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# One-year outcome of patients admitted after cardiac arrest compared to other causes of ICU admission. An ancillary analysis of the observational prospective and multicentric FROG-ICU study

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1 **One-year outcome of patients admitted after cardiac arrest compared to other causes of**  
2 **ICU admission. An ancillary analysis of the observational prospective and multicentric**  
3 **FROG-ICU study.**

4  
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7

8

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1 **Abstract**

2 **Objective.** While cardiac arrest (CA) patients discharged alive from intensive care unit (ICU)  
3 are considered to have good one-year survival but potential neurological impairment,  
4 comparisons with other ICU sub-populations non-admitted for CA purpose are still lacking.  
5 This study aimed to compare long-term outcome and health-related quality of life (HRQOL)  
6 between CA patients and patients admitted to ICU for all other causes.

7 **Methods.** In 1635 patients discharged alive from 21 European ICUs in an ancillary analysis of  
8 a prospective multicentric cohort, we compared CA causes of ICU admission to all other causes  
9 of ICU admissions (named non-CAs). The primary endpoint was one-year survival rate after  
10 ICU discharge. Secondary endpoints included HRQOL at 3, 6 and 12 months after ICU  
11 discharge using the outcome survey short form-36 (SF36). Propensity score matching was used  
12 to consider the probability of having CA.

13 **Results.** Of the 1635 patients, 1561 were included in this study comprised of 1447 non-CAs  
14 and 114 CAs. At one-year in the non-matched population, survival rate was greater in the CA  
15 group 89% *versus* the non-CA group 78% (log rank  $p=0.0056$ ). In the matched population, this  
16 difference persisted between CAs and non-CAs (log rank  $p=0.049$ ). The physical component  
17 summary of the SF36 scale was higher in the CA group than in the non-CA group at all time  
18 points in both non-matched and matched populations.

19 **Conclusions.** CA patients discharged alive from ICU have a better one-year survival and a  
20 better HRQOL specifically on physical functions than patients admitted to ICU for other causes.

21 **Trial registration:** ClinicalTrials.gov NCT01367093; registered on June 6, 2011.

22  
23

## 1 **Introduction**

2 The average survival rate of out-of-hospital cardiac arrest (OHCA) globally remains low, i.e.  
3 under 10%, while in-hospital CA (IHCA) survival rate reaches roughly 20%<sup>1-3</sup>. In both  
4 instances, when discharged alive from intensive care unit (ICU), evidence suggests that one-  
5 year mortality remains in the vicinity of 15%<sup>4-7</sup>. Previous comparisons with other populations  
6 have often been performed using healthcare system registries or populations which did not  
7 experience the burden of ICU stay<sup>4, 8</sup>. Major issues also remain on long-term functional  
8 outcomes in CA patients in whom literature is debatable. Furthermore, comparison of long-  
9 term outcome has only been performed between ICU CA patients and ward non-CA patients  
10 while the burden of ICU stay has never been considered<sup>9</sup>. As a result, no study to date has  
11 compared CA patients to non-CA patients hospitalized in the same ICUs with regard to long-  
12 term outcome.

13 Update of the Utstein resuscitation registry template for CA now emphasizes that assessment  
14 of outcomes at one year should consistently include health-related quality of life (HRQOL)  
15 parameters<sup>10</sup>. Indeed, while a majority of CA patients discharged alive from ICU have a good  
16 neurological outcome assessed on common scales (such as cerebral performance categories or  
17 modified Rankin scale), assessment of HRQOL, for which there is no specific scales for CA, is  
18 less well characterized. Depending on the HRQOL questionnaire used, certain studies have  
19 reported a return to pre-CA levels of functioning one year after CA<sup>5, 6, 8</sup>. By contrast, other  
20 studies underline that many patients also experience altered neurological functioning such as  
21 attention deficits and more anxiety and depression symptoms over a period of several years<sup>11</sup>.  
22<sup>12</sup>. In view of these confusing results, many physicians seemingly believe that CA patients  
23 discharged alive from ICU are likely or very likely to suffer severe cognitive or neurological  
24 impairments, which is far from evidence<sup>13</sup>.

1 A means to reconcile physician perceptions and evidence regarding CA outcomes would be to  
2 perform a comparison at ICU discharge of long-term survival rate and HRQOL between  
3 patients admitted to the same ICUs for CA and those admitted for all other causes including  
4 septic shock or respiratory failure. We hypothesized that one-year survival and HRQOL of  
5 patients hospitalized in ICU for a CA is likely to be at least similar to outcome of patients  
6 admitted for non-CA purposes.

7

## 1 **Methods**

### 2 *Study design*

3 This study is an ancillary analysis from the French and euROpean Outcome reGistry in Intensive  
4 Care Units (FROG-ICU) cohort. The original study was a prospective, observational,  
5 multicenter cohort study of 2087 patients and was designed to assess the long-term survival  
6 rates of patients admitted to ICU. The study was approved by the local ethics committees  
7 (Comité de Protection des Personnes, Ile de France IV, IRB n°00003835 and Commission  
8 d'éthique biomédicale de l'hôpital de Louvain, IRB n° B403201213352) and registered on  
9 <https://clinicaltrials.gov/ct2/show/NCT01367093>. The methodology and results of the original  
10 study have previously been published <sup>14, 15</sup>.

### 11 *Participants and inclusion criteria in the original study*

12 The FROG-ICU study involved 21 medical, surgical or mixed ICUs. All consecutive patients  
13 admitted to ICU were screened for eligibility. Inclusion criteria were mechanical ventilation  
14 and/or administration of at least one vasoactive agent (except dopamine) for more than 24  
15 hours. Exclusion criteria were at admission age <18 years old, severe head injury, obvious brain  
16 death, pregnancy or breastfeeding, an organ transplantation occurring in the past 12 months,  
17 and lack of social security coverage <sup>15</sup>.

### 18 *Definition of the CA and non-CA population*

19 CA patients correspond to patients for whom CA was the cause of ICU admission whether CA  
20 was out-of hospital or in-hospital. Non-CA patients correspond to all other causes of ICU  
21 admission.

### 22 *Inclusion Criteria*

23 All patients admitted to ICU with a diagnosis and subsequently discharged alive from ICU.

### 24 *Non-Inclusion Criteria*

25 Patients with no diagnosis at admission and lost of follow up were not included.

1 *Goals*

2 The primary endpoint was to assess in patients discharged alive from ICU the survival rate at  
3 one-year after ICU discharge while secondary endpoints included the HRQOL, the hospital  
4 anxiety and depression scale (HADS) and the revised impact of event scale (IES-R) assessed at  
5 3, 6 and 12 months after ICU discharge.

6 *Data collection*

7 Data regarding CA patients at ICU discharge were retrospectively collected from medical  
8 reports according to Utstein-style guidelines <sup>10</sup>. Briefly, these recommendations provide to  
9 researchers a structured framework to uniformly report CA.

10 Details regarding general data collection at ICU discharge have been reported in the original  
11 study <sup>15</sup>. Causes of ICU admission were also recorded and classified in 19 categories. Beside  
12 CA, most prevalent causes of ICU admission were individualized: respiratory failure, septic  
13 shock, neurological causes, cardiogenic shock, immediate post-operative room (urgent or  
14 scheduled surgery). The remaining 13 causes were coded as “other causes of ICU admission”.

15 The time point of baseline characteristics was defined at ICU discharge.

16 Health-related quality of life parameters.

17 Briefly, from ICU discharge, patients were contacted by phone-calls at 3, 6 and 12 months in  
18 order to collect, among other things, the vital status, potential re-admission for any cause and  
19 cardiovascular treatments prescribed. Quality-of-life questionnaires were sent 15 days before  
20 each phone-call. Interviewer ensured that questionnaires were received by the patient itself. As  
21 they were self-reported questionnaires, patients had to send back the completed questionnaires  
22 in dedicated pre-addressed envelopes. Relative were not allowed to complete these  
23 questionnaires.

24 *The French version of the medical outcome survey short form-36 (SF-36)*. Briefly, SF-36 is a  
25 measurement of mental and physical health status independently of the underlying disease. The



1 score is constructed with 36 items divided into 8 scales. The mental health component summary  
2 (MCS) score includes the following items: mental health, vitality, role limitations related to  
3 emotional distress and social function. The physical health component summary (PCS) score  
4 includes the following items: physical function, bodily pain, general health, and role limitations  
5 due to impaired physical function <sup>16</sup>. High scores are indicative of a good mental and physical  
6 health status.

7 *The French version of revised impact of event scale (IES-R)*. The IES-R is a symptomatic scale  
8 encompassing three main symptom clusters: intrusion, avoidance and hyperarousability. These  
9 clusters assess the symptoms of post-traumatic stress disorder (PTSD) induced by the ICU stay.  
10 Based on literature findings, a threshold at 33 was chosen for the probability of having PTSD  
11 <sup>17, 18</sup>.

12 *The French version of hospital anxiety and depression scale (HADS)*. HADS is a validated  
13 scale for screening emotional distress. It assesses anxiety and depression. This score includes  
14 seven questions for anxiety and seven questions for depression. Based on literature findings, a  
15 threshold of 8 points for each dimension was chosen in this study to indicate probable anxiety  
16 and depression <sup>18-20</sup>.

### 17 *Statistical analyses*

18 Data are expressed as median [interquartile range, IQR] or number (%) as appropriate. After  
19 visual assumption of normality and variance homogeneity by the F-test, Student's, Welch or  
20 Wilcoxon rank tests were applied for univariate analysis as appropriate. In order to balance  
21 CA with non-CA populations at ICU discharge, an analysis derived from the propensity score  
22 was performed. Propensity score is used in observational studies to estimate the effect of an  
23 intervention by creating a pseudo-randomization in order to reduce selection bias. With the  
24 matching propensity score method chosen, we expected a very good matching at the cost of  
25 a strong reduction in final populations. In the propensity score model herein, exposure was,

1 in a population of patients discharged alive from ICU, CA as cause of initial admission.  
2 Model variables included in the propensity score were variables associated with one-year  
3 outcome at 0.05 level and with less than 20% of missing data <sup>15</sup>. These variables, included  
4 according to both the biological plausibility and the statistical analysis, were already  
5 validated and published in the original study<sup>15</sup>: age, Charlson score, prior severe valvular  
6 disease, prior severe artery disease, chronic renal disease, recent active malignant tumor,  
7 prior physical or mental disabilities, red blood pack transfusion during ICU stay and length  
8 of stay. The following variables at ICU discharge were also included: systolic arterial  
9 pressure, temperature, platelets, white blood count, and total protein. CA and non-CA  
10 patients were matched using a 1:1 nearest neighbor matching algorithm with no replacement,  
11 along with a caliper of 0.1 of the standard deviation of the propensity score. Imbalance  
12 between the two groups before and after propensity score matching was assessed using a  
13 standardized difference, with a value < 10% considered as acceptable for defining the study  
14 patients' characteristics as being balanced with respect to the previously described features.  
15 Thereafter, one-year survival and HRQOL parameters were assessed in the matched dataset.  
16 A Holm post-hoc test was applied for multiple comparisons. Kaplan-Meier curves were  
17 drawn and overall one-year survival was estimated by using the log-rank test in non-matched  
18 and matched CA and non-CA populations. Secondary, a multivariate analysis using a logistic  
19 regression model including the variables described above was also performed to assess if CA  
20 was independently associated with one-year mortality. For each continuous variable in the  
21 multivariate analysis, the linearity assumption was tested. If there was no linear relationship  
22 a log and square transformation was tested. If the linearity assumption was still not suitable,  
23 the variable was broken considering the biological plausibility.  
24 Hazard ratios (HR) and odds ratios (OR) with their respective 95% confidence intervals (CI)  
25 were also calculated.

1 Lastly, analyses were performed to assess i) the association between CA and one-year mortality  
2 according to the aforementioned variables plus two cardiac biomarkers (hs troponin I and N-  
3 terminal pro-type B natriuretic peptide) and ii) the association between CA and one-year  
4 mortality according to other most prevalent causes. For secondary analyses, the above-  
5 mentioned continuous variables were divided on their medians. OR and their 95% CIs were  
6 also calculated. No imputation analysis has been performed on missing data. All tests were two-  
7 sided and a  $p$  value  $< 0.05$  was considered statistically significant. All analyses were performed  
8 using R 3.51 statistical software (The R Foundation for Statistical Computing, Vienna, Austria).

## 1 **Result**

### 2 *Patients*

3 Of the 2087 patients included in the FROG-ICU study, 1635 patients were discharged alive  
4 from ICU. Of the latter, 1561 were included in the present study population comprised of 114  
5 (7%) CA patients and 1447 (93%) non-CA patients discharged alive from ICU (**Figure 1**).  
6 Details about the 74 patients excluded due to lack of data are provided in **eTable 1**.

### 7 *Characteristics of the non-matched and matched cohort at ICU discharge.*

8 The general characteristics at ICU discharge according to CA diagnosis prior to propensity-  
9 score matching are presented in **Table 1**. Briefly, in the non-matched population, the CA group,  
10 compared to the non-CA group, had a lower Charlson score (0.0 [0.0 - 1.0] vs. 1 [0.0-2.0],  
11  $p < 0.0001$ ) and less recent active malignant tumors (1% vs. 13%,  $p = 0.0001$ ). Less transfusion  
12 of blood products was observed in the CA group compared to the non-CA group: red blood  
13 concentrate, 27% vs. 44% respectively ( $p = 0.0004$ ) and platelet concentrate, 5% vs. 16%  
14 respectively ( $p = 0.003$ ). At ICU discharge, hemoglobin, sodium, protein and creatinine levels  
15 were higher in the CA group compared to the non-CA group (hemoglobin: 10.5 [9.7 - 11.5]  
16 g/dL vs. 10.0 [8.9 - 11.1] g/dL,  $p = 0.002$ ; sodium: 141 [138 - 143] mmol/L vs. 139 [136 - 142]  
17 mmol/L,  $p = 0.003$ ; protein: 64 [58 - 69] g/L vs. 62 [56 - 69] g/L  $p = 0.018$ ; creatinine: 74 [60 -  
18 94] mmol/L vs. 66 [50 - 96] mmol/L  $p = 0.011$ ). **eTable 2** described in detail characteristics and  
19 management of CA patients. Briefly, 73% of patients in the CA group experienced OHCA,  
20 78% of whom were cerebral performance category (CPC) 1 or 2, while 20% were CPC 3 and  
21 2% were CPC 4, all at ICU discharge.

### 22 *Comparison of one-year survival between CA and non-CA patients.*

23 Among the 1561 included patients, 1237 (79%) were alive at one year. In the non-matched  
24 population, one-year survival was 89% in the CA group and 78% in the non-CA group (log  
25 rank  $p = 0.0056$ ) (**Figure 2, panel A**). Propensity score-matching allowed creating 68 pairs of

1 ICU patients. Standardized differences in percent, before and after matching, on the predefined  
2 characteristics are presented in **Table 2** and in **eFigure 1**. In the matched population,  
3 differences in one-year survival between CA and non-CA observed in the non-matched  
4 population also persisted after matching (log rank  $p=0.049$ ) (**Figure 2, panel B**). In the  
5 multivariate analysis, CA discharged alive from ICU was also found as being an independent  
6 factor associated with one-year survival (**eFigure 2**)

7 *Health-related quality of life parameters.*

8 In the non-matched population but not in the matched population, MCS aggregate score was  
9 higher at 3 months in the CA group compared to the non-CA group ( $p=0.0006$  and  $p=0.06$   
10 respectively) (**Figure 3A** and **3B**). In the non-matched population, PCS aggregate scores of the  
11 SF-36 questionnaire was greater at all studied time points in the CA group compared to the  
12 non-CA group ( $p=0.0009$ ,  $0.002$  and  $0.002$  at 3, 6 and 12 months respectively) (**Figure 3C**) All  
13 of these differences also persisted in the matched population ( $p=0.033$ ,  $0.033$  and  $0.048$  at 3, 6  
14 and 12 months respectively) (**Figure 3D**). IES-R and HADS scores are described in **eTable 3**  
15 for non-matched and matched populations. At one-year post-ICU discharge, in the non-matched  
16 population, proportions of anxiety and depression symptoms ( $HADS \geq 8$  for both parameters)  
17 were respectively 38% and 34% in the non-CA group compared to 28% and 28% in the CA  
18 group ( $p=0.184$  and  $0.60$  respectively). Proportion of patients with PTSD (IES-R scale  $\geq 33$ ) at  
19 one year was 20% in the non-CA group compared to 6% in the CA group, ( $p=0.036$ ). In the  
20 matched population, no difference between groups was observed for these two scales at any  
21 time points.

22 *Subgroup analysis.*

23 Cardiac arrest was a protective factor with regard to one-year mortality compared to the most  
24 frequent causes of ICU admission except for neurological causes of admission (**Figure 4**).  
25 Association between CA and one-year mortality after ICU discharge according to comorbidities

1 as well as clinical and biological parameters are depicted in **eFigure 3 and eFigure 4** showing  
2 a persistent protective effect of CA versus non-CA for the majority of the analyzed subgroups.  
3

## 1 **Discussion**

2 In this ancillary study of FROG-ICU which enrolled a large population of ICU patients alive at  
3 discharge from ICU, a better long-term survival and physical health status in CA patients  
4 compared with those admitted for any other cause were observed in patients with similar  
5 severity. Conversely, mental health status remained similar between CA and non-CA groups.

6 Our study shows that, in the FROG-ICU cohort, survival within the year following ICU  
7 discharge was consistently greater in CA than non-CA patients. Long-term post-ICU mortality  
8 rate in CA or non-CA patients were previously studied in separate cohorts and showed a greater  
9 mortality rate in non-CA than in CA patients <sup>5-7, 21-24</sup>. However, one major bias in interpreting  
10 differences in post-ICU outcome between non-CA and CA patients may be related to  
11 differences in baseline characteristics among studied cohorts. In one study which included only  
12 myocardial infarction patients, post-discharge mortality of the few patients with CA was similar  
13 to that of non-CA myocardial infarction patients <sup>9</sup>. To the best of our knowledge, there is no  
14 published study comparing long-term mortality between CA and non-CA patients hospitalized  
15 in the same ICUs. In the present study, survival benefit in the CA group might be explained at  
16 first glance by fewer co-morbidities and lower occurrence of ICU complications. However,  
17 adjustments on the many confounding factors maintained the observed survival benefit in CA  
18 patients. Explanations for this benefit are not straightforward. It can only be assumed that, in  
19 survivors, CA is a rapid and fully reversible hemodynamic condition, with little long-term  
20 consequences on organ functions, except for brain function. Conversely, non-CA causes of ICU  
21 admission, including septic shock, most often occurs on a background of severe pre-existing  
22 comorbidities and are associated with persistent long-term organ dysfunction at ICU discharge  
23 <sup>25, 26</sup>. For instance, our team previously demonstrated the persistence of long-lasting immune  
24 illness disorders one year after ICU discharge in patients admitted with septic shock <sup>27</sup>.

1 Altogether, in this FROG-ICU cohort, CA demonstrated a post-ICU survival benefit compared  
2 to non-CA patients.

3 Interestingly, this survival gain in CA patients was accompanied by HRQOL benefits. Our  
4 population of non-CA patients presented HRQOL scores in the year following ICU discharge  
5 in the range of what has already been published<sup>28</sup>. With regard to CA survivors, a recent review  
6 highlighted the absence of a specific measure of HRQOL and that SF-36 represented a reliable  
7 scale<sup>29</sup>. However, using the SF-36, our CA population had a similar HRQOL to those  
8 previously reported in CA patients<sup>6, 11, 30, 31</sup>. No comparison of HRQOL has been published to  
9 date between CA and non-CA patients discharged from ICU. Furthermore, our study shows  
10 that physical capacities are consistently better in CA compared to non-CA patients for all  
11 studied time points. Conversely, the burden of ICU stay on mental health status at one-year post  
12 ICU discharge was found to be similarly altered in both CA and non-CA patients. Lastly, one  
13 lingering issue could be the effectiveness of specific follow-up after ICU discharge in  
14 improving HRQOL. Preliminary data have demonstrated that in CA survivors, long-term  
15 HRQOL may be improved by managing emotional and psychological distress induced by CA  
16<sup>32</sup>.

### 17 *Limitations*

18 Several limitations of this study should be acknowledged. First, the design of our study prevents  
19 any firm conclusion with regard to causality between CA and non-CA on outcomes, even  
20 though this association persisted after adjustment by using propensity score-matching. While  
21 propensity score-matching appears to be a powerful solution to balance both fundamentally  
22 different populations, this score is not primarily intended to be used for this purpose. Indeed,  
23 the variable of exposure was CA at admission but, as we aimed to assess the survival rate at  
24 one-year, only in patient discharged alive from ICU, the variables used in matching were post-  
25 exposure, *i.e.* at discharge. It is also likely that propensity score-matching might have missed



1 some important parameters. However, parameters included in the propensity score were factors  
2 associated to one-year survival, validated in the multivariate analysis of the original study <sup>15</sup>.  
3 Third, regarding the considerable differences in population sizes and in baseline characteristics  
4 between CA and non-CA populations, propensity score deeply reduced the sample size in the  
5 matched population confirming its matching capacities. Thus, for the survival analysis, a  
6 significant difference was observed on the log rank test although the HR confidence interval  
7 slightly crossed 1. To strengthen survival analysis results obtained from the propensity score-  
8 matching, a multivariate analysis including the whole population was also undertaken and  
9 found a similar result, *i.e.* CA is an independent factor associated with one-year survival.  
10 Fourth, this study only looked at the long-term outcome of patients discharged alive from ICU  
11 and our results could not be generalized to the pre-discharge period. Fifth, roughly only 1/3 of  
12 non-CAs and only 2/3 of CAs provided quality-of-life data. Even considering the number of  
13 deaths during the one-year follow-up, these missing data could be an important source of bias.  
14 Finally, we included both IHCA and OHCA. IHCA usually has a better prognosis, and thus the  
15 inclusion of IHCA would have biased the analysis towards a "healthier" CA group <sup>33</sup>.

## 16 **Conclusions**

17 This study shows that, in patients discharged alive from ICU, CA patients had better one-year  
18 survival and better quality of life compared to non-CA patients. This work highlights that  
19 despite the burden of ICU stay, in patients discharged alive from ICU, the long-term outcome  
20 after a CA remains the most favorable among all main causes of ICU admission.

21

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2 *Authors' contributions.* AK, AM, EG, ND: study concept and design. AM, EG: Data  
3 acquisition. AC, AK, AM, BM, EF, EG, ND: Analysis and interpretation of the data. AK, ND:  
4 Drafting of the manuscript. Critical revision of the manuscript: all declared authors. AK, EF,  
5 EG: Statistical analysis. EG, AM: Administrative, technical, or material support. EG, AM:  
6 Study supervision. All authors read and approved the final manuscript.

7 *Availability of supporting data.* EG and AM had full access to all data in the study and take  
8 responsibility for the integrity of the data and the accuracy of the data analysis.

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20

21

1 **Figure Legends**

2 Figure 1: Flow chart. \* Proportion of non-CA excluded patients was similar to CA excluded  
3 patients ( $p=1$ ).

4 ICU: Intensive care unit.

5 Figure 2: Survival curve from intensive care unit discharge to 1-year post-discharge in non-  
6 cardiac arrest and cardiac arrest patients in the non-matched (Panel A) and matched (Panel B)  
7 population.

8 Figure 3: SF-36 (MCS and PCS) in the non-matched and matched populations at 3, 6 and 12  
9 months in cardiac arrest and non-cardiac arrest patients. Panel A: MCS non-matched; Panel  
10 B: MCS matched; Panel C: MCS non-matched; Panel D: MCS matched. \*:  $p \leq 0.05$

11 MCS: Mental component summary, PCS: Physical component summary.

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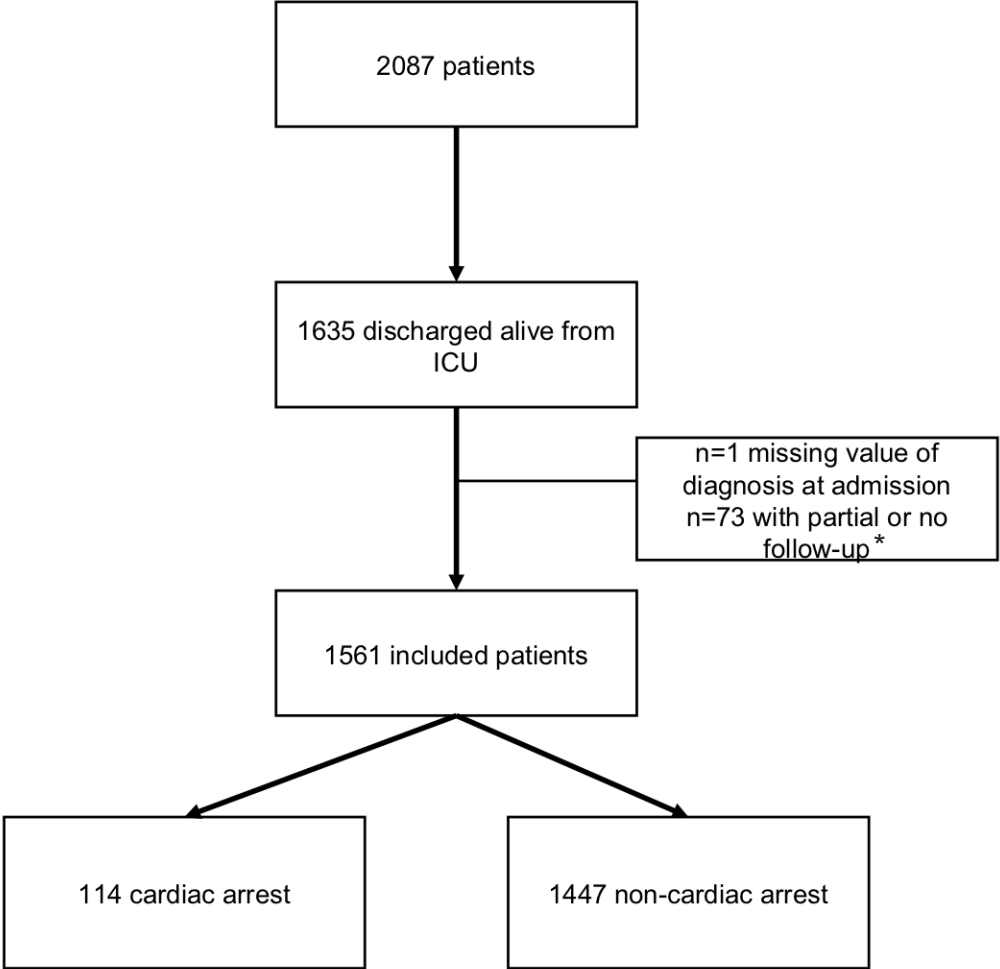
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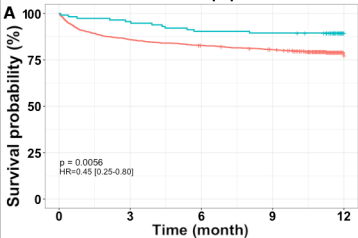
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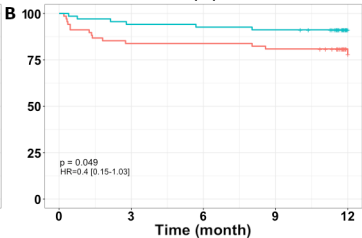




**Non-matched population**

Number at risk

—	1447	1242	1196	1159	408
—	114	109	103	102	40

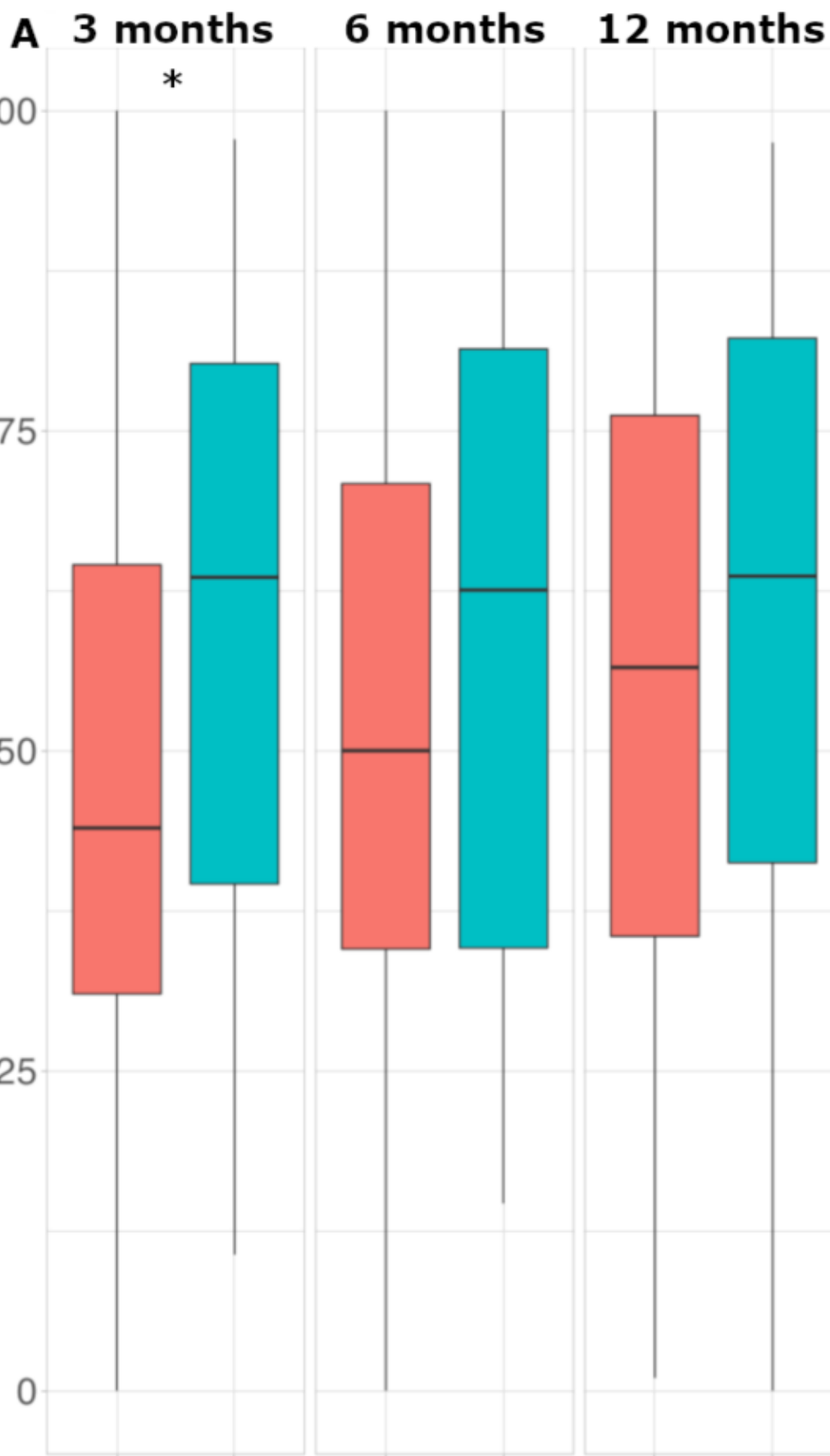
**Matched population**

Number at risk

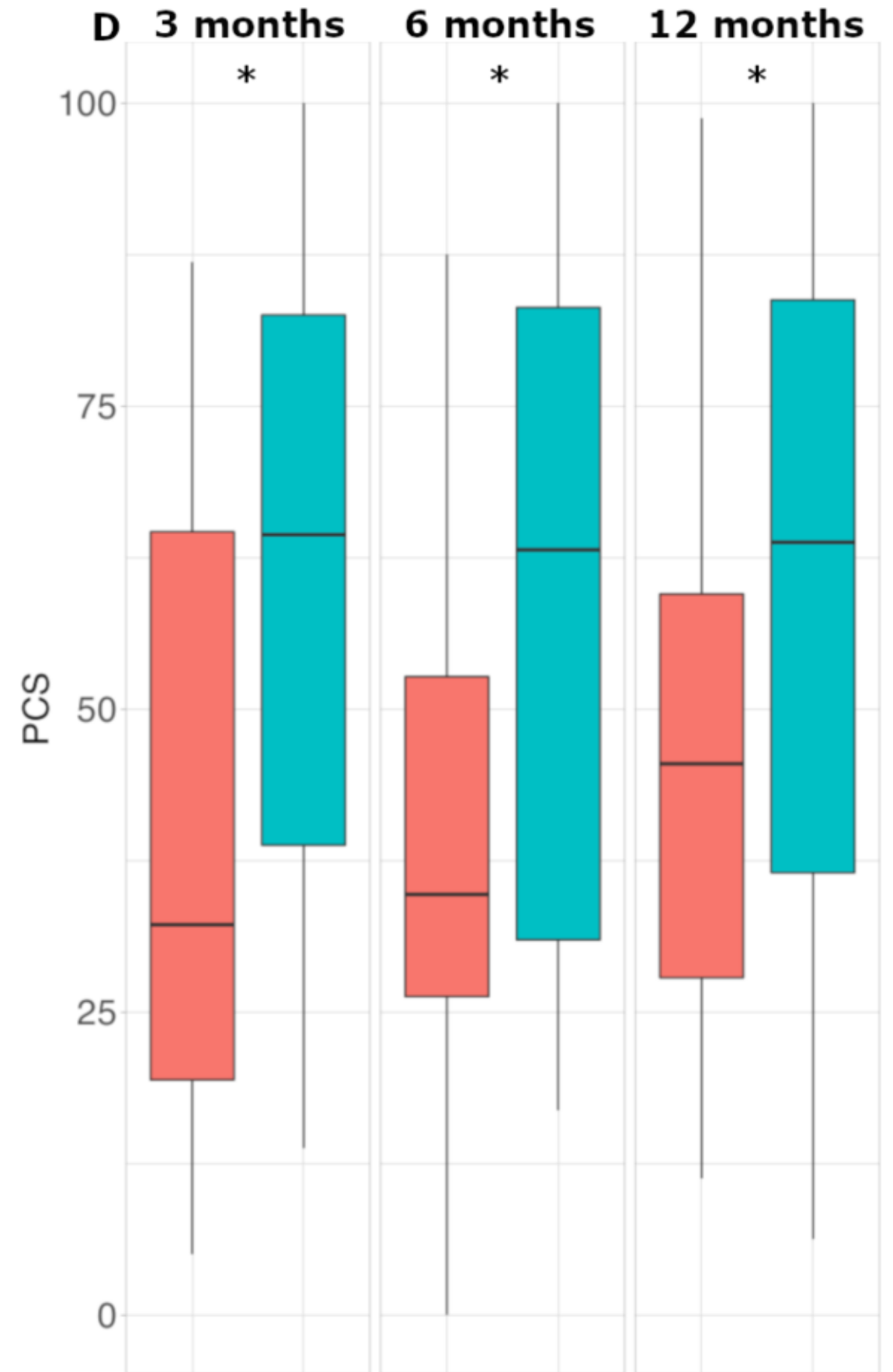
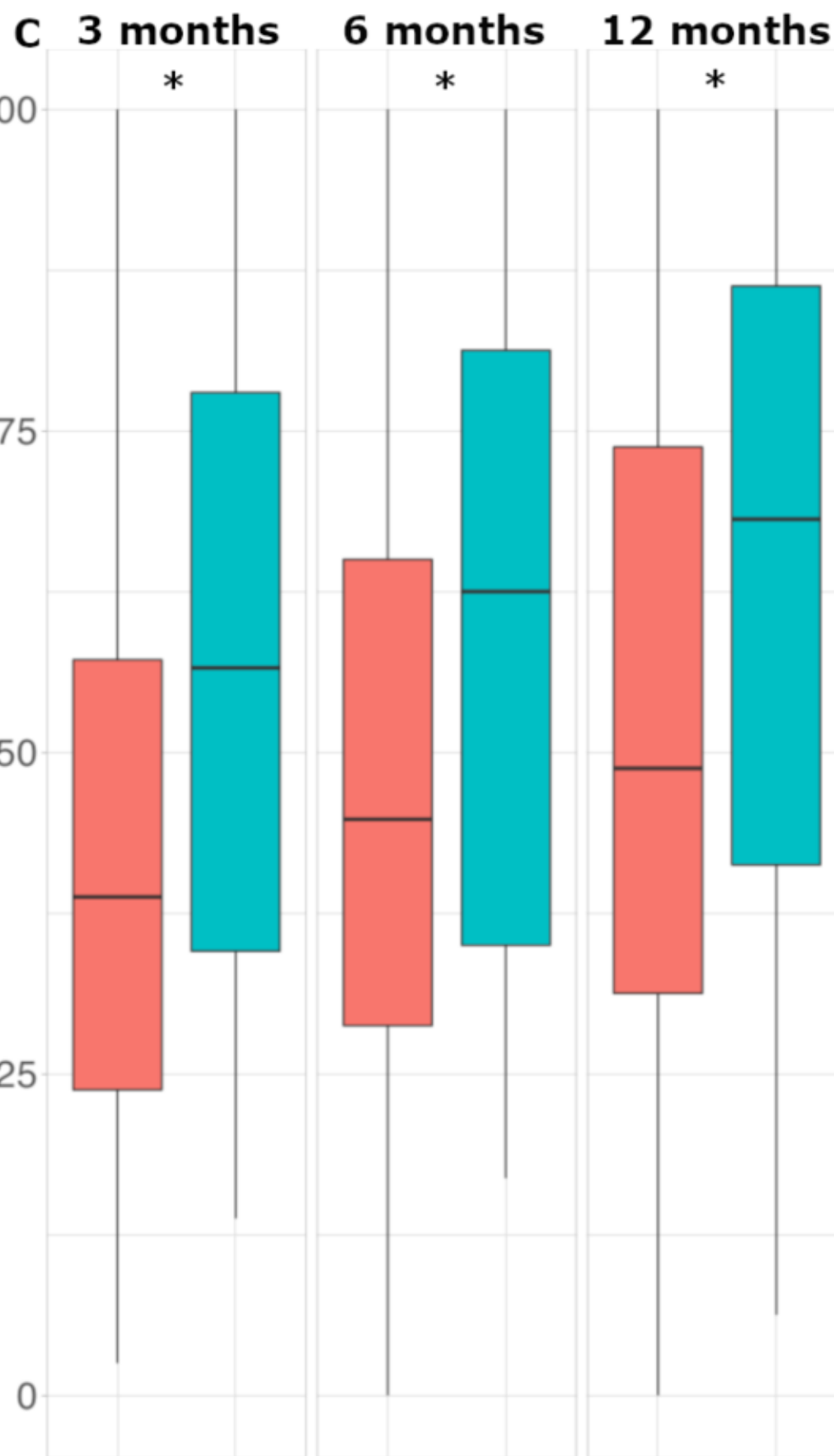
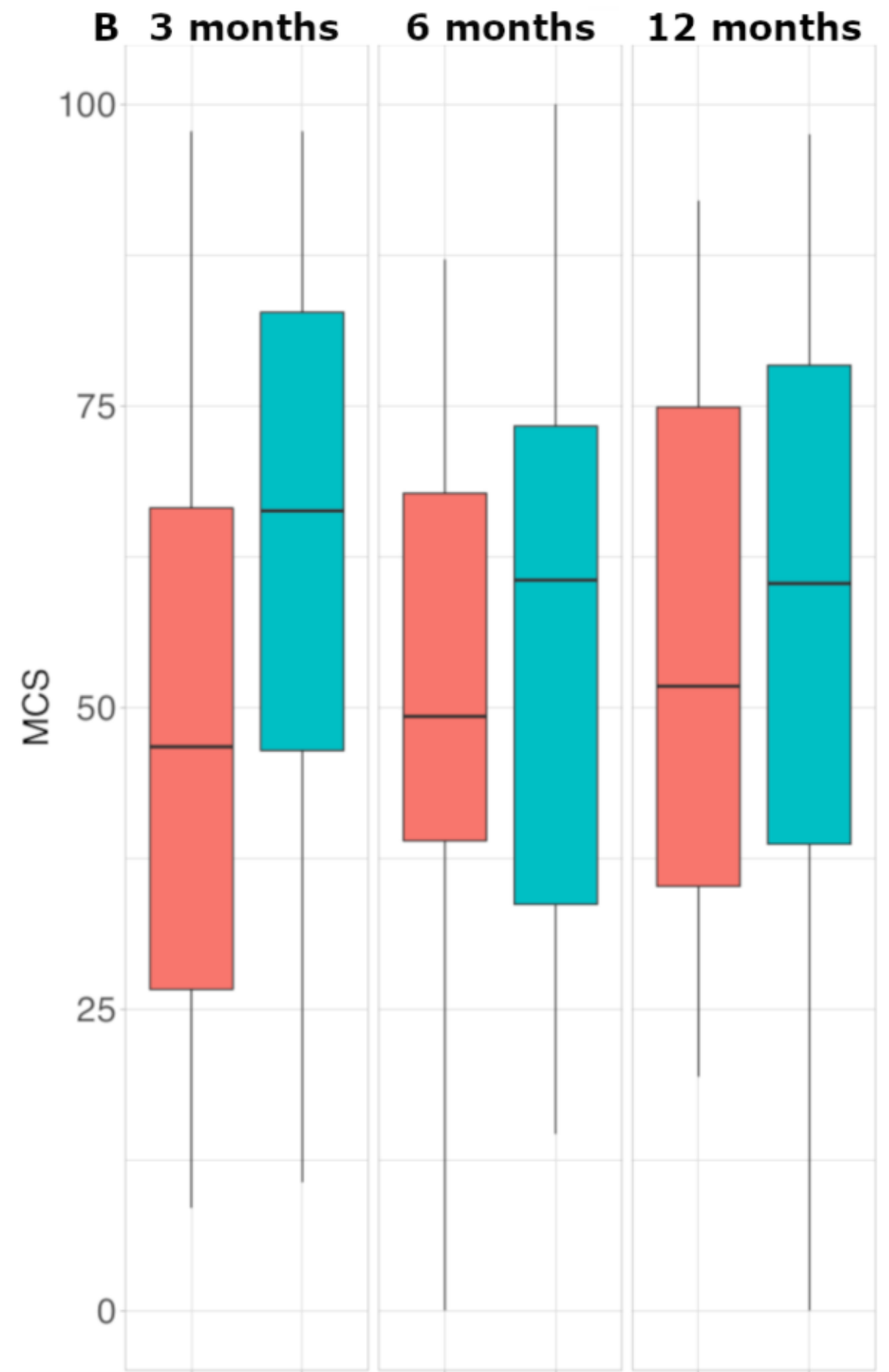
—	68	57	57	55	27
—	68	64	63	62	30

— Non-cardiac arrest — Cardiac arrest

### Non-matched population

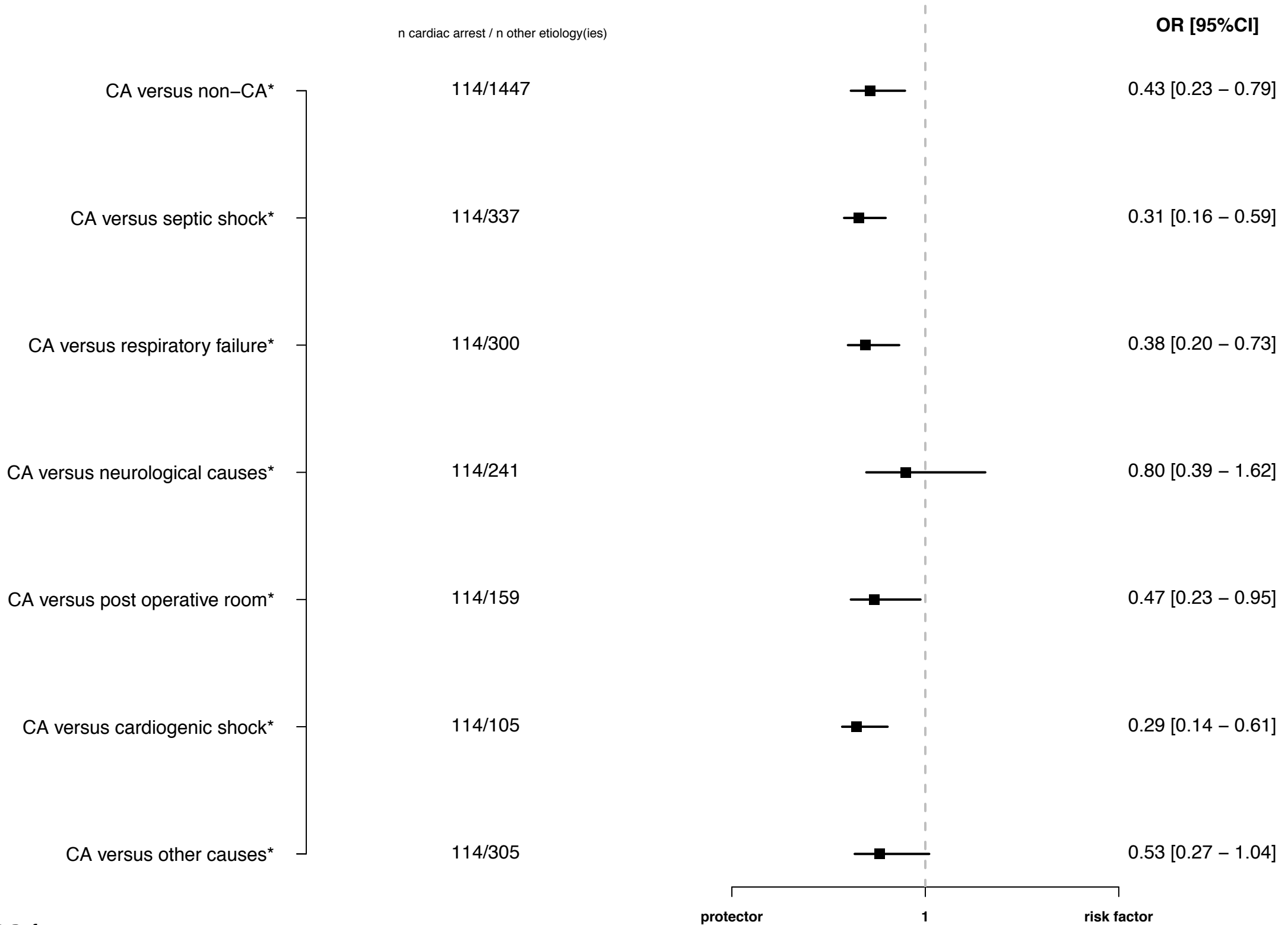


### Matched population



Non-cardiac arrest Cardiac arrest

# One-year mortality



\*: Reference group

Table 1: Characteristics of the non-matched populations at ICU discharge.

Variables	n available	Global population (n=1561) n (%) or median [IQR]	n available	Non-cardiac arrest (n=1447) n (%) or median [IQR]	n available	Cardiac arrest (n=114) n (%) or median [IQR]	p
<b>Demographic data</b>							
Age (year)	1561	61 [49 - 73]	1447	61 [48 - 73]	114	61 [50 - 72]	0.72
Women	1561	567 (36 %)	1447	530 (36.6 %)	114	37 (32.5 %)	0.37
Body mass index (kg/m <sup>2</sup> )	975	26 [23 - 31]	906	26 [23 - 31]	69	26 [24 - 30]	0.99
<b>Medical history</b>							
Charlson score	1561	1.0 [0.0 - 2.0]	1447	1.0 [0.0 - 2.0]	114	0.0 [0.0 - 1.0]	<0.0001
Severe valvular disease	1559	53 (3 %)	1445	48 (3 %)	114	5 (4 %)	0.59
Peripheral vascular disease	1559	139 (9 %)	1445	125 (9 %)	114	14 (12 %)	0.19
Prior stroke	1559	64 (4 %)	1445	55 (4 %)	114	9 (8 %)	0.046
Hypertension	1559	638 (41 %)	1445	601 (42 %)	114	37 (32 %)	0.056
Coronary artery disease	1559	123 (8 %)	1445	109 (8 %)	114	14 (12 %)	0.071
Chronic heart failure	1559	107 (7 %)	1445	95 (7 %)	114	12 (11 %)	0.11
Diabetes mellitus	1559	273 (18 %)	1445	262 (18 %)	114	11 (10 %)	0.022
Chronic obstructive pulmonary disease	1559	172 (11 %)	1445	165 (11 %)	114	7 (6 %)	0.083
Chronic renal disease	1559	164 (11 %)	1445	158 (11 %)	114	6 (5 %)	0.057
Recent active malignant tumors	1559	187 (12 %)	1445	186 (13 %)	114	1 (1 %)	0.0001
Prior physical or mental disability	1559	52 (3 %)	1445	50 (3 %)	114	2 (2 %)	0.58
<b>Causes of ICU admission</b>							
Cardiac arrest	1561	114 (7 %)			114	114 (100%)	
Septic shock	1561	337 (22 %)	1447	337 (23 %)			
Respiratory failure	1561	300 (19 %)	1447	300 (21 %)			
Neurological causes	1561	241 (15 %)	1447	241 (17 %)			
Post-operative	1561	159 (10 %)	1447	159 (11 %)			
Cardiogenic shock	1561	105 (7 %)	1447	105 (7 %)			
Others <sup>a</sup>	1561	305 (20 %)	1447	305 (21 %)			
<b>ICU events</b>							
Renal replacement therapy	1561	284 (18 %)	1447	268 (19 %)	114	16 (14 %)	0.23
Red blood concentrate administered	1561	670 (43 %)	1447	639 (44 %)	114	31 (27 %)	0.0004
Platelet concentrate administered	1561	234 (15 %)	1447	228 (16 %)	114	6 (5 %)	0.003
Tracheotomy	1561	240 (15 %)	1447	230 (16 %)	114	10 (9 %)	0.042
Inotrope and or vasopressors administered	1561	1146 (73 %)	1447	1052 (73 %)	114	94 (82 %)	0.023
Atrial fibrillation during ICU stay	1405	151 (11 %)	1299	142 (11 %)	106	9 (8 %)	0.44
<b>Parameters at ICU discharge</b>							
Temperature	1399	37.1 [36.8 - 37.5]	1299	37.1 [36.8 - 37.5]	100	37.2 [36.8 - 37.6]	0.17
Systolic blood pressure (mmHg)	1358	125 [111 - 139]	1259	125 [111 - 139]	99	121 [109 - 140]	0.51
Diastolic blood pressure (mmHg)	1299	68 [59 - 77]	1201	68 [59 - 77]	98	67 [60 - 75]	0.41
Heart rate (/min)	1342	90 [79 - 101]	1243	90 [79 - 101]	99	87 [78 - 100]	0.56
Lactate (mmol/L)	651	1.0 [0.7 - 1.3]	604	1.0 [0.7 - 1.3]	47	0.8 [0.7 - 1.1]	0.064
Sodium (mmol/L)	1446	139 [136 - 142]	1344	139 [136 - 142]	102	141 [138 - 143]	0.003
Potassium (mmol/l)	1431	3.9 [3.6 - 4.2]	1329	3.9 [3.6 - 4.2]	102	3.9 [3.6 - 4.2]	0.19
Protein (g/L)	1272	62 [56 - 69]	1179	62 [56 - 69]	93	64 [58 - 69]	0.018
Creatinemia (μmol/L)	1501	66 [51 - 95]	1392	66 [50 - 96]	109	74 [60 - 94]	0.011
Hemoglobin (g/L)	1358	10.0 [9.0 - 11.2]	1265	10.0 [8.9 - 11.1]	93	10.5 [9.7 - 11.5]	0.002
White blood count (G/L)	1348	9.6 [7.0 - 13.1]	1254	9.6 [7.0 - 13.2]	94	9.6 [7.7 - 12.1]	0.83
Platelet count (G/L)	1342	293 [184 - 436]	1251	297 [184 - 443]	91	250 [188 - 374]	0.18
Glycemia (g/L)	1301	6.8 [5.7 - 8.3]	1203	6.8 [5.7 - 8.3]	98	6.7 [5.6 - 8.4]	0.89
<b>Cardiac biomarkers</b>							
High sensitive troponin I (pg/mL)	1205	11.1 [4.1 - 38.4]	1113	10.0 [3.9 - 33.8]	92	42.0 [18.4 - 267.1]	<0.0001
N-terminal pro-B type natriuretic peptide (pg/mL)	1203	543.1 [148.4 - 2073.0]	1112	518.1 [140.4 - 1968.0]	91	1421.0 [423.5 - 5719.0]	<0.0001
<b>Outcome</b>							
ICU length of stay (days)	1561	12 [7 - 21]	1447	13 [7 - 21]	114	9 [5 - 16]	0.0005
Survival one-year after ICU discharge	1561	1237 (79 %)	1447	1135 (78 %)	114	102 (89 %)	0.005

<sup>a</sup> Others (n=305) included anaphylactic shock (n=2), acute pancreatitis (n=10), hemorrhagic shock (n=84), hypovolemic shock (n=20), liver failure (n=18), metabolic causes (n=11), mixed (n=15), multiple organ failure (n=4), renal failure (n=11), severe sepsis (n=38), trauma (n=86), thrombotic microangiopathies (n=6)

Table 2: Characteristics of non-cardiac arrest and cardiac arrest patients at ICU discharge before and after propensity score matching.

Variables	Non-matched population			Matched population		
	Non-cardiac arrest (n=1447) n (%) or median [IQR]	Cardiac arrest (n=114) n (%) or median [IQR]	SD	Non-cardiac arrest (n=68) n (%) or median [IQR]	Cardiac arrest (n=68) n (%) or median [IQR]	SD
Age (years)	61 [48 – 73]	61 [50 – 72]	5.3	64 [54 – 76]	66 [52 – 74]	5.9
Charlson score > 1	513 (35 %)	27 (24 %)	-25.9	18 (26 %)	19 (28 %)	3.3
Severe vascular disease	125 (9 %)	14 (12 %)	11.8	8 (12 %)	6 (9 %)	-9.6
Severe valvular disease	48 (3 %)	5 (4 %)	5.5	3 (4 %)	2 (3 %)	-7.8
Chronic renal disease	158 (11 %)	6 (5 %)	-20.9	4 (6 %)	3 (4 %)	-6.6
Recent active malignant tumor	186 (13 %)	1 (1 %)	-48.8	-	-	0
Prior physical or mental disability	50 (3 %)	2 (2 %)	-10.7	1 (1 %)	1 (1 %)	-0
Red blood pack administered	639 (44 %)	31 (27 %)	-35.9	16 (24 %)	18 (26 %)	6.7
Temperature (°C)	37.1 [36.8 - 37.5]	37.2 [36.8 - 37.6]	14.7	37.0 [36.9 - 37.6]	37.1 [36.7 - 37.5]	-9.3
Systolic blood pressure (mmHg)	125 [111 – 139]	121 [109 – 140]	-6.8	127 [116 – 138]	125 [108 – 142]	0.9
Protein > 62 g/L	575 (49 %)	53 (57 %)	16.5	35 (51 %)	35 (51 %)	0
White blood count > 9.6 G/L	626 (50 %)	45 (48 %)	-4.1	36 (53 %)	37 (54 %)	2.9
Platelets > 290 G/L	642 (51 %)	38 (42 %)	-19.2	30 (44 %)	30 (44 %)	0
Length of stay > 14 days	605 (42 %)	35 (31 %)	-23.2	17 (25 %)	20 (29 %)	9.9

SD: standardized difference