Are survivors of cardiac arrest provided with standard cardiac rehabilitation?

Results from a national survey of hospitals and municipalities in Denmark

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Title: Are survivors of cardiac arrest provided with standard cardiac rehabilitation? – Results from a national survey of hospitals and municipalities in Denmark.

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Abstract

Aim

To quantify the provision of standard cardiac rehabilitation to Danish survivors of cardiac arrest at a programme level, and to analyse whether organisational factors influenced the provision.

Method

We mapped the provision of cardiac rehabilitation core components to survivors of cardiac arrest and compared this to a reference group of patients after acute myocardial infarct (AMI) using data from a cross-sectional program-level survey among all hospitals (n=34) and municipalities (n= 98) in Denmark. Organisational factors of potential importance to service provision were considered: health care region, size of catchment area/population, type of department/municipality and socio-economical index.

Results

Response rates for the provision of each core component of cardiac rehabilitation ranged from 64% to 98%. All hospitals and municipalities provided some aspect of cardiac rehabilitation to survivors of cardiac arrest. Across hospitals, provision of four core components of cardiac rehabilitation to survivors of cardiac arrest was lower compared to post AMI patients: patient education (RR=0.45 (95% CI 0.27 to 0.75)), exercise training (RR=0.69 (95% CI 0.49 to 0.98)), screening for anxiety and depression (RR=0.64 (95% CI 0.46 to 0.90), and nutritional counselling RR=0.76 (95% CI 0.62 to 0.93)). No difference was found in the provision of core components across municipalities. Overall, the provision of cardiac rehabilitation to survivors of cardiac arrest was not affected by organizational factors

Conclusion

This study indicates a need for future research to inform the development, adoption and implementation of equal access to all components of cardiac rehabilitation for survivors of cardiac in Denmark

Introduction

Survival after an out-of-hospital cardiac arrest is increasing due to improvements in bystander resuscitation and improved acute hospital care[1,2]. In Denmark, one year survival after out-of-hospital cardiac arrest improved from 3.9% to 16% between 2001 and 2018 meaning there are at least 800 new survivors of out-of-hospital cardiac arrest every year[3]. Cardiac arrest may cause brain injury in up to 50% of survivors of cardiac arrest. This, combined with underlying cardiac conditions, causes survivors to suffer from a wide range of cognitive, psychological or physical problems impacting negatively on their quality of life[2,4,5]. Hence, rehabilitation to meet survivors needs has been recommended in international guidelines including those produced by the European Resuscitation Council[6].

Cardiac rehabilitation is a comprehensive intervention that commonly includes the following core elements: physical training, patient education, psychosocial management and secondary prevention[7]. In Denmark, guidelines state patients should be systematically referred to cardiac rehabilitation after ischemic heart disease[8,9]. An attendance rate of 48% aligns with the standard rate for Europe[10] and the United Kingdom[11]. It has been recommended for survivors of cardiac arrest of cardiac cause for secondary prevention of cardiac disease[12–14] and recent studies have found it to be tolerable and to optimize survivors´ physical condition[15,16].

Post cardiac arrest care has previously been mapped in Sweden and the Netherlands but these studies focused on the post-hospital discharge phase, i.e. the provision of out-patient clinic follow-up to survivors and families[17] and screening for cognitive impairments and referral to cognitive rehabilitation [18]. Mapping the provision of cardiac rehabilitation to survivors of cardiac arrest can inform future development, adoption and implementation of rehabilitation services to the survivors but, to our knowledge, have not previously been undertaken.

In Denmark, cardiac rehabilitation is provided either in hospital or local community settings (referred to as municipalities). The provision has been mapped nationally at a program level every third year since 2013[19]. The 2018 mapping survey collected data on provision to survivors of cardiac arrest for the first time.

Aim

Based on data from the 2018 mapping survey we aimed to quantify the provision of standard cardiac rehabilitation at a programme level to Danish survivors of cardiac arrest and further, to analyse whether organisational factors influenced the provision. Our hypothesis was that cardiac rehabilitation is not systematically provided to Danish survivors of cardiac arrest. Based on earlier findings[9,20,21], we further hypothesised that organisational factors would influence the provision of cardiac rehabilitation to this population..

Method

Study reporting follows the STROBE Statement for cross-sectional studies (www.strobe-statement.org). This cross sectional study used data collected in 2018 as part of a routine nationwide electronic survey among all hospitals (n=34) and municipalities (n= 98) in Denmark. The nationwide survey was designed to map current services and quality of cardiac rehabilitation at a program-level[19]. The survey is administrated by the Danish cardiac rehabilitation Database (DHRD) which has been described in depth elsewhere[9,19]. Hence, only the details of the method relevant to the data in this paper will be described here.

National survey

There were two versions of the survey – one for the hospitals and one for the municipalities – providing similar but context-adapted questions allowing for comparison between the two settings. In Denmark, hospitals provide specialized rehabilitation services, while the main responsibility for

cardiac rehabilitation rests with the municipalities, but with the possibility of outsourcing the services to the hospitals[22].

The hospital survey was constructed from a previously tested and utilized questionnaire[23]. The municipality survey was similar to the hospital version, with minor modifications, for example, the wording was changed from 'hospital' to 'municipality'. Content validity was tested both in the previous and current versions[9].

The hospital and municipality surveys were sent as web-based questionnaires to respondents employed in a leading or coordinating role relevant to local cardiac rehabilitation services. The majority of hospital respondents (n=28) were qualified nurses with clinical responsibility for delivering cardiac rehabilitation. Two were nurses responsible for coordinating provision of cardiac rehabilitation while the remaining four were leaders of cardiology departments. The majority of municipality respondents were leaders with either full responsibility (n=26) or some responsibility (n=18) for the provision of cardiac rehabilitation. Twenty nine were employees working within cardiac rehabilitation and 22 had other positions (e.g. rehabilitation coordinator or rehabilitation consultant). The respondents were encouraged to consult colleagues in case they did not know the answer to a question.

Each respondent received an e-mail invitation to fill out the web-based questionnaire. Two e-mail reminders were sent and finally, remaining non-respondents were contacted by telephone. Surveys were administered using SurveyXact software (Copyright ©Rambøll).

Core components of cardiac rehabilitation

To map the current provision of cardiac rehabilitation services at a program-level, the survey asks about all the core components recommended by the Danish national clinical guidelines for cardiac rehabilitation[8], both overall, and divided into several specific cardiac diagnoses. In previous surveys[9],

only rehabilitation services for ischemic heart disease, heart failure and heart valve disease were mapped. However, in 2018, survivors of cardiac arrest were added to the list of target groups for cardiac rehabilitation in Denmark, with a possibility to mark provision to 'all', 'some' or 'none' of the patients in this diagnostic group. Thus, using data from the 2018 nationwide cross-sectional electronic survey dataset, we were able to map the provision of; exercise training, patient education, psychosocial support, anxiety and depression screening, nutritional counselling and smoking cessation as the core components of rehabilitation provided to survivors of cardiac arrest in both hospitals and municipalities.

Organisational factors

To assess possible differences in the provision of cardiac rehabilitation to survivors of cardiac arrest in relation to organisational factors we collected organisational information as follows:

Hospitals: we sought information regarding health care region (five in total), hospital catchment area, population size, and degree of specialization (cardiology specialist department yes/no).

Municipalities: we extracted data on organizational aspects including health care region, classification according to geography, (urban/suburban/rural), municipality population size, and socioeconomic index; this is calculated by the Danish Ministry of Social Affairs and based on 15 different socioeconomic variables such as education level and number of people without an attachment to the labour market. A socioeconomic index value above 1 means the municipality has a greater expenditure requirement relative to the average of all municipalities while a value below 1 means a lower expenditure requirement. Variables were chosen in accordance with Egholm et al.[9] and information was obtained from the Ministry of Social Affairs and the Interior (www.noegletal.dk).

Statistics

All statistical analyses were performed using the software SAS Enterprise Guide 5.1 (SAS Institute Inc., Cary, NC, USA). We only took responses to the cardiac rehabilitation core components into consideration in the analysis. Descriptive statistics were used for all categorical variables with proportion of hospitals and municipalities described as frequencies and percentages respectively. First, the provision of each cardiac rehabilitation core component to survivors of cardiac arrest were calculated for hospitals and municipalities respectively. Secondly, Chi-square test or Fisher's exact test (when cell count went below five) was used to explore differences in the provision of core components (provided to all vs provided to some or none of the patients) to survivors of cardiac arrest and AMI. When significant difference were explored (p value below 0.05) the relative Risk (RR) was calculated. We used the provision of each core component to patients after acute myocardial infarction (AMI) as a reference since the Danish national rehabilitation guidelines emphasize cardiac rehabilitation for this patient group [8]. Finally, to describe possible differences in the provision of cardiac rehabilitation to survivors of cardiac arrest based on organizational aspects, we grouped hospitals and municipalities into locations that systematically provided a core component to all, and locations that only provided a core component to some or none of the survivors. Except municipality population size which was divided into quartiles, all additional organizational information for hospitals and municipalities was categorized in accordance with Egholm et al [9]. Differences in the provision due to the additional organizational information were tested using Chi-square test or Fisher's exact test when cell count went below five. Level of statistical significance was set at $p<0.05$.

Data approval and ethics

As only program-level data were collected, according to Danish law, approval from The Scientific Ethical Committee was not necessary for this study. Permission to use the survey data was granted by the DHRD steering committee. Names of the survey respondents, hospitals and municipalities were kept confidential.

Results

The survey was sent to all 34 hospitals offering cardiac rehabilitation and all 98 municipalities in Denmark. Study flow is presented in fig. 1. [insert Figure 1.] The proportion of responses on the provision of each of the core components of cardiac rehabilitation was 100% for the hospitals and 97% for the municipalities, irrespective of cardiac diagnosis. Response proportions for provision of each core component in relation to survivors of cardiac arrest were slightly lower, ranging from 64% to 94% for hospitals and 84% to 98% for municipalities. Due to current national organizational issues, screening for anxiety and depression is offered only in hospitals and smoking cessation only in the municipalities[24].

The provision of cardiac rehabilitation core components irrespective of cardiac diagnosis, in Danish hospitals and municipalities is available in appendix 1.

All hospitals and municipalities provided a minimum of one core component to survivors of cardiac arrest and almost all the specific core components were provided to at least some survivors of cardiac arrest by the hospitals and municipalities. The provision of the core components in Danish hospitals and municipalities is illustrated in table 1.

Table 1: The provision of core components in rehabilitation services to survivors of cardiac arrest in Danish hospitals and Municipalities

	Hospitals			Municipalities		
Core component	All patients	Some patients	No patients	All patients	Some patients	No patients
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Patient education	10 (40%)	13 (52%)	2 (8%)	64 (78%)	16 (20%)	2 (2%)
Exercise training	18 (56%)	13 (41%)	1 (3%)	75 (81%)	14 (15%)	4 (4%)
Psychosocial support	24 (77%)	5 (16%)	2 (7%)	52 (62%)	13 (15%)	19 (23)
Screening for Anxiety and depression*	18 (56%)	13 (41%)	1 (3%)	N/A	N/A	N/A
Nutritional counselling	22 (76%)	6 (21%)	1 (3%)	58 (69%)	18 (21%)	8 (10%)
Smoking cessation*	N/A	N/A	N/A	69 (84%)	9 (11%)	4 (5%)

*Due to current national organizational issues, screening for anxiety and depression is offered only in hospitals and smoking cessation only in the municipalities [24].

Fig. 2 illustrates the provision of each core component by hospitals and municipalities to survivors of cardiac arrest compared to post AMI patients [insert Figure 1.]. Significant differences were found for patient education ($p<0.001$), exercise training ($p=0.03$), screening for anxiety and depression ($p=0.01$) and nutritional counselling ($p=0.01$) in hospitals. RR for patient education was RR=0.45 (95% CI 0.27 to 0.75), RR=0.69 (95% CI 0.49 to 0.98) for exercise training, RR=0.64 (95% CI 0.46 to 0.90) for screening for anxiety and depression and RR=0.76 (95% CI 0.62 to 0.93) for nutritional counselling when hospital provision of these components was compared between survivors of cardiac arrest and AMI. In the municipalities, no significant differences were found between survivors of cardiac arrest and AMI.

Organisational factors influencing the provision of cardiac rehabilitation

Differences in the provision of cardiac rehabilitation to survivors of cardiac arrest according to selected organizational factors are displayed in tables 2 and 3 respectively. At a hospital level, only the provision of nutritional counselling varied significantly between regions ($p=0.04$). For municipalities, patient education varied between regions ($p=0.02$) and the provision of exercise training varied with population size ($p<0.001$). No other differences were found based on organizational factors.

Table 2: Proportion of hospitals that provide core components to all (systematic provision) or only some/none survivors of cardiac arrest (no systematic provision) in relation to organizational structure; a) National health care region, b) Population size in catchment area and c) Cardiology specialist department.

	Patient education		**Exercise training**		**Psychosocial support**		**Screening for anxiety and depression**		**Nutritional counselling**	
	Systematic provision	No systematic provision	Systematic provision	No systematic provision	Systematic provision	No systematic provision	Systematic provision	No systematic provision	Systematic provision	No systematic provision
Variable	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Region										
Capital Region	3 (33%)	6 (67%)	5 (56%)	4 (44%)	7 (78%)	2 (22%)	4 (44%)	5 (56%)	9 (100%)	0 (0%)
Region Zealand	4 (80%)	1 (20%)	5 (83%)	1 (17%)	5 (100%)	0 (0%)	3 (60%)	2 (40%)	4 (80%)	1 (20%)
Region of Southern Denmark	6 (86%)	1 (14%)	4 (50%)	4 (50%)	5 (63%)	3 (37%)	4 (50%)	4 (50%)	3 (38%)	5 (62%)
Central Denmark Region	1 (50%)	50 1 (50%)	3 (43%)	4 (57%	5 (83%)	1 (17%)	4 (67%)	2 (33%)	4 (80%)	1 (20%)
North Denmark Region	1 (50%)	1 (50%)	1 (50%)	1 (50%)	2 (67%)	1 (33%)	3 (75%)	1 (25%)	2 (100%)	0 (0%)
	p=0.17		p=0.71		p=0.63		p=0.87		p=0.04	
Population size in catchment area										
<=100.000	2 (40%)	3 (60%)	4 (80%)	1 (20%)	3 (60%)	2 (40%)	3 (60%)	2 (40%)	4 (80%)	1 (20%)
>100.000 - <=200.000	7 (47%)	8 (53%)	11 (58%)	8 (42%)	16 (84%)	3 (16%)	11 (55%)	9 (45%)	14 (78%)	4 (22%)
>200.000 - <=300.000	1 (33%)	2 (67%)	2 (40%)	3 (60%)	4 (100%)	0 (0%)	3 (75%)	1 (25%)	3 (100%)	0 (0%)
>300.000	0 (0%)	2 (100%)	1 (33%)	2 (67%)	1 (33%)	2 (67%)	1 (33%)	2(67)	1 (33%)	2 (67%)
	p=0.91		p=0.52		p=0.10		p=0.79		p=0.35	
Specialist cardiology department										
No	6 (46%)	7 (54%)	9 (47%)	10 (53%)	13 (72%)	5 (28%)	11 (58%)	8 (42%)	13 (81%)	3 (19%)
Yes	4 (33%)	8 (67%)	9 (69%)	4 (31%)	11 (85%)	2 (15%)	7 (54%)	6 (46%)	9 (69%)	4 (31%)
	p=0.69		p=0.30		p=0.67		p=0.82*		p=0.67	

*P-value calculated from a Chi-square test instead of a Fisher's exact test

Table 3: Proportions of municipalities that provide core components to all (systematic provision) or only some/none survivors of cardiac arrest (no systematic provision) in relation to organizational structure; a) National health care region, b) Population size in catchment area, c) Classification (geographical) and d) Socio-economic index

	Patient education		**Exercise training**		**Psychosocial support**		**Nutritional counselling**		**Smoking cessation**	
	Systematic provision	No systematic provision	Systematic provision	No systematic provision	Systematic provision	No systematic provision	Systematic provision	No systematic provision	Systematic provision	No systematic provision
Variable										
Region										
Capital Region	18 (72%)	7 (28%)	27 (93%)	2 (75%)	15 (58%)	11 (42%)	17 (63%)	10 (37%)	16 (76%)	5 (23%)
Region Zealand	10 (91)	(9%)	12 (80%)	3 (20%)	8 (73%)	3 (27%)	10 (91%)	1 (9%)	13 (93%)	1 (7%)
Region of Southern Denmark	8 (47%)	9 (53%)	14 (70%)	6 (30%)	7 (39%)	11 (61%)	10 (59%)	7 (41%)	14 (74%)	5 (26 %)
Central Denmark Region	16 (89%)	2 (11%)	14 (82%)	3 (18%)	13 (72(%)	5 (28%)	13 (72%)	5 (28%)	15 (88%)	2 (12%)
North Denmark Region	10 (91%)	1 (9%)	7 (64%)	4 (36%)	9 (82%)	2 (18%)	13 (72%)	(28%)	11 (100%)	0 (0%)
	p=0.02		p=0.14		p=0.13		p=0.44		p=0.26	
Population size in catchment area										
<=29.669	17 (81%)	4 (19%)	23 (96%)	1 (4%)	13 (62%)	8 (38%)	16 (73%)	6 (27%)	17 (89%)	2 (11%)
>29.669- <=42.884	16 (84%)	3 (16%)	20 (90%)	2 (9%)	13 (68%)	6 (32%)	15 (75%)	5 (25%)	17 (85%)	3 (15%)
>42.884 - <=60.356	16 (80%)	4 (20%)	19 (83%)	4 (17%)	15 (68%)	7 32%)	15 (75%)	5 (25%)	18 (82%)	4 (18%)
>60.356	13 (59%)	9 (41%)	12 (52%)	11 (47%)	11 (50%)	11 (50%)	12 (55%)	10 (45%)	17 (81%)	4 (19%)
	p=0.26		p<0.001		p=0.59		p=0.43		p=0.90	
Geographical Classification										
Urban	21 (72%)	8 (28%)	31 (89%)	4 (11%)	20 (67%)	10 (33%)	20 (65%)	11 (35%)	22 (85%)	4 (15%)
Suburban	9 (75%)	3 (25%)	12 (80%)	3 (20%)	7 (58%)	5 (42%)	10 (77%)	3 (23%)	11 (79%)	3 (21%)
Rural	32 (78%)	9 (22%)	31 (74%)	11 (26%)	25 (60%)	17 (40%)	28 (70%)	12 (30%)	36 (86%)	6 (14%)
	p=0.93		p=0.25		p=0.82		P=0.78		p=0.85	
Socioeconomic index										
Low (below index 1)	27 (69%)	23 (31%)	38 (84%)	7 (16%)	26 (65%)	14 (35%)	27 (66%)	14 (34%)	35 (81%)	8 (19%)
High (over index 1)	35 (81%)	8 (19%)	36 (77%)	11 (23%)	26 (59%)	18 (41%)	31 (72%)	12 (28%)	34 (87%)	5 (13%)
	p=0.30		p=0.43		p=0.66		p=0.64		p=0.55	

Discussion

This study is, to our knowledge, the first to report on the provision of standard cardiac rehabilitation following cardiac arrest. We found that survivors of cardiac arrest to some extent are provided with standard cardiac rehabilitation by hospitals and municipalities in Denmark, but at hospital level rehabilitation is provided less consistently to survivors of cardiac arrest than to AMI patients. For municipalities, the provision of psychosocial support was broadly low for both survivors and AMI patients. Overall, the provision of standard cardiac rehabilitation aimed at survivors of cardiac arrest was similar across the health care regions and was not affected by organizational factors.

Post-cardiac arrest care has previously been mapped in Sweden and the Netherlands but these studies focused on the post-hospital discharge phase, i.e. the provision of out-patient clinic follow-up to survivors and families[17] and screening for cognitive impairments and referral to cognitive rehabilitation[18]. Results showed that these post-hospital care elements were far from successfully implemented despite existing international recommendations for rehabilitation after cardiac arrest[6]. We show a similar situation for rehabilitation after hospital discharge in our study.

Similar to other countries, Denmark currently has no clinical guidelines on post-cardiac arrest care, including rehabilitation. Danish national cardiac rehabilitation guidelines state that patients diagnosed with ischemic heart disease, heart failure or after heart valve replacement should be systematically referred to cardiac rehabilitation[8,9]. Despite the lack of national guidelines addressing rehabilitation services for survivors of cardiac arrest, our results show that all hospitals and municipalities in Denmark deliver some components of standard cardiac rehabilitation to survivors of cardiac arrest. Still the hospital results show that a lower proportion of survivors of cardiac arrest were provided with four core components of cardiac rehabilitation (patient education, exercise training, screening for anxiety and depression and nutritional counselling) compared to AMI patients. This lower hospital level provision was found to be independent of the organizational factors analyzed in this study. In

contrast, there was no difference in the proportion of municipalities providing cardiac rehabilitation to survivors of cardiac arrest and AMI. A possible explanation could be that a patient with a sudden cardiac arrest caused by coronary heart disease is routinely referred by the hospital to the municipality for cardiac rehabilitation in line with current guidelines for coronary heart disease or heart failure[8]. In the municipalities, the provision of cardiac rehabilitation services to survivors of cardiac arrest is likely to be generic and based on one of the underlying diseases that is mentioned in the national guidelines for cardiac rehabilitation[8] – hence similar to AMI. Conversely, the survivors of cardiac arrest population at the hospital level do not follow the coronary heart disease referral pathway into cardiac rehabilitation and are therefore not seen in standard cardiac rehabilitation services. However, further research in referral pathways for survivors of cardiac arrest is required to determine whether this explanation is accurate.

Previous studies found that organisational factors (e.g. health care region, population size of the catchment area, and classification according to geography) influenced the provision of cardiac rehabilitation[9,20,21].We only found a few statistically significant differences in the organisational factors. This is likely explained by the small sample size, in particular for hospitals. While not statistically significant, there are variations in provisions between sites, (e.g. variation in the systematic provision of exercise training in hospitals and municipalities in relation to the population size), which may be relevant for practise. Also it is plausible that other organisational factors than those included in this study may affect provision, as contextual factors are known to influence the implementation of interventions in healthcare[25].

Provision of standard cardiac rehabilitation is recommended in international literature, and has been demonstrated to be tolerated by patients with a cardiac cause of cardiac arrest as secondary prevention and to optimize their physical condition[12–16]. Cardiac rehabilitation has been extensively tested, improved and implemented[10,26]. Hence, the aim of further research should not be to reinvent cardiac

rehabilitation for cardiac arrest survivors. Rather, it should be to develop and adopt components that can be added to cardiac rehabilitation to meet the needs of survivors beyond their cardiac disease. For example, cognitive screening and interventions for cognitive deficits are not a part of standardised cardiac rehabilitation but are internationally recommended as essential components of rehabilitation after cardiac arrest[6–8,13]. Furthermore, current cardiac rehabilitation services do not meet the needs of caregivers. These are also recommended as recipients of rehabilitation after cardiac arrest as they are likely to suffer from emotional problems, including symptoms of post-traumatic stress after witnessing a cardiac arrest[27–31]. In addition, studies could focus on which implementation strategies that would be most successful in hospitals and municipality settings respectively. Hereby, research will support the implementation of standardized clinical pathways that allow tailored access to interventions that meet the individual needs of survivors. Our results demonstrate that in Denmark only to some extent and for some survivors are cardiac rehabilitation needs met. National rehabilitation guidelines that promote the provision of cardiac and cognitive rehabilitation to cardiac arrest survivors may be a solution to enhance rehabilitation services to this highly burdened patient group and their caregivers.

Limitations

This study is the first to map current provision of standard cardiac rehabilitation to survivors of cardiac arrest in Denmark and thus provides a benchmark to which the success of initiatives to improve the provision of rehabilitation can be assessed. Still, our study also has limitations, which must be considered when interpreting the findings. The 2018 nationwide cross-sectional survey was originally designed to map the provision of cardiac rehabilitation to ischemic heart patients and was not designed to map rehabilitation services for survivors of cardiac arrest. Data were self-reported and there was no requirement for specific evidence to be uploaded with the survey responses. Response options addressing cardiac arrest survivors were limited to the provision of cardiac

rehabilitation core components without the possibility to add additional information or services (e.g. the provision of cognitive rehabilitation or rehabilitation to family). Although the response rate for questions related to cardiac arrest survivors was lower than that of the overall response rate (response rate ranged from 64% to 94%), it was still above the 60% often regarded as acceptable[32]. Nonetheless, due to relative small population sizes (34 hospitals and 98 municipalities) the rate of missing responses likely reduce the strength in some of our analyses. Furthermore, the national survey was developed to quantify the provision of standard cardiac rehabilitation in an organizational context with the response categories "All" "Some" or "None" for each cardiac rehabilitation core component. Nevertheless, this induces uncertainty in quantifying the proportion of patients in each response category. We cannot tell if the response "none" reflects whether the service is not provided or that the service not is needed since patients are simply not referred.

To ensure an overview of the local cardiac rehabilitation provision, responders were all in leading or coordinating roles. Previous research within the field of cardiac rehabilitation indicates that staff in leading and coordinating roles may have differing perceptions of quality improvement issues[33]. Hence, leaders and coordinators could have varying views, knowledge and/or interest in the same question, which may induce potential bias in our results. Another issue is social-desirability bias where responders base their answers on social expectations rather than current practice. If present in our study, this would have caused an overestimation of the current provision and hence, not affect our overall conclusion - only strengthen it. Still, data were self-reported factors of evidence of were uploaded in the survey.

While this study may be useful to inform the implementation of rehabilitation to survivors of cardiac arrest in Denmark, it also highlights the general importance of studying the provision of rehabilitation services to this specific group of patients, and provides simple solution to do so. In addition, our study, creates national knowledge in the provision of rehabilitation services recommended to this

group of patients[6], which is important for visualizing the expansion and implementation of post-cardiac arrest care around the world.

In conclusion, our study indicates that, positively, all hospitals and municipalities in Denmark offer some components of cardiac rehabilitation to all or some survivors of cardiac arrest. This is despite the lack of national guidelines in Denmark for rehabilitation after cardiac arrest. However, there it still room for improvement. Hospital based cardiac rehabilitation provision to survivors of cardiac arrest remains lower than to patients suffering from an AMI. In addition, municipality provision of psychosocial support was low for both cardiac arrest survivors and AMI patients. Further research should support the implementation of standardized clinical pathways and help inform the development of national guidelines to promote the provision of rehabilitation after a cardiac arrest.

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Declaration of Conflicting Interests

The Authors declare that there is no conflicts of interest

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