RESEARCH

Open Access

The association between potential predictors and death of patients during the COVID-19 pandemic in Shiraz: a hierarchical multiple regression analysis

Zinat Mohebbi[1], Parvin Ghaemmaghami[2*] , Melika Rajaei[3], Mohammad Mehdi Keshtkar[4], Sina Ghanbarzadeh[5] and Bagher Khoram[6]

Abstract

Introduction Identifying clinical factors that increase the risk of mortality in COVID-19 patients is crucial. This enables targeted screening, optimizing treatment, and prevention of severe complications, ultimately reducing death rates. This study aimed to develop prediction models for the death of patients (i.e., survival or death) during the COVID-19 pandemic in Shiraz, exploring the main influencing factors.

Method We conducted a retrospective cohort study using hospital-based records of 1030 individuals diagnosed with COVID-19, who were hospitalized for treatment between March 21, 2021, and March 21, 2022, in Shiraz, Iran. Variables related to the final outcome were selected based on criteria and univariate logistic regression. Hierarchical multiple logistic regression and classification and regression tree (CART) models were utilized to explore the relationships between potential influencing factors and the final outcome. Additionally, methods were employed to identify the high-risk population for increased mortality rates during COVID-19. Finally, accuracy was evaluated the performance of the models, with the area under the receiver operator characteristic curve(AUC), sensitivity, and specificity metrics.

Results In this study, 558 (54.2%) individuals infected with COVID-19 died. The final model showed that the type of medicine antiviral (OR: 11.10, $p = 0.038$) than reference (antiviral and corticosteroid), and discharge oxygen saturation(O2) (OR: 1.10, $p < 0.001$) had a positive association with the chance of survival, but other variables were not considered as predictive variables. Predictive models for the final outcome(death) achieved accuracies ranging from 81 to 87% for hierarchical multiple logistic regression and from 87 to 94% for the CART model. Therefore, the CART model performed better than the hirerical multiple logistic regression model.

Conclusion These findings firstly elucidate the incidence and associated factors of the outcome (death) among patients in Shiraz, Iran. Furthermore, we demonstrated that antiviral medication alone (without corticosteroids) and high O2 increase the survival chances of COVID patients.

*Correspondence:
Parvin Ghaemmaghami
Ghaemmaghami.83@gmail.com
Full list of author information is available at the end of the article

Mohebbi *et al. BMC Public Health*   (2024) 24:1975

Page 8 of 9

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-024-19372-2.

> Supplementary Material 1

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

I hereby confirm that all experimental protocols conducted in this study were approved by the Shiraz University of Medical Sciences, Iran, based on a proposal with grant number 21032 and the Ethics code number IR.SUMS.NUMIMG.REC.1401.011 issued on 18.10.1401. In addition, informed consent was obtained from all subjects or their legal guardian(s) prior to their participation in the research.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Community Based Psychiatric Care Research Center, Department of Nursing, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
[2]School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
[3]Nurse, Shiraz University of Medical Sciences, Shiraz, Iran
[4]Nurse, Fasa University of Medical Sciences, Fasa, Iran
[5]Medical Student, Student Research Committee, Medical College, Shiraz University of Medical Sciences, Shiraz, Iran
[6]Instructor of Critical-Care Nursing, MSN, Department of Anesthesia, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran

References

1. Sahin A-R, Erdogan A, Agaoglu PM, Dineri Y, Cakirci A-Y, Senel M-E, et al. 2019 novel coronavirus (COVID-19) outbreak: a review of the current literature. EJMO. 2020;4(1):1–7.
2. Suter F, Consolaro E, Pedroni S, Moroni C, Pastò E, Paganini MV et al. A simple, home-therapy algorithm to prevent hospitalisation for COVID-19 patients: a retrospective observational matched-cohort study. EClinicalMedicine. 2021:100941.
3. Ghebreyesus T. May. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19-25 2020.
4. Hsieh Y-H, Lee J-Y, Chang H-L. SARS epidemiology modeling. Emerg Infect Dis. 2004;10(6):1165.
5. Rahman PNSN, Zaki R, Tan Z, Bibi S, Baghbanzadeh M, Aghamohammadi N, Zhang W, Haque U. Int J Epidemiol. 2020;49:717–26.
6. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395(10229):1054–62.
7. Xie J, Covassin N, Fan Z, Singh P, Gao W, Li G, et al. editors. Association between hypoxemia and mortality in patients with COVID-19. Mayo Clinic Proceedings; 2020: Elsevier.
8. Adhikari SP, Meng S, Wu Y-J, Mao Y-P, Ye R-X, Wang Q-Z, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. Infect Dis Poverty. 2020;9(1):1–12.
9. Hafeez A, Ahmad S, Siddqui SA, Ahmad M, Mishra S. A review of COVID-19 (coronavirus Disease-2019) diagnosis, treatments and prevention. Ejmo. 2020;4(2):116–25.
10. Javanmardi F, Keshavarzi A, Akbari A, Emami A, Pirbonyeh N. Prevalence of underlying diseases in died cases of COVID-19: a systematic review and meta-analysis. PLoS ONE. 2020;15(10):e0241265.
11. Albitar O, Ballouze R, Ooi JP, Ghadzi SMS. Risk factors for mortality among COVID-19 patients. Diabetes Res Clin Pract. 2020;166:108293.
12. Tazerji SS, Shahabinejad F, Tokasi M, Rad MA, Khan MS, Safdar M et al. Global data analysis and risk factors associated with morbidity and mortality of COVID-19. Gene Rep. 2022:101505.
13. Emami A, Javanmardi F, Akbari A, Yeganeh BS, Rezaei T, Bakhtiari H, et al. Liver biomarkers assay in COVID-19 cases: a comparison study between alive and dead patients. Iran J Public Health. 2022;51(1):172.
14. Tjendra Y, Al Mana AF, Espejo AP, Akgun Y, Millan NC, Gomez-Fernandez C, et al. Predicting disease severity and outcome in COVID-19 patients: a review of multiple biomarkers. Arch Pathol Lab Med. 2020;144(12):1465–74.
15. Malik P, Patel U, Mehta D, Patel N, Kelkar R, Akrmah M, et al. Biomarkers and outcomes of COVID-19 hospitalisations: systematic review and meta-analysis. BMJ evidence-based Med. 2021;26(3):107–8.
16. Mubayi A. Computational modeling approaches linking health and social sciences: sensitivity of social determinants on the patterns of health risk behaviors and diseases. Handbook of statistics. Elsevier; 2017. pp. 249–304.
17. Biswas A, et al. Identifying the sociodemographic and work-related factors related to workers' daily physical activity using a decision tree approach. BMC Public Health. 2023;23(1):1853.
18. Loh W-Y. Fifty years of classification and regression trees. Int Stat Rev. 2014;82(3):329–48.
19. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Yu T. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507–13.
20. Wenham C, Smith J, Morgan R. COVID-19: the gendered impacts of the outbreak. Lancet. 2020;395(10227):846–8.
21. Team E. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19)—China, 2020. China CDC Wkly. 2020;2(8):113.
22. Ergenc Z, Ergenc H, Araç S, Tör IH, Usanmaz M, Alkılınç E, Karacaer C, Kaya T, Nalbant A, Görgün S, Öztürk A, Yıldırım I. Predictors of disease severity, clinical course, and therapeutic outcome in COVID-19 patients: our experience with 1,700 patients. Eur Rev Med Pharmacol Sci. 2022;26(21):8180–8187. https://doi.org/10.26355/eurrev_202211_30171. PMID: 36394767.
23. Delanghe JR, Speeckaert MM, De Buyzere ML. COVID-19 related mortality and religious denomination vs. genetics. Clin Chem Lab Med. 2022;60(7):e157-e158. https://doi.org/10.1515/cclm-2022-0393. PMID: 35488443.
24. Huang X, Wei F, Hu L, Wen L, Chen K. Epidemiology and clinical characteristics of COVID-19. Arch Iran Med. 2020;23(4):268–71. https://doi.org/10.34172/aim.2020.09.
25. Ashinyo ME, Duti V, Dubik SD, Amegah KE, Kutsoati S, Oduro-Mensah E, Puplampu P, Gyansa-Lutterodt M, Darko DM, Buabeng KO, Ashinyo A. Clinical characteristics, treatment regimen and duration of hospitalization among COVID-19 patients in Ghana: a retrospective cohort study. The Pan African Medical Journal. 2020;37(Suppl 1).