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Effect of COVID-19 on the prevalence of bystanders performing cardiopulmonary resuscitation: A systematic review and meta-analysis

Artur Krawczyk[1], Krzysztof Kurek[2], Gabriella Nucera[3], Michał Pruc[1, 4], Damian Świeczkowski[5], Dawid Kacprzyk[1], Ewa Skrzypek[6], Nicola Luigi Bragazzi[7], Kamil Safiejko[8], Łukasz Szarpak[2, 8, 9]

[1]Research Unit, Polish Society of Disaster Medicine, Warsaw, Poland
[2]Department of Clinical Research and Development, LUXMED Group, Warsaw, Poland
[3]Department of Emergency, Fatebenefratelli Hospital, ASST Fatebenefratelli and Sacco, Milan, Italy
[4]Department of Public Health, International European University, Kyiv, Ukraine
[5]Department of Toxicology, Faculty of Pharmacy, Medical University of Gdansk, Poland
[6]Department of Medical Ethics and History of Medicine, Medical University of Warsaw, Poland
[7]Department of Mathematics and Statistics, Laboratory for Industrial and Applied Mathematics (LIAM), York University, Toronto, Canada
[8]Colorectal Cancer Unit, Maria Sklodowska-Curie Bialystok Oncology Center, Bialystok, Poland
[9]Henry JN Taub Department of Emergency Medicine, Baylor College of Medicine, Houston, TX, United States

Abstract

Background: *The importance of bystander cardiopulmonary resuscitation (CPR) during out-of-hospital cardiac arrests is especially important in the context of coronavirus disease 2019 (COVID-19) because it can significantly influence survival outcomes. The objective of this meta-analysis was to examine the primary outcomes of bystander CPR during the pandemic and pre-pandemic periods.*

Methods: *A search was conducted in the PubMed Central, Scopus, and EMBASE databases, as well as the Cochrane Central Register of Controlled Trials database, up to December 10, 2023. In cases where the value of I^2 was greater than or equal to 50% or the Q-test indicated that the p-value was less than or equal to 0.05, the studies were considered to be heterogeneous. Sensitivity assessment was performed using the leave-one-out methodology. The study protocol was registered in PROSPERO with the ID number CRD42023494912.*

Results: *Twenty-five articles were included in this meta-analysis. Pooled analysis showed that bystander CPR frequency during the COVID-19 pandemic was 38.8%, compared to 44.8% for the pre-pandemic period (odds ratio: 1.04; 95% confidence interval: 0.93–1.16; p = 0.48).*

Conclusions: *The article's conclusions indicate that the COVID-19 pandemic influenced a reduction in bystander CPR compared to the pre-pandemic period, but this difference was not statistically significant. Further research is recommended to understand attitudes, including the fears of witnesses, before performing CPR on patients with suspected or confirmed infectious diseases. The study highlights the importance of bystander intervention in emergency situations and the impact of a pandemic on public health response behaviors.* (Cardiol J 2025; 32, 1: 9–18)

Keywords: COVID-19, bystander cardiopulmonary resuscitation (CPR), out-of-hospital cardiac arrest (OHCA), pandemic impact, meta-analysis, public health

Address for correspondence: Ewa Skrzypek, PhD, MD, Department of Medical Ethics and History of Medicine, Medical University of Warsaw, ul. Zwirki i Wigury 61, 02–091 Warszawa, Poland, tel: +48604075561, e-mail: ewa.skrzypek@wum.edu.pl

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Introduction

Identifying that an individual is experiencing cardiac arrest, requesting support, and initiating bystander cardiopulmonary resuscitation (CPR) greatly enhances the likelihood of survival after a cardiac arrest that occurs outside of a medical facility [1, 2]. Currently, there is significant discussion over the impact of coronavirus disease 2019 (COVID-19) on non-traumatic out-of-hospital cardiac arrest (OHCA), particularly in relation to the outcomes that occur when the cardiac arrest happens outside of a hospital setting. This debate is taking place within the context of the COVID-19 pandemic. This period is often referred to as the COVID-19 era in scientific literature, and comparisons are being made to times before the pandemic. Based on Fan et al. [3], specific disparities were observed in the outcomes at the University Medical Center. These disparities included a decrease in the survival rate upon admission from 44.6% to 39.4%, a decrease in the survival rate upon discharge from 17.5% to 14.9%, and a deterioration in the neurological condition of the patients. However, hospitals with a lower level of reference did not exhibit comparable tendencies [3]. The structure of medical procedures provided during the intervention of Emergency Medical Services (EMS) has also changed, including a reduction in intubation attempts, a decrease in epinephrine administration, and a greater likelihood of completing resuscitation without return of spontaneous circulation (ROSC) at the scene [4]. The above observations were confirmed in a recently published meta-analysis, mainly in the context of pre-hospital death, survival to hospital admission (SHA), and survival to hospital discharge (SHD). Furthermore, there was a notable rise in the occurrence of OHCAs during the first wave of the COVID-19 pandemic, along with a decrease in the frequency of bystander CPR in areas with a high COVID-19 incidence [5].

However, further research of this subject is required. An in-depth analysis of the disparities between the waves of the pandemic should be conducted. One study separated the duration of the pandemic, from February 21, 2020 to December 31, 2020, into two periods. Both periods were analyzed and showed a comparable rise in the number of OHCAs [6]. However, what about the later time and the following surges in illness prevalence? Furthermore, particularly during the first phase of the COVID-19 pandemic, a particular constraint that might impact the results after OHCA was the scarcity of healthcare personnel and other resources within the healthcare system [7]. Healthcare personnel were largely engaged in the provision of care for COVID-19 patients and were reassigned from other departments [8–10]. An important issue that could influence outcomes after OHCA was also reduced motivation to perform CPR, especially in the case of bystander CPR [11]. Medical professionals' representatives have also said that the primary reason discouraging them from doing CPR was the fear of acquiring COVID-19. Additionally, the fear of contacting COVID-19 contributed to the reluctance of as many as 34% of medical professionals to conduct CPR [12].

Considering the aforementioned factors, the objective of this meta-analysis was to examine the primary outcome of bystander CPR during the pandemic and pre-pandemic periods. Additionally, the secondary outcomes included bystander witness parameters such as the frequency of bystander witnessing, activation of public access defibrillators, the occurrence of shockable heart rhythms, and the influence of these factors on survival rates to hospital admission, survival rates to hospital discharge, and survival with good neurological outcomes.

Methods

Literature search

This meta-analysis was performed under the guidance of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement [13]. This study was reported in the International Prospective Register of Systematic Reviews (PROSPERO) database (CRD42023494912). The protocol was developed a priori and accepted by all authors, and no protocol changes were made during the study. Given the nature of this investigation, ethics committee approval was not required.

Four databases (PubMed Central, Scopus, and EMBASE, as well as the Cochrane Central Register of Controlled Trials) were systematically searched up to December 10, 2023. Furthermore, Google Scholar was searched to identify additional studies through forward searches until December 12, 2023. We manually searched the reference lists of the included studies to identify additional eligible studies. The phrases we used for the literature search were as follows: "cardiac arrest" OR "out-of-hospital cardiac arrest" OR "OHCA" OR "heart arrest" OR "cardiopulmonary resuscitation" OR "CPR" OR "sudden cardiac death" AND "bystander" AND "severe acute respiratory syndrome coronavirus 2" OR "SARS-CoV-2" OR "COVID-19" OR "nCOV" OR "novel coronavirus".

Eligibility criteria

The inclusion criteria were as follows: studies on patients with OHCA with no gender and age restrictions, comparing bystander CPR occurrence in the pre-pandemic and pandemic periods, and English language.

The following exclusion criteria were applied: review articles, articles concerning the pediatric population, letters to editors, editorials, studies with non-original data, and studies without a comparator group.

Two authors (A.K. and M.P.) independently evaluated the studies found through the database search by using the aforementioned criteria in conjunction with the abstract and title. To resolve the conflicts, a third reviewer was consulted (L.S.). Two authors (A.K. and M.P.) independently evaluated the studies that made the title/abstract screening on the basis of the same criteria in the full texts. In cases of disagreement, a third reviewer (L.S.) was consulted to resolve the issues.

Data extraction

Two of the authors (A.K. and M.P.) independently extracted data. Disagreements were resolved through discussion with all authors and consensus. A standardized form was developed to extract the following data from eligible studies: (i) authors, country, and year of publication; (ii) study sample characteristics; (iii) resuscitation characteristics (i.e., cardiac arrest bystander witnessed, home location of OHCA, medical etiology of OHCA, implementation of public access defibrillation, and shockable rhythm occurrence); (iv) bystander CPR ratio; and (v) additional OHCA outcomes, e.g., SHA, SHD, and SHD with good neurological outcome, defined as grade 1 or 2 in Cerebral Performance Category (CPC) scale [14].

Quality assessment

Two authors (A.K. and G.N.) independently performed quality assessment in accordance with the Newcastle Ottawa Scale (NOS) [15]. Within this scale, every study is assessed based on 8 criteria that are divided into 3 categories: the selection of study groups, the comparability of the groups, and the determination of the conclusion. Each item was assessed on a scale of 1 point, except for comparability, which had a potential score of 2 points. The overall score ranged from 0 to 9, with higher ratings denoting superior quality. The potential scores achievable with this instrument ranged from 0 to 9. Research with a total score of 7 or more was deemed to be of good quality [16].

Statistical analysis

The statistical analyses were conducted using Review Manager (version 5.4, Nordic Cochrane Center, Cochrane Collaboration) and Stata (version 18, Software for Statistics and Data Science, StataCorp, College Station, TX, USA). The analyses were conducted using a two-tailed approach, with statistical significance defined as a p-value less than 0.05. For dichotomous data, we used odds ratios (OR) as the measure of effect along with 95% confidence intervals (CIs). For continuous data, we employed standardized mean differences (MD) with a 95% CI. The study provided the continuous results as the median, range, and interquartile range (IQR). For studies that did not provide the average value plus or minus the standard deviation (SD): 1. If a range or 95% CI was provided, the SD was computed using this information. 2. If the median with range or IQR was provided, these values were utilized to assess the skewness of the data. If the data did not have any bias, the mean and SD were computed [17]. Heterogeneity was assessed statistically using the Q test and I^2 statistics. If the value of I^2 was less than 50% and the Q-test indicated that the p-value was greater than 0.05, the studies were deemed to be in good agreement. In this case, a fixed-effects model was used for the combined analysis. Conversely, if the value of I^2 was greater than or equal to 50% or the Q-test indicated that the p-value was less than or equal to 0.05, the studies were considered to be heterogeneous. In such instances, a random-effects model was employed for the combined analysis [18]. We employed Egger's test and funnel plots to examine potential bias, and we assessed publication bias using funnel plot tests for asymmetry, but only if a single meta-analysis included more than 10 trials. In addition, a sensitivity assessment was performed using the leave-one-out methodology, in which 1 study was excluded at a time, and the overall impact size was estimated to identify possibly influential situations.

Results

The process of inclusion and exclusion, detailed in the PRISMA flow diagram, is presented in Figure 1. The search identified a total of 2453 records. After removing 1611 articles by automation tools, a further 760 articles were excluded after screening their title and abstract. Fifty-seven reports were considered irrelevant and excluded after the full texts had been reviewed. Finally, 25 studies were enrolled for meta-analysis [8, 19–42].

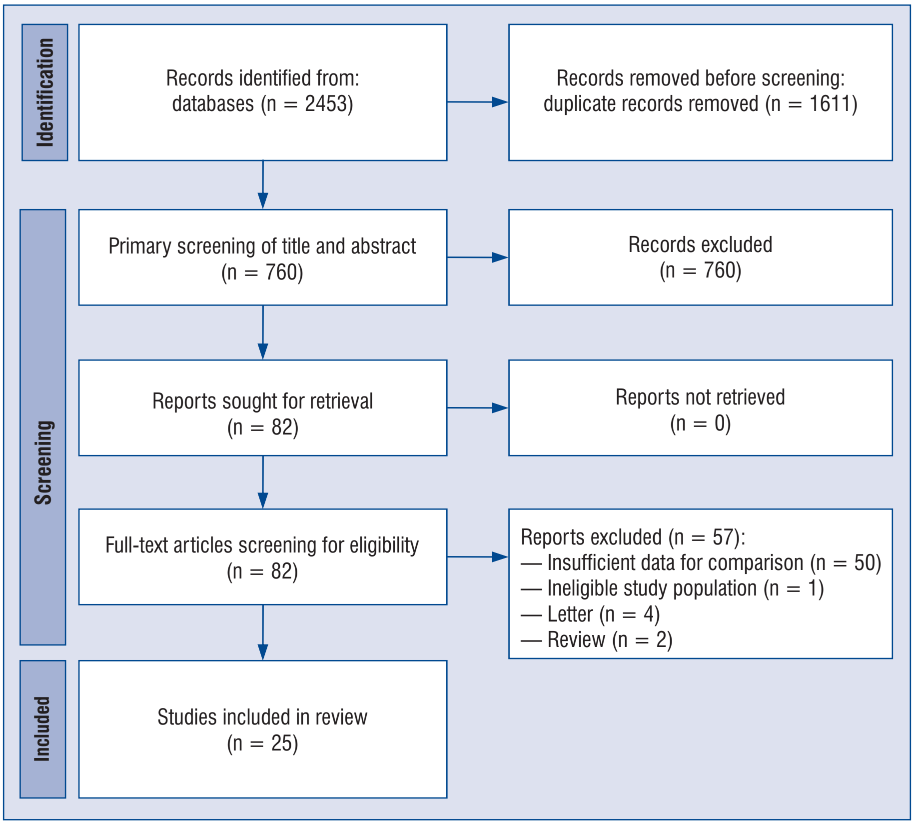

Figure 1. Flow diagram of the search strategy and study selection

Basic characteristics of included trials

Twenty-five articles were included in the analysis, with available data on 253,156 OHCAs. The participant baseline characteristics of the included studies are shown in Table 1. All the selected studies were published between 2020 and 2023. Of those 25 studies, 6 were performed in the USA, 2 in Australia, 2 in China, 2 in Italy, 2 in South Korea, 2 in Taiwan, 2 in Thailand, and one in each of the following countries: France, Germany, Japan, Spain, Sweden, Switzerland, and the United Kingdom (Fig. 2). The NOS scores of the 8 included studies were ≥ 7 (Table 1).

Primary outcome analysis

Twenty-five studies reported bystanders performing CPR during the pandemic and pre-pandemic periods. Pooled analysis showed that bystander CPR frequency during the COVID-19 pandemic was 38.8%, compared to 44.8% for the pre-pandemic period (OR: 1.04; 95% CI: 0.93–1.16; p = 0.48; Fig. 3). The results from the sensitivity analysis did not alter the direction.

Secondary outcomes analysis

Twenty-one studies reported bystander witnessed parameters among pandemic and pre-pandemic periods. In the pandemic period, the frequency of bystander witnessing was 49.9%, while in the pre-pandemic period it was 55.3% (OR: 0.94; 95% CI: 0.88–1.00; p = 0.04; **Suppl. Fig. S1**). Public access defibrillators activation in the COVID-19 pandemic and pre-pandemic periods also varied and amounted to 5.2% compared to 5.7%, respectively (OR: 0.66; 95% CI: 0.55–0.80; p < 0.001). Pooled analysis showed that shockable rhythm during the pandemic period occurred in 9.5% compared to 11.7% in the pre-pandemic period (OR: 0.90; 95% CI: 0.84–0.96; p = 0.002). Pooled analysis showed that in the COVID-19 pandemic period, the time to EMS arrival was statistically significantly longer compared to the pre-pandemic period (MD: 1.43; 95% CI: 1.00–1.86; p < 0.001; **Suppl. Fig. S2**).

Survival to hospital admission was statistically significantly lower for the pandemic period compared to the pre-pandemic period and was,

Table 1. Baseline characteristics of the study populations among included trials

Study	Country	Study design	Study group	No. of patients	Age, years	Male, n (%)	Home location of OHCA, n (%)	Medical etiology of OHCA, n (%)	NOS score
Baldi et al., 2020	Italy	Multicenter longitudinal prospective registry	Pre-pandemic	520	79 (65–86)	300 (57.7)	420 (81.0)	456 (89.0)	9
			Pandemic	694	77 (67–85)	430 (62.0)	623 (90.0)	613 (93.0)	
Baldi et al., 2021	Switzerland	Population-based, observational study	Pre-pandemic	933	71 (58–82)	636 (68.2)	596 (66.6)	761 (81.6)	8
			Pandemic	911	70 (56–80)	623 (68.4)	633 (71.4)	774 (85.0)	
Ball et al., 2020	Australia	Retrospective cohort study	Pre-pandemic	1218	67 (52–78)	845 (69.4)	929 (77.9)	965 (79.2)	8
			Pandemic	380	69 (54–80)	250 (65.8)	269 (72.3)	342 (90.0)	
Biskupski et al., 2022	USA	Single-center retrospective study	Pre-pandemic	28	65	17 (60.7)	15 (53.6)	5 (18.0)	7
			Pandemic	86	59	52 (60.5)	52 (60.5)	10 (12.0)	
Breglia et al., 2022	Italy	Retrospective observational study	Pre-pandemic	64	71.3 ± 17.3	46 (71.9)	NS	5 (7.8)	8
			Pandemic	50	71.1 ± 14.3	35 (70.0)	NS	20 (40.0)	
Chavez et al., 2022	USA	Secondary analysis of Texas CARES	Pre-pandemic	3619	63 (51–74)	2307 (63.8)	2926 (80.9)	NS	8
			Pandemic	4418	63 (51–74)	2781 (63.0)	3831 (86.7)	NS	
Chugh et al., 2022	USA	Prospective, population--based study	Pre-pandemic	1315	71.3 ± 15.8	857 (65.2)	NS	1315 (100)	8
			Pandemic	907	69.5 ± 17.0	586 (64.6)	NS	907 (100)	
Fothergill et al., 2021	UK	Retrospective, observational study	Pre-pandemic	1724	68 ± 20	1069 (62.0)	1474 (85.5)	522 (76.4)	9
			Pandemic	3122	71 ± 19	1839 (59.0)	2899 (92.9)	757 (66.7)	
Hosomi et al., 2022	Japan	Secondary analysis of the All-Japan Utstein Registry	Pre-pandemic	32,024	83 (75–89)	18,116 (56.6)	NS	19,806 (61.8)	8
			Pandemic	31,894	83 (76–89)	18,195 (57.0)	NS	20,131 (63.1)	
Kim et al., 2023	South Korea	Cross-sectional, retrospective, observational study	Pre-pandemic	25,355	67.6 ± 17.0	16,373 (64.6)	18,631 (73.5)	19,661 (77.5)	8
			Pandemic	26,566	68.0 ± 16.9	17,056 (64.2)	20,103 (75.7)	21,033 (79.2)	
Lai et al., 2020	USA	Population-based, cross-sectional study	Pre-pandemic	1336	68 ± 19	752 (57.1)	NS	NS	8
			Pandemic	3989	72 ± 18	2183 (55.8)	NS	NS	
Leung et al., 2023	China	Retrospective cohort study	Pre-pandemic	1502	76.8 ± 4.2	844 (56.2)	769 (51.2)	NS	9
			Pandemic	2185	77.7 ± 4.2	1293 (59.2)	1330 (60.9)	NS	
Li et al., 2023	China	Retrospective study	Pre-pandemic	19,027	82.0 ± 3.3	10,225 (53.7)	15,514 (81.5)	18,267 (96.0)	9
			Pandemic	30,962	83.3 ± 3.2	16,384 (52.9)	24,212 (78.2)	29,968 (96.8)	
Lim et al., 2021	South Korea	Retrospective observational study	Pre-pandemic	891	70.07 ± 15.06	577 (64.8)	592 (66.4)	NS	9
			Pandemic	1063	71.05 ± 14.98	647 (60.9)	761 (71.6)	NS	

→

Table 1 (cont.). Baseline characteristics of the study populations among included trials

Study	Country	Study design	Study group	No. of patients	Age, years	Male, n (%)	Home location of OHCA, n (%)	Medical etiology of OHCA, n (%)	NOS score
Liu et al., 2023	USA	Retrospective cohort study	Pre-pandemic	2837	64 (52–75)	1859 (65.5)	1875 (65.5)	1686 (59.4)	9
			Pandemic	3142	63 (51–75)	2005 (63.8)	2339 (74.4)	1754 (55.8)	
Liu et al., 2023b	Taiwan	Retrospective study	Pre-pandemic	567	76 (64–85)	313 (55.4)	427 (75.3)	NS	8
			Pandemic	497	78 (65–85)	292 (59.0)	384 (77.7)	NS	
Marijon et al., 2020	France	Population-based, observational study	Pre-pandemic	30,198	68.7 ± 17.9	18,668 (61.8)	22,822 (75.6)	NS	8
			Pandemic	519	69.7 ± 17.0	334 (64.4)	460 (90.2)	NS	
Ortiz et al., 2020	Spain	Secondary analysis of Spanish OHCA Registry	Pre-pandemic	1723	65.6 ± 16.9	1210 (70.2)	1042 (60.8)	NS	8
			Pandemic	1446	64.4 ± 16.5	1027 (71.0)	988 (68.3)	NS	
Phattharapornjaroen et al., 2022	Thailand	Retrospective cohort study	Pre-pandemic	76	70.0 ± 17.5	46 (60.5)	38 (50.0)	25 (32.9)	8
			Pandemic	60	65.4 ± 19.4	33 (55.0)	34 (56.7)	18 (30.0)	
Ristau et al., 2022	Germany	Epidemiological study	Pre-pandemic	5016	69.7 ± 16.9	3270 (65.2)	3145 (62.8)	3663 (73.0)	8
			Pandemic	5308	69.7 ± 16.6	3503 (65.9)	3519 (66.5)	3878 (73.1)	
Riyapan et al., 2022	Thailand	Multicentered, retrospective, observational study	Pre-pandemic	341	62.7 ± 18.5	210 (61.6)	239 (70.1)	165 (61.1)	9
			Pandemic	350	63.4 ± 19.4	208 (59.4)	259 (74.0)	155 (52.7)	
Sultanian et al., 2021	Sweden	Observational registry-based study	Pre-pandemic	930	70.8 ± 16.6	604 (64.9)	710 (76.3)	785 (90.8)	9
			Pandemic	1016	69.6 ± 17.8	697 (67.4)	784 (77.2)	640 (80.2)	
Talikowska et al., 2021	Australia	Retrospective cohort study	Pre-pandemic	501	60 (46–74)	345 (68.9)	370 (73.9)	389 (77.6)	8
			Pandemic	145	61 (46–74)	101 (69.7)	117 (80.7)	105 (72.4)	
Uy-Evanado et al., 2020	USA	Retrospective cohort study	Pre-pandemic	231	69.1 ± 17.4	137 (59.3)	145 (62.8)	NS	8
			Pandemic	278	64.9 ± 18.3	174 (62.6)	210 (75.5)	NS	
Yu et al., 2021	Taiwan	Retrospective cohort study	Pre-pandemic	570	70.9 ±16.5	353 (61.9)	453 (79.5)	NS	8
			Pandemic	622	70.4 ± 16.2	394 (63.3)	514 (82.6)	NS	

CARES — Cardiac Arrest Registry to Enhance Survival; NOS — Newcastle Ottawa Scale; NS — not specified; OHCA — out-of-hospital cardiac arrest

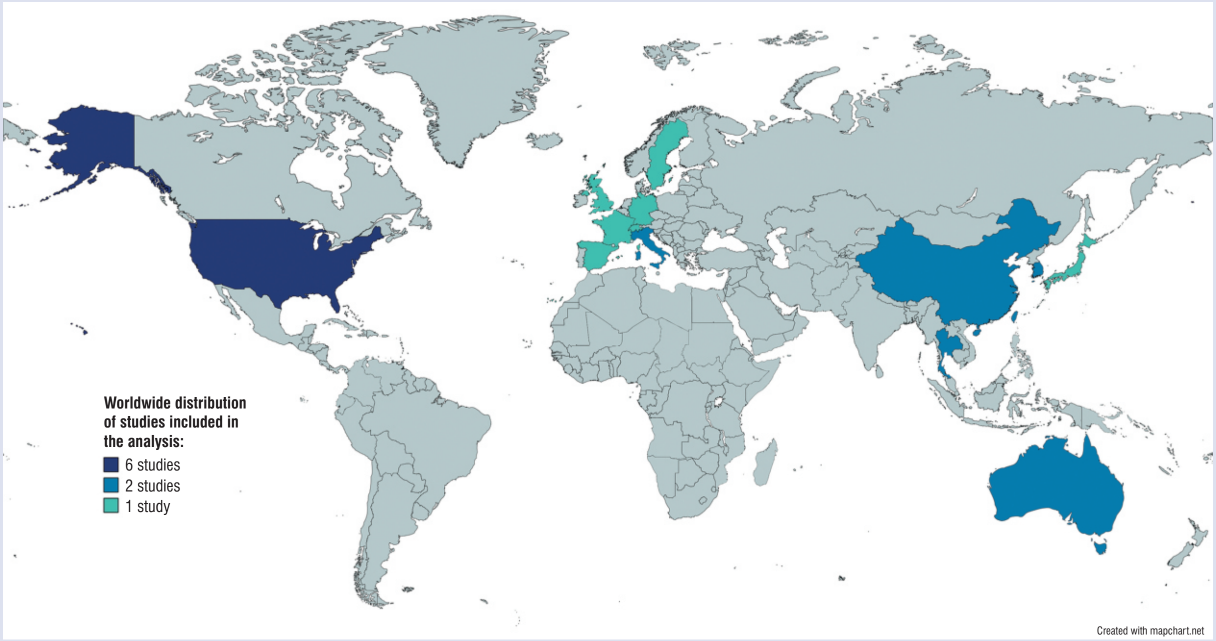

Figure 2. Global distribution of included trials

Study of subgroup	Pandemic period Events	Pandemic period Total	Pre-pandemic period Events	Pre-pandemic period Total	Weight	Odds ratio M–H, Random, 95% CI
Baldi 2021	282	911	309	933	4.4%	0.91 [0.74, 1.10]
Baldi 2020	140	694	162	520	3.9%	0.56 [0.43, 0.73]
Ball 2021	299	380	889	1218	3.8%	1.37 [1.04, 1.80]
Biskupski 2022	16	86	10	28	1.0%	0.41 [0.16, 1.06]
Breglia 2022	37	50	28	44	1.1%	1.63 [0.67, 3.93]
Chavez 2022	1863	4418	1670	3619	4.9%	0.85 [0.78, 0.93]
Chugh 2022	467	907	742	1315	4.5%	0.82 [0.69, 0.97]
Fothergill 2021	718	1135	359	683	4.4%	1.55 [1.28, 1.88]
Hosomi 2022	16118	31894	15704	32024	5.1%	1.06 [1.03, 1.10]
Kim 2023	16145	26566	15103	25355	5.1%	1.05 [1.02, 1.09]
Lai 2020	1359	3989	441	1336	4.8%	1.05 [0.92, 1.20]
Leung 2023	701	2185	392	1502	4.7%	1.34 [1.15, 1.55]
Li 2023	722	30962	396	19027	4.8%	1.12 [0.99, 1.27]
Lim 2021	636	1063	541	891	4.5%	0.96 [0.80, 1.16]
Liu 2023	2040	3142	1180	2837	4.9%	2.60 [2.34, 2.89]
Liu 2023 (B)	299	497	300	567	4.0%	1.34 [1.05, 1.72]
Marijon 2020	239	500	10945	17972	4.5%	0.59 [0.49, 0.70]
Ortiz 2020	538	1446	788	1723	4.7%	0.70 [0.61, 0.81]
Phattharapornjaroen 2022	28	60	26	76	1.6%	1.68 [0.84, 3.37]
Ristau 2022	2112	5308	1938	5016	5.0%	1.05 [0.97, 1.14]
Riyapan 2022	119	350	133	341	3.6%	0.81 [0.59, 1.10]
Sultanian 2021	577	1016	533	930	4.5%	0.98 [0.82, 1.17]
Talikowska 2021	108	145	368	501	2.8%	1.05 [0.69, 1.61]
Uy-Evanado 2020	141	278	142	231	3.3%	0.65 [0.45, 0.92]
Yu 2021	409	622	301	570	4.1%	1.72 [1.36, 2.17]
Total (95% CI)		**118604**		**119259**	**100.0%**	**1.04 [0.93, 1.16]**
Total events	46113		53400			

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 482.08$, df = 24 ($P < 0.00001$); $I^2 = 95\%$
Test for overall effect: Z = 0.71 (P = 0.48)

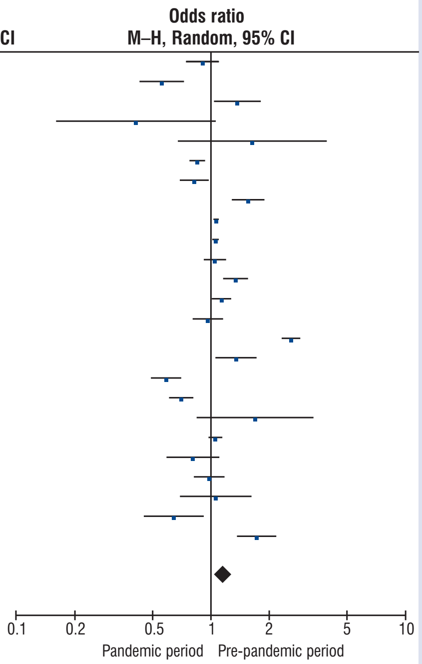

Figure 3. Forest plot of bystander cardiopulmonary resuscitation (CPR) among COVID-19 pandemic vs. pre-pandemic periods. The center of each square represents the odds ratios for individual trials, and the corresponding horizontal line stands for a 95% confidence interval (CI). The diamonds represent pooled results

respectively, 9.9% vs. 16.5% (OR: 0.68; 95% CI: 0.59–0.78; p < 0.001). COVID-19 also influenced survival to hospital discharge as well as SHD with good neurological outcomes, which were statistically significantly worse: 7.0% vs. 10.4% (OR: 0.56; 95% CI: 0.48–0.66; p < 0.001) and 6.1% vs. 8.7%

(OR: 0.64; 95% CI: 0.54–0.77; $p < 0.001$), respectively (**Suppl. Fig. S3**).

Discussion

Our meta-analysis revealed that the incidence of bystander CPR during the COVID-19 pandemic was 38.8%, in contrast to 44.8% during the pre-pandemic era. Contrary to the prevailing view, this outcome did not exhibit statistical significance. Following the first surge of the COVID-19 pandemic, several investigations documented alterations in the occurrence of cardiac arrest and a decrease in the administration of CPR by those present at the scene [35]. Nevertheless, the findings from the following investigations remain inconclusive. Prior to the conclusion of 2020, during a span of less than 8 months after the implementation of lockdown measures, a comprehensive investigation on the relationship between COVID-19 and OHCA revealed a decrease in the rates of CPR performed by bystanders [43]. However, a meta-analysis performed in 2021 found no noticeable difference in the frequencies of bystander CPR [44]. Presently, after a duration exceeding 2 years, it is evident that these changes have yet to transpire in a substantial manner. However, we have a comprehensive understanding of the remaining factors associated with bystanders of the occurrence, which have already had a noteworthy influence. The rate of bystander witnessing significantly decreased during the pandemic in comparison to the period before the pandemic (49.9% vs. 55.3%); similarly in the case of public access defibrillator activation (5.2% vs. 5.7%), shockable rhythm (9.5% vs. 11.7%), time from EMS activation to arrival on scene, SHA (9.9% vs. 16.5%), SHD (7.0% vs. 10.4%), as well as SHD with a good neurological outcome (6.1% vs. 8.7%). COVID-19 may have altered several variables of OHCA incidence and therapy. As a result of increased remote employment and decreased availability of public transportation, the site of arrests shifted. Prior to the implementation of the lockdown measures, around 70% of instances of cardiac arrests took place inside residential dwellings [45]. Post-lockdown, many studies indicate a rise in the frequency of arrests transpiring inside residences, accompanied by a decline in the occurrence of cardiac arrests in public settings [35, 46]. Significantly, the provision of bystander CPR and the placement of AED pads had a notable drop during the COVID-19 pandemic. Possible factors contributing to this phenomenon included a reduction in the ratio of OHCA incidents transpiring in public settings and OHCA incidents being noticed by bystanders due to individuals opting to remain at home and refraining from nonessential excursions. Moreover, the need to engage in close physical contact with patients, such as when applying AED pads and doing rescue breathing, may present a challenge for witnesses. Nevertheless, experiencing a cardiac arrest at home is more likely to be witnessed by a bystander who has a personal connection to the patient. It is possible that there has previously been exposure to a potential virus in a shared living area, which implies that the fear of becoming infected with the virus may have less impact on the decision to begin CPR. EMS staff take into account whether a bystander has previously started CPR while determining if they should commence CPR. Consequently, the probability of EMS initiating resuscitation is reduced, and these factors again significantly influenced SHA and SHD.

Limitations of the study

This study has both strengths and limitations. First, the study design of the included trials in this meta-analysis, which is predominantly observational, may not establish causality between observed phenomena. Another limitation of the study is the varying numbers of patients in each study. In addition, the unique circumstances of the COVID-19 pandemic may affect the outcomes and might not be applicable to non-pandemic conditions. Uncontrolled external variables, such as changes in healthcare policies or public behavior during the pandemic, could influence the outcomes. Among the strengths of the study are its design as a meta-analysis, the timeliness of the topic, and the fact that it is the most up-to-date systematic review and meta-analysis.

Conclusions

This meta-analysis showed that the COVID-19 pandemic influenced the reduction of bystander CPR compared to the pre-pandemic period; however, the difference did not show statistical significance. Further research is needed to determine attitudes, including the fears of witnesses, to an event before undertaking CPR on a patient with a sub-pandemic or confirmed infectious disease.

Data availability statement: The data that support the findings of this study are available on request from the corresponding author (E.S.).

Ethics statement: Given the nature of this investigation, the Ethics Committee was not relevant.

Author contributions: Conceptualization, A.K. and L.S.; methodology, A.K., K.K., and L.S.; software, N.L.B.; validation, A.K., K.K., and L.S.; formal analysis, A.K., N.L.B.; investigation, A.K., K.K., M.P., E.S., and L.S.; resources, A.K., K.K., L.S., and G.N.; data curation, A.K., N.L.B, and L.S; writing — original draft preparation, A.K., K.K., D.S., and L.S.; writing — review and editing, all authors; visualization, A.K.; supervision, K.K. and L.S.; project administration, A.K. All authors have read and agreed to the published version of the manuscript.

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