




Original Research

Risk Factor of Mortality Among Covid-19 Infected Doctor in East Java, Indonesia

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ARTICLE HISTORY

Received: 8 January 2022
Revised: 3 February 2022
Accepted: 22 February 2022

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KEYWORD

Risk factor; Mortality; Doctor; COVID-19; East Java



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ABSTRACT

Introduction: Doctors who died with COVID-19 were high and influenced by several factors. This study examined COVID-19 infected doctors and mortality risk factors in East Java.

Methods: This observational cohort study was conducted among doctors infected with COVID-19 in East Java during March 2020-September 2021 and collected the COVID-19 infected doctors' deaths report. Doctors received questionnaire on the status of COVID-19, history of infection, age, sex, type of doctor, type of specialization and resident, pregnancy, underlying disease and nutritional status. The doctors were followed up their COVID-19 condition. Data were described, and the association of potential risk factors was analyzed using univariate and multivariate analysis.

Result: We reported 2041 doctors infected with COVID-19. Majority of them was male, 162 doctors were more than 59 years old, 162 doctors (7,9%) were died. The odds ratio in each risk factor for mortality was older age doctors 15,468 (95% CI 10,587-22,601), male 6,128 (95% CI 3,906-9,614), general practitioner 2,461 (95% CI 1,769-3,423), doctors with underlying disease 39,842 (95% CI 23,077-68,798), Type II diabetes mellitus 82,504 (95% CI 42,767-159,162), cardiovascular disease 50,152 (95% CI 16,672-150,866), hypertension 19,425 (95% CI 10,528-35,840), chronic obstructive pulmonary disease 5,52 (95% CI 0,610-49,992), obesity 30,750 (95% CI 15,293-61,828) and Pregnant doctors 43,013 (95% CI 10,986-168,414) ($p < 0,05$). However, COPD and asthma showed not significant result in multivariate analysis.

Conclusion: Older age, male, general practitioner, doctors with underlying disease, cardiovascular disease, Type II diabetes mellitus, hypertension, obesity, pregnant doctors had been mortality risk factors among COVID-19 infected doctors

Cite this as: Sutrisno S, Romdhoni AC, Shoifi M, et al. Risk Factor of Mortality Among Covid-19 Infected Doctor in East Java, Indonesia (2022) *Asian J Heal Res.* 1(1):18-25. doi: <https://doi.org/10.55561/ajhr.v1i1.4>

INTRODUCTION

Until 29 September 2021, 233.739.792 Coronavirus Disease 2019 (COVID-19) cases have been reported since the first report at the end of December 2019 from Wuhan, China. SARS-CoV-2 had spread rapidly in all countries worldwide. The report showed 210.578.040 recovered cases and 4.782.139 deaths with COVID-19

worldwide[1, 2]. East Java had been the epicenter of the COVID-19 pandemic in Indonesia. It has been contributed to 29.404 deaths (case fatality rate: 7,44%) of 141.826 deaths in Indonesia[3]. Data on Indonesian Medical Association member directory showed 19.671 doctors In East Java until 29 September 2021[4].

However, doctors still contributed to a relatively high mortality rate in Indonesia compared to other

healthcare workers. The Indonesian medical association medic mitigation team reported 730 deaths among doctors in Indonesia with COVID-19. Based on their survey, 385 (52,7%) general practitioners died and 51,6% specialization doctors, of which 51 were obstetrics and gynecology specialists[5]. This mortality rate among doctors is constantly increasing in some countries. A previous study described men, the elderly, hypertension, type II diabetes mellitus, cardiovascular disease as the most prevalent risk factor in COVID-19 comorbidity and mortality[6–9].

However, there was limited previous research and report on COVID-19 infected doctors and the association between each type of risk factor with mortality in COVID-19. This study aimed to examine and report doctors infected with COVID-19 infected doctors and the mortality risk factor in East Java, Indonesia, and hope that doctors' death rate will not increase and raise awareness among doctors, especially in East Java, Indonesia.

MATERIAL AND METHODS

Study Design

This observational cohort study was conducted among doctors infected with COVID-19 in East Java during March 2020- 20 September 2021. We collected COVID-19 infected doctors' deaths reports during this study. The Medical Mitigation team of the Indonesian Medical Association East Java Region gave a questionnaire to all doctors in East Java through each branch of the Indonesia Medical Association and other societies. This questionnaire consisted of COVID-19 status (infected, post-infected, never infected), age (male, female), sex, living place, type of doctors (general practitioner, specialization doctor, resident doctor), type of specialization, type of resident, underlying disease, number of underlying diseases, pregnancy status, nutritional status (overweight, obesity, normal) and given to doctors during June-September 2021. All underlying diseases (diabetes mellitus type II, hypertension, cardiovascular disease, and others) were gathered.

Moreover, we added covid-19 infected data from our medic mitigation team, who routinely actively collects data from each branch of the Indonesian Medical Association and other societies. We also collected covid-19 infected deaths doctors from March 2020 until September 2021 and extracted the same data in the questionnaire. The doctors were followed up about their COVID-19 infection until the end of study. SARS-CoV-2 infection was determined based on the Indonesian Health Ministry COVID-19 guidelines using a positive result of reverse transcriptase-polymerase chain reaction and rapid antigen for SARS-CoV-2 and met the

requirements as a probable or suspect case of asymptomatic case.

This study had been approved by Health Research Ethical Committee Brawijaya University, Malang.

Statistical analysis

All data were described in the table. Categorical variables were reported as frequencies and numbers. Univariate analysis of categorical variables was analyzed using Chi-square test and followed with Odds ratio (OR) with 95% confidence interval (CI) to report the association from each type of risk factors and mortality, followed with multivariate analysis between variables. Statistical analysis was performed using SPSS version 20.0 for windows.

RESULT

Demographic data of doctors

A total of 2041 doctors (10,4% of total East Java doctors) reported being infected with COVID-19 during March 2020-20 September 2021. Among them, 162 doctors died with COVID-19, mean age 40 ± 12 , 1072 were males and general practitioner 41,4%. From the data, 698 (34,2%) doctors live in Surabaya, followed by 266 doctors from Malang Raya (Kota and Kabupaten Malang, Kota Batu) and 95 doctors from Sidoarjo. Among the 1736 underlying disease data, 163 doctors had underlying disease and the common underlying disease hypertension 3,1% and type II diabetes mellitus 3%. Sixteen female doctors with pregnancy and 38 obese doctors (Table 1).

Demographic data of resident, specialist doctor, and general practitioner

There were 845 general practitioners infected with COVID-19 and the highest death rate was general practitioners 11,8%. General practitioners had more female doctors infected with COVID-19. Most COVID-19 infected specialist doctors were obstetrics and gynecology doctors, followed by orthopedic and traumatology doctors. Meanwhile, in resident doctors, internal medicine is the most infected. Compared to others, 11% of general practitioners showed minimal one underlying disease. The most underlying disease in general practitioners and specialists was type II diabetes mellitus and hypertension. Meanwhile, in resident doctors, asthma and hypertension showed a higher prevalence (Table 2).

Risk factor for mortality among doctors

The highest odds ratio data for each risk factor for mortality was Type II diabetes mellitus, followed by cardiovascular disease, female doctors with pregnancy and was described in Table 3. The multivariate analysis showed significant results were age, male, general

Table 1. Demographic data of COVID-19 infected doctors in East Java, Indonesia

	Characteristic	N (%)
Age		40±12*
Age Group	< 60 years old	1879 (92.1)
	60+ years old	162 (7.9)
Sex	Male	1072 (52.5)
	Female	969 (47.5)
Condition	Deaths	162 (7.9)
	Recovered	1879 (92.1)
Type of doctor	General Practitioner	845 (41.4)
	Specialist doctor	579 (28.4)
	Resident doctor	617 (30.2)
Living place	Bangkalan	44 (2.2)
	Banyuwangi	62 (3.2)
	Blitar Kabupaten	25 (1.2)
	Blitar Kota	15 (0.7)
	Bojonegoro	28 (1.4)
	Bondowoso	17 (0.8)
	Gresik	48 (2.4)
	Jember	23 (1.1)
	Jombang	43 (2.1)
	Kediri Kabupaten	19 (0.9)
	Kediri Kota	33 (1.6)
	Lamongan	31 (1.5)
	Lumajang	15 (0.7)
	Madiun	62 (3)
	Magetan	7 (0.3)
	Malang Raya	266 (13)
	Mojokerto	75 (3.7)
	Nganjuk	18 (0.9)
	Ngawi	4 (0.2)
	Pacitan	35 (1.7)
	Pamekasan	22 (1.1)
	Pasuruan Kabupaten	7 (0.3)
	Pasuruan Kota	45 (2.2)
	Ponorogo	41 (2)
	Probolinggo Kabupaten	23 (1.1)
	Probolinggo Kota	3 (0.1)
	Sampang	38 (1.9)
	Sidoarjo	91 (4.5)
	Situbondo	4 (0.2)
	Sumenep	51 (2.5)
	Surabaya	698 (34.2)
	Trenggalek	47 (2.3)
	Tuban	36 (1.8)
	Tulungagung	62 (3)
Nutritional status (N = 1726)	Overweight	20 (1.2)
	Obesity	38 (2.2)
	Normal	1668 (96.6)
Pregnancy status	Yes	16 (1.7)
	No	953 (98.3)
Underlying disease (N=1736)	No Underlying disease	1573
	1 underlying disease	128
	2 underlying diseases	28
	3 underlying diseases	6
	4 underlying diseases	1
Underlying disease	Yes	163 (9.4)
	No	1573 (90.6)
Hypertension	Yes	53 (3.1)
	No	1683 (96.9)
Diabetes Mellitus Type II	Yes	52 (3)
	No	1684 (97)
Asthma	Yes	35 (2)
	No	1701 (98)
Cardiovascular disease	Yes	15 (0.9)
	No	1721 (90.1)
Chronic Obstructive Pulmonary Disease	Yes	5 (0.3)
	No	1731 (99.7)

Table 2. Demographic and characteristic data of residents, specialist doctors and general practitioners infected with COVID-19

	Resident doctor (n=617)	Specialist doctor (n=579)	General Practitioner (n=845)
Age	31.6 ±3.5	49±11.1	40.1±12.1
Recovered	613 (99.4)	521 (90)	745 (88.2)
Deaths	4 (0.6)	58 (10)	100 (11.8)
Male	318 (51.5)	386 (66.6)	369 (43.7)
Female	299 (48.5)	194 (33.4)	476 (56.3)
Living place			
Surabaya	431 (69.9)	207 (35.8)	61 (7.2)
Malang Raya	186 (30.1)	54 (9.3)	23 (2.7)
Sidoarjo		25 (4.3)	66 (7.8)
Others		293 (50.6)	695 (82.3)
Specialization type			
Pediatrics	34 (5.5)	49 (8.5)	
Andrology	5 (0.8)	1 (0.2)	
Anesthesiology and Reanimation	32 (5.2)	34 (5.9)	
Pediatric Surgery	2 (0.3)	4 (0.7)	
Plastic Reconstructive Surgery and Aesthetics	16 (2.6)	3 (0.5)	
Neurosurgery	30 (4.9)	15 (2.6)	
Cardio-Thoracic Surgery	17 (2.8)	3 (0.5)	
General surgery	28 (4.5)	39 (6.8)	
Emergency medicine	2 (0.3)	3 (0.5)	
Clinical Pharmacology	14 (2.3)	1 (0.2)	
Forensic Medicine and Medicolegal	36 (5.8)	4 (0.7)	
Cardiology and Vascular Medicine	22 (3.6)	27 (4.7)	
Physical medicine and rehabilitation	14 (2.3)	16 (2.8)	
Psychiatry	22 (3.6)	14 (2.4)	
Dermatovenerology	24 (3.9)	18 (3.1)	
Ophthalmology	11 (1.8)	36 (6.2)	
Clinical Microbiology	23 (3.7)	3 (0.5)	
Obstetrics and Gynecology	40 (6.5)	75 (13)	
Orthopedics and Traumatology	15 (2.4)	59 (10.2)	
Clinical Parasitology	14 (2.3)	1 (0.2)	
Pulmonology	37 (6.0)	22 (3.8)	
Anatomical Pathology	67 (10.9)	10 (1.7)	
Clinical pathology	22 (3.6)	23 (4.0)	
Internal Medicine	30 (4.9)	38 (6.6)	
Radiology	31 (5)	21 (3.6)	
Neurology	28 (4.5)	36 (6.2)	
Otolaryngology (ears, nose, throat) and HN (head-neck)		15 (2.6)	
Urology		9 (1.6)	
Nutritional status			
Obesity	12 (2.9)	9 (1.7)	15 (1.9)
Overweight	6 (1.5)	6 (1.1)	8 (1)
Normal	389 (95.6)	525 (97.2)	766 (97.1)
Pregnancy Status			
Yes	3 (1)	0 (0)	13 (2.7)
No	296 (99)	194 (100)	463 (97.3)
Underlying Disease	N=407	N=540	N=789
Yes	26 (6.4)	52 (9.6)	87 (11)
No	381 (93.6)	488 (90.4)	702 (89)
Underlying Disease			
1 Underlying Disease	21 (5.2)	39 (7.2)	69 (8.7)
>1 Underlying Disease	5 (1.2)	12 (2.3)	18 (2.2)
No	381 (93.6)	488 (90.4)	702 (89)
Hypertension			
Yes	2 (0.5)	21 (3.9)	30 (3.8)
No	405 (99.5)	519 (96.1)	759 (96.2)
Diabetes Mellitus Type II			
Yes	0	21 (3.9)	31 (3.9)
No	407 (100)	519 (96.1)	758 (96.1)
Asthma			
Yes	13 (3.2)	8 (1.5)	14 (1.8)
No	394 (96.8)	532 (98.5)	775 (98.2)
Cardiovascular disease			
Yes	0	6 (1.1)	9 (1.1)
No	407 (100)	534 (98.9)	780 (98.9)
Chronic Obstructive Pulmonary Disease			
Yes	0	1 (0.2)	4 (0.5)
No	407 (100)	539 (99.8)	785 (99.5)

Table 3. Risk factor of mortality among COVID-19 infected doctors (Univariate analysis)

Risk factor	Deaths (n=162)	Recovered (N=1879)	P value	Odds Ratio
Age Group				
60+ years old	86	69	<0.001	15.468 (10.587 – 22.601)
<60	93	1793		
Age				
Male	139	933	<0.001	6.128 (3.906-9.614)
Female	23	946		
Type of doctor				
Specialist doctor	58	52	0.036	1.450 (1.035-2.030)
General Practitioner	100	744	<0.001	2.461 (1.769-3.423)
Living place				
Surabaya	42	656	0.020	0.653 (0.453-0.939)
Underlying disease				
Yes	56	107	<0.001	39.842 (23.0773-68.798)
Hypertension	21	32	<0.001	19.425 (10.528-35.840)
Type II diabetes mellitus	35	17	<0.001	82.504 (42.767-159.162)
Cardiovascular Disease	10	5	<0.001	50.152 (16.672-150.866)
Chronic obstructive pulmonary disease	1	4	<0.001	5.520 (0.610-49.992)
Asthma	3	32	<0.001	2.091 (0.626-6.986)
Obesity	18	20	<0.001	30.750 (15.293-61.828)
Pregnancy				
Yes	4	11	<0.001	43.013 (10.986-168.414)
No	7	828		
Obstetrics and gynecology specialist				
Yes	11	64	0.152	1.671 (0.824-3.388)
No	47	457		
Paediatric specialist				
Yes	7	42	0.317	1.565 (0.669-3.665)
No	51	479		
Orthopedics dan Traumatology specialization				
Yes	4	55		
No	54	466	0.496	0.628 (0.219-1.800)

Table 4. Multivariate Analysis of Risk Factor

Risk Factor	p
Age group (>60)	0.000
Male	0.000
General Practitioner	0.000
Surabaya – Living Place	0.020
Hypertension	0.000
Type II Diabetes Mellitus	0.000
Cardiovascular Disease	0.000
Chronic obstructive pulmonary disease	0.391
Asthma	0.081
Pregnancy	0.001
Obesity	0.000
Overweight	0.000

practitioner, Surabaya, hypertension, diabetes mellitus type II, cardiovascular disease, pregnancy, obesity, and overweight. Meanwhile, chronic obstructive pulmonary disease and asthma showed non-significant result ($p>0,05$) (Table 4).

DISCUSSIONS

During our investigation, we discovered that 2041 doctors were infected with COVID-19. According to the report, 10,4% of all doctors in East Java were infected. This finding was consistent with a recent study that found 9% of healthcare workers were infected with COVID-19 and had a relative risk of developing severe

COVID-19 6.19 (95%CI 3.68-10.43)[10]. Unlike earlier findings of Bandyopadhyay et al., their findings indicated that infections were primarily in male doctors[11]. General practitioners were vulnerable to COVID-19 infection because of their scope of practice, extended working hours during the COVID-19 pandemic, and inappropriate personal protective equipment (PPE), sometimes reusing PPE during the pandemic. There have been several reports of inappropriate PPE (surgical mask, sometimes no PPE) and long periods of removing the mask while practicing in a hospital or other health facility and during large-scale community activities[12–14].

This study also identified that obstetrics and gynecology specialists showed a higher number of infected doctors because they had a higher number of patients during the COVID-19 pandemic and urgent surgery with a longer operation time but were frequently unaware of their patients COVID-19 status[15]. Interestingly, it was also observed that the internal medicine resident had a greater infection rate than the other resident. They became the primary doctor in charge of treating COVID-19 patients with pulmonology and anesthesiology residents during the residency program. However, social behavior among these residents could differ the rates.

We discovered a higher case fatality rate than a previous study that estimated the case fatality rate in South-East Asia at 0,20%. Their report, however, was conducted during the early phase of the covid-19 pandemic until May 2020, when COVID-19 transmissibility in Indonesia was still low[11] According to our previous data, 60 doctors died of COVID-19 in July 2021, with more infected doctors with COVID-19 during that period. The delta variant COVID-19 spread rapidly from June to August 2021 in East Java, decreasing the number of referral hospitals and COVID-19 ICU beds. Doctor carelessness after vaccination was one of the main reasons for this condition[16, 17]. Delta COVID-19 variants were resistant to neutralization by specific monoclonal antibodies, resulting in impaired spike protein binding and COVID-19 vaccination. Furthermore, this caused an increase in the rate of mortality and hospitalization[18, 19].

Our data identified older age, male, general practitioners, doctors with underlying disease, Type II diabetes mellitus, cardiovascular disease, hypertension, chronic obstructive pulmonary disease, asthma, obesity and pregnancy doctors as mortality risk factors among COVID-19 infected doctors. These findings align with those obtained by Kambhampati et al., who found that obesity, hypertension, type II diabetes mellitus, and cardiovascular disease were associated with greater hospitalization rates and mortality. While a study in Italy, older age, male sex, chronic obstructive pulmonary disease, type II diabetes mellitus were risk factors for mortality in Intensive care unit patients. [6, 20]. Male patients were anticipated to have higher Angiotensin-converting enzyme 2 expressions, which had an important role in SARS-CoV-2 entry in humans and was regulated by sex hormone and coded by the X-chromosome, leading to a higher infection rate and mortality [21–23]. Older age was associated with decreased natural immunity to COVID-19 infection and reduced in organ function due to their underlying disease [24, 25].

Meanwhile, each type of underlying disease may be related to increased mortality, with its mechanism, polypharmacy therapy usage, and impaired immune

function. Hypertension, cardiovascular disease, and type II diabetes mellitus up-regulate ACE-2 (SARS-CoV-2 binds to its target cells through this enzyme) in several organs and blood vessels, particularly in ACE inhibitors and angiotensin II receptor blockers (ARBs) therapy. This type of patient has a higher risk of developing severe COVID-19[26, 27].

Obesity is associated with underlying diseases and multiple cardiovascular risk factors through increased thrombogenicity and immunological hyper-reactivity, resulting in severe COVID-19 and increasing basal inflammatory status of Interleukin-6 and C-Reactive protein. Most studies reported obesity as a risk factor for prolonged hospitalization and admission to the critical care unit. [28–30]. Pregnant women are more susceptible to infection due to physiological change in T-Helper 1 cell, which produces cytokines such as interferon-gamma, certain interleukins, Th-2 change and transforming growth factor causing an immunosuppressive state that susceptibility to intracellular pathogens. Furthermore, adaptive conditions in pregnancy, such as increased oxygen consumption, limited lung expansion, and edema of the respiratory tract mucous membrane from the respiratory tract facilitate hypoxia. According to our data, pregnant doctors still work during the covid-19 pandemic, although they had reduced their working hours. Moreover, COVID-19 treatment in pregnancy was challenging due to their limitation in medication choices such as antiviral, antibiotic, symptomatic, emergency drugs, oxygenation, and other treatments[31–33]. It is strongly advised to improve obesity to normal nutritional status and treat the underlying disease adequately.

There were some limitations to this investigation. Some data were not thoroughly obtained from the underlying disease until nutritional status. This report could be underreported if doctors did not report themselves to the medic mitigation team. Future study needs to deepen other demographic and clinical factors.

CONCLUSION

In conclusion, older age, male, general practitioner, specialist doctor, doctors with underlying disease, cardiovascular disease, Type II diabetes mellitus, hypertension, obesity, pregnant doctor have been mortality risk factors among COVID-19 infected doctors. This study warned East Java doctors about their underlying diseases and risk factors for reducing their work hours, compliance with using the proper PPEs and living a healthy lifestyle.

ACKNOWLEDGMENTS

We want to thank those who supported this study and helped collect data, particularly the medic mitigation team Indonesian Medical Association East Java Region, and each branch and society in East Java, Indonesia.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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