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1 Effect of bystander CPR initiated by a dispatch centre following out-of-hospital cardiac arrest on 30-day
2 survival: Adjusted results from the French National Cardiac Arrest Registry.

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30 **ABSTRACT**

31 **Aim:** Cardiac arrest (CA) was considered irreversible until 1960, when basic
32 cardiopulmonary resuscitation (CPR) was defined. CPR guidelines include early recognition
33 of CA, rapid and effective CPR, effective defibrillation strategies and organized post-
34 resuscitation to ensure a strengthening of the survival chain. Bystanders are the key to
35 extremely early management, which is associated with the early medical care provided by
36 EMS. This study aims to assess the prognosis of a bystander's cardiac CPR when it is
37 initiated by the Dispatch Centre (DC).

38 **Methods:** We included patients in 3 groups according to who initiated the CPR. The groups
39 were matched according to multiple propensity partition methods. We presented our results in
40 terms of 30-day survival and neurological prognosis.

41 **Results:** 85634 patients were included. Statistical study focused on 18185 patients once the
42 exclusion criteria were applied. 12743 (70.1%) are men and the average age is 70.1 years.
43 Survival at D30 was 5.11% in the absence of CPR, 8.86% with bystander initiation and 7.35%
44 with DC initiation ($p < 0.001$). Survival at D30 with favourable neurologic prognosis (CPC 1-
45 2) was 76.30%, 83.69% and 82.82%, respectively. Our results show a 3.75% increase in the
46 chance of survival at D30 if CPR was initiated by bystanders compared to patients for whom
47 CPR was not initiated, a 2.25% increase in survival in the group that received from CPR
48 initiated by the DC compared to the group that did not receive CPR.

49 **Conclusions:** Bystander CPR initiated by the DC represents a suitable option following out-
50 of-hospital cardiac arrest.

51 **Key words:** Out-of-hospital cardiac arrest – Prognosis – Cardiopulmonary resuscitation –
52 Bystanders – Dispatch Centre

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59 **Introduction**

60 Out-of-hospital cardiac arrest (OHCA) is a major cause of mortality in the industrialized
61 world [1–3]. Epidemiological data estimate the global incidence of OHCA at 95.9 cases per
62 100.000 person-years [1,4]. OHCA affects 40.000 to 50.000 people per year in France [5] and
63 approximately 300.000 in Europe [6], where OHCA survival can range from 3% to 31%. In
64 France, survival rates vary from 4.9% to 11.4% according to the context (initial rhythm,
65 location, bystander,...) [1,6,7]. Importantly, we also note variations on telephone directed
66 CPR–[8]. The key elements of the treatment include early recognition of CA, rapid and
67 effective CPR, effective defibrillation strategies, and post-resuscitation care [9]. The early
68 initiation of CPR followed by rapid intervention of emergency services that provide high
69 quality CPR is essential.

70 It has been reported that bystander-initiated CPR increases survival and favourable neurologic
71 outcomes for patients presenting with OHCA [10,11]. Therefore, the impact of early CPR
72 initiation has been widely documented [1,6,12]. However, it is not known whether outcomes
73 differ when resuscitation has been specifically encouraged or not by the Dispatch Centre (DC).

74 In this context, the aim of this study was to assess the effect of dispatch-directed (DD)
75 telephonic cardiopulmonary resuscitation (TCPR) on patients' survival. We compared
76 survival and neurological outcomes of three groups of patients: 1) patients who have not
77 received ~~benefited~~ from bystander CPR; 2) patients who received ~~benefited~~ from bystander-
78 initiated CPR; and 3) patients who received ~~benefited~~ from bystander CPR initiated following
79 the advice of the DC.

80

81 **Methods**

82 Study setting

83 In France, the EMS [13] is a two-tiered, physician-based system with a Fire Department
84 ambulance for prompt intervention and basic life support (BLS), a single DC in each county,
85 and several prehospital Emergency Departments, which are called Mobile Emergency and
86 Resuscitation Services (MERS; “Service Mobile d’Urgence et de Réanimation” - SMUR) and
87 are responsible for out-of-hospital emergencies. Each MERS unit includes one or more
88 mobile medical teams (MMTs) that operate at the scene. These teams complement previously

89 attempted care (BLS) by initiating advanced cardiac life support (ACLS). When a call arrives
90 in one of the French Dispatch Centres, it is first taken by a call handler, who will record all
91 administrative data (address, identity, phone number) and the complaint. The call is then
92 transferred with an open communication to an Emergency Physician with CA notion and on
93 whether or not CPR is in progress. As soon as a CA is diagnosed on the phone, the bystander
94 will be asked to start or continue BLS if needed and to have someone bring an AED, if one is
95 available.

96

97 Study design

98 Our study was retrospective, comparative and multicentre, based on data from the French
99 National Cardiac arrest registry (RéAC). The registry is used by most French Emergency
100 Departments (90%) and 286 MERS and 94 DC participate to the data collection [14]. The
101 RéAC includes OHCA patients of any age, regardless of the aetiology, and the time at which
102 an MMT was involved. Investigators use a specific recording form during OHCA intervention
103 to enter patient data, times, care, and immediate survival status. The RéAC form meets the
104 requirements of the French Emergency Medical System (EMS) organizations and is structured
105 according to the Utstein universal style.[15] Data are reported in the RéAC secure database
106 (www.registreac.org). Each RéAC centre is provided with a data manager in charge of the
107 registry data input that the MERS teams have completed on a paper CRF. Files are completed
108 within 24 to 48 hours of their inclusion. A follow-up 30 days after the onset of the OHCA or
109 at hospital discharge is also performed and entered into the database.

110 Data were collected between 1st January 2012 and 1st May 2018.

111 We compared survival and neurological outcomes of three groups of patients:

- 112 - Group A: patients who have not received from bystander CPR;
- 113 - Group B: patients who received from bystander-initiated CPR
- 114 - Group C: patients who received from bystander CPR initiated following the advice of
115 the DC

116 Inclusion criteria

- 117 - medical OHCA according to the Utstein template [15,16]
- 118 - patients in whom ACLS was attempted.

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Exclusion criteria

- identification of cadavers (rigor mortis)
- non-medical CA
- no resuscitation by MMT
- files lacking data on mandatory criteria (Utstein core data)
- no flow (=no CPR) > 60 min
- patients with a known Do Not Attempt Resuscitation (DNAR) order.

Data collected included baseline clinical characteristics, times, history, bystander BLS, first aid provider BLS, first rhythm recorded by MMT, ACLS, pre-hospital treatment, ROSC, status at admission, patient transport, and admission parameters. Thirty-day follow-up included patient vital status and neurological outcomes.

We considered the patient shockable if the patient was shocked by an AED used by bystander or firefighter. Furthermore, if the patient had a shock-free AED pose before the arrival of the MMT, the rhythm was considered non-shockable. In the absence of this information, the chosen rhythm was the same as that recorded at the arrival of the MMT with a manual defibrillator.

No-Flow was determinate by the MMT at arrival on scene. It was determinate using the CA time, the first call and the time BLS was started by the bystander. For group C, (CPR directed by DC), the MMT retrieves starting time of directed-CPR in order to complete the registry database. Several quality controls were performed in real-time during data input to detect errors, inconsistencies, or out-of-bound values. Offline tests were performed to detect other types of errors that require verification from the participating MERS. Randomly chosen records were assessed by a clinical research associate to identify other inconsistencies or errors that should be included in the automated tests (on- or offline).

The main outcome was survival at day 30 (D30). The secondary outcome were the vital status at hospital admission, return of spontaneous circulation (ROSC) and neurological outcomes of survivors assessed by the cerebral performance category (CPC) scale, with a CPC score of 1-2 at D30 considered to be a favourable outcome.

Ethical approval

153 The present study was approved by the French Advisory Committee on Information
154 Processing in Health Research (CCTIRS) and the French National Data Protection
155 Commission (CNIL, authorization number 910946). The present study was also approved as a
156 medical assessment registry without a requirement for patient consent.

157 Statistical analysis

158 The first step was a comparison of main characteristics between 3 groups of OHCA patients
159 who were classified according to the primary resuscitation performed: no CPR initiated by the
160 bystander, CPR initiated by the bystander, CPR initiated by the DC.

161 The second step was a comparison of survival between groups after adjustment for different
162 confounding factors using a multiple propensity score method.

163

164 Description and comparisons of groups

165 Data are expressed as frequencies (%) for qualitative variables or the median [first
166 quartile–third quartile] depending the normality of the distribution. The normality of
167 distributions was assessed using the Kolmogorov–Smirnov test.

168 Categorical variables are expressed using a percentage (frequency). The group comparisons
169 were performed using Kruskal-Wallis and chi-square tests depending on the nature of the
170 variables.

171

172 Adjustment method

173 Propensity score methods were used to reduce the effects of potential confounding factors in
174 comparisons between groups. The propensity score was used to assemble well-balanced
175 groups. We performed a multiple propensity score adjustment approach, based on the Imbens’
176 description [17]. This approach is similar to the Austin’s description [18] for estimating
177 marginal treatment effects using logistic regression models.

178 The multiple propensity score method was adapted to the sample and to the number of groups
179 (3 in the case of the study). We therefore used a multinomial logistic regression for estimating
180 the multiple propensity scores as described by Spreuwenberg [19]. The dependent variable
181 was the groups previously described, and independent variables were introduced in the model
182 according to their statistical significance ($p < 0.05$) and/or their clinical relevance: sex, age
183 group (0-44 years, 45-59 years, 60-74 years and >74 years), initial rhythm (Asystole, PEA,
184 and VF/VT), cardiovascular and respiratory history, duration of no flow (time with no CPR at
185 all) (0-3 min, 4-8 min, 9-14 min and >14 min) and CA location. Then, for each participant, 3
186 predicted probabilities (multiple propensity scores) were obtained related to the 3 groups.

187 We evaluated the success of the multiple propensity scores with significance testing. For the
188 dichotomous variables, we used a logistic regression analysis with the categorical treatment
189 variable along with 2 multiple PSs as independent variables. For nominal variables, we used
190 multinomial logistic regression analysis with treatment as a factor and the 2 multiple PSs as
191 covariates.

192 To estimate the effect of bystander BLS (according to the 3 groups) on survival (survival at
193 day 30, vital status at hospital admission, ROSC and neurological outcome), taking into
194 account the influence of confounding characteristics, we used a logistic regression. Survival
195 was used as a binary dependent variable, and as independent variables, we included the
196 following covariates: a nominal variable indicating group membership (the no-CPR group
197 being considered as a reference), and 2 multiple propensity scores, and their product terms.

198 The results are expressed in terms of odds-ratios and their 95% confidence intervals. Based on
199 logistic regression, the average probability of survival for each group was computed.

200 All statistical analyses were performed using the IBM SPSS Statistics[®] v25.0 software (SPSS,
201 Chicago, IL), and differences were considered significant at a type 1 error of 5%.

202

203 **Results**

204 RéAC database identified 85634 OHCAs between January 1st, 2012, and May 1st, 2018. In
205 line with inclusion and exclusion criteria, 18185 OHCAs were finally included in the study
206 (figure 1)

207 Comparisons among populations (Table 1 and Table 2)

208 Overall, approximately 70% of the population was male (69.6% in group A, 68.7% in group B
209 and 71.7% in group C). A cardiac cause of CA was suspected in 71.8% of the overall
210 population. The bystander was a family member in 71.8% of the cases. For group B with
211 spontaneous bystander CPR, family represented only 35.5% of the bystanders (p <0.001).

212 For 40.2% of the patients in group B, CPR was performed with chest compressions (CC)
213 associated with ventilation (V). This rate decreased to only 7.4% for group C (p<0.001).

214 Non-shockable rhythm represented 70,5% in the general population. There was a higher
215 proportion of FV or pulseless TV in group C (n=1980, 36.3%) and a higher asystole
216 proportion in group A (n=6926, 69.4%) (p<0.001).

217 We found a small proportion of patients who were shocked by a “public” AED (2.2% of the
218 overall population), although this proportion was higher in group B, 8% (p<0,001). Only
219 3.2% in group C were shocked by a “public” AED.

220 Regarding the “firefighter” AED shocks, 24.8% of the general population received at least
221 one shock. This rate was higher in the groups that received CPR: 29.2% for group B and
222 30.2% in group C. On the other hand, this rate was one-fifth of the population (20.6%) in
223 group A (p<0,001).

224 Regarding ACLS, there was no difference in the proportion of patients who were intubated
225 between groups (p=0.127). On the other hand, adrenaline was administered in 90% of cases
226 (n=16370) in the global population.

227 The study showed, before any adjustments to the population, a better survival rate at D30 for
228 patients receiving bystander CPR (groups B and C) (Table 2). The survival rate at D30 in
229 group B (n = 315) was 11.5% vs 9.3% in group C (n = 508), and it decreased to 3.9% in group
230 A (n = 390) (p <0.001).

231 We found, for group A (n = 2809), 28.1% of ROSC at scene versus 38.3% for group B (n =
232 1054) and 35.7% for group C (n = 1949) (p <0.001) (Table 2). Finally, the neurological
233 prognosis was also better in groups B (n=254) and C (n=390), with 84.9% and 83.2% of

234 patients with CPC scores of 1 and 2, respectively, whereas only 74.5% (n=266) of patients of
235 group A had CPC scores of 1 and 2 (p <0.001).

236 Comparison of adjusted population

237 After adjustment, the population of groups A, B and C were no longer significantly different
238 for the following variables: age, sex, cardiovascular and respiratory history, initial rhythm and
239 no-flow duration, as shown in Table 3.

240 However, the location of cardiac arrest maintained a statistically significant difference after
241 adjustment, with a higher prevalence of CA occurring at home in group A (n=8249, 82.6%)
242 versus 55.5% (n=1527) for group B and 75.9% (n=4138) for group C (p=0.01) (Table 3).

243 There was a better survival rate at D30 in the group with bystander-initiated CPR (8.86%).
244 Nevertheless, the rate of survival in group C was (7.35%), which was higher than that for
245 group A (5.11%) (Table 4). The odds ratios comparing group A to groups B and C show a
246 significantly increased chance of survival with OR of 1.82 [1.53;2.17] for group B and 1.48
247 [1.26;1.74] for group C compared to group A.

248 ROSC and survival at hospital admission were also better in groups B and C compared to
249 group A after adjustment. The odds ratios for ROSC were 1.25 [1.13;1.37] (35.22%) for
250 group B and 1.13 [1.03;1.22] (32.94%) for group C. For survival at hospital admission, the
251 OR was 1.27 [1.15;1.41] (30.20%) for group B and 1.21 [1.11;1.31] (29.14%) for group C.

252 Finally, the neurological outcomes of the surviving patients were also evaluated in this
253 population. A CPC score of 1 or 2 at D30 was considered a good outcome. Good neurological
254 outcomes were significantly more prevalent in group B (83.69% of patients) and had an OR
255 of 1.86 [1.48;2.32] compared to group A (76.30% of patients). The rates are slightly lower in
256 group C with 82.82% of patients having a good neurological outcome, but the OR was still
257 positive compared to group A (1.50 [1.23;1.84]).

258 **Discussion**

259 First, our study highlights the favourable 30-day survival outcome of patients who
260 received bystander CPR initiated by the DC providing TCPR advice when the onsite
261 bystander(s) did not initiate CPR on their own. Second, these results point out favourable
262 effects of early CPR initiated spontaneously by bystanders and emphasize the necessity of
263 ongoing generalized CPR training at the population-wide level.

264 Bystander CPR

265 CPR was started by a bystander in 45.1% of cases, whether it was initiated by the DC
266 or not. Those results are similar to those reported in other studies, for example in a European
267 study EuReCa (41.3%) (~~47.1%~~) and in a Korean study KoCARC (48.7%)[20,21]. It has also
268 been underlined that in the German Resuscitation Registry (GRR), the overall bystander CPR
269 rate (excluding first responders) on all CPR patients (including e.g. trauma) was 39.7% and
270 the dispatcher directed CPR rate was 21.2% [8,22].

271 We noticed that in the CPR directed by DC group, over 70% (71.7%) of the bystander
272 were family, which suggest that they are willing to help but unable to start before being
273 directed to. Whereas, in the immediate CPR group, only 35.5% of the bystanders were family
274 ($p<0.001$). This could be explained by the fact that more CA in the CPR directed group
275 occurred at home than in the group immediate CPR (75.9% vs 55.5%).

276 A study conducted in Japan investigated the effects of TCPER on outcome, and more
277 specifically by type of bystander. CPR was more easily performed by a non-family bystander
278 [20]. This trend was also observed in our study. The explanations for this trend are probably
279 based on the emotional state of the family member, where following instructions is difficult,
280 with a fear of hurting a loved one, or risking of failing resuscitation that can lead to post-
281 traumatic stress [23]. This finding strongly suggests the need to continue awareness
282 campaigns about the need and importance of early CPR.

283 CPR quality and defibrillation

284 ERC (European Resuscitation Council) guidelines for CA, underline that for a non-
285 trained bystander, only CC only should be delivered, and CC and ventilation should be
286 delivered by trained teams. In the subgroup of our study receiving bystander CPR, 40%
287 received CPR delivered with CC and ventilation. This high rate is probably related to the fact
288 that a bystander who initiated CPR is likely to have had a previous CPR training emphasizing
289 the need for compression and ventilation, if possible.

290 It is important to highlight the low rate of use of AEDs in our study, although it has
291 been established that the delay to the first shock is decisive for survival [2,24–26] and must be
292 issued as soon as possible.

293

294 Recently, we have noticed a great decrease in the delay from CA to first shock, due to
295 the French campaign to place AEDs everywhere, especially in most public places. Many
296 recent studies recognize that the use of public AEDs increases the chances of survival of
297 patients with OHCA [27–33].

298 A previous study has described a graphical model for predicting survival during
299 OHCA [34]. This model was used to evaluate survival (discharge from the hospital). A
300 multiple logistic regression model using time between collapse and CPR (I_{CPR}), time between
301 collapse and first shock (I_{defib}) and time between collapse and advanced care (I_{ACLS}) to limit
302 the effect of confounding factors was applied. The shorter the time required for the procedure
303 is, the higher the survival rates are. This model shows the quantitative contribution of each
304 intervention (CPR, EEC, initiation of specialized resuscitation) to the survival rate.

305 Dispatch–directed telephonic CPR

306 To this point, it is also relevant to highlight the DC rule in the management of OHCA.
307 A literature review in 2011 focused on the survival benefit after OHCA depending on whether
308 the CPR was conducted with or without the DC telephone assistance. All studies found an
309 improvement in survival with the DC instructions, but the authors report a lack of power in
310 statistical analysis, not concluding that there was a statistically significant difference. [35]

311 Another study conducted between 2015 and 2016 in Korea, published in 2018,
312 highlighted the importance of dispatch-directed telephonic CPR. Two groups were presented:
313 smartphone-based advanced cardiac life support (SALS) and basic life support (BLS), i.e.,
314 those who received advanced resuscitation initiated by telephone and those who received
315 conventional resuscitation. The survival rate was slightly higher in the SALS group than in
316 the BLS group (4.0% vs. 1.7%), but the difference was not shown to be significant ($p =$
317 0.078)[36].

318 Interestingly, and to the best of our knowledge, our study is the first study with
319 sufficient statistical power to show a prognosis significant difference in OHCA with initiated
320 dispatch–directed telephonic CPR.

321 Another aspect of the issue has been studied recently [26]. A mobile-phone
322 positioning system to locate CPR-trained volunteers was activated when ambulances,
323 firefighters or police officers were dispatched. 9828 volunteers trained in CPR were recruited.

324

325 The positioning system was activated in 667 OHCA: CPR initiated by the volunteers
326 was 62% (188 patients out of 305) in the intervention group and 48% in the control group
327 (172 patients out of 360) $p < 0.001$) but without any improvement in patient prognosis [26].

328 Limitations of the study

329 In our study, inclusion criteria may differ to other registries where any BLS or
330 defibrillation were the relevant criteria and not the start of ALS, that can make data analysis
331 and comparisons more challenging. Moreover, and for completeness, we conducted this 18185-
332 patient study excluding 78% of the population from the ReAC registry analysis, including
333 16.5% (n=14107) of whom were old dead and 28.8% (n=24723) of whom without bystander.

334 We must mention that we were not able to assess the MERS team compliance to the
335 ReAC protocol and so it might have an impact of the outcomes measured.

336 Another point is that we were not interested in long-term survival or neurological and
337 functional prognoses. There are uncertainties about the exact aetiology in many cases of
338 OHCA. RéAC registry does not contain some characteristics that are evaluated in other
339 registers and that omission could have influenced the results (for example ethnicity, even if
340 the data on ethnicity are actually still debated [21]).

341

342 Finally, we also do not have all relevant information about the bystanders, such as age,
343 whether or not the bystanders were trained in CPR, or the number of bystanders involved in
344 CPR, which could have been interesting information to have to create a typical bystander
345 profile.

346 **Conclusion**

347 Immediate bystander CPR is the most favourable case for a patient's prognosis. However, our
348 study highlights the effectiveness of dispatch- directed telephonic CPR by bystanders.

349

350

351 **Conflict of interest statement**

352 No conflicts of interest to declare.

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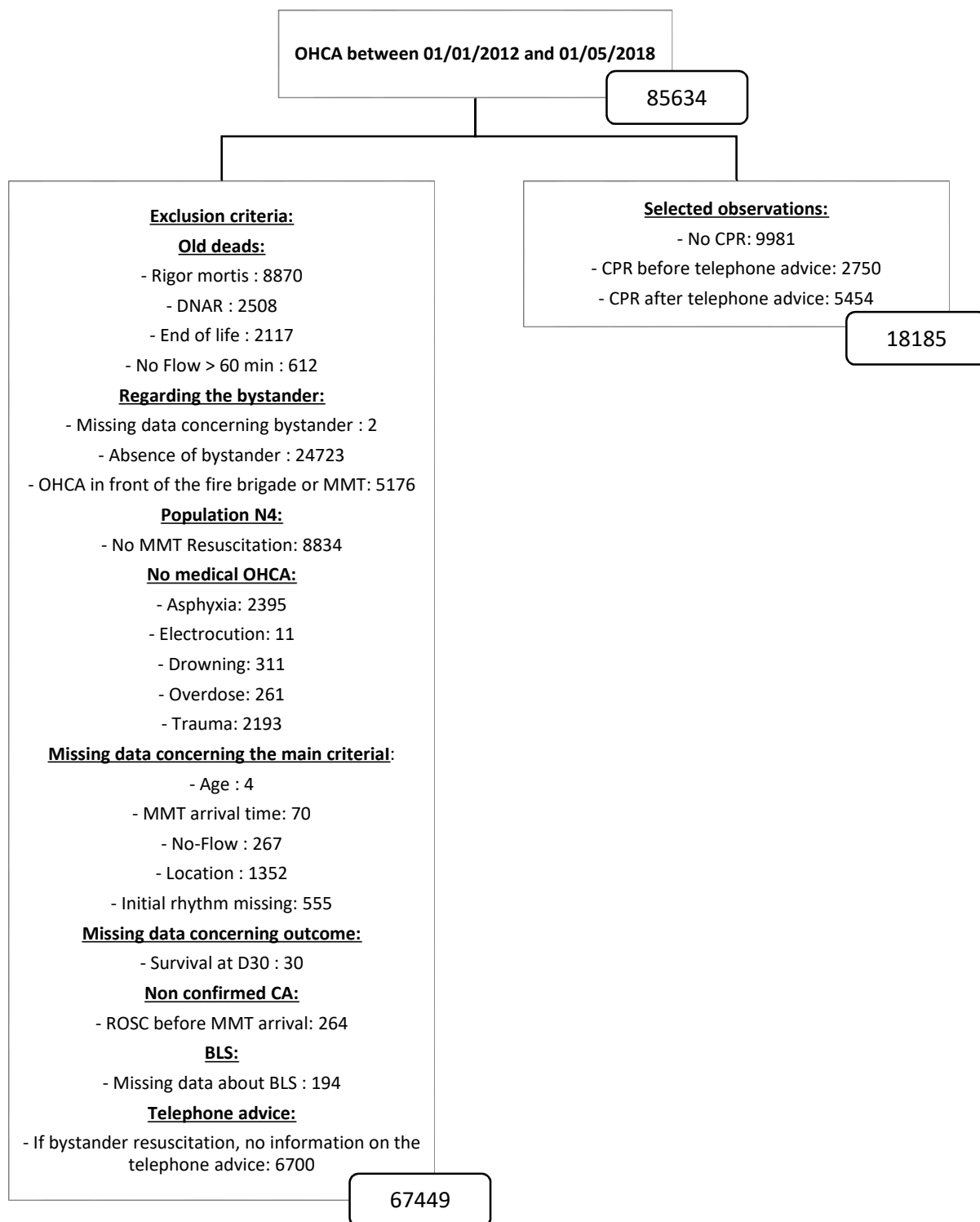


Figure 1: Flow-Chart of the study.

Characteristics	Global population N = 18185	Group A No CPR by bystander N = 9981	Group B CPR by bystander N = 2750	Group C CPR directed by DC N = 5454	P
Age (Years)					<0.001
- (0-44) years	1756 (9.7%)	785 (7.9%)	296 (10.8%)	675 (12.4%)	
- (45-59) years	4073 (22.4%)	2039 (20.4%)	625 (22.7%)	1409 (25.8%)	
- (60-74) years	6244 (34.3%)	3467 (34.7%)	871 (31.7%)	1906 (34.9%)	
- >74 years	6112 (33.6%)	3690 (37.0%)	958 (34.8%)	1464 (26.8%)	
Gender (% Men)	12743 (70.1%)	6945 (69.6%)	1888 (68.7%)	3910 (71.7%)	0.005
Place (% home)	13914 (76.5%)	8249 (82.6%)	1527 (55.5%)	4138 (75.9%)	<0.001
Bystander (% family)	13055 (71.8%)	8172 (81.9%)	977 (35.5%)	3906 (71.7%)	<0.001
Known cardiovascular history (%)	9048 (49.8%)	5072 (50.8%)	1369 (49.8%)	2607 (47.8%)	0.002
Known respiratory history (%)	2610 (14.4%)	1582 (15.9%)	342 (12.4%)	686 (12.6%)	<0.001
Cardiac cause (%)	13065 (71.8%)	7081 (70.9%)	1883 (68.5%)	4101 (75.2%)	<0.001
BLS					
- CPR	6927 (38.1%)	0 (0%)	2530 (92.0%)	4397 (80.6%)	<0.001
- Chest compression only	6081 (33.4%)	0 (0%)	1605 (59.2%)	4476 (82.4%)	<0.001
- Ventilation only	26 (0.3%)	0 (0%)	15 (0.6%)	11 (0.2%)	<0.001
- Chest compression and ventilation	2037 (25%)	0 (0%)	1089 (40.2%)	948 (7.4%)	<0.001
- « public » shock AED	393 (2.2%)	0 (0%)	220 (8.0 %)	173 (3.2%)	<0.001
- « FF » shock AED	4509 (24.8%)	2058 (20.6%)	804 (29.2%)	1647 (30.2%)	<0.001
Specialized resuscitation					
Time:					
- Call - MMT arrival (min)	20 (14 ; 27)	20 (14 ; 28)	19 (13 ; 27)	19 (13 ; 25)	<0.001
- Call - ROSC or death (min)	47 (35 ; 59)	47 (37 ; 59)	45 (32 ; 60)	46 (34 ; 58)	<0.001
No Flow:					<0.001
- (0-3) min	5036 (27.7%)	720 (7.3%)	1379 (50.2%)	2937 (53.9%)	
- (4-8) min	3957 (21.8%)	2520 (25.2%)	433 (15.7%)	1004 (18.4%)	
- (9-14) min	4412 (24.2%)	3248 (32.5%)	420 (15.3%)	744 (13.6%)	
- >14 min	4780 (26.3)	3493 (35.0%)	518 (18.8%)	769 (14.1%)	
Initial rhythm:					<0.001
- Asystole	11759 (64.7%)	6926 (69.4%)	1625 (59.1%)	3208 (58.8%)	
- PEA	1060 (5.8%)	603 (6.0%)	191 (6.9%)	266 (4.9%)	
- VF/VT	5366 (29.5%)	2452 (24.6%)	934 (34.0%)	1980 (36.3%)	
Advanced Life Support					
- Shock by MMT	5003 (27.5%)	2435 (24.4%)	765 (27.8%)	1803 (33.1%)	<0.001
- Intubation	17238 (94.8%)	9431 (94.5%)	2616 (95.1%)	5191 (95.2%)	0.127
- Venous catheter	18051 (99.3%)	9888 (99.1%)	2740 (99.6%)	5423 (99.4%)	0.002
- Epinephrine injection	16370 (90%)	9067 (90.8%)	2414 (87.8%)	4889 (89.6%)	<0.001

Table 1: Global and bystander CPR groups characteristics

*Data are expressed as frequencies (%) for qualitative variables or median (Q1; Q3) for quantitative variables

OHCA: Out-hospital cardiac arrest. BLS: Basic Life Support. CPR: Cardio pulmonary Resuscitation. AED: External automatic defibrillator. FF: Firefighter. MMT: Mobile Medical Team. ROSC: Return of spontaneous circulation. PEA: pulseless electrical activity. VF: ventricular fibrillation. VT: ventricular tachycardia.

Description	Global population n = 18185	Group A	Group B	Group C	p
		No bystander's CPR n = 9981	Bystander's CPR n = 2750	CRP directed by DC ^c n = 5454	
- ROSC ^a	5812 (32%)	2809 (28.1%)	1054 (38.3%)	1949 (35.7%)	<0.001
- Survival at hospital admission	4983 (27.4%)	2249 (22.5%)	936 (34.0%)	1798 (33.0%)	<0.001
- Survival at D30	1213 (6.7%)	390 (3.9%)	315 (11.5%)	508 (9.3%)	<0.001
- If survival, CPC ^b 1-2 at D30	910 (80.9%)	266 (74.5%)	254 (84.9%)	390 (83.2%)	0.001

Table 2: Global and groups survival before adjustment.

^aROSC : Return of spontaneous circulation, ^bCPC : Cerebral Performance Category, ^cDC: Emergency Call Centre

Characteristics	Group A No CPR by bystander N = 99981	Group B CPR by bystander N = 2750	Group C CPR directed by ECC N = 5454	p Before adjustment	p After adjustment
Age (Years)				<0.001	0.999
- (0-44) years	785 (7.9%)	296 (10.8%)	675 (12.4%)		
- (45-59) years	2039 (20.4%)	625 (22.7%)	1409 (25.8%)		
- (60-74) years	3467 (34.7%)	871 (31.7%)	1906 (34.9%)		
- >74 years	3690 (37.0%)	958 (34.8%)	1464 (26.8%)		
Gender (% Men)	6945 (69.6%)	1888 (68.7%)	3910 (71.7%)	0.005	0.997
Place (% home)	8249 (82.6%)	1527 (55.5%)	4138 (75.9%)	<0.001	0.010
Known cardiovascular history (%)	5072 (50.8%)	1369 (49.8%)	2607 (47.8%)	0.002	0.998
Known respiratory history (%)	1582 (15.9%)	342 (12.4%)	686 (12.6%)	<0.001	0.999
Initial rhythm:				<0.001	0.999
- VF/VT	2452 (24.6%)	934 (34.0%)	1980 (36.3%)		
- PEA	603 (6.0%)	191 (6.9%)	266 (4.9%)		
- Asystole	6926 (69.4%)	1625 (59.1%)	3208 (58.8%)		
No Flow:				<0.001	0.686
- (0-3) min	720 (7.3%)	1379 (50.2%)	2937 (53.9%)		
- (4-8) min	2520 (25.2%)	433 (15.7%)	1004 (18.4%)		
- (9-14) min	3248 (32.5%)	420 (15.3%)	744 (13.6%)		
- >14 min	3493 (35.0%)	518 (18.8%)	769 (14.1%)		

Table 3: Differences groups before and after adjustment.

^aOHCA: Out-hospital cardiac arrest, ^bBLS : Basic Life Support, ^cCPR : Cardio pulmonary Resuscitation, ^dAED : External automatic defibrillator, ^eFF: Firefighter, ^fMMT: Médical Mobile Team, ^gROSC : Return of spontaneous circulation, ^hEAWP: electrical activity without pulse, ⁱFV: ventricular fibrillation, ^jTV: ventricular tachycardia.

Description N = 18185	Group A		Group B		Group C	
	No bystander's CPR		Bystander's CPR		CPR directed by DC ^c	
	%	OR [95%CI]	%	OR [95%CI]	%	OR [95%CI]
- Survival at D30	5.11	1	8.86	1.82 [1.53;2.17]	7.35	1.48 [1.26;1.74]
- ROSC ^a (%)	30.41	1	35.22	1.25 [1.13;1.37]	32.94	1.13 [1.03;1.22]
- Survival at hospital admission (%)	25.43	1	30.20	1.27 [1.15;1.41]	29.14	1.21 [1.11;1.31]
- If survival, CPC 1-2 ^b at D30 (%)	76.30	1	83.69	1.86 [1.48;2.32]	82.82	1.50 [1.23;1.84]

Table 4: Average secondary criteria according to adjusted groups.

^aROSC : Return of spontaneous circulation, ^bCPC : Cerebral Performance Category, ^cDC: Dispatch Centre