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Treatment of the Aged Patients at a Large Cardiac Rehabilitation Center in the Southern Brazil and Some Aspects of Their Dropout from the Therapeutic Programs

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Abstract

AIM: This paper aims to assess the dropout rate in different age groups through the example of the large cardiac rehabilitation centre affiliated with the Institute of Sports Medicine, University of Caxias do Sul.

MATERIAL AND METHODS: A historic cohort study comprising the following groups: Non-Old < 65 (n = 141); Young-Old 65-74 (n = 128); and Middle-Old 75-84 years old (n = 57). The exercise program lasted 48 sessions and dropout was defined as attendance of 50% of sessions or less. Logistic binominal regression was performed to assess the risk of dropout. For all analyses, a two-tailed P value of < 0.05 was used.

RESULTS: The total dropout rate was 38.6%. The Young-Old and Middle-Old groups showed lower dropouts compared to Non-Old patients (p = 0.01). Young-Old has 96% less risk for dropout compared to Non-Old group (adjusted odds ratios = 1.96 [1.16–3.29]). Furthermore, patients underwent the Coronary Artery Bypass Graft showed a lower rate of dropout (p = 0.001). The absence of CABG involved three times more risk of dropout (p = 0.001).

CONCLUSION: The Non-Old and the Middle-Old patients showed higher dropout rates compared to Young-Old. To ensure the best possible rehabilitation and to improve patients´ participation in CR, these programs should be adjusted to the needs of patients in terms of their age.

Introduction

The increase in the life expectancy of the population has been in part driven by reduced mortality of aged people [1]. The number of people aged 65 or more is expected to grow from ca. 524 million in 2010 to almost 1.5 billion in 2050, with most of the increase in the developing countries. In Brazil, for example, the same demographic ageing which took more than a century in developed France occurred in two decades [2]. In a descriptive study covering the period from 1970 to 2010 the increase in the ageing index (AI) of 268% was determined for Brazil in general, with still higher AI established for the state of Rio Grande do Sul (RS) [3]. According to the data from the National Public Health Care System, in the RS, during 1991-2012 absolute number of seniors increased by 652,655 corresponding to the rise of the proportion of elderly people from 8.9% to 13.6% [4].

Despite the increase in longevity, the higher proportion of comorbidities distinguishes the older from the younger population [1]. It's known that the elderly people have 2-3 times higher incidence of acute myocardial infarction (AMI) than the younger ones. They also tend to have more complications associated with prolonged hospital stays, low physical activity and hence, suffer substantially higher fatality

rates due to coronary artery disease (CAD) [5]. Furthermore, cardiovascular disease (CVD) is by far the most important cause of hospitalisation among the elderly, and CAD is the leading cause of death in Brazil. A recent study showed that CVD accounted for 43.1% of all deaths that occurred between 2006 and 2010 in Brazil [6]. Because of high rates of morbidity and mortality, primary and secondary prevention programs are important strategies not only for alleviating cardiovascular risk factors but also for decrease the mortality and improvement of life quality for elderly patients [5].

Over the past four decades, rehabilitation programs have been recognised as an important tool in the medical care of patients with CVD. Preventive strategies for clinical practice should be developed based on cardiovascular rehabilitation programs because:

1) CVD is the leading cause of death in most countries; it is a major cause of disability and contributes significantly to increase healthcare costs.

2) Atherosclerosis can develop slowly over decades and its clinical manifestations are only seen in advanced stages of the disease.

3) Most CVD is closely associated with lifestyle.

4) Risk factors such as obesity, smoking, diabetes mellitus and hypertension have increased in the last decades.

5) The cardiac rehabilitation programs (CRP) are able to minimise risk factors and reduce morbidity and mortality [7].

Despite the low representation of older people in most experimental and observational studies on cardiac rehabilitation (CR), there seems to be clear that CR has the most beneficial effect of on younger patients compared to elder ones [8, 9]. At the same time, the risk of adverse reactions and complications for the elderly during the exercise sessions is similar to that of younger patients. Even though the age is not a determining factor for physical, functional and psychosocial response to a CRP, the existing stereotypes often prevent health professionals from prescription these exercises to the aged patients [8]. It seems clear that for many reasons the most important predictive factor for not entering in a CRP is the age [9]. In that respect, the strongest possible recommendations have an extremely high importance for entering the CRP.

CR is indicated for all patients with different presentations of CAD as it is known to have a positive effect on the treatment [7]. Nevertheless, elderly patients are less likely to be referred to a CRP [10]. It was shown that attendance to a CRP in a long-term reduces all-cause mortality [11]. However, the majority of older than 70 years referred to a CR program still avoids any training session [11, 12]. The term "old" often defines patients >65, despite the fact that most specialists consider patients 65-75 years old relatively young, while those >75 or 80 are "very elderly" and for them the CR data are still less available [13].

The dropout rate of aged patients from CR programs in Brazil was not comprehensively analysed and no differentiation by age group was carried out.

Thereby, this study aims to analyse the dropout rate of old people in a Brazilian CRP on the example of the large CR centre affiliated with the Institute of Sports Medicine (University of Caxias do Sul, RS). Comparative analysis of different age groups was also the aim of the present work.

Materials and Methods

Ethical aspects

This historic cohort study was conducted in the Cardiac Rehabilitation Service of the Sports Medicine Institute (SMI) at the University of Caxias do Sul (UCS), Brazil. The research was approved by the Research and Ethics Committee of the Cenecista Faculty of Bento Gonçalves. All patients had given informed consent.

Study Population

All patients were referred and attended the CRP between March 2011 and June 2016. They were divided into groups according to age: Non-Old (< 65 years); Young- Old (65-74 years); Middle-Old (75-84); and Oldest-Old (≥ 85 years), which is consistent with previous studies [14]. The exclusion criterion was the absence of data or discrepancy in the medical records.

Measures

The clinical characteristics assessed were: AMI with hospital report; CAD proved by cine coronary angiography; heart failure (HF) with an echocardiogram and coronary artery bypass grafting (CABG) and percutaneous transluminal coronary angioplasty (PTCA) with stent placement, both with hospital report. Also, risk factors analysed were: hypertension, diabetes mellitus, dyslipidemia, all three considered from a report of attending physician; tobacco was self-reported at medical interview.

The body mass index (BMI) was classified as corresponding to normal (≤ 24.99), to overweight (25-29.99) and to obesity (≥ 30). The exercise capacity (EC) was assessed according to the percentiles of maximal oxygen uptake (VO_2max) of the study

sample. The functional capacity classification varies according to age and gender. So, the calculation was done separately according to the type of assessment, exercise testing (ergometry) or cardiopulmonary exercise testing (ergo spirometry). Both tests were carried out using Micromed Biotecnologia Ergo PC Elite version 3.3.6.2. Protocol ramp was used in all exercises. Dropout was defined as attending 50% of the rehabilitation program or less, which is consistent with previous studies [15].

Cardiac Rehabilitation

A multidisciplinary rehabilitation program of 48 sessions of training was offered to each patient after being referred by an assistant physician. The program included: exercise training, dietary counselling by nutritionists, smoking cessation, and psychological support. Patients enrolled through National Health System (NHS) trained twice a week and those enrolled in Private Health Plan (PHP), trained 3 times a week. Before the training, the patients were seen by the nurse to assess vital signs. The session training lasted 60 min and it was conducted by physical educators. The exercise training program consisted of a combination of aerobic and strengthening exercises. In the end of the session, the physiotherapist coordinated stretching the major muscle groups.

Data collection and Statistical Methods

Data collection was performed using a spreadsheet online of Google Drive® from March 2013 to June 2015, in the SMI of UCS, a university service of CR. Statistical analysis was made with SPSS® software 22.0 version with descriptive statistics for sample characterization. The results were presented as a mean and standard deviation, absolute numbers for frequency and percentages values.

Clinical characteristics between age groups at baseline were compared using ANOVA (quantitative analyses) and by Chi-square for categorical variables. The logistic regression binominal was performed to assess the risk of dropout according to age groups, and to verify the confounding factors.

First, it was verified the correlation of the dropout with each variable by the obtaining the odds ratio. In the following steps, those variables were selected whose value level was less than 0.20 according to the descriptive test of significance. Then, the adjusted odds ratio was performed using logistic regression model. For all analyses was used a two-tailed P-value <0.05.

Results

Clinical Characteristics According to Age Groups

Out of 362 patients, 31 were excluded because of lack of information or disagreement of data in the medical records. Moreover, only 5 patients were Oldest-Old (≥ 85 years) and because of no sufficiency of this sample, these patients were excluded as well. Thus, in total the sample consisted of 326 patients. 141 of them were Non- Old Patients (<65); 128 were Young-Old people (65-74 years), and 57 were Middle- Old people (75-84 years old). The patients enrolled by NHS constituted 52.3% and by PHP, 47.7%. The overall mean age was 63.82 years (± 11.66) and 180 patients (55.2%) were men. Clinical characteristics according to age groups are summarised in Table 1.

Table 1: Clinical characteristic according to age: non-old group (< 65 y), young-old-group (65-74 y) and of the middle-old group (75-84 y)

Mean (sd[2])		Non-Old (n = 141)	Young-Old (n = 128)	Middle-Old (n = 57)	P value
Age		52.99 (8.57)	69.21 (2.85)	78.49 (2.61)	NA[1]
Body Mass Index		28.34 (5.29)	29.12 (5.97)	28.29 (4.89)	0.79
Ergometry VO_2 Max: ml/kg/min		26,09 (9,55)	21.30 (9.91)	14.42 (5.55)	<0.01
Ergospirometry VO_2 Max: ml/kg/min		20,47 (6,33)	17.18 (4.76)	14.02 (6.06)	<0.01
Prevalence at baseline (%)					
Gender Male		77 (54.6%)	54 (57.8%)	29 (50.9%)	0.66
Heart Failure		30 (21.3%)	33 (25.8%)	13 (22.8%)	0.64
Coronary Artery Disease		111 (78,7%)	98 (76.6%)	41 (71.9%)	0.32
Acute Myocardial Infarction		68 (48,2%)	44 (34.4%)	20 (35.1%)	0.03
CABG[3]		36 (25.5%)	40 (31.3%)	12 (21.1%)	0.82
PTCA[4] with stent		46 (32.9%)	34 (26.6%)	22 (38.6%)	0.73
Diabetes		34 (24.1%)	47 (36.7%)	22 (38.6%)	0.01
Hypertension		98 (69.5%)	106 (82.8%)	49 (86%)	<0.01
Dyslipidemia		80 (56.7%)	84 (65.6%)	33 (57.9%)	0.56
Smoker	Current	22 (15.7%)	19 (14.8%)	3 (2.5%)	0.05
	Ex-smoker	57 (40.7%)	40 (31.3%)	21 (36.8%)	
	Non-smoker	61 (43.6%)	69 (53.9%)	34 (59.6%)	

y: years; 1: not applicable; 2: standard deviation; 3: coronary artery bypass grafting; 4: percutaneous transluminal coronary angioplasty.

The clinical characteristics were comparable and a similar clinical status can be seen in both groups. Most significantly older people differ from more often cases of hypertension, diabetes, and by a higher number of non-smokers ($p < 0.05$). According to enrollment, the Non-Old group more often was covered by NHS, while in the Middle- Old group PHP prevailed. These results tend to be significant ($p = 0.07$). Older people were less prone to AMI and had lower EC in both tests ($p < 0.05$).

Dropout in Cardiac Rehabilitation Program

The overall mean of attendance at exercise sessions of the rehabilitation program was 28.94 (± 13.94), a frequency mean of 60.29%. Regarding dropouts, 120 patients (36.8%) abandoned the exercise program (≤ 24 sessions). Table 2 shows the clinical characteristics according to the dropout rates which differ significantly for different age groups.

Table 2: Clinical characteristics according to drop out in cardiac rehabilitation

		Dropout (n = 120)	Non-Dropout (n = 206)	P value
Enrollment	National Health System	70 (58.3%)	101 (49%)	0.10
	Private Health Plan	50 (41.7%)	105 (51%)	
Gender	Men	64 (53.3%)	116 (56.3%)	0.60
	Women	56 (46.7%)	90 (43.7%)	
Age	Non-Old	62 (51.7%)	79 (38.3%)	0.01
	Young-Old	35 (29.2%)	93 (45.1%)	
	Middle-Old	23 (19.2%)	34 (16.5%)	
Heart Failure		28 (23.3%)	48 (23.3%)	0.99
Coronary Artery Disease		93 (77,5%)	157 (76.2%)	0.79
Acute Myocardial Infarction		50 (41,7%)	82 (39.8%)	0.74
CABG[1]		19 (15.8%)	69 (33.5%)	<0.01
PTCA[2] + stent		42 (35%)	60 (29.1%)	0.27
Tobacco	Current	20 (16.7%)	23 (11.2%)	0.20
	Ex-smoker	46 (38.3%)	72 (35%)	
	Non-smoker	54 (45%)	111 (53.9%)	
Diabetes		35 (29.2%)	68 (33%)	0.47
Hypertension		92 (76.7%)	161 (78.2%)	0.75
Dyslipidemia		70 (58.3%)	127 (61.7%)	0.55
Exercise capacity	0-25th	31 (25.8%)	50 (24.3%)	0.47
(Percentile VO_2 max)	26-50th	32 (26.7%)	51 (25.5%)	
	51-75th	24 (20%)	81 (24.8%)	
	76-100th	33 (27.5%)	81 (24.8%)	
Body Mass Index	Normal (≤ 24.99)	27 (22.5%)	45 (21.8%)	0.82
	Overweight (25-29.99)	53 (44.2%)	98 (47.6%)	
	Obesity (≥ 30)	40 (33.3%)	63 (30.6%)	

1: coronary artery bypass grafting; 2: percutaneous transluminal coronary angioplasty.

Thus, the group Young-Old showed lower dropout rate compared to non-old patients (p = 0.01). Furthermore, patients underwent CABG, showed a lower rate of dropout at the end of the program (p = 0.001). The variables Enrolled, Tobacco, Age, and CABG and, thus, were selected to the binary logistic regression.

Logistic Regression Model for Dropout in Cardiac Rehabilitation

Logistic backwards regression was performed to identify the confounding factors. The remaining significant variables are shown in Table 3.

Table 3: Logistic regression model for dropout in cardiac rehabilitation

		Adjusted Odds Ratio	95% CI	P value
Enrollment	Private Health Plan (reference)	1.00		
	National Health System	1.45	0.89–2.35	0.12
Tobacco	Current (reference)	1.00		
	Ex-smoker	1.24	0.59–2.63	0.56
	Non-smoker	1.69	0.81–2.52	0.15
Age	Non-Old, <65 y (reference)	1.00		
	Young-Old, 65-74 y	1.96	1.16–3.29	0.01
	Middle-Old, ≥ 75	1.06	0.55–2.04	0.84
CABG[1]	Yes (reference)	1.00		
	No	2.76	1.53–4.95	<0.01

1: coronary artery bypass grafting.

The type of enrollment and tobacco status did not show any significant correlation with dropout. The age, on the other hand, showed that Young-Old people have 96% less risk of drop out compared to Non-Old (AOR: 1.96 [1.16–3.29]). The absence of CABG, in turn, increases the risk of dropout by almost three times (AOR: 2.76 [1.53–4.95]).

Discussion

The study consisted of 326 patients who attended the CRP of the SMI at the UCS. The patients were referred by physicians of the NHS and of PHPs. As expected, EC decreased with age of patients while comorbidities enhanced. The overall dropout was 36.8% and the age was seen as an important predictor for dropout. At the end of exercise program, the non-old patients showed higher dropout rate compared to young-old patients. The women did not show any difference regarding dropout. At the same time, CABG reduced the risk of dropout.

The prevalence of males in the literature varies due to differences in selection of participants in the studies, but it is clear that men, among older patients, are also most in this type of service [8, 17-19]. Our findings show same results. Our results have shown high frequencies of the risks of CVDs, especially of hypertension which corroborates with data of other studies [5, 17, 20]. The different clinical characteristics depending on age were expected and observed in our study. The ergo spirometry proved that VO_2 max in very old patients is very rare. The functional capacity of a person decreases significantly with advanced age [21]. Some studies showed lower functional capacities of older people at baseline in CRP. Nevertheless, this age group seems to respond better to an exercise program, and tend to have superior relative improvements of aerobic capacity [22-24]. The effects of aerobic capacity were not a goal of the present study which only described EC at baseline in the program. A significant decrease of VO_2 max was observed in the linear test, either by exercise testing or cardiopulmonary exercise test. Other comorbidities, as diabetes and hypertension noted in Table 1, were more common in older patients because they have more pathologies and this is in concordance with previous studies [9, 25].

The dropout rate of the elderly in CR programs worth discussing, since the patients, who abandoned the programs are more prone to cardiac complications than those who complete them [26]. Also, a reduced mortality was documented after 14-years follow-up, with control of a dose-response. Beauchamp et al. showed that attendance at 10-24% of training sessions have a good correlation with the greater global cause of mortality if compared with an attendance rate of 75-100% [12]. In our study, the overall dropout rate was 36.8% (120 of 326). The literature data shows some variations in these values. Thus Turk-Adawi et al. observed 49.7% of dropout [27], Worcester et al. found 19.08% [28] and Pardaens et al. registered about 20% of overall dropout from CR program [29]. This difference should be due to the socio-cultural specificity of different samples as they belong obviously to different societies and countries.

Suaya et al. evaluated outpatient CR training effect on the patients that had acute MI or CABG surgery using a statistical sample which comprised 267427 post- hospitalisation patients aged ≥ 65-year-old [9]. They found CR and exercise training was prescribed to 13.9% of the patients hospitalised with acute MI and to 31.0% of the patients after CABG surgery [9]. Patients underwent this kind of surgery shown higher adherence due to the severity of the medical conditions. Worcester et al. found the attendance rates of 66%, 51% and 25% respectively for CABG, AMI, and PTCA. In several studies, the CABG surgery was found to be a variable which can serve a predictor for non-dropout. In the work of Yohannes et al. [30] the correlation between CABG cases and accomplishment of CR program was also established, however for AMI and PTCA such relation was not found. Similar results were observed in the work [28] where it was noted that patients after CABG less likely abandon CR program than patients after acute coronary syndrome or HF. High degree of adhesion of CABG patients to CR program was also shown in the article [27] (AOR: 1.54 [1.24-1.82]). In our study, 27% of all patients had CABG surgery and these cases were equally distributed between age groups. It may be noted that our results corroborate with the literature data establishing a correlation between CABG cases and adherence to CR program. The AOR showed that participants of CR program that never underwent a CABG surgery had almost three times more risk for dropout. These findings were not observed for AMI or PTCA patients. However, it is not associated with 'poor' adherence of AMI patients but rather with higher adherence to the program of CABG patients. This could be explained by the severity of CABG which serves as a motivator for changes in lifestyle [8].

The multicenter cohort study presented in [27] was performed in 39 CR services and analysed 4,442 patients. The authors noted that younger patients (aged <65 years) were more likely to abandon the program compared to older patients (aged ≥ 65 years). In this article, the notion of "adherent" (i.e. patients attended > 50% of sessions) was used as reciprocal to "drop out". Besides, this paper did not distinguish the old people and therefore our results should be compared with observations made in [27] with attention to the methodological differences. A prospective study, in turn, consisted of 556 patients eligible to participate in secondary prevention program of exercises. There a mean age was 64,9 years old and the overall dropout rate were 23.4% [28]. This paper studied predictors for the dropout and found no difference between patients < 70 and ≥ 70 years old. In another prospective research, the dropout rate of approximately 20% was documented for all cases where one or more sessions were analysed [21]. However, a quantitative analyst was carried out in this article using only the mean age, while partitioning by age group has not been made and therefore higher rates of dropout for elderly patients could not be noticed.

In turn, Yohannes coordinated a study which included 189 post-AMI patients. They were recruited from a consecutive series of outpatient referrals prior to a CRP consisted of 6 weeks [30]. The authors considered dropout those who abandon the CR program during first two weeks and completers were those who attended the entire program (12 sessions). The quantitative assessment made in [30] has shown a trend for younger patients to drop out (61.4 y vs. 58.7 y, $p = 0.08$). In another large cohort study, which sought to assess the rate and predictors for dropout of CR program, age was not used as a factor [21]. For a 12-week program overall dropout rate was found to be 12.9 %; however, there was no clear definition of what was considered "dropout" and what was "completer" in their study [21]. On the other hand, another cohort of 872 patients with mean age of 67 years, did not define dropout objectively and, in turn, used subjective parameters for such a concept. In this study, it was seen dropout rates greater in patients over 65 years; however, it is difficult to consider these findings since the fall of methods [31].

The notion of dropout (from CR program) is not strictly defined. Most often participation in < 50% of the training sessions is regarded as a dropout, but some other approaches, such as abandon during first weeks, also exist. At the same time, it seems that even participation in 50% of sessions may not be enough for adequate rehabilitation. So, the concept of dropout needs to be standardised, which is however not the goal of the present contribution. In any case, in the present research, it was shown that Young-Old (65-74 years) demonstrated the lowest rate of dropout (AOR 1.96 [1:16 to 3:29], $p = 0.01$) compared to non-elderly patients (< 65 years). On the other hand, the dropout rate of the Non-elderly group was close to that of the Middle-old group. It can be probably assumed that younger people are more often diverted from CR treatment by higher workload and family responsibilities [32], while elderly are more dependent and more often suffer greater disability, not necessarily from CVD but also from co- morbidities such as arthritis [33].

This study has some limitations which must be acknowledged. One of them is the nature of observational historic cohort study. Despite the broad spectrum of used variables, some potentially significant parameters are lacking, including for instance information on illness cognition (i.e. how people perceive the situation they experience). The latter has been recognised in the literature as a crucial determinant of health-promoting behaviour along with the financial situation [30, 34-36]. Besides the factors such as self-motivation [37] and work demands [32], also have been recognised as important in the

literature. Another limitation of the present study was exclusion the Oldest-Old group due to the inadequate number of patients in this age category. In addition, thirty-seven patients were not included in the study because they did not attend any session at all after being evaluated in CR centre. Further research could clarify the reasons of that dropout.

Besides, the electronic database used in the present study was built from medical records collected in a single CR centre and therefore some measurement bias cannot be excluded. Despite the mentioned limitations, the present study is the first attempt to differentiate age groups in the analysis of dropout rate of aged people in a Brazilian CR program. It has shown that there are important differences between dropout rates in different age groups. We also consider this contribution quite representative because even with omitted Oldest-Old patients the statistical samples can be considered moderate in size, compared to other, not numerous studies based on still smaller sample sizes. Our main outcome was achieved objectively based on the attendance lists. In spite of being carried out in single-site, the study covered rather a long period of time and was performed in a large CR service, in a university centre of reference of southern Brazil.

In conclusion, the dropout rate in a large Brazilian CR centre was approximately 39% during 48 sessions of exercise program. The Non-Old and the Middle-Old patients showed increased dropout rates compared to Young-Old. Thus, there is a difference of dropout rate at elderly categories. To ensure the best possible rehabilitation and to improve patients´ participation in CR, the CR programs should be customised to patients' needs in terms of their age. It was also established that CABG procedure is associated with better adherence to the program. The study also confirmed that despite reduced functional capacity of older people, it should not be considered an obstacle for CR and these patients remain admissible to CR program.

Due to limited literature data, more studies involving elder patients are needed, particularly those > 84 years, since the low presence of them in this type of service. This is necessary for analysis of the problems that came with ageing and could contribute to dropout.

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