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Clinical paper

Associations between initial heart rhythm and self-reported health among cardiac arrest survivors – A nationwide registry study

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Abstract

Background: Non-shockable initial rhythm is a known risk factor for high mortality at cardiac arrest (CA). However, knowledge on its association with self-reported health in CA survivors is still incomplete.

Aim: To examine the associations between initial rhythm and self-reported health in CA survivors.

Methods: This nationwide study used data from the Swedish Register for Cardiopulmonary Resuscitation 3–6 months post CA. Health status was measured using EQ-5D-5L and psychological distress by the Hospital Anxiety and Depression Scale (HADS). Kruskal-Wallis test was used to examine differences in self-reported health between groups of different initial rhythms. To control for potential confounders, age, sex, place of CA, aetiology, witnessed status, time to CPR, time to defibrillation, and neurological function were included as covariates in multiple regression analyses for continuous and categorical outcomes.

Results: The study included 1783 adult CA survivors. Overall, the CA survivors reported good health status and symptoms of anxiety or depression were uncommon (13.7% and 13.9% respectively). Survivors with PEA and asystole reported significantly more problems in all dimensions of health status ($p = 0.037$ to $p < 0.001$), anxiety ($p = 0.034$), and depression ($p = 0.017$) compared to VT/VF. Overall, these differences did not remain in the adjusted regression analyses.

Conclusions: Initial rhythm is not associated with self-reported health when potential confounders are controlled. Initial rhythm seems to be an indicator of unfavourable factors causing the arrest, or factors related to characteristics and treatment. Therefore, initial rhythm may be used as a proxy for identifying patients at risk for poor outcomes such as worse health status and psychological distress.

Keywords: Anxiety, Depression, Heart arrest, Heart rhythm, Health, Initial rhythm, Psychological distress

Introduction

Cardiac arrest (CA) is one of the leading causes of death in the world. [1,2] It is known that the initial heart rhythm in CA has a major impact on survival. In short, having a shockable rhythm is associated with better chance of survival and good neurological recovery. [3–6] Although initial rhythm is important for survival and other significant outcomes, little is known about its implications for self-reported health and quality of life.

No study has investigated the association between initial rhythm and self-reported health after CA, while a few have used initial rhythm as an adjusting covariate. [7–9] It has been suggested that non-shockable rhythm is associated with worse self-reported health. [7,8] However, the mechanism is not clear. There is a critical need for studies specifically examining the association between initial rhythm and self-reported health, considering potential confounders.

Sex is an example of a confounding variable that has been found to be associated with both initial rhythm and self-reported health in CA survivors; women surviving CA have reported a higher degree of depression and anxiety, and worse health status, compared to men. [10–12] Women are also more likely to suffer CA with non-shockable initial rhythm compared to men. [13–15] Other potential confounding variables are age, place of CA, aetiology, witnessed CA, time to CPR, time to defibrillation, and neurological outcome.

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Determining the association between initial rhythm and self-reported health is important in developing screening tools and improving post-resuscitation care based on individual needs. Therefore, the aim of this study was to examine the associations between initial rhythm and self-reported health in CA survivors.

Methods

Design

This nationwide register study included data from the Swedish Register of Cardiopulmonary Resuscitation (https://shlr.registercentrum.se), collected between 1st January 2014 and 31st December 2017. The study was performed in compliance with Swedish laws and institutional guidelines and have been approved by the Regional Ethical Review Board in Stockholm, Sweden (No. 2013/1959-31/4), and the Swedish Ethics Review Authority (No. 2021-05041).

The Swedish Register of Cardiopulmonary Resuscitation

The Swedish Register of Cardiopulmonary Resuscitation includes nearly 100% of all CAs in Sweden where CPR has been commenced, both out-of-hospital (OHCA) and in-hospital cardiac arrest (IHCA). Data is collected on three occasions. The first registration is performed by healthcare professionals at the time of arrest and includes patient characteristics and information about the CA event such as initial rhythm. The second registration is performed 30 days post CA, and includes follow-up registration on survival, post-resuscitation care, and neurological function measured by the cerebral performance category scale (CPC). Survivors alive at 3–6 months post CA and being $\geq$ 18 years of age are eligible to participate in the third registration based on patient reported outcome measures (PROM) to assess self-reported health. Exclusion criteria for this registration are language difficulty and severe cognitive impairment. A questionnaire and an invitation to a structured telephone interview are sent out to all CA survivors with an instruction to complete the questionnaire during the interview. A resuscitation coordinator or cardiac rehabilitation nurse conducts the interviews and instantly files data into the register (https://shlr.registercentrum.se).

Study sample

In the present study, all survivors 18 years or older at the time for the CA and completed registration of PROMs during 2014–2017 were included. During this period, 2141 survivors had completed the questionnaire. Of these, observations with missing data for initial rhythm were excluded (n = 358) resulting in a final sample of 1783 CA survivors.

Study variables

In the present study, the following variables were selected from the Swedish Register for Cardiopulmonary Resuscitation: initial rhythm, age, sex (women/men), place (IHCA/OHCA), aetiology (heart disease/other), witnessed (yes/no), defibrillation (yes/no), time to defibrillation ($\leq$ 5 min/> 5 min), time to CPR ($\leq$ 1 min/> 1 min), pharmacological treatment (yes/no), target temperature management (yes/no), and neurological function (assessed by the CPC scale). Initial heart rhythm is the first rhythm registered by the defibrillator or electrocardiography during an arrest. The groups of rhythm are categorized as VT/VF, PEA, and asystole. VT and VF are both shockable rhythms, whereas PEA and asystole are non-shockable rhythms. The cut-off for time to defibrillation and time to CPR was based on Swedish guidelines. Pharmacological treatment refers to administration of adrenaline and/or amiodarone. In addition to these variables, two self-reported instruments were included to measure health status (EQ-5D-5L) [16] and psychological distress (Hospital Anxiety and Depression Scale, HADS). [17]

EQ-5D-5L

The EQ-5D-5L is designed to measure generic health status. The questionnaire includes a descriptive system (EQ-5D health dimensions) and a visual analogue scale (EQ VAS). The descriptive system covers five health dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The severity of health problems is rated on a scale from 'No problems' (1) to 'Extreme problems' (5). [16] The responses can also be dichotomized into 'No problems' (1) and 'Problems' (2–5) to reflect the prevalence of health problems. The visual analogue scale (EQ VAS) is used to rate the overall health from 'The worst health you can imagine' (0) to 'The best health you can imagine' (100). The EQ-5D-5L has not been validated in CA survivors but the Core Outcome Set for Cardiac Arrest (COSCA) has recommended it as one of the core outcomes in CA survivors. [18]

HADS

The HADS is a screening instrument for detecting symptoms of anxiety and depression. The instrument includes 14 items; seven about depression and seven about anxiety. Each item has four response categories, from 0 to 3, thus generating a possible subscale score between 0 and 21 for anxiety and depression respectively. Higher scores indicate higher symptom levels. [17] In addition to the scale scores, cut-off scores have been suggested by Snaith: normal (0–7), mild (8–10), and moderate to major problems (11–21). [19] In the present study, both subscale scores and cut-off scores were used. The HADS has not been validated in CA survivors but have demonstrated good measurement properties in other related patient groups, for example in myocardial infarction. [20] It has also been recommended for CA follow-up by the American Heart Association [21] and the European Resuscitation Council. [22] The internal consistency reliability, evaluated using the Cronbach's alpha, was satisfactory for both HADS anxiety (α = 0.89) and HADS depression (α = 0.87) in the present study.

Statistical analyses

Descriptive statistics were used to present the sample and study variables. Continuous data was described with mean and standard deviations, ordinal data with median and quartiles, and nominal data with frequencies. Age differences between survivors with VF/VT, PEA, and asystole were analysed with the Kruskal-Wallis test while differences in sex, location, aetiology, witnessed, and defibrillation were analysed with the Pearson chi-square test.

The Kruskal-Wallis test was also used to compare differences in health status and psychological distress between survivors with VT/VF, PEA, and asystole. The Dunn's post hoc test was used to identify differences between the different rhythms.

To control the analyses for potential confounding variables, multiple regression analyses were conducted. Multiple linear models were used for continuous outcome variables and multiple proportional odds models (i.e., ordinal regression) were used for ordered categorical outcome variables. In all models, self-reported health

was used as outcome variable and initial rhythm as explanatory variable. The analyses controlled for age, sex (women, men), place (OHCA, IHCA), aetiology (cardiac, other), witnessed status (yes, no), time to CPR (≤ 1 min, > 1 min), time to defibrillation (≤ 5 min, > 5 min), and neurological function. Initial rhythm and neurological function were included as dummy-coded variables with VT/VF and CPC 1 as reference categories respectively. No problems with multicollinearity were detected. Since problems with non-normality distributed residuals were detected in the linear regression analyses, bootstrapped confidence intervals and p-values were calculated using the non-parametric percentile method, based on 2000 replications.

Statistical significance was set at $p < 0.05$. All analyses were conducted in R 4.3.2 (The R Foundation for Statistical Computing, Vienna, Austria) and Rstudio 2023.12.0 (PBC, Boston, MA) using the following packages: boot.pval 0.5, brant 0.3–0, dunn.test 1.3.5, gmodels 2.18.1.1, summarytools 1.0.1.

Result

Sample characteristics

The sample included 1783 CA survivors of which a majority were men ($n = 1270$, 71.2%). The age varied between 18–94, with a median age of 68 years (q1-q3 = 58–75). A majority of the survivors suffered IHCA ($n = 1131$, 63.4%). In addition, most of the CAs were caused by heart disease ($n = 1359$, 77.2%), were witnessed ($n = 1660$, 94.0%), and were defibrillated ($n = 1274$, 72.1%). In total, 1537 (87.2%) of the survivors had a good neurological function (CPC 1) at the time of PROM registration. The initial rhythm was predominantly VT/VF ($n = 1280$, 71.8%), followed by asystole (n = 328, 18.4%) and PEA ($n = 175$, 9.8%).

There was a significant difference in all background variables between the initial heart rhythms ($p < 0.001$), except for witnessed status ($p = 0.059$). Survivors with shockable rhythm were significantly younger ($p < 0.001$), more likely to be male ($p < 0.001$), suffering an OHCA ($p < 0.001$), having a cardiac aetiology ($p < 0.001$), and having good neurological function at the time for the PROM registration ($p < 0.001$) (Table 1).

Health status

Using the dichotomized scores of the EQ-5D-5L health dimensions, most CA survivors reported problems with pain/discomfort ($n = 1021$, 57.3%), followed by anxiety/depression ($n = 851$, 47.8%), usual activities ($n = 840$, 47.1%), mobility ($n = 720$, 40.4%), and self-care ($n = 345$, 19.4%). Except for anxiety/depression ($p = 0.213$), the prevalence of health problems was significantly more common in survivors with asystole and PEA compared to survivors with VT/VF ($p = 0.004$ to $p < 0.001$).

Using the un-dichotomized scores of the EQ-5D-5L health dimensions, problems with pain/discomfort was reported as most burdensome (Mdn = 2, q1-q3 = 1–3) while problems with self-care were reported as least burdensome (Mdn = 1, q1-q3 = 1–1). There was a significant difference in all health dimensions between survivors with VT/VF, asystole, and PEA ($p = 0.037$ to $p < 0.001$). The Dunn's post hoc analyses showed that survivors with PEA and asystole reported significantly more burdensome problems in all health dimensions, except for anxiety/depression, compared to survivors with VT/VF. No significant differences were shown between survivors with asystole compared to PEA (Table 2). However, the multiple proportional odds logistic regression models showed that initial rhythm was not associated with health status measured by the EQ-5D-5L health dimensions when age, sex, place of CA, aetiology, witnessed status, time to CPR, time to defibrillation, and neurological function were controlled. The exception was the health dimension anxiety/depression; survivors with PEA or asystole had a higher probability of worse outcome ($p = 0.031$ and $p = 0.042$) (Table 3).

Health status measured by the EQ VAS was overall good (Mdn = 75, q1-q3 = 55–85). However, there was a significant difference between survivors with VT/VF, asystole, and PEA ($p < 0.001$). The Dunn's post hoc analysis revealed that CA survivors with VT/VF reported significantly better health status compared to survivors with asystole or PEA (Table 2). However, the multiple linear regression analysis showed that initial rhythm was not associated with health status measured by the EQ VAS when age, sex, place of CA, aetiology, witnessed status, time to CPR, time to defibrillation, and neurological function were controlled (Table 4).

Psychological distress

According to the cut-off scores of HADS, 13.7% ($n = 245$) reported problems of anxiety, out of which 5.6% ($n = 100$) were moderate to major. Regarding depression, 13.9% ($n = 247$) reported problems, out of which 5.7% ($n = 102$) were moderate to major.

According to the HADS subscale scores, the overall symptom level of psychological distress was low; the median score was 2 (q1-q3 = 0–5) for anxiety and 2 (q1-q3 = 1–5) for depression. However, there were significant differences in symptoms of anxiety and depression between CA survivors with VF/VT, PEA, and asystole ($p = 0.034$ and $p = 0.017$ respectively). The Dunn's post-hoc analyses showed that survivors with VF/VT reported lower symptom levels of both anxiety and depression compared to survivors with asystole. No significant differences were shown between survivors with VF/VT and PEA or between survivors with asystole and PEA (Table 2).

The multiple linear regression analyses showed that initial rhythm was not associated with symptoms of anxiety or depression when age, sex, place of CA, aetiology, witnessed status, time to CPR, time to defibrillation, and neurological function were controlled (Table 4).

Discussion

To the best of our knowledge, this nationwide register study represents the largest investigation of CA survivors examining the impact of initial rhythm on self-reported health. The findings showed that survivors generally report good health, encompassing both health status and psychological distress. Nevertheless, the unadjusted analyses reveals notable associations between the initial rhythm and self-reported health. Specifically, survivors with non-shockable initial rhythm reported poorer health status and higher levels of psychological distress in comparison to those with shockable rhythm. Overall, these associations were attenuated in the adjusted analysis.

This study shows an overall good health status and psychological well-being among the CA survivors. While a notable minority reported problems related to health status and psychological distress, these problems were predominantly in the lower range. Examination of the subscale scores in HADS revealed low levels of anxiety and depression symptoms, aligning with previous research indicating generally favourable health outcomes among CA survivors, with a minority experiencing more extensive problems. [11,23]

Table 1 – Sample characteristics (n = 1783).

		Initial rhythm			
Variables	All, *n* = 1783	VT/VF, *n* = 1280	PEA, *n* = 175	Asystole, *n* = 328	p-value
Age, Mdn (Q1, Q3)	68 (58, 75)	67 (58, 74)	70 (62, 77)	71 (60, 78)	< 0.001 [a]
Sex, n (%)					< 0.001[b]
Men	1270 (71.2)	959 (74.9)	113 (64.6)	198 (60.4)	
Women	513 (28.8)	321 (25.1)	62 (35.4)	130 (39.6)	
Place, n (%)					< 0.001[b]
IHCA	1131 (63.4)	717 (56.0)	130 (74.3)	284 (86.6)	
OHCA	652 (36.6)	563 (44.0)	45 (25.7)	44 (13.4)	
Aetiology, n (%)					< 0.001[b]
Heart disease	1359 (77.2)	1119 (88.3)	50 (29.2)	190 (58.8)	
Other	402 (22.8)	148 (11.7)	121 (70.8)	133 (41.2)	
Missing data	22	13	4	5	
Witnessed CA, n (%)					0.059[b]
Yes	1660 (94.0)	1197 (94.3)	153 (90.0)	310 (95.1)	
No	106 (6.0)	73 (5.7)	17 (10.0)	16 (4.9)	
Missing data	17	10	5	2	
Defibrillation, n (%)					< 0.001[b]
Yes	1274 (72.1)	1235 (96.9)	20 (11.6)	19 (6.0)	
No	493 (27.9)	40 (3.1)	153 (88.4)	300 (94.0)	
Missing data	16	5	2	9	
Pharmacological treatment, n (%) [c]					< 0.001[b]
Yes	730 (42.8)	497 (40.5)	108 (63.5)	125 (40.9)	
No	794 (57.2)	731 (59.5)	62 (36.5)	181 (59.2)	
Missing data	79	52	5	22	
Target temperature management, n (%)					0.600[b]
Yes	86 (4.9)	59 (4.7)	11 (6.4)	16 (5.0)	
No	1669 (95.1)	1206 (95.3)	160 (93.6)	303 (95.0)	
Missing data	28	15	4	9	
Time to CPR, n (%)					< 0.001[b]
≤ 1 min	1290 (84.3)	878 (81.9)	135 (84.9)	277 (92.6)	
> 1 min	240 (15.7)	194 (18.1)	24 (15.1)	22 (7.4)	
Missing data	253	208	16	29	
Time to defibrillation, n (%)					< 0.001[b]
≤ 5 min	791 (68.8)	782 (70.1)	1 (6.3)	8 (44.4)	
> 5 min	359 (31.2)	334 (29.9)	15 (93.8)	10 (55.6)	
Missing data	633	164	159	310	
Cerebral Performance Category, n (%)					< 0.001[b]
CPC 1, good performance	1537 (87.2)	1142 (90.0)	130 (76.5)	265 (82.0)	
CPC 2, moderate disability	180 (10.2)	100 (7.9)	32 (18.8)	48 (14.9)	
CPC 3, severe disability	45 (2.6)	27 (2.1)	8 (4.7)	10 (3.1)	
Missing data	21	11	5	5	

CA = Cardiac Arrest, IHCA = In-Hospital Cardiac Arrest, OHCA = Out-of-Hospital Cardiac Arrest, PEA = Pulseless Electrical Activity, VF = Ventricular Fibrillation, VT = Ventricular Tachycardia.

[a] Kruskal-Wallis test.

[b] Pearson chi-square test.

[c] Pharmacological treatment refers to administration of adrenaline and/or amiodarone.

In the initial, unadjusted analysis, survivors with a shockable rhythm reported higher levels of health compared to those with a non-shockable rhythm. Significant disparities were observed across all dimensions of health status and psychological distress, except of anxiety/depression as measured by the EQ-5D-5L. This aligns with findings from prior research; two Australian studies on OHCA patients found that those not surviving 12 months post-arrest or experiencing poor recovery more frequently had a non-shockable initial rhythm. Additionally, survivors with PEA or asystole demonstrated a higher propensity for unfavourable functional outcomes and a lower likelihood of regaining health and independence. [23,24] However, considering the adjusting covariates, the significant association between initial rhythm and health status and psychosocial distress disappeared, except for anxiety/depression measured by the EQ-5D-5L. This incongruent finding might be due to that this health dimension in EQ-5D-5L combines both anxiety and depression. Despite this, it is reasonable to posit that the initial rhythm has no direct effect on self-reported health. The results suggest that a non-shockable rhythm is not a predictor of worse outcomes but an indicator of unfavourable factors causing the arrest, or factors related to characteristics and treatment. Therefore, initial rhythm may be used as a proxy for identifying patients at risk for poor outcomes.

The majority of the survivors in the present study had VT/VF as the recorded initial rhythm. This rhythm is more favourable due to its association with increased chances of survival and a more positive prognosis for recovery. [1,23,24] However, a noteworthy trend is

Table 2 – Health status and psychological distress by initial rhythm (n = 1783).

		Initial rhythm				
	All survivors	VF/VT	PEA	Asystole	p-value [a]	Post hoc test [b]
Health status, Mdn (Q1, Q3)						
Mobility	1 (1, 2)	1 (1, 2)	2 (1, 3)	2 (1, 3)	< 0.001	AB-
Self-care	1 (1, 1)	1 (1, 1)	1 (1, 2)	1 (1, 2)	< 0.001	AB-
Usual activities	1 (1, 2)	1 (1, 2)	2 (1, 3)	2 (1, 3)	< 0.001	AB-
Pain/Discomfort	2 (1, 3)	2 (1, 2)	2 (1, 3)	2 (1, 3)	< 0.001	AB-
Anxiety/Depression	1 (1, 2)	1 (1, 2)	2 (1, 2)	2 (1, 2)	0.037	-
EQ VAS, Mdn (Q1, Q3)	75 (55, 85)	75 (60, 85)	70 (50, 80)	70 (50, 80)	< 0.001	AB-
Psychological distress, Mdn (Q1, Q3)						
Anxiety	2 (0, 5)	2 (0, 5)	2 (0, 6)	2 (1, 6)	0.034	-B-
Depression	2 (1, 5)	2 (1, 5)	3 (1, 6)	2 (1, 5.5)	0.017	-B-

EQ VAS = EQ Visual Analogue Scale, PEA = Pulseless Electrical Activity, VF = Ventricular Fibrillation, VT = Ventricular Tachycardia.

[a] Kruskal-Wallis test.

[b] Dunn's post hoc test with Bonferroni corrected p-values; significant differences are represented by: A = VF/VT vs. PEA, B = VF/VT vs. Asystole, and C = PEA vs. Asystole.

Table 3 – Associations between initial rhythm and health status based on proportional odds logistic regression analysis.

Outcome variable	Predictor variables [a]	OR	CI 95%	p-value
Mobility	VT/VF	Ref		
	PEA	1.29	0.82, 2.02	0.270
	Asystole	1.33	0.90, 1.97	0.157
	Model statistics: $\chi^2(13) = 390.8$, $p < 0.001$, McFadden = 0.10			
Self-care	VT/VF	Ref		
	PEA	1.29	0.73, 2.27	0.381
	Asystole	1.41	0.86, 2.33	0.180
	Model statistics: $\chi^2(13) = 336.1$, $p < 0.001$, McFadden = 0.14			
Usual activities	VT/VF	Ref		
	PEA	1.06	0.69, 1.63	0.787
	Asystole	1.20	0.83, 1.74	0.328
	Model statistics: $\chi^2(13) = 347.4$, $p < 0.001$, McFadden = 0.08			
Pain/Discomfort	VT/VF	Ref		
	PEA	1.15	0.76, 1.75	0.510
	Asystole	1.14	0.80, 1.64	0.467
	Model statistics: $\chi^2(13) = 104.6$, $p < 0.001$, McFadden = 0.02			
Anxiety/Depression	VT/VF	Ref		
	PEA	1.62	1.04, 2.52	0.031
	Asystole	1.49	1.01, 2.19	0.042
	Model statistics: $\chi^2(13) = 199.8$, $p < 0.001$, McFadden = 0.05			

VF = Ventricular Fibrillation, VT = Ventricular Tachycardia, PEA = Pulseless Electrical Activity.

[a] Adjusted for age, sex, place of CA, aetiology, witnessed status, time to CPR, time to defibrillation, and neurological function

the declining proportion of VT/VF as the initial rhythm, accompanied by a rising percentage of asystole and PEA. [25,26] Survivors with PEA and asystole likely represent a more medically fragile cohort characterized by advanced age, multimorbidity, and a more complex aetiology as the cause of the CA. Consequently, future CA survivors may necessitate increased care, posing potential implications for the healthcare system. It is imperative to recognize the importance of structured follow-up for CA survivors. Such efforts not only contribute to securing the chain of survival but also hold the potential to enhance self-reported health outcomes and facilitate early return to work. [22,27] Moreover, the time-factor is likely to impact the complexity of the arrest. Many arrhythmias progress from VT/VF to PEA and asystole. Prolonged events, as seen in PEA and asystole, expose survivors to increased risk of organ damage and potential long-lasting consequences. Swift and effective recognition and treatment of CA are essential for improving survival and optimizing outcomes, as increased time is associated with worse outcomes. [28]

Methodological limitations

This study has some limitations that need to be considered. The cross-sectional design omits any causal conclusions regarding the association between initial rhythm and self-reported health. As no information of the survivors' health before the CA is registered, it cannot be excluded that survivors with non-shockable rhythms suffered poorer health status and higher levels of psychological distress already before the CA. It should also be noted that the large share of survivors with non-shockable rhythms can be explained by the fact that the present study only included survivors. The initial rhythm is

Table 4 – Associations between initial rhythm as explanatory variable and health status and psychological distress as outcome variables based on multiple linear regression analysis.

Outcome variable	Predictor variables [a]	B	CI 95% [b]	p-value [b]
EQ-VAS	VT/VF	Ref		
	PEA	1.12	-3.12, 5.49	0.615
	Asystole	-1.51	-5.12, 2.23	0.433
	Model statistics: $F(13, 1707) = 27.5$, $p < 0.001$, $R^2 = 0.17$			
HADS Anxiety	VT/VF	Ref		
	PEA	0.45	-0.38, 1.28	0.285
	Asystole	0.65	-0.10, 1.35	0.085
	Model statistics: $F(13, 1707) = 13.8$, $p < 0.001$, $R^2 = 0.10$			
HADS Depression	VT/VF	Ref		
	PEA	0.24	-0.53, 1.04	0.539
	Asystole	0.29	-0.46, 0.96	0.417
	Model statistics: $F(13, 1707) = 21.9$, $p < 0.001$, $R^y = 0.14$			

EQ VAS = EQ Visual Analogue Scale, HADS = Hospital Anxiety and Depression Scale, PEA = Pulseless Electrical Activity, VF = Ventricular Fibrillation, VT = Ventricular Tachycardia.

[a] Adjusted for age, sex, place, aetiology, witnessed status, time to CPR, time to defibrillation, and neurological function.

[b] Bootstrapped confidence intervals and p-values based on the percentile method and 2000 replications.

reported by healthcare professionals involved in the acute treatment of CA. In general, it is not routinely checked for accuracy. However, the register is continuously validated against medical records.

Another limitation is that the Swedish Register of Cardiopulmonary Resuscitation has limited information about dropout for the PROM registration. Participation in follow-up interviews is voluntary, and information about reasons for unwillingness to participate is lacking. Additionally, both HADS and EQ-5D-5L are generic tools; hence they do not measure the impact of the CA. Thus, no strong conclusions can be drawn on whether reported health problems are related to the CA or to other health problems. However, this issue is universal to all CA studies until today, as no disease-specific instrument has yet been developed. To increase the understanding of the impact CA has on survivors' lives, disease specific instruments designed for CA are needed.

Conclusion

This study shows that initial rhythm is not associated with self-reported health when potential confounders are controlled. However, initial rhythm seems to be an indicator of unfavourable factors causing the arrest, or factors related to characteristics and treatment. Therefore, initial rhythm may be used as a proxy for identifying patients at risk for poor outcomes such as worse health status and psychological distress.

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CRediT authorship contribution statement

Kristofer Årestedt: Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Martina Rooth:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Anders Bremer:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Conceptualization. **Lauri Koistinen:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Mina Attin:** Writing – review & editing, Writing – original draft. **Johan Israelsson:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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