

## ORIGINAL RESEARCH

## CORONA EXPERIENCE

# The match of CO–RADS score and vaccination status of COVID–19 patients applying to the emergency room

Necip Gokhan Guner <sup>1</sup>✉, Ensar Durmus <sup>2</sup>, Fatih Guneyesu <sup>3</sup>✉, Nuray Aslan <sup>4</sup>✉, Yusuf Yurumez <sup>5</sup>✉

**Author affiliation:**

1. Sakarya University Teaching & Research Hospital Emergency Service, Adapazari Sakarya, Turkey. {ORCID:0000–0001–5052–9242}
2. Sakarya University Teaching & Research Hospital Emergency Service, Adapazari Sakarya, Turkey. {ORCID:0000–0001–7722–6639}
3. Sakarya University Teaching & Research Hospital Emergency Service, Adapazari Sakarya, Turkey. {ORCID:0000–0002–8433–3763}
4. Sakarya University Teaching & Research Hospital Emergency Service, Adapazari Sakarya, Turkey. {ORCID:0000–0001–8059–4862}
5. Sakarya University Teaching & Research Hospital Emergency Service, Adapazari Sakarya, Turkey. {ORCID:0000–0003–3917–9434}

**Correspondence:** Ensar Durmus; ensar.durmus@saglik.gov.tr; Phone: +905058665782; Mobile: 90 5058665782

## Abstract

**Objective:** This study examined COVID–19 Reporting and Data System (CO–RADS) scores, reverse transcription polymerase chain reaction (RT–PCR) positivity, and COVID–19 vaccination status of COVID–19 patients who reported to the emergency room (ER). Thus, it aimed to present how much effective the vaccines were.

**Methodology:** It was a cross–sectional, retrospective, descriptive research, covering the period between June 08, 2021 to August 08, 2021. The study was conducted at Sakarya University Teaching & Research Hospital, Sakarya. Institutional ethical review committee certificate was not required as it was a retrospective study.

**Results:** One hundred four cases were included in the study, of which 61 (58.7%) were male, and 43 (41.3%) were female. Of the patients, 35 (33.6%) had no COVID–19 vaccination, 46 (44.2%) had two–doses CoronaVac, one (1%) had two–doses BNT162b2. Out of 104 patients, 12 had a CO–RADS–3 score, 17 had a CO–RADS–4 score, and 60 patients had a CO–RADS–5 score. No significant difference was recognized between unvaccinated cases and vaccinated patients with two CoronaVac doses in terms of hospitalization, RT–PCR positivity and mortality (respectively:  $\chi^2 = 0.176$ ,  $SD = 1$ ,  $p = 0.675$ ;  $\chi^2 = 0.025$ ,  $SD = 1$ ,  $p = 0.874$ ;  $\chi^2 = 0.830$ ,  $SD = 1$ ,  $p = 0.362$ ). Two doses CoronaVac vaccinated patients' length of stay in the hospital was determined to be more succinct than cases who had never been inoculated ( $U = 596.500$ ,  $p = 0.045$ ,  $z = 2.003$ ,  $r = -0.22$ ).

**Conclusion:** Prolonged time after CoronaVac vaccination may reduce the vaccine's protection against COVID–19 pneumonia. The protection of two doses of BNT162b2 against COVID–19 pneumonia presents promise in the fight against the pandemic. Those inoculated with at least two doses of CoronaVac or BNT162b2 had a shorter hospital stay than those not vaccinated. RT–PCR positivity may continue to be observed in vaccinated patients.

**Key words:** Emergency room; COVID–19; CO–RADS; Vaccination; Mortality

**Abbreviations:** LoS - Length of stay; CT- Computed tomography; ER - Emergency room; CO–RADS - COVID–19 Reporting and Data System; RT–PCR - Reverse transcription–polymerase chain reaction;

**Citation:** Guner NG, Durmus R, Guneyesu F, Aslan N, Yurumez Y. The match of CO–RADS score and vaccination status of COVID–19 patients applying to the emergency room. *Anaesth. pain intensive care* 2021;25(6):771–776; DOI: [10.35975/apic.v25i6.1701](https://doi.org/10.35975/apic.v25i6.1701)

**Received:** September 15, 2021, **Reviewed:** September 29, 2021, **Accepted:** October 18, 2021

## 1. Introduction

An international level effort to control the COVID–19 pandemic still continues. This viral disease has been negatively affecting the whole world for the last two years. The governments took restrictive measures to prevent the spread of the virus among people; on the other hand, medical professionals focused on the disease treatment methods. Although many drugs have been tried against the COVID–19, a definitive treatment could not be developed till now.<sup>1</sup> Due to the heavy burden on economic, social, and health systems caused by the pandemic, it needs to be brought under control as soon as possible, for which vaccine development research commenced worldwide.<sup>2</sup>

The vaccine for COVID–19 is required to protect from this disease, especially preventing severe morbidity and mortality, and reducing the need of hospitalization, the intensive care requirement, and shortening the length of stay (LoS) in the hospital.<sup>3</sup>

Pfizer–BioNTech COVID-19 vaccine (BNT162b2) produced by Pfizer & Biontech) is an mRNA vaccine, and marketed under international nonproprietary name: tozinameran, and trade name Comirnaty®). CoronaVac (Vero Cell), is an inactive vaccine, is prepared by Sinovac Life Sciences, China. Both these vaccines are approved for use in Turkey and some other countries to combat COVID–19.<sup>4</sup> The vaccination process began with the vaccination of elderly and high–risk individuals with the CoronaVac vaccine in January 2021, and the vaccination increased rapidly with the introduction of the BNT162b2 vaccine in April 2021. An estimated 5,289,724,918 doses of COVID–19 vaccine have been used worldwide by September 01, 2021; 57.5% of the population of Turkey having been vaccinated with at least one dose of the COVID–19 vaccine.<sup>5,6</sup>

This study analyzed the patients who reported to our tertiary care hospital emergency room (ER) with COVID–19 symptoms. The computed tomography (CT) findings, the reverse transcription–polymerase chain reaction (RT–PCR) positivity, vaccination and mortality status, and hospital processes of the patients were investigated. Hence, the association between vaccination and COVID–19 lung lesions was observed; furthermore, it was aimed to inspect the effectiveness of COVID–19 vaccines.

## 2. Methodology

### 1.1 Research Type

This study is cross–sectional, retrospective, and descriptive research, covering a period between June 08, 2021 to August 08, 2021.

The research sample was the patients who reported to the Sakarya Training and Research Hospital (SEAH) adult ER with COVID–19 signs and in whom a thoracic CT with CO–RADS score were done.

### 1.2 Definitions

Turkish Ministry of Health's vaccine application strategy practices CoronaVac vaccines in three doses at four–week intervals, and the BNT162b2 vaccine in two doses at the same intervals.<sup>7</sup> People could choose the BNT162b2 vaccine as their third vaccine if they had had two doses of CoronaVac vaccine.

RT–PCR was tested by taking oropharyngeal and nasopharyngeal combined swabs in all patients with COVID–19 signs.

The COVID–19 Reporting and Data System (CO–RADS) is a reliable radiological scoring system used to predict the severity of COVID–19 disease by interpreting thoracic CT findings.<sup>8</sup> It includes scores from one to five, which can be used primarily in the triage of suspected COVID–19 patients in the ER.<sup>9</sup>

Radiology physicians of a private company interpreted the CT images and reported the CO–RADS score. The CO–RADS scoring is interpreted as:

- CO–RADS 1: Very low suspicion,
- CO–RADS 2: Low suspicion,
- CO–RADS 3: Equivocal/element,
- CO–RADS 4: High suspicion,
- CO–RADS 5: Very high suspicion,
- CO–RADS 6: Proven.<sup>10</sup>

### 1.3 Inclusion Criteria

Patients aged 18 and over, with at least one COVID–19 symptom, reporting to the SEAH ER, who had a thoracic CT and CO–RADS score, and whose full clinical information could be accessed from the hospital automated record system.

### 1.4 Exclusion Criteria

Patients younger than 18 years old, pregnant ladies, and patients whose complete information was not available, were excluded from the study.

### 1.5 Data Collection

The data were retrieved from the hospital automation system regarding enrolled patients' gender, age, CO–RADS score, the name of the vaccine if used, the time between vaccination and admission to the ER, the number of vaccine doses, RT–PCR test results, hospitalization status, length of stay (LoS) in the hospital and the mortality status.

## 1.6 Statistical Analysis

The obtained data were analyzed with the IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp. Released 2012, Armonk, NY: IBM Corp.). Skewness and Kurtosis values were inquired to be in the range of  $-2/+2$  for the data to provide the normal distribution.<sup>11</sup> For comparison of categorical data chi-square test was utilized. An independent t-test was utilized to compare two independent data groups that were normally distributed, and the Mann-Whitney U test was used for those not normally distributed. A  $p < 0.05$  was considered statistically significant.

## 1.7 Permissions

For this research, permission was obtained from the hospital's chief physician, and the Scientific Research Platform of Turkey Health Ministry.

## 3. Results

In Sakarya Province, the first vaccination program started with CoronaVac on January 14, 2021 among healthcare workers, over 65 y, and high-risk patients with comorbidities; vaccination with the BNT162b2 was started after April 02, 2021. As of August 08, 2021, 425702 CoronaVac doses had been injected in Sakarya, and the number of those who received two vaccine doses was 191452. On the other hand, 491424 BNT162b2 doses were inoculated. The number of people who received two doses of BNT162b2 was 164099. Accordingly, the total BNT162b2 use was higher than the CoronaVac dose in Sakarya; but the number of people receiving two doses of CoronaVac was higher.

One hundred four cases were included in the study, of which 61 (58.7%) were male, and 43 (41.3%) were female. The patients' mean age was  $64.3 \pm 17.2$  y and ranged from 20 to 97 years. According to the Independent t-test result, the mean age of female patients (mean:  $67.9 \pm 18$  y) was higher than that of male patients (mean:  $61.7 \pm 16.4$  y), but there was no statistically significant difference [ $t(102) = -1.8, p = 0.071$ ].

Patient data by vaccination status are presented in Table 1.

Of the thoracic CTs taken in the ER, seven were interpreted as CO-RADS-1, eight as CO-RADS-2, 12 as CO-RADS-3, 17 of them as CO-RADS-4, and 60 as CO-RADS-5.

When the vaccination status was considered, no vital difference was observed between the genders of the patients who had never been inoculated and those who had at least one dose of vaccination ( $p = 0.298$ ). There was no significant variation in hospitalization between patients who were not vaccinated and those who received at least one dose of vaccine ( $p = 0.492$ ). In addition, no significant difference was observed between vaccinated and unvaccinated patients in terms of mortality and RT-PCR positivity ( $p = 0.107$  and  $p = 0.734$  respectively). There was statistically no notable difference between the LoS in the hospital between unvaccinated patients and vaccinated at least one dose ( $p = 0.074$ ). Notwithstanding, it was ascertained that the inoculated patients' average LoS in the hospital was more concise than unvaccinated cases, except for those with a single dose of the BNT162b2.

**Table 1: Comparison of vaccination and patients' status**

Parameters		No vaccine n (%)	1 x CoronaVac n (%)	1 x BNT162b2 n (%)	2 x CoronaVac n (%)	2 x BNT162b2 n (%)	3 x CoronaVac n (%)	2 x CoronaVac +1 x BNT162b2 n (%)
Hospitalization Status	Outpatient	7 (28)	2 (8)	0	11 (44)	0	3 (12)	2 (8)
	Inpatient	28 (35)	3 (4)	7 (9)	35 (44)	1 (1)	3 (4)	2 (3)
Mortality	No	26 (30)	4 (5)	7 (8)	38 (44)	1 (1)	6 (7)	4 (5)
	Yes	9 (50)	1 (6)	0	8 (44)	0	0	0
RT-PCR	Positive	23 (35)	3 (5)	4 (6)	31 (47)	0	4 (6)	1 (2)
	Negative	12 (32)	2 (5)	3 (8)	15 (39)	1 (3)	2 (5)	3 (8)
Mean Age		63.9	58.4	56.6	66.8	73	69.8	49.3
Mean LoS in Hospital		7.7	2.8	11.1	4.5	5	2.3	5.5
Days between last vaccination till the admission		-	41	60.6	58.6	103	3.2	1

Data shows patient numbers and the percentage in the same row; n (%)

**Table 2: Association of vaccination and RT-PCR result with CO-RADS score**

Vaccination Status	CO-RADS-1 N (%) <sup>a</sup>	CO-RADS-2 N (%) <sup>a</sup>	CO-RADS-3 N (%) <sup>a</sup>	CO-RADS-4 N (%) <sup>a</sup>	CO-RADS-5 N (%) <sup>a</sup>	Total N (%) <sup>a</sup>
No vaccine	2 (1.9)	3 (2.9)	3 (2.9)	6 (5.8)	21 (20.2)	35 (33.7)
1 x CoronaVac	1 (1)	0	1 (1)	0	3 (2.9)	4 (3.9)
1 x BNT162b2	1 (1)	0	1 (1)	0	5 (4.8)	6 (5.8)
2 x CoronaVac	1 (1)	4 (3.9)	5 (4.8)	9 (8.7)	27 (26)	46 (44.2)
2 x BNT162b2	0	1 (1)	0	0	0	1 (1)
3 x CoronaVac	1 (1)	0	1 (1)	1 (1)	3 (2.9)	6 (5.8)
2 x CoronaVac + 1 x BNT162b2	1 (1)	0	1 (1)	1 (1)	1 (1)	4 (3.9)
Total	7 (6.7)	8 (7.7)	12 (11.5)	17 (16.3)	60 (57.7)	104 (100)
RT-PCR result	+	2 (1.9)	4 (3.9)	6 (5.8)	14 (13.5)	40 (38.5)
	-	5 (4.8)	4 (3.9)	6 (5.8)	3 (2.9)	20 (19.2)

<sup>a</sup> It is the percentage value in all patients.

No significant difference was recognized between unvaccinated cases and immunized patients with two CoronaVac doses in terms of hospitalization, RT-PCR positivity and mortality ( $p = 0.675$ ;  $p = 0.874$  and  $p = 0.362$  respectively). Double CoronaVac vaccinated patients' LoS in the hospital was determined to be more succinct than cases who had never been inoculated ( $p = 0.045$ ).

It was observed that 18 of the CoronaVac vaccinated patients reported to the hospital within the first 24 hours after injecting the second vaccine dose. It typically requires two weeks after injection for the immunity against the virus that causes COVID-19.<sup>12</sup> Excluding patients admitted to the ER within two weeks of second-dose CoronaVac vaccination, the number of patients diagnosed with a preliminary diagnosis of COVID-19 and had a thoracic CT scan decreased to 28 people. It was determined that these patients reported to the ER after a mean of 96.2 ( $\pm 38.3$ , median of 100) days after the second CoronaVac dose.

The CO-RADS score and vaccination status of the patients are presented in Table 2. No patient with a score of CO-RADS 3-4-5 was detected among those injected with two doses of the BNT162b2. It was perceived that the number of RT-PCR positive patients increased as the CO-RADS value increased and RT-PCR positivity reached the highest number and rate in patients with CO-RADS-5. Consequently, it was recognized that inoculated patients with two CoronaVac doses had COVID-19 thoracic CT findings in the highest number and rate.

## 4. Discussion

Very small number of authentic trials have been conducted regarding COVID-19 vaccines, although a large number

of research papers have been published about the disease itself during the last two years. Fernando P. Polack et al. reported that people older than 16, who were vaccinated with two doses of BNT162b2 mRNA vaccine, were protected from COVID-19 at a rate of 95%.<sup>13</sup> Considering that the total number of BNT162b2 vaccines administered in Sakarya province is higher than CoronaVac, it would be remarkable that only one of the patients included in the study received two doses of BNT162b2 vaccine. This patient also reported to the ER 105 days after the second vaccination dose, and the thoracic CT result was CO-RADS 2. When the results of our study are analyzed, it can be thought that the BNT162b2 vaccine can provide better protection against lung lesions seen in CT of patient with two doses of vaccination.

There was no big difference in hospitalization, mortality, and RT-PCR positivity between patients vaccinated with two doses of CoronaVac and those who had never been vaccinated, which may lead to the thought that the CoronaVac vaccine was inefficient against COVID-19. This idea might be supported because two doses of Coronavac had the highest number of patients with CO-RADS 3 to 5 scores. However, these patients reported to the ER 96.2 days after the second dose, and that the vaccine's protective effect may have decreased with this time. Hongxing Pan et al. stated that it would be beneficial to have a third dose vaccination after six months from the second dose of CoronaVac.<sup>14</sup> Our study results confirmed that the third dose of the CoronaVac vaccine should be discussed to prevent lung lesions due to COVID-19, but it hinted that the six months might be prolonged.

CoronaVac vaccination of the older population and the long period after inoculation might have decreased the

effectiveness and protection of the vaccine. In addition, it should be remarked that only CoronaVac was injected into the elderly, all high–risk patients, during the first 78 days of the vaccination program. Nevertheless, Otavio T Ranzani et al. published that although two doses of CoronaVac vaccine reduced hospitalizations and mortality in patients aged 70 and over. However, the vaccine's effectiveness decreased as the patients' age increased.<sup>15</sup>

The low number of three–doses CoronaVac vaccinated patients or two doses of CoronaVac plus one dose of BNT162b2 could be interpreted as increasing the protective effect of the vaccines when three doses were applied, or it might also be due to the low number of patients vaccinated with three doses in the population during the study period.

RT–PCR positivity was primarily observed in those with a CO–RADS 4–5 score, and with this aspect, our study supports other published studies confirming the success of the CO–RADS scoring system in diagnosing COVID–19 disease.<sup>10,16,17</sup> In addition, it was determined that the CO–RADS score of the patients who were vaccinated twice with CoronaVac was the highest. On the other hand, the fact that people vaccinated with two doses of BNT162b2 occupied a low rate in our study inferred that the BNT162b2 vaccine was more protective against COVID–19 pneumonia.

Except for vaccinated with a single BNT162b2 dose, the LoS in the hospital was more precise in all vaccinated groups than unvaccinated patients. This situation might be because these patients reported to the ER 60 days after being inoculated; hence, it could be supposed that the vaccine's protective effect might have been reduced.

## 5. Limitation

The limitation of this study is that it was a single–center study, and many vaccinated patients might have reported to other hospitals.

## 6. Conclusion

Prolonged time after CoronaVac vaccination may reduce the vaccine's protective effect against COVID–19 pneumonia. The protection of two doses of BNT162b2 against COVID–19 pneumonia presents promise in the fight against the pandemic. CO–RADS–compliant pneumonia was less common in patients vaccinated with three doses of CoronaVac or two doses of CoronaVac plus one dose of BNT162b2 than those vaccinated with only two doses CoronaVac. Those vaccinated with at least two doses of CoronaVac or BNT162b2 had a shorter hospital stay than those not vaccinated. RT–PCR positivity may continue to be observed in vaccinated patients.

## 7. Conflict of interest

The authors have no conflict of interest in this study.

## 8. Financial disclosure

This research was not funded by any organization.

## 9. Authors' contribution

NA: Concept and design, Acquisition of data, Manuscript drafting, Final approval

ED: Conception and design, Acquisition of data, Analysis and interpretation of data, Manuscript drafting, Final approval

YY: Conception and design, Acquisition of data, Manuscript drafting, Critical revision, Final approval

NGG: Acquisition of data, Analysis and interpretation of data, Critical revision, Final approval

FG: Analysis and interpretation of data, Critical revision, Final approval

## 10. References

1. Bhavana V, Thakor P, Singh SB, Mehra NK. COVID–19: Pathophysiology, treatment options, nanotechnology approaches, and research agenda to combating the SARS–CoV2 pandemic. *Life Sci.* 2020 Nov 15;261:118336. [PubMed] DOI: [10.1016/j.lfs.2020.118336](https://doi.org/10.1016/j.lfs.2020.118336)
2. Zhao J, Zhao S, Ou J, Zhang J, Lan W, Guan W, et al. COVID–19: Coronavirus vaccine development updates. *Front Immunol.* 2020;11:602256. [PubMed] DOI: [10.3389/fimmu.2020.602256](https://doi.org/10.3389/fimmu.2020.602256)
3. Hodgson SH, Mansatta K, Mallett G, Harris V, Emary KRW, Pollard AJ. What defines an efficacious COVID–19 vaccine? A review of the challenges assessing the clinical efficacy of vaccines against SARS–CoV–2. *Lancet Infect Dis.* 2021 Feb;21(2):e26–35. [PubMed] DOI: [10.1016/S1473-3099\(20\)30773-8](https://doi.org/10.1016/S1473-3099(20)30773-8)
4. [T.R. Ministry of Health Covid–19 Vaccine Information Platform] T.C. Sağlık Bakanlığı Covid–19 Aşısı Bilgilendirme Platformu [Internet]. Turkey Vaccine Table. 2021 [cited 2021 Apr 30]. Available from: <https://covid19asi.saglik.gov.tr/>
5. WHO Coronavirus Disease (COVID–19) Dashboard [Internet]. [cited 2021 Jan 26]. Available from: <https://covid19.who.int>
6. Ritchie H, Mathieu E, Rodés–Guirao L, Appel C, Giattino C, Ortiz–Ospina E, et al. Coronavirus Pandemic (COVID–19). Our World Data [Internet]. 2020 Mar 5 [cited 2021 Sep 3]; Available from: <https://ourworldindata.org/covid-vaccinations>
7. [COVID–19 Vaccine National Implementation Strategy] COVID–19 Aşısı Ulusal Uygulama Stratejisi [Internet]. [T.R. Ministry of Health Covid–19 Vaccine Information Platform]T.C. Sağlık Bakanlığı Covid–19 Aşısı Bilgilendirme Platformu. 2021 [cited 2021 Apr 30]. Available from: <https://covid19asi.saglik.gov.tr/TR-77706/covid-19-asi-usul-uygulama-stratejisi.html>

8. Penha D, Pinto EG, Matos F, Hochegger B, Monaghan C, Taborda-Barata L, et al. CO–RADS: coronavirus classification review. *J Clin Imaging Sci*. 2021 Feb 15;11:9. [PubMed] DOI: [10.25259/JCIS\\_192\\_2020](https://doi.org/10.25259/JCIS_192_2020)
9. Lieveld AWE, Azijli K, Teunissen BP, van Haaften RM, Kootte RS, van den Berk IAH, et al. Chest CT in COVID–19 at the ED: Validation of the COVID–19 Reporting and Data System (CO–RADS) and CT Severity Score. *Chest*. 2021 Mar;159(3):1126–35. [PubMed] DOI: [10.1016/j.chest.2020.11.026](https://doi.org/10.1016/j.chest.2020.11.026)
10. Prokop M, van Everdingen W, van Rees Vellinga T, Quarles van Ufford H, Stöger L, Beenen L, et al. CO–RADS: A categorical CT assessment scheme for patients suspected of having covid–19—definition and evaluation. *Radiology*. 2020 Aug 1;296(2):E97–104. [PubMed] DOI: [10.1148/radiol.2020201473](https://doi.org/10.1148/radiol.2020201473)
11. George D, Mallery P. IBM SPSS statistics 25 step by step: a simple guide and reference. 15th ed. New York ; London: Routledge, Taylor & Francis Group; 2019. p.404.
12. CDC. COVID–19 Vaccination [Internet]. Centers for Disease Control and Prevention. 2020 [cited 2021 Sep 4]. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/keythingstoknow.html>
13. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al. Safety and Efficacy of the BNT162b2 mRNA covid–19 vaccine. *N Engl J Med*. 2020 Dec 31;383(27):2603–15. [PubMed] DOI: [10.1056/NEJMoa2034577](https://doi.org/10.1056/NEJMoa2034577)
14. Pan H, Wu Q, Zeng G, Yang J, Jiang D, Deng X, et al. Immunogenicity and safety of a third dose, and immune persistence of CoronaVac vaccine in healthy adults aged 18–59 years: interim results from a double–blind, randomized, placebo–controlled phase 2 clinical trial. *medRxiv*. 2021 Jul. DOI: [10.1101/2021.07.23.21261026](https://doi.org/10.1101/2021.07.23.21261026)
15. Ranzani OT, Hitchings MDT, Dorion M, D'Agostini TL, de Paula RC, de Paula OFP, et al. Effectiveness of the CoronaVac vaccine in older adults during a gamma variant associated epidemic of covid–19 in Brazil: test negative case–control study. *BMJ*. 2021 Aug 20;374:n2015. [PubMed] DOI: [10.1136/bmj.n2015](https://doi.org/10.1136/bmj.n2015)
16. Hermans JJR, Groen J, Zwets E, Boxma–De Klerk BM, Van Werkhoven JM, Ong DSY, et al. Chest CT for triage during COVID–19 on the emergency department: myth or truth? *Emerg Radiol*. 2020 Dec;27(6):641–51. [PubMed] DOI: [10.1007/s10140-020-01821-1](https://doi.org/10.1007/s10140-020-01821-1)
17. Fujioka T, Takahashi M, Mori M, Tsuchiya J, Yamaga E, Horii T, et al. Evaluation of the usefulness of CO–RADS for chest CT in patients suspected of having COVID–19. *Diagnostics*. 2020 Aug 19;10(9):608. [PubMed] DOI: [10.3390/diagnostics10090608](https://doi.org/10.3390/diagnostics10090608)