

Cardiopulmonary Resuscitation Techniques in the COVID-19 Pandemic Era: Literature Review

Arista Maisyaroh¹, Syaifuddin Kurnianto¹, Eko Prasetya Widiyanto¹, Primasari Mahardika Rahmawati¹, Retno Sari Nurhabibah¹

¹Nursing Diploma Program, Faculty of Nursing, Universitas Jember, Lumajang, Indonesia

Correspondence should be addressed to:
Arista Maisyaroh
aristamaisyaroh@unej.ac.id

Abstract:

Cardiac resuscitation in the era of the COVID-19 pandemic meets its challenges; in addition to the high prevalence of cardiac and pulmonary arrest events in these patients, the transmission rate to health workers who carry out CPR assistance is also relatively high. Therefore, it is necessary to develop CPR techniques in COVID-19 patients that can increase the success of CPR and reduce transmission rates. The purpose of the study was to explain how CPR techniques are in COVID-19 patients. The literature review method through data collection with an electronic database and evaluation of the literature review will use Critical Appraisal to test validity. Data collection with electronic databases was conducted through PubMed, Taylor & Francis, and Google Scholar with the keyword "CPR," "COVID-19," and "technique." The data was successfully collected in the database of 548 articles then filtered the inclusion and exclusion criteria into ten pieces; then the article passed the Critical Appraisal test. The results of the CPR Technique Literature Review for covid patients added are the use of level C/3 PPE, PPE must be worn during CPR for patients with the confirmed or suspected transmission of COVID-19 infection, but the use of PPE during chest compressions is not associated with a decrease in the speed or depth of compressions chest; recommended compression depth is 2-2.4 inches (5-6cm); manual chest compressions have been described as effective when given in the center of the chest, at a rate of 100-120 minutes.

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INTRODUCTION

December 2019, in the city of Wuhan (China) the first time COVID-19 was discovered. SARS and MERS are the causes of the Coronavirus. In some cases, the virus only causes mild respiratory infections such as the flu. However, the virus can also cause serious respiratory infections such as pneumonia (pneumonia). This virus is transmitted from human to human through common routes such as direct transmission, contact transmission, airborne transmission via aerosols and during medical procedures. Examples of common spread include coughing, sneezing, contact with the mucous membranes of the mouth, eyes, and nose.

According to reports as of September 8, 2021, the number of Covid-19 cases has reached 221,14,742 cases worldwide with 4,574,089 deaths worldwide exposed to Covid-19. While in Indonesia there are 4,147,365 people, East Java is one of the provinces exposed to Covid-19 with a total of 3,886.65, especially in Lumajang Regency with 8579 confirmed cases and a death rate of 911 people (Astuti & Rahmawati, undated) until May. more than 5 million people from 200 countries around the world, causing more than 300,000 deaths. There were 23,165 cases with a

death rate of 1418 people in Indonesia as of May 26, 2020, this made Indonesia the country with the highest CFR death rate of 6.12% (case fatality rate) in ASEAN.

Based on data published by WHO, there are several variants of SARS CoV2 that cause covid-19. The two variants are related variants (VOC) and target variants (VOI). Manifestations of Covid-19 infection can cause acute respiratory distress syndrome and/or multi-organ failure and death (Lippi, Lavie, & Sanchis-Gomar, 2020; Mattiuzzi & Lippi, 2020). The most common symptoms of Covid-19 are non-specific and mainly include fever, cough and myalgias. As for other mild symptoms such as sore throat, headache, chills, diarrhea, nausea, or vomiting. Clinically, Covid-19 is categorized as mild to moderate disease (non-pneumonia and pneumonia). There are signs and symptoms of severe disease, such as shortness of breath, respiratory rate of more than 30 x/minute, SPO2 less than 95%. The first aid performed with BHD is patient and lung ventilation (CPR) (Wilistuti, Anna, & Mirwanti, 2018).

The ability to perform high-quality CPR is an important element in the management of patients with sudden cardiac arrest, directly affecting survival and reducing neurologic losses. during the current SARS-CoV-2 pandemic, many patients were infected or suspected of SARS, so the use of PPE was necessary and had to be worn during CPR for patients with confirmed or suspected transmission of COVID-19 infection, but according to previous studies the use of PPE during chest compressions was not associated with decreased rate or depth of chest compressions. Cardiopulmonary Resuscitation (CPR) is a process of restoring respiratory and circulatory functions in patients who have experienced respiratory and cardiac arrest and are not expected to die at this time. Cardiac arrest is a palpable large pulse (carotid artery, femoral artery) with a bluish color (cyanosis), respiratory arrest, or the pupils do not dilate because they do not respond to light stimulation and the patient is unconscious. Cardiopulmonary resuscitation (CPR) that is effective is to use compression followed by ventilation. This action can be carried out by people who have expertise in the health sector. Primary respiratory arrest can be caused by many things, for example drug poisoning, drowning, inhaling smoke/vapors/gas, obstruction of the airway by foreign objects, electric shock, lightning strikes, and other trauma. Respiratory arrest is indicated by movement of the victim's chest and a lack of airflow for breathing.

The purpose of this study is to explain how the CPR technique works in COVID 19 patients. while CPR is of high weight in the following conditions, namely with a speed boost at 100-120x/minute, and a strong push at a depth of 5-6 cm. The prone position is recommended for severe hypoxemic respiratory failure, based on clinical trial data showing reduced mortality with this treatment. Its use has increased since the Covid-19 pandemic for patients with acute respiratory distress syndrome (ARDS) and severe hypoxaemia.

It is supported by findings that Indonesia has the highest mortality rate (6.12%) among Southeast Asian countries (Atmojo et al., 2020). Meanwhile, during a pandemic, health workers are vulnerable to transmission even when using personal protective equipment (PPE) (Christian et al., 2004). Given the transmission is through droplets or airflow so that it spreads quickly which requires controlling the source of infection (Atmojo et al., 2020; Kombong & Hatala, 2021). The findings proved that nurses in the room were exposed to this virus after carrying out this action (SungNam & YoungHong, 2017). This is because during the one-hour procedure, there are several splashed aerosols coupled with position adjustments and sweat wipes (Atmojo et al., 2020). Ambon City is the provincial capital as well as a port, tourism, and education center so that the spread ranges. Report from the Gugus Team, Ambon City is exposed to this disease as much as 88.33% so it is still in the red zone (Task Force for the Acceleration of Handling COVID 19). The purpose of the study was to explain CPR techniques in COVID-19 patients.

METHOD

A literature review search is a thorough summary of several research studies determined by a particular theme. The data used in this study uses secondary data obtained through previous researchers. Data collection methods with electronic databases were carried out through PubMed, Tailor & Francis, and Scholar. Keywords or keywords used to find sources by using clinical information search for the intended source in the form of Booleans consisting of (AND, OR, and NOT), which aim to filter and narrow the search so that it makes it easier to choose the intended source of the journal article. Search for articles in English relevant to the topic electronically using several databases, namely PubMed, Tailor & Francis, and Google Scholar, through the "CPR" AND "COVID-19" AND "TECHNIQUE" keywords.

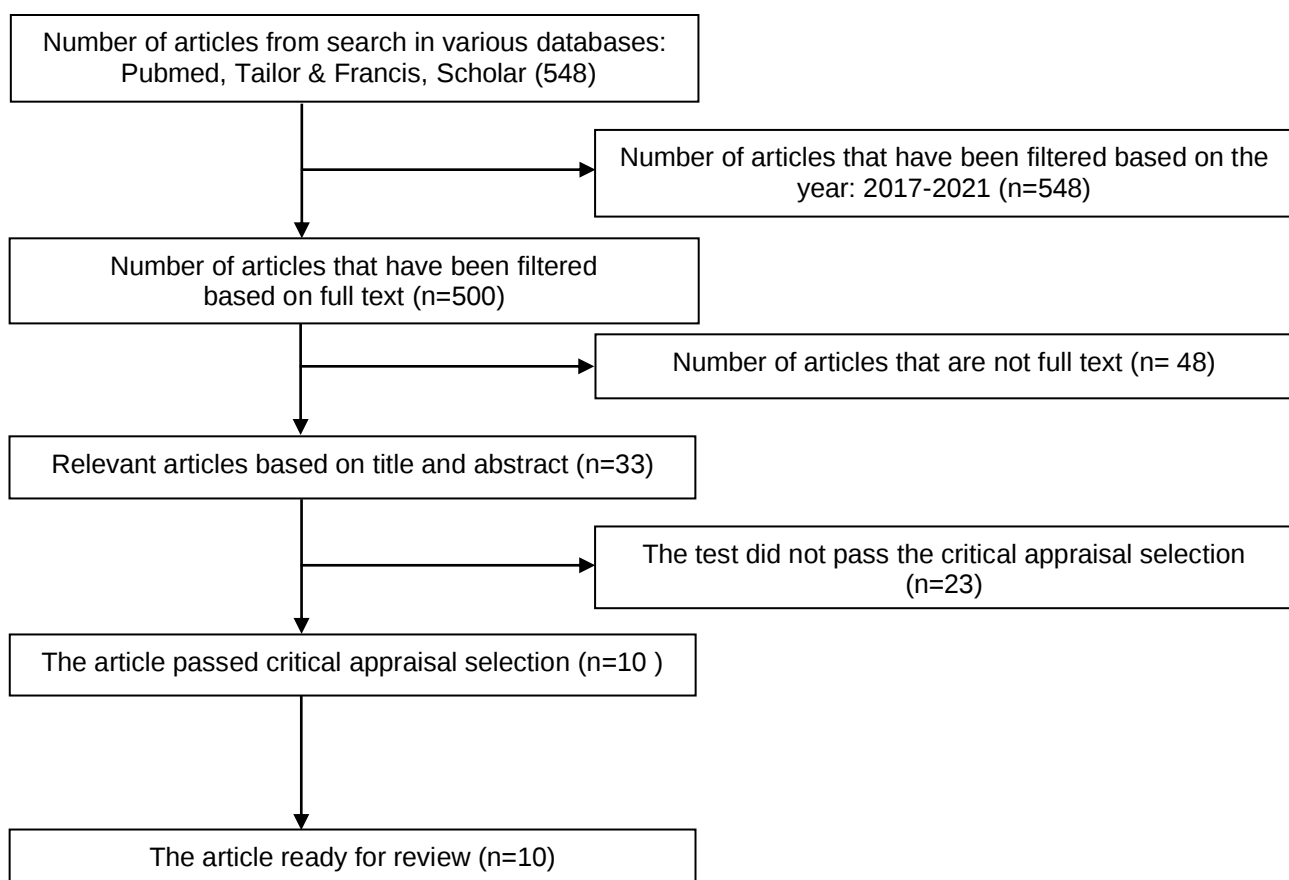


Figure 1. Flow Chart and Search Outcomes

RESULT

General Research Characteristics

The results of searching, selecting and assessing the quality of the literature obtained as many as 10 (ten) journals/articles that carried out literature reviews. Of the ten journals/articles, research was conducted in 7 (seven) countries, including Italy research (Moscarelli et al., 2020), Poland 2 studies (Moscarelli et al., 2020) and (Małysz et al., 2020), Austria 2 studies (Kienbacher et al., 2022) and (Kienbacher et al., 2021), Chinese research (Cui and Jiang, 2021), Australian 2

studies (Couper et al., 2020) and (Ha, 2020), Indonesian research (Nabilah and Sonia, 2021), and Pakistan with research (Ali et al., 2021).

Characteristics of Research Respondents by Gender

Table 1. Distribution of Respondents by Gender

No	Author	Respondents	Male	Female
1	Moscarelli et al. (2020)	36	-	-
2	Malysz et al. (2020)	35	-	-
3	Kienbacher et al. (2022)	48	-	4
4	Cui and Jiang (2021)	258	60	-
5	Kienbacher et al. (2021)	48	-	-
6	Malysz et al. (2020)	67	-	25
7	Couper et al. (2020)	1.141	-	-
8	Nabilah and Sonia. (2021)	-	-	-
9	Ali et al. (2021)	-	-	-
10	Ha (2020)	-	-	-
Total		1.633	60	29

*In the study (Nabilah and Sonia, 2021; Ali et al., 2021; Ha, 2020) did not mention the number of respondents.

**In the study (Cui and Jiang, 2021), the only article mentioning the gender of the respondent was male, and in research (Kienbacher et al., 2022; Malysz et al., 2020), articles that mention the respondent's gender is female.

Based on table 1, it is known that the number of respondents was 1.633 respondents, with male respondents 60 and female respondents 29.

The Use of Personal Protection Equipment (PPE) in Cardiopulmonary Resuscitation Techniques in the Era of the COVID-19 Pandemic

Table 2. Use of PPE in CPR Techniques in the Era of the COVID-19 Pandemic

No	Author	Level	PPE
1	Moscarelli et al. (2020)	-	-
2	Malysz et al. (2020)	-	FFP2 mask, goggles and visor, gloves nitrile hands
3	Kienbacher et al. (2022)	-	protective gowns, masks, gloves, eye protection
4	Cui and Jiang (2021)	Level C / Level 3	protective gowns, masks, gloves, eye protection
5	Kienbacher et al. (2021)	-	FFP 1, 2, 3
6	Malysz et al. (2020)	-	FFP1 filter mask, goggles, visor, double nitrile gloves
7	Couper et al. (2020)	-	N95 mask, gloves, eye protection.
8	Nabilah and Sonia (2021)	Level 3/ Level C	Goggles, face shields, head cover/headcap, N95 mask, handshake, cape/hazmat, and gaiters/boots
9	Ali et al. (2021)	-	-
10	Ha (2020)	Level 2/ Level B	Fluid-resistant surgical gown, head covering covering the neck and N95

*In research (Moscarelli et al., 2020; Ali et al., 2021) did not mention what level and use of PPE.

Based on table 2, it explains that the PPE used in cardiopulmonary resuscitation techniques in the era of the covid-19 pandemic uses Level C / Level 3, namely in research (Cui and Jiang, 2021; Nabilah and Sonia., 2021) using Level B / Level 2 in research (Ha, 2020). Meanwhile, other studies did not include the level of PPE used.

Depth of Chest Compressions in the Era of the COVID-19 Pandemic

Table 3. Depth of chest compressions during the Covid-19 pandemic

No	Author	Respondents
1	Moscarelli et al. (2020)	5-6 cm
2	Malysz et al. (2020)	50-60 mm
3	Kienbacher et al. (2022)	-
4	Cui and Jiang (2021)	1,3 inches
5	Kienbacher et al. (2021)	-
6	Malysz et al. (2020)	50-60 mm
7	Couper et al. (2020)	-
8	Nabilah and Sonia (2021)	-
9	Ali et al. (2021)	36-57 mm
10	Ha (2020)	-

*In studies (Kienbacher et al., 2022; Kienbacher et al., 2021; Couper et al., 2020; Nabilah and Sonia., 2021; Ha, 2020) did not mention the depth of cardiac compression.

Based on table 3 it is known that research (Malysz et al, 2020) chest compression depth is 50-60 mm, in research (Mocarelli et al, 2020) with a depth of 5-6 cm, in research (Cui and jiang, 2021) with a depth of 1.3 mm, in research (Ali et al, 2021) with a depth of 36-57 mm, whereas in studies (Kienbacher et al, 2022; Kienbacher et al, 2021; Couper et al, 2020, Nabilah and Sonia, 2021; Ha, 2020) does not include depth when perform chest compressions on patients suspected of Covid-19.

Speed of Chest Compressions in the Era of the COVID-19 Pandemic

Table 4. Speed of chest compressions during the Covid-19 pandemic

No	Author	Respondents
1	Moscarelli et al. (2020)	100-120 x / minute
2	Malysz et al. (2020)	100-120 x/ minute
3	Kienbacher et al. (2022)	100-120 x/ minute
4	Cui and Jiang (2021)	-
5	Kienbacher et al. (2021)	100-120 x / minute
6	Malysz et al. (2020)	100-120 x/ minute
7	Couper et al. (2020)	-
8	Nabilah and Sonia (2021)	-
9	Ali et al. (2021)	109-114 x/ minute
10	Ha (2020)	-

*In studies (Couper et al., 2020; Nabilah and Sonia., 2021; Ha, 2020; Cui and Jiang, 2021) did not mention the compression rate of the heart.

Based on table 4. it is known that in studies (Moscarelli et al., 2020; Malysz et al., 2020; Kienbacher et al., 2022; Kienbacher et al., 2021; Malysz et al., 2020) in studies (Ali et al., 2021) with compression velocity chest 109-114 x/minute.

The Patients' Position during the CPR Procedure during the Covid-19 Pandemic

Table 5. Patients' Position during CPR in the Era of the COVID-19 Pandemic

No	Author	Technique	Position
1	Moscarelli et al. (2020)	2 hands and 1 hand Fingers of one hand	Face down
2	Malysz et al. (2020)	Manual chest compressions	Supine
3	Kienbacher et al. (2022)	-	-
4	Cui and Jiang (2021)	-	-
5	Kienbacher et al. (2021)	-	-
6	Malysz et al. (2020)	Manual, bait device reverse cpr, LUCAS 3 device	Supine
7	Couper et al. (2020)	-	-
8	Nabilah and Sonia (2021)	-	-
9	Ali et al. (2021)	Standard direct CPR with alternative training methods such as hybrid training or online-only (AT)	Supine
10	Ha (2020)	-	-

*The study (Moscarelli et al., 2020) includes the only article that mentions patient positioning

Based on the table above, it is known that the average patient position during CPR during the COVID-19 pandemic was supine and face down.

DISCUSSION

Gender of Research Respondents

In the ten research journals, the distribution of respondents based on gender was highest in Cui and Jiang's research, 2021 with 60 males gender, while the other research mentioned in the study of Malysz et al., 2020 with 25 female respondents; Kienbacher et al., 2022 with 4 female respondents, while in the study of Moscarelli et al., 2020; Malysz et al., 2020; Kienbacher et al., 2021; Couper et al., 2020; Nabilah and Sonia., 2021; Ali et al., 2021; Ha, 2020 doesn't mention gender. However, in the 10 journals, the number of respondents was the number of paramedics who participated in conducting training and actions in CPR in the pandemic era. Based on table 1, the distribution of respondents based on gender in the study articles contained men and women with a total number of 1.633 respondents with 60 men and 29 women. You can sort the respondent's data from the most, namely from the article (Couper et al., 2020) with a total of 1,141 respondents without explaining what gender the respondents belonged to, (Cui and Jiang, 2021) there were 258 respondents with 60 male gender, (Malysz et al., 2020) with a total of 67 respondents with a total gender of 25 female, (Kienbacher et al., 2021) with a total of 48 respondents without explaining how many genders are male or female, (Kienbacher et al., 2022) with a total of 48 respondents stating that 4 respondents were female, (Moscarelli et al., 2020) with 36 respondents, and (Malysz et al., 2020) with a total of 35 respondents.

The Use of Personal Protection Equipment (PPE) in Cardiopulmonary Resuscitation Techniques in the Era of the COVID-19 Pandemic

From several studies, several types of PPE use can be classified when performing CPR during the Covid-19 pandemic. Based on table 2, it explains that PPE is divided into 2 levels, according to the table it is explained that there is use of PPE with Level C/Level 3 and use of Level

B/Level 2. Recommendations for PPE during CPR have been issued during the Covid-19 pandemic, including wearing protective gowns with masks, gloves, and eye protection to protect medical personnel (Cui and Jiang, 2021). So, the researchers concluded that the use of PPE when performing CPR in the era of the Covid-19 pandemic consisted of gowns with masks, gloves, and eye protection.

Depth of Chest Compressions in the Era of the COVID-19 Pandemic

According to table 3, the depth of chest compressions in the era of the Covid-19 pandemic (Malysz et al., 2020) showed that the depth of chest compressions was 50-60 mm, in research (Moscarelli et al., 2020) with a depth of 5-6 cm, in studies (Cui and jiang, 2021) with a depth of 1.3 inches, in research (Ali et al, 2021) with a depth of 36-57 mm, while in studies (Kienbacher et al, 2022; Kienbacher et al, 2021; Couper et al, 2020, Nabilah and Sonia, 2021; Ha, 2020) does not include the depth when performing chest compressions on patients suspected of Covid-19. The recommended site for chest compressions is below the mid-sternal area, with a compression depth of 2-2.4 inches (5-6 cm). Giving CPR must also minimize interruptions and provide opportunities for full chest recoil (AHA, 2015). The recommended compression depth is 2-2.4 inches (5-6 cm). Compression depth of 5 cm will give better results when compared to a depth of less than 5 cm. Meanwhile, a depth of more than 6 cm is feared to cause injury to other organs even though it is not life threatening (Compression et al., 2019). Manual chest compressions are described as effective if given in the center of the chest at a depth of 5-6 cm and a speed of 100-120 minutes with as few interruptions as possible and complete chest recoil after each compression (Moscarelli et al., 2020).

Speed of Chest Compressions in the Era of the COVID-19 Pandemic

Based on the results from table 4, it is known that in research (Moscarelli et al., 2020; Malysz et al., 2020; Kienbacher et al., 2022; Kienbacher et al., 2021; Malysz et al., 2020) in research (Ali et al., 2021) with chest compression rate 109-114 x/minute. The American Heart Association (AHA) guidelines provide evidence-based strategies that can be used in cardiovascular emergencies. The focus of the AHA guidelines is on ensuring the implementation of high-quality CPR. If chest compressions are done correctly, consistently, limiting the number of CPR compression stops as much as possible will help restore tissue perfusion, the distribution of the duration of the CPR action from several articles is more frequent with a period of 100-120 x/minute. An insufficient number of chest compressions can reduce a person's survival rate, conversely if excessive chest compressions can cause the sternum to stretch and have a negative impact on the amount of blood returning to the heart (Septiany, 2021). Manual chest compressions are described as effective when given in the center of the chest, at a rate of 100-120 minutes (Moscarelli et al., 2020). The target set according to the 2015 quality standard set by the ERC is a speed of 100 to 120 compressions per minute (Malysz et al., 2020). The rate of chest compressions in the AHA guidelines is specifically stated to be 100-120 times per minute. This provision has changed from the previous minimum of 100 times per minute. This guideline change in compression speed is based on research that excessive compression speed will negatively affect resuscitation success (Marti, 2018). The factor of fatigue and degradation of rescue skills is the cause of failure in performing quality compressions during CPR.

The Patients' Position during the CPR Procedure during the Covid-19 Pandemic

Based on table 5, the patient's position during CPR during the Covid-19 pandemic has been distributed according to 10 articles, there are various heart massage techniques with 1 face down

position and 9 supine positions. As for the heart massage technique in the face-down position using 2 hands and 1 hand for adults and the fingers of one hand in pediatric patients, the face-down position is recommended for severe hypoxemic respiratory failure, based on clinical trial data showing reduced mortality with treatment this (Moscarelli et al., 2020), there are also those who still use manual techniques in a supine position. The face down position as a treatment for acute respiratory distress syndrome (ARDS) was first described in 1976, there are 3 techniques reviewed in one of the articles by (Małysz et al., 2020) with mentions of Manual technique, CPR feedback device, LUCAS 3 device, and some use standard live CPR techniques with alternative training methods such as hybrid or online-only (AT) training. The aim was to compare learning outcomes between standard instructor-led, class-based CPR training with alternative training methods among lay people (Ali et al., 2021). Therefore, it can be concluded that the patient's position when performing CPR in the era of the Covid-19 pandemic, namely the face down position with the supine position.

CONCLUSION

Based on an analysis of several journal articles on cardiopulmonary resuscitation techniques in Covid-19 patients, 4 conclusions were obtained, (1) The use of PPE for cardiopulmonary resuscitation techniques in the Covid-19 pandemic era was divided into 2 levels, namely the use of Level C/Level 3 PPE and use of Level B/Level 2, which includes the use of a gown with a mask, gloves and eye protection. (2) The recommended chest compression depth during the Covid-19 pandemic is 2-2.4 inches (5-6 cm). A compression depth of 5 cm will give better results. While a depth of more than 6 cm is feared to cause injury to other organs. (3) The speed of chest compressions in the era of the Covid-19 pandemic, according to the AHA guidelines, is to ensure quality CPR implementation. Manual chest compressions are said to be effective if given in the center of the chest at a rate of 100-120 minutes. Fatigue and decreased rescue skills are the causes of failure to perform quality compressions during CPR. (4) In the era of the Covid-19 pandemic, there is a heart massage technique in a prone position using 2 hands and 1 hand for adults and the fingers of one hand for pediatric patients. The prone position is recommended for severe hypoxemic respiratory failure; based on clinical trial data showing a reduction in mortality with this treatment some continue to use manual techniques in the supine position. there are three techniques reviewed in one of the articles by mentioning the Manual technique, CPR feedback device, LUCAS 3 device, and some use standard live CPR techniques with alternative training methods such as hybrid or online only (AT) training.

CONFLICT OF INTEREST

The authors stated that they did not competing interests in producing this manuscript.

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