RCA guidelines

Resuscitation in the Era of COVID-19 Pandemics

Korean Association of Cardiopulmonary Resuscitation
Kyoung-Chul Cha, MD, PhD

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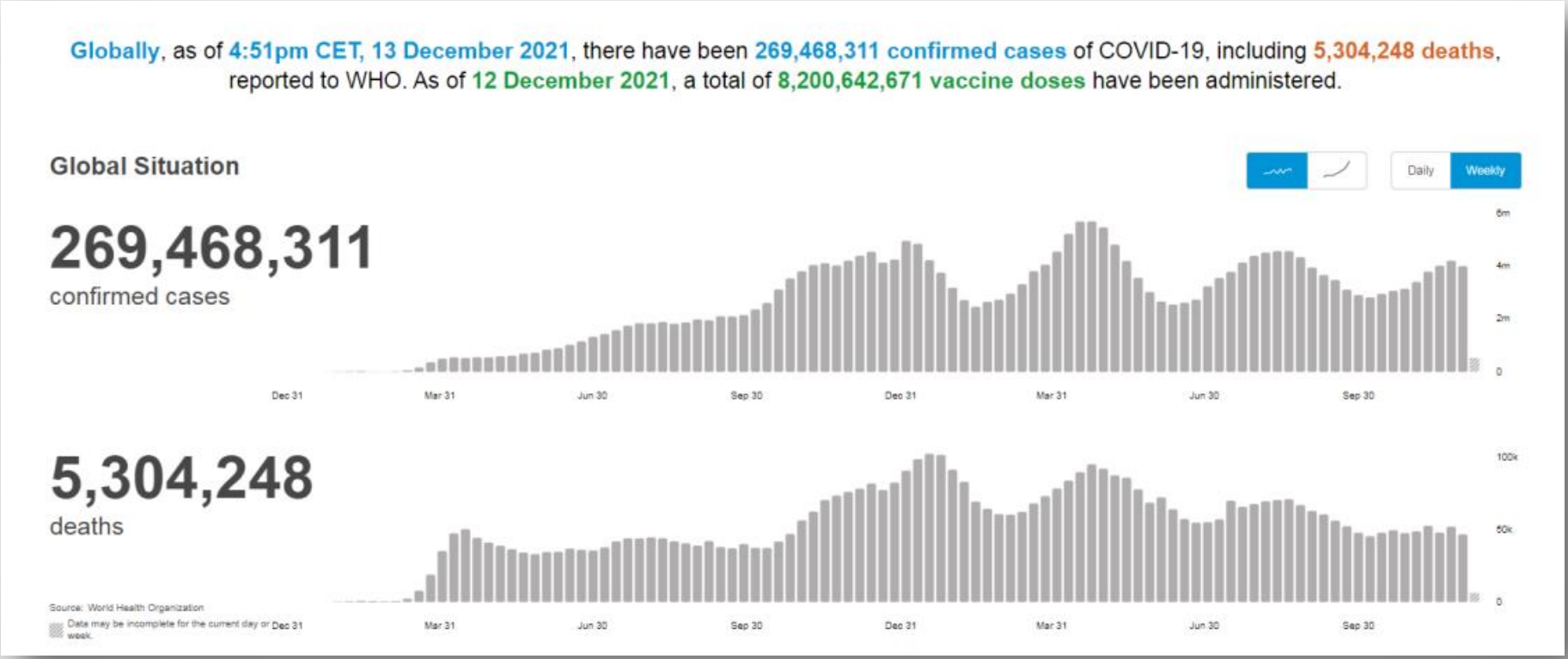
Conflict of Interest

- None

COVID-19 Incidence Worldwide



WHO

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Interim Guidelines for Basic and Advanced Life Support in Patients with Suspected or Confirmed COVID-19

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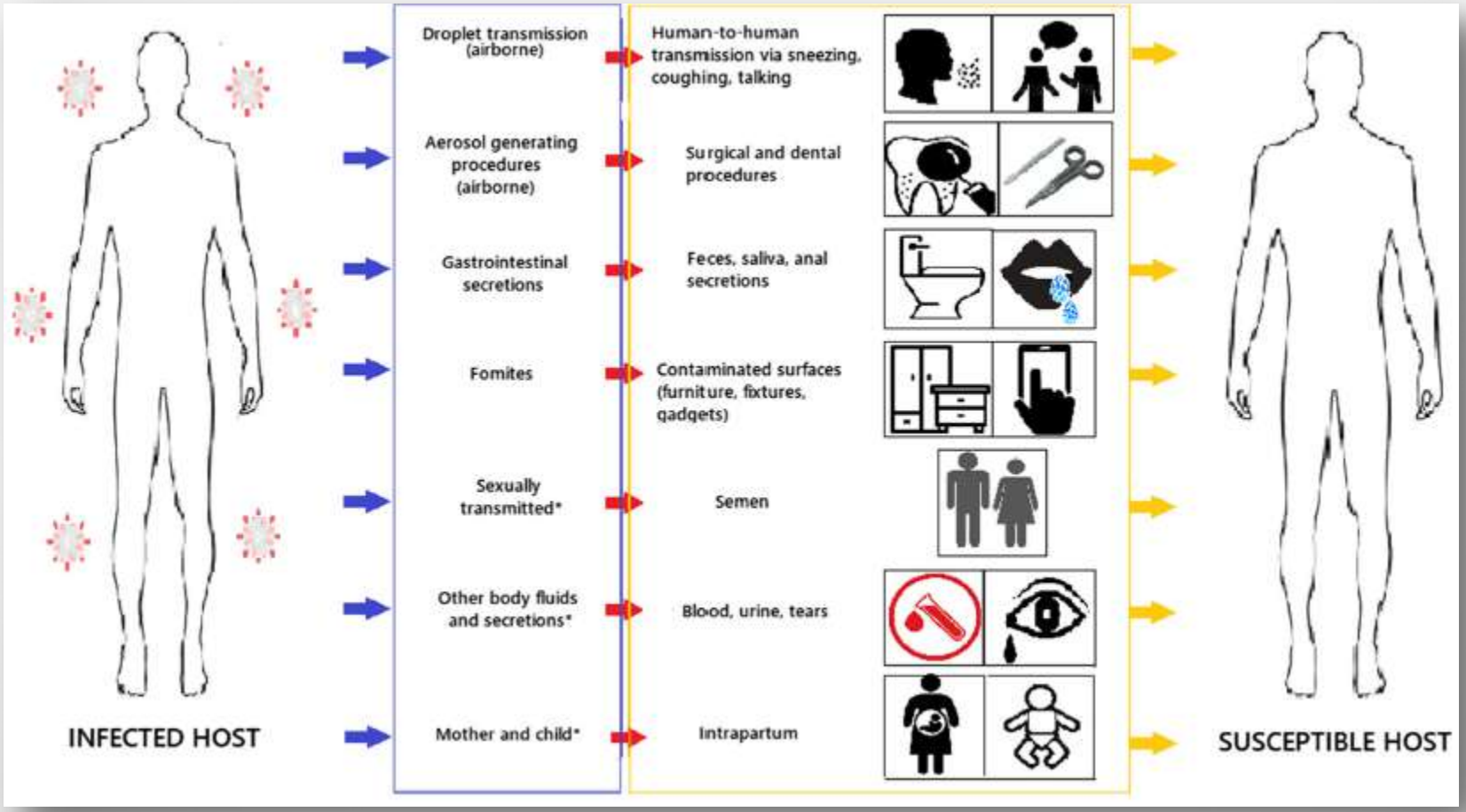
Transmission Routes



SN Compr Clin Med. 2020

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CPR: High Risk for Contracting Disease

- Aerosol-generating procedures
  - Chest compressions
  - Positive-pressure ventilation
  - Establishment of an advanced airway
- Proximity to one another and patient
- Lapse in infection-control practices

Circulation. 2020

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Cardiac Arrest and Infection Risk

Box 1. Research questions

Research question one
In individuals in any setting, is delivery of (1) chest compressions, (2) defibrillation or (3) cardiopulmonary resuscitation associated with aerosol generation?
Research question two
In individuals in any setting wearing any/no personal protective equipment, is delivery of (1) chest compressions, (2) defibrillation or (3) cardiopulmonary resuscitation associated with transmission of infection?
Research question three
In individuals delivering chest compressions and/or defibrillation and/or CPR in any setting, does wearing of personal protective equipment compared with wearing any alternative system of personal protective equipment or no personal protective equipment affect infection with the same organism as the patient, personal protective equipment effectiveness, or quality of CPR?

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ILCOR CoSTR

We suggest that chest compressions and cardiopulmonary resuscitation have the potential to generate aerosols (weak recommendation, very low certainty evidence).

We suggest that in the current COVID-19 pandemic lay rescuers consider compressions and public-access defibrillation (good practice statement).
We suggest that in the current COVID-19 pandemic, lay rescuers who are willing, trained and able to do so, consider providing rescue breaths to infants and children in addition to chest compressions (good practice statement).
We suggest that in the current COVID-19 pandemic, healthcare professionals should use personal protective equipment for aerosol generating procedures during resuscitation (weak recommendation, very low certainty evidence).
We suggest it may be reasonable for healthcare providers to consider defibrillation before donning personal protective equipment for aerosol generating procedures in situations where the provider assesses the benefits may exceed the risks (good practice statement).

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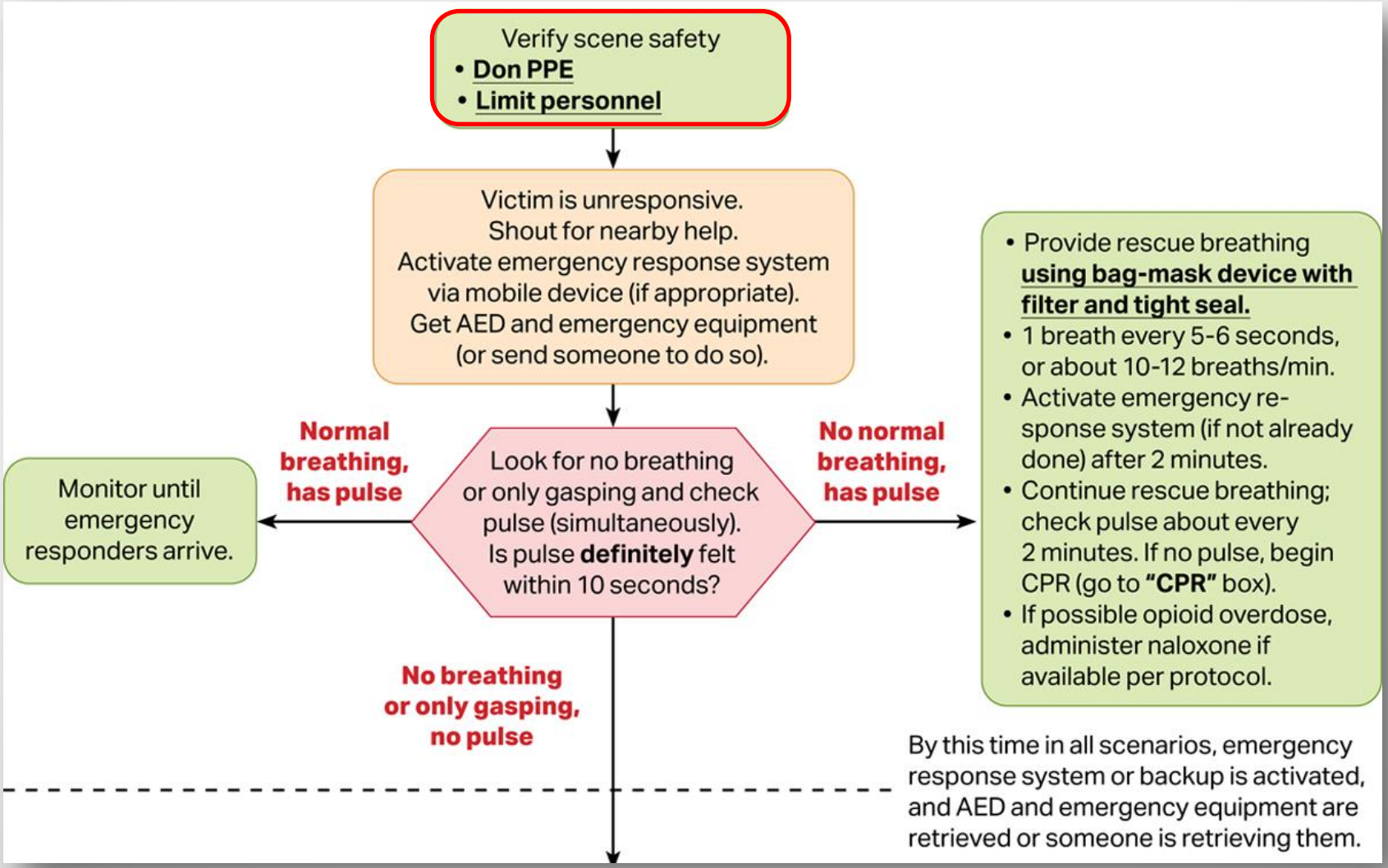
Don PPE



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Risk Factor for SARS-CoV Transmission

Risk Factors for SARS Transmission from Patients Requiring Intubation: A Multicentre Investigation in Toronto, Canada

Parameter	OR	95% CI	p value
HCW's eye/mucous membranes exposed to body fluids	7.34	(2.19, 24.52)	.001
Patient APACHE II score ≥20	17.05	(3.20, 90.75)	.009
HCW present during ECG	3.52	(1.58, 7.86)	.002
HCW present during intubation	2.79	(1.40, 5.58)	.004
Patient PaO_2 to FiO_2 ratio ≤59	8.65	(2.31, 32.36)	.001

HCW = health care worker.
doi:10.1371/journal.pone.0010717.t004

PlosOne. 2010

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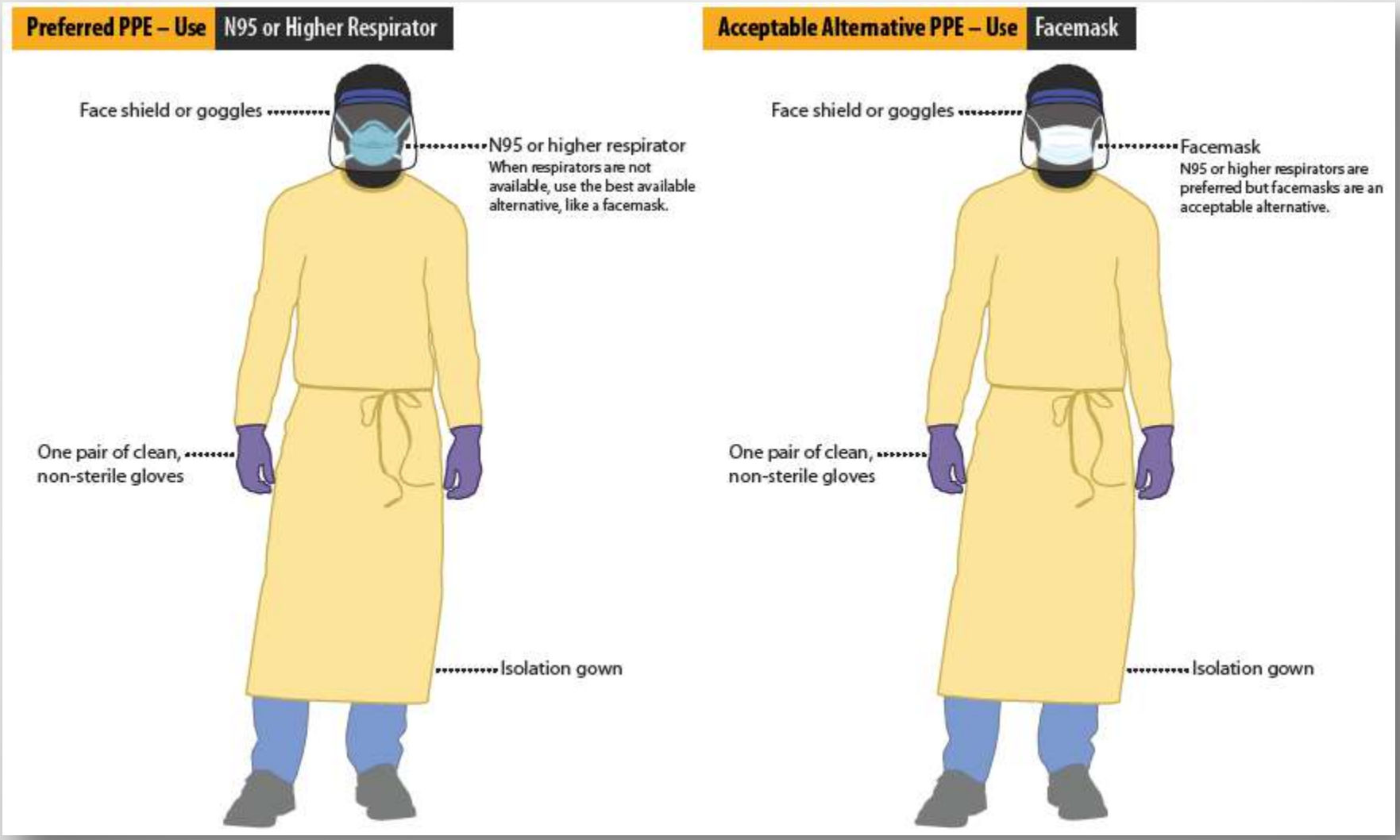
Personal Protective Equipment



US CDC. 2020

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PPE vs COVID-19 Infection (1/2)

Contents lists available at ScienceDirect

Journal of Infection and Chemotherapy

journal homepage: http://www.elsevier.com/locate/jic

Note

Effectiveness of personal protective equipment in preventing severe acute respiratory syndrome coronavirus 2 infection among healthcare workers☆

- Single center, prospective cohort study
- N95 mask, gloves, gown, cap, eye shields, hand sanitizer, PAPR during AGP
- All participants were seronegative

J Infect Chemother. 2021

PPE vs COVID-19 Infection (2/2)

Association between personal protective equipment and SARS-CoV-2 infection risk in emergency department healthcare workers

- A nationwide survey (64 Eds)
- FFP2 or equivalent and eye protection
- Type of PPE was not associated with incidence of COVID-19

Eur J Emerg Med. *2021*

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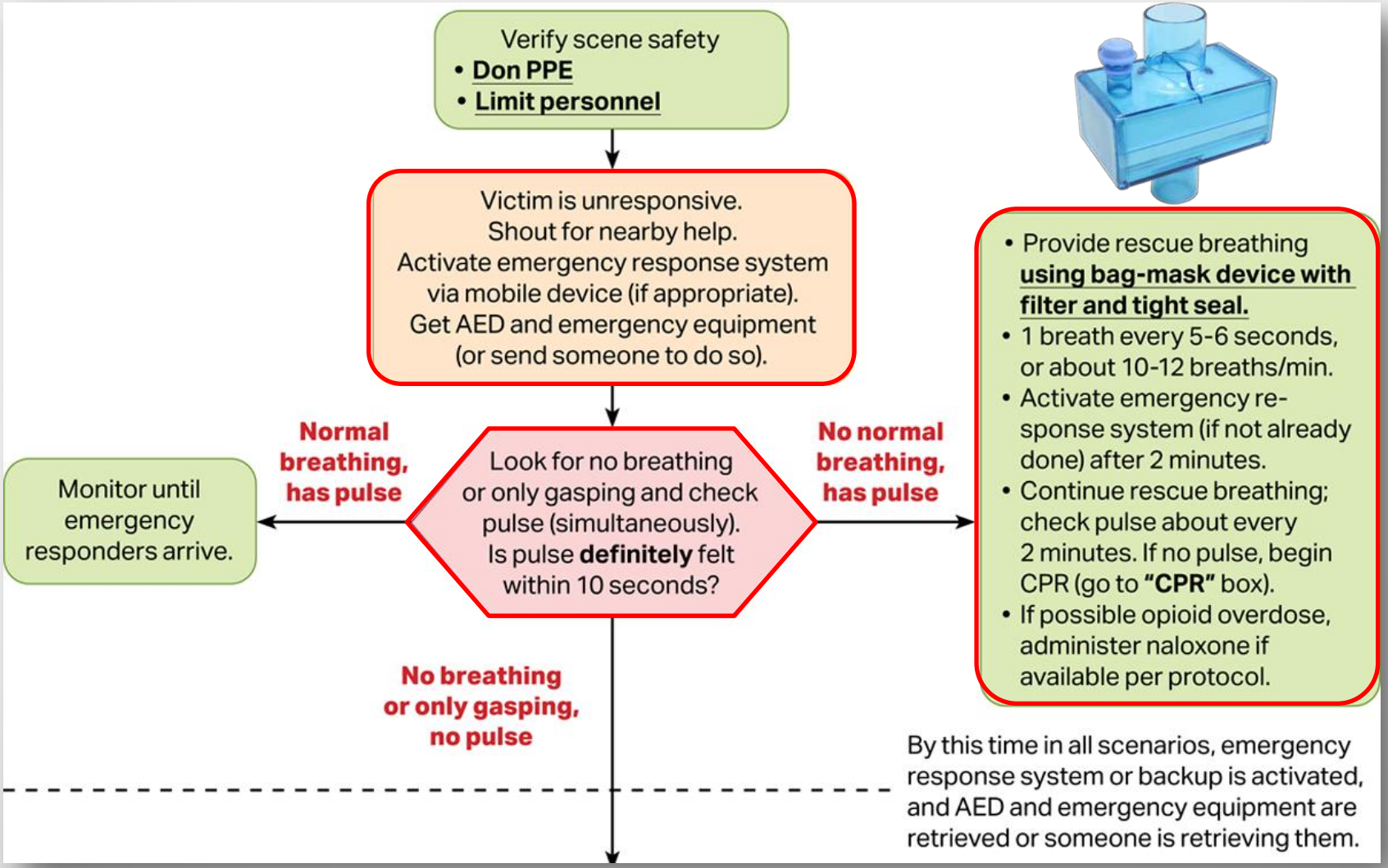
Rescue Breathing with Filter



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Mechanical Chest Compression

CPR
Begin cycles of 30 compressions and 2 breaths
using bag-mask device with filter and tight seal
OR
continuous compressions with passive oxygenation using face mask.
Use AED as soon as it is available.

AED arrives.

Check rhythm.
Shockable rhythm?

Yes, shockable

Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check).
Continue until ALS providers take over or victim starts to move.

No, nonshockable

Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check).
Continue until ALS providers take over or victim starts to move.

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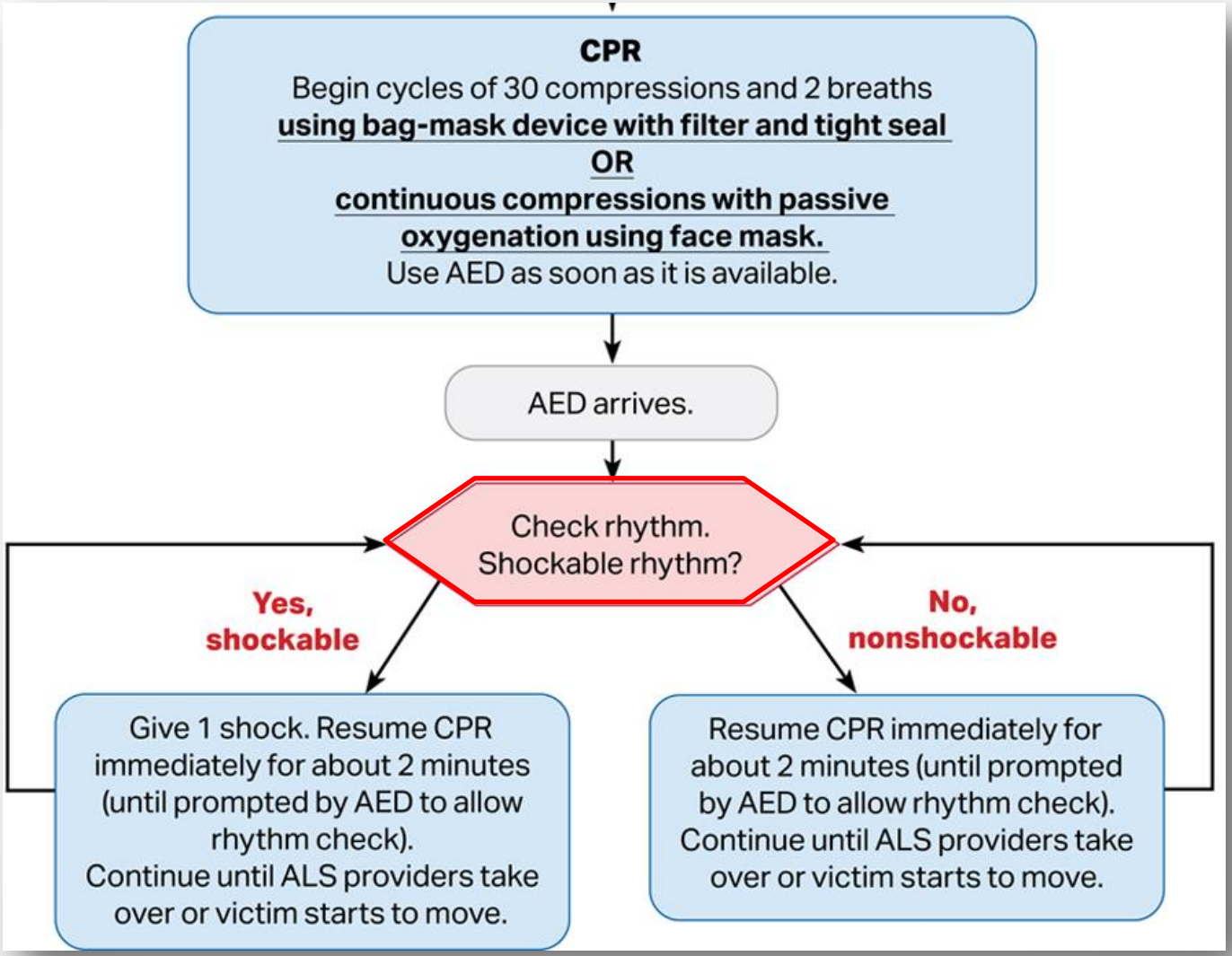
Defibrillation



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Is Defibrillation AGP? (1/2)

Aerosol Generating Procedures and Risk of Transmission of Acute Respiratory Infections to Healthcare Workers: A Systematic Review

- Systematic review based on case-control and retrospective cohort studies

Chest compressions (1 case-control study)	4.5 (1.5, 13.8) [24]	
Chest compressions (2 cohort studies)	3.0 (0.4, 24.5) [25]	1.4 (0.2, 11.2); 27.3%
	0.4 (0.0**, 7.8) [27]	
Defibrillation (2 cohort studies)	0.5 (0.0**, 12.2) [27]	2.5 (0.1, 43.9); 55.3%
	7.9 (0.8, 79.0) [25]	

PlosOne. 2012

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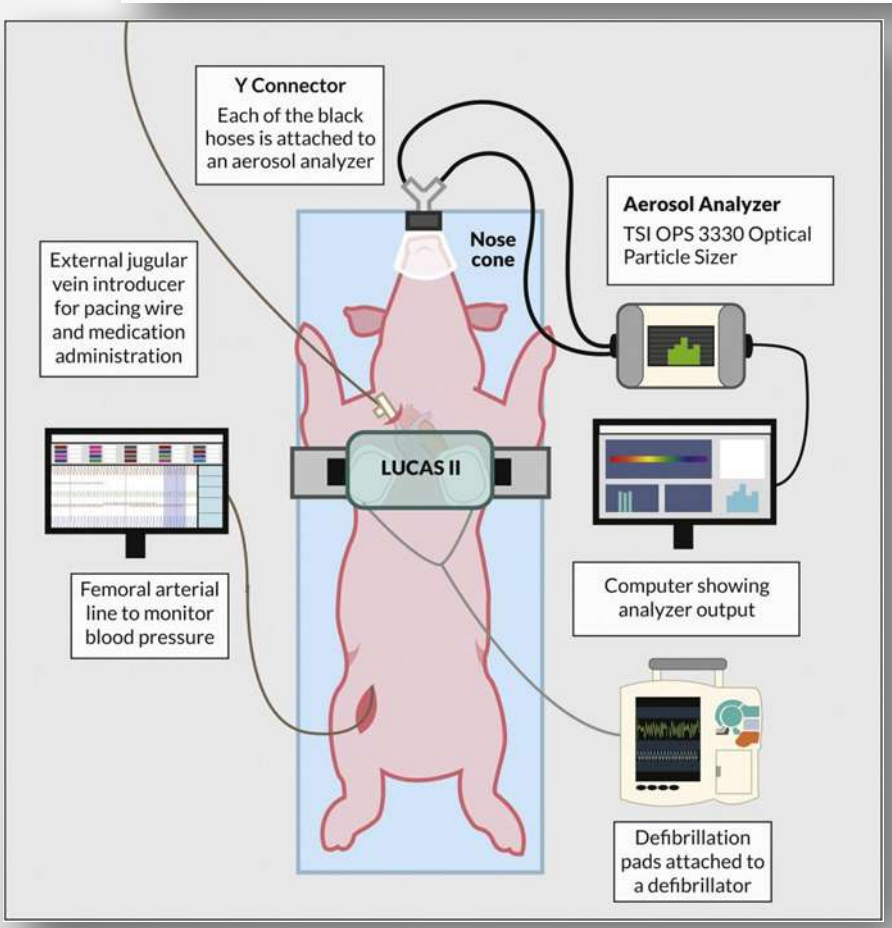
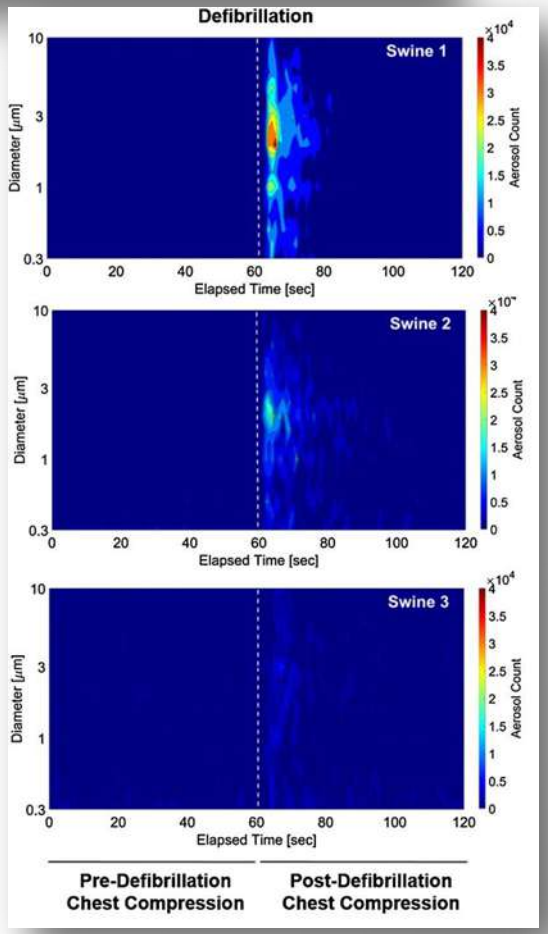
Is Defibrillation AGP? (2/2)

Aerosol generation during chest compression and defibrillation in a swine cardiac arrest model





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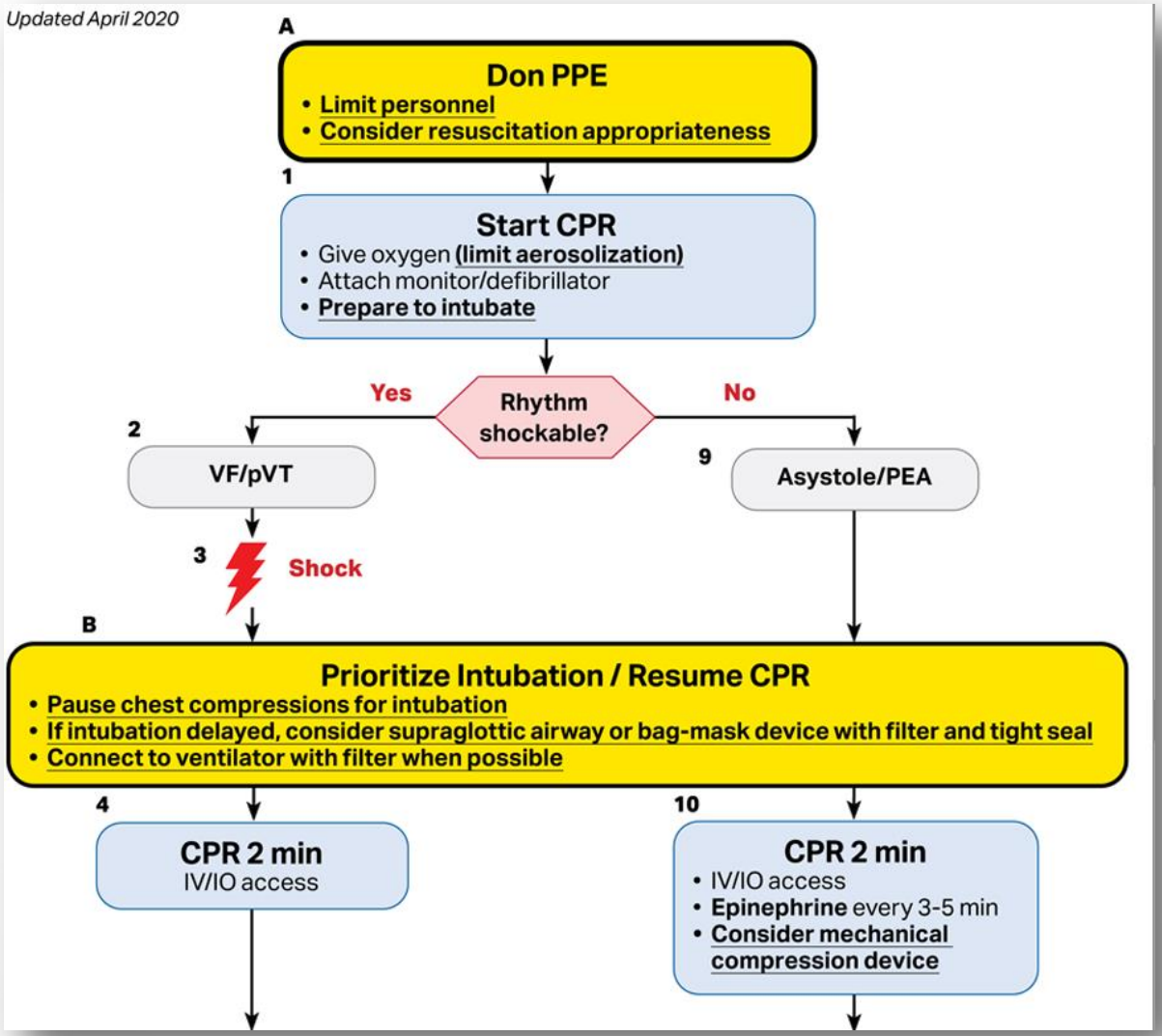
Prioritize Oxygenation and Ventilation



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Consider Resuscitation Appropriateness

- Address goals of care
- Adopt policies to guide determination, taking into account patient risk factors for survival

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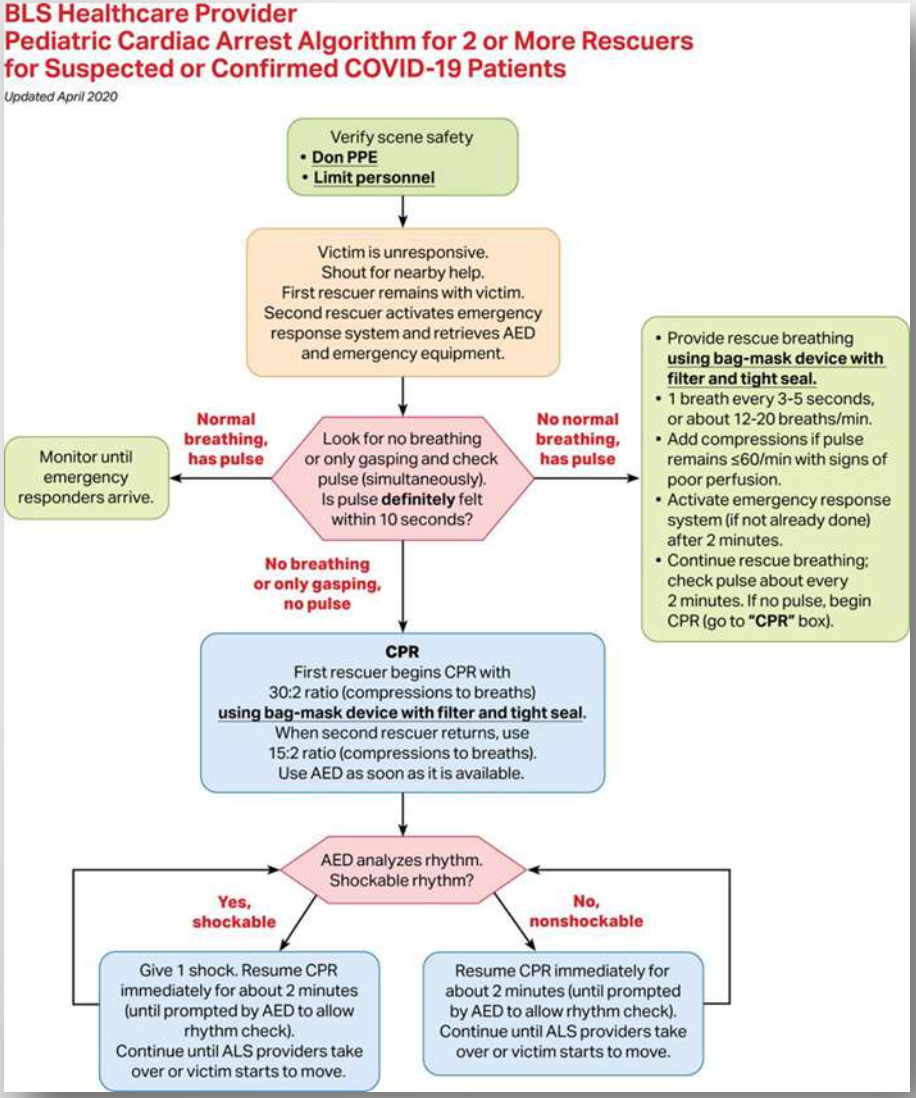
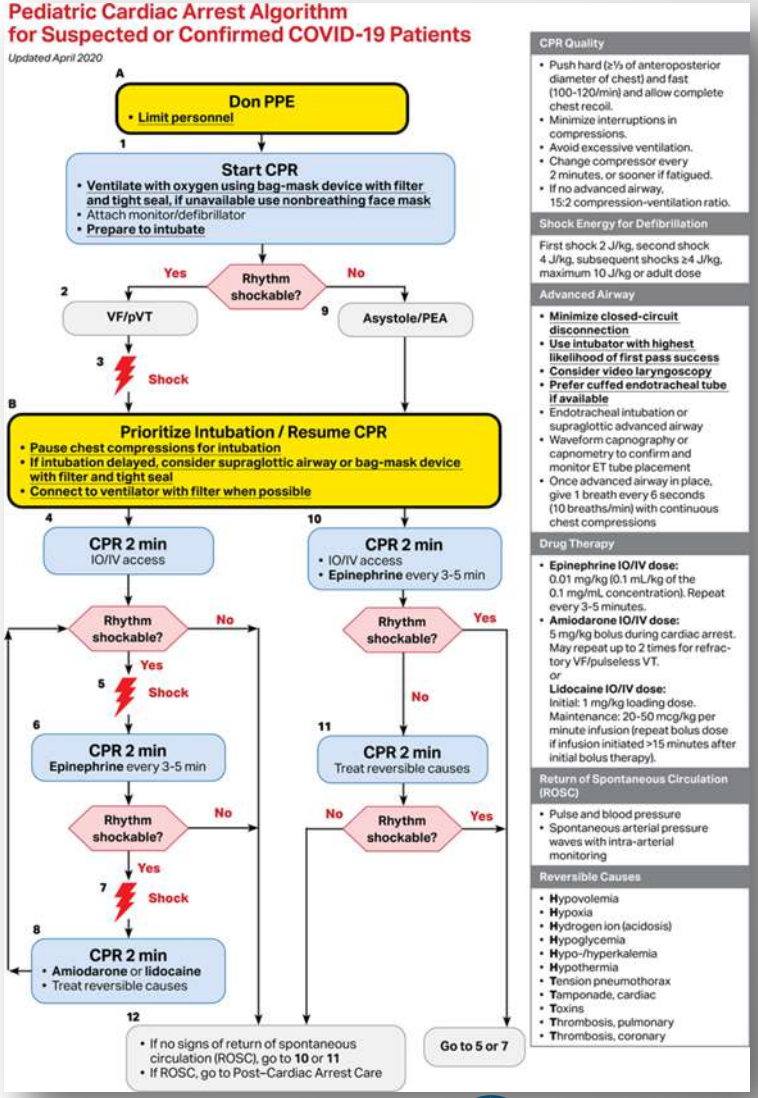
Pediatric Cardiac Arrest





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Lay Rescuers

KACPR. 2021

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Intubated Patients at Cardiac Arrest

- Leaving the patients on MV
- Adjust the ventilator settings
  - FiO_2 to 1.0
  - Pressure or volume controlled ventilation
  - Limit pressure or tidal volume to generate adequate chest rise
  - Trigger off
  - Adjust respiratory rate
    - 10 breaths/min for adult or children
    - 30 breaths/min for neonates

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Prone Patients at Cardiac Arrest

- Without an advanced airway
  - Place in the supine position and resuscitate
- With an advanced airway
  - Place the defibrillator pads in the AP position
  - Compression over T7/10 vertebral bodies.

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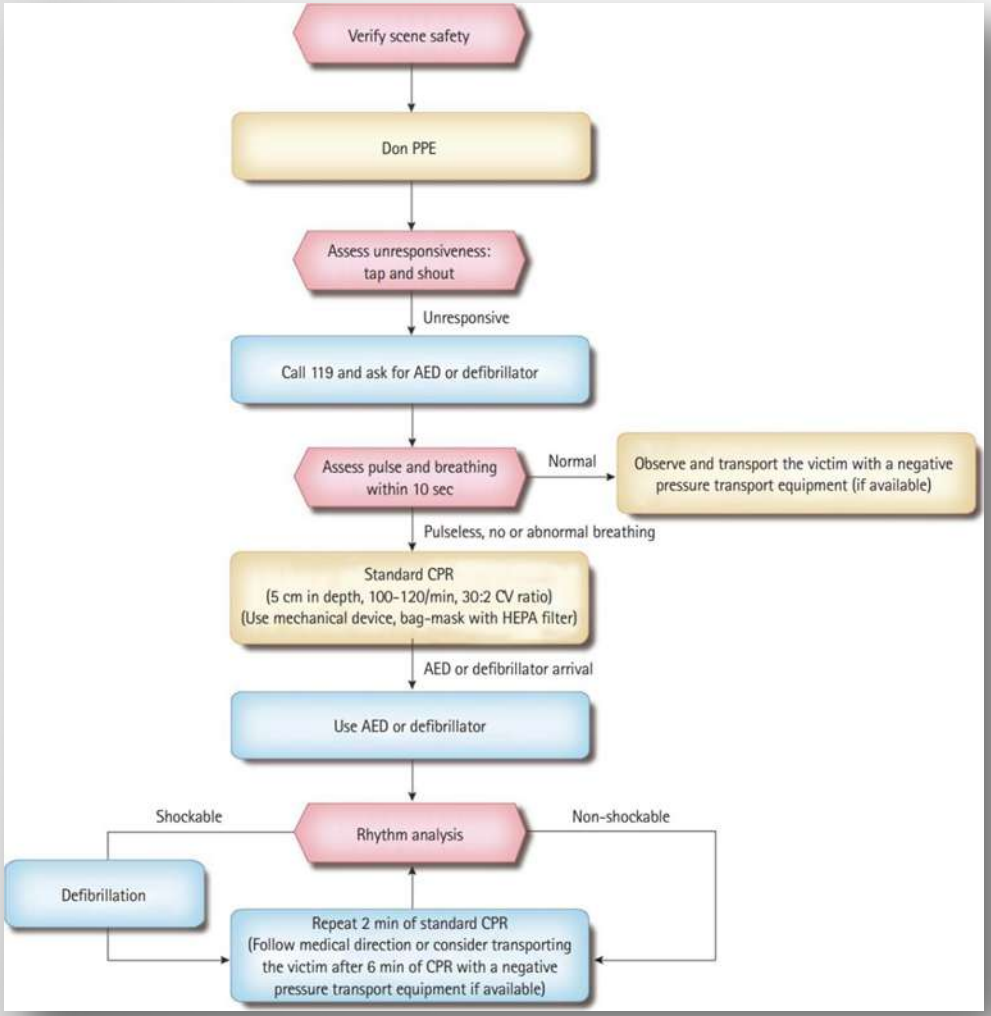
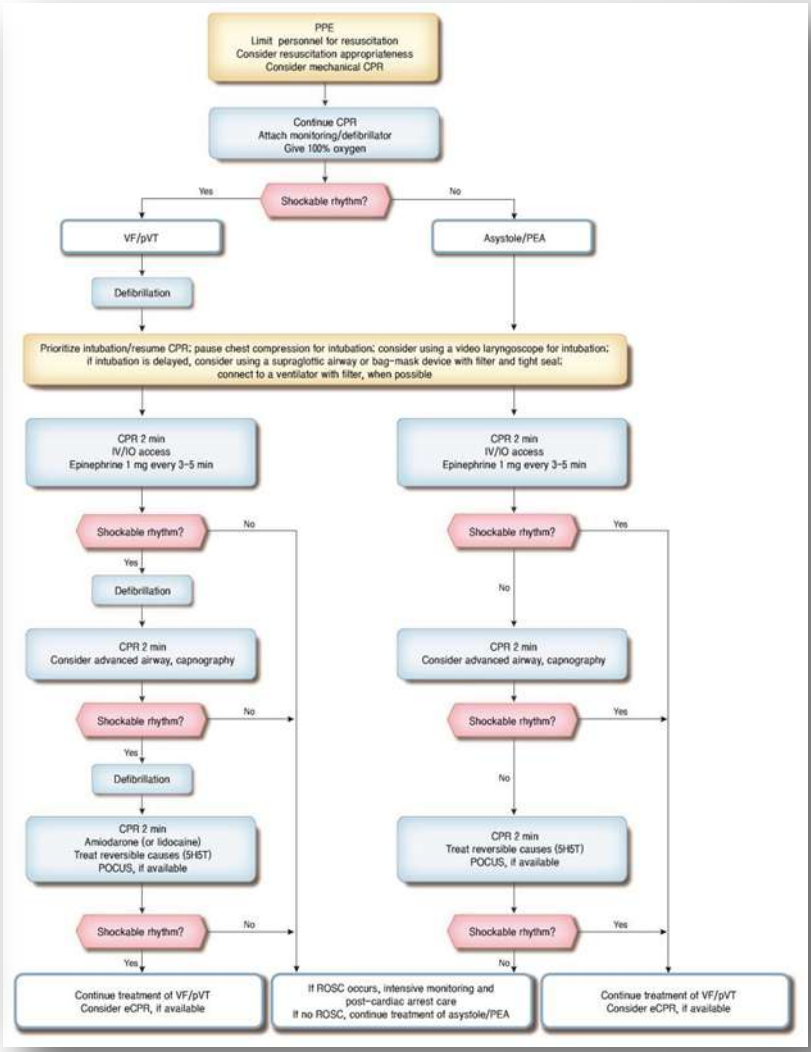
Korean Guidelines





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CEEM. 2021

Incidence and Outcomes for Out-of-hospital Cardiac Arrest

United States (1/2)

Table 1. Baseline Characteristics of Patients During the Pandemic Period of March 16 Through April 30, 2020, vs the Same Period in 2019

Variable	Patients, No. (%)		Standardized difference, %[a]
	2019 (n = 9440)	2020 (n = 9863)	
Patient factors			
Age, y			
Mean (SD)	62.2 (19.2)	62.6 (19.3)	2.1
Median (IQR)	65.0 (52.0-76.0)	65.0 (52.0-77.0)	
Sex			
Female	3517 (37.3)	3819 (38.7)	3.0
Male	5922 (62.7)	6040 (61.3)	
Missing, No.	1	4	
Race/ethnicity			
White	4844 (51.3)	4716 (48.1)	17.6
Black	2137 (22.6)	2751 (28.0)	
Other	915 (9.7)	1160 (11.8)	
Unknown	1544 (16.4)	1186 (12.1)	
Missing, No.	NA	50	

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United States (1/2)

Table 1. Baseline Characteristics of Patients During the Pandemic Period of March 16 Through April 30, 2020, vs the Same Period in 2019

Variable	Patients, No. (%) 2019 (n = 9440)	Patients, No. (%) 2020 (n = 9863)	Standardized difference, %[a]
Cardiac arrest factors			
First documented cardiac arrest rhythm			
Nonshockable			
Asystole	5071 (53.7)	5862 (59.6)	
Pulseless electrical activity	1766 (18.7)	1801 (18.3)	
Unknown nonshockable rhythm	829 (8.8)	750 (7.6)	
Shockable			
Ventricular fibrillation	1277 (13.5)	1034 (10.5)	14.2
Ventricular tachycardia	75 (0.8)	80 (0.8)	
Unknown shockable rhythm	422 (4.5)	309 (3.1)	
Missing, No.	NA	27	

JAMA Cardiol. 2021

United States (1/2)

Table 1. Baseline Characteristics of Patients During the Pandemic Period of March 16 Through April 30, 2020, vs the Same Period in 2019

Variable	Patients, No. (%) 2019 (n = 9440)	Patients, No. (%) 2020 (n = 9863)	Standardized difference, %[a]
Location of cardiac arrest			
Home	6590 (69.8)	7385 (74.9)	
Industrial or commercial building	771 (8.2)	377 (3.8)	
Nursing home and other health care residence	1479 (15.7)	1609 (16.3)	
Street and other public areas	455 (4.8)	393 (4.0)	21.3
Recreational facility	104 (1.1)	35 (0.4)	
Other	41 (0.4)	60 (0.6)	
Missing, No.	NA	4	
Witnessed status of cardiac arrest			
Bystander witnessed	4127 (43.7)	4049 (41.1)	
Unwitnessed	5313 (56.3)	5812 (58.9)	5.4
Missing, No.	NA	2	

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United States (1/2)

Table 2. Incidence Rate of Out-of-Hospital Cardiac Arrest (OHCA) During the 2020 Pandemic Period vs 2019, Overall and Stratified by County-Level Coronavirus Disease 2019 (COVID-19) Mortality Rate[a]

Variable	Unadjusted OHCA incidence, mean (SD), per 1 000 000 residents		Adjusted mean difference in incidence (95% CI)	*P* value	Incidence rate ratio
	2020	2019			
Overall	88.5 (64.1)	69.7 (49.8)	14.8 (14.2-15.3)	<.001	1.21
County-level COVID-19 mortality rate per million residents					
0-25	86.7 (47.8)	79.7 (43.8)	4.3 (3.2-5.4)	<.001	1.05
26-100	64.1 (43.2)	57.7 (41.5)	6.9 (6.0-7.9)	<.001	1.12
101-250	111.6 (81.9)	83.8 (63.3)	22.0 (20.7-23.3)	<.001	1.26
251-500	121.0 (65.2)	73.9 (49.8)	38.6 (37.1-40.1)	<.001	1.52
>500	90.9 (85.1)	55.5 (57.2)	28.7 (26.7-30.6)	<.001	1.52

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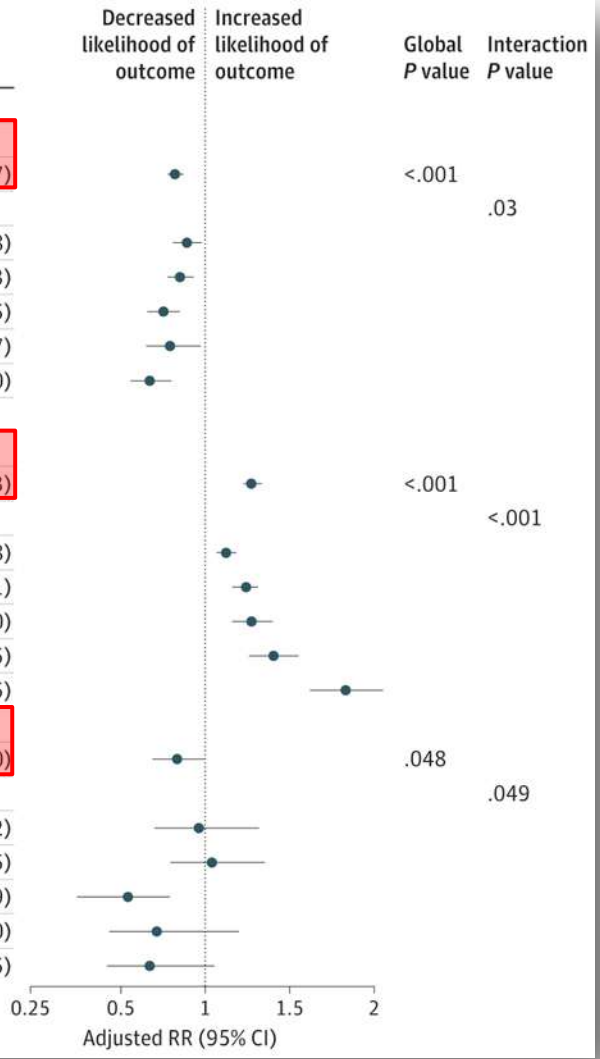
United States Registry (2/2)

Source	Rate, % 2019	2020	Adjusted RR (95% CI)	Global *P* value	Interaction *P* value
Primary outcome					
Sustained ROSC					
Overall	29.8	23.0	0.82 (0.78-0.87)	<.001	
County-level COVID-19 deaths per million population					.03
0-25	29.0	25.2	0.89 (0.81-0.98)		
26-100	31.4	25.4	0.85 (0.78-0.93)		
101-250	30.1	20.4	0.75 (0.66-0.85)		
251-500	27.0	20.0	0.79 (0.65-0.97)		
>500	28.8	17.3	0.67 (0.56-0.80)		
Secondary outcomes					
Termination of resuscitation					
Overall	39.9	53.9	1.27 (1.23-1.33)	<.001	
County-level COVID-19 deaths per million population					<.001
0-25	46.5	53.6	1.12 (1.07-1.18)		
26-100	36.7	48.3	1.24 (1.16-1.31)		
101-250	38.6	52.4	1.27 (1.16-1.40)		
251-500	41.0	62.1	1.40 (1.26-1.55)		
>500	33.1	66.5	1.83 (1.62-2.05)		
Survival to discharge					
Overall	9.8	6.6	0.83 (0.69-1.00)	.048	
County-level COVID-19 deaths per million population					.049
0-25	10.4	8.4	0.96 (0.70-1.32)		
26-100	10.5	8.8	1.04 (0.80-1.35)		
101-250	12.5	5.0	0.54 (0.36-0.79)		
251-500	7.6	4.8	0.71 (0.43-1.20)		
>500	6.2	2.9	0.67 (0.42-1.05)		



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Systematic Review (1/6)

Time period	Before pandemic	
	During pandemic	
Sample Size	Before pandemic	23789
	During pandemic	11590
Difference in OHCA incidence	2019	4018
	2020	8822
	Percentage change	119.6%

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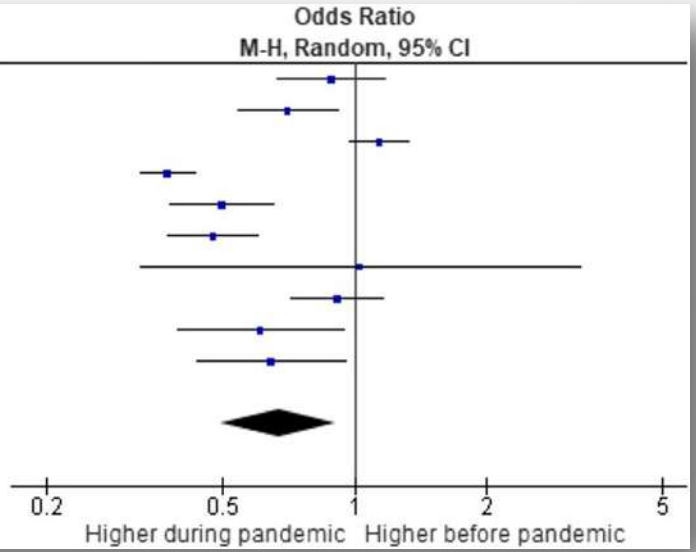
Systematic Review (2/6)

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	156	321	253	490	10.6%	0.89 [0.67, 1.17]
Ball 2020	827	1218	285	380	10.7%	0.71 [0.54, 0.92]
Elmer 2020	6302	12252	329	683	11.3%	1.14 [0.98, 1.33]
Lai 2020	1922	2302	6244	6709	11.3%	0.38 [0.33, 0.44]
Marijon 2020	2357	3052	454	521	10.7%	0.50 [0.38, 0.66]
Ortiz 2020	1109	1634	473	580	10.9%	0.48 [0.38, 0.60]
Paoli 2020	200	206	194	200	4.4%	1.03 [0.33, 3.25]
Sayre 2020	292	540	297	527	10.8%	0.91 [0.72, 1.16]
Semeraro 2020	509	563	586	624	9.4%	0.61 [0.40, 0.94]
Uy-Evanado 2020	157	231	213	278	9.8%	0.65 [0.44, 0.96]
Total (95% CI)		**22319**		**10992**	**100.0%**	**0.67 [0.49, 0.91]**
Total events	13831		9328			

Heterogeneity: $Tau^2 = 0.21$; $Chi^2 = 128.97$, df = 9 ($P < 0.00001$); $I^2 = 93\%$

Test for overall effect: $Z = 2.55$ ($P = 0.01$)



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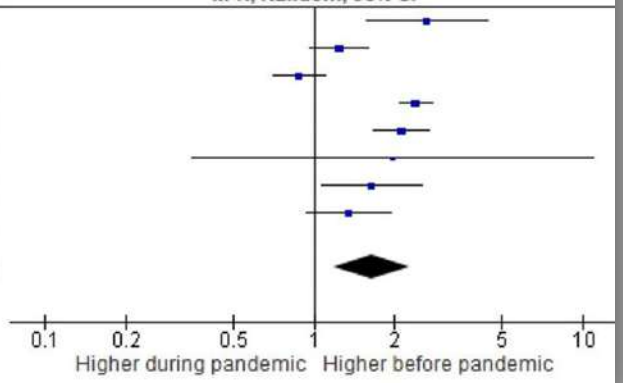
Systematic Review (3/6)

(e) ROSC achieved

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	44	222	27	314	11.4%	2.63 [1.57, 4.39]
Ball 2020	416	1218	112	380	14.6%	1.24 [0.97, 1.59]
Elmer 2020	1529	12252	95	683	14.9%	0.88 [0.71, 1.10]
Lai 2020	463	1336	727	3989	15.5%	2.38 [2.07, 2.73]
Ortiz 2020	525	1723	107	623	14.8%	2.11 [1.68, 2.67]
Paoli 2020	4	206	2	200	3.0%	1.96 [0.36, 10.82]
Semeraro 2020	54	563	38	624	12.5%	1.64 [1.06, 2.52]
Uy-Evanado 2020	95	231	95	278	13.4%	1.35 [0.94, 1.93]
Total (95% CI)		**17751**		**7091**	**100.0%**	**1.63 [1.18, 2.26]**
Total events	3130		1203			

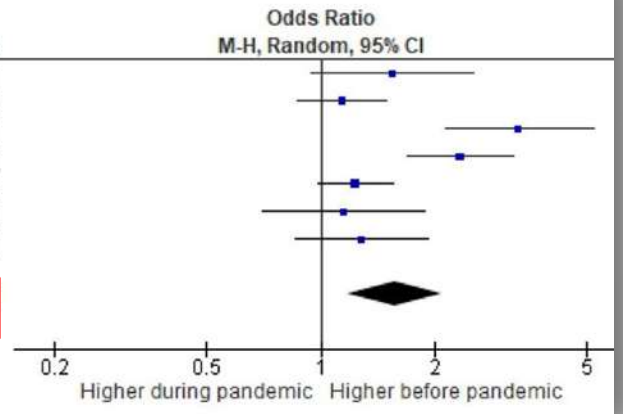
Heterogeneity: $Tau^2 = 0.17$; $Chi^2 = 69.39$, $df = 7$ ($P < 0.00001$); $I^2 = 90\%$
Test for overall effect: $Z = 2.93$ ($P = 0.003$)



(f) Shockable rhythm/shocked events

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	37	222	36	314	12.2%	1.54 [0.94, 2.53]
Ball 2020	318	1218	90	380	16.3%	1.14 [0.87, 1.49]
Lai 2020	38	345	45	1254	13.0%	3.33 [2.12, 5.21]
Marijon 2020	472	2471	46	500	15.4%	2.33 [1.69, 3.21]
Ortiz 2020	386	1723	118	623	17.0%	1.24 [0.98, 1.56]
Semeraro 2020	34	563	33	624	12.2%	1.15 [0.70, 1.88]
Uy-Evanado 2020	64	231	64	278	13.9%	1.28 [0.86, 1.91]
Total (95% CI)		**6773**		**3973**	**100.0%**	**1.57 [1.17, 2.09]**
Total events	1349		432			

Heterogeneity: $Tau^2 = 0.11$; $Chi^2 = 27.76$, $df = 6$ ($P = 0.0001$); $I^2 = 78\%$
Test for overall effect: $Z = 3.05$ ($P = 0.002$)



Resuscitation. 2020

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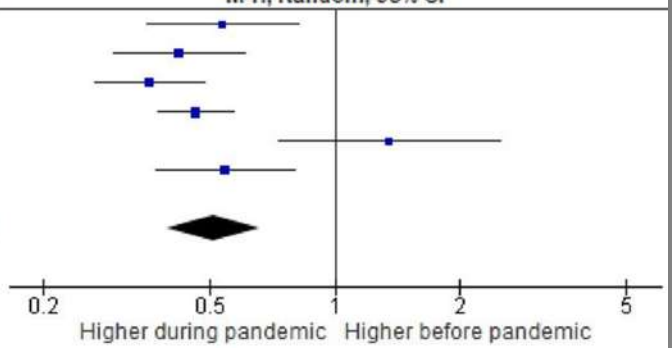
Systematic Review (4/6)

(g) OHCA at home

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	267	321	442	490	15.3%	0.54 [0.35, 0.82]
Ball 2020	965	1218	342	380	17.0%	0.42 [0.29, 0.61]
Marijon 2020	2336	3042	460	510	18.9%	0.36 [0.27, 0.49]
Ortiz 2020	1042	1723	478	623	22.0%	0.46 [0.38, 0.57]
Semeraro 2020	82	110	65	95	10.5%	1.35 [0.73, 2.49]
Uy-Evanado 2020	145	231	210	278	16.4%	0.55 [0.37, 0.80]
Total (95% CI)		6645		2376	100.0%	0.51 [0.40, 0.66]
Total events	4837		1997			

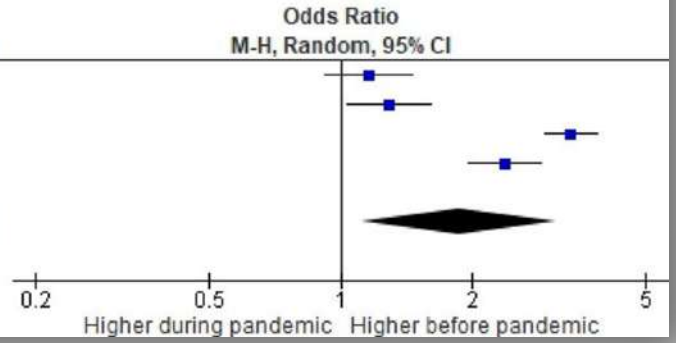
Heterogeneity: $Tau^2 = 0.07$; $Chi^2 = 15.87$, df = 5 (P = 0.007); $I^2 = 68\%$
Test for overall effect: Z = 5.13 (P < 0.00001)



(h) Endotracheal Intubation

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Ball 2020	594	1218	171	380	24.7%	1.16 [0.92, 1.47]
Elmer 2020	2760	6571	127	353	24.8%	1.29 [1.03, 1.61]
Lai 2020	1011	1336	1915	3989	25.5%	3.37 [2.93, 3.87]
Ortiz 2020	1224	1723	320	630	25.1%	2.38 [1.97, 2.87]
Total (95% CI)		10848		5352	100.0%	1.87 [1.12, 3.13]
Total events	5589		2533			

Heterogeneity: $Tau^2 = 0.27$; $Chi^2 = 87.74$, df = 3 (P < 0.00001); $I^2 = 97\%$
Test for overall effect: Z = 2.39 (P = 0.02)



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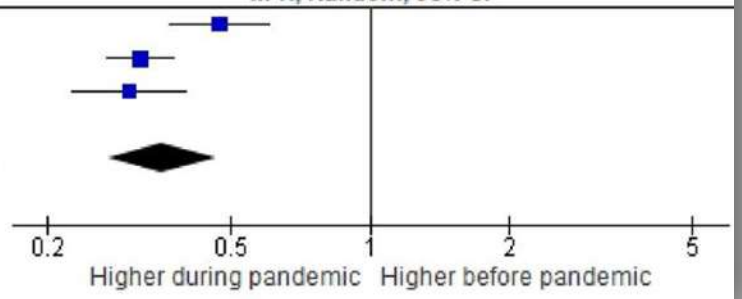
Systematic Review (5/6)

(i) Supraglottic airway

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Elmer 2020	904	6571	89	353	32.2%	0.47 [0.37, 0.61]
Lai 2020	193	1336	1385	3989	38.2%	0.32 [0.27, 0.37]
Ortiz 2020	103	1723	110	630	29.6%	0.30 [0.23, 0.40]
Total (95% CI)		9630		4972	100.0%	0.36 [0.27, 0.46]
Total events	1200		1584			

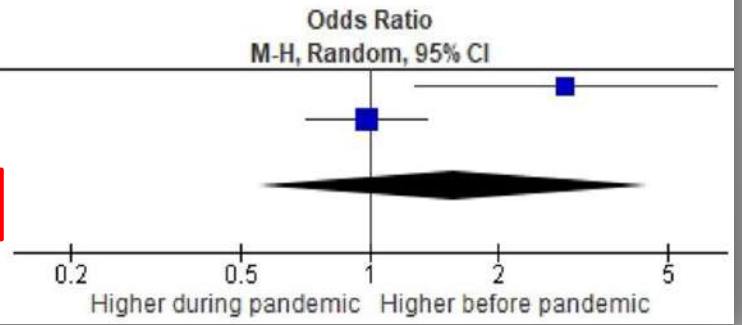
Heterogeneity: Tau² = 0.04; Chi² = 8.07, df = 2 (P = 0.02); I² = 75%
Test for overall effect: Z = 7.57 (P < 0.00001)



(j) Mechanical CPR device used

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	23	138	9	138	43.7%	2.87 [1.27, 6.45]
Ball 2020	177	1218	56	380	56.3%	0.98 [0.71, 1.36]
Total (95% CI)		1356		518	100.0%	1.57 [0.55, 4.45]
Total events	200		65			

Heterogeneity: Tau² = 0.47; Chi² = 5.77, df = 1 (P = 0.02); I² = 83%
Test for overall effect: Z = 0.85 (P = 0.40)



Resuscitation. 2020

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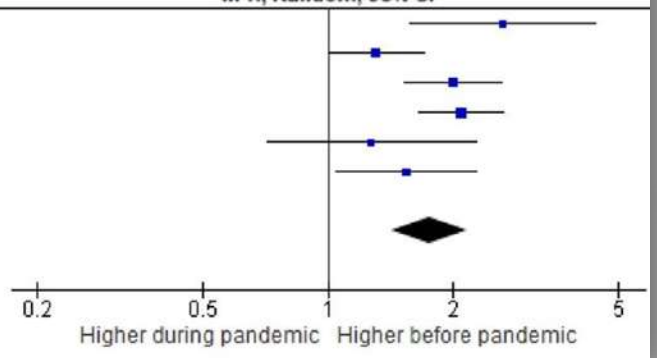
Systematic Review (6/6)

(l) Survival to hospital admission

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	44	222	27	314	11.0%	2.63 [1.57, 4.39]
Ball 2020	359	1218	92	380	21.0%	1.31 [1.00, 1.71]
Marijon 2020	695	3052	67	521	20.7%	2.00 [1.53, 2.62]
Ortiz 2020	525	1634	107	580	22.6%	2.09 [1.66, 2.64]
Semeraro 2020	42	110	31	95	9.5%	1.28 [0.72, 2.27]
Uy-Evanado 2020	74	231	65	278	15.1%	1.54 [1.04, 2.29]
Total (95% CI)		**6467**		**2168**	**100.0%**	**1.75 [1.42, 2.17]**
Total events	1739		389			

Heterogeneity: $Tau^2 = 0.04$; $Chi^2 = 11.72$, df = 5 (P = 0.04); $I^2 = 57\%$

Test for overall effect: Z = 5.18 (P < 0.00001)

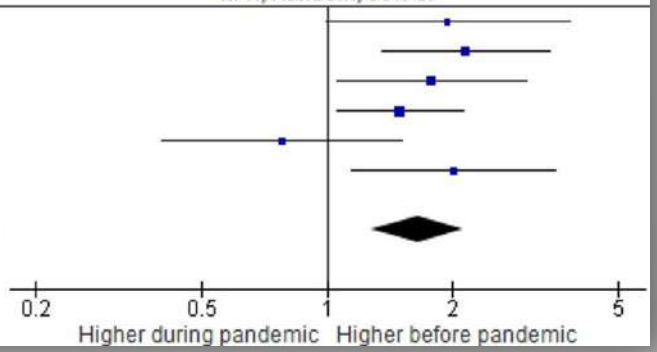


(m) Survival to hospital discharge

Study or Subgroup	Before pandemic Events	Total	During pandemic Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Baldi 2020	21	222	16	314	11.2%	1.95 [0.99, 3.82]
Ball 2020	142	1218	22	380	19.3%	2.15 [1.35, 3.42]
Marijon 2020	164	3052	16	517	16.5%	1.78 [1.05, 3.00]
Ortiz 2020	168	1723	42	623	26.8%	1.49 [1.05, 2.12]
Semeraro 2020	22	110	23	95	11.5%	0.78 [0.40, 1.52]
Uy-Evanado 2020	34	231	22	278	14.6%	2.01 [1.14, 3.54]
Total (95% CI)		**6556**		**2207**	**100.0%**	**1.65 [1.28, 2.12]**
Total events	551		141			

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 7.19$, df = 5 (P = 0.21); $I^2 = 30\%$

Test for overall effect: Z = 3.86 (P = 0.0001)



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Taiwan

Impact of the COVID-19 pandemic on emergency medical service response to out-of-hospital cardiac arrests in Taiwan: a retrospective observational study

Table 2 COVID-19's influence on outcomes among patients with out-of-hospital cardiac arrest

Patient outcomes	2019 (n=570)	2020 (n=622)	P value
Prehospital ROSC	37 (6.49)	16 (2.57)	0.001
Sustained ROSC	119 (20.88)	126 (20.26)	0.791
Survival discharge	34 (5.96)	31 (4.98)	0.456
Favourable neurological function	24 (4.21)	13 (2.09)	0.035

ROSC, return of spontaneous circulation.

Osaka City, Japan

Table 1 – Characteristics and outcomes of OHCA patients between the non-COVID-19 pandemic period and the COVID-19 pandemic period.

	COVID-19 pandemic period (Feb-July, 2020) (n = 825)		Non-COVID-19 pandemic period (Feb-July, 2019) (n = 862)		p-value
Age, years, median (IQR)	77.0	(66.0–85.0)	75.0	(63.0–83.0)	0.002
Men, n (%)	529	(64.1)	551	(63.9)	0.589
Good ADL before arrest, n (%)	592	(71.8)	614	(71.2)	0.778
Witnessed by bystander, n (%)	282	(34.2)	310	(36.0)	0.445
Location of arrest, public place, n (%)	168	(20.4)	225	(26.1)	0.006
Origin of arrest, cardiac origin, n (%)	742	(89.9)	746	(86.5)	0.034
VF as the first documented rhythm, n (%)	85	(10.3)	69	(8.0)	0.108
Bystander CPR, n (%)	272	(33.0)	356	(41.3)	<0.001
Public-access AED pad application, n (%)	24	(2.9)	53	(6.1)	0.002
Shocks by public-access AEDs, n (%)	10	(1.2)	16	(1.9)	0.326
Dispatcher instruction, n (%)	511	(61.9)	507	(58.8)	0.196
Adrenaline administration, (%)	222	(26.9)	254	(29.5)	0.256
Advanced airway management, n (%)					
Endotracheal intubation	96	(11.6)	166	(19.3)	<0.001
Supraglottic airway	422	(51.2)	345	(40.0)	
No advanced airway management	307	(37.2)	351	(40.7)	
Response time (call to contact with patients), min, median (IQR)	6.0	(5.0–8.0)	7.0	(6.0–9.0)	<0.001
On-scene time (arrival at the scene to dispatch at the hospital), min, median (IQR)	15.0	(11.0–18.0)	15.0	(11.0–19.0)	0.713
Hospital arrival time (call to hospital arrival), min, median (IQR)	27.0	(22.0–32.0)	28.0	(23.0–32.0)	0.006
Prehospital ROSC, n (%)	75	(9.1)	108	(12.5)	0.028
One-month survival, n (%)	68	(8.2)	80	(9.3)	0.491
Neurologically favorable outcome, n (%)	38	(4.6)	53	(6.1)	0.196

Resusc Plus. 2021

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Republic of Korea

The Comparison of Emergency Medical Service Responses to and Outcomes of Out-of-hospital Cardiac Arrest before and during the COVID-19 Pandemic in an Area of Korea

JKMS. 2021

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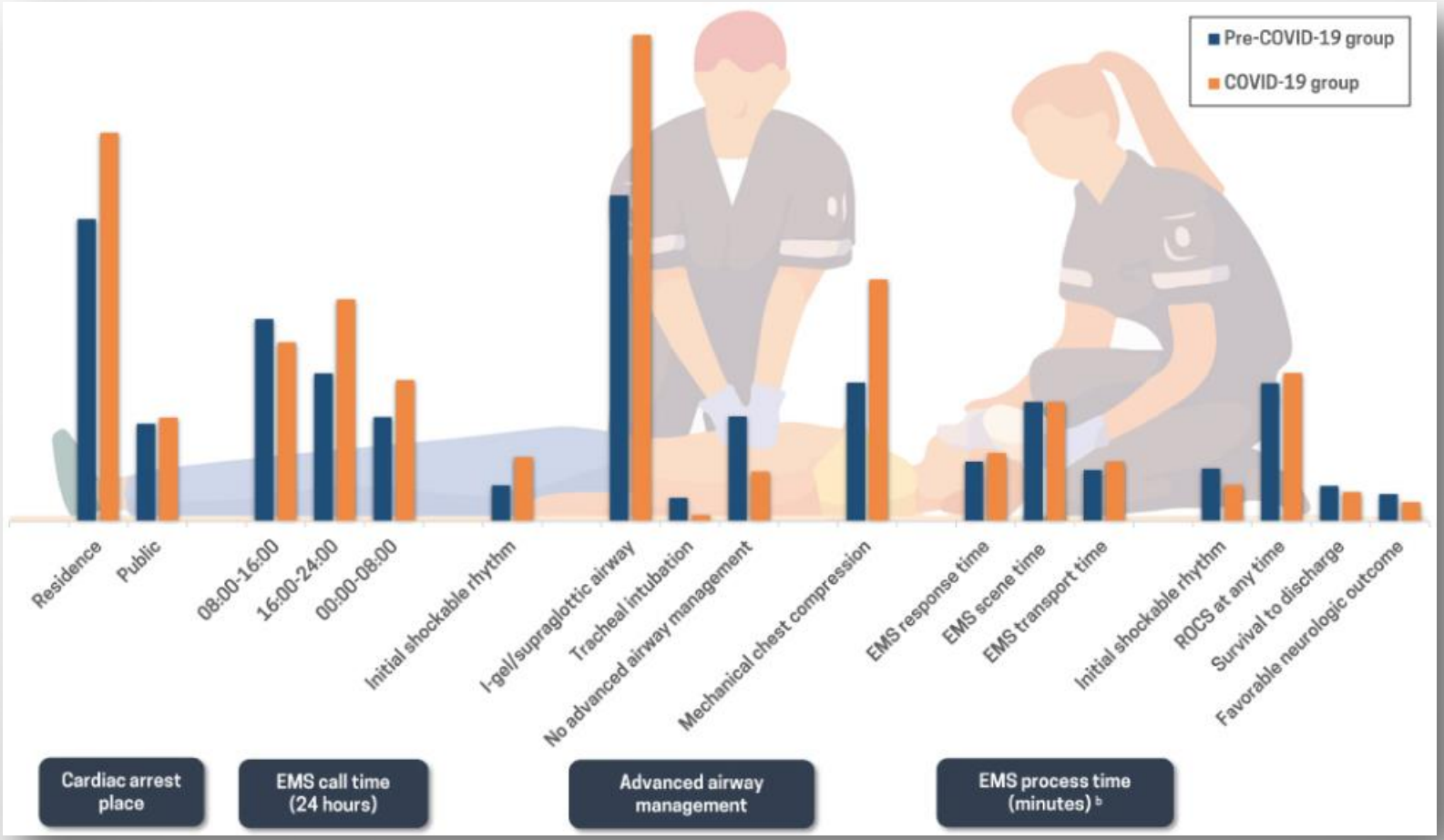
Republic of Korea



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Republic of Korea

The Comparison of Emergency Medical Service Responses to and Outcomes of Out-of-hospital Cardiac Arrest before and during the COVID-19 Pandemic in an Area of Korea

Table 3. The impact of COVID-19 on the hospital outcomes

Group	Survival at admission				Survival to discharge			
	Total	Survival	Incidence	Adjusted OR (95% CI)	Total	Survival	Incidence	Adjusted OR (95% CI)
Total patient group								
Pre-COVID-19	891 (45.60)	201 (50.63)	22.56	Reference	891 (45.60)	70 (54.69)	7.86	Reference
COVID-19	1,063 (54.40)	196 (49.37)	18.44	0.776 (0.605–0.996)	1,063 (54.40)	58 (45.31)	5.46	0.677 (0.442–1.034)
Propensity group[a]								
Pre-COVID-19	888 (50.00)	200 (55.25)	22.52	Reference	888 (50.00)	69 (58.47)	7.78	Reference
COVID-19	888 (50.00)	162 (44.75)	18.24	0.768 (0.592–0.995)	888 (50.00)	49 (41.53)	5.52	0.693 (0.446–1.077)

JKMS. 2021

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Korean Association of CardioPulmonary Resuscitation

Potential Causes (1/2)

- Severity of SARS-CoV-2-related cardiac arrest
- Implementation of termination of resuscitation guidance
- local crisis standards of care
- Patient hesitancy to seek medical care contributing to delays in care

Circ Cardiovasc Qual Outcomes. *2021*

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Potential Causes (2/2)

- Delayed provision of prompt chest compression and defibrillation
- PPE may have accelerated rescuer fatigue resulting in decreased CPR quality
- Earlier termination of resuscitative efforts
- Overwhelmed Emergency Medical Services systems
- Significant delays in presentation for medical care

Circ Cardiovasc Qual Outcomes. *2021*

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Needs for Guideline Update

- Poor resuscitation outcomes
- More accurate understanding of the transmissibility of SARS-CoV-2
- Stabilizing of PPE availability
- Widespread vaccination

2021 Guidance for BLS/ACLS in COVID-19 Patients

Reduce Provider Risk

Table 1. New SARS-CoV-2 Infections among Vaccinated Health Care Workers from December 16, 2020, through February 9, 2021.

Days after Vaccination	Vaccinated Persons		
	With New Infection (N=379)	Tested (N=14,604)*	Eligible for Testing (N=36,659)†
	number		*number (percent)*
Dose 1			
Days 1–7	145	5794	35,673 (97.3)
Days 8–14	125	7844	34,404 (93.8)
Days 15–21	57	7958	32,667 (89.1)
Day 22 or later, before dose 2	15	4286	32,327 (88.2)
Dose 2			
Days 1–7	22	5546	23,100 (63.0)
Days 8–14	8	4909	16,082 (43.9)
Day 15 or later	7	4167	14,990 (40.9)

* Shown are the numbers of unique health care workers who underwent testing (not the number of individual tests).

† Shown are the numbers and percentages of persons among 36,659 vaccinated health care workers who were eligible to undergo testing each week as of February 9, 2021.

NEJM. 2021

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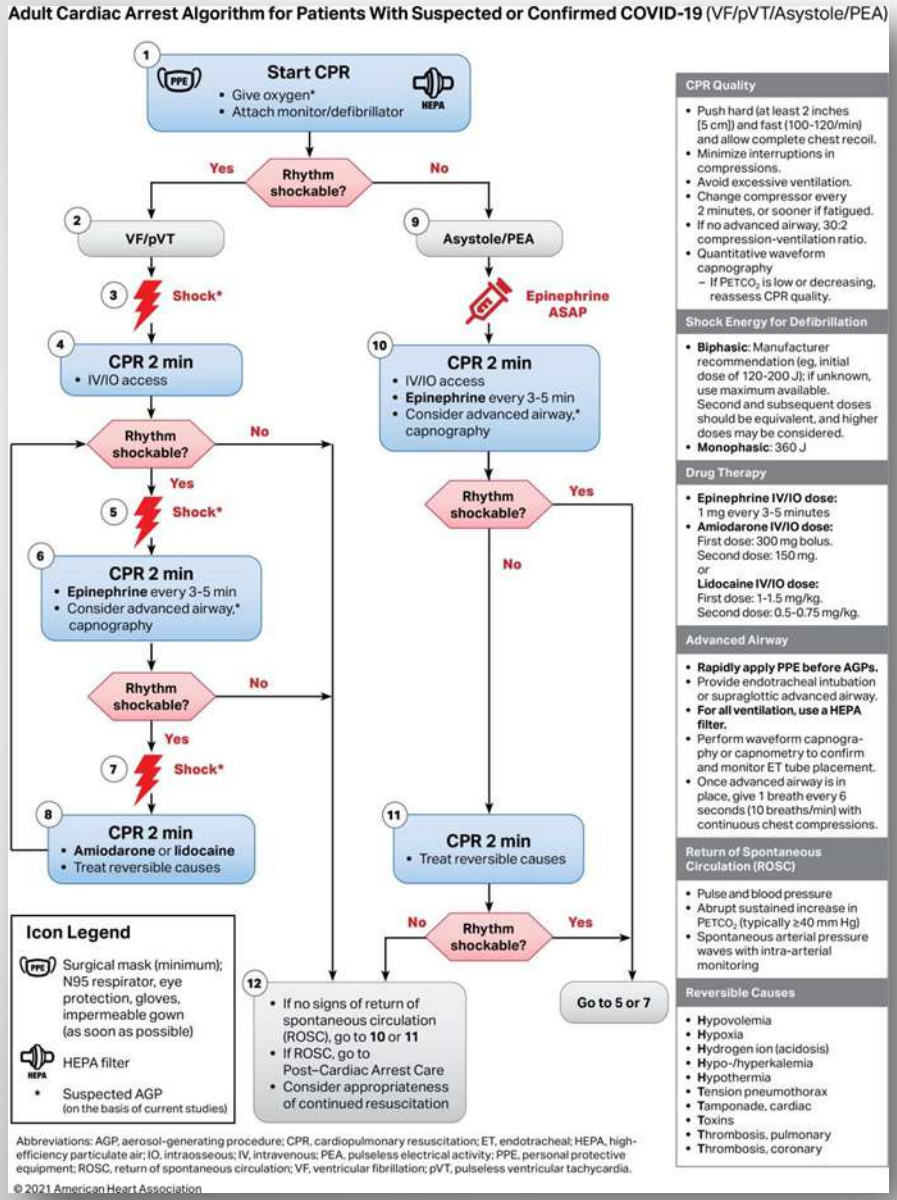
Reduce Provider Exposure and Provide Timely Care

Reduce provider exposure and provide timely care

- Rapidly provide chest compressions, without delay or interruption
- Do not delay chest compressions for provider PPE or to place a face covering on the patient
- Relieve initial resuscitation personnel with providers wearing appropriate PPE for AGPs as soon as possible
- Don appropriate PPE for AGPs (N95 masks with eye protection or positive-airway pressure respirators, gloves and gowns) prior to confirmed AGPs including bag-mask ventilation, intubation and positive pressure ventilation
- Limit unprotected rescuers from exposure of AGPs
- Consider using mechanical CPR devices *if available and personnel are already trained*
- Communicate COVID-19 status of the patient to any new providers and clearly communicate expectations of appropriate risk-matched PPE

Adult Cardiac Arrest Algorithm



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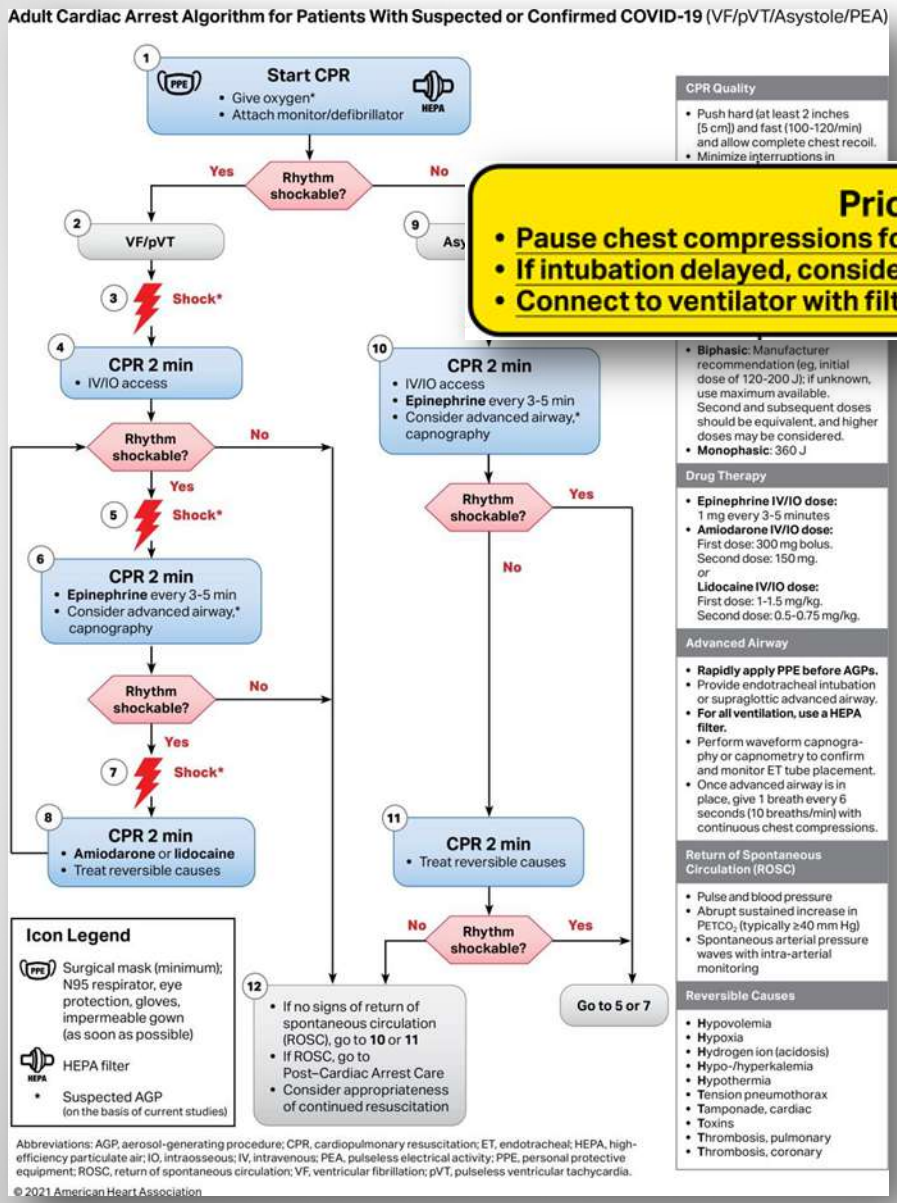
Adult Cardiac Arrest Algorithm



Don PPE

- Limit personnel
- Consider resuscitation appropriateness

Prioritize Intubation / Resume CPR

- Pause chest compressions for intubation
- If intubation delayed, consider supraglottic airway or bag-mask device with filter and tight seal
- Connect to ventilator with filter when possible

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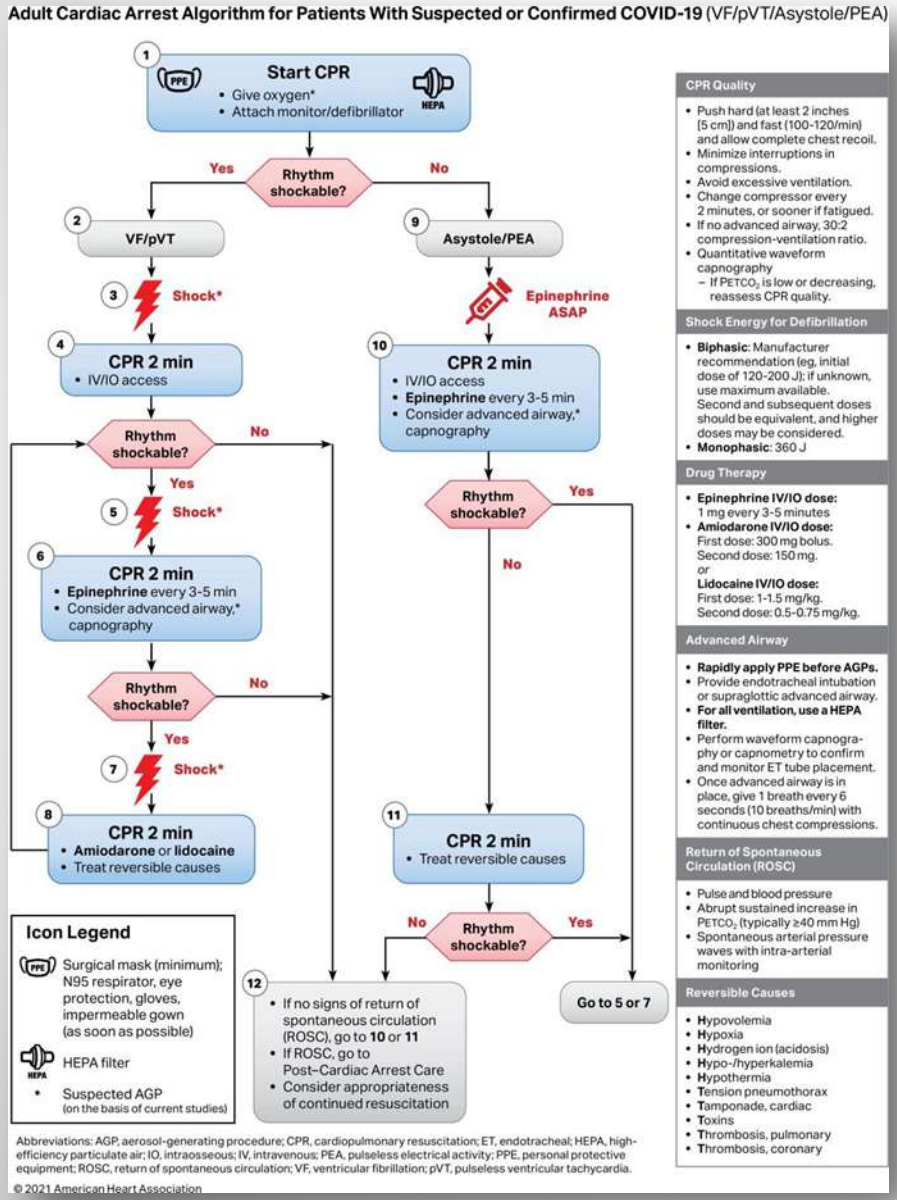
Adult Cardiac Arrest Algorithm



Icon Legend

- Surgical mask (minimum); N95 respirator, eye protection, gloves, impermeable gown (as soon as possible)
- HEPA filter
- * Suspected AGP (on the basis of current studies)

Advanced Airway

- **Rapidly apply PPE before AGPs.**
- Provide endotracheal intubation or supraglottic advanced airway.
- Perform waveform capnography or capnometry to confirm and monitor ET tube placement.
- **For all ventilation, use a HEPA filter.**

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Specific Considerations

- Agonal breathing
  - Passive oxygenation overlaid with a surgical facemask

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Neonatal Resuscitation

- Encourage mother to wear a surgical mask
- A case for transplacental transmission of SARS-CoV-2 infection

Nat Comm. 2021

Considerations for RCA Guidelines for Basic and Advanced Life Support in Patients with Suspected of Confirmed COVID-19

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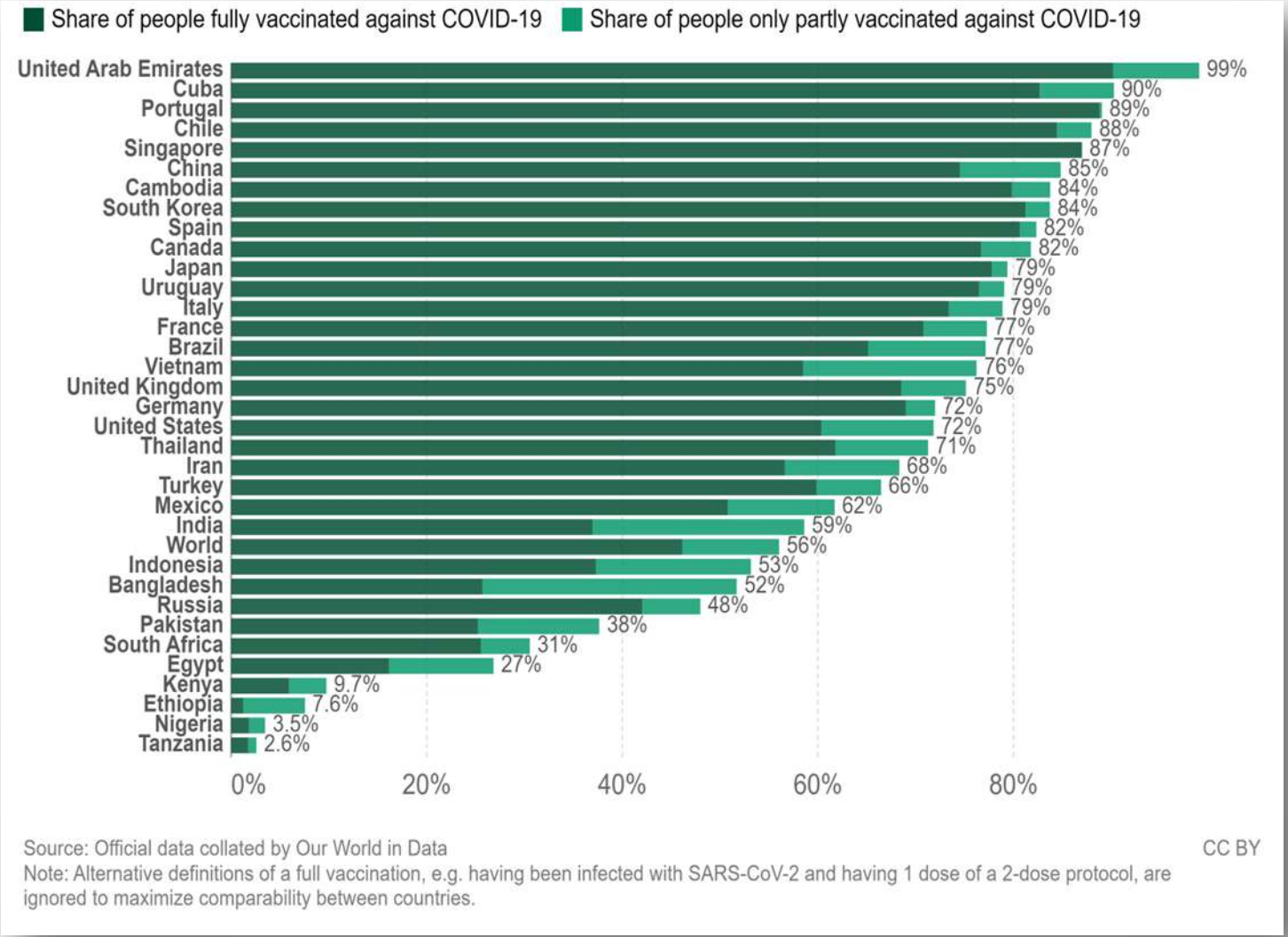
Korean Association of CardioPulmonary Resuscitation

COVID-19 Vaccination



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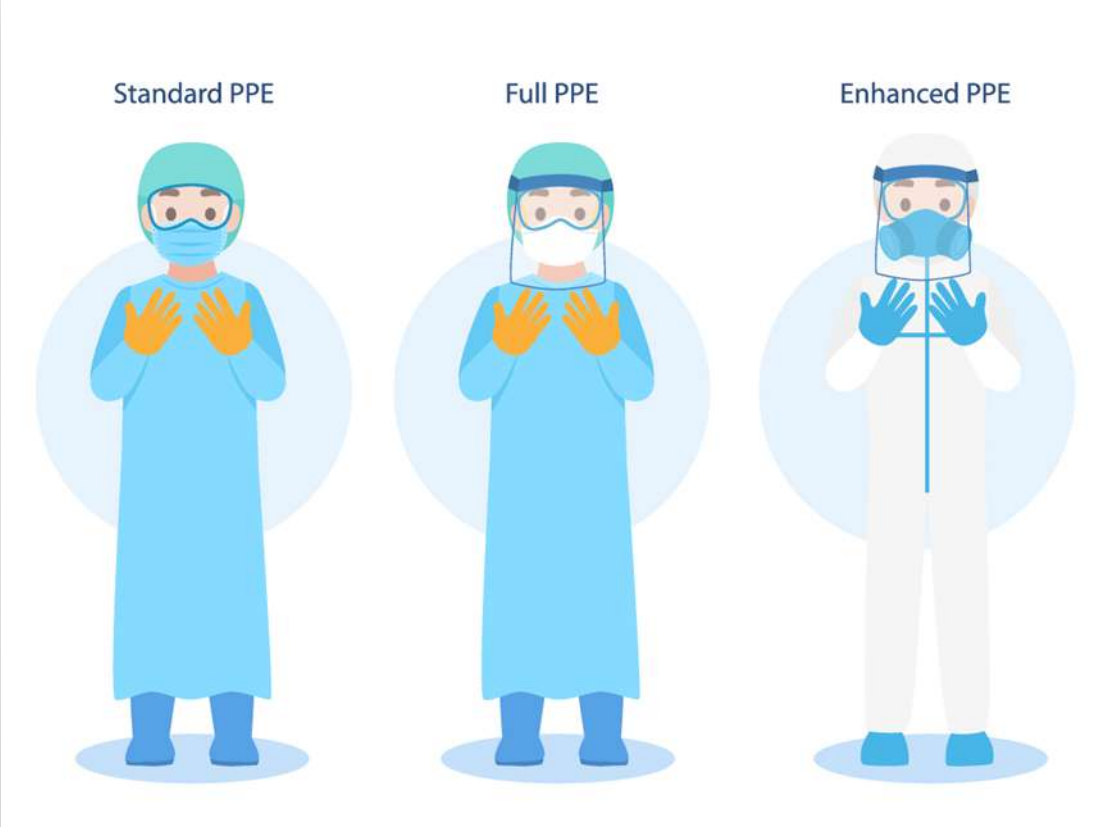
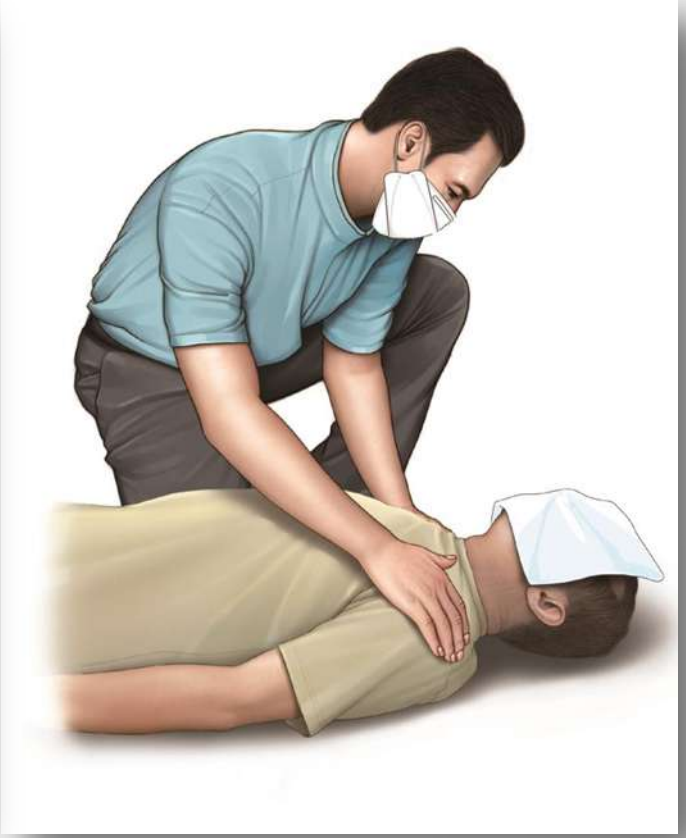
Minimizing Delay for Resuscitation





Revised Resuscitation Protocol

Evaluation of a revised resuscitation protocol for out-of-hospital cardiac arrest patients due to COVID-19 safety protocols: a single-center retrospective study in Japan

Outcomes, number, (%)	All patients (N = 443)	The conventional CPR period (2019.01–2020.03) (N = 267)	The COVID-19 safety protocol period (2020.04–2020.12) (N = 176)	The COVID-19 safety protocol	
				Crude OR [95% CI]	Adjusted OR [95% CI]
Hospitalization survival	75 (16.9%)	50 (18.7%)	25 (14.2%)	0.72 [0.43–1.21]	0.61 [0.32–1.18]
ROSC after hospital arrival	152 (34.3%)	89 (33.3%)	63 (35.8%)	1.12 [0.75–1.66]	1.11 [0.69–1.79]
1-month survival after OHCA	23 (5.2%)	14 (5.2%)	9 (5.1%)	0.97 [0.41–2.30]	1.14 [0.37–3.50]

Sci Rep. 2020

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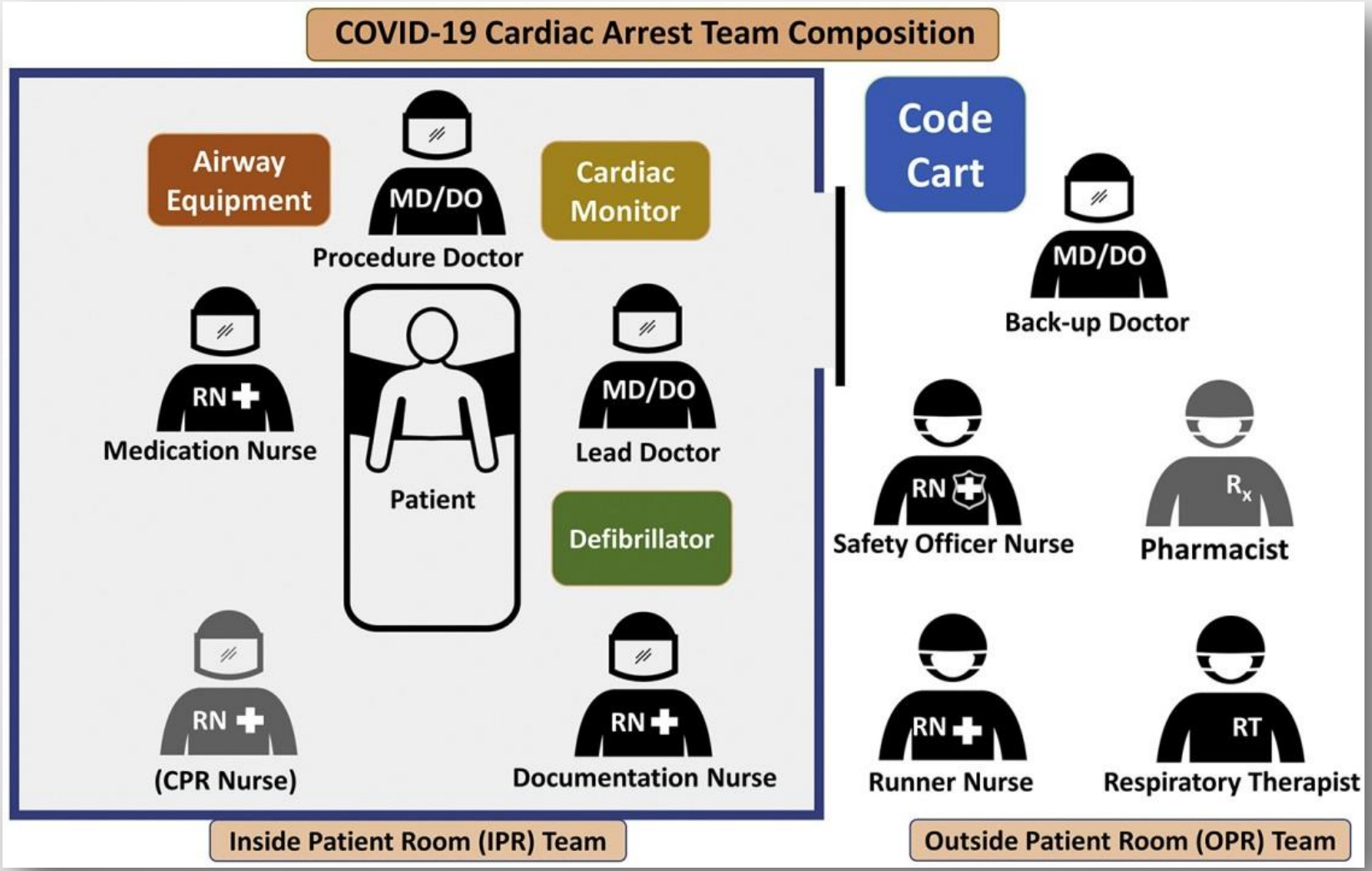
Provision of Timely Care



AJEM. 2020

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Korean Association of CardioPulmonary Resuscitation

Careful Consideration of TOR

Table 4 External validations of multimodal TOR rules for predicting death prior to discharge ($n = 170$)

TOR rules		Death	Survival	Sensitivity (95% CI)	Specificity (95% CI)	FPV (95% CI)	PPV (95% CI)	NPV (95% CI)
Before arriving at the ED								
International BLS-TOR	met all criteria	121	1	74.2%	85.7%	0.8%	99.2%	12.5%
	did not fulfill	42	6	(66.7–80.6)	(42.0–99.2)	(0.04–5.2)	(84.8–99.9)	(5.2–25.9)
Goto's rule	met all criteria	58	0	35.6%	100%	0%	100%	6.3%
	did not fulfill	105	7	(28.4–43.5)	(56.1–100)	(0–7.7)	(92.3–100)	(2.8–12.9)
KoCARC TOR rule I	met all criteria	93	0	57.1%	100%	0%	100%	9.1%
	did not fulfill	70	7	(49.1–64.7)	(56.1–100)	(0–4.9)	(95.1–100)	(4.0–18.4)
KoCARC TOR rule II	met all criteria	97	1	56.5%	85.7%	1.0%	98.9%	8.3%
	did not fulfill	66	6	(51.5–67.0)	(42.0–99.2)	(0.05–6.4)	(93.6–99.9)	(3.4–17.9)
KoCARC TOR rule III	met all criteria	78	0	47.9%	100%	0%	100%	7.6%
	did not fulfill	85	7	(40.0–55.8)	(56.1–100)	(0–5.8)	(94.2–100)	(3.4–15.6)
New TOR Model 1	met all criteria	35	0	21.5%	100%	0%	100%	5.2%
	did not fulfill	128	7	(15.6–28.7)	(56.1–100)	(0–12.3)	(87.7–100)	(2.3–10.8)
After ED arrival								
International ALS TOR	met all criteria	23	0	14.1%	100%	0	100%	4.8%
	did not fulfill	140	7	(9.3–20.6)	(56.1–100)	(0–17.8)	(82.2–100)	(2.1–9.9)
SOS-KANTO's rule	met all criteria	33	0	20.2%	100%	0%	100%	5.2%
	did not fulfill	130	7	(14.5–27.4)	(56.1–100)	(0–12.9)	(87.0–100)	(2.3–10.6)
New TOR Model 2	met all criteria	45	0	27.6%	100%	0%	100%	5.6%
	did not fulfill	118	7	(21.0–35.2)	(56.1–100)	(0–9.7)	(90.2–100)	(2.4–11.6)

ALS advanced life support, *BLS-TOR* basic life support and termination of resuscitation, *CI* confidence interval, *ED* emergency department, *FPV* false positive value, *KoCARC* Korean Cardiac Arrest Research Consortium in 2015–2017; *NPV* negative predictive value, *PPV* positive predictive value, *SOS-KANTO* survey of survivors after cardiac arrest conducted in the Kanto area in 2012 (2017)

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Thank You