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Clinical paper

Sex differences in the quality-of-life and functional outcome of cardiac arrest survivors

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Abstract

Aim: Although survival from out-of-hospital cardiac arrest (OHCA) is improving, little is known about the long-term outcome of survivors. In this study, we assess the impact of sex on 12 month functional recovery and health-related quality-of-life (HRQoL) outcomes in OHCA survivors.

Methods: Between 2010 and 2016, consecutive adult OHCA survivors were invited to participate in structured telephone interviews using the Glasgow Outcome Scale–Extended (GOSE), the EuroQol-5D (EQ-5D), and 12-Item Short Form (SF-12) health survey.

Results: Of the 2300 patients discharged alive, 175 (7.6%) died during the follow-up period with the rate of death at 12 months being higher in women compared to men (10.4% vs. 6.4%; $p = 0.002$). Of the 2125 12 month survivors, 1752 (82.5%) participated in the interviews. Unadjusted outcomes were consistently poorer for females compared to males, with fewer women reporting good functional recovery (GOSE ≥ 7, 53.5% vs. 64.8%, $p < 0.001$) and living at home without care (60.7% vs. 76.4%, $p < 0.001$). After adjustment, female sex reduced the odds of good functional recovery (adjusted odds ratio [AOR] 0.69, 95% CI: 0.53–0.88; $p = 0.004$), living at home without care (AOR 0.57, 95% CI: 0.43–0.76; $p < 0.001$), an EQ-5D index score of 1 (AOR 0.57, 95% CI: 0.43–0.75; $p < 0.001$), an SF-12 mental component summary ≥ 50 (AOR 0.56, 95% CI: 0.40–0.78; $p = 0.001$) and an SF-12 physical component summary ≥ 50 (AOR 0.53, 95% CI: 0.39–0.71; $p < 0.001$).

Conclusions: Women report poorer functional recovery and HRQoL after OHCA. Further research is needed to better understand the reasons for these disparities.

Keywords: Cardiac arrest, Resuscitation, Prognosis, Follow-up studies, Quality of life

Introduction

Although survival from out-of-hospital cardiac arrest (OHCA) is often reported to be low,[1] recent systems-based initiatives to expedite access to life-saving interventions have led to significant improvements to survival rates.[2–5] As short-term prognosis improves, however, there is increasing community interest in the long-term functional recovery and health-related quality-of-life (HRQoL) of survivors, and the factors that contribute to optimal recovery after OHCA.[6,7]

Some studies have identified factors that are associated with an increased probability of achieving good functional recovery and HRQoL

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after OHCA, including younger age, initial shockable rhythm, cardiac aetiology, public location and witness status.[6,8–12] What is unclear is whether sex-disparities exist in the long-term outcome of OHCA survivors. Importantly, sex-disparities in treatment and short-term outcomes are well documented,[13] with some studies reporting better survival among women compared to men.[14] There is also evidence which suggests that women are less likely to receive targeted post-resuscitation care and are more likely to have active care withdrawn prematurely.[15–17]

In this study, we examine whether sex differences exist in the 12-month functional outcome and HRQoL of OHCA survivors using a large registry of long-term follow-up of OHCA patients.

Methods

Study design

Between 1st January 2010 and 31st December 2016, we conducted a prospective study involving consecutive patients aged 18 years or older who were discharged alive from hospital following a non-traumatic OHCA. The study, including the collection and use of registry data, was approved the Victorian Department of Health Human Research Ethics Committee as a quality assurance project (#08-02).

Setting

The study was conducted in the Australian state of Victoria, which operates a single state-wide EMS system covering 227,000 sq. km and servicing a population of 5.7 million people. In 2016/17, the EMS responded to more than 850,000 emergency incidents of which 6034 were OHCA events. Advanced life support and intensive care paramedics are dispatched concurrently to suspected OHCA events identified in the emergency call. In most parts of urban and selected areas of rural Victoria, basic life support-trained first responders including fire-fighters and community volunteers are also dispatched to suspected cardiac arrest events.

Data sources

Data for this study were collected from the Victorian Ambulance Cardiac Arrest Registry (VACAR). The VACAR prospectively records details of all OHCA events where EMS are in attendance in the state of Victoria. The registry methodology has been described in detail elsewhere.[4] Since January 2010, adult patients who are discharged alive following OHCA are invited at 12 months post-arrest to undergo structured telephone interview.[18] Before patient contact, the VACAR cross-references all survivor details with state-wide death records from the Victorian Registry of Births, Deaths and Marriages to identify patients who have died during the 12-month period. Patients who are identified as being alive are sent a letter advising of the intention to conduct telephone interviews relating to their quality-of-life. Patients who do not opt out are then contacted by a research assistant experienced in the administration of the HRQoL instruments (described below). At least five attempts are made to contact patients at different time points, including after hours. The patient may elect a proxy (usually a close relative) to be interviewed on their behalf.[18]

Outcome measures

The primary outcome measure of this study was good functional recovery in 12-month survivors measured using the Glasgow Outcome Scale–Extended (GOSE). The secondary outcomes included 12-month mortality, living at home without care, an index score of 1 on the EuroQol-5D-3L (EQ-5D) health survey, and a score $\geq$50 on the 12-Item Short Form (SF-12) health survey for both mental and physical components. The instruments used are described briefly below, and have been validated previously in OHCA survivors.[19]

Glasgow Outcome Scale–Extended (GOSE)

The GOSE is a widely utilised method of rating functional recovery on an eight-point scale from death (score of one) to upper good recovery (score of eight).[20] The GOSE covers domains such as cognition, self-care, mobility, relationship, and social activities. For this study, a score $\geq$7 indicates good functional recovery.

EuroQol-5D-3L (EQ-5D) health survey

The EQ-5D covers five domains including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.[21] An index score is produced ranging from −0.594 to 1, where a score below zero indicates a state 'worse than death' and a score of one indicates the optimal health state. The EQ-5D also administers a visual analogue scale (VAS) which asks patients to rate their pre- and post-arrest health state on a scale from 0 to 100, where zero indicates the worst imaginable health state and 100 indicates the best imaginable health state.

Twelve-Item Short Form (SF-12) health survey

The SF-12 measures HRQoL via two components, including the physical component summary which considers physical functioning, role (physical), bodily pain and general health, and the mental component summary which considers vitality, social functioning, role (emotional) and mental health.[22] Each score ranges from 0 to 100, where a score $\geq$50 indicates no disability and $<$30 indicates severe disability. The SF-12 can also be used to derive the SF-6D, which covers six health dimensions including: physical functioning, role limitation, bodily pain, social functioning, mental state and vitality. Unlike the GOSE and EQ-5D, the SF-12 is not considered appropriate for proxy response.

Data analysis

Statistical analyses were undertaken using Stata Statistical Software 15 (StataCorp, 2018, College Station, TX) and a two-sided significance level $<$0.05 was considered statistically significant. Sex differences in baseline characteristics were compared using the chi-square test and the Wilcoxon rank sum test, as appropriate. In survivors to hospital discharge, we compared sex differences in the rate of death up to 12 months using Kaplan–Meier curves and the log-rank test. Unadjusted outcome measures (GOSE, living status, EQ-5D, and SF-12) were compared between male and female 12-month responders using the chi-square test and the student's t-test, as appropriate. We compared the SF-12 mental and physical component summaries in our population against Australian norms by calculating the standardised mean difference.[23] Differences in the standardised mean difference between men and women were compared using the student's t-test.

Adjusted odds ratios (AORs) for the effect of female sex on 12-month good functional recovery were assessed using multivariable logistic regression models. The models were adjusted for age, arrest aetiology, witness status, bystander cardiopulmonary resuscitation (CPR), public location, initial shockable rhythm, the time between

EMS arrival and return of spontaneous circulation (ROSC) (i.e. time to ROSC), and urban region. We supplemented the primary analysis with a sensitivity analysis consisting of multiple imputation to handle missing outcome data for non-responders. Twenty imputed datasets were generated using the baseline variables described above, and the final model provided AORs and confidence intervals which account for the variance within, and between, imputed datasets. Interaction terms between female sex and age were assessed in these models.

The impact of female sex on the secondary outcomes, including living at home without care, an EQ-5D index score of 1, and an SF-12 mental and physical component summary ≥50, were assessed using the same approach. In addition to the above sensitivity analysis, we also compared the results of our logistic regression models with linear regression models in which we used the continuous values for the EQ-5D index score and SF-12 mental and physical component summaries as the outcome variables.

Results

Patient population

Between 2010 and 2016, a total of 16,787 adult non-traumatic OHCA received an attempted resuscitation by EMS, of which 2300 (13.8%) survived to hospital discharge and were included in the analysis. Sex differences in the baseline characteristics of survivors to hospital discharge are shown in Table S1 of the Supplementary appendix.

12-Month follow-up

Of the 2300 survivors to hospital discharge, 175 (7.6%) died during the 12 month follow-up period. Fig. 1 shows that the probability of death in females was higher than males at three months post-arrest (5.0% vs. 2.6%), six months post-arrest (7.1% vs. 4.5%) and 12 months post-arrest (10.4% vs. 6.4%) (log-rank test, p = 0.002).

Of the 2125 patients eligible for telephone interview, 1752 (82.5%) participated. The mean time between the patient's cardiac arrest and follow-up was 12.4 months (SD, 0.8), and did not differ by sex. The 12 month follow-up rate was lower in females compared to males (76.2% vs. 84.2%, p < 0.001). The majority of non-responders were lost to follow-up (75.1%), but this was lower in females compared to males (67.3% vs. 78.3%, p = 0.02). The remaining non-responders either refused to participate (10.5%), were not appropriate for interview (6.7%), were not a Victorian resident (4.8%), or did not participate for other reasons (2.0%).

Sex-differences in the baseline characteristics of 12-month responders are shown in Table 1. The proportion of females discharged home following arrest was also lower than males (82.4% vs. 88.4%, p = 0.003). Overall, 369 (21.1%) 12-month responders were proxies, and this did not differ by sex. When compared to males, females were less likely to be working before their arrest (37.3% vs. 53.6%, p < 0.001) and reported lower rates of higher education (39.6% vs. 56.4%, p < 0.001). The baseline characteristics of non-responders are shown in Table S2 of the Supplementary appendix.

Unadjusted sex differences in functional recovery and HRQoL

Table 2 shows the unadjusted sex differences in functional recovery and HRQoL outcomes of 12-month responders. According to the GOSE, fewer females reported good functional recovery and there was a concomitant increase in the rate of severe or vegetative disabilities among females (19.8% vs. 11.8%, p < 0.001). The proportion of patients living at home without care was lower in females compared to males (60.7% vs. 76.4%, p < 0.001).

According to the EQ-5D, the mean index score and the proportion of patients with an index score of 1 (best imaginable health status) was lower in females compared to males. Females reported a significantly higher incidence of problems with each of the five EQ-5D health domains, with the largest sex differences being mobility and anxiety/depression (Fig. 2). Although the pre-arrest VAS did not differ between females and males (mean, 79 [SD 18] vs. 80 [SD 19], p = 0.38), females rated their post-arrest health status lower than males (mean, 72 [SD 18] vs. 74 [SD 19], p = 0.04).

The mean SF-12 mental and physical component summaries differed significantly across sexes (Table 2). The proportion of patients with an SF-12 mental or physical component score ≥50 was also lower in females compared with males (p < 0.001 for both). When compared to the population norms, female OHCA survivors reported significantly lower physical component summary scores (standardised mean difference, −0.28, 95% CI: −0.41 to −0.15), although mental component summaries did not differ. When compared to population norms, standardised mean differences were poorer in women compared to men for both mental and physical component summaries (Fig. S1 in the Supplementary appendix). Sex differences in the SF-6D health dimensions are shown in Fig. 3. The largest sex differences were observed for the health dimensions of physical functioning and mental health.

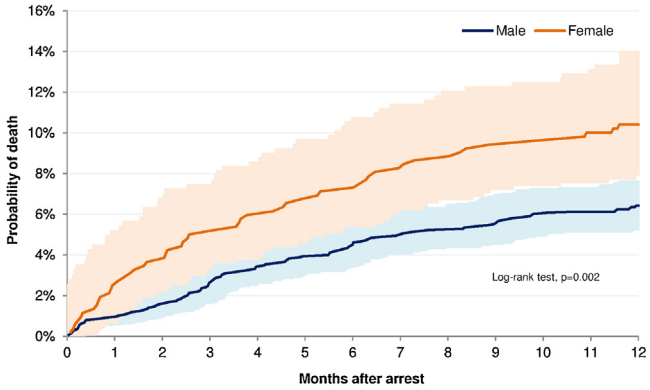

Fig. 1 – Sex differences in the rate of death at 12 month follow-up.

Table 1 – Characteristics of OHCA patients who responded to 12-month follow-up, stratified by sex.

	Overall n = 1752	Male n = 1399	Female n = 353	p-Value
Age in years, median (IQR)	61 (50, 71)	61 (51, 70)	61 (49, 74)	0.62
Arrest aetiology, n (%)				
Cardiac	1610 (91.9)	1309 (93.6)	301 (85.3)	<0.001
Respiratory	65 (3.7)	40 (2.9)	25 (7.1)	<0.001
Drug overdose/poisoning	27 (1.5)	19 (1.4)	8 (2.3)	0.22
Other	50 (2.9)	31 (2.2)	19 (5.4)	0.001
Witness, n (%)				
No witness	182 (10.4)	138 (9.9)	44 (12.5)	0.16
Bystander	994 (56.8)	821 (58.8)	173 (49.0)	0.001
EMS	573 (32.8)	437 (31.3)	136 (38.5)	0.01
Missing	3 (0.2)	3 (0.3)	0	–
Bystander CPR[a], n (%)	981 (83.4)	818 (85.3)	163 (75.1)	<0.001
Arrest location, n (%)				
Private residence	837 (47.8)	625 (44.7)	212 (60.1)	<0.001
Aged care facility or supported accommodation	10 (0.6)	7 (0.5)	3 (0.9)	0.44
Public location	648 (37.0)	569 (40.7)	79 (22.4)	<0.001
Other	257 (14.7)	198 (14.2)	59 (16.7)	0.22
Initial arrest rhythm, n (%)				
Shockable	1472 (84.5)	1213 (87.2)	259 (73.8)	<0.001
Pulseless electrical activity	168 (9.6)	97 (7.0)	71 (20.2)	<0.001
Asystole	98 (5.6)	79 (5.7)	19 (5.4)	0.85
Other non-shockable	4 (0.2)	2 (0.1)	2 (0.6)	0.14
Missing	10 (0.6)	8 (0.6)	2 (0.6)	–
Time intervals, median (IQR)				
Call to EMS arrival[a]	7.3 (5.8, 9.3)	7.3 (5.7, 9.2)	7.3 (5.9, 9.3)	0.92
EMS arrival to first ROSC	6.6 (2.2, 10.9)	6.6 (2.2, 10.9)	4.4 (2.2, 10.9)	0.18
Urban region, n (%)	1335 (76.2)	1070 (76.5)	265 (75.1)	0.58
Discharge direction, n (%)				
Home	1513 (87.2)	1223 (88.4)	290 (82.4)	0.003
Rehabilitation	196 (11.3)	143 (10.3)	53 (15.1)	0.01
Aged care facility	27 (1.6)	18 (1.3)	9 (2.6)	0.09
Missing	16 (0.9)	15 (1.1)	1 (0.3)	–
Responder type, n (%)				
Patient	1383 (78.9)	1097 (78.4)	286 (81.0)	0.28
Proxy	369 (21.1)	302 (21.6)	67 (19.0)	0.28
Highest level of education, n (%)				
Primary/elementary school or less	73 (4.7)	50 (4.0)	23 (7.5)	0.009
High school	663 (42.3)	500 (39.7)	163 (52.9)	<0.001
College or university	832 (53.1)	710 (56.4)	122 (39.6)	<0.001
Missing	184 (10.5)	139 (9.9)	45 (12.8)	–
Work status, n (%)				
Working before arrest	878 (50.3)	747 (53.6)	131 (37.3)	<0.001
Working after arrest, if working prior	648 (74.0)	562 (75.3)	86 (66.2)	0.03
Missing	7 (0.4)	5 (0.4)	2 (0.6)	–

CPR denotes cardiopulmonary resuscitation, EMS emergency medical service, IQR interquartile range, ROSC return of spontaneous circulation. Proportions exclude missing data.
[a] Excludes EMS witnessed arrests.

Adjusted sex differences in functional recovery and HRQoL

Table 3 reports the AORs for the effect of female sex on functional recovery and HRQoL outcomes in 12-month responders. For the primary outcome, female sex was independently associated with a 31% reduction in the odds of good functional recovery according to the GOSE (AOR 0.69, 95% CI: 0.53 to 0.88; p = 0.004). In the sensitivity analysis, imputation of missing outcome data for non-responders led to similar estimates for the effect of female sex on the odds of good functional recovery. In a model testing an interaction term between age and female sex, the interaction term was non-significant (AOR 0.89, 95% CI: 0.76–1.04; p = 0.15).

Table 2 – Health-related outcomes for 12-month responders, stratified by sex.

	Overall	Male	Female	p-Value
	n = 1752	n = 1399	n = 353	
Glasgow Outcome Scale-Extended, n (%)				
Vegetative state	5 (0.3)	2 (0.1)	3 (0.9)	0.03
Lower severe disability	146 (3.4)	106 (7.6)	40 (11.3)	0.03
Upper severe disability	83 (4.8)	56 (4.0)	27 (7.7)	0.004
Lower moderate recovery	146 (8.4)	107 (7.7)	39 (11.1)	0.04
Upper moderate recovery	274 (15.7)	219 (15.8)	55 (15.6)	0.94
Lower good recovery	543 (31.2)	440 (31.7)	103 (29.2)	0.37
Upper good recovery	546 (31.3)	460 (33.1)	86 (24.4)	0.002
Missing	9 (0.5)	9 (0.6)	0	–
Residential status, n (%)				
Living at home without care	1275 (73.2)	1063 (76.4)	212 (60.7)	<0.001
Living at home with care	391 (22.5)	274 (19.7)	117 (33.5)	<0.001
Not living at home	75 (4.3)	55 (4.0)	20 (5.7)	0.14
Missing	11 (0.6)	7 (0.5)	4 (1.1)	–
EQ-5D index score				
Mean (SD)	0.81 (0.25)	0.83 (0.23)	0.72 (0.30)	<0.001
1.00, n (%)	673 (39.9)	579 (43.0)	94 (27.6)	<0.001
0.80–0.99, n (%)	399 (23.6)	309 (22.9)	90 (26.4)	0.18
0.60–0.79, n (%)	414 (24.5)	328 (24.3)	86 (25.2)	0.73
<0.60, n (%)	203 (12.0)	132 (9.8)	71 (20.8)	<0.001
Missing, n (%)	63 (3.6)	51 (3.7)	12 (3.4)	–
EQ-5D VAS, mean (SD)				
VAS before arrest	80 (18)	80 (18)	79 (18)	0.38
VAS after arrest	74 (19)	74 (19)	72 (18)	0.04
SF-12 Mental component summary[a]				
Mean (SD)	54.0 (8.7)	54.6 (8.1)	52.0 (10.4)	<0.001
≥50, n (%)	1080 (80.2)	883 (82.5)	197 (71.6)	<0.001
40–49, n (%)	151 (11.2)	112 (10.5)	39 (14.2)	0.08
30–39, n (%)	78 (5.8)	52 (4.9)	26 (9.5)	0.004
<30, n (%)	37 (2.8)	24 (2.2)	13 (4.7)	0.02
Missing, n (%)	37 (2.7)	26 (2.4)	11 (3.9)	–
SF-12 Physical component summary[a]				
Mean (SD)	46.5 (10.9)	47.3 (10.7)	43.6 (11.3)	<0.001
≥50, n (%)	740 (53.5)	624 (56.9)	116 (40.6)	<0.001
40–49, n (%)	304 (22.6)	232 (21.7)	72 (26.2)	0.11
3–39, n (%)	201 (14.9)	140 (13.1)	61 (22.2)	<0.001
<30, n (%)	138 (10.3)	101 (9.4)	37 (13.5)	0.05
Missing, n (%)	37 (2.7)	26 (2.4)	11 (3.9)	–

IQR denotes interquartile range, VAS visual analogue scale. Proportions exclude missing data.
[a] Patient responders only (n = 1383).

For the secondary outcomes, female sex was independently associated with poorer odds of living at home without care (AOR 0.57, 95% CI: 0.43–0.76; $p < 0.001$), an EQ-5D index score equal to 1 (AOR 0.57, 95% CI: 0.43–0.75; $p < 0.001$), an SF-12 mental component score ≥50 (AOR 0.56, 95% CI: 0.40–0.78; $p = 0.001$) and an SF-12 physical component score ≥50 (AOR 0.53, 95% CI: 0.39–0.71; $p < 0.001$). Similar findings were seen in the sensitivity analyses. None of the models testing an interaction term between age and female sex were significant. Finally, in the models using the continuous outcomes for the EQ-5D and the SF-12, female sex was associated with an adjusted mean difference in the EQ-5D index score of −0.8 (95% CI: −0.11 to −0.05; $p < 0.001$), an adjusted mean difference in the SF-12 mental component summary of −2.1 (95% CI: −3.3 to −0.9; $p < 0.001$) and an adjusted mean difference in the SF-12 physical component summary of −2.8 (95% CI: −4.3 to −1.3; $p < 0.001$).

Discussion

This study presents one of the largest cohorts of long-term follow-up of OHCA survivors reported in the literature so far. Our findings indicate that female survivors of OHCA experience significantly poorer long-term functional outcomes compared to their male counterparts at 12 months post-arrest, even after adjustment for important baseline confounders. We observed significant differences in outcomes between male and female OHCA survivors across all of our functional recovery and HRQoL instruments, including after standardisation to the general population. Female survivors describe significantly more problems with mobility, self-care, performing usual activities, pain and anxiety/depression. According to both the SF-12 and EQ-5D, the most significant differences between male and female responders were observed for the domains relating to mobility/physical functioning and mental health issues.

Although a number of smaller studies have examined factors associated with long-term functional recovery in OHCA survivors, sex has not always been identified as a predictor of outcome. A study from Denmark involving 796 OHCA survivors of working age demonstrated that female survivors were significantly less likely to return to sustainable employment.[12] In comparison, a report from France did not find any sex differences in the likelihood of returning to work after OHCA.[9] The association between sex and long-term HRQoL outcomes in OHCA survivors has also been conflicting. A report from France involving 255 OHCA survivors who completed the SF-36 at a mean time of 38 months following their cardiac arrest showed that women reported significantly more problems with physical functioning, mental health, and bodily pain.[8] In contrast, a study of 110 12-month survivors of OHCA from the Netherlands did not find any sex differences in the SF-36 mental or physical component summaries.[10]

As our registry does not collect information regarding functional recovery at baseline, it is difficult to comment on whether the observed neurological or physical deficits in women were present at the time of hospital discharge. Our data do indicate that female survivors were more likely to be discharged to rehabilitation or aged care facilities and fewer survived to 12 months post-arrest, both of which suggest poorer neurological outcomes at discharge. A recent systematic review of 13 OHCA studies found that female sex was associated with an increased likelihood of survival to hospital discharge, despite fewer favourable arrest characteristics such as initial shockable rhythms.[14] As initial shockable rhythms increase the likelihood of good long-term functional recovery,[18,24] it is plausible that any short-term survival benefit in females is at the expense of poorer neurological outcomes.

There may be differences in the treatment of men and women following OHCA which could also help to explain our findings. Two studies from the United States report that female OHCA patients

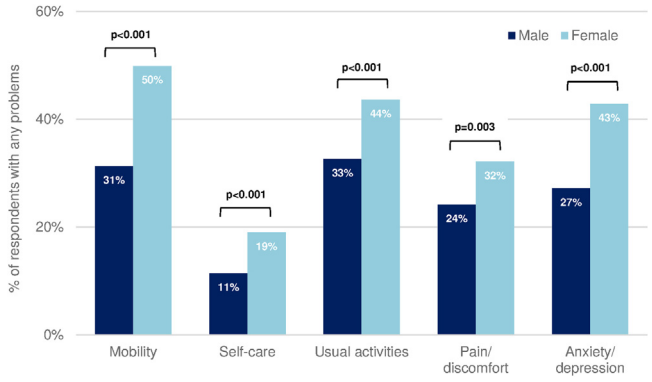

Fig. 2 – Sex differences in the EQ-5D health survey domains for 12-month responders.

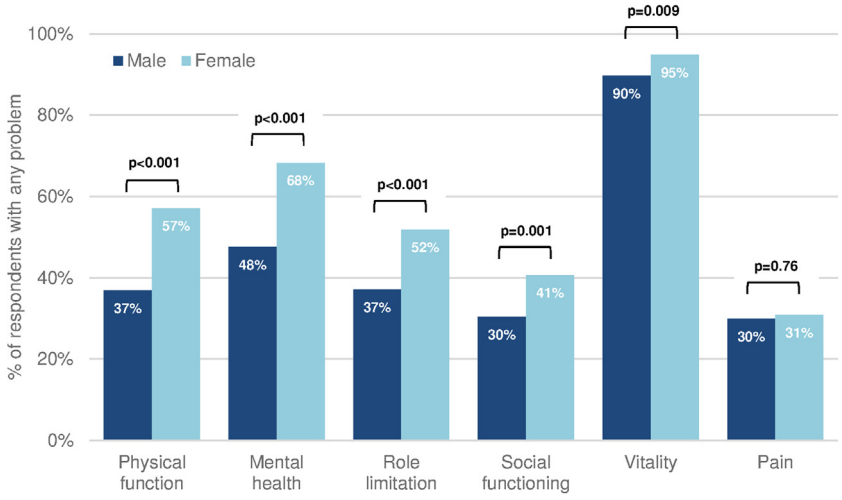

Fig. 3 – Sex differences in the SF-6D health dimensions for 12-month responders.

Table 3 – Adjusted odds ratios (95% CI) for the effect of female sex on 12-month functional recovery and HRQoL outcomes.

	Primary estimate[a]		Sensitivity analysis[a,b]	
	AOR (95% CI)	p-Value	AOR (95% CI)	p-Value
Good functional recovery (GOSE ≥ 7)	0.69 (0.53, 0.88)	0.004	0.68 (0.52, 0.89)	0.005
Living at home without care	0.57 (0.43, 0.76)	<0.001	0.56 (0.41, 0.75)	<0.001
EQ-5D Index score equal to 1	0.57 (0.43, 0.75)	<0.001	0.55 (0.42, 0.73)	<0.001
SF-12 Mental Component ≥50	0.56 (0.40, 0.78)	0.001	0.57 (0.42, 0.78)	0.001
SF-12 Physical Component ≥50	0.53 (0.39, 0.71)	<0.001	0.57 (0.42, 0.76)	<0.001

AOR denotes adjusted odds ratios, CI confidence interval.
[a] Models adjusted for age, arrest aetiology, witness status, bystander CPR, public location, initial shockable rhythm, time to first ROSC and urban region.
[b] Sensitivity analysis consisting of multiple imputation to handle missing outcome data for non-responders.

receive fewer post-resuscitation interventions compared to their male counterparts, including lower rates of coronary angiography, percutaneous coronary intervention and targeted temperature management.[15,25] One of these reports showed that sex differences in survival with good neurological recovery were explained in part by differences in the use of post-resuscitation interventions.[15] Another retrospective study involving 1311 cardiac arrest patients from the United States also demonstrated that female sex was an independent predictor of an increased likelihood of withdrawing life-sustaining therapy.[16] It is possible that sex differences in the adoption of effective post-resuscitation therapies may explain both short-term and long-term differences in neurological recovery.[26]

A number of reports involving acute coronary syndrome,[27] stroke[28,29] and heart failure[30] populations have also reported poorer

long-term HRQoL outcomes in women. A common finding in these reports is the additional number of women reporting mental health issues, and in particular, problems with anxiety and depression.[27–29] In our study, the largest sex-difference was identified in the health domains relating to physical functioning and mental health issues. Depressed mood may be an important reason why a larger number of female survivors of OHCA report issues with physical functioning and usual activities.[28] In addition, caregiver support may be an important modifier in how patients perceive their HRQoL and functional recovery after OHCA, but it is unclear whether the sex of the caregiver also influences the likelihood of achieving optimal neurological recovery. Unfournately, due to limitations in our data we were unable to measure the impact of caregiver characteristics on the HRQoL of survivors. Finally, our study also showed that women were less likely to return to work after surviving their OHCA, which could delay recovery and increase the likelihood of mental health issues.[31]

Limitations

Our study has a number of limitations. Although we had very little missing outcome data among 12-month responders, a total of 373 (17.6%) patients did not participate in the telephone interviews. The proportion of female survivors who did not participate was higher than males, and this may have led to bias in our results. Our sensitivity analysis using multiple imputation attempted to mitigate this by considering variables which could help to explain the pattern of missing data. In addition, 21.1% of our responders were nominated proxies, however, excluding these responses from our study would have limited the generalisability of our findings, particularly among severely disabled or non-English speaking minorities. Interestingly, despite the ethnic diversity of the Australian population, only 6 (0.3%) patients contacted at 12 months did not participate due to a language barrier. In addition, our study examined functional outcomes and HRQoL at 12 months post-arrest so we are unable to demonstrate changes in outcome over a longer period of time. Our study could not adjust for in-hospital treatment factors which may have influenced outcomes, or differences in post cardiac arrest follow-up or rehabilitation. Finally, while our generic measures of HRQoL provide a broad overview of patient's health status, they may fail to capture the complexities of a patient's condition or the outcomes that are important to the patient.[19]

Conclusion

Our study indicates that female survivors of OHCA experience significantly poorer long-term functional outcomes compared to their male counterparts, despite adjustment for a range of baseline characteristics. Although the reasons for this difference remain unclear, female survivors in our study described significantly more mental health issues compared to their male counterparts, a finding which could alter the perception or expectation of recovery. Further research is also needed to better understand the role of post-resuscitation and post-discharge therapies on the likelihood of achieving good long-term functional recovery.

Conflicts of interest

None.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.resuscitation.2019.01.034.

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