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Dropout during a 12-week, Transitional, Exercise-based Cardiac Rehabilitation Program: a Mixed-methods Prospective Cohort Study

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Abstract

Aim: Investigate the dropout rate during a 12-week transitional exercise-based cardiac rehabilitation (exCR) program focusing on a halfway transition phase between hospital and the municipality based cardiac rehabilitation. Secondly, investigate patient characteristics associated with dropout at the transition.

Methods: Patients with coronary heart disease, heart failure or heart valve surgery referred to exCR were included in a prospective cohort study conducted between 1.3.2018-28.2.2019 at Zealand University Hospital. ExCR was initiated at the hospital with a halfway transitional to local health care centres in the municipalities. Dropouts were identified every third week through telephone interviews. A Kaplan-Meier time-to-event analysis was used to investigate time to dropout, while multiple logistic regression assessed associations between patient characteristics and dropout at the transition.

Results: Of 560 patients eligible for exCR, 279 participated in the study. Fourteen patients were lost to follow up and 103 dropped out, resulting in a dropout rate of 39% (95% CI: 33% to 45%). Of the 103 dropouts, 72 patients (70%) dropped out at the transition. In the adjusted analysis, patients attached to the labour market were associated with dropout at the transition (OR=6.31 (95% CI: 2.04 to 19.54)). Further, odds of dropping out at transition were reduced for each extra exercise session attended (OR=0.79 (95% CI: 0.66 to 0.94)).

Conclusion: The transition phase constitutes a critical dropout period in exCR, in which increased attention on patient adherence is needed. In clinical practice, communication and strategies addressing patient retention across settings could be essential to prevent dropout in transitional exCR.

Introduction

The benefits of cardiac rehabilitation are well established, including reductions in cardiovascular mortality and re-hospitalization (1,2). Despite the evidence, uptake of cardiac rehabilitation remains low (3,4). In Europe, only half of all eligible cardiac patients participate in rehabilitation with some countries having an even lower participation rate (3,4). Another challenge is high dropout rates, with 20% to 56% of patients dropping out during the rehabilitation period (4–6). In exercise-based cardiac rehabilitation (exCR) a dose-response relationship between number of attended exercise sessions and mortality has been documented (7–9), highlighting the importance of retaining patients for as many sessions as possible.

A large number of factors have showed to increase the likelihood for dropping out in exCR with some of the most evident barriers to completion being gender, age and cardiac diagnosis, but including also body mass index, family status, occupational status, education level, smoking, accessibility to cardiac rehabilitation facilities, anxiety/depression symptoms and lower exercise capacity (4,10–13). Beswick et al. in 2004 summarize the many possible reasons identified by health professionals and patients into three overall categories (14). Patient factors concerning e.g. lack of interest or work commitments for the patients, professional factors regarding e.g. attitudes or referral issues among the health professionals and service factors relating to e.g. location of and accessibility to the healthcare centre (14).

In relation to service factors the organization of cardiac rehabilitation has changed during recent years (15). An international trend has been to move patient care outside the hospitals, either to community-based centres, to the patients' homes or GP clinics (15). The rationale is to increase accessibility to rehabilitation by moving the health services closer to patients in an attempt to increase the completion rates and prevent dropout from cardiac rehabilitation

(11,13). In 2007, the responsibility for CR services in Denmark shifted from a regional level (responsible for hospital management) to a shared responsibility between regional and local community level (administrative entities called municipalities) (16). Hence, in Denmark, exCR is delivered in all of the 98 municipalities, only specialized services are provided at the hospitals. The majority of patients without specialized needs will therefore have a transition from the hospital to the municipality (17). In Denmark this transition happened either at the beginning of the exCR program (phase II) or halfway through (18). Overall, surprisingly little information is available on the impact of having a transition phase.

Knowledge on how transition influences the rehabilitation pathway and if the likelihood for dropping out in the transition phase also is associated with the commonly reported patient characteristics known to influence dropout in traditional exCR (4,10–13) is, to our knowledge, not available for exCR - or for other patient groups.

Several studies have provided knowledge on how to promote enrolment in cardiac rehabilitation, but how to decrease dropout from the program are still needed (19). Yet this is of importance to support development of organizational strategies to increase patient participation and retention in rehabilitation which, judging by the low completion rates in exCR, are highly needed (3,4).

The primary aim of this study was to investigate the dropout rate during a 12-week transitional exCR program with a special focus on the transition phase between hospital and municipalities occurring halfway through the program. Secondly, to investigate patient characteristics associated with dropout at the transition phase. The hypothesis was that the transition phase creates a critical period for dropout during the exCR program.

Methods

Design

The study was designed as a mixed-methods prospective cohort study using data from a clinical cohort coordinated by the Department of Physiotherapy and Occupational Therapy, Zealand University Hospital and conducted to explore overall completion rates in exCR. Study reporting is in accordance with the STROBE guidelines (20).

According to Danish law, research using questionnaires or registry-based research without human biological material does not require approval from an ethics committee (21); however, the study conformed to the principles of the Declaration of Helsinki. Written informed consent was collected, and all participants were informed both verbally and in writing and could withdraw their consent at any time. The study was approved by The Danish Data Protection Agency (REG-003-2018).

Study population

The study population consisted of patients hospitalized at the Department of Cardiology, Zealand University Hospital and referred to exCR between 01.03.18 and 28.02.19. Patients were hospitalized with either coronary heart disease, heart valve surgery or heart failure. Patients with physical or mental disabilities restricting them from participating in exCR were excluded. Patients never attending any of the scheduled supervised exercise sessions and patients without a telephone or unable to speak or understand Danish were excluded.

Procedures

All patients attended a preliminary examination with a physiotherapist, one to two weeks after hospital discharge. After the examination, patients were invited to participate in a 12-week standardized transitional exCR program based on national clinical guidelines (22).

The program consisted of 24 exercise sessions with a transition from hospital setting to the municipalities between exercise session number 12 and 13.

Each exercise session lasting 60 minutes performed two times per week and supervised by a physiotherapist both at the hospital and in the municipalities. The exCR was group-based but consisted of an individually-adapted progressive exercise program with a combination of aerobic exercises (ranging from moderate to high intensities) and strengthening exercises. In addition to the Danish guidelines for cardiac rehabilitation, the program further encompassed patient education, risk factor management and healthy lifestyle behaviour, scheduled with 3 sessions for patients with coronary heart disease and heart valve surgery and 2 sessions for patients with heart failure, delivered parallel with the exercise based intervention by a multidisciplinary team (18).

All patients started the first 6 weeks of the exCR program at the Zealand University Hospital. As a follow on from the hospital-based program, patients continued the next 6 weeks at local health care centres in the municipalities where the patients were living. All programs were placed during daytime within normal work hours. During the final exercise session at the hospital, a physiotherapist discussed goals and rehabilitation plan together with the patient and helped arrange the transition between hospital and the municipality. Hereafter, patients were invited to an individual pre-examination performed by a physiotherapist in the municipality, including the same set of physical tests as in the hospital and a resetting of goals. Goals were based on patients' needs and wishes together with the physiotherapist. After exercise session 24, the last session, patients were invited for a final examination containing same set of tests and evaluation of the goalsetting. Before entering the exCR, patients were informed about this being one intervention performed in two settings. Information between hospital and the municipalities exchanged through a national electronic referral system.

Data collection

Dropout

The primary outcome of the study was dropout during the 12-week exCR period. Data was collected through telephone interviews conducted every third week by research assistants. The interviews were performed using a standard manual designed for the study. Patients were asked about their attendance in the exCR program the past three weeks. If a patient dropped out, the exercise session number of the dropout was registered (number 2-23). If a patient dropped out at the transition phase, between exercise session number 12 and 13, this was registered as an independent data point. Patients who during the telephone interview stated they no longer participated in the exCR were defined as dropouts. After dropout, patients were no longer contacted and did not attend any more exercise sessions. All other patients were defined as completers. Number of attended exercise sessions did not have an influence on the definition of dropouts or completers.

Patients were classified as lost to follow-up if they either died during follow-up or the interviewer was not able to get in touch with them before the 12-week study period had ended.

All patients who dropped out were asked the same question by the interviewer: “*May I ask, what your reason is for dropping out?*”. All answers were transcribed verbatim by the same interviewer who conducted the telephone interview.

Patient characteristics

Patient characteristics were collected either through a self-reported questionnaire handed to patients during the preliminary examination or from medical records. Number of attended exercise sessions were collected through the telephone interview every third week.

Gender, age, weight, height, family status, occupational status (employed vs. unemployed, early retirement or retired person), education level and smoking habits were extracted from the questionnaire. Medical records were reviewed for cardiac diagnoses, distance to the

hospital and the municipality and results from following tests. A submaximal cycling test (Borg 15) preformed with a progressive load, using Borg Rate of Perceived Exertion (RPE) scale to determine level of exhaustion (23). Hospital Anxiety and Depression Scale (HADS) (24) ranging from 0-21, where a lower score indicates a low risk of mood disorder. Finally, a disease-specific, self-reported health related quality of life questionnaire, (HeartQoL) (25) was measured in three categories: physical, mental, and global score ranging from 0 to 3, where a higher score indicates a better health related quality of life. Test and questionnaires was performed according to national recommendations for cardiac rehabilitation (18).

Data analysis

Data regarding patient characteristics are presented for the total study population, and further subdivided into completers and patients dropping out at transition. Normally distributed data are presented as mean and standard deviation (SD), non-parametric data as median and interquartile ranges (IQR) and categorical variables as numbers (n) and proportions (%).

Baseline differences between completers and dropouts at transition were investigated using an independent-samples t-test for normally distributed data, Mann-Whitney test for non-parametric data and chi-squared test for categorical variables.

Time-to-event analysis using the Kaplan-Meier method was used to investigate the overall dropout from the 12-week exCR program in the total study population. This also included patients who were lost to follow up (patients who had died or did not answer the telephone) as the Kaplan-Meier method allows these to be right censored, meaning they are being accounted for in the analysis as long as data are available. Time to event was defined as the period between start of the exCR program until dropout. The confidence interval for the Kaplan-Meier curve was estimated using the standard error (26). The dropout rate and estimated 95% confidence interval (CI) were calculated and reported. The dropout rate is

visually presented as a single Kaplan-Meier curve and the dropout rate and 95% CI were reported for every three weeks.

Secondly, to assess associations between selected patient characteristics and dropout at the transition phase, we conducted a multiple logistic regression analysis including the most evident predictors for dropout in exCR based on existing literature (gender, age and cardiac diagnoses) (4,10–13) and significant baseline differences in patient characteristics between completers and patients dropping out at transition. Due to the nature of an explorative study and the very few instances of missing data (four patients) data were not imputed. The results are presented as odds ratio (OR) with 95% CI. The Hosmer-Lemeshow test was used to evaluate the goodness of fit of the logistic regression model (27). Model assumption was met if p-value > 0.05. We further evaluated influential observations using diagnostic plots showing the deviance and leverage of each observation and the Pearson residual and assessed multicollinearity with a variance inflation factor (VIP) threshold of >5 (28). Calculation of chi-squared (χ^2) and corresponding p-values, the coefficient of determination (*McFadden's pseudo R²*) and the correctly predicted percentage were further calculated for the model. The final model had no influential observations, it met the standard of the Hosmer-Lemeshow goodness of fit test (p>0.05) (27), the assumption of no multicollinearity was met (VIF<3) and with a 73% correctly predicted percentage it was considered acceptable (29).

The statistical software STATA/IC, version 16.0 (StataCorp, College Station, Texas, USA) was used for all data analyses. The level of significance was set at p-value < 0.05.

Qualitative responses to why a patient dropped out were read twice and shortened down into central keywords. Subsequently, the different keywords were divided into overarching categories by the first author (CGS), reflecting the responses. Keywords, responses and the overarching categories were double-checked by and discussed with another author (BB) to

ensure they reflected the data. Finally, the overarching categories are presented as numbers and proportions and further divided into; patient, professional and service factors following the framework of Beswick et al. (14).

Results

Study flow

After the preliminary examination, 560 patients were eligible for participation in the exCR program, from which 279 patients (50%) accepted the invitation to participate in the study.

The total study population ended in 265 of the 279 patients (95 %) (Figure 1).

Patient characteristics of the total study population

The majority of the study population (n=265) was male (77%), the mean age was 68.1 years (SD=10.3) and the most prevalent cardiac diagnosis was coronary heart disease (57%) (Table 1).

Dropout during the 12-week exCR program

A total of 279 patients started the exCR program, 14 were lost to follow-up, leaving data regarding time for dropout in 265 patients, of those 103 patients dropped out. At exercise session number 6, a total of 8 patients (3% (95% CI: 1% to 6%)) from the entire population had dropped out. At exercise session 12, 18 patients (7% (95% CI: 4% to 10%)) had dropped out. At exercise session number 18, 96 patients had dropped out (36% (95% CI: 31% to 42%)) and at the end of the program (exercise session 24) a total of 103 patients (39% (95% CI: 33% to 45%)) had dropped out of the total population (Figure 2).

Of the 103 patient that dropped out, 72 patients (70 %) dropped out at the transition phase between the hospital and the municipalities. In comparison, 18 patients (17%) dropped out during the hospital phase and 13 patients (13%) at the municipality phase.

Associations between patient characteristics and dropout at the transition

A multiple logistic regression model containing gender, age, cardiac diagnosis, occupational status and number of attended exercise sessions until transition was developed. Being attached to the labour market was significantly associated with dropout at the transition compared to not being attached to the labour market OR=6.31 (95% CI: 2.04 to 19.54). Further, the odds of dropping out at transition were reduced for each extra exercise session attended until the transition OR=0.79 (95% CI: 0.66 to 0.94) (Table 2).

Reasons for dropping out

A total of 103 patients dropped out of the exCR program, all patients were asked about the reason for the dropout. Of the 103 reasons gathered, 8 patients stated two reasons for dropout at the transition and 2 patients stated two reasons for dropout in the hospital or municipalities resulting in 113 reasons for dropout. At the transition phase, the most frequently reported answer for dropout was that patients had to return to work with 24%. The most frequently reported reason for dropout at the hospital or the municipalities was related to comorbidities with 39% (Table 3).

Results from the three categories inspired by Beswich et al. in 2004 (14) point towards patient factors as the main reason for dropout from both the transition phase and the hospital or municipalities (Table 3).

Discussion

We investigated dropout during a 12-week exCR program with a transition phase between hospital and municipalities after 6 weeks. In total, 39% of the patients dropped out during the rehabilitation, and of these, 70% of dropouts occurred at the transition phase. Patients attached to the labour market and patients who attended less exercise sessions before transition were more likely to drop out at the transition. Our findings highlight the need for an increased focus on effective strategies to prevent dropout in exCR, especially at the transition from one setting to another.

An overall dropout rate of 39% found in our study is in line with other international and more traditional cardiac rehabilitation studies, where rates range from 20% to 56% (4–6). Variation in dropout rates across countries is expected due to organizational differences in rehabilitation interventions and health care systems (15). The total dropout rate from our study also concurs with a previous Danish study of a transitional exCR program that reported a total dropout rate of 35% (30).

Previous literature from traditional cardiac rehabilitation programs has suggested that factors as easier accessibility and enhancement of social support in local health care centres could increase completion rates and lower dropout from exCR (11,13). However, it has also been hypothesized that the transition phase influences patient care pathways and constitutes a barrier for patients' participation (31). This has, to our knowledge, never previously been scientifically studied.

Our study showed that having a structured transition from hospital to the municipality does facilitate the continuation of 61%, but further adaptations are needed to prevent the 39% dropout so that the maintenance of exercise is continued. Since 70% of the total dropouts occur in the transition phase between hospital and the municipality the transition phase is a barrier for further continuation and exceeds the benefit of easier accessibility and

enhancement of social support in local health care centres for a high number of cardiac patients. This highlights that the transition phase is a critical period for patient dropout. Consequently, focus on and adaptations of the transition phase seem essential, and more knowledge on reasons for discontinuation and patient needs and wishes in order to complete exCR is necessary. Future research should also address critical time periods in exCR.

In general, transitional rehabilitation is an international trend as more and more people are referred to local health care centres or home-based intervention (15). Despite this, surprisingly little information exists on the impact of the transition on the cardiac rehabilitation pathway. Hence, our study is the first to create greater insight into the consequences of having a transition between settings in exCR. However, our data is collected in an exCR program with the transition phase halfway through the program. Investigations into whether results from such organization, with a transition phase halfway through the program, could be generalizable to other exCR programs where the transition occurs e.g. at the beginning of the program is needed. Nonetheless, our findings point towards an increased focus and further research in patient care pathways across settings and strategies to enhance retention as the transition constitutes a potentially critical dropout period in exCR.

We found that number of attended exercise sessions were associated with dropout at transition indicating that patients attending less exercise sessions were more likely to dropout at the transitions phase. Studies have reported an association between attended exCR sessions and long-term risks, e.g. mortality and adverse events (7–9). The dose-response relationship highlights the importance of following clinical guidelines for cardiac rehabilitation of a minimum of 24 exercise sessions over 8-12 weeks (22). In the present study, 34% of the total population had dropped out at the transition phase, resulting in patients only receiving 50% or less of the intended exercise sessions. Results from a more traditional cardiac rehabilitation program in Denmark shows that 76% of patients attended at least 75% of the scheduled

exercise sessions in hospital (32) and 54% attended at least 80% of the scheduled exercise sessions in the municipality (33). Normally, individual patient benefits will be assessed after exCR completion. For this reason, the effect of exCR participation remains unknown for those who drop out. Nonetheless, based on our findings and the existing dose-response relationship (7–9), exCR programs with a transition phase may result in insignificant health benefits for a large proportion of patients due to a high dropout rate at the transition.

Patients attached to the labour market were also associated with a dropout at the transition phase (adjusted OR=6.31 (95% CI: 2.04 to 19.54)), supported by the most common reason provided from the patients “Had to return to work” by 24%. The same reason is found in the National Audit of Cardiac Rehabilitation from the British Heart Foundation where especially younger male patients stated “returned to work” (10.1%) as one of the main reasons for not completing cardiac rehabilitation (4). The transition phase halfway through the program could for some patients seem like a natural opportunity to leave the program and return to work. This is supported by a Danish report from 2015 concluding that 20-25% of patients with cardiovascular diseases felt pressured to return to work as soon as possible (34).

Due to the positive effect of cardiac rehabilitation and the low utilization rates, interventions that promote retention in cardiac rehabilitation are of interest (19). A wide spectrum of delivery models, e.g. home-based programs tailored to patients’ preference and needs, seem essential instead of a single standardized model so that the maintenance of exercise is continued (19). These models are, however, far from available in many health care settings. Hence, there is an urgent need for successful strategies to prevent dropout in standardized delivery models and especially at the transition phase between settings in cardiac rehabilitation. In Denmark, hospitals are seen as specialists, whereas the municipalities are considered more like generalists in exCR (18). Evidence shows an association between high trust in the health care providers and adherence to treatment in patients (35). Hence, plans for

creating coherent pathways and strategies on how to communicate between health care providers and patients about the patient care pathways in clinical practice seem essential. This is supported by our finding that 22% of the patients drop out in the transition because they prefer another location than the municipalities.

Overall, an increased clinical focus on effective strategies to prevent dropout in exCR, especially at the transition from one setting to another is crucial.

Strengths and limitations

Our findings reflect current clinical practice, as we assessed dropout from exCR in an everyday setting with the inclusion of the most common cardiac diagnoses in the national disease management program (18), namely coronary heart diseases, heart failure and heart valve surgery. Further, dropout was stated by the patients and registered at the actual number of exercise session with a minimum of recall bias as patients were contacted every third week.

The study, however, holds some limitations. First, information on dropouts was collected through continuous telephone interviews. This could potentially have felt like a reminder motivating patients to attend more exercise sessions and as a result underestimating the actual number of dropouts (36).

Second, the definition of a dropout or a completer is not based on the number of attended exercise sessions, leaving the possibility that a completer could have attended all between 1 to 24 exercise sessions in this study. The definition of a dropout or a completer varies across the existing literature (11,12), potentially confounding efforts to generalize study results.

Third, only 50% of the eligible cardiac patients agreed to participate in this study. In research in general, attenders differ slightly from non-attenders in terms of demographics, socioeconomics, and disease characteristics, often representing socioeconomically advantaged

patients (37). From cardiac rehabilitation literature it is known that patients with a low socioeconomic status typically have a higher dropout rate (11,12). Hence, the actual dropout rate in our study is likely to be even higher had all eligible patients been included.

Fourth, due to the relatively small sample size, no other adjustments than the most common confounders for participation in exCR were included in the statistical analysis. Investigating other factors associated with dropout across the entire rehabilitation pathway using more sophisticated statistical methods, will be an extremely useful future piece of research. The likelihood of dropping out in the transitional phase has never been studied and is thereby unknown. Hence, we were unable to perform a power calculation before initiating our study. Future research within the same area can base power calculations based on our findings.

Conclusion

Every four out of ten patients drop out during a 12-week transitional exCR program. More than two thirds of the dropouts occur at the halfway transition between hospital and municipalities making the transitional phase a critical period in exCR. Our findings highlight the need for an increased focus on effective strategies to prevent dropout in exCR, especially at the transition from one setting to another.

Implications for practice

- A transition phase from one setting to another is a critical period for patient dropout from exercise-based cardiac rehabilitation.
- Communication and strategies addressing retention and patient care pathways seem essential to prevent dropout in transitional exercise-based cardiac rehabilitation.
- Additional research addressing both positive and negative elements of transitional exercise-based cardiac rehabilitation setup is needed.

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Competing interests

Dr. Skou is associate editor of the Journal of Orthopaedic & Sports Physical Therapy, has received grants from The Lundbeck Foundation, personal fees from Munksgaard and TrustMe-Ed, all of which are outside the submitted work. He is co-founder of Good Life with Osteoarthritis in Denmark (GLA:D[®]), a not-for profit initiative hosted at University of Southern Denmark aimed at implementing clinical guidelines for osteoarthritis in clinical practice.

The Authors declare that there is no other conflict of interest.

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Table 1. Patient characteristics for the total population (n=265) and subdivided into those patients who complete the program (completers) compared to those who drop out at transition (dropouts at transition)

	Total population		Completers		Dropouts at transition		p-value [#]
	(n=265)		(n= 162)		(n=72)		
	n	%	n	%	n	%	
Gender							
Female	60	(23%)	38	(75%)	13	(25%)	0.356 ^a
Male	205	(77%)	124	(68%)	59	(32%)	
Age years, mean (SD)							
18-64 years	85	(32%)	39	(52%)	36	(48%)	<0.001 ^b
≥ 65 years	177	(68%)	121	(78%)	35	(22%)	< 0.001 ^a
BMI (kilogram/meter²), mean (SD)							
	27.6	(4.86)	26.9	(4.5)	28.1	(4.7)	0.070 ^b
Family Status							
Living with a partner	201	(77%)	120	(68%)	56	(32%)	0.410 ^a
Living without a partner	60	(23%)	40	(74%)	14	(26%)	
Occupational status							
On labour market	80	(31%)	33	(47%)	37	(53%)	< 0.001 ^a
Off labour market	182	(69%)	128	(80%)	33	(20%)	
Education level							
Lower level	138	(54%)	81	(68%)	38	(32%)	0.877 ^a
Middle level	89	(35%)	55	(70%)	24	(30%)	
Higher level	27	(11%)	19	(73%)	7	(27%)	
Smoking							
Yes	32	(12%)	18	(67%)	9	(33%)	0.740 ^a
No or former smoker	228	(88%)	141	(70%)	61	(30%)	
Cardiac diagnosis							
Coronary heart disease	152	(57%)	93	(67%)	45	(33%)	0.686 ^a
Heart failure	76	(29%)	45	(70%)	19	(30%)	
Heart valve surgery	37	(14%)	24	(75%)	8	(25%)	
Distance to hospital (kilometres), median (IQR)							
	14.2	(5.7-21.3)	14.2	(5.8-22.6)	14.2	(4.8-17.6)	0.134 ^c
Distance to municipalities (kilometres), median (IQR)							
	7.5	(3.2-13.1)	7.5	(3.1-12.8)	6.6	(3.1-13.5)	0.961 ^c
HADS, median (IQR)							
Anxiety score	4.0	(2.0-7.0)	4.5	(2.0-7.5)	4.0	(2.0-8.0)	0.938 ^c
Depression score	3.0	(1.0-6.0)	3.0	(1.0-5.0)	2.0	(1.0-6.0)	0.897 ^c
Borg 15 (Watt), mean (SD)							
	73.4	(21.7)	72.3	(21.3)	77.7	(21.2)	0.085 ^b
HeartQoL, median (IQR)							
Physical score	2.0	(1.1-2.4)	1.8	(1.1-2.3)	2.1	(1.3-2.6)	0.124 ^c
Mental score	2.5	(1.8-3.0)	2.5	(2.0-3.0)	2.5	(1.8-3.0)	0.603 ^c
Global score	2.0	(1.4-2.4)	2.0	(1.4-2.4)	2.1	(1.5-2.6)	0.217 ^c
Number of attended exercise sessions until transition median (IQR)							
	11	(9-12)	11	(10-12)	10	(9-11)	0.002 ^c

Numbers are stated as n and proportion (%) unless otherwise specified.

[#]P-value for statistical difference in patient characteristics is between completers and dropouts at transition.

^a Chi² test, ^b t-test, ^c Mann-Whitney test

Abbreviations: SD: Standard deviation. BMI: Body Mass Index. IQR: Inter quartile range 25-75%. HADS: Hospital Anxiety and Depression Scale. Borg 15: a submaximal cycling test “Borg Rating Scale of Perceived Exertion”. HeartQoL: Heart specific health related quality of life questionnaire.

Table 2. Multiple logistic regression model of patient characteristics associated with the likelihood for dropout at transition between patients who drop out at transition (n=72) compared to those who complete the program (n=162) in a 12-week exercise-based cardiac rehabilitation program

	Multiple logistic regression model *		
	OR	95% CI	p-value
Gender			
Female		Reference	
Male	0.94	(0.42 to 2.08)	0.869
Age			
+65 years		Reference	
18-64 years	0.61	(0.20 to 1.87)	0.389
Cardiac diagnosis			
Coronary heart disease		Reference	
Heart failure	0.85	(0.41 to 1.74)	0.655
Heart valve surgery	0.78	(0.30 to 2.00)	0.604
Occupational status			
Off labour market		Reference	
On labour market	6.31	(2.04 to 19.54)	0.001
Number of attended exercise sessions until transition			
	0.79	(0.66 to 0.94)	0.008

Results are presented in odds ratio (OR) and 95% confidence interval (CI).

*Model information: DF=4 $\chi^2=31.48$, $p<0.05$; McFadden's pseudo $R^2=0.111$; Correctly classified=73%

Table 3. Overarching categorization of reasons for dropout during the exercise-based cardiac rehabilitation subdivided into a; Patient factors, b; Professional factors and c; Service factors inspired by the framework of Beswick et al. in 2004 (14)

		Dropout at transition n=72		Dropout at hospital or municipalities n=31	
		n	(%)	n	(%)
A	1. Had to return to work	17	(24%)	3	(10%)
A	2. Did not feel the need for further supervised training	14	(19%)	1	(3%)
C	3. Preferred another exercise location than the municipalities	16	(22%)	1	(3%)
A /B	4. Patient or professional did not feel that the program matched physical level or expectations	8	(11%)	9	(29%)
C	5. Logistic problems e.g. distance or transportation	6	(8%)	3	(10%)
A	6. Exacerbation in cardiac disease status	7	(10%)	3	(10%)
A	7. Comorbidities	5	(7%)	12	(39%)
-	8. Unknown	7	(10%)	1	(3%)

Eight patients stated two reasons for dropout at the transition phase and two patients stated two reasons for dropout in the hospital or municipalities.

The % are calculated based on the number of patients who dropped out either at the transition (n=72) or in the hospital/municipalities (n=31).

Figure legend

Figure 1. Study flow. *Completers: a patient who never stated a dropout during telephone interview **Dropouts: a patient who during the telephone interview stated they no longer participated in the exercise-based cardiac rehabilitation program.

Figure 2. Time to dropout in a 12-week exercise-based cardiac rehabilitation program with a transition phase from the hospital to the municipalities after six weeks.