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Appropriateness/inappropriateness of access to an in-hospital rehabilitation program for patients with respiratory disease

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Abstract

There are no descriptions of the "ideal candidate" or validated indices to justify admitting respiratory patients to hospital-based rehabilitation. This study aimed to quantify appropriate/inappropriate admissions to in-hospital rehabilitation programs among respiratory patients. We analyzed hospitalization records from the ICS Maugeri repository (01 January 2015 - 31 December 2024) across seven Italian ICS Maugeri centers. Patients were categorized as chronic respiratory failure (CRF; 45.70%), chronic obstructive pulmonary disease (COPD; 22.76%), asthma (0.07%), obstructive sleep apnea (OSAS; 10.89%), and miscellaneous dyspnea not related to COPD (19.84%).

Anthropometric, Cumulative Illness Rating Scale, Medical Research Council (MRC) scale, Barthel dyspnea, COPD Assessment Test (CAT), 6-minute walk test (6MWT), and Short Physical Performance Battery (SPPB) were collected. Appropriateness of hospital admission was defined according to literature-based severity cut-offs for all disability items, while inappropriateness was computed on four contemporary items (excluding MRC). The cohort was predominantly male, aged 60-70 years, with CRF (46%) and multiple comorbidities; most (84%) were admitted from home, while >95% of patients returned home. High overall appropriateness in the whole group was 73-87% across items, with the highest % for 6MWT predicted across all TPs (74% OSAS-94% CRF) and lower for SPPB (60% OSAS-78% CRF) and for the MRC dyspnea score (75% OSAS-89% CRF).

The CRF group demonstrated very high appropriateness (>78% in all items), COPD presented strong appropriateness for deconditioning (6MWT: 83%) dyspnea (MRC: 84%), asthma patients showed a lower CAT appropriateness (64%). The OSAS subgroup had the lowest entry appropriateness (55-74%). The dyspnea group exhibited high appropriateness for deconditioning (6MWT: 83%) and for dyspnea (MRC: 81%, Barthel dyspnea: 81%). Among 6086 complete cases, only 2.8% were deemed to be inappropriate admissions. The highest inappropriateness was in the dyspnea subgroup (6%), while the lowest was for CRF (0.7%). Entry appropriateness was high or very high for overall items, showing 6MWT the best rate and CAT and SPPB the worst. CRF patients showed the highest appropriateness, while the rate of inappropriateness was overall low, with dyspnea and OSAS subgroups the worst and CRF the best. Future strategies must focus on developing standardized, multifaceted evaluation tools to objectively guide inpatient rehabilitation referrals.

Key words: appropriateness, treatable traits, hospital rehabilitation.

Introduction

Health care appropriateness refers to prescription to the right patient, at the right time, and for the right duration, and at a favourable risk-benefit ratio [1]. The application of appropriateness in the healthcare sector represents a key strategy for addressing the limited availability of resources by ensuring their optimal use. Appropriateness in healthcare requires the involvement of the two main stakeholders: first, healthcare professionals, who, when reviewing prescribed interventions, should recognize inappropriate prescription not as a restriction for limiting resources, but as an opportunity to optimize their use. Second, Decision-makers, who when analysing financial statements, should move beyond the mere perspective of volumes and short-term reimbursements, and embrace appropriateness not as a cost-cutting measure but as a way to maximize the value of available resources by directing them towards the dissemination of innovative approaches that have already demonstrated effectiveness. In clinical practice, the judgment of appropriateness should be conditioned by the risk-benefit profile of health interventions and by the preferences/expectations of the individual patient, without being influenced by costs [2]. An indiscriminate increase in health resources, without strict regulation of health technology assessment, does not necessarily improve public health, but risks producing waste and inequalities, as well as posing greater dangers to patients [3]. It is widely demonstrated that early pulmonary rehabilitation (PR) programs after exacerbation, including those carried out at home, improve exercise tolerance, muscle strength, dyspnoea indices, and quality of life while reducing the number of exacerbations [4]. Despite its proven benefits, PR remains both underutilised and under-resourced: in fact, less than 5% of COPD patients who can benefit from PR undergo PR treatment [5]. Collectively, these issues contribute to significant health inequalities for people with chronic respiratory diseases [6]. There is high heterogeneity in the availability of resources and services across the various regions of the Italian national territory, leading to a lack of univocal approaches to disease management based on the specific resources available [7]. Under-use of PR can delay or prevent a patient's recovery, leading to complications, unnecessary hospital admissions and more expensive healthcare interventions and absences from work [7]. On the other hand, selecting the wrong candidate or rehabilitation setting leads to wasted resources for the payer themselves [7].

As in other healthcare areas, there is an inappropriate use of resources with regard to PR, which is reflected in incorrect indications to specific settings and types of patients. From this, it follows that the payer finds it difficult to grasp the complexity of rehabilitation treatment as a whole,

which affects the remuneration of the process.

The best way to optimize appropriateness is to select the right candidate. To identify the ideal candidate for a post-hospitalisation rehabilitation pathway, patients should be classified according to 4 main domains (function, disability, social participation, and personal expectations) in order to design a personalised programme that addresses personal disabilities, symptoms and dysfunctions. An individual patient assessment helps to identify several treatable problems specific to the patient, enabling the development and implementation of a personalised treatment plan [8].

To date, there is no precise, standardized description of the "ideal candidate," nor is there a validated threshold of disability required to justify admitting respiratory patients to intensive hospital-based rehabilitation courses.

Without clear, objective criteria mapping patient disability levels to specific care settings, clinical practice remains subjective, regional disparities persist, and payers lack the transparent framework necessary to fairly evaluate and remunerate the complexity of PR.

This study aims to evaluate the appropriateness of hospital admissions of patients with respiratory diseases to a rehabilitation facility using several validated items defined in the scientific literature.

Specifically, the analysis will assess, over a ten-year observation period, the frequency of appropriate and inappropriate admissions in order to better understand the criteria guiding referrals to PR and to identify potential areas for improvement in the patient selection and admission management processes.

Materials and Methods

We analysed all hospitalisation data retrieved from the Qlik ICS Maugeri central repository, which contains clinical admission records from January 01, 2015 to 31 December 31, 2024 in the following centres of the Istituti Clinici Scientifici Maugeri of Milan, Bari, Pavia, Lumezzane (Bs), Montescano (Pv), Telesse (Bn), and Tradate (Va), Italy. The ICS Maugeri network provides a system of inpatient and outpatient rehabilitation services across Italy, from north to south, including rural areas. These units serve as referral centers for pulmonary rehabilitation (PR), weaning from mechanical ventilation, and chronic care. Together, these units account for approximately 20% of all PR admissions in Italy.

For patients with multiple hospitalisations during the study period, only the first admission was considered for analysis. Collected data were categorised according to the main therapeutic

pathway (TP) at admission: chronic respiratory failure (CRF), chronic obstructive pulmonary disease (COPD), asthma, obstructive sleep apnoea syndrome (OSAS) and miscellaneous dyspnoea of any cause excluding COPD. For each PT TP the following parameters were recorded: anthropometric data (sex and age), when available, the Comorbidity Index of the Cumulative Illness Rating Scale (CIRS) [9], dyspnoea assessed using the Medical Research Council (MRC) scale [10] and Barthel dyspnoea Index [11], disease impact measured with the COPD assessment test (CAT) [12], exercise tolerance measured with the 6MWT walk test [13], and motor disability using the Short Physical Performance Battery (SPPB) scale [14]. We therefore defined hospitalisation as appropriate based on treatable items identified in the literature, using specific severity cut-offs [11,15-18], as detailed in Table 1.

All patients referred to a standardized inpatient multidisciplinary PR program (6 days/week; 2-3 hours/day) based on pneumologists, nurses, physiotherapists, dietitians and psychologists' indications. Physiotherapy program comprised exercise training and airway clearance. Drugs optimization, education, nutrition, psychosocial interventions were also offered. All evaluations were shared through a computerized portal, through which the physician activates the various professionals necessary to carry out the rehabilitation process. Within the rehabilitation team, the patient's path is periodically re-evaluated and the various changes to the ongoing treatment were discussed in dedicated meetings attended by the referring physician, a physiotherapy representative, nursing coordinator and, when necessary, specialists in nutrition, speech therapy, and neuropsychological assessment.

The proportion of appropriate hospitalisations was calculated for the overall cohort of patients and stratified by each therapeutic pathway (TP) for each selected item with respect to the total number of admissions with available baseline data for the item. For patients with complete baseline data for four selected items (MRC was excluded in favour of the Barthel Dyspnoea score due to the high number of missing data, its high correlation with Barthel Dyspnoea, and the fact that the latter is more informative, as it captures the level of disability related to activities of daily living (ADLs)) we also calculated the proportion of inappropriate admissions, defined as hospitalisations in which all four entry criteria fell outside the predefined appropriateness thresholds.

Data extraction and analysis were conducted in accordance with current data-protection regulations (EU General Data Protection Regulation 2016/679), the principles of the Declaration of Helsinki (2013 revision). The study protocol was reviewed and approved by the Institutional Review Board (No. CET 6L0018390-25; Pavia, 11 March 2025). Given the

retrospective design of the study, participants did not provide specific written informed consent for this study. However, all participants had provided informed consent at the time of hospital admission for the scientific use of their personal data.

Statistical analysis

The data were analysed descriptively and expressed as mean $\pm$ standard deviation, number (n) and percentage (%). Due to the high number of missing data for treatable items in the overall cohort and for each therapeutic pathway (TP), all available data were indicated as a number and as a percentage of the total.

Results

Table 2 shows the patient cohort analysed by individual TPs. The sample is predominantly male (62.95%), with an average age in the sixth to seventh decade, primarily affected by chronic respiratory failure (45.70%) and presenting several comorbidities. The average length of hospital stay ranged from 15 to 25 days, consistent with the characteristics of the specific TP. Access to the rehabilitation facility occurred mainly from the home setting (84.30% of the total admissions), with a higher prevalence of patients with OSAS. Patients with chronic respiratory failure were more frequently admitted from the acute hospital setting (22.20%). The vast majority of patients were discharged home (> 95%), while fewer than 3% were transferred to an acute care hospital, and less than 2% died during hospitalisation.

Table 3 shows, for the overall cohort of patients and stratified by individual TPs, the number of available data for each item, the related baseline values, and the proportion of appropriateness.

The overall cohort showed a high to very high percentage of appropriateness across all assessed items, ranging from 73% for the SPPB to 87% for the 6MWT (Table 3).

Across the different therapeutic pathways (TPs), the highest appropriateness was consistently observed for the 6MWT (range: 74%–94%), while values lower than 70% were found in CAT, Bathel dyspnoea and SPPB.

Patients with CRF exhibited a very high percentage of appropriateness (all items higher than 78%), reflecting the greater severity of their condition and therefore a potentially larger margin for recovery.

In the COPD subgroup, appropriateness was particularly high in the area of deconditioning, as indicated by the 6MWT (83%), with good appropriateness also observed for dyspnoea levels during ADLs (79%).

The least represented group in pulmonary rehabilitation was patients admitted for asthma, specifically showing an appropriateness for the CAT score (68.3%), which is consistent with the known natural history of the disease disability. Nevertheless, a subset of asthmatic patients exhibited severely reduced 6MWT values and could therefore benefit from a rehabilitation program.

As expected, OSAS patients were those most frequently admitted from home (96.55%) and who had the lowest % of appropriateness at entry (range 55-75 %). The cut-off of appropriateness for deconditioning (74%) identified a subset of OSAS patients with effort impairment and coexisting severe metabolic conditions, such as obesity, that contribute to a more sedentary lifestyle.

In the remaining group, characterised by the prevalent symptom of dyspnoea without a clear respiratory diagnosis, the most representative measures for an appropriate referral to a pulmonary rehabilitation facility were deconditioning to exertion (83%) and dyspnoea (both MRC and Barthel dyspnoea 81%)

Among 6086 hospitalisations with complete data for four baseline items (MRC excluded), the 2.8% of admissions were classified as inappropriate for inpatient pulmonary rehabilitation. The dyspnoea subgroup with no identified cause showed the highest rate of inappropriate referrals (6.2%), while the CRF group had the lowest (0.7%) (Figure 1).

Discussion

The present study shows that patients undergoing inpatient pulmonary rehabilitation were predominantly older men with chronic respiratory failure (CRF) and multiple comorbidities. Most patients were admitted from home and discharged back home at the end of the rehabilitation program. According to the selected appropriateness criteria, the proportion of patients meeting entry disability thresholds ranged from 73% to 87% in the overall cohort. Among the evaluated items, the 6-min walk test (6MWT % predicted) showed the highest frequency of appropriateness (74–94%), whereas the SPPB 60–78% and the CAT 64–84% were less frequently met. The CRF subgroup, representing the most clinically severe population, showed the highest appropriateness rates. Conversely, the overall rate of inappropriate admissions—defined as the absence of any entry criterion meeting the

predefined severity thresholds—was low (2.80%), with the highest rates observed in the dyspnoea and OSAS subgroups and the lowest in the CRF subgroup.

The ideal candidate for pulmonary rehabilitation is a symptomatic subject with impaired functional status, low participation in activities of daily living (ADLs), and low health-related quality of life (HRQoL), who is a high consumer of healthcare resources and suffering from the systemic (i.e., non-respiratory) consequences [19-23].

Otherwise, the current guidelines on PR [19-22] are mainly based on the experience of the programs provided to outpatients and do not offer any multifaceted tool to determine the clear indication for priority of inpatient PR prescription.

From a management perspective, in order to optimise resources throughout the healthcare system and achieve a favourable cost-benefit ratio, it is essential to select patients whose characteristics are suitable for pulmonary rehabilitation.

Inpatient programs are effective, but may be expensive and should thus be reserved for the more complex subjects.

Payment for PR varies widely among healthcare systems worldwide. Reimbursement may represent gross underpayment due to underreporting by hospitals of charges and rehabilitation services required [24], but also gross overpayment due to inappropriate candidate selection for PR and choice of setting.

Furthermore, during this period of economic contraction, health payers need tools to define 'priority setting' and 'budget impact' in order to cover PR costs and ensure the optimal distribution of health resources. This is because we require robust instruments and outcomes in order to make informed decisions about how to invest money in this field [25,26]. The macroscopic architecture of a country's healthcare delivery—whether structured as a Health Insurance System or a Universalistic/National Health System—profoundly shapes how PR is organized, how patients are referred, and how strictly "appropriateness" is enforced. While the clinical benefits of PR are widely recognized, health system dynamics determine who has access, who bears the costs, and which clinical subgroups are ultimately prioritized. Even among patients with private health insurance, coverage remains the single largest perceived barrier to referral, followed closely by transportation limitations, which restrict the continuity of rehabilitation services. Conversely, universal systems are uniquely vulnerable to overcrowding and inappropriate admissions because services are "free" at the point of care. While access is universally mandated in principle, budget caps create fixed capacity constraints.

Clinicians really need to be able to define the priority of PR prescription based on objective and measurable treatable traits parameters of disease, such as respiratory function, disability, nonparticipation in ADLs, and the complexity of their condition. The main characteristics that define the treatable trait on which to base access to rehabilitation are: the possibility of being identified and measured, of being treatable or modifiable, which has a measurable impact on clinical outcomes [27]. The proposal for an assessment of appropriateness based on defined treatable traits facilitates a personalised approach, ensuring greater specificity and favouring precision medicine. It recognises the diversity of clinical conditions in patients with similar diagnoses, evaluates differences in response and optimises management of chronicity, as well as preventing disease progression.

In this direction, we have previously proposed an ambulatory multicomprehensive triage (Pulmonary Rehabilitation Decisional Score), based on lung function, clinical parameters, disability, frailty, and participation in ADLs, as useful for staging the clinical priority of PR prescription, facilitating the preparation of a waiting list and sustainability of the health system [28].

To advance research in this field, we have conducted a retrospective analysis of a large sample to determine the appropriateness/inappropriateness of access to an in-hospital rehabilitation programme for patients with respiratory pathology, based on recognised criteria and their disability thresholds.

Our data confirmed the typical population admitted to PR programmes, with a male prevalence and an average age in the sixth or seventh decade, with several comorbidities.

The main diagnosis at admission was CRF, with or without COPD. A previous study of 547 patients admitted to an inpatient PR programme found that 18% had COPD without CRF, 58% had CRF with different diseases but COPD as the main diagnosis, 7% were tracheostomised survivors of the ICU, and 17% had dyspnoea with miscellaneous diseases [29].

The relatively frequent admissions of patients with OSAS and those presenting with dyspnoea without a confirmed obstructive diagnosis—who largely originated from home settings—may represent a potential source of lower appropriateness. Although these conditions are rarely addressed in pulmonary rehabilitation guidelines, the level of disability observed in these patients was often substantial, frequently associated with metabolic comorbidities, frailty, and clinical instability. These factors may justify the need for a rehabilitation pathway that goes beyond the underlying respiratory diagnosis alone.

We showed that the clinical outcome was optimal: the vast majority of patients were discharged home, fewer than 3% were transferred to an acute care hospital, and fewer than 2% died during in hospital stay. These low transfer and mortality rates indicate, on one hand, the good quality of care and indirectly also the appropriate selection of patients for admission by avoiding overly unstable patients or those in the end-of-life phase.

In addition, physical deconditioning as measured by the 6MWT test has been demonstrated to be the most significant treatable trait in both the general population and the individual PTs, making it a useful tool for evaluating patients for inclusion in rehabilitation programs and as an index of effective improvement.

It is not surprising that patients with CRF presented a very high percentage of appropriateness, reflecting the greater severity of their condition and therefore their greater potential for recovery. Also, for the COPD subgroup, the appropriateness was achieved more in the field of deconditioning as highlighted by the 6MWT, with good appropriateness related to the level of dyspnoea during ADLs.

A small group of disabled asthmatic patients have severely reduced 6MWT values and would therefore benefit from a rehabilitation pathway.

As expected, OSAS patients presented the lowest % of appropriateness on entry, while appropriateness deconditioning was high when severe metabolic diseases, such as obesity, lead to a more sedentary lifestyle. Our group has previously identified this condition [30].

Also, for the remaining group with the prevalent symptom of dyspnoea without an evident respiratory diagnosis, a high impact of the disease, as measured by the CAT scale, was particularly high, confirming the PR need. This subgroup of patients (not COPD) requires increased attention to care and PR, as is also recommended in recent guidelines [24].

With regard to the inappropriateness of access for the Maugeri ICS population, it should be emphasised that only 2.8% of admissions were classified as inappropriate, with chronic respiratory failure being the most common condition and identified as the most appropriate based on the characteristics objectified through the scales taken into consideration, compared to pathologies causing dyspnoea without a clear functional genesis.

Limitations

The retrospective nature of the study must be highlighted as a limitation, as it inevitably results in a high number of missing data that could have influenced the estimation of appropriateness and inappropriateness rates. In addition, considering that COPD and dyspnea are the most

represented respiratory disease categories in this study (together accounting for about 43%) and have the lowest percentage of missing data among the measures included in the composite inappropriateness definition (none exceeding 30% of unavailable data), our composite inappropriateness measure appears to be mainly applicable to these two conditions. Furthermore, the lack of specific functional data for each pathology defined by administrative codes must be noted. Finally, even if the sample is particularly large, the fact that the study was conducted only in a territory like Italy with a specific healthcare organization could limit its generalizability in other contexts.

Practical implications

In pulmonary rehabilitation, the application of a diagnostic-therapeutic pathway based on the presence of specific treatable conditions or traits represents an area of growing scientific and technological development. In this context, the use of specific cut-offs and tools for standardizing clinical-instrumental evaluations is of fundamental importance for the referral of patients to specialized rehabilitation facilities, particularly following acute hospitalisation. By establishing objective thresholds for admission, this research aims to bridge the gap between clinical and organizational appropriateness, minimizing resource waste for payers while ensuring equitable access to life-changing rehabilitation for respiratory patients.

The findings related to the OSAS and “miscellaneous dyspnoea” subgroups are particularly interesting. OSAS subgroup is clearly the most at risk of inappropriate hospital admission; therefore, the present study reinforces the need to promote robust outpatient, home-based, hybrid, or telemonitoring-supported multidisciplinary programs in this context. The 'miscellaneous dyspnoea' group, on the other hand, is heterogeneous and typically includes elderly, disabled, and comorbid patients recovering from an episode of acute respiratory failure without a clearly defined underlying respiratory pathology. This group is increasingly represented in rehabilitation wards due to population aging, chronicity, frailty, and multimorbidity. Moreover, it has not yet been fully recognized within international PR guidelines, but it represents an emerging social and healthcare “tsunami” that will require responses across both hospital and community settings [31].

Conclusions

The evaluation of inpatient pulmonary rehabilitation patterns reveals a service heavily utilized by a highly complex, older, and predominantly male patient population with chronic

respiratory failure (CRF) and multiple comorbidities. While entry disability criteria are robustly met within the core CRF subgroup, notable pockets of inappropriate admissions exist within the dyspnea and Obstructive Sleep Apnea Syndrome subgroups. These insights underscore that, while the service successfully targets high-severity, functionally impaired patients, there is a critical opportunity to optimize resource allocation.

Implementing targeted patient-selection strategies and standardized, multifaceted referral tools may further refine admission appropriateness, maximize clinical outcomes, and enhance overall health system efficiency.

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Table 1. Treatable items and related appropriateness cut-offs for accessing an in-hospital rehabilitation programme.

Treatable Items	Measure/score	Cut off for PR appropriateness	References
Disease Impact	CAT	CAT $\geq$ 18 points	[16]
Dyspnea during ADL	Barthel dyspnea	> 13.5 points	[11]
Effort tolerance	6MWT	6MWT < 70% of predicted	[17]
Disability/Deconditioning	SPPB score	$\leq$ 9 points	[18]

PR, pulmonary rehabilitation; MRC, Medical Research Council; CAT, COPD Assessment Test; 6MWT, 6-minute walking distance; SPPB, Short Physical Performance Battery.

Table 2. Anthropometric and clinical parameters at admission (2015-2024) for the entire cohort and stratified by therapeutic pathways.

	Whole group	CRF	COPD	Asthma	OSAS	Miscellaneous Dyspnea
Patients, n (%)	38.961 (100)	17.809 (45.70)	8.870 (22.76)	308 (0.79)	4.244 (10.89)	7.730 (19.84)
Males, n (%)	24.526 (62.95)	11.015 (61.85)	6.065 (68.37)	99 (32.14)	2.765 (65.15)	4.582 (59.27)
Age, y	69.82 $\pm$ 11.30	70.94 $\pm$ 10.76	71.87 $\pm$ 9.27	68.24 $\pm$ 12.56	64.05 $\pm$ 12.57	68 $\pm$ 12
CIRS 2, score	4.19 $\pm$ 2.04	4.45 $\pm$ 2.09	4.21 $\pm$ 2.04	3.70 $\pm$ 2.19	3.84 $\pm$ 1.90	3.65 $\pm$ 1.85
LOS, days	23.16 $\pm$ 11.95	25.18 $\pm$ 13.08	24.72 $\pm$ 10.75	22.54 $\pm$ 7.89	15.44 $\pm$ 9.10	20.96 $\pm$ 9.75
Provenience, n (%)						
<i>Home</i>	32.844 (84.30)	13.855 (77.80)	7.858 (88.60)	285 (92.53)	4097 (96.55)	6614 (85.56)
<i>Acute hospital</i>	6117 (15.70)	3954 (22.20)	1012 (11.40)	23 (7.47)	147 (3.45)	1.116 (14.44)
Discharge, n (%)						
<i>Home/Home care</i>	37.241 (95.58)	16.654 (93.51)	8591 (96.85)	305 (99.02)	4220 (99.45)	7494 (96.95)
<i>Acute hospital</i>	1.125 (2.88)	663 (3.72)	240 (2.70)	3 (0.98)	22 (0.50)	197 (2.55)
<i>Deaths</i>	595 (1.52)	492 (2.76)	39 (0.43)	0 (0)	2 (0.05)	39 (0.50)

CRF, chronic respiratory failure; COPD, chronic obstructive pulmonary disease, CIRS, Cumulative Illness Rating Scale; LOS, length of stay

Table 3. Available baseline scores/values of the five selected items (column) and percentage of appropriateness for the overall cohort and stratified by individual therapeutic pathways (rows).

	MRC	CAT	Barthel dyspnea	6MWT % pred	SPPB
Whole group (N=38961)					
Data available, n (%)	8943 (23)	12482 (32)	18116 (46.5)	24424 (62.7)	16189 (41.6)
Baseline values	2.93±1.17	22.09±7.56	33.90±21.09	41.14±23.95	6.46±3.89
% appropriateness	85.6	74.2	81.1	87.4	73.1
CRF (N=17809)					
Data available, n (%)	4877 (27.4)	5579 (31.3)	8142 (45.7)	11128 (62.5)	8732 (49)
Baseline values	3.15±1.12	24.33±6.83	39.77±21.84	38.48±22.52	5.68±4.04
% appropriateness	89.1	84.2	87.7	94.2	78.1
COPD (N= 8870)					
Data available, n (%)	1779 (20.1)	3639 (41)	4068 (45.9)	6025 (67.9)	2886 (32.5)
Baseline values	2.74±1.12	19.98±7.58	29.32±17.84	50.93±21.52	8.00±3.19
% appropriateness	84.0	64.3	79.3	83.2	61.7
Asthma (N= 308)					
Data available, n (%)	95 (30.8)	101 (32.8)	135 (43.8)	256 (83.1)	124 (40.3)
Baseline values	2.67±1.08	21.15±7.61	29.43±18.62	48.94±21.61	6.95±3.04
% appropriateness	85.3	68.3	79.3	83.2	75.8
OSAS (N= 4244)					
Data available, n (%)	775 (18.3)	528 (12.4)	1760 (41.5)	2019 (47.6)	1092 (25.7)
Baseline values	2.50±1.32	20.31±8.09	21.10±18.48	52.78±24.33	7.82±3.54
% appropriateness	74.8	64.2	55.5	74.1	60.3
M. Dyspnea (N= 7730)					
Data available, n (%)	1417 (18.3)	2635 (34.1)	4011 (51.9)	4996 (64.6)	3355 (43.4)
Baseline values	2.66±1.18	20.66±7.63	32.41±19.75	50.62±22.51	6.73±3.61
% appropriateness	81.1	68.7	80.8	82.8	73.8

Legend: For selected item, the proportion of appropriate hospitalizations was calculated for the overall cohort of patients and stratified by each therapeutic pathway (TP) with respect to the total number of admissions with data item available. CRF, chronic respiratory failure; COPD, chronic obstructive pulmonary disease; OSAS, obstructive sleep apnoea syndrome; M, miscellaneous.

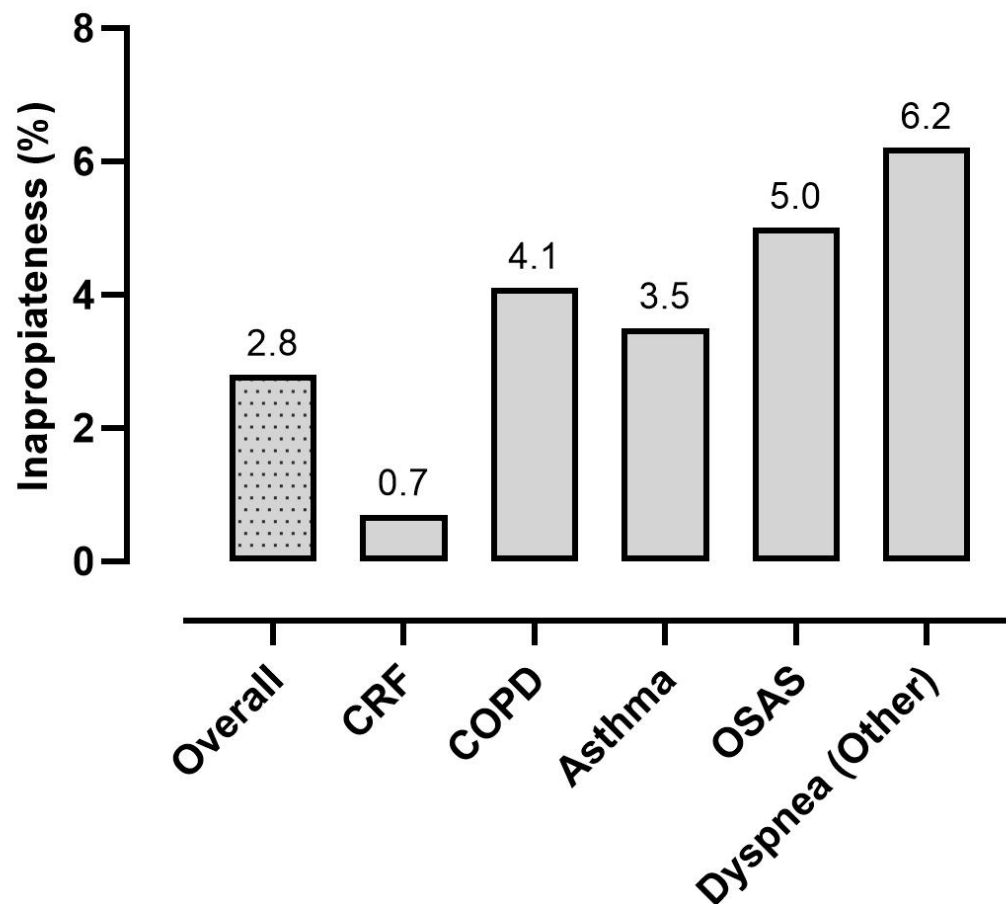


Figure 1. Percentage of inappropriateness for four combined items (CAT, Barthel Dyspnoea, 6MWD, SPPB) calculated for the overall cohort and stratified according to the individual TPs (data available for 6086 hospitalisations). MRC, Medical Research Council; CAT, COPD assessment test; 6MWD, six-minute walking test; SPPB, Short Physical Performance Battery; CRF, chronic respiratory failure; COPD, chronic obstructive pulmonary disease; OSAS = obstructive sleep apnoea syndrome.