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ORIGINAL RESEARCH

P-ROSC, UB-ROSC, and RACA Scores in Predicting the Return of Spontaneous Circulation in Out-of-hospital Cardiac Arrest: A Retrospective Cohort

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Abstract: **Introduction:** Prehospital Return of Spontaneous Circulation (P-ROSC), Utstein-Based Return of Spontaneous Circulation (UB-ROSC), and Return of Spontaneous Circulation After Cardiac Arrest (RACA) scores have been developed to estimate the likelihood of Return of Spontaneous Circulation (ROSC) in Out-of-hospital cardiac arrest (OHCA). This study aimed to validate and compare these three scoring systems. **Methods:** A retrospective cohort study was conducted using electronic medical records of OHCA patients transported by Ramathibodi Emergency Medical Service (EMS) from January 2021 to October 2024. We included all OHCA patients aged >18 years who transported by Ramathibodi EMS. RACA, UB-ROSC, and P-ROSC scores were calculated, and ROSC was recorded. The area under the ROC curve (AUC) of each score were calculated to assess predictive accuracy. **Results:** Among 336 OHCA cases, 94 (27.97%) patients achieved ROSC. The RACA score demonstrated the highest predictive accuracy, with an AUC of 0.77 (95% CI: 0.71–0.82). The UB-ROSC score followed with an AUC of 0.72 (95% CI: 0.66–0.78), while the P-ROSC score had the lowest predictive value with an AUC of 0.64 (95% CI: 0.58–0.70). Calibration analysis indicated that the RACA score aligned most closely with observed outcomes compared to the UB-ROSC and P-ROSC scores. The RACA score exhibited the best overall performance in terms of both discrimination and calibration. **Conclusion:** Among the three predictive models assessed, the RACA and UB-ROSC scores demonstrated fair predictive accuracy for ROSC in OHCA patients, while the P-ROSC score had poor predictive value.

Keywords: Out-of-Hospital Cardiac Arrest; Return of Spontaneous Circulation; predictive value of tests; Emergency Medical Service

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1. Introduction

Out-of-hospital cardiac arrest (OHCA) remains a critical global health concern, with the annual incidence of emergency medical services (EMS)-treated OHCA cases ranging from 30 to 170 per 100,000 population (1-3). These events present significant challenges to healthcare systems, particularly concerning resuscitation outcomes and resource allocation (2). Globally, EMS personnel initiate or continue resuscitation in approximately 50%–60% of OHCA cases; however, survival rates remain discouragingly low (4). Data from the Pan-Asian Resuscitation Outcomes Study (PAROS) indicate survival-to-discharge rates as low as 0.5%–0.85% (5). In Thailand, 30-day survival rates for OHCA cases range from 1.7% to 8.6% (6), reflecting a substantial public health burden and persistently poor outcomes.

Multiple independent factors influence OHCA outcomes, including patient demographics, medical history, and specific circumstances of the event. Key variables impacting survival and return of spontaneous circulation (ROSC) likelihood include patient age, comorbidities, cause of arrest, witness status, and the location of the arrest (public vs. private setting) (7). In Thailand, the EMS system employs a multi-tiered model comprising hospital-based Comprehensive Life Support (CLS) led by physicians, Advanced Life Support (ALS) led by paramedics or nurses, and volunteer-driven Basic Life Support services (4). Although this three-tier ambulance system was only recently implemented, physician-led CLS teams have long been the standard in Thai medical schools. The disparity in training and resource availability across these tiers contributes to variability in resuscitation practices and outcomes. Reported ROSC rates for OHCA in Thailand vary widely, ranging from 20.4% (6), 25.6% (8), and 36.3% (9) to 53.4% (10) and even as high as 72% (11). This variability underscores the differences in patient pop-

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ulations, EMS capabilities, and clinical practices.

To address these inconsistencies, several predictive scoring systems have been developed and validated across diverse EMS contexts. Notable among these are the Prehospital Return of Spontaneous Circulation (P-ROSC) score derived from the PAROS registry (12), the Return of Spontaneous Circulation after Cardiac Arrest (RACA) score (13, 14), and the Utstein-Based Return of Spontaneous Circulation (UB-ROSC) score (15, 16). These models incorporate critical factors such as sex, age, arrest location, presumed cause of arrest, witness status, bystander CPR, initial cardiac rhythm, and EMS response time.

A distinct advantage of the P-ROSC, RACA, and UB-ROSC scores is their applicability early in the resuscitation process, as they rely on variables available when ALS personnel first assess the patient. In contrast to other models, such as WATCH-CPR (9) and PRAD-CCPR (17), these three scores do not require data on CPR duration, making them particularly useful in fast-paced EMS environments.

The predictive performance of the P-ROSC (12), RACA (13, 14, 18, 19, 20, 21) , and UB-ROSC (15, 16) scores has been extensively validated in various populations. While the P-ROSC score has been evaluated across Pan-Asian regions, including limited studies in Thailand, these analyses have involved relatively small sample sizes compared to larger population studies. Similarly, the UB-ROSC and RACA scores have been widely validated in European populations but have not been directly compared within the Thai EMS system. Given the distinct challenges of Thailand's EMS framework—such as varying levels of prehospital care and the lack of standardized CPR training for laypersons—it is imperative to evaluate the effectiveness of these predictive models in the Thai context.

This study aimed to validate and compare the predictive accuracy of the P-ROSC, UB-ROSC, and RACA scores for predicting ROSC in OHCA patients transported by EMS in Thailand.

2. Methods

2.1. Study design and setting

We conducted a prognostic accuracy study using a retrospective cohort design, analyzing data from the electronic medical records (EMR) system of Ramathibodi Hospital, a tertiary university hospital in Bangkok, Thailand. Data were collected between January 2021 and October 2024. During this period, annual emergency department (ED) visits ranged from 26,936 to 43,459, with reported cases of cardiac arrest varying between 72 and 93 per year.

The EMS system at Ramathibodi Hospital operates under the Emergency Medical Operation (EMO) Center, established in 2020. This center manages an average of 900 cases annually, with a consistent upward trend in case volume over the years. The EMO Center operates within Service Zone 8 of Bangkok's Erawan Center, covering an area of 4.66 square kilometers with a perimeter of 18.1 kilometers. The prehospital CLS team is physician-led and comprises paramedics, nurses, and emergency physicians delivering advanced prehospital care.

For non-traumatic cardiac arrest cases, the hospital employs a "stay-and-play" strategy, akin to practices in Europe, wherein resuscitation efforts are performed on-site. However, if a reversible cause necessitating hospital intervention is identified, patient transport to the hospital is prioritized. Conversely, all traumatic cardiac arrest cases are managed using a "scoop-and-run" approach, ensuring rapid transport with appropriate stabilization. In suspected OHCA incidents, the EMS dispatcher deploys two emergency units—a BLS, and either an ALS or CLS team. Additionally, dispatchers provide bystanders with real-time guidance for chest compressions through video calls or telephone-assisted CPR.

This study was approved by the Faculty of Medicine, Committee on Human Rights Related to Research Involving Human Subjects, Ramathibodi Hospital, Mahidol University (COA. NO MURA2024/499). The ethics committee did not require consent for this research because reviewing the medical record is the reason for the waiver and a statement covering patient data confidentiality and compliance with the Declaration of Helsinki.

2.2. Participants

All adult patients (aged >18 years) who experienced OHCA, received cardiopulmonary resuscitation (CPR), and were transported by Ramathibodi EMS to any hospital were included in this study. Exclusion criteria encompassed patients with a documented Do Not Resuscitate (DNR) order, those exhibiting signs of irreversible death, cases with incomplete or missing essential data in the EMR, and pregnant patients.

2.3. Data Collection and Outcome Measurement

Data were systematically extracted from the EMR system of Ramathibodi Hospital, which maintains comprehensive documentation of OHCA cases. Data were collected on variables included in the P-ROSC, UB-ROSC, and RACA scores (Supplement 1). These variables encompassed patient age, gender, whether the cardiac arrest was witnessed or unwitnessed, and the presence of bystander-initiated CPR. Cardiac arrest locations were categorized as home, nursing home, workplace, school, street, public building, or sports facility. The initial cardiac rhythm was identified and classified as either shockable (e.g., ventricular fibrillation or ventricular tachycardia) or non-shockable (e.g., asystole or pulseless electrical activity). Additionally, data on prehospital drug administration and the presumed cause of cardiac arrest were recorded.

Time-related variables included the date and time of the arrest, CPR duration, EMS response time, low-flow and no-flow intervals, collapse-to-defibrillation time, and collapse-to-ALS team arrival time. Additionally, the work shift during which the medical personnel responded was recorded (Supplement 1).

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2.4. Outcome

The primary outcome was the achievement of ROSC, defined as the restoration of a palpable pulse and effective circulation, occurring either during prehospital care in the ambulance or upon arrival at the emergency department.

2.5. Definitions

First Seen Arrest: The initial observation of a patient collapsing, as reported by a relative or bystander.

physiciansReturn of Spontaneous Circulation (ROSC): The restoration of a palpable pulse lasting more than 20 seconds, including both sustained and non-sustained pulses, occurring during prehospital care or upon arrival at the emergency department (ED).

Medical Team Shift: Morning Shift: 08:00–16:00, afternoon Shift: 16:00–24:00 and night Shift: 00:00–08:00

Total Time: The duration from the receipt of an emergency call by the ambulance center to the ambulance's return to base.

Activation Time: The interval from the ambulance center receiving a call to the ambulance's departure from the base.

Response Time: The time from ambulance activation to arrival at the scene.

Scene Time: The time from ambulance arrival at the scene to departure from the scene.

Transport Time: The time from ambulance departure from the scene to hospital arrival.

Distance to Scene: The measured distance from the ambulance base to the incident scene.

Distance to Hospital: The measured distance from the scene to the receiving hospital.

Bystander CPR: Cardiopulmonary resuscitation (CPR) administered before the arrival of the Comprehensive Life Support (CLS) team, performed by family members, laypersons, Basic Life Support providers, or medical personnel.

No-Flow Time (Arrest to Chest Compression): The time from the first observed arrest to the initiation of chest compressions by any responder.

BLS CPR Time (Low-Flow Time for ALS Team): The duration from the start of BLS to the transition to Advanced Life Support (ALS).

Time to First Defibrillation: The interval from the first observed arrest to the delivery of the first defibrillation shock.

Collapse to ALS Arrival: The time from the first observed arrest to the arrival of the ALS ambulance at the scene.

Arrest to ACLS Initiation: The time from the first observed collapse to the initiation of Advanced Cardiac Life Support (ACLS).

Time to Adrenaline Administration: The interval from the start of ACLS to the administration of the first dose of adrenaline.

ALS CPR Time: The total duration from the initiation of ACLS to the termination of CPR efforts.

2.6. Statistical Analysis

Reported ROSC rates for OHCA in Thailand exhibit considerable variability, ranging from 20.4% to 72%(8, 9, 10, 11, 22). At our EMS dispatch center, the observed ROSC rate for OHCA cases is approximately 30%.

To ensure adequate statistical power for validating the predictive performance of the P-ROSC, RACA, and UB-ROSC scores, a sample size calculation was conducted using the Master Formula for estimating proportions. Assuming a 95% confidence level, a 5% margin of error, and an estimated ROSC proportion of 30%, the minimum required sample size was calculated to be 323 patients. Statistical analyses were conducted using STATA version 16.0 (StataCorp LLC, College Station, TX, USA).

Categorical variables were presented as frequencies and percentages, and comparisons were made using the Pearson's chi-squared test. Continuous variables were summarized as means with standard deviations (SD) for normally distributed data and compared using Student's t-test for two independent numerical groups. For non-normally distributed data, outliers were identified and managed using the interquartile range (IQR) method. We used complete case analysis to address missing data, excluding cases with any missing values from the final analysis. A two-tailed p-value < 0.05 was considered statistically significant, with a 95% confidence interval (CI) that excluded the null value of 1.

The predictive performance of the P-ROSC, RACA, and UB-ROSC scores was evaluated using the Area Under the Receiver Operating Characteristic Curve (AUC). AUC was classified as follows: 90 -100 = excellent; 80 - 90 = good; 70 - 80 = fair; 60 - 70 = poor; 50 - 60 = fail. Calibration analyses were performed to examine the agreement between predicted and observed outcomes for each scoring system.

3. Results

Between January 1, 2021, and October 30, 2024, a total of 414 OHCA cases were eligible to the study. Following the exclusion of cases involving DNR orders or signs of irreversible death (69 patients), incomplete data (6 patients), or patients younger than 18 years (3 patients), 336 cases were eligible for analysis. Among these, 94 (27.97%) patients achieved ROSC, while 242 (72.03%) patients did not (Figure 1).

3.1. Baseline Characteristics of the Study Participants

The mean age of participants was 59.32 ± 18.99 years, with the non-ROSC group exhibiting a slightly higher average age (p = 0.798). Male patients accounted for 65.8% of the total cohort, with a higher proportion observed in the non-ROSC group (p = 0.216). Notably, ROSC cases were significantly more likely to be witnessed arrests compared to non-ROSC cases (78.7% vs. 55.8%, p < 0.001), including a greater incidence of EMS-witnessed arrests (11.7% vs. 2.9%, p = 0.001). However, no significant difference was found in the

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rates of bystander CPR between the groups (p = 0.559). Operational times were critical factors influencing outcomes. The ROSC group experienced significantly shorter activation times (4.8 minutes vs. 6.1 minutes, p = 0.022) and transport times (12.3 minutes vs. 14.9 minutes, p < 0.001) compared to the non-ROSC group. Resuscitation timelines further reflected this trend, with the ROSC group demonstrating a markedly shorter median no-flow time (2 minutes vs. 10 minutes; p <0.001). Additionally, the median collapse-to-ALS arrival time was significantly reduced in the ROSC group (17.0 minutes vs 26.0 minutes, p < 0.001). Regarding the underlying causes of cardiac arrest, suspected pulmonary embolism (6.4% vs. 1.2%, p = 0.009), hypoxia (56.4% vs. 35.1%, p < 0.001), and myocardial infarction (20.0% vs. 9.5%, p = 0.006) were more prevalent among ROSC patients. These findings highlight the critical impact of rapid EMS response, the occurrence of witnessed arrests, and specific etiologies such as hypoxia and pulmonary embolism on achieving ROSC. In contrast, delayed response times and fewer EMS-witnessed arrests were characteristic of non-ROSC cases. (Table 1).

3.2. Predictive ability of the Prehospital scores

The RACA score demonstrated the highest predictive accuracy for ROSC, with an AUC of 0.77 (95% CI: 0.71–0.82), categorizing it as a fair predictor. The UB-ROSC score followed with an AUC of 0.72 (95% CI: 0.66–0.78), also classified as fair. Conversely, the P-ROSC score exhibited the lowest predictive performance, with an AUC of 0.64 (95% CI: 0.58–0.70), placing it in the poor category (Table 2 and Figure 2).

Table 3 presents the predictive accuracy of the RACA, UB-ROSC, and P-ROSC scores for ROSC. The probability estimates of the RACA and UB-ROSC scores, as well as the P-ROSC score, were stratified into deciles. Accuracy indices, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (PLR), and negative likelihood ratio (NLR), were calculated for each cutoff category.

3.3. The calibration analysis of the scores

The calibration analysis of the RACA score demonstrated strong predictive performance for ROSC. The Observed-to-Expected (O:E) ratio was 0.878, indicating a slight underestimation of ROSC outcomes. The Calibration-in-the-Large (CITL) value of -0.225 suggested a minor negative bias, reflecting a slight underprediction of ROSC likelihood. The calibration slope was 1.005, closely approximating the ideal value of 1, signifying excellent alignment between predicted and observed outcomes. Additionally, the RACA score achieved an AUC of 0.766, confirming its strong discriminatory ability to distinguish between patients who achieved ROSC and those who did not. The calibration curve further supported these findings, as the smoother line closely aligned with the reference line, demonstrating accurate calibration across the full probability spectrum. The shaded confidence intervals indicated model reliability, and the distribution of observed data points reinforced the consistency between predicted and actual ROSC probabilities (Figure 3).

The UB-ROSC score exhibited suboptimal calibration in predicting ROSC. The calibration slope was 0.495, indicating that the model's predictions were less responsive to variations in actual outcomes. Additionally, the Observed-to-Expected (O:E) ratio of 0.687 suggests that the UB-ROSC score consistently overestimated the likelihood of ROSC, particularly in cases with higher predicted probabilities. This overestimation highlights limitations in the UB-ROSC score's predictive accuracy, especially in differentiating between patients more or less likely to achieve ROSC. The calibration curve further illustrates this discrepancy, with predictions deviating from the reference line at higher probability ranges, reflecting reduced reliability in these scenarios (Figure 3).

The calibration plot for the P-ROSC score indicates moderate alignment between predicted and observed probabilities of ROSC. The Calibration-in-the-Large (CITL) value of 0.858 suggests a slight overestimation of ROSC probabilities. Additionally, the calibration slope of 0.427 reflects notable miscalibration, particularly at higher predicted probabilities, where the model tends to overpredict outcomes. The area under the curve (AUC) was 0.619, highlighting poor discriminative ability in distinguishing between ROSC and non-ROSC cases. Visual assessment of the calibration plot shows that while predicted probabilities align reasonably well with observed outcomes at lower probability levels, significant divergence occurs at higher predicted probabilities. The shaded confidence band further emphasizes the variability and limited reliability of the P-ROSC model's predictions. In comparison to the RACA and UB-ROSC models, the P-ROSC score demonstrated the weakest performance, with the lowest AUC and the lowest observed-to-expected (O:E) ratio, underscoring its limited utility in predicting ROSC outcomes (Figure 3).

4. Discussion

This study externally validated the predictive performance of three scoring systems for ROSC in OHCA cases. Among the models assessed, the RACA score demonstrated the highest predictive accuracy, effectively distinguishing between ROSC and non-ROSC outcomes. The University of British Columbia ROSC (UB-ROSC) score exhibited moderate predictive capability, suggesting its practical utility in prehospital settings. Conversely, the Prehospital ROSC (P-ROSC) score showed the lowest predictive performance, highlighting its limitations within this specific EMS context.

In this study, the RACA score achieved an area under the curve (AUC) of 0.77, marginally surpassing its original validation AUC of 0.73 (13) and aligning with results from studies conducted in Helsinki (18), Italy, and Switzerland (20). Similar trends have been observed in Asian populations (12, 19, 21), reinforcing the score's generalizability. This robust performance may be attributed to the RACA score's comprehensive integration of multiple predictive variables, enhancing its accuracy in forecasting ROSC. Despite being developed

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in 2010, the RACA score remains clinically relevant, as evidenced by a 2022 Italian study reporting a sustained AUC despite updates to CPR guidelines (14). Additionally, the implementation of a "stay-and-play" strategy—similar to European EMS protocols—by our team may have enhanced the applicability and predictive accuracy of the RACA score in our clinical setting.

The UB-ROSC score, initially validated with an AUC of 0.83 (15), has been supported by subsequent studies (23). Originally developed to predict ROSC upon hospital admission, its predictive performance declined slightly when applied to OHCA cases in the prehospital setting. In our study, the UB-ROSC score demonstrated moderate predictive performance, yielding an AUC of 0.72 for predicting ROSC in both prehospital and emergency department (ED) settings. This finding is consistent with results from studies conducted in Italy and Switzerland (16) and the Pan-Asia study (12, 24). Our analysis revealed that the RACA score outperformed the UB-ROSC score in terms of AUC, aligning with the Pan-Asia study (12). However, other studies have reported higher AUCs for the UB-ROSC score compared to the RACA score, although these differences were not statistically significant (24).

The UB-ROSC score was intentionally designed to be more straightforward than the RACA score. For instance, while the RACA score incorporates continuous data for the variable "time from arrest to EMS arrival," the UB-ROSC simplifies this into categorical data. Similarly, the initial cardiac rhythm in the UB-ROSC score is dichotomized into "shockable" and "non-shockable" categories. This simplification, though enhancing ease of use, may contribute to reduced predictive accuracy (AUC) compared to the more detailed RACA score.

The P-ROSC score exhibited the lowest predictive performance in our study, with an AUC of 0.62, notably lower than the AUC of 0.81 reported in the original validation study (12). This diminished performance may be attributed to the limited number of variables incorporated into the P-ROSC model. A key limitation lies in the simplification of the "arrest to EMS arrival time" variable into "response time," which may fail to capture the critical interval between the recognition of cardiac arrest and the initiation of the emergency call. In our context, this interval is often extended due to the absence of routine CPR education in the standard curriculum. As a result, only individuals with a specific interest in CPR pursue training, contributing to significant delays in emergency response.

Furthermore, the P-ROSC score places a stronger emphasis on shockable rhythms; however, in our study, limited access to automated external defibrillators (AEDs) resulted in an average time to defibrillation of approximately 15 minutes. This extended delay likely shifts the cardiac arrest beyond the electrical phase of CPR, where the myocardium becomes less responsive to cardioversion (25, 26). Variations in treatment protocols may also contribute to these findings. In high-income countries such as Japan, Taiwan, and South Korea, extracorporeal cardiopulmonary resuscitation (ECPR) protocols are available even in prehospital settings and emergency departments, potentially offering substantial improvements in patient outcomes. Conversely, ECPR is infrequently performed in Thailand due to limited resources and expertise. Additionally, our protocol requires prehospital drug administration for all cases requiring advanced cardiac life support (ACLS). These factors together contribute to the reduced predictive accuracy of the P-ROSC score in our setting.

All predictive scores can support EMS personnel in making informed decisions, especially in resource-limited settings like Thailand. These scores facilitate communication by providing clear data on resuscitation outcomes and assisting in emotional discussions with families (15). They also aid decision-making, such as determining when to adopt a "stay-and-play" strategy for patients with low survival potential or deciding whether hospital transport is necessary. Additionally, these scores offer valuable insights that can guide the initiation of advanced interventions, such as extracorporeal membrane oxygenation (ECMO) or helicopter emergency medical services (HEMS), when appropriate.

The higher predictive accuracy of the RACA score highlights its value in evaluating EMS quality across different units or communities, guiding improvements in resuscitation practices, and serving as a benchmark for performance (27, 28). However, its complexity may limit its real-time application in prehospital care. This limitation could be addressed by utilizing tools such as the UB-ROSC online calculator, which simplifies the score's implementation in real-time scenarios (29). The UB-ROSC score, while less accurate than the RACA score, still offers value due to its simplicity and focus on sustained ROSC. Its moderate performance underscores its potential to set realistic expectations during resuscitation and assist in decision-making within prehospital settings (15, 16). The calibration plot reveals an overestimation of ROSC, which becomes more evident in higher-score cases. While this overestimation requires caution, it is generally more acceptable than undertriage, ensuring that patients are not prematurely excluded from critical interventions.

Despite its limitations in predictive ability, the P-ROSC score remains valuable due to its simplicity and adaptability, particularly in resource-constrained prehospital settings.

5. Limitations

This study had several limitations: The study was conducted at a single center, which may limit the generalizability of the findings to other institutions or regions with different patient demographics or EMS systems. Additionally, the limited sample size may result in underpowered analyses for certain conditions, such as time to defibrillation, which is restricted to cases with shockable rhythms. As a retrospective study, it is subject to inherent limitations, such as selection bias and potential information gaps. To mitigate these biases, standardized record forms were used to collect consistent and detailed data, ensuring all essential information was included. This approach helps reduce recall bias and improves data

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accuracy. Finally data availability and completeness: Missing or incomplete data may still arise, particularly from private hospitals that prioritize patient privacy and may not disclose outcomes. To maintain the integrity of the analysis, patients with incomplete or missing critical information were excluded from the study.

6. Conclusions

Among the three predictive models assessed, the RACA and UB-ROSC scores demonstrated fair predictive accuracy for ROSC in OHCA patients, while the P-ROSC score had poor predictive value. The RACA score exhibited the best overall performance in terms of both discrimination and calibration. These findings highlight the need for careful selection of prediction models when guiding prehospital resuscitation strategies and outcomes expectations.

7. Declarations

7.1. Acknowledgments

No.

7.2. Author Contribution

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

7.3. Ethical considerations

This study was approved by the Faculty of Medicine, Committee on Human Rights Related to Research Involving Human Subjects, Ramathibodi Hospital, Mahidol University (COA. NO MURA2024/499). The ethics committee did not require consent for this research because reviewing the medical record is the reason for the waiver and a statement covering patient data confidentiality and compliance with the Declaration of Helsinki.

7.4. Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

7.5. Funding Source

No funding was obtained for this study.

7.6. Competing interests

No.

7.7. Using artificial inteligence chatbots

During the preparation of this work the author(s) used ChatGPT4.0 in order to check and correct grammatical error during the manuscript writing process. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

References

1. Kiguchi T, Okubo M, Nishiyama C, Maconochie I, Ong MEH, Kern KB, et al. Out-of-hospital cardiac arrest across the World: First report from the International Liaison Committee on Resuscitation (ILCOR). Resuscitation. 2020;152:39-49.
2. Gräsner JT, Herlitz J, Tjelmeland IBM, Wnent J, Masterson S, Lilja G, et al. European Resuscitation Council Guidelines 2021: Epidemiology of cardiac arrest in Europe. Resuscitation. 2021;161:61-79.
3. Zheng J, Lv C, Zheng W, Zhang G, Tan H, Ma Y, et al. Incidence, process of care, and outcomes of out-of-hospital cardiac arrest in China: a prospective study of the BASIC-OHCA registry. Lancet Public Health. 2023;8(12):e923-e32.
4. Laksanamapune T, Yuksen C, Thiamdao N. Pre-hospital Associated Factors of Survival in Traumatic Out-of-hospital Cardiac Arrests: An 11-Year Retrospective Cohort Study. Arch Acad Emerg Med. 2025;13(1):e15.
5. Ong ME, Shin SD, De Souza NN, Tanaka H, Nishiuchi T, Song KJ, et al. Outcomes for out-of-hospital cardiac arrests across 7 countries in Asia: The Pan Asian Resuscitation Outcomes Study (PAROS). Resuscitation. 2015;96:100-8.
6. Sirikul W, Piankusol C, Wittayachamnankul B, Riyapan S, Supasaovapak J, Wongtanasarasin W, et al. A retrospective multi-centre cohort study: Pre-hospital survival factors of out-of-hospital cardiac arrest (OHCA) patients in Thailand. Resusc Plus. 2022;9:100196.
7. Hayakawa K, Tasaki O, Hamasaki T, Sakai T, Shiozaki T, Nakagawa Y, et al. Prognostic indicators and outcome prediction model for patients with return of spontaneous circulation from cardiopulmonary arrest: the Utstein Osaka Project. Resuscitation. 2011;82(7):874-80.
8. Monsomboon A, Chantawatsharakorn P, Suksuriyayothin S, Keorochana K, Mukda A, Prapruetkit N, et al. Prevalence of emergency medical service utilisation in patients with out-of-hospital cardiac arrest in Thailand. Emerg Med J. 2016;33(3):213-7.
9. Amnuaypattanapon K, Thanachartwet V, Desakorn V, Chamnanchanunt S, Pukrittayakamee S, Sahassananda D, et al. Predictive model of return of spontaneous circulation among patients with out-of-hospital cardiac arrest in Thailand: The WATCH-CPR Score. Int J Clin Pract. 2020;74(7):e13502.
10. Yeeheng U. Factors associated with successful resusci-

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tation of out-of-hospital cardiac arrest at Rajavithi Hospital's Narenthorn Emergency Medical Service Center, Thailand. Asia Pac J Public Health. 2011;23(4):601-7.
11. Huabbangyang T, Sangketchon C, Ittiphisit S, Uoun K, Saumok C. Predictive Factors of Outcome in Cases of Out-of-hospital Cardiac Arrest Due to Traffic Accident Injuries in Thailand; a National Database Study. Arch Acad Emerg Med. 2022;10(1):e64.
12. Liu N, Liu M, Chen X, Ning Y, Lee JW, Siddiqui FJ, et al. Development and validation of an interpretable prehospital return of spontaneous circulation (P-ROSC) score for patients with out-of-hospital cardiac arrest using machine learning: A retrospective study. EClinicalMedicine. 2022;48:101422.
13. Gräsner JT, Meybohm P, Lefering R, Wnent J, Bahr J, Messelken M, et al. ROSC after cardiac arrest–the RACA score to predict outcome after out-of-hospital cardiac arrest. Eur Heart J. 2011;32(13):1649-56.
14. Gamberini L, Tartivita CN, Guarnera M, Allegri D, Baroncini S, Scquizzato T, et al. External validation and insights about the calibration of the return of spontaneous circulation after cardiac arrest (RACA) score. Resusc Plus. 2022;10:100225.
15. Baldi E, Caputo ML, Savastano S, Burkart R, Klersy C, Benvenuti C, et al. An Utstein-based model score to predict survival to hospital admission: The UB-ROSC score. Int J Cardiol. 2020;308:84-9.
16. Caputo ML, Baldi E, Burkart R, Wilmes A, Cresta R, Benvenuti C, et al. Validation of Utstein-Based score to predict return of spontaneous circulation (UB-ROSC) in patients with out-of-hospital cardiac arrest. Resuscitation. 2024;197:110113.
17. Huabbangyang T, Silakoon A, Papukdee P, Klaiangthong R, Thongpean C, Pralomcharoensuk W, et al. Sustained Return of Spontaneous Circulation Following Out-of-Hospital Cardiac Arrest; Developing a Predictive Model Based on Multivariate Analysis. Arch Acad Emerg Med. 2023;11(1):e33.
18. Kupari P, Skrifvars M, Kuisma M. External validation of the ROSC after cardiac arrest (RACA) score in a physician staffed emergency medical service system. Scand J Trauma Resusc Emerg Med. 2017;25(1):34.
19. Liu N, Ong MEH, Ho AFW, Pek PP, Lu TC, Khruekarnchana P, et al. Validation of the ROSC after cardiac arrest (RACA) score in Pan-Asian out-of-hospital cardiac arrest patients. Resuscitation. 2020;149:53-9.
20. Caputo ML, Baldi E, Savastano S, Burkart R, Benvenuti C, Klersy C, et al. Validation of the return of spontaneous circulation after cardiac arrest (RACA) score in two different national territories. Resuscitation. 2019;134:62-8.
21. Wu CY, Lu TC, Su PI, Tsai CL, Tay J, Wu MC, et al. End-tidal Carbon Dioxide + Return of Spontaneous Circulation After Cardiac Arrest (RACA) Score to Predict Outcomes After Out-of-hospital Cardiac Arrest. West J Emerg Med. 2023;24(3):605-14.
22. Riyapan S, Chantanakomes J, Roongsaenthong P, Tianwibool P, Wittayachamnankul B, Supasaovapak J, et al. Impact of the COVID-19 outbreak on out-of-hospital cardiac arrest management and outcomes in a low-resource emergency medical service system: a perspective from Thailand. Int J Emerg Med. 2022;15(1):26.
23. Wang CH, Tay J, Wu CY, Wu MC, Su PI, Fang YD, et al. External Validation and Comparison of Statistical and Machine Learning-Based Models in Predicting Outcomes Following Out-of-Hospital Cardiac Arrest: A Multicenter Retrospective Analysis. J Am Heart Assoc. 2024;13(20):e037088.
24. Huang CY, Lu TC, Tsai CL, Wu CY, Chou E, Wang CH, et al. Point-of-care testing for adult out-of-hospital cardiac arrest resuscitated at the ED to predict ROSC: Development and external validation of POC-ED-ROSC model. Am J Emerg Med. 2023;71:86-94.
25. Goto Y, Funada A, Maeda T, Goto Y. Time boundaries of the three-phase time-sensitive model for ventricular fibrillation cardiac arrest. Resusc Plus. 2021;6:100095.
26. Gilmore CM, Rea TD, Becker LJ, Eisenberg MS. Three-phase model of cardiac arrest: time-dependent benefit of bystander cardiopulmonary resuscitation. Am J Cardiol. 2006;98(4):497-9.
27. Richardson ASC, Tonna JE, Nanjayya V, Nixon P, Abrams DC, Raman L, et al. Extracorporeal Cardiopulmonary Resuscitation in Adults. Interim Guideline Consensus Statement From the Extracorporeal Life Support Organization. Asaio j. 2021;67(3):221-8.
28. Schewe JC, Kappler J, Heister U, Weber SU, Diepenseifen CJ, Frings B, et al. Outcome of out-of-hospital cardiac arrest over a period of 15 years in comparison to the RACA score in a physician staffed urban emergency medical service in Germany. Resuscitation. 2015;96:232-8.
29. Martinell L, Nielsen N, Herlitz J, Karlsson T, Horn J, Wise MP, et al. Early predictors of poor outcome after out-of-hospital cardiac arrest. Crit Care. 2017;21(1):96.

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Table 1: Baseline characteristics of the Return of Spontaneous Circulation (ROSC) and non-ROSC in Out-of-hospital cardiac arrest (continue)

Variable	ROSC (N=94)	Non-ROSC (N=242)	P value
Age (year)			
Median [IQR]	59.0 [45.0, 74.0]	60.5 [47.0, 75.0]	0.798
Gender			
Male	57 (60.6)	164 (67.8)	0.216
Shift of operation			
Morning	47 (50.0)	105 (43.4)	0.138
Afternoon	35 (37.2)	83 (34.3)	
Night	12 (12.8)	54 (22.3)	
Place of incident			
Home	60 (63.8)	175 (73.2)	0.098
Workplace	8 (8.5)	22 (9.2)	
Public transport	4 (4.3)	4 (1.7)	
Nursing home	0 (0.0)	1 (0.4)	
Street	15 (16.0)	31 (13.0)	
Recreational area	3 (3.2)	3 (1.3)	
Medical facility	2 (2.1)	0 (0.0)	
Others	2 (2.1)	3 (1.3)	
Public place	22(23.4)	38(15.7)	
Trauma	12 (12.8)	22 (9.1)	0.316
Operation time (minute)			
Total time	69.0 [54.0, 93.0]	71.0 [50.0, 89.0]	0.357
Activation time	5.0 [3.0, 6.0]	5.0 [3.0, 8.0]	0.008
Response time	15.0 [11.0, 19.0]	16.0 [11.0, 20.0]	0.594
Scene time	44.0 [30.0, 55.0]	46.0 [31.0, 54.0]	0.714
Transport time	12.0 [7.0, 17.0]	17.0 [10.0, 17.0]	<0.001
Prearrival instruction for chest compression			
Yes	83 (88.3)	223 (92.1)	0.266
Any witness arrest		135 (55.8)	<0.001
Yes	74 (78.7)		
EMS witness arrest			
Yes	11 (11.7)	7 (2.9)	0.001
Basic ambulance arrives before			
ALS arrived before	70(76.09)	195(83.33)	0.155
BLS arrived before	22(23.91)	39(16.67)	
Bystander CPR			
No bystander	9 (9.6)	16 (6.6)	0.559
Family	34 (36.2)	108 (44.6)	
First responder	33 (35.1)	83 (34.3)	
Layperson	10 (10.6)	18 (7.4)	
Medical personal	8 (8.5)	17 (7.0)	
AED			
No AED	47 (50.5)	138 (57.7)	0.389
AED does not shock	33 (35.5)	79 (33.1)	
AED Shock	13 (14.0)	22 (9.2)	
Shockable initial rhythm			
Yes	20 (21.3)	36 (14.9)	0.162
Initial Rhythm for ALS and CLS			
Asystole	50 (53.8)	179 (74.6)	0.001
PEA	26 (28.0)	34 (14.2)	
Shockable rhythm	16 (17.2)	27 (11.2)	
Unknown	1 (1.1)	0 (0.0)	
Resuscitation Time (minute)			
Arrest to chest compression	2.0 [0.0, 11.0]	10.0 [1.0, 22.0]	<0.001
BLS CPR time	12.5 [2.0, 19.0]	17.0 [5.0, 24.0]	0.038
Time to first defibrillation	8.0 [2.0, 17.0]	15.0 [6.0, 24.0]	0.147
Collapse to ALS arrive	17.0(6.0, 28.0)	26.0(17.0,40.0)	<0.001
Arrest to ACLS	18.0 [8.0, 28.0]	27.0 [19.0, 40.0]	<0.001
ALS CPR time	18.0 [12.0, 35.0]	30.0 [24.0, 38.0]	<0.001
Presume cause of arrest (could be more than one cause)			
Acidosis	31 (33.0)	93 (38.4)	0.353
Hypoxia	53 (56.4)	85 (35.1)	<0.001
Cardiac cause	27 (28.7)	90 (37.2)	0.144

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Table 1: Baseline characteristics of the Return of Spontaneous Circulation (ROSC) and non-ROSC in Out-of-hospital cardiac arrest

Variable	ROSC (N=94)	Non-ROSC (N=242)	P value
Hypo/hyperkalemia	17 (18.1)	61 (25.2)	0.165
Traumatic	8(8.5)	23(9.5)	0.778
Hypovolemia	17 (18.1)	30 (12.4)	0.177
Suspected myocardial infarction	19 (20.0)	23 (9.5)	0.006
Pulmonary embolism	6 (6.4)	3 (1.2)	0.009
Intoxication	2 (2.1)	6 (2.5)	0.849
Cardiac tamponade	0 (0.0)	1(1.7)	0.210
Pneumothorax	0 (0.0)	2(0.8)	0.377
Unknown	0 (0.0)	3 (1.2)	0.278

Data are presented as number (%) or median (interquartile range (IQR)). ROSC: Return of Spontaneous Circulation, ALS: advance life support, BLS: basic life support, AED: automated external defibrillators, PEA: Pulseless electrical activity, CPR: cardiopulmonary resuscitation.

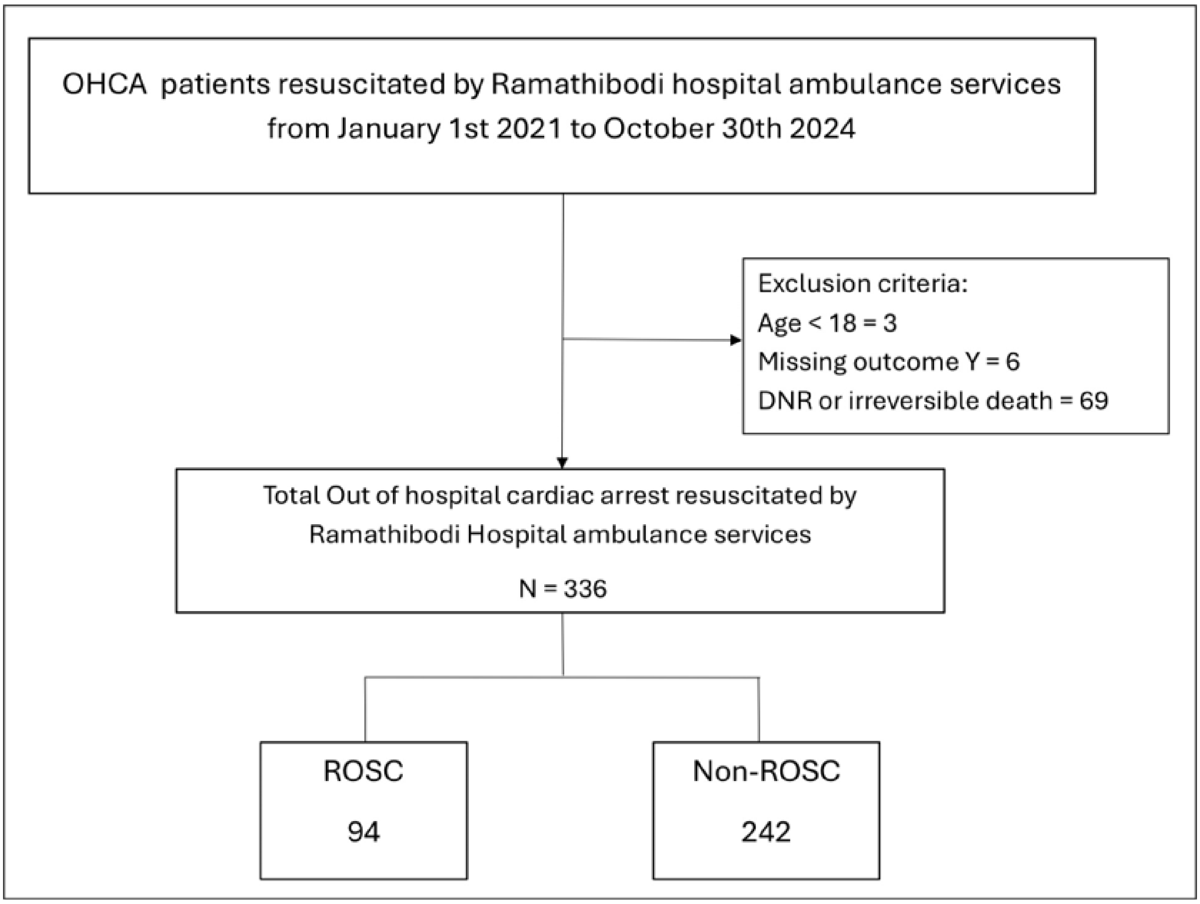

Figure 1: Study flowchart of patients' inclusion.

Table 2: Predictive ability of the prehospital score

Score	Probability for ROSC		AUC (95%CI)	P value
	ROSC	Non-ROSC		
RACA	0.48 (0.28,0.59)	0.23 (0.14,0.35)	0.77 (0.71-0.82)	<0.001
UB-ROSC	0.67 (0.38,0.83)	0.35 (0.14,0.60)	0.72 (0.66-0.78)	<0.001
P-ROSC	0.27 (0.25,0.31)	0.27(0.25-0.27	0.64 (0.58-0.70)	0.008

P-ROSC: Prehospital Return of Spontaneous Circulation, UB-ROSC: Utstein-Based Return of Spontaneous Circulation, RACA: Return of Spontaneous Circulation after Cardiac Arrest, ROSC: Return of Spontaneous Circulation, AUC: Area Under the Receiver Operating Characteristic Curve, CI: confidence interval.

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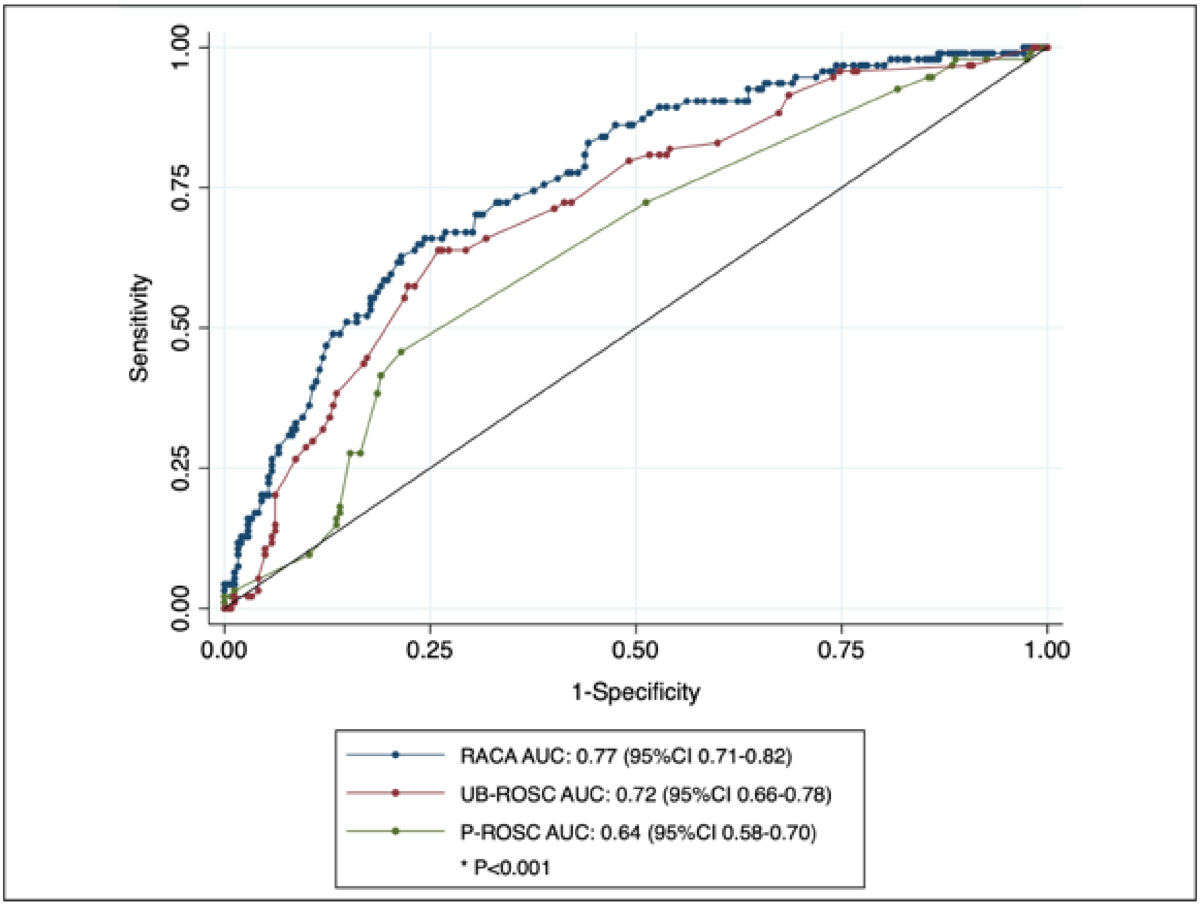

Figure 2: Receiver operating characteristic (ROC) curve for Return of Spontaneous Circulation After Cardiac Arrest (RACA), Utstein-Based Return of Spontaneous Circulation (UB-ROSC), and Prehospital Return of Spontaneous Circulation (P-ROSC).

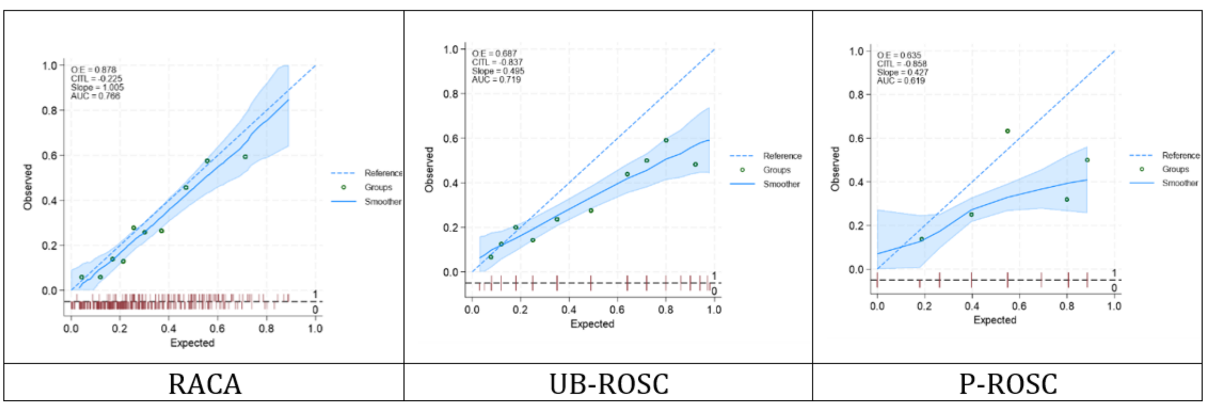

Figure 3: The calibration plot for Return of Spontaneous Circulation After Cardiac Arrest (RACA) score; Utstein-Based Return of Spontaneous Circulation (UB-ROSC) score, and Prehospital Return of Spontaneous Circulation (P-ROSC) score in predicting the Return of Spontaneous Circulation (ROSC).

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Table 3: Predictive accuracy for ROSC of RACA, UB-ROSC, and P-ROSC score in each cut-off category

Score	N (%)*	Sensitivity	Specificity	PPV	NPV	PLR	NLR
RACA							
0-9	2 (2.13)	2.10 (0.30-7.50)	85.10 (80.00-89.40)	5.30 (0.60-17.70)	69.10 (63.50-74.30)	0.14 (0.04-0.58)	1.15 (1.08-1.22)
10-19	7 (7.45)	7.40 (3.00-14.70)	74.40 (68.40-79.80)	10.10 (4.20-19.80)	67.40 (61.40-73.00)	0.29 (0.14-0.61)	1.24 (1.13-1.37)
20-29	17 (18.09)	18.10 (10.90-27.40)	74.00 (68.00-79.40)	21.20 (12.90-31.80)	69.90 (63.90-75.50)	0.69 (0.43-1.12)	1.11 (0.98-1.25)
30-39	12 (12.77)	12.80 (6.80-21.20)	86.80 (81.80-90.80)	27.30 (15.00-42.80)	71.90 (66.40-77.00)	0.97 (0.52-1.79)	1.01 (0.92-1.10)
40-49	14 (14.89)	14.90 (8.40-23.70)	91.70 (87.50-94.90)	41.20 (24.60-59.30)	73.50 (68.20-78.40)	1.80 (0.95-3.42)	0.93 (0.85-1.02)
50-59	21 (22.34)	22.30 (14.40-32.10)	93.40 (89.50-96.20)	56.80 (39.50-72.90)	75.60 (70.30-80.30)	3.38 (1.84-6.19)	0.83 (0.74-0.93)
60-69	10 (10.64)	10.60 (5.20-18.70)	96.30 (93.10-98.30)	52.60 (28.90-75.60)	73.50 (68.30-78.30)	2.86 (1.20-6.82)	0.93 (0.86-1.00)
70-79	7 (7.45)	7.40 (3.00-14.70)	99.20 (97.00-99.90)	77.80 (40.00-97.20)	73.40 (68.30-78.10)	9.01 (1.91-42.59)	0.93 (0.88-0.99)
80-89	4 (4.26)	4.30 (1.20-10.50)	99.20 (97.00-99.90)	66.70 (22.30-95.70)	72.70 (67.60-77.50)	5.15 (0.96-27.64)	0.97 (0.92-1.01)
UB-ROSC							
0-9	3 (3.19)	3.20 (0.70-9.00)	90.50 (86.10-93.90)	11.50 (2.40-30.20)	70.60 (65.20-75.70)	0.34 (0.10-1.09)	0.31 (0.10-1.01)
10-19	8 (8.51)	8.50 (3.70-16.10)	76.90 (71.00-82.00)	12.50 (5.60-23.20)	68.40 (62.50-73.90)	0.37 (0.18-0.74)	1.19 (1.09-1.31)
20-29	7 (7.45)	7.40 (3.00-14.70)	86.40 (81.40-90.40)	17.50 (7.30-32.80)	70.60 (65.10-75.70)	0.55 (0.25-1.19)	1.07 (0.99-1.16)
30-39	8 (8.51)	8.50 (3.70-16.10)	88.40 (83.70-92.20)	22.20 (10.10-39.20)	71.30 (65.90-76.40)	0.74 (0.35-1.56)	1.03 (0.96-1.12)
40-49	6 (6.38)	6.40 (2.40-13.40)	89.70 (85.10-93.20)	19.40 (7.50-37.50)	71.10 (65.70-76.20)	0.62 (0.26-1.46)	1.04 (0.98-1.12)
50-59	8 (8.51)	8.50 (3.70-16.10)	91.30 (87.00-94.50)	27.60 (12.70-47.20)	72.00 (66.60-76.90)	0.98 (0.45-2.14)	1.00 (0.93-1.08)
60-69	13 (13.83)	13.80 (7.60-22.50)	93.80 (90.00-96.50)	46.40 (27.50-66.10)	73.70 (68.40-78.50)	2.23 (1.10-4.51)	0.92 (0.84-1.00)
70-79	13 (13.83)	13.80 (7.60-22.50)	93.80 (90.00-96.50)	46.40 (27.50-66.10)	73.70 (68.40-78.50)	2.23 (1.10-4.51)	0.92 (0.84-1.00)
80-89	15 (15.96)	16.00 (9.20-25.00)	95.50 (92.00-97.70)	57.70 (36.90-76.60)	74.50 (69.30-79.30)	3.51 (1.67-7.36)	0.88 (0.80-0.97)
90-100	13 (13.83)	13.80 (7.60-22.50)	93.80 (90.00-96.50)	46.40 (27.50-66.10)	73.70 (68.40-78.50)	2.23 (1.10-4.51)	0.92 (0.84-1.00)
P-ROSC							
0-9	2 (2.10)	2.10 (0.30-7.50)	97.50 (94.70-99.10)	25.00 (3.20-65.10)	72.00 (66.80-76.70)	0.86 (0.18-4.18)	1.00 (0.97-1.04)
10-19	0 (0.00)	0.00 (0.00-3.80)	91.30 (87.00-94.50)	0.00 (0.00-16.10)	70.20 (64.80-75.20)	0.00 (0.00-0.00)	1.10 (1.05-1.14)
20-29	5 (5.30)	5.30 (1.70-12.00)	93.00 (89.00-95.90)	22.70 (7.80-45.40)	71.70 (66.30-76.60)	0.76 (0.29-1.99)	1.02 (0.96-1.08)
30-39	51 (54.26)	54.30 (43.70-64.60)	36.80 (30.70-43.20)	25.00 (19.20-31.50)	67.40 (58.70-75.30)	0.86 (0.70-1.06)	1.24 (0.94-1.64)
40-49	19 (20.21)	20.20 (12.60-29.80)	95.50 (92.00-97.70)	63.30 (43.90-80.10)	75.50 (70.30-80.20)	4.45 (2.20-8.98)	0.84 (0.75-0.93)
50-59	2 (2.13)	2.10 (0.30-7.50)	99.60 (97.70-100.00)	66.70 (9.40-99.20)	72.40 (67.20-77.10)	5.15 (0.47-56.11)	0.98 (0.95-1.01)
60-69	13 (13.83)	13.80 (7.60-22.50)	87.20 (82.30-91.10)	29.50 (16.80-45.20)	72.30 (66.70-77.30)	1.08 (0.59-1.97)	0.99 (0.90-1.09)
70-79	2 (2.13)	2.10 (0.30-7.50)	99.20 (97.00-99.90)	50.00 (6.80-93.20)	72.30 (67.10-77.00)	2.57 (0.37-18.01)	0.99 (0.96-1.02)

*: Number of patients with Return of Spontaneous Circulation (ROSC). RACA: Return of Spontaneous Circulation after Cardiac Arrest, UB-ROSC: Utstein-Based Return of Spontaneous Circulation, P-ROSC: Prehospital Return of Spontaneous Circulation, PPV: positive predictive value, NPV: negative predictive value, LR: likelihood ratio, CI: confidence interval.

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Supplement table 1: The variables and their weights for P-ROSC and UB-ROSC, as well as the coefficients for RACA in predicting ROSC

Variable	P-ROSC	UB-ROSC	RACA
Age (years)			
<60	13	0	-0.2*age
60-80	10	0	
80-85	10	-9	
85-90	7	-9	
≥90	0	-9	
Arrest Witnessed			
No	0		0
Professional (EMS)	27	13	0.5
Lay person	19		0.6
Bystander CPR			
Present			0.2
Witness		4	
No witness		-5	
No			
Witness		2	
No witness		0	
Sex			
Female		0	0
Male		-3	-0.2
Time for EMS arrival (minutes)			
<5	9	0	-0.04 × minutes
5-8	7	0	
9-10	3	0	
11	3	-4	
12-14	0	-4	
≥15	0	-7	
First Rhythm			
asystole	0	0	-1.1
PEA	0	0	-0.8
Shockable	30	21	0
Prehospital Drug Administration			
Yes	21		
No	0		
Etiology			
Cardiac		0	
Trauma		-3	-0.6
Drowning (hypoxia)		1	0.7
Respiratory(hypoxia)		19	0.7
Intoxication		0	0.5
Other non-cardiac		0	0
Location			
At home		0	
Nursing home		-7	-0.3
Workplace		6	
School		0	0.3 (Public Place)
Street		4	0.3 (Public Place)
Public building		5	0.3 (Public Place)
Medical intuition		5	0.5
Doctor office			1.2
Sport		7	

P-ROSC: Prehospital Return of Spontaneous Circulation, UB-ROSC: Utstein-Based Return of Spontaneous Circulation, RACA: Return of Spontaneous Circulation after Cardiac Arrest, PEA: Pulseless electrical activity, CPR: cardiopulmonary resuscitation, EMS: emergency medical services.

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