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Cardiac Rehabilitation in Very Old Patients: Data From the Italian Survey on Cardiac Rehabilitation-2008 (ISYDE-2008)—Official Report of the Italian Association for Cardiovascular Prevention, Rehabilitation, and Epidemiology

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Background. Using data from the Italian SurveY on carDiac rEhabilitation-2008 (ISYDE-2008), this study provides insight into the level of implementation of cardiac rehabilitation (CR) in very old cardiac patients.

Methods. Data from 165 CR units were collected online from January 28 to February 10, 2008.

Results. The study cohort consisted of 2,281 patients (66.9 ± 11.8 years): 1,714 (62.4 ± 9.6 years, 78% male) aged<75 years and 567 aged ≥75 years (80.8 ± 4.5 years, 59% male). Compared with adults, a higher percentage of older patients were referred to CR programs after cardiac surgery or acute heart failure and showed more acute phase complications and comorbidity. Older patients were less likely discharged to home, more likely transferred to nursing homes, or discharged with social networks activation. Older patients had higher death rate during CR programs (odds ratio = 4.6; 95% confidence interval = 1.6–12.9; $p = .004$).

Conclusion. The ISYDE-2008 survey provided a detailed snapshot of CR in very old cardiac patients.

Key Words: Cardiac rehabilitation, Elderly—ISYDE 2008 survey—Secondary prevention—Coronary artery disease.

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RANDOMIZED clinical trials have demonstrated that in patients with cardiovascular disease, comprehensive cardiac rehabilitation (CR) improves exercise tolerance, coronary risk factors, psychological well-being, and health-related quality of life and, according to several observational studies or meta-analyses, decreases the risk of new cardiac events (1–5).

In 2006, the Italian National System for Guidelines of the Italian Health Ministry published the Guidelines on Cardiac Rehabilitation and Secondary Prevention, with the endorsement of the Italian Agency of Regional Health Systems (6). Although the adherence to guidelines has been shown to be associated with improved outcomes, their current implementation in Italy, as in other European countries, remains frequently defective (7–12).

The benefits of CR programs have been well documented in young and middle-aged coronary heart disease patients, whereas older patients are rarely, if ever, included in CR programs and are poorly represented in clinical trials (13–14). On the other hand, one randomized clinical trial did show that CR is at least as effective in older as in adult patients (15). In spite of such evidence, older patients are less likely

to be referred to formal CR programs and, when referred, experience poor program compliance (16,17). The lack of referral to CR programs could be related to a more compromised clinical and functional status of these older patients, who are more likely to present with frailty, higher burden of comorbidities, and disability (18).

Despite epidemiological data show that patients aged 75 years and older requiring cardiac care are increasing, to date, only limited age-specific data are available from observational studies reporting CR in the elderly patients. Most of these data refer to patients with an average patient age <75 years (15,19–21) and from studies of postinfarction CR with small numbers of patients aged >75 years (15,22,23). Nevertheless, several studies have demonstrated that older patients derive similar and sometimes greater relative improvements in exercise tolerance and self-reported physical function in comparison with adult patients after exercise-based CR (23–25).

In the recent past, the Italian Association for Cardiovascular Prevention, Rehabilitation, and Epidemiology (GICR-IACPR) promoted and carried out a detailed observational study of CR programs available in Italy (26,27). The first Italian SurveY on carDiac rEhabilitation (ISYDE)-1999 survey offered an overview of CR services in Italy, illustrating the core components of the existing programs (26). The ISYDE-2008 survey was launched aiming at evaluating whether or not progress had been made in CR practice (27). The broad participation of CR centers throughout Italy and the dimension of surveyed population proved to represent the real, pragmatic rehabilitation world, and clinical profile of patients referred to CR programs.

Because a considerable part of this study cohort consisted of patients >75 years, the present survey aimed at providing an insight in the clinical characteristics and course of a very old population in the real world of CR in Italy.

Methods

Study Design

The multicenter prospective observational study design of the ISYDE-2008 has been described in detail elsewhere (26,27). In summary, the primary purpose of this study was to take a snapshot on current organization, settings, and provision of CR in Italy and to describe the patient population referred to CR, giving a comprehensive and detailed description of clinical characteristics, risk profile, diagnostic procedures, exercise and educational program, discharge modalities, treatment at discharge, and follow-up schedules. The enrolment period lasted from January 28 to February 10, 2008. Data were collected on a web-based case report form, which collected data on clinical characteristics, diagnostic procedures, exercise and educational programs, treatment, and follow-up plans of all the consecutive patients discharged from CR programs in the 2-week study period. The present study focuses on very old patients (≥75 years) compared with the adult population.

Participating Centers

The survey was designed to be carried out in all Italian residential and outpatient CR centers. Centers were invited to participate in the survey on a purely voluntary basis by the executive board of the study and by the regional GICR-IACPR coordinator, who was responsible for interfacing with the investigators in each of the participating centers and overlooked the implementation of the survey protocol. Based on information collected from previous surveys and registries and through an active search of National Health System–authorized facilities carried out at regional level, 208 facilities were identified as potential providers of CR programs and were invited to participate in the study. However, 18 centers were found, on contact, to be inactive or still in a preoperational phase at the time of the study, whereas 25 (13% of the remaining 190) were unwilling or unable to participate. Thus, data collected in the study refer to 165 CR units (87% of all invited facilities). These CR units, representative of national CR organization, were subdivided in 103 (62.4%) residential units, 18 (10.9%) facilities with day hospital care, 33 (20%) facilities with outpatient CR (information not available in 11 [6.7%] CR units). The complete list of ISYDE-2008 investigators and participating centers with names of the director or contact physician is reported in Appendix 1, whereas the updated directory of all Italian Cardiac Rehabilitation Centers of the GICR-IACPR network is available on the official website of the GICR http://www.iacpr.it.

Statistical Analysis

The main analysis was performed subdividing the study cohort into two groups, according to age cutoff of 75 years. Data are expressed as means ± *SD* or proportions. Comparisons between groups were performed by unpaired *t* test, χ^2, or Fisher's Exact Test as required. Correlations between variables were assessed with Pearson's correlation coefficient. Predictors of death were evaluated with multivariate logistic regression analysis. All analyses were performed using SAS (Version 9.1, Cary, NC) with significance set at $p < .05$.

Results

Table 1 summarizes the demographic characteristics and referral pattern of CR programs in young adult and older study population. The total study cohort consisted of 2,281 patients (66.9 ± 11.8 years, 75% male): 1,714 (75.1%; 62.4 ± 9.6 years, 78% male) aged < 75 years and 567 (24.9%) aged ≥75 years (80.8 ± 4.5 years, 59% male). Compared with adults, a higher percentage of older patients were

Table 1. Demographics Characteristics and Indications to Cardiac Rehabilitation Programs in Adults and Older Patients

	<75 years (n = 1,714)	>75years (n = 567)	
	n (%)	n (%)	p Value
Male gender	1344 (78.4)	333 (58.7)	<.0001
Cardiovascular risk factors*			
0–2	672 (39.2)	239 (42.1)	.21
3–5	875 (51.0)	284 (50.0)	.69
>5	167 (9.7)	44 (7.8)	.15
Indications to cardiac rehabilitation			
Coronary artery surgery	553 (32)	134 (23)	<.0001
Valvular surgery	284 (16)	77 (13)	.09
Coronary artery + valvular surgery	109 (6.4)	63 (11.1)	<.001
Thoracic aorta surgery	41 (2.4)	13 (2.3)	.89
Acute coronary syndrome	149 (8.7)	52 (9.2)	.72
Percutaneous transluminal coronary angioplasty	269 (15.7)	57 (10.0)	<.001
Chronic heart failure	164 (9.6)	121 (21.3)	<.0001
Peripheral artery disease	14 (0.8)	8 (1.4)	.20
Other	35 (2.0)	6 (1.1)	.12

*Smoking, family history of early coronary heart disease, high blood pressure, hypercholesterolemia, body mass index >27, diabetes, sedentary lifestyle, and early menopause.

referred to CR programs for combined coronary and valvular surgery or after an episode of acute heart failure, whereas a lower percentage of older patients were referred to CR programs after isolated coronary surgery or percutaneous transluminal coronary angioplasty. No differences were observed in cardiovascular risk factors score (including smoking, history, hypertension, dyslipidemia, obesity, diabetes, sedentary lifestyle, and early menopause) between groups.

Table 2. Comorbidities in Adults and Older Patients Referred to Cardiac Rehabilitation Programs

	<75 years (n = 1,714)	>75years (n = 567)	
	n (%)	n (%)	p Value
Previous myocardial infarction	377 (22.0)	126 (22.2)	.91
Previous percutaneous transluminal coronary angioplasty	170 (9.9)	55 (9.7)	.88
Previous cardiac surgery	180 (10.5)	70 (12.3)	.22
Carotid arteries atherosclerosis*	97 (5.6)	63 (11.1)	<.0001
Symptomatic peripheral artery disease†	98 (5.7)	53 (9.3)	<.01
Chronic obstructive pulmonary disease	192 (11.2)	106 (18.7)	<.0001
Chronic respiratory insufficiency‡	60 (3.5)	52 (9.2)	<.0001
Chronic kidney disease§	103 (6.0)	97 (17.1)	<.0001
Stroke	50 (2.9)	33 (5.8)	.001
Cognitive impairment	24 (1.4)	40 (7.1)	<.0001
Gastroesophageal disease	78 (4.5)	40 (7.1)	.02
Diabetes	339 (19.8)	136 (24.0)	.03
Cancer	57 (3.3)	26 (4.6)	.16
Orthopedic/joints/immune-related disease	129 (7.5)	78 (13.8)	<.0001

*Stenosis >70% or previous revascularization.
†Fontaine stage >1 or previous revascularization.
‡Long-term oxygen therapy.
§Creatinine ≥1.5 mg/dL.

Table 3. Complications During Cardiac Rehabilitation Programs in Adults and Older Patients

	<75 years (n = 1,714)	>75years (n = 567)	
	n (%)	n (%)	p Value
Atrial fibrillation	122 (7.1)	80 (14.1)	<.0001
Severe ventricular arrhythmias*	34 (2.0)	9 (1.6)	.55
Definitive pacemaker implantation	9 (0.5)	4 (0.7)	.62
Acute myocardial infarction	7 (0.4)	3 (0.5)	.71
Cerebrovascular events†	12 (0.7)	3 (0.5)	.66
Cognitive impairment	21 (1.2)	22 (3.9)	<.0001
Anemia‡	106 (6.2)	55 (9.7)	<.01
Acute or worsening of chronic kidney disease§	32 (1.9)	39 (6.9)	<.0001
Sternal revision	6 (0.3)	3 (0.5)	.55
Massive pleural effusion needing thoracentesis	19 (1.1)	13 (2.3)	.04
Inotropic support/mechanical assistance	16 (0.9)	7 (1.2)	.53
Respiratory assistance‖	20 (1.2)	21 (3.7)	<.0001
Systemic infections	38 (2.2)	29 (5.1)	<.01
Blood transfusions	21 (1.2)	10 (1.8)	.34
Others	24 (0.01)	6 (0.01)	.88

*>30 s or symptomatic ventricular tachycardia.
†Stroke, transient ischemic attack.
‡Hb ≤10 g/dL or ≥3 g/dl reduction with respect to the preindex event value.
§Creatinine ≥2.5 mg/dL when preindex event value <1 mg/dL or creatinine increase ≥1 mg/dL in patients with previous chronic kidney disease.
‖Including oxygen therapy, mechanical ventilation, continuous positive airway pressure, bilevel positive airway pressure >96 h.

Older patients showed a greater frequency of comorbidities (Table 2), such as critical stenosis of carotid arteries and peripheral artery disease, chronic obstructive pulmonary disease, chronic kidney disease, neurological sequelae after stroke or cognitive impairment, gastroesophageal disease, diabetes, and orthopedic/joints/immune-related disease.

During CR programs, a higher percentage of older patients developed complications as persistent atrial fibrillation (AF), cognitive impairment, and acute kidney disease or worsening of chronic kidney disease (Table 3). Other complications, particularly frequent in older patients, were anemia, systemic infections, massive pleural effusion requiring thoracentesis, and acute respiratory insufficiency with need for respiratory assistance.

Differences between older and adult patients were also detected in the access to diagnostic procedures during CR. Older patients less frequently underwent diagnostic procedures, such as exercise and cardiopulmonary stress testing on admission or at discharge, whereas no difference was observed in the performance of 6-minute walking test (6MWT) (Table 4). As many as 275 older patients (48%) received no physical performance test (6-minute walking test, exercise stress testing, or cardiopulmonary exercise testing); this proportion was significantly greater than in adult patients (34%, $p < .0001$). Compared with adults, older patients not performing any physical performance testing showed a higher percentage of comorbidities, such as respiratory insufficiency (58% vs 41%, $p < .0001$),

Table 4. Diagnostic and Therapeutic Procedures During Cardiac Rehabilitation Programs in Adults and Older Patients

	<75 years (n = 1,714)	>75years (n = 567)	
	n (%)	n (%)	p Value
6-min walking test on admission	749 (43.7)	234 (41.3)	.31
6-min walking test at discharge	705 (41.1)	242 (42.7)	.52
Exercise stress testing on admission	388 (22.6)	58 (10.2)	<.0001
Exercise stress testing at discharge	619 (36.1)	86 (15.2)	<.0001
Cardiopulmonary exercise stress testing on admission	106 (6.2)	16 (2.8)	<.01
Cardiopulmonary exercise stress testing at discharge	138 (8.0)	19 (3.3)	<.001
Echocardiography (n)	1509 (88.0)	513 (90.5)	.11
Electrocardiogram telemetry >72 h	500 (29.2)	194 (34.2)	.02
Venous infusions	137 (8.0)	102 (18.0)	<.0001
Geriatric multidimensional evaluation	308 (18.0)	146 (25.7)	<.0001
Computed tomography	58 (3.4)	31 (5.5)	.03
Ultrasounds	260 (15.2)	114 (20.1)	<.01
Group exercise sessions	1396 (81.4)	399 (70.4)	<.0001
Individual exercise sessions	369 (21.5)	218 (38.4)	<.0001

chronic kidney disease (53% vs 46%, $p < .0001$), and cognitive impairment (66% vs 33%, $p < .0001$), and a higher percentage of complications during the CR program, such as cognitive deterioration (65% vs 34%, $p = .0005$), kidney failure (63% vs 37%, $p < .0001$), and need of inotropic support or mechanical assistance (65% vs 35%, $p = .001$). Echocardiography showed a lower percentage of older patients with preserved left ventricular ejection fraction (LVEF>50%) compared with adult patients (50.3% vs 61.7%, $p < .0001$, respectively).

Educational and psychological interventions were more frequently not performed in older patients compared with adult patients (Table 5). Particularly, older patients received less general information on cardiovascular risk factors, diet, physical activity, smoking cessation, drug management, and psychological intervention. On the other hand, they more often received information on chronic heart failure (CHF) (Table 5).

At discharge, compared with young adult patients, elderly patients were more frequently prescribed with nitrates, diuretics, digitalis, amiodarone, antihypertensive drugs other than ACE-I or ARB, antidepressants and heparin, and less frequently with beta blockers, aspirin, omega-3 fatty acids, statins, and ezetimibe (Table 6).

Older patients had a significantly longer hospital length of stay (19 ± 9 vs 18 ± 10 days, $p = .009$) and less accesses to the day hospital care (13 ± 9 vs 16 ± 9 days, $p = .04$) or to outpatient clinic (4 ± 9 vs 15 ± 9 days, $p = .0008$), despite a longer length of clinical supervision (123 ± 153 vs 81 ± 120 days, $p = .013$). Older patients were less likely to be discharged home (88% vs 92%, $p = .004$) and, rather, more likely to be transferred to nursing homes (1.1% vs 0.1%, $p = .001$) or discharged with social assistance networks activation (0.5% vs 0.06%, $p = .02$).

Table 5. Educational and Psychological Interventions Performed During Cardiac Rehabilitation Programs in Adults and Older Patients

	<75 years (n = 1,714)	>75years (n = 567)	
	n (%)	n (%)	p Value
General information on risk factors			
None	48 (2.8)	50 (8.8)	<.0001
Group	893 (52.1)	267 (47.0)	
Individualized	359 (20.9)	136 (24.0)	
Both	414 (24.1)	114 (20.1)	
Diet			
None	131 (7.6)	87 (15.3)	<.0001
Group	783 (45.7)	238 (42.0)	
Individualized	491 (28.6)	149 (26.3)	
Both	309 (18.0)	93 (16.4)	
Physical activity			
None	57 (3.3)	49 (8.6)	<.0001
Group	1020 (59.5)	262 (46.2)	
Individualized	252 (14.7)	116 (20.5)	
Both	385 (22.5)	140 (24.7)	
Smoking			
None	1006 (58.7)	426 (75.1)	<.0001
Group	431 (25.1)	98 (17.3)	
Individualized	157 (9.2)	17 (3.0)	
Both	120 (7.0)	26 (4.6)	
Drug therapy management			
None	160 (9.3)	101 (17.8)	<.0001
Group	285 (16.6)	74 (13.0)	
Individualized	1031 (60.1)	322 (56.8)	
Both	238 (13.9)	70 (12.3)	
Oral anticoagulant therapy management			
None	1166 (68.0)	367 (64.7)	.35
Group	140 (8.2)	53 (9.3)	
Individualized	311 (18.1)	118 (20.8)	
Both	97 (5.7)	29 (5.1)	
Diabetes			
None	1041 (60.7)	351 (62.0)	.23
Group	279 (16.3)	78 (13.8)	
Individualized	253 (14.8)	98 (17.3)	
Both	141 (8.2)	40 (7.0)	
Heart failure			
None	1171 (68.3)	334 (58.9)	<.0001
Group	262 (15.3)	86 (15.2)	
Individualized	163 (9.5)	102 (18.0)	
Both	118 (6.9)	45 (7.9)	
Psychological intervention			
None	576 (33.6)	248 (46.7)	<.0001
Group	432 (25.2)	115 (20.3)	
Individualized	332 (19.4)	110 (19.4)	
Both	374 (21.8)	94 (16.6)	

Finally, very old patients had an increased death rate during CR program compared with the adult cohort (9/567 vs 6/1714, $p = .002$, respectively).

Bivariate analysis showed that the occurrence of AF during the CR program ($r = .05$, $p = .01$), respiratory insufficiency ($r = .08$, $p < .0001$), acute kidney failure ($r = .05$, $p = .01$), and stroke or cognitive impairment ($r = .04$, $p = .04$) were significant predictors of death.

Multivariate logistic analysis showed that developing AF during CR programs (odds ratio = 3.5, 95% confidence interval = 1.1–11.3, $p = .03$), and respiratory insufficiency

Table 6. Drug Therapy at Hospital Discharge After Cardiac Rehabilitation Programs in Adults and Older Patients

	<75 years (n = 1,714)	≥75 years (n = 567)	
	n (%)	n (%)	p Value
Inhibitors of angiotensin-converting enzyme	947 (55.2)	310 (54.7)	.81
Angiotensin II receptor blockers	283 (16.5)	104 (18.3)	.31
Beta blockers	1233 (72.0)	333 (58.7)	<.0001
Nitrates	304 (17.7)	136 (24.0)	<.01
Diuretics	777 (45.3)	391 (69.0)	<.0001
Statins	1180 (68.8)	330 (58.2)	<.0001
Fibrates	7 (0.4)	1 (0.2)	.42
Omega-3 fatty acids	314 (18.3)	64 (11.3)	<.0001
Oral anticoagulant therapy	440 (25.7)	164 (28.9)	.13
Aspirin	1169 (68.2)	339 (59.8)	<.001
Other antiplatelet drug	421 (24.6)	120 (21.2)	<.001
Digitalis	78 (4.5)	46 (8.1)	<.001
Amiodarone	84 (4.9)	48 (8.5)	<.01
Calcium channel blockers	315 (18.4)	121 (21.3)	.12
Other antihypertensives	57 (3.3)	37 (6.5)	<.001
Insulin	156 (9.1)	55 (9.7)	.67
Oral hypoglycemic drugs	263 (15.3)	90 (15.9)	.76
Antidepressant	90 (5.2)	51 (9.0)	<.001
Antiarrhythmics	29 (1.7)	12 (2.1)	.51
Heparin	31 (1.8)	23 (4.1)	<.01

(odds ratio = 5.5, 95% confidence interval = 1.4–22.3, p = .01) were significant predictors of death.

Discussion

To the best of our knowledge, our study, by deriving data from the 2008 ISYDE survey, is the first to explore in such depth the characteristics of the "real world" CR patients aged >75 years admitted to CR programs in Italy.

Although exercise-based CR is recognized as an essential component in the contemporary management of patients with heart disease, including the older, admission to CR and secondary prevention programs has been estimated at only~20% for older eligible patients (13–15). Therefore, poor participation and adherence represent a critical problem for assuring the best treatment to older patients after an acute cardiac event (15,19–21,23). Furthermore, in the majority of these studies, the representation of patients older than 75 years, the "real world" old patients, has been poor or difficult to evaluate.

Several cultural, economic, logistic, and organization barriers to patient referral and subsequent program entry and adherence have been recognized The strength of the primary care physician's referral to CR seems one of the most powerful predictor of subsequent participation (14–16).

The present survey revealed that 59% of patients admitted to CR are aged >65 years and that 25% are aged >75 years. Overall, roughly half of the very old patients were enrolled in CR after cardiac surgery, reflecting the increased trend of older patients undergoing cardiac surgery in Italy (28) and the decline in operative mortality due to increased surgical experience and to improvement of surgical strategies (29), despite very old patients are at higher risk (30). Therefore, in the light of our data, we can conclude that in Italy, there is an increasing trend to include older patients into CR programs, despite their higher clinical risk profile.

Interestingly, heart failure was the second only to cardiac surgery as indication to CR in very old patients, more than twice that was observed in the adults cohort. This may reflect the higher prevalence of CHF in the very elderly patients (31), due to the increased severity and complexity of cardiac disease, associated with higher frequency of comorbidities, in particular respiratory and renal insufficiency, that may easily precipitate an acute episode of heart failure in this age population (32).

The lower percentage of very old patients enrolled into CR after percutaneous coronary angioplasty may reflect a low reliance on secondary prevention programs in the very old, despite evidence of their effectiveness even in the very advanced age range (14–17).

In line with previous literature data (17,33,34), this survey confirmed in older patients the large burden of comorbidities. This might also explain the higher frequency of complications occurring both during the acute phase of hospitalization for the acute event and/or during CR.

Our study yields insights on AF, the most common arrhythmia seen in older cardiac patients. Although physical activity has been reported to increase the risk of AF (35), we do not believe that the onset of physical activity within the CR program could have been responsible for a higher AF frequency during this period because greater leisure-time activity and walking are rather associated with lower incidence of AF, and conversely, intensity of exercise had a U-shaped relationship with AF, with lower risk among individuals exercising with moderate, but not high, intensity (36).

Acute kidney disease occurred more frequently in older patients during CR programs compared with the adult cohort. This might be the consequence of a diffused atherosclerotic process and/or impaired renal blood flow due to heart failure.

Diagnostic procedures were underused in very old patients undergoing CR programs. In particular, compared with adults, a larger proportion of older patients did not perform any type of physical performance test. These findings might reflect a more compromised physical status or level of disability preventing older patients to perform exercise stress testing or might be due to the more frequent comorbidities with relative contraindication. This might have prognostic relevance because the lack of referral to exercise stress testing is by itself a negative prognostic indicator after an acute cardiac event (37). Interestingly, no differences among age groups were found in the use of 6-minute walking test, which requires lower aerobic performance and therefore was preferentially adopted in the evaluation of

very old patients. In this survey, age-associated physical disability is also revealed by the great number of tailored physical therapy interventions performed by very old patients, who required individual attention rather than group session. It is also well known that disability is inversely correlated with aerobic capacity and depression in older coronary artery disease patients (38). However, we could not exclude that some of the lower referral to performance test was due to physical fear or choice by physician rather than to the real functional status of the older patient.

Educational interventions focused on physical therapy were less frequently provided to very old patients compared with the adult cohort. Again, this might be the consequence of bias toward a perceived reduced efficacy of secondary prevention in this age range but also to the more frequent mental deterioration or use of antidepressant drugs in very old patients (39). Conversely, information on drug therapy was more frequent in older patients, who are often on polypharmacological regimens, at a higher risk of iatrogenic complications; also psychological interventions were more frequent, likely due to the higher prevalence of depression in this population (40).

The present survey revealed also interesting differences relatively to drugs use. In agreement with literature data (40), older patients were discharged by CR Units with fewer indications to beta blockers, statin, and antiplatelet drugs compared to adult patients, thus confirming the difficulties of adopting in the real clinical world and in very old patients the recommendations of international guidelines regarding secondary prevention (14–17).

Finally, mortality during CR in very old patients was higher compared with the adult cohort, possibly reflecting the higher clinical risk profile of this very elderly cohort rather than indicating adverse effects of CR program. In fact, we do not have a control group of >75-year-old patients not enrolled in CR programs, where mortality could have been even higher. The development of AF and respiratory insufficiency was the most significant predictor of death during CR programs, independently of age and other comorbidities.

The major limitation of the present study was the lack of reporting some important functional and clinical parameters of possible interest; this was due to the short-term survey characteristics of the study, which collected the essential data in order to characterize the demographic and clinical course of the patients. However, the survey successfully highlighted crucial differences in the very old patient population entering CR programs in Italy.

In conclusion, this study shows in a large population the differences in access, clinical presentation, and course of very elderly patients entering CR programs. In the research agenda, studies are needed in order to identify the best strategies for expanding referral to CR in very old patients, fostering the application of tailored functional evaluation, educational intervention, appropriate drug treatment, and adherence to secondary prevention guidelines, with the aim of reducing in-hospital complications and improving functional recovery, long-term mortality, morbidity, and quality of life in this very elderly population of patients.

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