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## **Work factors associated with return to work in out-of-hospital cardiac arrest survivors**

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Key words: out-of-hospital; cardiac arrest; return to work; long-term outcome; occupational; work

Running title: Return to work after cardiac arrest

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## **Abstract**

Introduction. Although the survival rate after out-of-hospital cardiac arrest (OHCA) has increased over time, little is known about the return to work of OHCA survivors. We aim to evaluate prevalence and factors associated with return to work (RTW) in OHCA survivors.

Patients and methods. All consecutive OHCA survivors aged 18-65 years and discharged alive from a Paris tertiary intensive care unit between 2000 and 2013 were included. Pre-hospital care, in-hospital care, and after-hospital discharge data, such as work description (work location, job classification, nature of the job) were compared relative to work status and RTW. Factors associated with RTW were evaluated using multivariable logistic regression.

Results. 153 OHCA survivors were included in the analysis. Among them, 96 (62.8%) returned to work an average of 714 days after OHCA (SD 1031); mostly to the same job (n=72, 75%). Six patients changed jobs (4%) and 12 reduced their activity (10.6%). Factors associated with RTW were younger age (adjusted odds ratio (aOR) 3.64 [1.10; 12.02]), being managers and professionals, and service and sales workers (compared to technicians and associate professionals, clerical support workers, respectively aOR 3.43 [1.05; 11.22] and 4.69 [1.14; 19.37]), and workplace occurrence (aOR 11.72 [1.37; 99.93]).

Conclusion. Two thirds of OHCA survivors, in the present study, returned to work. Patients with a higher-level job, and with the arrest occurring in the workplace, were more likely to return to work. Further research should include more details of job contents, evolution, financial consequences, as well as prevention practices related to work location.

Survival after out-of-hospital cardiac arrest (OHCA) has increased over the last few decades.<sup>1-4</sup> There is growing interest in the specifics of qualitative survival, including health-related quality of life (HRQOL), of OHCA survivors.<sup>5-7</sup> Recently, Smith et al have reported similar 12 month HRQOL between OHCA survivors and individuals from the general population.<sup>8</sup> We observed similar results in our Parisian cohort and found that younger age and male gender were associated with better long-term HRQOL.<sup>9</sup>

Work is a major component of health and functioning. It has been found that among the OHCA survivors assumed to return to work (RTW), those with cognitive impairment were more likely to be on sick leave compared with those without cognitive impairment.<sup>10</sup> Of 12,332 working-age patients who suffered an OHCA recorded in the Danish Cardiac Arrest Register, 796 survived and 610 (76.6%) returned to work, but no details were given about the nature of the job.<sup>11</sup> We aimed to describe the prevalence of, and factors associated with, RTW in a French cohort of OHCA survivors.

## **Methods**

The design and inclusion criteria in the cohort have been described previously.<sup>9</sup> In brief, all consecutive OHCA patients of our intensive care unit between 2000 and 2013 were prospectively included. Among the survivors followed, only working-age patients (18-65 years old) who had a job when the cardiac arrest occurred were included in the present study. Data of pre- and in-hospital care were recorded according to the Utstein style.<sup>12</sup> In the present study, we focus on demographic data, cardiac arrest location, and initial Utstein variables (i.e. time from collapse to cardiopulmonary resuscitation [CPR] –“no-flow”-, time from CPR to

restoration of spontaneous circulation [ROSC], presence of a witness, bystander CPR, and external defibrillation).

Initial job content was coded using the 2008 International Standard Classification of Occupations (ISCO-08) and recoded into four categories based on the first digits (1: managers and professionals; 2: technicians and associate professionals, clerical support workers; 3: services and sales workers ; 4: craft and related trades workers, plant and machine operators and assemblers, elementary occupations; no skilled agricultural, forestry and fishery workers were included, as expected for an urban area).<sup>13</sup> Jobs requiring manual tasks (defined as having a combination of at least two biomechanical factors), responsibilities (defined as involving a high level of decision making), and intellectual content (defined as involving a high level of mental demand) were also coded by an occupational health specialist. OHCA occurring in a work setting was recorded as well.

RTW was evaluated by a trained clinical research assistant during standardized telephone interviews. A standardized protocol was used for follow-up, and the patient was declared lost to follow-up for interview after 3 series of 6 attempts each were performed without success. Information on the type of activity (similar, reduced), job change, or retirement was included (reduced activity was considered as RTW). Neurological performance was also evaluated using the Cerebral Performance Category (CPC),<sup>14</sup> as well as/including independence in everyday activities assessed by the Katz index for activities of daily living (ADL).<sup>9</sup> CPC scores range from 1 to 5: (1) good cerebral performance; (2) moderate cerebral disability; (3) severe cerebral disability; (4) coma or vegetative state and (5) death. In the present study, we defined good neurological performance by CPC1 and intermediate or poor neurological performance by CPC other than 1. The ADL index ranks performance adequacy in the six functions of bathing, dressing, toilet, transferring, continence, and feeding. Participants

reporting that they needed help with any of the activities (i.e. ADL < 6) were considered to have impaired ADL.

We described OHCA characteristics according to return to work as well as type of professional activity. We then analyzed factors associated with RTW, coded yes/no, using multivariable logistic regression. The dependent variable was return to work, while independent variables included OHCA characteristics, which were associated with the main outcome in the univariate analysis having a p-value lower than or equal to 0.20, in order to avoid having too many variables in the model. To take into account a potential period effect, we divided the study into 2 equal time periods (2000- 2006, 2007 -2013). Separate models with job content and classification were constructed to avoid over-adjustment.

The accepted level of significance was set at  $p \leq 0.05$  for all analyses. Statistical analyses were carried out using the Statistic Analysis Software SAS V9.4 package (SAS Institute, Inc. Cary, NC, USA). Data description was performed according to the STROBE guidelines related to observational study reporting.<sup>15</sup> Our local ethics committee approved the study.

## **Results**

Of 379 survivors followed, 153 were included in the study (mean follow-up 1643 days, standard deviation 1371, median 1268, interquartile range 525- 2387 range 61-4967 , **Figure 1**). Most of them suffered OHCA after 2007 (n =111, 73%). Mean time from collapse to start of CPR was 3.9 (standard deviation 4.55) min and mean time from CPR to ROSC was 13.7 (SD 10.53) min.

Ninety-six (96) /153 (62.8%) OHCA survivors returned to work an average of 714 (SD 1031) days after OHCA occurrence (median 241 days, interquartile range 93-911 days) and mostly to the same job (Table 1). Retirement was more frequent in older survivors, except for manual workers. Three workers returned to work and retired a few months later, and one returned to work but suffered from myocardial infarction and stopped working 2 years later (considered here as return to work). Good neurological outcome (CPC1 n=130/89.0% compared to CP2 n=12/8.2% and CPC3 n=4/2.7%, no CPC4 was observed), and normal daily life autonomy were associated with RTW ( $P<0.0005$ ).

The factors associated with return to work were younger age, being “managers and professionals” (compared to “technicians and associate professionals, clerical support workers”) and workplace occurrence, as well as initial period (2000-2006 vs 2007-2013, Table 2). Work contents (manual, with responsibility, intellectual) were not significantly associated with RTW.

Workplace location was strongly associated with time from CPR to ROSC ( $p<0.001$ ), but not with time from collapse to CPR, nor with other components of the chain of survival. RTW was more likely for those with a work place occurrence, although the confidence interval was very broad (table 2). In total, 68% (n=15 of 22) of those with the OHCA occurring at the workplace were able to RTW at the same job and working level.

## **Discussion**

In the present study, we found that about two-thirds of OHCA survivors of working age returned to work. Moreover, we observed a strong association between certain work factors,

like workplace occurrence, and a high-position job, and the RTW of OHCA patients discharged alive from hospital.

Similar results were observed in a previously published study focusing on employment after therapeutic hypothermia based on 87 OHCA survivors: 65% of them returned to work, a rate similar to our study (62.8%).<sup>16</sup> Interestingly, while OHCA survival increased in the second study period (2007-2013), we observed a lower proportion of patients who returned to work in that period. These results differ from the Kragholm study, which found a more frequent RTW rate in the most recent years (i.e. 2011 vs. 2001).<sup>11</sup> Improvement in the survival chain has led to survival improvement with the AED deployment plan in 2007, but has also increased the number of patients sent to hospital, and led to a lower proportion of long-term survival. Cultural differences in sick-leave between countries, and differences for health coverage in France are also a possible explanation.<sup>10</sup>

The notion of the workplace is heterogeneous.<sup>17</sup> Nevertheless, workplace location might differ from the “classical” public setting defined in the Utstein style, as better survival has been shown in such a setting.<sup>18</sup> Sasson et al. found that witnessed OHCA, shockable rhythm, and achieved return of spontaneous circulation are predictors of survival in OHCA.<sup>1</sup> In the present study, we observed such an association especially when the probable underlying factor is a shorter time of low flow in this particular location. However, there is room for improvement, since the association of workplace location of cardiac arrest with no flow time, as well as with other components of the survival chain, were not significant. Workplace as a prognostic factor might have important consequences for prevention and return to work.<sup>19</sup> When OHCA occurs

in the workplace setting, it might lead to anticipation of RTW, and to analysis of the initial workplace management and the chain of survival for improvement, such as prevention of OHCA and other potential work risks.

We acknowledge several limitations in the present study. Selection effects related to the specificities of our monocentric cohort of OHCA survivors have been previously discussed, with no sociodemographic difference on followed and lost to follow-up patients.<sup>9</sup> OHCA patients with a greater likelihood of RTW are not more likely to be referred to our center than another, and a selection effect is unlikely to have occurred, and the social distribution is similar to that of the Paris area.<sup>20</sup> Second, we have focused on RTW (“employability”) rather than time for RTW. It could indeed be argued that neurological recovery may improve over the first 12 months. However, some patients in the present analysis have changed their working status over time: 3 have retired, and one suffered from a myocardial infarction 2 years after her RTW. Last, we did not analyze the association between job content and return to work. We only observed an association between the international job classification and the main outcome, but none with the content. This may be related to the quality of data collection gathered during the telephone interview, as the interviewer did not focus on real job exposure assessment. Other aspects of the job exposure were also not analyzed here, such as the organizational or psychosocial context of work, the size of the company, and the involvement of the occupational health services.<sup>21</sup> Thus, we could not interpret work differences in detail, and only more information about job contents from further research will allow reliable conclusions.

In conclusion, this study emphasizes the importance of studying RTW after OHCA. Further research should include more details of job contents, evolution, and financial consequences,

as well as prevention practices related to work location, and information provided to patients about optimizing their RTW.

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**Table 1. Description between work status and relevant variables (sociodemographic, Utstein, work, period)**

variable	Not at work (and not retire) N=47 (31.3%)	Retire N=10 (6.2%)	At work. same job N=72 (47.7%)	At work. reduce activity N=16 (10.6%)	At work. different job N=6 (4.0%)	Total N=153 (100%)	P
<b>Sex</b>							
Men	40 (85.11%)	8 (80.00%)	60 (83.33%)	12 (75.00%)	5 (83.33%)	126 (82.35%)	0.5
Women	7 (14.89%)	2 (20.00%)	12 (16.67%)	4 (25.00%)	1 (16.67%)	27 (17.65%)	
<b>Age (yrs)</b>							<b>0.023*</b>
<45	8 (17.02%)		25 (34.72%)	9 (56.25%)	4 (66.67%)	48 (31.37%)	
45-55	23 (48.94%)	1 (10.00%)	24 (33.33%)	6 (37.50%)	1 (16.67%)	55 (35.95%)	
≥55	16 (34.04%)	9 (90.00%)	23 (31.94%)	1 (6.25%)	1 (16.67%)	50 (32.68%)	
<b>Bystander on scene</b>							0.5
No	2 (4.26%)		2 (2.78%)			4 (2.61%)	
Yes	44 (93.62%)	10 (100.0%)	68 (94.44%)	16 (100.0%)	5 (83.33%)	144 (94.12%)	
<b>CPR initiated by bystanders?</b>							0.5
No	17 (36.17%)	4 (40.00%)	27 (37.50%)	9 (56.25%)	2 (33.33%)	60 (39.22%)	
Yes	27 (57.45%)	6 (60.00%)	43 (59.72%)	7 (43.75%)	4 (66.67%)	88 (57.52%)	
<b>Shockable rhythm</b>							0.5
No	11 (23.40%)	1 (10.00%)	5 (6.94%)	3 (18.75%)		20 (13.07%)	
Yes	36 (76.60%)	9 (90.00%)	67 (93.06%)	13 (81.25%)	6 (100.0%)	133 (86.93%)	
<b>Cardiac cause?</b>							0.5
No	11 (23.40%)	1 (10.00%)	8 (11.11%)	4 (25.00%)		24 (15.69%)	
Yes	35 (74.47%)	9 (90.00%)	62 (86.11%)	11 (68.75%)	5 (83.33%)	123 (80.39%)	
<b>Workplace occurrence</b>							0.5
No	43 (91.49%)	10 (100.0%)	57 (79.17%)	12 (75.00%)	4 (66.67%)	128 (83.66%)	
Yes	1 (2.13%)		15 (20.83%)	4 (25.00%)	2 (33.33%)	22 (14.38%)	
<b>Job classification**</b>							0.5
1	15 (31.91%)	2 (20.00%)	35 (48.61%)	8 (50.00%)	3 (50.00%)	65 (42.48%)	
2	11 (23.40%)	4 (40.00%)	13 (18.06%)		1 (16.67%)	29 (18.95%)	
3	3 (6.38%)	3 (30.00%)	14 (19.44%)	5 (31.25%)	1 (16.67%)	26 (16.99%)	
4	17 (36.17%)	1 (10.00%)	10 (13.89%)	3 (18.75%)	1 (16.67%)	32 (20.92%)	
<b>Manual work</b>							0.5
No	23 (48.94%)	6 (60.00%)	49 (68.06%)	9 (56.25%)	2 (33.33%)	90 (58.82%)	
Yes	24 (51.06%)	4 (40.00%)	23 (31.94%)	7 (43.75%)	4 (66.67%)	63 (41.18%)	
<b>Responsibility work?</b>							0.5
No	26 (55.32%)	5 (50.00%)	33 (45.83%)	8 (50.00%)	5 (83.33%)	77 (50.33%)	
Yes	21 (44.68%)	5 (50.00%)	39 (54.17%)	8 (50.00%)	1 (16.67%)	76 (49.67%)	
<b>Intellectual work ?</b>							0.5
No	24 (51.06%)	4 (40.00%)	29 (40.28%)	8 (50.00%)	3 (50.00%)	68 (44.44%)	
Yes	23 (48.94%)	6 (60.00%)	43 (59.72%)	8 (50.00%)	3 (50.00%)	85 (55.56%)	
<b>Year</b>							<b>0.0354*</b>
2000-6	4 (8.51%)	4 (40.00%)	26 (36.11%)	5 (31.25%)	2 (33.33%)	41 (26.80%)	
2007-13	43 (91.49%)	6 (60.00%)	46 (63.89%)	11 (68.75%)	4 (66.67%)	112 (73.20%)	

CPR = cardio pulmonary resuscitation \*P<0.05 \*\*Initial job content was coded using 2008 International Standard Classification of Occupations (ISCO-08) and recoded into four categories based on the first digits 1: managers and professionals; 2: technicians and associate professionals, clerical support workers; 3: services and sales workers ; 4: craft

and related trades workers, plant and machine operators and assemblers, elementary occupations. Missing data are not showed.

**Table 2. Association between return-to-work and relevant variables (sociodemographic, Utstein, work, period)**

	N	n of RTW	%	OR crude	p=	OR adjusted <sup>1</sup>	p=	OR adjusted <sup>1</sup>	p=
<b>Sex</b>					0.6427		0.7519		0.0000
Men	126	78	61.9	1		1		1	
Women	27	18	66.67	1.23 [ 0.51; 2.96]		1.23 [ 0.34; 4.52]		1.58 [ 0.47; 5.32]	
<b>Age (yrs)</b>					0.0025*		0.0072*		0.0000
<45	48	40	83.33	3.87 [ 1.53; 9.79]		3.64 [ 1.10; 12.02]		3.56 [ 1.13; 11.19]	
45-55	55	31	56.36	1		1		1	
≥55	50	25	50	0.77 [ 0.36; 1.67]		0.53 [ 0.20; 1.41]		0.64 [ 0.25; 1.63]	
<b>Bystander on scene</b>					0.6147		0.9123		0.0000
No	4	2	50	1		1		1	
Yes	144	90	62.5	1.67 [ 0.23; 12.18]		1.16 [ 0.09; 15.38]		0.70 [ 0.05; 9.96]	
<b>CPR initiated by bystanders?</b>					0.7565		0.6922		0.0000
No	60	39	65	1		1		1	
Yes	88	55	62.5	0.90 [ 0.45; 1.78]		1.20 [ 0.48; 2.98]		1.29 [ 0.53; 3.15]	
<b>Shockable rhythm</b>					0.0287*		0.281		0.0000
No	20	8	40	1		1		1	
Yes	133	88	66.17	2.93 [ 1.12; 7.69]		2.14 [ 0.54; 8.54]		3.32 [ 0.90; 12.25]	
<b>Cardiac cause?</b>					0.1929		0.4928		0.0000
No	24	12	50	1		1		1	
Yes	123	79	64.23	1.80 [ 0.74; 4.33]		1.59 [ 0.42; 5.97]		1.45 [ 0.42; 5.00]	
<b>Workplace occurrence</b>					0.0094*		0.0244*		0.0000
No	128	75	58.59	1		1		1	
Yes	22	21	95.45	14.84 [ 1.94; 113.75]		11.72 [ 1.37; 99.93]		12.66 [ 1.41; 113.53]	
<b>Job classification**</b>					0.0053*		0.0201*		0.0000
1	65	48	73.85	3.03 [ 1.21; 7.55]		3.43 [ 1.05; 11.22]			
2	29	14	48.28	1		1			
3	26	20	76.92	3.57 [ 1.11; 11.48]		4.69 [ 1.14; 19.37]			
4	32	14	43.75	0.83 [ 0.30; 2.29]		0.89 [ 0.24; 3.27]			
<b>Manual work</b>					0.1251				0.0000
No	90	61	67.78	1				1	
Yes	63	35	55.56	0.59 [ 0.31; 1.16]				0.72 [ 0.24; 2.18]	
<b>Responsibility work?</b>					0.4394				0.0000
No	77	46	59.74	1				1	
Yes	76	50	65.79	1.30 [ 0.67; 2.50]				1.15 [ 0.39; 3.41]	
<b>Intellectual work ?</b>					0.3701				0.0000
No	68	40	58.82	1				1	
Yes	85	56	65.88	1.35 [ 0.70; 2.61]				1.06 [ 0.33; 3.43]	
<b>Year</b>					0.0077*		0.0409*		0.0000
2000-6	41	33	80.49	1		1		1	
2007-13	112	63	56.25	0.31 [ 0.13; 0.74]		0.34 [ 0.12; 0.96]		0.31 [ 0.12; 0.83]	

N=total number, n of RTW= number of return-to-work OR= odds ratio CPR = cardio pulmonary resuscitation <sup>1</sup> All variables included in the model are showed \*P<0.05 \*\*Initial job content was coded using 2008 International Standard Classification of Occupations (ISCO-08) and

recoded into four categories based on the first digits 1: managers and professionals; 2: technicians and associate professionals, clerical support workers; 3: services and sales workers ; 4: craft and related trades workers, plant and machine operators and assemblers, elementary occupations. Missing data are not showed.

Figure 1. Flow chart.

