al. report in their study that being a non-smoker is an independent risk factor for the development of pneumonia, which is not in accordance with the results of our study (20). Lippi et al. reported in their meta-analysis that active smoking is not associated with severity of coronavirus disease 2019 (21).

The majority of investigators report that almost all age groups can contract COVID-19, but severe clinical features develop in older patients, and in patients with cardiovascular comorbidities and chronic respiratory diseases (22). However, numerous studies have stressed the important role of obesity in poor disease outcome, including fatal outcomes in obese patients (23). Obesity is related to poor disease outcome through several mechanisms, but the most emphasized is the influence of chronic inflammation, oxidative stress and impaired immune response in these patients (24). Our study, using univariable regressive analysis, showed that obesity with BMI ≥ 30 kg/m², is a statistically significant predictor of severe clinical forms that include the onset of pneumonia, but not for fatal outcomes of the disease. Pongpirul et al. found that

obesity was independent risk factor for COVID-19 pneumonia, what is in accordance with the results of our study (25). If obesity is related to other risk factors, such as smoking (26) or diabetes (27), the risk of development of severe clinical features and fatal outcomes increases even more.

Numerous investigators have shown that diabetes is significantly related to the development of severe clinical features, and increases the possibility of fatal outcome in patients with COVID-19 (28). In our sample of subjects, 5.57% had diabetes as a comorbidity. The results obtained using univariable regressive analysis in our patients showed that diabetes is a predictor of the onset of pneumonia and severe clinical features, but this was not confirmed using multivariable regressive analysis. Interestingly enough, the odds ratio changed direction and went from “predictor” in univariate regression (Table 3) to “protector” in multivariate regression. This may be due to potential confounders which were not assessed by our analysis.

The majority of authors indicate that chronic respiratory diseases (Asthma, Chronic Obstructive Pulmonary Disease) are predictors of severe clinical features in COVID-19 (29), while other studies (30) found that chronic respiratory diseases are not predictors of severe clinical forms, hospitalization in ICU or fatal outcome due to SarsCov-2 infection. Our study showed that asthma and COPD are not predictors for the onset of pneumonia and development of severe clinical features with fatal outcome in patients, using multivariable regressive analyses.

Patients with hypertension are at greater risk for SarsCov-2 virus infection and severe clinical features (8), and these patients, when they contract COVID-19, are at greater risk of a fatal outcome. Similar results were confirmed in our study. We found that hypertension was a predictor for development of severe clinical features in patients with COVID-19.

The majority of authors report that patients with cancer are at greater risk of contracting COVID-19, with the explanation that their immune system is weakened due to the underlying disease and the aggressive treatment they are receiving,

and they are susceptible to severe forms of the disease (31, 32, 6). However, the results of a meta-analysis (Wang et al.) showed that the independent risk factors related to COVID-19 were hypertension, diabetes, chronic obstructive pulmonary disease, cardiovascular and cerebrovascular diseases, while no correlation was found between an increased risk for the disease among patients with liver disease, kidney disease and cancer (33). The results of our study are similar to the results of Wang's study and showed that the presence of cancer is not associated with higher odds of severe clinical features and all-cause mortality.

Limitation of the Study

In conducting this study, we did not examine the patients personally, but the data used in the study were obtained from the existing medical documentation. We included in the study patients, registered by seven family medicine teams in the city of Banja Luka, Bosnia and Herzegovina. Consequently, we cannot be sure that the results are representative for the whole country. Most patients from the urban area were included in the study. We did not examine possible differences between patients from urban and rural areas. Due to observational nature of the study, potential confounding variables could not be excluded. The aim of the study was to assess independent predictors of pneumonia, severe clinical feature as well as all-cause mortality. Therefore, the strength of the association (odds ratio) could not be interpreted because it is possible that some of them do not represent a total effect rather than a partial effect, i.e. an effect that does not go through the mediators.

Conclusion

Our study indicated the important predictors of COVID-19 morbidity, and also the predictors for the development of pneumonia, or severe clinical features and mortality. It appeared that older age, male gender and obesity were predictors for the onset of severe clinical features and mortality in patients with COVID-19, but regarding smoking

habits, no evidence was found to support a connection. In relation to comorbidities present, hypertension appeared to be an important predictor for the development of severe clinical features.

What is Already Known on This Topic:

COVID-19 is a new and poorly known disease. Furthermore, risk factors contributing to COVID-19 morbidity, severe clinical forms of the disease and mortality are poorly known.

What This Study Adds:

This study identified frequent risk factors in the observed population of patients with COVID-19 at The Primary Health Care Center, Banja Luka.

Authors' Contributions: All authors contributed equally to the article.

Conflict of Interest: The authors declare that they have no conflict of interest.

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