

Original Article



Gray area; a novel strategy to confront COVID-19 in emergency departments

Rouzbah Rajaei Ghafouri¹, Samad Shams Vahdati¹, Sajjad Ahmadi¹, Zahra Hosseinnejad¹, Mohammad Khalilzad², Amirreza Naseri^{2,3*}

¹Emergency and trauma care research center, Tabriz University of Medical Sciences, Tabriz, Iran

²Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran

³Aging Research Institute, Tabriz University of Medical Sciences, Tabriz, Iran

Article info

Article History:

Received: 9 Feb. 2022

Accepted: 23 March 2022

e-Published: 9 Oct. 2022

Keywords:

- COVID-19
- Emergency service
- Pandemics
- SARS-CoV-2

Abstract

Introduction: Coronavirus disease 2019 (COVID-19) pandemic, affects almost every aspect of human life. To confront this crisis, a separate ward called gray area was designed for emergency departments (EDs) and applied at the provincial level in East-Azerbaijan, Iran. This study aimed to evaluate the effectiveness of this project, increase the serviceability and segregation of the location of infected patients, and show how feasible and fruitful it can be.

Methods: This study is an analytical study. The statistical data collection from 39 hospitals was performed between 20 March to 21 September 2020. Descriptive Statistics as well as correlation coefficients were calculated using the 26th version of IBM SPSS.

Results: Among 77489 COVID-19 patients admitted to the EDs, approximately 0.38% of patients died in EDs. 22.63% of EDs area was allocated to COVID-19 patients and 70.46% of ED nurses, worked in the gray area. There was no significant correlation between area, number of patients, number of nurses, number of shifts of nurses, number of nurses for each patient, number of nurse shifts for each patient, and area for each patient with mortality rate and rates of disposition in 6 and 12 hours.

Conclusion: Gray area is an appropriate strategy to confront COVID-19 in EDs and if more studies approve these results, this strategy can be used to confront this pandemic and future similar conditions in resource-limited countries.

Introduction

In 2020, the world society faced a novel crisis. A new Infectious disease called coronavirus disease 2019 (COVID-19), affects almost every aspect of human life. In the front line, there are medical services. For such a condition, health policymakers should have a strategy to respond rapidly and effectively.

China, as the first country to face the COVID-19 crisis, had the experience of severe acute respiratory syndrome (SARS) outbreak, in 2004.¹ A survey of the status of hospital emergency preparedness for infectious disease outbreaks in 2007, found that emergency preparedness for the infectious disease was in the early stage. Only 1.8% of the total physicians and 2.5% of the total nurses were specialized in infectious disease.² During the current pandemic in China, a decrease in emergency department (ED) visits were associated with increases in the proportion of severe condition during ED visit.³ Also, in America, a 42% of declined in ED visits was reported by the Centers for Disease Control and Prevention (CDC).⁴

Taiwan, as a country that expected to have the second-highest number of COVID-19 cases after China, quickly instituted specific approaches. This quick response made Taiwan one of the most prospering countries during this pandemic. Despite the decrease in ED visits, COVID-19 pandemic consequences had a negative effect on the acuity of this service, and the incidence of in-hospital cardiac arrest increased significantly.⁵

Before the announcement of the first confirmed cases of the disease in East Azerbaijan (EA), by the order of the treatment deputy of the province, a separate ward called the gray area (respiratory area), was designed in the EDs of hospitals. Facilitation of pathway to differentiate the diagnosis and admission of patients with positive COVID-19 infection tests and patients with suspected COVID-19-related respiratory disease had led to create the "gray area"⁶. The Changes in ED and personnel and physician divisions were based on the deputy's instructions. These manuals were applied at the provincial level. For faster identification of infected patients, the

*Corresponding Author: Amirreza Naseri, Email: Amirx2eza@gmail.com

© 2022 The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

response team designed a diagnostic algorithm. This process managed patients by considering their exposure history and respiratory status. This study aimed to evaluate the effectiveness of this project, increase the serviceability and segregation of the location of infected patients, and show how feasible and fruitful it can be.

Methods

This study is an analytical study based on the actions of the treatment deputy of Tabriz University of Medical Sciences, during the COVID-19 disease pandemic at the level of hospitals in EA province, Iran. Statistical information includes the ED and gray area in a square meter, number of COVID-19 patients referred to ED, number of nurses in ED and gray area, number of shifts of nurses in non-COVID-19 section and gray area, number of patients dispositioned within 6 and 12 hours, number of deaths due to COVID-19, number of general practitioners and emergency medicine specialists in ED, and rate of mortality due to COVID-19 collected from 39 hospitals in EA province, Iran, from 20 March to 21 September 2020. The detailed information about the “gray area” was reported elsewhere.⁶ In summary, all patients with respiratory symptoms entered the COVID-19 triage unit; negative chest CT-scan, normal serum levels of Erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), lactate dehydrogenase (LDH) and lymphocyte counts were the criteria for discharge.

Descriptive Statistics include minimum, maximum, sum, mean, and standard deviation, as well as Pearson correlation coefficients calculated using the 26th version of IBM SPSS software with 95% of confidence intervals and 0.05 level of significance for p-value.

Results

The results of descriptive analyzes are summarized in Table 1. Totally among 77489 COVID-19 patients who visited the ED in EA province in the mentioned period,

299 of them lost their lives in ED, which leads to a 0.38% motility rate. Approximately 22.63% of EDs area, was allocated to COVID-19 patients. Of 850 nurses in EDs, 599 (70.46%) worked in the gray area.

Table 2 shows the correlation coefficients between different factors. There was no significant correlation between gray area, number of COVID-19 patients referred to ED, number of nurses in the gray area, number of shifts of nurses in the gray area, number of nurses for each patient, number of nurse shifts for each patient, and area for each patient with mortality rate and rates of disposition in 6 and 12 hours. Totally 226 general practitioners and 129 emergency medicine specialists worked in EDs.

Discussion

We report the situation of EDs in EA province, Iran, during the COVID-19 pandemic. The overall mortality rate of COVID-19 was approximately 0.38% in EDs of EA province. Occupation of hospital intensive care unit (ICU) or ward beds, due to the huge number of COVID-19 cases, could negatively affect this rate.

To perfectly identify and manage the urgently COVID-19 patients, a guideline is designed by the Tabriz University of Medical Science. To avoid the transmission of infection among healthcare staff and other patients, COVID-19 patients' rooms and other rooms are separated into three distinct areas; 1- high-risk area or infected area, 2- medium-risk area or semi-infected area, 3- low-risk area or clean area. Special protocols are also designed for each area due to the level of infection. In addition, patients with respiratory symptoms are separated from others at the entrance. The triage nurses make approaches according to patients' symptoms and refer the suspected patients to a separated waiting room or examination room or isolated room. Also, top priority patients are sent to gray area immediately.⁶

A similar study conducted in Italy in the terms of the gray area found the adoption of this area beneficial.

Table 1. Descriptive statistics

Category	Minimum	Maximum	Sum	Mean	SD
Emergency department area (m ²)	80.00	2000.00	24611.00	631.05	358.46
Gray area (m ²)	6.00	700.00	5571.00	142.84	155.99
Number of COVID-19 patients referred to ED	0.00	13337.00	77489.00	1986.89	2570.44
Number of nurses in ED	5.00	80.00	850.00	21.79	13.22
Number of nurses in the gray area	0.00	38.00	599.00	15.35	8.66
Number of shifts of nurses in non-COVID-19 section	21.00	6480.00	59928.00	1536.61	1598.29
Number of shifts of nurses in the gray area	0.00	4080.00	34724.00	938.48	898.02
Number of patients dispositioned within 6 hours	31.00	12003.00	60790.00	1599.73	2435.27
Number of patients dispositioned within 12 hours	34.00	13070.00	62269.00	1638.65	2563.80
Number of deaths due to COVID-19 in ED	0.00	88.00	299.00	8.08	16.67
Number of general practitioners in ED	0.00	15.00	226.00	5.79	4.03
Number of emergency medicine specialists in ED	0.00	17.00	129.00	3.30	4.12

m²: square meter; ED: Emergency Department; COVID-19: Coronavirus Disease 2019; SD: standard deviation

Table 2. Pearson correlations

		mortality rate in ED	disposition in 6 hours	disposition in 12 hours
Gray area (m ²)	Correlation coefficient	-0.06	0.08	0.11
	<i>P</i> value	0.71	0.62	0.49
Number of COVID-19 patients referred to ED	Correlation coefficient	-0.12	-0.08	-0.05
	<i>P</i> value	0.44	0.61	0.73
Number of nurses in the gray area	Correlation coefficient	-0.22	0.03	0.06
	<i>P</i> value	0.18	0.85	0.71
Number of shifts of nurses in the gray area	Correlation coefficient	-0.04	-0.06	-0.04
	<i>P</i> value	0.79	0.70	0.79
Number of nurses for each patient	Correlation coefficient	0.03	0.19	0.19
	<i>P</i> value	0.82	0.26	0.24
Number of nurse shifts for each patient	Correlation coefficient	0.05	0.22	0.21
	<i>P</i> value	0.73	0.19	0.20
Area for each patient	Correlation coefficient	0.24	0.22	0.22
	<i>P</i> value	0.15	0.17	0.17

ED: emergency department

Administration of this method led to properly identifying and managing COVID-19 patients who otherwise could be referred to other medical wards, in presence of COVID-19-negative patients; so that transmission of infection would deteriorate the situation. In this way, the scenario of an intra-hospital epidemic outbreak was avoided.⁷ Designing a gray area in hospitals, during the COVID-19 pandemic or similar conditions in the future, will ensure patients with other problems to refer to hospitals, without worrying about getting infected.

The idea of the gray area could be fruitful in many aspects; for instance, the spread of infection among healthcare staff will decrease. Also, patients with typical symptoms of COVID-19 are separated from others until getting the result of PCR exam and then, the patient will whether be referred to special medical wards or discharged, so that, disease transmission between COVID-19 positive patients and other urgent patients will reduce. Considering the situation in resource-limited countries,⁸ the mentioned advantages seem crucial in the management of the current pandemic.

This study had multiple limitations. One of them is neglecting the role of medical facilities in the ED. The other one is the effects of different drugs and supplements on the mortality of the patients. The rate of hygiene observance in healthcare workers is another factor that could affect these outcomes.

Conclusion

In conclusion, our study demonstrated an appropriate outcome for the gray area strategy in EDs. If more studies approve these results, this strategy can be used in other regions, for confronting this pandemic and future similar conditions in resource-limited countries.

Acknowledgments

This study is supported by Tabriz University of Medical Sciences

Study Highlights

What is current knowledge?

- A separate ward called the gray area, was designed to confront COVID-19 in the emergency departments.

What is new here?

- This study found an appropriate outcome for this strategy; therefore, it can be used in future similar conditions in resource-limited countries.

(registration code: 65382).

Authors' Contribution

RRG, SSV, SA, ZH: Investigation, resources, project administration, conceptualization, methodology, validation. MK, AN: Investigation, Data curation; Roles/Writing - original draft. All authors read and approved the final manuscript.

Availability of Data

The analyzed datasets are available from the corresponding author.

Conflict of Interest

There is no conflict of interest.

Ethical Approval

The Ethics committee of Tabriz University of medical science reviewed and approved the study protocol, according to the Declaration of Helsinki (Ethics code: IR.TBZMED.REC.1399.335).

Funding

None.

References

1. Bouey J. Strengthening China's Public Health Response System: From SARS to COVID-19. *Am J Public Health.* 2020;110(7):939-940. doi: 10.2105/AJPH.2020.305654.
2. Hui Z, Jian-Shi H, Xiong H, Peng L, Da-Long Q. An analysis of the current status of hospital emergency preparedness for infectious disease outbreaks in Beijing, China. *Am J Infect*

- Control. 2007;35(1):62-7. doi: [10.1016/j.ajic.2006.03.014](https://doi.org/10.1016/j.ajic.2006.03.014).
3. Sun H, Liu K, Li M, Tang S, Monte AA, Wang J, et al. The influence of coronavirus disease 2019 on emergency department visits in Nanjing, China: A multicentre cross-sectional study. *Am J Emerg Med*. 2020;38(10):2101-9. doi: [10.1016/j.ajem.2020.07.086](https://doi.org/10.1016/j.ajem.2020.07.086)
4. Boserup B, McKenney M, Elkbuli A. The impact of the COVID-19 pandemic on emergency department visits and patient safety in the United States. *Am J Emerg Med*. 2020;38(9):1732-6. doi: [10.1016/j.ajem.2020.06.007](https://doi.org/10.1016/j.ajem.2020.06.007)
5. Sung CW, Lu TC, Fang CC, Huang CH, Chen WJ, Chen SC, et al. Impact of COVID-19 pandemic on emergency department services acuity and possible collateral damage. *Resuscitation*. 2020;153:185-6. doi: [10.1016/j.resuscitation.2020.06.021](https://doi.org/10.1016/j.resuscitation.2020.06.021)
6. Dadashzadeh A, Garaje Alamdari N, Ala A, Dehghannejad J, Jabbarzadeh F, Babaie N. Triage guidelines for emergency department patients with COVID-19. *J Res Clin Med*. 2020;8:12. doi: [10.34172/jrcm.2020.012](https://doi.org/10.34172/jrcm.2020.012)
7. Scichilone N, Basile L, Battaglia S, Benfante A, Fonte R, Gambino F, et al. Management of suspected COVID-19 patients in a low prevalence region. *Chron Respir Dis*. 2020;17:1479973120961843. doi: [10.1177/1479973120961843](https://doi.org/10.1177/1479973120961843)
8. Sanaie S, Naseri A, Mahmoodpoor A. COVID-19; critical care challenges in resource-limited countries. *J Res Clin Med*. 2021;9(1):18. doi: [10.34172/jrcm.2021.018](https://doi.org/10.34172/jrcm.2021.018)