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The predicting factors of clinical outcomes in patients with COVID-19 in the Kingdom of Saudi Arabia [KSA]: A multi-center cohort study

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Abstract:

Background: On March 2020, the first case of coronavirus disease-19 was registered in the Kingdom of Saudi Arabia and subsequently the first mortality case. The predicting factors for patients' outcomes are essential to triage patients with COVID-19. This may provide low-cost facilities that help in the fight against the existing global pandemic.

Objectives: This study aimed to predict hospitalization and death outcomes of COVID-19 patients using the simplest facilities.

Method: The electronic medical records of 280 COVID-19 patients between March 2020 and May 2021 were retrieved from a multi-centre of healthcare facilities across Kingdom of Saudi Arabian cites. All demographic and clinical information were examined to determine predictors and outcomes.

Results: Of the 280 COVID -19 patients enrolled in our study, 14.3% were aged ≥ 66 years and 62.5% were female. The elderly (≥ 66 years, P= 0.000) and male patients (P= 0.001) were significantly hospitalized by COVID -19 than others. Patients with symptoms were hospitalized significantly more than patients without symptoms (P= 0.001). Patients with chronic conditions were hospitalized more frequently (P= 0.001). Hospitalization status also did not differ by smoking. Fever occurred significantly more frequently in patients with one or more chronic diseases (P = 0.000). Elderly (≥ 66 years, P= 0.000) and male patients of COVID -19 (P= 0.022) had significant evidence of association with death outcome than others. Hospitalization status was associated with death (P = 0.000).

Conclusion: This study reported that male gender and advanced age COVID-19 patients are independent predictors for both hospital admission and death outcomes more than others. The COVID-19 patients who complain from symptoms are at risk for hospitalization as well. Additionally, having chronic clinical conditions are predictor factor for hospital admission outcome. Finally, the hospitalized patients of COVID-19 infection are at risk for death outcome.

Keywords: COVID-19, death outcome, hospitalization, predicting factors.

Introduction:

The World Health Organization (WHO) notified the appearance of pneumonia cases of unknown causation exactly on 31 December 2019 in Wuhan city, China. COVID-19 was isolated from these patients. It was

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supposed epidemiologically due to seafood exposures in Wuhan city market (1). The COVID-19 disease spread rapidly and reported in further countries at the end of January 2020. COVID-19 was considered as an international public health emergency specifically of acute respiratory disease (2,3). The WHO notified that there is a global pandemic of COVID-19 outbreak on March 11, 2020 (4).

The Kingdom of Saudi Arabia (KSA) registered the first case of COVID-19 disease and subsequently the first mortality case in March 2020 (5). COVID-19 cases who were complicated with severe respiratory illness, frequently need hospitalization and associated with a high mortality rate (2). Regarding the Middle East Governments, the development of the healthcare quality is their top priority (6). Around all KSA, the standard protocol of COVID-19 infection prevention and control was updated. In addition to increase health centers which possess many intensive care unit, hospital beds and isolation beds for suspected as well as quarantined cases (3,6,7).

The hospitals become overwhelmed due to this pandemic as a mild symptomatic patient is expected to burst a hospital wide disaster (2). Now more health service researches are mandatory relying on the recognizing of predicting factors. The predicting factors that help to expect patients' outcomes are essential to triage patients with COVID-19. This may provide low-cost facilities that help in the fight against the existing global pandemic.

There was a study conducted in KSA dealing with just descriptions of clinical characteristics of COVID-19 as well as its clinical outcomes (8). Another study dealt with categorization of the clinical characteristics and outcomes of COVID-19 patients by chronic conditions (5), as it was known that patients with chronic diseases are more susceptible for COVID-19 infection and sever deteriorating health (9).

As COVID-19 infection is still persistent up to date and it highly cost the community both for citizens and the Government. This study was conducted in order to predict the clinical outcomes for COVID-19 patients in terms of hospitalization and death depending on the simplest facilities. The aim of the present study was to examine whether routine demographic and clinical information of patients with COVID-19 on presentation were informative in predicting these clinical outcomes. This prediction is essential to be before dealing with expensive laboratory investigations. This research may aid for better health outcomes due to early planning the strategy of patient's treatment. It also helps the patients and Government by decreasing the cost which could be spent due to late hospitalization decision or unwanted hospitalization.

Patients and Methods:

Patients: In this study 280 adults of COVID-19 patients were recruited, of both sexes, aging 15 up to more than 66 years old.

Methods: It was descriptive, retrospective, cross-sectional study. The electronic medical records of all infected patients with COVID-19 between March 2020 and May 2021 were retrieved from a multi-centre of health care facilities across Kingdom of Saudi Arabia cites. These patients had confirmed infection with COVID-19 in the laboratory using real-time reverse transcriptase-polymerase chain reaction (RT-PCR).

Predictors: A patient's medical record consists of multiple data. The data were examined for routine basic information which are considered as predictors. These predictors are age, gender, smoking status, residence, occupation and nationality. In addition, these data were examined for clinical characteristics including all existing chronic co-morbidity as well as the kind of symptoms that the patients presented with.

According to age, patients were grouped as 15-25 years, 26-35 years, 36-45 years, 46-55 years, 56-65 years and lastly more 66 years.

The occupations were classified as healthcare worker, education sector, military sectors, unemployment and others.

The most common reported symptoms that the patients in this study presented with were arranged as the following: fever, headache, dyspnoea, loss sense of smell, loss sense of taste, nausea and vomiting

Outcomes: Also, the data were examined for clinical outcomes including hospitalization and death from COVID-19.

These patients then were categorized according to the hospitalization, death and chronic disease.

The percentages of COVID-19 patients with different chronic conditions were determined as well. The most common chronic diseases associated with COVID-19 infection in this study were autoimmune lymphoproliferative syndrome, cancer, chronic kidney disease, cardiovascular disease, chronic liver disease, hypertension, diabetes mellitus and asthma.

Ethical Considerations

This study's protocol, involving human participants, was reviewed and approved by Ethics Committee of Institutional Review Board (IRB), General Directorate of Health Affairs, Tabuk Region. [Registration No. H-07-TU-077]. The written informed consents of patients included in this study were not required according to the national legislation and the institutional necessity.

Statistical analysis:

The data obtained were analyzed using Statistical Package for Social Sciences (SPSS; version 24). Descriptive data were expressed as frequencies and percentages to examine the distribution of study

variables between the hospitalized group and the non-hospitalized group; the Chi-squared test or Fisher's exact test was used to compare categorical variables between groups. No imputation was performed for all tests, and a P value of 0.05 was considered statistically significant.

Results

Of the 280 COVID -19 patients enrolled in our study, 18.25% were aged 15-25 years, 21.4% were aged 26-35 years, 22.5% were aged 36-45 years, 11.8% were aged 46-55 years and 56-65 years, and 14.3% were aged more than 66 years. In addition, 62.5% were females; 97.5% were Saudis; more than half of the participants were from Tabuk; more than 40% were unemployed; the majority were non-smokers. Moreover, 182 (65%) of the patients involved in current study were classified as having at least one symptom; 98 (35%) patients were classified as having no symptoms. In addition, chronic diseases in COVID -19 patients were stratified into two groups: 49 (17.5%) patients were classified as having at least one chronic disease; 231 (82.5%) COVID -19 patients were classified as having no chronic diseases.

Baseline characteristics of patients infected with COVID-19 were grouped according to hospitalization status are summarized in Table 1. The hospitalized patients were 124 while non hospitalized patients were 156. The chi-square and Fischer's exact test showed that elderly (≥ 66 years, P= 0.000) and male patients (P= 0.001) were significantly more likely to be hospitalized by COVID-19 than others. Hospitalization status also varied by occupation and region (P= 0.000). Patients with symptoms were hospitalized significantly more often than patients without symptoms (P= 0.001). In addition, patients with chronic conditions were hospitalized more frequently (P= 0.001). Hospitalization status also did not differ by smoking.

Baseline characteristics of patients are summarized in Table 2 according to the presence or absence of chronic diseases. There were 49 patients with chronic conditions and 231 patients without chronic conditions. Chi-square test and Fischer's exact test in Table 2 showed that patients with a history of chronic diseases were males (P=0.001) and in the age group (56-65) (P = 0.025). Patients with one or more chronic diseases had significantly higher reported symptomatology than patients with no history of chronic diseases. For the entire study population, dyspnea (57%), loss of sense of smell (44%), and males (P=0.001) and fever (31%) were the most commonly reported symptoms. Fever occurred significantly more frequently in patients with one or more chronic diseases (P = 0.000), meaning that patients with chronic diseases were more likely to report fever as a symptom of COVID -19. Regarding chronic diseases, the most common chronic disease was immunodeficiency disease such as Autoimmune Lymphoproliferative Syndrome, which accounted for 54% of patients with chronic diseases, followed by 28.9% with cancer and 26.7% with chronic kidney disease (Figure 1). In terms of patient outcomes, death was recorded in only 3.90% of cases for the entire study population. The chi-square and Fischer's exact test (Table 3) showed that elderly (≥ 66 years, P= 0.000) and male patients of COVID -19 (P= 0.022) had significant evidence of association with death outcome than others. Hospitalization status was associated with death (P = 0.000). In contrast, chronic disease was not significantly associated with death. The results showed that 18.20% of patients with chronic disease died compared with 81.80% of patients without chronic disease. This implies that elderly male patients were more likely to die in hospital than others.

Table 1: Baseline Characteristics of the 280 Patients Infected with COVID-19 by hospitalization status

Characteristic		Total Patients (%) (N=288)	Hospitalized Patients (%) (N=124)	Non hospitalized Patients (%) (N=156)	P value
Gender	Male	105(37.50%)	67(54.00%)	38(24.40%)	0.001*
	Female	175(62.50%)	57(46.00%)	118(75.60%)	
Nationality	Saudi	273(97.50%)	124(100.00%)	149(95.50%)	0.017*
	Non Saudi	7(2.50%)	0(0.00%)	7(4.50%)	
Region	Makkah	32(11.43%)	31(25.00%)	1(0.60%)	0.000*
	Riyadh	49(17.50%)	20(16.10%)	29(18.60%)	
	Tabuk	160(57.14%)	68(54.80%)	92(59.00%)	
	Eastern Province	16(5.71%)	1(0.80%)	15(9.60%)	
	Medina	10(3.57%)	2(1.60%)	8(5.10%)	
	Qassim	2(0.71%)	0(0.00%)	2(1.30%)	
	Jazan	5(1.79%)	2(1.60%)	3(1.90%)	
	Northern Borders	3(1.07%)	0(0.00%)	3(1.90%)	
	Aseer	1(0.36%)	0(0.00%)	1(0.60%)	
	Al Jowf	2(0.71%)	0(0.00%)	2(1.30%)	
Occupations	Healthcare worker	16(5.71%)	6(4.90%)	10(6.40%)	0.000*
	Education Sector	43(15.36%)	8(6.60%)	35(22.40%)	
	Military Sectors	13(4.64%)	3(2.50%)	10(6.40%)	
	Others	85(30.36%)	55(45.00%)	30(19.20%)	
	Unemployment	121(43.21%)	50(41.00%)	71(45.50%)	
Age	15-25	51(18.21%)	5(4.00%)	46(29.50%)	0.000*
	26-35	60(21.43%)	14(11.30%)	46(29.50%)	
	36-45	63(22.50%)	19(15.30%)	44(28.20%)	
	46-55	33(11.79%)	16(12.90%)	17(10.90%)	
	56-65	33(11.79%)	30(24.20%)	3(1.90%)	
	66 & more	40(14.29%)	40(32.30%)	0(0.00%)	
Smoking	Yes	22(7.86%)	7(5.60%)	15(9.60%)	0.222
	No	258(92.14%)	117(94.40%)	141(90.40%)	
Death	Yes	11(3.93%)	11(8.90%)	0(0.00%)	0.000*
	No	269(96.07%)	113(91.10%)	156(100.00%)	
Symptoms	Yes	182(65.00%)	94(75.80%)	88(56.40%)	0.001*
	No	98(35.00%)	30(24.20%)	68(43.60%)	
Chronic diseases	Yes	49(17.50%)	49(39.50%)	0(0.00%)	0.001*
	No	231(82.50%)	75(60.50%)	156(100.00%)	

Table 2: Baseline Characteristics and Outcomes of the 280 Patients Infected with COVID-19 Stratified by with or without Chronic Conditions

Characteristic		Total Patients (%) (N=280)	Patient with chronic conditions (%) (n=49)	Patient without chronic conditions (%) (n=231)	P value
Gender	Male	105(37.50%)	29(59.18%)	76(32.90%)	0.001*
	Female	175(62.50%)	20(40.82%)	155(67.10%)	
Age	15-25	51(18.21%)	1(2.04%)	50(21.65%)	0.000*
	26-35	60(21.43%)	5(10.20%)	55(23.81%)	
	36-45	63(22.50%)	13(26.53%)	50(21.65%)	
	46-55	33(11.79%)	3(6.12%)	30(12.99%)	
	56-65	33(11.79%)	15(30.61%)	18(7.79%)	
	66& more	40(14.29%)	12(24.49%)	28(12.12%)	
Smoking	Yes	22(7.86%)	3(6.12%)	19(8.23%)	0.952
	No	258(92.14%)	46(93.9%)	202(91.8%)	
Symptoms	Yes	182(65.00%)	43(87.80%)	139(60.20%)	0.000*
	No	98(35.00%)	6(12.20%)	92(39.83%)	
Fever	Yes	88(31.43%)	33(67.30%)	55(23.80%)	0.000*
	No	192(68.57%)	16(32.70%)	176(76.20%)	
Headache	Yes	42(15.00%)	4(36.40%)	38(17.00%)	0.112
	No	193(68.93%)	7(63.60%)	186(83.00%)	
Dyspnea	Yes	160(57.14%)	32(65.30%)	128(55.40%)	0.204
	No	120(42.86%)	17(34.70%)	103(44.60%)	
Loss sense of Smell	Yes	124(44.29%)	4(36.40%)	120(53.60%)	0.357
	No	111(39.64%)	7(63.60%)	104(46.40%)	
Loss sense of taste	Yes	41(14.64%)	0(0.00%)	41(18.30%)	0.221
	No	194(69.29%)	11(100.00%)	183(81.70%)	
Nausea and vomiting	Yes	34(12.14%)	10(20.40%)	24(10.40%)	0.088
	No	246(87.86%)	39(79.50%)	207(89.60%)	

Table 3: Association between Death and Baseline Characteristics

Characteristic		Death rate	Survival rate	P value
Gender	Male	8(72.70%)	97(36.10%)	0.022*
	Female	3(27.30%)	172(63.90%)	
Age	15-25	0(0.00%)	51(19.00%)	0.000*
	26-35	0(0.00%)	60(22.30%)	
	36-45	1(9.10%)	62(23.00%)	
	46-55	0(0.00%)	33(12.30%)	
	56-65	2(18.20%)	31(11.50%)	
	66 & more	8(72.70%)	32(11.90%)	
Symptoms	Yes	9(81.80%)	173(65.00%)	0.341
	No	2(18.20%)	93(35.00%)	
Chronic diseases	Yes	2(18.20%)	47(17.50%)	.951
	No	9(81.80%)	222(82.50%)	
Hospitalization for COVID-19	Yes	11(100.00%)	113(42.00%)	0.000*
	No	0(0.00%)	156(58.00%)	

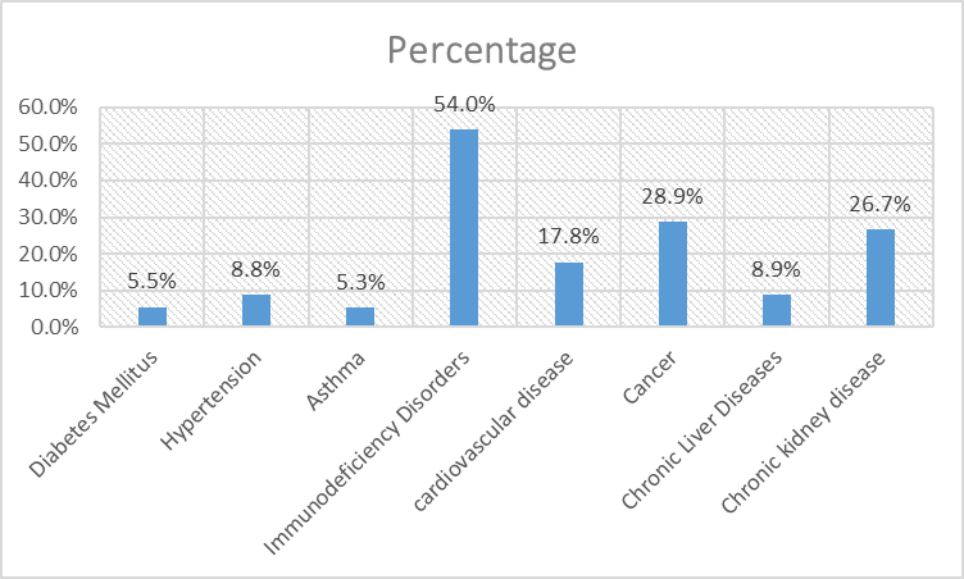

Figure 1: Percentages of COVID-19 patients with chronic conditions.

Discussion:

The current study was conducted in KSA to evaluate the probability of using comprehensive data on demographic and clinical characteristics in predicting clinical outcomes of patients with COVID-19 infection. These clinical outcomes are both hospitalization and death. It was identified several predictor factors for these outcomes.

The predictor factors for hospitalization outcome: The present study explored a relationship between sex and hospitalization in patients infected with COVID-19. As men with COVID-19 infection had been hospitalized more than women. Regardless of that, generally, women were more infected with COVID-19 than men. This finding was consistent with other reports which revealed that the rate of COVID-19 hospitalization was higher among men than women (10-12). This is explained as there is better women' immunity against virus than men. This may be due to that the innate and adaptive immune responses were affected by genes found on the X chromosome and sex hormones, as together give protection for females (13). In addition to a higher concentration of angiotensin-converting enzyme 2 (ACE2) present on testes tissue and plasma in men than women (14,15). ACE2 is a receptor for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (16). This study showed that elderly patients with COVID-19 infection are more prone for hospitalization than younger patients. This finding was supported by the previous literatures which determined that the age of 60 years or more of Covid -19 patients was associated with hospitalization (11,12,17). This is because those older individuals have a deficiency in ACE2 protein expression and there will be an additional ACE2 deficiency after viral invasion. This ACE2 deficiency would much facilitate the progression of inflammatory and hyper-coagulation processes at lung level (18).The COVID-19 patients, in the present study, who presented with symptoms are

more prone for hospitalization outcome than those without symptoms. This good point for a better health in community, as this let the hospital capacity and medical staff to focus on those patients who complain and give them good care. Notably, in this study, a higher percentage of total COVID-19 patients presented with dyspnea then less frequently they presented with loss of sense of smell then fever. This finding did not cope with other studies (19, 20). Reasonably, as the primary clinical symptom in their total patients was the fever, this might be due to a difference in locality as the last studies were conducted in Wuhan and Italy while our study was in KSA. In this study, it was found that as well, COVID-19 patients with chronic conditions were admitted to hospital more frequently than those without chronic conditions. This was in agreement with other literature findings which revealed that comorbidities predict hospitalization outcome rather than outpatient care (11). According to our study in KSA, approximately 17.5% of COVID-19 positive individuals had at least one chronic disease. About 54% of these patients had immunodeficiency disorder, 28.9% of them had cancer and 26.7% of them had chronic kidney disease. These findings were inconsistent with other studies who demonstrated that around 25% of COVID-19 patients had at least one associated comorbidity (21). The heart diseases, including hypertension along with cardiovascular diseases, are the most comorbidity association with their COVID-19 infection (22). This difference could be attributed to a different locality, as their data collected from France, Italy, Netherlands, Spain, and Sweden. However, the present study sample size might have not been large enough to detect same percentages and graduation of comorbidity. This study demonstrated that, the majority of COVD-19 infected people with chronic co-morbidity were men and independently they aged between 56-65 years old. This explained as that the immune response is decreasing with increasing comorbidity in older adults (23). These COVD-19 patients with chronic co-morbidity had more possibility to present with symptoms than others. Fever was the primary symptom that they presented with. However, in current study, the dyspnea was the most common clinical symptom in total patients. This may be as a result of a decrease in immunity due to comorbidity and fever aids in the enhancement of immune-protective mechanisms (23, 24). Interestingly, consistent with another study (11), it was revealed that there was no association between smoking and hospitalization. However, other studies have detected an association between smoking and death which is the higher tragedy outcome. As one literature showed that the smoking is associated with a higher mortality in COVID-19 patients while another revealed that there was an inverse correlation between smoking and death (25,26). This might not be due to a few numbers of smoker in KSA leading not detecting an association between smoking and hospitalization. This study quantified a range of demographic risk factors for COVID-19 related hospitalization. These factors are nationality, region and occupations. Probably, more sample size is mandatory in order to give full outcome identification from these factors.

The predictor factors for death outcome: In addition to above, this study identified that male patients with covid-19 infection have more death outcome than women. This outcome was in keeping with another study which explained that males are at risk for death in patients with severe COVID-19(27-29). This may be due to that testosterone hormone in male can suppress the immunity while estrogen in females can enhance the immunity (28). Additionally, in male, the fate of stressed endothelial cells in lung is necrosis while apoptosis is more in females (30). In addition, the early antiviral response by the innate sensing of SARS-CoV-2 genetic material is activated by estrogen (reviewed by 28). In contrast, another study revealed that there was no association between sex-dependent mortality and COVID-19 severity; as they focused their attention only on two candidate genes which have a crucial rule in viral infection. (31). The present study also indicated that elderly patients with COVID-19 infection were further susceptible to death outcome than younger patients. This finding agreed with other studies which explained that death happened more in older age COVID-19 patients (32-34). This is probably due to that an older patient has less rigorous immune response (32). In addition to that, the older patient has more risk for resistance to drugs. This might lead to attenuate their drug efficacy, thereby, ending with poor treatment risk and higher mortality outcomes (35). Fortunately, in the present study, there was a very low percentage of the COVID-19 patients who admitted to hospital and then passed to death outcome while all the patients who died were currently hospitalized. This perhaps due to a good medical care in hospital. As in KSA, the Ministry of Health designated many hospitals for COVID-19-infected patients (36). However, despite these health improvements, hospitalization is still considered as a risk predictor for death outcome. We recommend conducting a further studies in KSA about COVID-19 using laboratory investigations in predicting clinical outcomes. The current study has one limitation related to sample size which was not too large.

Conclusion:

In order to avoid the delay in diagnosis and treatment of COVID-19 infection as a result of a long waiting for access to medical care, the planning of fast and quick strategies to select the patients depending on their demographic and health conditional priorities. These priorities are determined when we identify the predicted factors for clinical outcomes including both

hospitalization and death. The current study reported that men and elderly COVID-19 patients independently are noticeable risk factors associated with both hospital admission and death outcomes more than others. The latter is so important in conducting patients' selection quickly to admit hospital until they undergo investigation. The COVID-19 patients who complaining from symptoms are at risk for hospitalization, as well.

Additionally, the COVID-19 patients with chronic conditions are predicted factors for hospital admission outcome. The characteristics of these patients were more men and independently they aged between 56-65 years old. They presented primarily with fever as, well. Finally, the hospitalized patients of COVID-19 infection are at risk for death outcome.

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Authors' Contribution:

Janan A. Alrefaee wrote all research and plan research name and arrange all process of research submission for publication and correction

Hanan Daghash did all data analysis

Sarah Hamdy Alanazi reread the research for any correction notes

Aishah E Albalawi, gave the first idea about the research

All other authors (**Aishah E Albalawi, Norah A. Althobaiti, Tharaa K Abu Hasbu, Mohammad S Abusuliman**) contribute with data collection from all hospitals

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العوامل التنبؤية للنتائج السريرية لدى مرضى كوفيد-19 في المملكة العربية السعودية: دراسة جماعية متعددة المراكز

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نبذة مختصرة

الخلفية:

في مارس 2020 ، تم تسجيل أول حالة إصابة بمرض كوفيد -19 في المملكة العربية السعودية وبالتالي حالة الوفاة الأولى. تعتبر عوامل التنبؤ بنتائج المرضى ضرورية لفرز مرضى كوفيد -19. قد يوفر هذا مرافق منخفضة التكلفة تساعد في مكافحة الوباء العالمي الحالي. هدفت هذه الدراسة إلى التنبؤ بنتائج الاستشفاء والوفاة لمرضى كوفيد -19 باستخدام أبسط المرافق.

الطريقة: تم استرداد السجلات الطبية الإلكترونية لـ 280 مريضًا من كوفيد -19 بين مارس 2020 ومايو 2021 من مركز متعدد مرافق الرعاية الصحية في جميع أنحاء المملكة العربية السعودية. تم فحص جميع المعلومات الديموغرافية والسريرية لتحديد المتنبئين والنتائج.

النتائج: من بين 280 مريضًا مصابًا بفيروس كوفيد -19 مسجلين في دراستنا، كان 14.3٪ تتراوح أعمارهم ≤ 66 عامًا و 62.5٪ من الإناث. تم إدخال كبار السن (≤ 66 عامًا ، P = 0.000) والمرضى الذكور المصابين ب كوفيد -19 (P = 0.001) بشكل كبير إلى المستشفى أكثر من غيرهم.

تم إدخال المرضى الذين يعانون من الأعراض إلى المستشفى بشكل ملحوظ أكثر من المرضى الذين ليس لديهم أعراض (P = 0.001). تم إدخال المرضى الذين يعانون من أمراض مزمنة إلى المستشفى اكثر (P = 0.001). حالة الاستشفاء أيضا لم تختلف بالنسبه للتدخين. تحدث الحمى بشكل ملحوظ أكثر في المرضى الذين يعانون من مرض مزمن واحد أو أكثر (P = 0.000). كان لدى كبار السن (≤66 عامًا ، P = 0.000) والمرضى الذكور من كوفيد -19 (P = 0.022) أدلة مهمة على الارتباط بنتيجة الوفاة أكثر من غيرهم. ارتبطت حالة الاستشفاء بالموت (P = 0.000).

الخلاصة: ذكرت هذه الدراسة أن الرجال وكبار السن من مرضى كوفيد -19 هم معرضون بشكل مستقل لكل من دخول المستشفى ونتائج الوفاة أكثر من غيرهم. مرضى كوفيد -19 الذين يشكون من الأعراض معرضون لخطر الاستشفاء أيضًا.

بالإضافة إلى ذلك، فإن مرضى كوفيد -19 المصابين بأمراض مزمنة متوقع تعرضهم لدخول المستشفى. أخيرًا، يتعرض المرضى المقيمون في المستشفى المصابون بعدوى كوفيد -19 لخطر الوفاة.

الكلمات المفتاحية: كوفيد -19 ، الاستشفاء ، الموت ، التنبؤ بالعوامل ، المخاطر.