



# Philippine COVID-19 Living Clinical Practice Guidelines

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In cooperation with the Philippine Society for Microbiology and Infectious Diseases

Funded by the DOH AHEAD Program through the PCHRD

## EVIDENCE SUMMARY

### Among health care workers how effective is the use of personal protective equipment in the wards, ICU, and emergency room in the prevention of COVID 19 infection?

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#### **PPE in Hospital**

#### **RECOMMENDATION**

We recommend the use of the following PPE: disposable hat, medical protective mask (N95 or higher standard), goggles or face shield (anti-fog), medical protective clothing, disposable gloves and disposable shoe covers or dedicated closed footwear as an effective intervention in the prevention of COVID-19 among health care workers in areas with possible direct patient care of COVID-19 positive patients and aerosol generating procedures. (*Moderate quality of evidence; Strong recommendation*)

#### **Consensus Issues**

Direct patient care<sup>1</sup> is defined as hands on, face-to-face contact with patients for the purpose of diagnosis, treatment and monitoring. This recommendation was made by the panel as it prioritized giving the best available protection to the healthcare workers. Whenever possible, hospital administrators should invest in these PPEs. Strict adherence to the appropriate use of PPEs must be observed even if healthcare workers have already been vaccinated against COVID-19.

<sup>1</sup>National Center for Emerging, Zoonotic and Infectious Diseases-Division of Healthcare Quality Promotion. (2020). *The National Healthcare Safety Network (NHSN) Manual- Healthcare Personnel Safety Component Protocol: Healthcare Personnel Exposure Module*. Atlanta, GA, USA: CDC.



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## Key Findings

Three studies and a case report were found on the use of PPE among health care workers to prevent COVID infection. Moderate certainty evidence from three studies showed that the use of Level 2 PPE (disposable hat, medical protective mask (N95 or higher standard), goggles (anti-fog) or protective mask (anti-fog), medical gown clothing or white coats covered by medical protective clothing, disposable gloves and disposable shoe covers), N95 respirators and face shields protected health care workers in hospital settings from COVID-19 infections. On the other hand, very low certainty evidence showed no significant protective effect from the use of face/surgical masks, gowns, and/or disposable gloves if used individually.

## Introduction

The COVID-19 pandemic has placed the health care workers (HCW) at high risk of infection. The use of personal protective equipment (PPE) has been shown to be effective in preventing infection against related betacoronaviruses that have caused epidemics, such as severe acute respiratory syndrome (SARS) or Middle East respiratory syndrome (MERS) [1,2]. PPE use depends on the risk of exposure, availability, and environmental control. The evidence on PPE recommendations, including the use of face mask, face shield, gowns and gloves, to prevent COVID 19 infection among health care workers are limited.

## Review Methods

We searched MEDLINE, Cochrane CENTRAL, ChinaXiv, MedRXIV, BioRXIV and ongoing and completed trials on USA: <https://clinicaltrials.gov/>; China: <http://www.chictr.org.cn/searchprojen.aspx> and WHO: <https://www.who.int/clinical-trials-registry-platform>. We also searched for published/ongoing studies on the COVID-19 Open Living Evidence Synthesis: <https://covid-nma.com/> and the Living Evidence on COVID-19: [https://zika.ispm.unibe.ch/assets/data/pub/search\\_beta/](https://zika.ispm.unibe.ch/assets/data/pub/search_beta/). The initial search date was 31 March 2021 (updated 30 April 2021).

The following keywords were used: 'covid', 'COVID-19', 'coronavirus', 'SARS-CoV-2', 'viral', 'infection', 'respiratory', 'respirator', 'surgical mask', 'N95 mask', 'PPE', 'personal protective equipment', 'face shield', 'goggles', 'eye protector', 'gown', 'gloves', 'health care worker', 'COVID-19', 'coronavirus', 'SARS-CoV-2'. Subject headings and free text were combined<sup>1</sup>. We included experimental or observational studies, meta-analysis/systematic reviews, completed trials and/or preprints that investigated the efficacy of PPE in preventing COVID 19 infection among health care workers in non-surgical areas (wards, ICU, emergency room). Two reviewers appraised the methodological quality of included studies using the Newcastle Ottawa Scale. We used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach to assess the certainty of the evidence related to the outcomes.

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<sup>1</sup> (((((((((((COVID 19[MeSH Terms]) AND health care workers (personal protective equipment[MeSH Terms])) OR (face mask[MeSH Terms])) OR (surgical mask[MeSH Terms])) OR (respirators[MeSH Terms])) OR (goggles[MeSH Terms])) OR (face shield[MeSH Terms])) OR (eye protector[MeSH Terms])) OR (gowns, surgical[MeSH Terms])) OR (gloves, surgical[MeSH Terms])) AND (health care worker[MeSH Terms])



## Results

### Characteristics of included studies

Four observational studies (cohort, case control and cross sectional) and a case report were included. Two of these studies were also found in two systematic reviews [1,2] that reported on the association of COVID 19 infection with the use of PPE. Only data relevant to health workers in these studies were considered. Population of the studies were on health care workers mostly employed in health care facilities that attend to patients with COVID 19. Information on the various PPEs that were used by the health care workers while working in the health care facilities was gathered and their association with COVID 19 infection were assessed. Refer to Appendix 1 for detailed characteristics of these included studies.

### Methodological quality

Four studies, two cohort [3,4], a case control [5] and a cross sectional [6], were assessed as having low quality and a case report [7] as very low quality. The studies were direct evidence and with no inconsistencies, however with high risk of bias. For the three observational studies, two used a structured questionnaire [3] [6] and one reviewed infectious records [5] to gather data and thus subject to recall and information bias. Another study [4] was a surveillance data of COVID positive HCW before and after the implementation of the use of face shield. For the protective effect of the use of face shield in two studies [4] [6], confounders in the assessment could be its use together with the standard PPE, compliance of HCW on properly wearing it and in other preventive measures and the type of work done whether or not it is an aerosol generating procedure.

### Level 2 Protection

Moderate quality evidence from a retrospective cohort study by Wang et al. [3] showed the protective effect of Level 2 protection among 5442 medical staff of Neurosurgery Departments of 107 hospitals in Hubei China (OR 0.03 [95% CI 0, 0.19]). Of the 120 who were infected, 54 were neurosurgeons and 66 were nurses involved with COVID 19 patients with patient contact time between 5 to 90 minutes (average time: 35 minutes) Level 2 in their center involved the use of the following: disposable hat, medical protective mask (N95 or higher standard), goggles (anti-fog) or protective mask (anti-fog), medical gown clothing or white coats covered by medical protective clothing, disposable gloves and disposable shoe covers.

Additional data from a cross sectional study in Bangladesh involving 190 HCW in 19 health facilities [6], a possible protective effect in using PPE was reported (OR 0.15 [95% CI 0.02, 1.21]). The evidence was downgraded due to imprecision. However, the type of PPE used in this study was not specified; thus, this was not included in the analysis.

### N95 respirators

Moderate certainty evidence involving 493 participants demonstrated a protective effect with the use of N95 respirators (OR: 0.035 [95% CI 0.002 to 0.603]). This was a case control study in Wuhan China [5] but was assessed as to have a large effect. Another study [6] from Bangladesh involving 190 health workers also demonstrated the N95 protective effect during aerosol generating procedure (OR 0.37 [95% CI 0.16-0.87]).



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## Face mask

In the cross-sectional study in Bangladesh [6], very low certainty evidence suggested that the use of medical/surgical masks while attending to COVID 19 patients was not associated with infection among 190 health workers (OR 1.40 [95% CI 0.30, 6.42]) [5]. The evidence was downgraded as very low due to imprecision. The study used a structured questionnaire which was answered by the participants and therefore subject to recall bias. A case report [6], however, showed that among 37 health care workers who were exposed to a COVID-19 patient, 3/34 (8.8%) who did not wear a mask were infected while none of the three who were wearing a mask were infected.

## Face shield

Moderate certainty evidence [4] before and after face shield use was implemented demonstrated the protective effect of face shield with standard PPE among 6527 health care personnel (HCP) who were tested for COVID. (RR 0.297 [95% CI 0.228, 0.385]). The type of PPE used was not discussed. The data was from a surveillance study in a quaternary health care system in Texas. Biweekly testing for HCP in high-risk units (emergency department, transplant units and COVID-19 units) and weekly testing for HCP in cluster areas ( $\geq 3$  cases of HCP with COVID-19 diagnosis or any case of hospital-acquired infection) were done. Testing was voluntary for HCP and HCP in other areas if they desire or if with exposure history. HCP with previous positive COVID-19 diagnosis were excluded. This was a cohort study and was initially graded as low but was upgraded due to the large effect.

A cross sectional study [6] showed that using face shield/goggles when attending to COVID-19 patients was protective for health care workers (OR 0.44 [95% CI 0.23, 0.843]). The evidence was downgraded to very low as the study used a structured questionnaire which may have increased risk of recall bias. In both studies cited, confounders in the assessment of the protective effect of face shield may be present as cited in the methodological quality.

## Disposable gowns/gloves

No significant difference in the incidence of COVID infection was observed among 190 health care workers who used disposable gowns (OR 1.08 [95% CI 0.53, 2.20]) and disposable gloves (OR 1.01 [95% CI 0.38, 2.68]) while caring for infected patients [6]. For aerosol-generating procedures, no benefit was also noted for gowns (OR 0.77 [95% CI 0.31, 1.88]) and gloves (OR 0.62 [95% CI 0.13, 2.90]). This effect was based on very low-quality evidence from one study [5]. The evidence was downgraded due to imprecision and risk of bias with use of a structured questionnaire subject to recall bias.

## Recommendations from Other Groups

The table below provides a summary of PPE recommendations from four different health agencies. [8] PPE recommendations across countries differ in terms of setting, type of personnel, and activity.



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**Table 1.** Comparisons of personal protective equipment recommendations from the World Health Organization, the US Centers for Disease Prevention and Control (CDC), the European CDC, and Korea CDC [9, 10, 37, 47]

Settings	KCDC (March 2020)	WHO (April 2020)	CDC (May 2020)	ECDC (May 2020)
Triage: patient examination with direct contact	<ul style="list-style-type: none"> <li>• KF94 mask or equivalent respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup> or coveralls with foot covers</li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Medical mask</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• N95 respirator (or facemask if a respirator is not available)</li> <li>• Eye protection<sup>a</sup></li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Surgical mask or, if available, FFP2 respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup> or apron</li> <li>• Gloves</li> </ul>
Usual inpatient care	<ul style="list-style-type: none"> <li>• KF94 mask or equivalent respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup> or coveralls with foot covers</li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Medical mask</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• N95 respirator (or higher-level respirator) or facemask (if a respirator is not available)</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown</li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Surgical mask or, if available, FFP2 respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup> or apron</li> <li>• Gloves</li> </ul>
Aerosol-generating procedures <sup>c</sup>	<ul style="list-style-type: none"> <li>• KF94 mask, equivalent respirator, or PAPR</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup> or coveralls with foot covers</li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• N95, FFP2, or FFP3 respirator</li> <li>• Eye protection</li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> <li>• Apron (if gowns are not fluid-resistant)</li> </ul>	<ul style="list-style-type: none"> <li>• N95 or higher-level respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• FFP3 respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> </ul>
Collecting specimens (not involving aerosol-generating procedures)	<ul style="list-style-type: none"> <li>• KF94 mask, equivalent respirator, or PAPR</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup> or coveralls with foot covers</li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Medical mask</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> </ul>	<ul style="list-style-type: none"> <li>• N95 or higher-level respirator (or facemask if a respirator is not available)</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup></li> <li>• Gloves</li> </ul>	<p>Enclosed spaces:</p> <ul style="list-style-type: none"> <li>• Surgical mask or, if available, FFP respirator</li> <li>• Eye protection<sup>a</sup></li> <li>• Gown<sup>b</sup>, gloves</li> </ul> <p>Drive-through or outdoor facilities:</p> <ul style="list-style-type: none"> <li>• Surgical mask</li> </ul>

WHO, World Health Organization; CDC, Centers for Disease Prevention and Control; ECDC, European Centers for Disease Prevention and Control; KCDC, Korea Centers for Disease Prevention and Control; PAPR, powered air-purifying respirator; FFP, filtering facepiece.

<sup>a</sup>Eye protection includes goggles or a face shield.

<sup>b</sup>Gown refers to a long-sleeved, fluid-resistant gown.

<sup>c</sup>Aerosol-generating procedures include endotracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, manual ventilation, bronchoscopy, open suctioning, sputum induction, nebulizer therapy, etc.

World Health Organization (19 March 2020) [9] stated that the types of PPE to be used when caring for COVID-19 patients will vary according to the setting and type of personnel and activity. Healthcare workers involved in the direct care of patients should use the following PPE: gowns, gloves, medical masks, and eye protection (goggles or face shield). For aerosol-generating procedures (e.g., tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy) healthcare workers should use respirators, eye protection, gloves, and gowns; aprons should also be used if gowns are not fluid resistant.

The European Center for Disease Control (9 Feb 2021) [10] recommends healthcare workers in contact with a possible or confirmed COVID-19 case to wear a well-fitted respirator, eye protection (i.e., visor or goggles), gloves, and a long-sleeved gown if there is risk for contact with body fluids and in settings where contamination is presumably high, such as where aerosol generating procedures are performed. Aprons can be used in place of gowns, if contact with body fluids is low. Gloves and the gown or apron should be changed between patient contacts.

The Australia Department of Health (09 Nov 2020) [11] included the following in the routine care of patients with suspected or confirmed COVID-19: surgical mask or particulate filter masks (P2 or N95 masks) depending on risk of blood body fluid, long sleeves gown / aprons, eye protection, face shield, wrap-around safety glasses/visor /goggles, and disposable non sterile gloves. Head cover and boots or shoe covers is not recommended unless gross contamination is anticipated or they are required as standard attire in operating theatre or trauma room.



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The US Centers for Disease Control (23 Feb 2021) [12] had recommendations similar to the Australian Department of Health which included N95 or higher respirators (If not available, use face mask), face shield/goggles, clean non-sterile gloves and isolation gown.

### Research Gaps

Based on [clinicaltrials.gov](https://clinicaltrials.gov), there is one completed trial on the use of PPE in health care workers (completed January 2021) and one ongoing trial on with or without PPE during neonatal resuscitation.

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### Appendix 1. Characteristics of Included studies

	<b>Setting</b>	<b>Population</b>	<b>Intervention</b>	<b>Comparator</b>	<b>Outcome</b>
<b>Wang Q</b>	Hubei China	5442 medical staff of 107 Neurosurgery Departments	Adequate Level 2 PPE <sup>1</sup>	Inadequate PPE	Number of HCW infected and not infected with COVID 19
<b>Wang X</b>	Wuhan China	493 Medical staff of Zhongnan Hospital	With N95 respirator	No N95 respirators	Number of HCW infected and not infected with COVID 19
<b>Khalil SN</b>	Dhaka Bangladesh	190 Medical staff in 19 health facilities	Face mask		Number of HCW with face mask infected with COVID 19
			Face shield		Number of HCW with face shield infected with COVID 19
			PPE		Number of HCW with PPE infected with COVID 19
			Gloves		Number of HCW with gloves infected with COVID 19
			N95		Number of HCW with N95 respirator infected with COVID 19
<b>Mojajer A</b>	Houston Texas	6527 Health Care Personnel of a quaternary health hospital	Face shield <sup>2</sup> with standard PPE	Standard PPE	Number of HCP infected before and after implementation of use of face shield with standard PPE





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				Number of HCP with HAI before and after implementation of use of face shield with standard PPE
<b>Heinzerling A</b>	Solano California	37 Medical staff exposed to Index patient	Face mask	Number of HCW with face mask infected with COVID 19
			Gloves	Number of HCW wearing gloves infected with COVID 19

<sup>1</sup> Adequate PPE: disposable hat, medical protective mask (N95 or higher standard), goggles (anti-fog) or protective mask (anti-fog), medical gown clothing or white coats covered by medical protective clothing, disposable gloves and disposable shoe covers.

<sup>2</sup> Face shield used was a Lazarus 3D (Corvallis, OR, USA)

<sup>3</sup> Abbreviations: HCW: health care worker; HCP: health care personnel



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## Appendix 2. GRADE Evidence Profile

PPE Level 2 compared to No PPE Level 2 in prevention of COVID 19 infection in health care workers

Certainty assessment							Summary of findings				
Participants (studies) Follow up	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Study event rates (%)		Relative effect (95% CI)	Anticipated absolute effects	
							With No PPE Level 2	With PPE Level 2		Risk with No PPE Level 2	Risk difference with PPE Level 2
<b>COVID infection (assessed with: RT PCR)</b>											
5442 (1 observational study)	not serious	not serious	not serious	serious <sup>a</sup>	strong association all plausible residual confounding would reduce the demonstrated effect	⊕⊕⊕○ MODERATE	119/4155 (2.9%)	1/1287 (0.1%)	<b>RR 36.9</b> (5.2 to 263.6)	29 per 1,000	<b>1,000 more per 1,000</b> (from 120 more to 1,000 more)

CI: Confidence interval; RR: Risk ratio

**Explanations**

- a. Wide confidence interval

N95 respirators compared to no N95 respirators for prevention of COVID 19 infection in health care workers

Certainty assessment							Summary of findings				
Participants (studies) Follow up	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Study event rates (%)		Relative effect (95% CI)	Anticipated absolute effects	
							With no N95 respirators	With N95 respirators		Risk with no N95 respirators	Risk difference with N95 respirators
<b>N95 respirators vs no N95 respirators in prevention of COVID 19 INFECTION</b>											
10 cases 483 controls (1 observational study)	not serious	not serious	not serious	not serious	strong association	⊕⊕⊕○ MODERATE	10 cases 483 controls		<b>OR 0.035</b> (0.002 to 0.603)	<b>Moderate</b> 0 per 1,000	<b>0 fewer per 1,000</b> (from 0 fewer to 0 fewer)

CI: Confidence interval; OR: Odds ratio



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Face Shield compared to No Face Shield for prevention of COVID 19 infection in health care workers

Certainty assessment							Summary of findings				
Participants (studies) Follow up	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Study event rates (%)		Relative effect (95% CI)	Anticipated absolute effects	
							With No Face Shield	With Face Shield		Risk with No Face Shield	Risk difference with Face Shield

Face shield vs no face shield in the prevention of COVID 19 infection

6527 (1 observational study)	serious <sup>a</sup>	not serious	not serious	not serious	strong association all plausible residual confounding would suggest spurious effect, while no effect was observed	⊕⊕⊕○ MODERATE	166/2486 (6.7%)	80/4041 (2.0%)	<b>RR 0.297</b> (0.228 to 0.385)	67 per 1,000	<b>47 fewer per 1,000</b> (from 52 fewer to 41 fewer)
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CI: Confidence interval; RR: Risk ratio

**Explanations**

a. Protective effect of face shield may be compounded by its use with standard PPE, compliance of health care personnel on its use and other preventive measures and the type of work that is done



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Appendix Table 3. Characteristics of ongoing clinical trials

No	Clinical Trial ID / Title	Study design, status	Population	Intervention Group(s)	Comparison Group(s)	Outcomes
1	NCT04712045 (UK) Rational Use of Personal Protective Equipment: a Randomised Trial and Quality Improvement Intervention During COVID-19 Pandemic	Interventional clinical trial, completed (15 Jan 2021)	Health care workers	<b>New PPE:</b> Level 2 PPE which involves wearing a short-sleeve gown and a single pair of gloves	<b>Old PPE</b> Level 2 PPE which involves wearing a long-sleeve gown and double pairs of gloves	Primary outcome: Proportion of participants and simulated patients with contamination as assessed by ultraviolet light  <b>Secondary Outcome:</b> <ol style="list-style-type: none"> <li>1. Participants' perception of personal comfort and safety and safety of the patients as assessed through structured questionnaire [Time Frame: immediately before simulations and immediately after simulations]</li> <li>2. Changes in participants perception of personal comfort and safety and safety of patients as assessed through a semi-structured questionnaire [Time Frame: immediately before training, immediately after training and immediately after simulation]</li> <li>3. The difference in the area of contamination between New and Standard PPE as analyzed through python script [Time Frame: immediately after simulations]</li> </ol>
2	NCT04666233 (Padova, Italy)	Randomized open label trial, not yet recruiting  (no date)	Health care workers	<b>With PPE</b>	<b>Without PPE</b>	Primary Outcome:  Initiation of positive pressure ventilation [Time Frame: 5 minutes]



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	Personal Protective Equipment for the Prevention of SARS-Cov-2 During Neonatal Resuscitation					<p>Secondary Outcome:</p> <ol style="list-style-type: none"><li>1. Duration of intubation procedure [Time Frame: 5 minutes]</li><li>2. Correct use of personal protective equipment [Time Frame: 20 minutes]</li><li>3. Participant's opinion on discomfort using personal protective equipment [Time Frame: 20 minutes Level of discomfort in performing the procedures: 0 (no discomfort), 1 (low discomfort) ,2 (high discomfort)</li><li>4. Time of initiation of chest compressions [Time Frame: 20 minutes]</li></ol>
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