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External validation of the simple NULL-PLEASE clinical score in predicting outcome of out-of-hospital cardiac arrest

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Running title: NULL-PLEASE predicts out-of-hospital cardiac arrest outcome

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CLINICAL SIGNIFICANCE

- A 'futility' score(NULL-PLEASE) incorporating adverse resuscitation features(Non-shockable rhythm, Unwitnessed arrest, Long no-flow or Long low-flow period, blood pH<7.2, Lactate>7.0 mmol/l, End-stage chronic kidney disease, Age≥85 years, Still resuscitation and Extra-cardiac cause) may help identify out-of-hospital cardiac arrest (OHCA) patients unlikely to survive.
- This validation study shows the NULL-PLEASE score had a predictive ability for early in-hospital outcome of OHCA. A high probability of fatality was evident with score of ≥5.

Abstract

Background: Rapid clinical decision-making on further management of patients with out-of-hospital cardiac arrest may be challenging. Recently, a 'futility' score (NULL-PLEASE) incorporating multiple adverse resuscitation features (Non-shockable rhythm, Unwitnessed arrest, Long no-flow or Long low-flow period, blood pH <7.2, Lactate >7.0 mmol/l, End-stage chronic kidney disease on dialysis, Age ≥85 years, Still resuscitation and Extra-cardiac cause) has been proposed to help identify out-of-hospital cardiac arrest patients unlikely to survive; however, external independent score validation is lacking.

Methods and Results: We retrospectively validated the NULL-PLEASE predictive ability for early in-hospital outcome of out-of-hospital cardiac arrest in a single-centre cohort of 547 consecutive out-of-hospital cardiac arrest patients admitted from April 2013 to October 2016 (mean age 66.3±13.2 years); 227 patients (41.5%) died. Since pH and Lactate were inconsistently measured, a modified NULL-PLEASE score excluding both variables was calculated as the principal analysis. A sensitivity analysis included the subgroup with pH data available (n=177).

Long low-flow period and age ≥85 years were independently associated with fatal outcome (both p<0.001). Patients with a modified NULL-PLEASE score of ≥5 had a 3.3-fold greater risk of fatal outcome compared to score=0-4 (Odds Ratio 3.34; 95% Confidence Interval [CI], 2.29-4.89;

p<0.001); 77% of non-survivors had a score ≥5; NULL-PLEASE showed a modest predictive ability for fatal outcome (c-statistic 0.658; 95%CI, 0.613-0.704; p<0.001). Sensitivity analysis yielded similar results, with 88% of non-survivors having a score ≥5.

Conclusions: The NULL-PLEASE score was predictive for early in-hospital outcome of out-of-hospital cardiac arrest, with a 3.3-fold greater odds for fatal outcome at the score values of ≥5.

Key words: Out-of-hospital cardiac arrest; resuscitation; outcome; prediction; NULL-PLEASE score; in-hospital mortality.

Introduction

Out-of-hospital cardiac arrest annually occurs in 250.000-300.000 patients worldwide[1]. Despite some regional variations, all published out-of-hospital cardiac arrest survival rates are disappointingly low. In a large meta-analysis of 79 cohort studies with total of 142.740 out-of-hospital cardiac arrest patients, pooled survival rates to hospital admission and subsequent hospital discharge were 23.4% (95% Confidence Interval [CI], 20.7 to 26.1) and 7.6% (95% CI, 6.7 to 8.4), respectively[2], with no significant improvement over a 30-year period covered in the meta-analysis (from 1980 to 2008).

In well-organized pre-hospital systems, successful return of spontaneous circulation with cardiopulmonary resuscitation may be achieved in up to 50% of out-of-hospital cardiac arrest patients, but far smaller proportion survive to hospital discharge[3]. Most recent international guidelines for post-resuscitation care consistently emphasize the importance of an early use of invasive and interventional strategies in out-of-hospital cardiac arrest patients to improve their ultimate survival[4, 5], acknowledging however that clinical decision-making on the termination of resuscitation efforts or utilization of expensive, sometimes lengthy post-resuscitation care resources may be challenging.

The European Resuscitation Council and the European Society of Intensive Care Medicine offer a prognostication algorithm based on clinical examination, biomarkers, imaging and electrophysiological testing, which should be initiated 5 days post out-of-hospital cardiac arrest, or 72 hours after completing the targeted temperature management treatment[6]. Notwithstanding various ethical issues[7], there is a clear need for accurate prognostic assessment which would facilitate an earlier identification of out-of-hospital cardiac arrest patients who would clearly benefit from intensive advanced post-resuscitation care.

Several clinical scores have been reported to predict the outcome of out-of-hospital cardiac arrest at early stages[8-10], but no single prognostication tool has been recommended to guide decision-making regarding individual out-of-hospital cardiac arrest patients. Recently, a new simple 'futility' score (the NULL-PLEASE score) has been proposed to help identify patients unlikely to survive out-of-hospital cardiac arrest post admission to intensive care unit[11]. The

score includes several unfavourable arrest- or patient-related characteristics (that is, non-shockable rhythm, unwitnessed arrest, long no-flow or low-flow period, blood pH <7.2, lactate >7.0 mmol/l, end-stage chronic kidney disease on dialysis, age ≥85 years, still ongoing cardiopulmonary resuscitation and extra-cardiac cause of arrest). This simple score was originally validated in a small retrospective historical cohort of 56 consecutive patients admitted to intensive care unit post out-of-hospital cardiac arrest, but external independent validation was lacking for this score.

In the present study, we provide the first external independent validation of the predictive ability of the NULL-PLEASE score for early in-hospital fatal outcome of out-of-hospital cardiac arrest in a single-centre, contemporary cohort of 547 consecutive out-of-hospital cardiac arrest patients.

Methods

Patient selection

We retrospectively retrieved the electronic medical records of consecutive patients who were referred to the Resuscitation Unit of the Emergency Centre, Clinical Centre of Serbia due to an out-of-hospital cardiac arrest, in the time period from 1st April 2013 to 1st October 2016. These medical records include demographic data (i.e., age and gender), descriptive data on the circumstances of out-of-hospital cardiac arrest (i.e., witnessed status, bystander cardiopulmonary resuscitation before the emergency medical unit arrival, approximate duration of the basic life support and advanced life support before arrival to the Resuscitation Unit), data on the advanced life support in the Resuscitation Unit, diagnosis of the underlying condition presumably resulting in out-of-hospital cardiac arrest and the ultimate vital status – survivor or non-survivor of the out-of-hospital cardiac arrest. However, blood biochemistry data (pH, lactate) were inconsistently recorded in the Emergency Centre electronic database during the study period. The study was approved by the hospital Ethical Committee and has therefore

been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Study setting

In Belgrade and its closest suburb area (overall ≥2 million of citizens), out-of-hospital cardiac arrest is managed by mobile emergency units. Out-of-hospital resuscitation (including the basic life support and advanced life support measures) is delivered by the emergency teams which include one physician trained in emergency medicine, a nurse technician and a paramedic. Excluding patients who died before or within the first 5-10 minutes of the mobile emergency unit arrival, all other out-of-hospital cardiac arrest victims in whom at least a brief, transient successful return of spontaneous circulation has been established in the field are by default transported to the Resuscitation Unit of the Emergency Centre, Clinical Centre of Serbia, either under ongoing cardiopulmonary resuscitation or with established sustained return of spontaneous circulation; Clinical Centre of Serbia is the largest hospital in Serbia and a tertiary healthcare centre equipped for all measures of advanced cardiac life support. Whilst most of the out-of-hospital cardiac arrest cases in Belgrade are referred to the Resuscitation Unit of the Emergency Centre, Clinical Centre of Serbia, a small number of out-of-hospital cardiac arrest victims are referred to other city hospitals, when out-of-hospital cardiac arrest occurs in the close proximity of the hospital.

The Resuscitation Unit of the Emergency Centre establishes the vital status on admission, continues cardiopulmonary resuscitation/advanced life support of the referred patient as needed, and transfers patients with successful return of spontaneous circulation to the Coronary Care Unit, Intensive Care Unit, Surgery, or elsewhere as needed for further treatment. Although there is no formal time limit, out-of-hospital cardiac arrest patients rarely spend more than 3 hours in the Resuscitation Unit.

Study outcomes

The primary outcome of the study was death in the Resuscitation Unit or survival until transfer to other Emergency Centre departments. Patients were transferred as soon as the underlying

cause of out-of-hospital cardiac arrest has been established and a successful return of spontaneous circulation has been achieved.

The NULL-PLEASE score

As originally reported, the NULL-PLEASE score assigns 2 points each to the following initial arrest characteristics: **N**on-shockable rhythm, **U**nwitnessed arrest, **L**ong no-flow period (no bystander cardiopulmonary resuscitation prior to arrival of the emergency medical team), **L**ong low-flow period (>30 minutes cardiopulmonary resuscitation before return of spontaneous circulation), and 1 point each to the following patient characteristics: arterial **p**H <7.2, **L**actate >7.0 mmol/l, **E**nd-stage renal failure on dialysis, **A**ge ≥85 years, **S**till (ongoing) cardiopulmonary resuscitation and **E**xtra-cardiac (e.g., traumatic) cause of arrest.

Due to the inconsistent reporting of the blood biochemistry in the Emergency centre database, data on arterial blood pH were unavailable for 370 (67.6%) patients, whilst lactate values were missing in almost all patients due to technical issues. Hence, a modified NULL-PLEASE score excluding both variables was calculated as the principal analysis (that is, we tested the NULL-EASE score) and a sensitivity analysis performed on the subgroup of 177 patients (32.4%) with available arterial blood **p**H values (that is, we tested the NULL-PEASE score). In all patients, blood sampling was performed at arrival to the Resuscitation Unit of the Emergency Centre.

Statistical analysis

The study cohort and out-of-hospital cardiac arrest characteristics are described using descriptive statistics. Categorical variables were summarized as proportion (number and percentage), and continuous variables as mean value with standard deviation (SD) and/or median with interquartile range (IQR).

The associations of the modified NULL-PLEASE (i.e. NULL-EASE) score components with the primary study outcome were examined using univariate logistic regression analysis. Odds Ratios (OR) with 95% CI and P value were obtained individually for each of the score components and for the score as a whole. The predictive ability of the NULL-EASE score for the primary study outcome was tested using the area under the receiver-operating characteristics (ROC) curve

analysis and *c*-statistic as a measure of the area under the ROC curve. The *c*-statistic quantifies discriminant ability of the score (indicated by a *c*-statistic of ≥0.5), which is as better as the *c*-statistic value is closer to 1.

We also conducted a subgroup sensitivity analysis in out-of-hospital cardiac arrest patients with available arterial blood pH values in the identical way as the main analysis, using the NULL-PEASE score.

Statistical analyses were performed using SPSS 20.0 software package (SPSS Inc., Chicago, Illinois). Two-sided p values of <0.05 were considered statistically significant.

Results

Of 547 patients with out-of-hospital cardiac arrest who were referred to the Emergency Centre Reanimation Unit during the period from 1st April 2013 to 1st October 2016, 227 (41.5%) were non-survivors. The mean value of modified NULL-PLEASE score (i.e., NULL-EASE score), containing only clinical variables was 5.13±2.07 (range 0-11), and the median value was 5.0 (IQR 4.0-7.0).

Baseline characteristics

Baseline characteristics of the out-of-hospital cardiac arrest cohort and comparisons between survivors and non-survivors are shown in Table 1. In the whole cohort, mean and median age was 66.3±13.2 years (range 2-94) and 68.0 years (IQR 58-79), respectively. Non-survivors were significantly older than survivors (p=0.009). There were 231 (42.2%) female patients, with no significant sex differences between the groups.

Initial arrest characteristics

Compared to survivors, a long low-flow period was more frequent among non-survivors, with a higher prevalence of age ≥85 years (both p≤0.001), Table 1. There were no statistically significant differences in the proportion of non-shockable rhythm at presentation, unwitnessed arrest, long no-flow period, end-stage chronic kidney disease on dialysis and still ongoing cardiopulmonary resuscitation at admission between survivors and non-survivors (Table 1).

The mean NULL-EASE score was significantly lower in survivors of out-of-hospital cardiac arrest compared to non-survivors (Table 1). The proportion of survivors versus non-survivors per each NULL-EASE score category is shown in Figure 1. Of note, 77% of non-survivors had a NULL-EASE score ≥5.

Predictors of unfavourable outcome of out-of-hospital cardiac arrest

Age was significantly associated with fatal outcome of out-of-hospital cardiac arrest on univariate logistic regression analysis (Table 2). The odds for fatal outcome were higher in male

patients with out-of-hospital cardiac arrest in comparison to female patients, but the difference was not statistically significant.

Of the NULL-EASE score components, long low-flow period and age >85 years were significantly associated with fatal outcome (Table 2). The odds for fatal outcome were higher in patients presenting with non-shockable rhythm, but the difference was of borderline significance.

Predictive ability of the NULL-EASE score

The NULL-EASE score was significantly associated with fatal outcome of out-of-hospital cardiac arrest (OR 1.32; 95%CI, 1.21-1.45, p<0.001, Table 2) and showed a modest predictive ability for fatal outcome in patients presenting with out-of-hospital cardiac arrest (c-statistic 0.658; 95%CI, 0.613-0.704; p<0.001), Figure 2A. Patients with a NULL-EASE score of ≥5 (present in 77.1% of non-survivors) had a 3.3-fold greater risk of fatal outcome before being transferred from the Reanimation Unit to another Emergency Centre department (OR 3.34; 95%CI, 2.29-4.89; p<0.001), Table 2.

Subgroup analysis in out-of-hospital cardiac arrest patients with available blood PH value (the NULL-PEASE score)

We performed the same analyses in out-of-hospital cardiac arrest patients with available blood PH values (n=177), testing the modified NULL-PLEASE score with arterial blood **p**H, but without **L**actate values (i.e., the NULL-PEASE score). Compared to patients with unavailable arterial blood PH value, those with known blood PH more frequently survived and less often had a long low-flow period (both p<0.001), but were older and more commonly had end-stage chronic kidney disease on dialysis (Web-only Supplementary Table w1). The mean NULL-EASE score was significantly higher in patients with unavailable blood pH value (p=0.012).

Within this subgroup (Web-only Supplementary Table w2), non-survivors more commonly had long low-flow period (p<0.001) and the mean NULL-PEASE score was higher when compared to survivors (both p<0.05). Of the NULL-PEASE score components, only long low-flow period was significantly associated with fatal outcome of out-of-hospital cardiac arrest (Web-only Supplementary Table w3).

The NULL-PEASE score was significantly associated with fatal outcome of out-of-hospital cardiac arrest (OR 1.21; 95%CI, 1.00-1.45; p=0.046) and showed a modest predictive ability for fatal outcome in patients presenting with out-of-hospital cardiac arrest (c-statistic 0.632; 95%CI, 0.523-0.741; p=0.035), Figure 2B. Patients with a NULL-PEASE score of ≥5 (present in 88% of non-survivors) had a 5-fold greater risk of fatal outcome (OR 5.06; 95%CI, 1.45-4.89; p=0.011) (Web-only Supplementary Table w3).

Discussion

In the present study we provide the first independent external validation of the NULL-PLEASE futility score for the prediction of early in-hospital fatal outcome of out-of-hospital cardiac arrest in relatively large, contemporary cohort of consecutive out-of-hospital cardiac arrest patients. We show that the modified NULL-PLEASE score was significantly associated with fatal outcome of out-of-hospital cardiac arrest in the first hours post referral to a tertiary healthcare facility; out-of-hospital cardiac arrest patients with a modified NULL-PLEASE score ≥5 either without (NULL-EASE) or with (NULL-PEASE) addition of the pH criterion had a 3.3-fold and 5.0-fold greater odds for a fatal outcome, respectively, in comparison to those with the respective score values of 0-4. Also, both showed a similar modest predictive ability for the early fatal outcome of out-of-hospital cardiac arrest (c-statistics 0.658 (95%CI, 0.613-0.704; p<0.001) and 0.632 (95%CI, 0.523-0.741; p=0.035), respectively).

Compared to the original NULL-PLEASE report[11], the present study has a much larger study cohort (i.e., n=56 vs. n=547 patients) but given the retrospective design, there was incomplete data on the blood pH and lactate values. In the original report[11], the out-of-hospital cardiac arrest cohort was derived from patients already admitted to intensive care unit, whilst our study addressed the outcome of out-of-hospital cardiac arrest in patients referred to an emergency healthcare centre *before* admission to the most appropriate ward (that is, at an earlier stage of the patient pathway – where decision making on futility is perhaps more relevant). Also, we evaluated early in-hospital mortality (during the stay in the Resuscitation

Unit) and not mortality at hospital discharge. This may partly explain the much higher survival rate in our study in comparison to the original NULL-PLEASE score report (58.5% vs. 28.5%).

The large meta-analysis by Sasson et al[2] highlighted several important features associated with likelihood of survival from out-of-hospital cardiac arrest to hospital discharge. First, the meta-analysis confirmed the value of bystander cardiopulmonary resuscitation, the importance of shockable rhythm(s) and the key role of achieving return of spontaneous circulation in the field, before hospitalization. Second, the study revealed that the effect size of 5 key studied variables (that is, witnessed or unwitnessed arrest, bystander cardiopulmonary resuscitation, ventricular tachycardia or ventricular fibrillation vs. all other rhythms, asystole and pre-hospital successful return of spontaneous circulation) on survival to hospital discharge in individual studies was strongly influenced by the out-of-hospital cardiac arrest care setting in respective study. Overall, 36% of all out-of-hospital cardiac arrest cases in that meta-analysis were unwitnessed, asystole was reported in 42% of out-of-hospital cardiac arrest cases, ventricular tachycardia or ventricular fibrillation was present in 40% of patients and return of spontaneous circulation was achieved in the field (that is, prior to hospital admission) in 22% of patients; pre-hospital achievement of return of spontaneous circulation was the most consistent and the strongest predictor of out-of-hospital cardiac arrest survival to hospital discharge[2].

Large proportions of out-of-hospital cardiac arrest patients with non-shockable rhythm, long no-flow or long low-flow period despite low percentage of unwitnessed out-of-hospital cardiac arrest in our study suggest a delay between the out-of-hospital cardiac arrest and notification of emergency care team, with low rates of bystander engagement (including bystander cardiopulmonary resuscitation), thus flagging-up the issues which must be improved. Nonetheless, the early in-hospital survival from out-of-hospital cardiac arrest (from admission to the Resuscitation Unit until transfer to other Emergency Centre departments) was 58.5% in our cohort. To what proportion this initial survival rate would translate into the ultimate out-of-hospital cardiac arrest survival at hospital discharge in our cohort requires further research with a prospective consecutive cohort, which is currently underway.

Several prediction methods have been previously described, including the APACHE II score[12] which has been originally developed as a general measure of disease severity and correlated well with mortality risk in patients admitted to intensive care unit due to trauma[13], septic shock[14] or post-transplantation[15], but this score performed only modestly in the prediction of the outcome of out-of-hospital cardiac arrest [8]. More recently, a more complicated tool for risk stratification after out-of-hospital cardiac arrest – the CAHP (Cardiac Arrest Hospital Prognosis) score - has been validated for the prediction of poor *neurologic*c outcome in out-of-hospital cardiac arrest patients admitted to an intensive care unit. The CAHP score included age, non-shockable rhythm, time from collapse to basic life support, time from basic life support to return of spontaneous circulation, location of cardiac arrest, epinephrine dose and arterial pH, and showed a good predictive capability in two validation cohorts (c-statistics 0.91 and 0.85)[9].

Nonetheless, early prognostication of patients experiencing out-of-hospital cardiac arrest still remains challenging, and no single risk assessment tool has been recommended for the prognostic classification of out-of-hospital cardiac arrest patients (especially one balancing simplicity and practicality). Accurate and rapid risk stratification of out-of-hospital cardiac arrest patients would facilitate clinical decision-making, allocation of resources and further clinical research.

A recent analysis of data from nearly 7000 out-of-hospital cardiac arrest patients (derived from two large registries - Paris, France and King County, Washington state, and a major multicenter randomized trial) identified out-of-hospital cardiac arrest not witnessed by emergency medical services personnel, non-shockable initial cardiac rhythm and no return of spontaneous circulation prior to administration of 3 mg of epinephrine to be significantly associated with increased risk of in-hospital death post out-of-hospital cardiac arrest. Indeed, meeting all three criteria essentially had a 100% specificity and positive predictive value for death prior to hospital discharge (of the 2800 out-of-hospital cardiac arrest patients who met all three criteria, only one survived)[16]. The early identification of out-of-hospital cardiac arrest patients with no chance of survival may also help in family decision regarding organ donation.

Limitations

Limitations of this observational, retrospective, single-centre study include possible selection bias and confounding by unknown or unmeasured variables. In addition, the study setting itself, with the inclusion of only patients who survived to transportation to the Resuscitation Unit of the Emergency Centre, may have created a selection bias toward out-of-hospital cardiac arrest patients with generally better prognosis. Due to incomplete data on blood biomarkers (i.e., blood PH and lactate) we used a modified NULL-PLEASE score not inclusive of these two parameters. Of note, a recent large retrospective study including 44.985 medical and 20.432 surgical acutely ill patients, which evaluated the ability of four different scores to predict in-hospital death within 24 hours from admission, showed that a score using only vital signs had better predictive ability in comparison to three scores based on laboratory data[17]. As discussed by other investigators[9], the estimation of resuscitation delays in clinical practice is often an approximation and may be inaccurate. Finally, we retrospectively evaluated a modified NULL-PLEASE score in a single-centre cohort of out-of-hospital cardiac arrest patients and our finding may not be applicable to other out-of-hospital cardiac arrest cohorts.

In conclusion, the NULL-PLEASE score had a modest predictive ability for early in-hospital outcome of out-of-hospital cardiac arrest, with a 3.3-fold greater odds for fatal outcome at the score values of ≥5 when compared to patients with a score of 0 to 4.

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All authors reported no conflict of interest.

Author contribution

T.S.P. – study design, data analysis/interpretation, drafting article, statistics; M.M. – data collection, data analysis, statistics, drafting article; S.S., T.J. and I.J. – data collection, data interpretation, critical revision of article; M.R.A. - data interpretation, critical revision of article;

R.A. - critical revision of article; G.Y.H.L. – study concept/design, data interpretation, critical revision of article. All authors approved the final manuscript.

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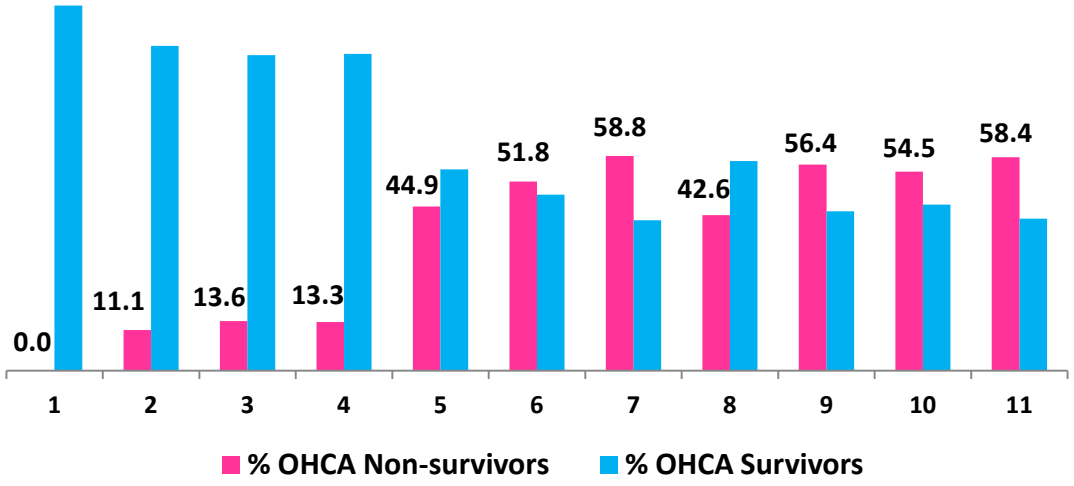
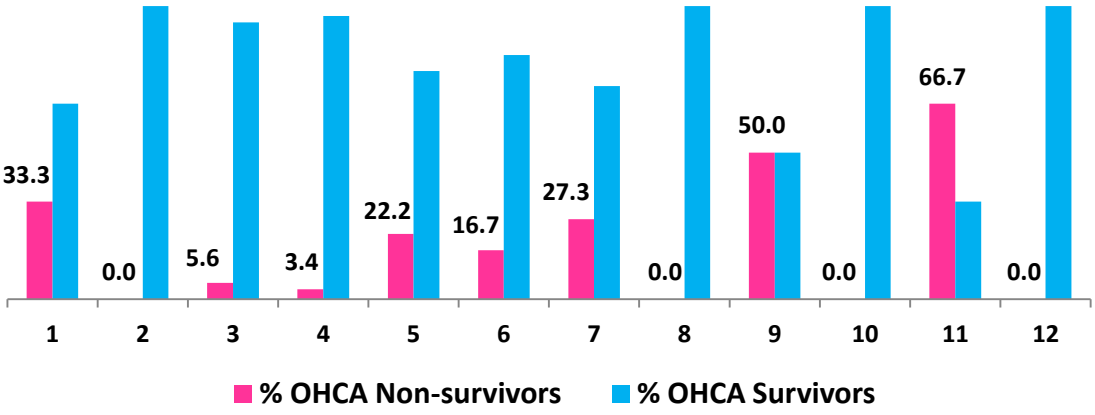
Figure 1. Proportion of out-of-hospital cardiac arrest survivors and non-survivors per each NULL-EASE score category (A); Proportion of out-of-hospital cardiac arrest survivors and non-survivors per each NULL-PEASE score category (B).

A.



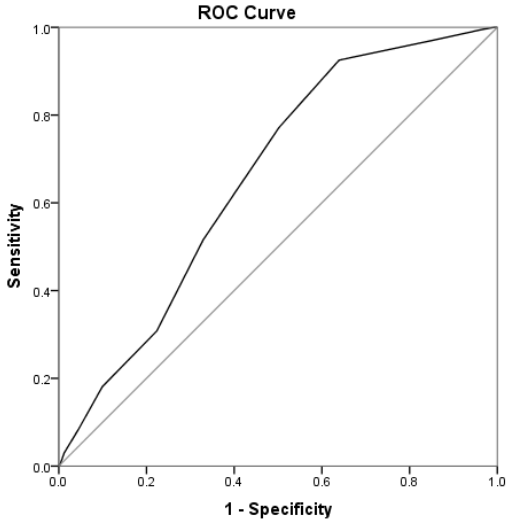
B.



OHCA: Out-of-hospital cardiac arrest.

Figure 2. Predictive ability of the NULL-EASE score for fatal outcome in patients presenting with out-of-hospital cardiac arrest (A). Predictive ability of the NULL-PEASE score for fatal outcome in patients presenting with out-of-hospital cardiac arrest (B).

A.



B.

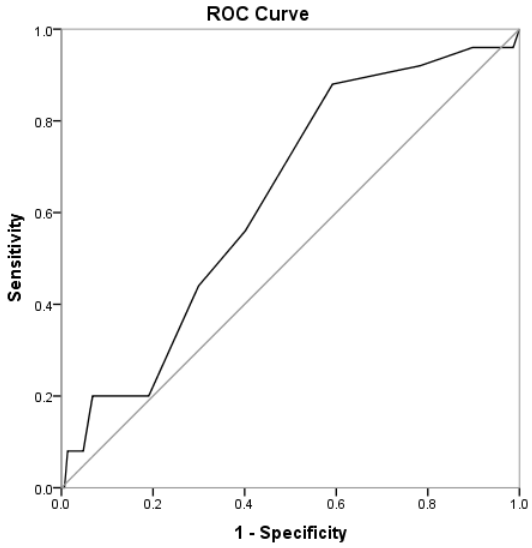


Table 1. Baseline characteristics of the out-of-hospital cardiac arrest cohort, including the modified NULL-PLEASE score components.

		All N=547	Survivors N=320 (58.5)	Non-survivors N=227 (41.5)	P
	Age, years (mean±SD))	66.3 ±16.2	64.8 ±16.5	68.4 ±15.5	0.009
	Age, years (median, IQR)	68.0 (58.0-79.0)	67.0 (54.0-78.0)	71.0 (61.0-81.0)	
	Male sex	316 (57.8)	175 (54.7)	141 (62.1)	0.095
N	**Non-shockable rhythm**	487 (89.0)	278 (86.9)	209 (92.1)	0.070
U	**Unwitnessed arrest**	81 (14.8)	41 (12.8)	40 (17.6)	0.142
L	**Long no-flow period**	249 (45.5)	149 (46.6)	100 (44.1)	0.601
L	**Long low-flow period**	342 (62.5)	135 (42.2)	207 (91.2)	<0.001
E	**End-stage chronic kidney disease on dialysis**	24 (4.4)	13 (4.1)	11 (4.8)	0.677
A	**Age >85 years**	48 (8.9)	17 (5.4)	31 (13.7)	0.001
S	**Still ongoing cardiopulmonary resuscitation**	152 (27.8)	91 (28.4)	61 (26.9)	0.700
E	**Extra-cardiac cause of arrest**	256 (46.8)	158 (49.4)	98 (43.2)	0.165
	The NULL-EASE score (mean)	5.13±2.07	4.66±2.12	5.78±1.81	<0.001
	The NULL-EASE score ≥5	332 (61.5)	157 (50.2)	175 (77.1)	<0.001

Values are presented as numbers with percentage, unless otherwise stated.

SD: Standard Deviation; IQR: Inter-quartile range.

Table 2. Univariate logistic regression analysis of the relationship between baseline characteristics and the NULL-EASE score components with fatal outcome of out-of-hospital cardiac arrest.

		OR	95% CI	p
	Age	1.01	1.00-1.03	0.011
	Male sex	1.36	0.96-1.92	0.083
N	**Non-shockable rhythm**	1.32	0.99-1.77	0.058
U	**Unwitnessed arrest**	1.27	0.95-1.53	0.120
L	**Long no-flow period**	0.95	0.80-1.13	0.561
L	**Long low-flow period**	3.77	2.92-4.86	<0.001
E	**End-stage chronic kidney disease**	1.20	0.53-2.74	0.660
A	**Age >85 years**	2.75	1.48-5.11	0.001
S	**Still ongoing cardiopulmonary resuscitation**	0.93	0.63-1.35	0.687
E	**Extra-cardiac cause of arrest**	0.78	0.55-1.10	0.152
	The NULL-EASE score (continuous)	1.32	1.21-1.45	<0.001
	The NULL-EASE score ≥5	3.34	2.29-4.89	<0.001

OR: Odds Ratio; CI: Confidence Interval.