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Content comparison of health-related quality of life instruments for COPD

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Summary
Background: Due to the increasing importance of quality of life assessments in chronic obstructive pulmonary disease (COPD) patients, and the increased use of the International Classification of Functioning, Disability and Health (ICF) for comparative purposes it is essential to understand the relationship between health-related quality of life (HRQL) instruments and the ICF.
Objective: The objective of this study was to compare the content of recommended COPD-specific HRQL instruments using the ICF as reference. COPD-specific instruments mentioned in widely accepted guidelines were linked to the ICF using standardized linking rules. The degree of agreement between various health professionals was assessed by calculating the kappa statistic.
Results: Eleven instruments were included. They varied strongly in the number of concepts contained and the number of ICF categories used to map these concepts. A total of 548 concepts were identified and linked to 60 different ICF categories. Only the single category 'dyspnea' was covered by all instruments, whilst 21 categories were unique to specific instruments. The relationships of the measures with the ICF were identified.

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Conclusions: This study may aid researchers and clinicians to choose the most appropriate instrument for a specific purpose as well as help compare studies that have used different instruments for HRQL assessment.

Introduction

The rising prevalence of chronic obstructive pulmonary disease (COPD) is increasingly evident worldwide. Due to the ageing of the population and the increase in disease prevalence, COPD is projected to become the fifth leading cause of years lived with disability and the third most common cause of death by 2020.[1]

From a societal and patient perspective, COPD is associated with increased healthcare costs[2] and decreased quality of life.[3] Quality of life of patients suffering from the multiple structural and functional changes is increasingly being accepted as one of the most important health outcomes to consider in managing the disease. Consequently, improving quality of life is considered a major goal in widely recognized guidelines for the management of COPD, such as those of the British Thoracic Society (BTS)[4] and the European Respiratory Society (ERS).[5] More recently, the GOLD guidelines, issued by the US National Heart, Lung, and Blood Institute and the World Health Organization,[6,7] identified the goals of effective COPD management, which included relief of symptoms, improving exercise tolerance and quality of life. Similarly, numerous societies' guidelines for pulmonary rehabilitation—among them the BTS,[8] the ERS,[9,10] the American Thoracic Society (ATS),[10,11] the American College of Chest Physicians (ACCP) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACPR)[12]—consider quality of life a major goal in patients with COPD.

The recognition of the importance of systematically assessing symptoms and functional limitations in order to optimize the management of COPD has led to the development and use of numerous condition-specific health-related quality of life (HRQL) instruments. None of the aforementioned organizations has made recommendations regarding the use of specific HRQL instruments, in part because of insufficient comparative data. The need to perform head-to-head comparisons and to develop specific and standardized methods to enhance the interpretability of HRQL instruments for clinicians was identified at an ATS-sponsored conference on measuring health outcomes for patients with COPD,[13] and has been emphasized in review articles.[14]

When selecting HRQL instruments for research or clinical settings, the validity, practicability, and discrimination of the potential HRQL instruments are to be considered and compared. Some COPD-specific HRQL instruments have been compared and reviewed in detail.[14–16] Detailed content comparisons are hardly to be found in the literature. This is likely due to the variable use of concepts, scales, and items in the different COPD-specific HRQL instruments, and the lack of a common framework and terminology. With the newly available International Classification of Functioning, Disability and Health (ICF),[17] a universal framework exists in which the items and scales of various HRQL instruments can better be compared.[18,19] Interestingly, the International Classification of Impairments, Disabilities, and Handicaps (ICIDH), the predecessor of the ICF, was already considered "suitable for categorizing much of the morbidity arising from respiratory diseases" according to the old ATS's official statement on pulmonary rehabilitation.[11]

Since the ICF is being increasingly applied in clinical research and practice, it will likely be used in future clinical and epidemiological trials, as well as in health reports or serve as a reference for comparative studies. A combination of both the ICF and the disease-specific HRQL instruments could be applied simultaneously.

The objective of our study was to examine and to compare the contents of HRQL instruments used in COPD, using the ICF as the frame of reference and to identify the relationship of the instruments with the ICF.

Methods

To compare the most widely used and recommended COPD-specific HRQL instruments we (1) identified and selected the HRQL instruments mentioned in major national and international COPD guidelines and reviews, (2) linked the concepts contained in the HRQL instruments to the ICF, and (3) compared the contents covered by the different HRQL instruments.

Selection of HRQL instruments

Multiple sources were used to identify disease-specific HRQL instruments in COPD: (i) guidelines for the management and rehabilitation of COPD, as set forth by British Societies,[4,8,20] the European Respiratory Society,[5] and the American Thoracic Society[11,21]; (ii) the GOLD Guidelines[6]; (iii) the pulmonary rehabilitation guidelines published by the ACCP and AACPR,[12] and their updates[7,22]; and (iv) COPD-specific HRQL instruments cited in the recently published reviews.[14,16] When more than one version was available, the most recent version was studied.[23]

The international classification of functioning, disability and health, ICF

The ICF (formerly ICIDH–2, http://www3.who.int/icf/icftemplate.cfm) was developed in a comprehensive consensus process conducted worldwide over the past few

years. Endorsement by the World Health Assembly occurred in May 2001.

The overall aim of the ICF classification is to provide a unified and standard language and framework for the description of health and health-related states. The ICF encompasses all aspects of human health and health-relevant components of well-being, and describes situations involving human functioning and its restrictions. The ICF serves as a framework to organize this information in a meaningful, interrelated, and easily accessible way.

The overall structure of the ICF is shown in Fig. 1. The two main subdivisions cover Functioning & Disability (*Part 1*) and Contextual Factors (*Part 2*). Each of these two subdivisions is further divided into '*components*': (i) Body Functions, (ii) Body Structures, (iii) Activities and Participation, (iv) Environmental Factors, and (v) Personal Factors. The letters b, s, d, e and pf refer to the components 'Body Functions' (b), 'Body Structures' (s), 'Activities and Participation' (d), 'Environmental Factors' (e) and 'Personal Factors' (pf). The letters are followed by a numeric code that defines the chapter number (first digit) and the category levels up to the fourth level (suffix of two, three, or four digits). Categories are the units of the ICF classification. They are arranged in a stem–branch–leaf scheme, so that a lower-level category shares the attributes of the higher level of which it is a member. For further information on the conceptual background, underlying definitions and structure of the ICF, we refer to the respective WHO publication.[17]

Linking of HRQL instruments to the ICF

In order to compare the content of the various COPD-specific HRQL instruments, we first linked each instrument to the ICF. The detailed classification, including all categories with their definitions and inclusion and exclusion criteria, was applied throughout the linking procedure.

The linking procedure was performed independently by two groups, each made up of three healthcare professionals.

Group 1 consisted of three psychologists with experience in quality of life and outcomes research. Group 2 included three medical doctors from diverse backgrounds: respiratory medicine (AS), public health (JR), and physical medicine and rehabilitation (GS).

Both groups were trained in the use of the ICF and were familiar with the HRQL instruments. They followed the coding guidelines described in the Annex two of the ICF[17] and a standardized linking approach.[19,24] In addition, (i) a version of each measure and the ICF was available to each group member, (ii) the two groups identified the concepts covered by each item of the HRQL instruments independently, (iii) the identified concepts were linked to the ICF categories that most precisely covered the concepts of each of the items (for examples see Table 1), and (iv) the two groups' results were compared and kappa statistics performed. In case of disagreement, results were discussed between the two groups and a consensus was reached for the final version.

Data analyses and content comparison

The documentation of the linkage process and data management were conducted using a simple database. The reliability of the linkage process was evaluated by calculating kappa coefficients and 95% bootstrap confidence intervals based on the two independent linkage versions of each instrument. Kappa statistics were calculated per component, at the 1st (chapter) and 2nd (category) ICF levels to indicate the degree of agreement between the two groups of health professionals conducting the linkage procedure. The kappa analysis was performed with SAS.

In a first step, the identified concepts from the instruments are described according to their frequency distribution across the ICF components. In a second step, the identified concepts from the instruments are described according to their frequency distribution across the addressed ICF chapters (1st level) and categories (2nd level).
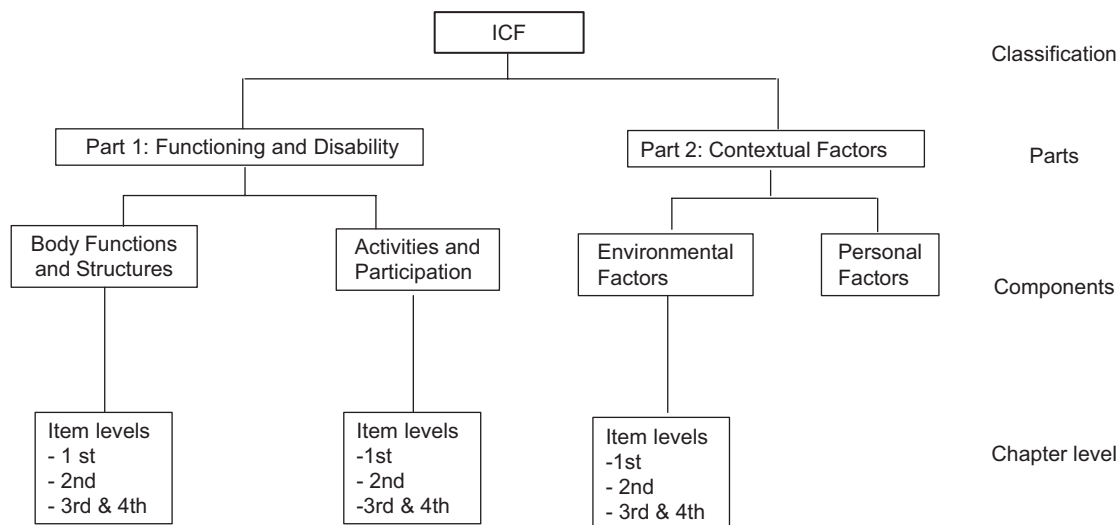

Figure 1 Structure of the International Classification of Functioning, Disability and Health (ICF). Within the chapters (i.e., the first item level), categories can be discriminated (i.e., 2nd–4th item level).

Table 1 Demonstration of linking procedure using selected items.

Items (measure)	Concepts	ICF			
		Component	Chapter (1st level)	Categories (2nd level)	(3rd level)
My cough or breathing disturbs my sleep (SGRQ)	My cough	b	Functions of the respiratory system (b4)	Additional respiratory function such as cough (b450)	—
	My breathing	b	Functions of the respiratory system (b4)	Respiration functions (b440)	—
	Sleep disturbance	b	Mental functions (b1)	Sleep functions (b134)	Quality of sleep (b1444)
Because of my lung disease, I cannot put on my socks, stockings or shoes (MRF-28)	My lung disease	Health condition	Substitute for the underlying disease, classified in the complementary ICD 10		
	Putting on socks, stockings or shoes	d	Self care (d5)	Dressing (d540)	Putting on footwear (d5402)

According to the guidelines of each of the ethics committees (University of Bern, Switzerland and Ludwig-Maximilian University, Munich, Germany) approval was not necessary.

Results

Selected HRQL instruments

Altogether, 11 COPD-specific HRQL instruments were identified: (1) the St. George's respiratory questionnaire (SGRQ),[25] (2) the chronic respiratory questionnaire, standardized version (CRQ-SAS),[23] (3) the pulmonary functional status & dyspnea questionnaire, modified version (PFSDQ-M),[26] (4) the pulmonary functional status scale (PFSS),[27] (5) the breathing problems questionnaire (BPQ)[28] (the shortened version BPQ-S was not chosen as it exclusively applies to patients in rehabilitation settings), (6) the Seattle obstructive lung disease questionnaire (SOLDQ),[29] (7) the quality of life for respiratory illness questionnaire (QOL-RIQ),[30] (8) the airway questionnaires 20 (AQ20),[31] (9) the London chest activity of daily living scale (LCADL),[32] (10) the Maugeri Foundation respiratory failure questionnaire (MRF28),[33] and (11) the clinical COPD questionnaire (CCQ).[34]

Linking process

Examples of the results after application of the coding and linking procedure are shown in Table 1. Terms referring to a time sequence, including 'in the last 2 weeks' or 'day-to-day problems', cannot be linked to the ICF and were assigned *nd* (not definable). Terms such as 'your chest condition', 'your lung disease' were used in many items as a substitute or umbrella term for the underlying disease and were assigned *hc* (health condition). Health conditions are classified and coded in the complementary International Classification of Diseases, ICD 10 (example given in Table 1).

Linking results

Table 2 shows the results of the evaluation of the linkage procedure by kappa statistics and bootstrapped confidence intervals. Estimated kappa values range from 0.81 to 0.92. None of the 95% confidence intervals encloses zero, thus linker agreement exceeds chance.

Table 3 shows the number of identified concepts from the selected instruments as well as summarized for all instruments. The table also includes the concepts' distribution

Table 2 Estimated kappa coefficient and the bootstrapped confidence intervals at the component, 1st (chapter) and 2nd (category) ICF levels.

	Estimated kappa coefficient	95% Bootstrapped confidence intervals
Component	0.58	[0.51;0.64]
Chapter 1st level	0.69	[0.64;0.74]
2nd level	0.72	[0.68;0.77]

Table 3 COPD-specific HRQL instruments: number of identified concepts, and summarized for all instruments.

	SGRQ n	(%)*	CRQ-SAS n	(%)*	PFSDQ-M n	(%)*	PFSS n	(%)*	BPQ n	(%)*	SOLDQ n	(%)*	QOL-RIQ n	(%)*	AQ20 n	(%)*	LCADL n	(%)*	MRF28 n	(%)*	CCQ n	(%)*	Total n	(%)*
Number of items	50		20		40		38		33		29		55		20		16		28		10		339	
Number of concepts	105		38		68		49		52		46		62		30		35		39		24		548	
Concepts linked to ICF component																								
Body Functions (b)	45	(42.9)	28	(73.7)	36	(52.9)	13	(26.5)	15	(28.8)	20	(43.5)	34	(54.8)	19	(63.3)	18	(51.4)	15	(38.5)	12	(50)	255	(46.5)
Activity and Participation (d)	46	(43.8)	7	(18.4)	32	(47.1)	31	(63.3)	21	(40.4)	21	(45.6)	20	(32.3)	8	(26.7)	16	(45.7)	17	(43.6)	12	(50)	231	(42.2)
Environmental Factors (e)	6	(5.7)					3	(6.1)	13	(25)	3	(6.5)	7	(11.3)	2	(6.7)	1	(2.9)	3	(7.7)			38	(6.9)
Personal Factors (pf)	6	(5.7)	3	(7.9)			2	(4.1)	3	(5.8)	1	(2.2)	1	(1.6)	1	(3.3)			4	(10.2)			21	(3.8)
Concepts not covered by the ICF	2	(1.9)									1	(2.2)											3	(0.6)

The table also includes the number of concepts as represented across the four ICF components as well as the number of concepts, which were not linked to the ICF. Empty boxes indicate that the respective instrument did not cover contents of that component.

*Percentages are calculated based on the total number of concepts for each instrument.

across the ICF components, as well as the number of concepts not covered by the ICF. Within the 11 selected instruments 548 concepts have been identified. The SGRQ contains the highest ($n = 105$) and the CCQ the lowest number of concepts ($n = 24$). All HRQL instruments covered the ICF components 'body functions' and 'activities and participation' and none of the component 'body structure'. 'Environmental factors' are not covered by CRQ-SAS, PFSDQ-M, CCQ and 'personal factors' are not covered by PFSDQ-M, LCADL, CCQ.

Most concepts ($n = 255$) have been linked to ICF categories from the component 'Activity and Participation'. In contrast, only 38 of the concepts (6.9%) has been linked to 'Environmental Factors'. Three concepts could not be linked by the ICF; 'unpleasant side effects from medication' (SGRQ), 'production of phlegm' (SGRQ, CCQ), and 'current treatment' (SOLQ).

Table 4 shows the linkage of the concepts to the ICF categories 'body functions', Table 5 to 'activities and participation', and Table 6 to 'environmental factors'. The numbers contained in the tables represent the frequency with which the ICF categories were addressed in the different HRQL instruments. While the number of concepts linked to a specific ICF category can provide insights into this issue, no conclusion regarding the psychometric properties and the suitability of the instrument for a specified purpose can be made. A higher number may indicate that either the instrument contains a determined concept more than once or that the ICF classification did not differentiate that concept in greater detail, and therefore several items from a specific instrument had to be linked to the same ICF category. For example, in the CRQ-SAS the ICF category *emotional* functions (b152), which may include positive and negative aspects, was chosen to link a number of different states such as "angry or upset", "feeling of fear or panic", "feeling worried or depressed", or "feeling relaxed, free of tension, satisfied". If the ICF would have more refined categories for these different states, the named items would have been linked to these categories.

A total of 60 different ICF categories (2nd level) corresponding to 4.1% of all existing ICF categories have been used to map the contents of the 11 instruments.

The instrument with the broadest bandwidth of content coverage is the SGRQ. To link the concepts of the SGRQ 33 different ICF categories have been used.

The content of the identified items that cover 'personal factors' refers to coping strategies, personal wishes, helplessness, and dependences.

Discussion

This paper selected the most widely used instruments to evaluate COPD patients, examined the content by linking the concepts to the ICF, and in the process generated an inventory, which can contribute to the understanding of the content of the current instruments in relation to the ICF. The instruments studied varied strongly in the number of concepts they contain and the number of ICF categories used to map these concepts.

A total of 60 different ICF categories were used to map the contents of the 11 instruments. Only one category,

Table 4 Linkage of concepts from COPD-specific HRQL instruments to the respective ICF categories in the component body functions.

ICF component body functions (b)		Instruments										
*	Category	SGRQ	CRQ-SAS	PFSDQ-M	PFSS	BPQ	SOLDQ	QOL-RIQ	AQ20	LCADL	MRF28	CCQ
b1	b110 Consciousness function										1	
	b126 Personality functions	1	1		3		1	2			1	
	b130 Energy and drive functions	1	5	15		1	1	3	1		2	
	b134 Sleep functions	1				2		2	1		1	
	b140 Attention function										1	
	b144 Memory functions										3	
	b147 Psychomotor functions		1		1			1	1			
	b152 Emotional functions	3	10	6	4	6	6	6	5		1	2
b2	b265 Touch functions							1				
	b280 Sensation of pain	1										
	b289 Sensation of pain, unspecified							1				
b3	b340 Alternative vocalization functions								1			
b4	b410 Heart functions, tachycardia							1				
	b440 Respiration functions	11	1			1	3	4	2	1		6
	b450 Cough	5	1				1	2	1			2
	b455 Exercise tolerance functions	3	1				1	3				
	b460 Dyspnea	14	8	15	2	4	7	2	7	17	5	2
	Wheezing	2						1				
	b469 Functions, sensations of the respiratory system, unspecified	3				1		1				
b6	b640 Sexual functions				3			3				
b8	b840 Sensations of pins and needles							1				

The figures depict the number of items within the instrument that contained concepts linked to the respective ICF category.

*Chapters: b1 (mental functions), b2 (sensory functions and pain), b3 (voice and speech functions), b4 (functions of the cardiovascular, haematological, immunological and respiratory systems), b5 (functions of the digestive, metabolic and endocrine systems), b6 (genitourinary and reproductive functions), b8 (functions of the skin and related structures).

dyspnea (b460) was addressed by all instruments. By linking all instruments to the ICF it could be shown that the classification is a very precise tool with few exceptions. The precision can be illustrated by, for example, the item 'breathing problems when exposed to flowers, trees, plants' of the QOL-RIQ (item 7, section 'circumstances that might trigger chest problems'), which is well represented by the ICF category e220.

Within the component *body functions* we found most similarities regarding the contents addressed in the chapter mental (b1), and respiratory and cardiovascular functions (b4). Considering the most frequent clinical symptoms of COPD,[6] it is obvious that all HRQL instruments clarify the impact of dyspnea, addressed by category b460. Similarly, anxiety and depression show a high prevalence in patients with COPD. Therefore, it is not surprising that all but one instrument covered these contents, which are addressed in the ICF category b152. While we found similarities in these exemplified main health domains, there are striking differences in what is considered further relevant within this component. For example, some clinically highly relevant symptoms, such as coughing (b450), were not covered by four instruments. However, since cough and phlegm is of questionable relevance for very severe COPD it may not have been included in the MRF 28 and the LCADL, developed for the most severe COPD patients. It is noteworthy, that only the SGRQ and the CCQ refer to the production of phlegm. This is remarkable, since it is well known that exacerbations are more frequent in those COPD patients with regular sputum production. Similarly, clinical assessment of health status in all patients with COPD should include questions about sleep quality and possible co-existing sleep apnoea syndrome.[22] However, sleep functions (b134) were assessed by six instruments only.

Within the component *activities and participation*, it becomes obvious that patients with COPD face a number of problems regarding walking (d450), climbing (d455), lifting and carrying objects (d430), covered by most HRQL instruments. Other important consequences of exercise intolerance include increased difficulty in washing oneself (d510), dressing (d540), shopping (d620), doing housework (d610), and playing sports or games (d920). These activities are part of the chapters mobility (d4), self-care (d5), domestic (d6), and social life (d9) and consistent with the

Table 5 Linkage of concepts from COPD-specific HRQL instruments to the respective ICF categories in the component activity and participation.

ICF component activity and participation (d)		Instruments										
*	Category	SGRQ	CRQ-SAS	PFSDQ-M	PFSS	BPQ	SOLDQ	QOL-RIQ	AQ20	LCADL	MRF28	CCQ
	Activity and participation (global)	1			2	2						1
d2	d230 Carrying out daily routine			2		2	3			1	1	1
d3	d330 Speaking (talking)	1								1	2	1
d4	d410 Changing basic body position	1				2	2			1	2	
	d415 Maintaining a body position	2			1	1						
	d430 Lifting and carrying objects	2			1	1	2	1				1
	d440 Fine hand use (picking up)										1	
	d445 Hand and arm use				1							
	d450 Walking	5	1	9	3	3	3					1
	d455 Moving around (climbing)	6		3	2	1	5	2	1	1		1
	d460 Moving in different locations	2							1	1		
	d475 Driving (cycle)	1			1			1				
	d498 Mobility, other specified			3								
d5	d510 Washing oneself	3	1	6	2	2	1	2		2	2	1
	d520 Caring for body parts			3	1						1	
	d530 Toileting					2		1				
	d540 Dressing	2	1	3	2		1	1		2	2	1
	d550 Eating		1			2						
d6	d620 Shopping	1	1		3	1		1			1	
	d630 Preparing meals			3	2						1	
	d640 Doing housework	3	1		1	1	1	2	1	6	1	1
	d649 Household task, unspecified				2							
	d650 Caring for household objects	3			1	1			1		1	
	d660 Assisting others	1						1				1
d7	d750 Informal social relationships				1	1						
	d760 Family relationships					1						
	d770 Intimate relationships	1						1	1			
d8	d850 Remunerative employment	1										
	d859 Work, unspecified	1							1			
d9	d910 Community life				1							
	d920 Recreation and leisure	8	1		4	2	2	4	2	1	2	2
	d930 Religion and spirituality	1										

The figures depict the number of items within the instrument that contained concepts linked to the respective ICF category.
 *Chapters: d2 (general tasks and demands), d3 (communication), d4 (mobility), d5 (self-care), d6 (domestic life), d7 (interpersonal interactions and relationships), d8 (major life areas), d9 (community, social, and civic life).

results of a recent international COPD survey.[35] This study showed, that 40–60% of COPD patients experience limitations in normal physical exertion, sports and leisure activities, as well as in household chores and social activities.

However within these chapters, there was no category covered by all instruments. In addition only a limited number of the HRQL instruments address contents of the chapters communication (d3), relationships (d7), or major life areas (d8). For example, only the SGRQ and the AQ20 evaluate issues of employment and work. Since patients with mild to moderate COPD may experience work-related difficulties,[4,6] the inclusion of such questions appears to be justified. However, since essentially the large majority of very severe COPD patients are old and retired, this might explain that this issue is not addressed by the MRF 28 and the LCADL. Similarly, speech difficulties are an important

compromised function in COPD patients.[35] It is therefore surprising that talking limitations (d330) were addressed only by four HRQL instruments (SGRQ, LCADL, MRF 28, CCQ).

The differences are most pronounced within the scarcely covered contents on *environmental factors*. In view of the fact that tobacco smoking and environmental pollution are major risk factors for COPD, the restricted coverage of the component 'environmental factors' is remarkable. The fact that the SGRQ, QOL-RIQ, BPQ, and AQ20 address air quality and climate aspects seems to be a particular strength of these instruments.

When considering all instruments evaluated here there are 21 items unique to specific instruments. These items ultimately influence the choice of the instrument for a specific clinical purpose.

The first question when selecting HRQL instruments for a specific purpose is to decide what should be measured. For

Table 6 Linkage of concepts from COPD-specific HRQL instruments to the respective ICF categories in the component environmental factors.

ICF component body functions (b)		Instruments										
*	Category	SGRQ	CRQ-SAS	PFSDQ-M	PFSS	BPQ	SOLDQ	QOL-RIQ	AQ20	LCADL	MRF28	CCQ
e1	e110 Drugs (medication)	4							1			
	e115 Technology for personal use (nebulizer, oxygen, respiratory device)					3					1	
e2	e220 Flora and fauna						2					
	e225 Climate	1				5	3					
	e260 Air quality	1				2	2	1				
e3	Support and relationship (global)			3	3					1		
	e310 Immediate family					1					1	
	e315 Extended family										1	
	e320 Friends					1						
	e355 Health professionals					1						

The figures depict the number of items within the instrument that contained concepts linked to the respective ICF category.
   *Chapters: e1 (products and technology), e2 (natural environment and human-made changes to environment, e3 (support and relationships), e4 (attitudes).

this the study endpoints, the population studied, and the intervention must be considered. The second question is to decide which instrument to use from all the available instruments. Since the ICF-based comparison provides information about the contents addressed in the different instruments, it may be a very useful tool in the selection process. In the choice of a HRQL instrument further considerations, such as practicability (e.g. interviewer vs. self-administered instruments, standardized as opposed to individualized items, length of the instrument, response categories, and psychometric characteristics) have to be then taken into account.

When selecting condition-specific instruments it would be worthwhile to examine the overlap with generic HRQL instruments. Such a comparison is possible through linkage of the items to the ICF. Ideally, there would be only a minimal overlap to minimize the number of questions that need to be answered.

The linkage process has been evaluated by calculating kappa coefficients, which showed satisfactory results for linker agreement even though the groups consisted of different professional backgrounds. Kappa is an often used and simple indicator of agreement accounting for chance.

Several limitations apply to this study. First, the ICF was not specifically designed for COPD resulting in the fact, that three concepts were not represented by the ICF. These concepts have been identified by this study and may be incorporated in future versions of the ICF. Second, the four concepts referring to 'personal factors' identified in the instruments could not be linked since they are not yet contained in the current ICF version. Third, the linkage process revealed, that the category emotional factors (b152) are addressed very frequently in the different instruments, which may indicate that ICF does not differentiate sufficiently in this context. For example, the most common emotional states that may be specified in a future version of the ICF are upset, fear, anxiousness, and depressed states. Similarly, it would be better not to put the symptoms dyspnea and wheezing into the same category b460, but create two distinct categories.

It is important to emphasize that the results of the content comparison of the HRQL instruments based on the ICF cannot substitute a thorough study of the instruments under consideration. The tables summarizing the results of the content comparison do not provide information about the kind of response categories that are applied or the psychometric properties of the instruments.

The ICF provides an excellent framework when comparing the content of HRQL instruments for COPD. This content comparison provides valuable information to study the heterogeneity and overlapping of the instruments regarding their representation of body structures, body functions, activities and participation, and environmental factors. The comparison of these instruments provides interesting insight into their similarities and differences and does so in a detailed and structured way.

Our results somewhat contradict, at least in terms of the ICF, previous assumptions made about COPD-specific HRQL instruments—that 'their content is generally similar',[14] that 'all items in the questionnaire are common to all patients with the disease', and that 'the items are those that reflect the usual effect of the disease in a population of patients with COPD'.[15] The selection of an appropriate COPD-specific HRQL instrument depends, among other considerations, on the study question, the population to be studied, and the intervention. No single COPD-specific HRQL instrument is ideal for all applications. However, the first question to ask when selecting a COPD-specific HRQL instrument is *What should be measured?* This ICF-based content comparison can help researchers and clinicians decide which tool to use.

Conflict of interest statement

The authors declare that they have no competing interests.

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