


Validation of the brief international classification of functioning, disability, and health core set for obstructive pulmonary disease in the Chinese context

Chronic Respiratory Disease
Volume 16: 1–14
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DOI: 10.1177/1479973119843648
journals.sagepub.com/home/crd


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Abstract

In order to determine the validity of the International Classification of Functioning, Disability, and Health brief Core Set for Obstructive Pulmonary Disease (ICF-OPD) for the assessment of functioning and environmental factors in Chinese chronic OPD (COPD) patients, we conducted a cross-sectional study with a convenience sample of 100 COPD patients. Data were collected using common questionnaires for COPD patients (Modified British Medical Research Council Questionnaire, COPD Assessment Test, St George's Respiratory Questionnaire (SGRQ)), the Brief ICF Core Set for OPD, and the comprehensive ICF checklist. All except one category of the Brief ICF-OPD Core Set were confirmed in our evaluation of its content validity, but there is a high prevalence of problems in 8 categories that were not considered in the Brief ICF-OPD Core Set. The functioning-related components of the Brief ICF-OPD Core Set largely performed similarly to SGRQ in terms of differentiating between patients with different disease severity. Moreover, high correlations between the Brief ICF-OPD Core Set overall score and component scores with the respective SGRQ scales and moderate correlations between ICF-OPD Core Set overall score and component scores and lung function parameters. This study largely confirmed content, known group, and convergent validity of the ICF-OPD.

Keywords

Chronic obstructive pulmonary disease, international classification of functioning, disability and health core set, international classification of functioning, disability and health checklist, international classification of functioning, disability and health, SGRQ

Date received: 17 November 2018; accepted: 26 February 2019

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Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality throughout the world. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2018, COPD is currently the fourth leading cause of death in the world and is projected to be the third leading cause of death by 2020.¹ In China, COPD has been the third leading cause of death, second only to hypertension and diabetes.^{2,3} The most recent Chinese national survey on COPD has been performed from 2012 to 2015 and reported an overall prevalence of spirometry-defined COPD of 8.6%, accounting for about 100 million people. The prevalence among individuals aged 40 years or older even increased to 13.7% as compared with 8.2% in 2007.^{4,5} Tobacco smoking is the primary risk factor but other noxious gases and particles can also cause a poorly reversible airflow limitation, which is the principal feature of COPD.⁶ Ambient air pollution caused by rapid industrialization and urbanization in the past decades and a large population of smokers is likely to be responsible for the high prevalence of COPD in China.^{5,7,8}

Although medicines are the main therapy during the course of COPD treatment, especially when acute and transient episodes of exacerbated respiratory symptoms occur, the presence of side effects may restrict pharmacologic therapy.^{9,10} Pulmonary rehabilitation is recognized as a core component of the management of individuals with COPD and has clearly demonstrated to improve functional exercise capacity and health-related quality of life (QoL) with evidence being especially strong in patients with moderate to severe disease.^{11,12} However, interventions should be individualized to the unique needs of the patients considering the severity and complexity of disease and disability.¹³ Comprehensive measures to assess the aforementioned complexity are thus necessary.

Some widely used measures to assess symptoms, health status, and risk of future events in COPD include the Modified British Medical Research Council (mMRC) Questionnaire, the Chronic Respiratory Questionnaire (CRQ), the St George's Respiratory Questionnaire (SGRQ), the COPD Assessment Test (CAT), and the COPD Control Questionnaire (CCQ).^{14–16} However, an international standard for the measurement of functioning is currently missing.

The World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) provides the basis for such measure.¹⁷

The ICF Core Set for obstructive pulmonary disease (ICF-OPD) is a set of ICF categories derived from the ICF and designed to record specific aspects of the functioning of OPD patients as well as the influence of environmental factors on patients' health. There are two types of ICF-OPD Core Set: the Brief and the Comprehensive Core Set. The Brief Core Set represents a minimum standard for data on functioning to be collected in OPD patients while the Comprehensive Core Set is supposed to represent the full spectrum of aspects of functioning and environmental factors relevant to OPD patients and is supposed to guide rehabilitation from a multidisciplinary perspective.^{18,19}

As no studies have validated the ICF core sets for OPD in the Chinese context so far, this study aimed to validate the Brief ICF-OPD Core Set in Chinese patients with COPD. The specific aims were to evaluate the (a) content validity, (b) known group validity, and (c) convergent validity of the Brief ICF-OPD Core Set.

Patients and methods

Design

A cross-sectional study, using individual interviews with standardized questionnaires including mMRC, CAT, SGRQ, and two ICF-based measurement tools, was conducted in a convenience sample of patients with COPD. The study received Ethical approval from the Ruijin Hospital Institutional Review Board.

Patients

One-hundred COPD patients who were in stable condition and did not have exacerbations for at least 1 month were selected by convenience to participate in this study. Patients were included if they had a COPD diagnosis according to GOLD guidelines. Patients were excluded if they presented severe psychiatric conditions and/or were unable to respond to instructions of researchers and guardians. The objective of the study and its requirements were explained to the subjects, and all participants provided written informed consent. The sociodemographic and clinical characteristics of the participants are provided in Table 1.

Measures

In this study, the Brief ICF-OPD Core Set was used to assess functioning and disability as well as environmental factors in all patients. This ICF Core Set

Table 1. Demographics and clinical characteristics of included patients.

Characteristics	
Gender (male:female)	94:6
Age (M, IQR)	68 [64, 75]
BMI (M, IQR)	23.22 [21.45, 24.90]
Education level (n, %)	
Primary school	11%
Secondary school	27%
High school	32%
University	30%
Marital status (n, %)	
Married	95%
Divorced	0%
Widowed	4%
Single	1%
Smoking (%)	
Current smokers	84%
Ex-smokers	13%
Non smokers	3%

M: median; IQR: interquartile range [p25, p75]; BMI: body mass index.

comprises six categories in body functions and structures, four categories in activities and participation, and four categories in environmental factors. The Body Function and Structures component includes respiration function (b440), additional respiratory function (b450), exercise tolerance functions (b455), sensations associated with cardiovascular and respiratory function (b460), structure of cardiovascular system (s410), and structure of respiratory system (s430). The Activity and Participation component includes carrying out daily routine (d230), walking (d450), moving around (d455), and doing housework (d640). The Environment component consists of products of substances for personal consumption (e110), products and technology for personal use in daily living (e115), climate (e225), and air quality (e260). ICF qualifiers were applied to rate the degree of problems in each category of the Body Function and Structures component and the Activity and Participation component with a generic five-point scale: *no problem* (0), *mild problem* (1), *moderate problem* (2), *severe problem* (3), and *complete problem* (4). Environmental factors were graded with three response levels: being a barrier (+1), having no influence (0), or being a facilitator (-1).

For evaluating the content validity of the Brief ICF-OPD Core Set in the Chinese context, the WHO ICF checklist was applied in addition. The ICF

checklist consists of a selection of 125 categories from the whole ICF classification system and provides a concise questionnaire for health professionals to use in clinical practice.¹⁷ Studies have reported that the checklist is a practical tool to elicit and record information on the functioning and disability of an individual and the categories of ICF checklist were found to be common in most chronic diseases.^{17,20} For all functioning components of the ICF checklist, participants were asked whether they had impairment, limitation or restriction in body functions, body structures, and activities and participation, respectively. For environmental factor, they were asked if the respective factor was either a barrier or facilitator or no influence.²¹

For evaluating the known group validity of the Brief ICF-OPD Core Set, we compared scores of the Brief ICF-OPD Core Set and scores of SGRQ in COPD patients according to the GOLD and ABCD classification groups based on mMRC and CAT. Several previous studies have demonstrated that SGRQ is a reliable and valid assessment tool for evaluating QoL, and its ability to differentiate between groups with various clinical symptoms and lung function parameters has been demonstrated in COPD patients.^{22,23} Our hypothesis was that scores of the ICF-OPD Core Set should be higher in groups with more severe disease. SGRQ scores of the symptom, activity, and impact parts were also evaluated to confirm that the results acquired by the GOLD and ABCD classification could actually reflect the disease severity. Secondly, we evaluated scores of the ICF-OPD Core Set in the Body Function and Structures component, the Activity and Participation component, the Environment component, and the total components based on the GOLD and ABCD classification.

For evaluating the convergent validity of the Brief ICF-OPD Core Set in the Chinese context, we compared the score of the Brief ICF-OPD Core Set and SGRQ for each grade and examined correlations between ICF-OPD Core Set components and SGRQ subscales. To assess whether the assessment based on the Brief ICF-OPD Core Set can well reflect pulmonary function of COPD patients, we examined the current lung parameters of COPD patients including predicted forced expiratory volume in 1 s (FEV1% pred) and FEV1/forced vital capacity (FVC) before the interviews were carried out. Then, the correlations of these lung parameters with partial and total scores of the Brief ICF-OPD Core Set were evaluated. We

hypothesized that higher scores in ICF functioning components corresponded to higher scores in SGRQ and greater impairment in pulmonary function.

Data analysis

For the evaluation of content validity, relative frequencies (prevalences) of persons who reported a problem in each specific category of the ICF checklist were calculated. A relative frequency of problems in one category below 0.30 was considered not relevant and therefore the specific category was not reported.²⁴ The remaining categories were compared with the Brief ICF-OPD Core Set.

For the evaluation of known group validity, frequencies and extent of problems along ICF-Core Set components were compared across patients with different disease severity according to GOLD and ABCD classification. To investigate differences in the frequency of problems among participants among the four COPD grades, Cochran–Armitage trend tests were performed. To investigate differences in the extent of problems among the four COPD grades, Kruskal–Wallis tests were applied. If the overall test was significant, post hoc tests were used to compare individual groups.

To investigate convergent validity of the Brief ICF-OPD Core Set, Spearman correlation coefficients between scores of Core Set components, SGRQ, and lung parameters were calculated.

SPSS (version 20.0; SPSS, Chicago, Illinois, USA) and GraphPad Prism (version 7; GraphPad Software, San Diego, California, USA) were used for all statistical analysis and drawing graphs, and the level of significance was set to $p < 0.05$.

Results

Content validity: Identification of the most common problems in Chinese COPD patients using the ICF checklist

To identify whether the Brief ICF-OPD Core Set could cover the most common problems in Chinese COPD patients, we investigated the frequency of problems using the WHO ICF checklist. Table 2 shows the frequency of problems in each category of the checklist for the ICF categories that were endorsed by over 30% of the COPD patients. All concepts covered in the Brief ICF-OPD Core Set except e260 (air pollution) were identified. Eleven additional ICF categories were endorsed by over 30% of the

sample: b134 (sleep), b210 (seeing), b280 (pain), s2 (structures of eye and ear), s5 (structure related to the digestive, metabolic and endocrine systems), d440 (lifting and carrying objects), d455 (driving), e310 (support and relationships of immediate family), e335 (support and relationships of health professionals), e410 (individual attitudes of immediate family members), and e450 (individual attitudes of health professionals).

Known-group validity: Comparison of the ability of SGRQ and the Brief ICF-OPD Core Set to differentiate between COPD grades

Figures 1 and 2 show the three component and total scores of SGRQ and the Brief ICF-OPD Core Set across disease severity groups according to two classical classifications of COPD disease severity from GOLD 2018. Except for slightly lower scores of patients in group GOLD 3 than group GOLD 2 for the ICF activity and participation component scores, median values of total and partial scores increased with degree of airflow limitation and symptom severity according to GOLD classification. Differences between GOLD 1 and GOLD 4 were all statistically significant. No significant intergroup differences were found for the ICF environmental factors component.

For ABCD classification, total scores and subscale scores of SGRQ and ICF OPD Core Set were lower in the C group than in the B group. Otherwise, the order was as expected. Differences between A and D group were all statistically significant. No significant intergroup differences were found for the ICF environmental factors component.

We further assessed the QoL among COPD patients according to the ICF-OPD framework to inform the development of further rehabilitation interventions. Specially, we analyzed the frequency and extent of the impairments of COPD patients and the differences among COPD classifications based on the specific categories of the Brief ICF-OPD Core Set (Tables 3 and 4). When the frequency of the difficulties among different grades of COPD were analyzed, it was observed that impairments in b455 (exercise tolerance functions), s430 (structure of respiratory system), d455 (moving around), and e110 (products or substances for personal consumption) were most frequent (frequency above 70%) regardless of COPD grades. At the same time, the frequency of problems increased from GOLD 1 to GOLD 4 in ICF-OPD categories b440 (respiration functions), b450

Table 2. Chinese COPD patient prevalence in categories of ICF checklist.^a

Component	Code	Category	Percent of linked concepts
Body functions	b440	<i>Respiratory functions</i>	96.74
	b134	sleep	41
	b420	<i>Blood pressure</i>	40.22
	b410	<i>Heart</i>	39.13
	b130	<i>Energy and drive functions</i>	39
	b210	Seeing	34.78
	b280	pain	34.78
	Body structures	s430	<i>Structure of respiratory system</i>
s2		Structures of eye and ear	62
s410		<i>Structure of cardiovascular system</i>	50
s5		Structure related to the digestive, metabolic and endocrine systems	41
Activities and participations	d450	<i>Walking</i>	76
	d430	Lifting and carrying objects	59
	d220	<i>Undertake multiple tasks</i>	46
	d475	Driving	41
	d640	<i>Doing housework</i>	39
Environmental factors	e110	<i>Products or substances for personal consumption</i>	80
	e225	<i>Climate</i>	55
	e310/e410	Support, relationships and attitudes of Immediate family	50
	e355/e450	Support, relationships and attitudes of health professionals	43
	e115	<i>Products and technology for personal use in daily living</i>	40

ICF-OPD: International Classification of Functioning, Disability, and Health; COPD: Chinese chronic obstructive pulmonary disease.

^aThe categories in italics are those included in the ICF Core Set for OPD.

(additional respiratory functions), d230 (carrying out daily routine), d450 (walking), d455 (moving around), and d640 (doing housework). This trend was also found for the ABCD classification in b440 (respiration functions), d230 (carrying out daily routine), d450 (walking), d640 (doing housework), and e115 (products and technology for personal use in daily living).

In relation to the extent of the impairments, we found that except the environment components of the Brief ICF-OPD Core Set, there were more self-feeling impairments in the other components with the higher COPD grade. However, the impairment of b460 (sensations associated with cardiovascular and respiratory functions) and s410 (structure of cardiovascular system) were not found increased in either GOLD classification or ABCD classification.

Convergent validity: Correlation between SGRQ, lung parameters of COPD, and the Brief ICF-OPD Core Set

Correlations between the ICF-OPD Core Set and SGRQ scales are given in Table 5. Positive

correlations were found between overall and component scores of the Brief ICF-OPD Core Set and SGRQ overall and subscale scores. We found significantly moderate correlations between ICF-OPD Total, ICF-OPD Function and Structure component, and ICF-OPD Activity and Participation component scores and lung function parameters, FEV1% pred and FEV1/FVC (Table 6). Apart from the correlations of ICF Activity and Participation component and ICF total score with FEV1% pred which were both about 0.1 lower than the correlations found for the respective SGRQ scales, the size of correlations was similar for ICF-OPD Core Set and SGRQ.

Discussion

Existing clinical practice indicators such as lung function and blood examination do not fully reflect the overall health status of COPD patients. It is necessary to collect standardized information on functioning and environmental factors as to comprehensively evaluate patients' health and identify key targets for rehabilitative interventions. The Brief ICF-OPD Core Set, consisting of 14 ICF categories scored with ICF

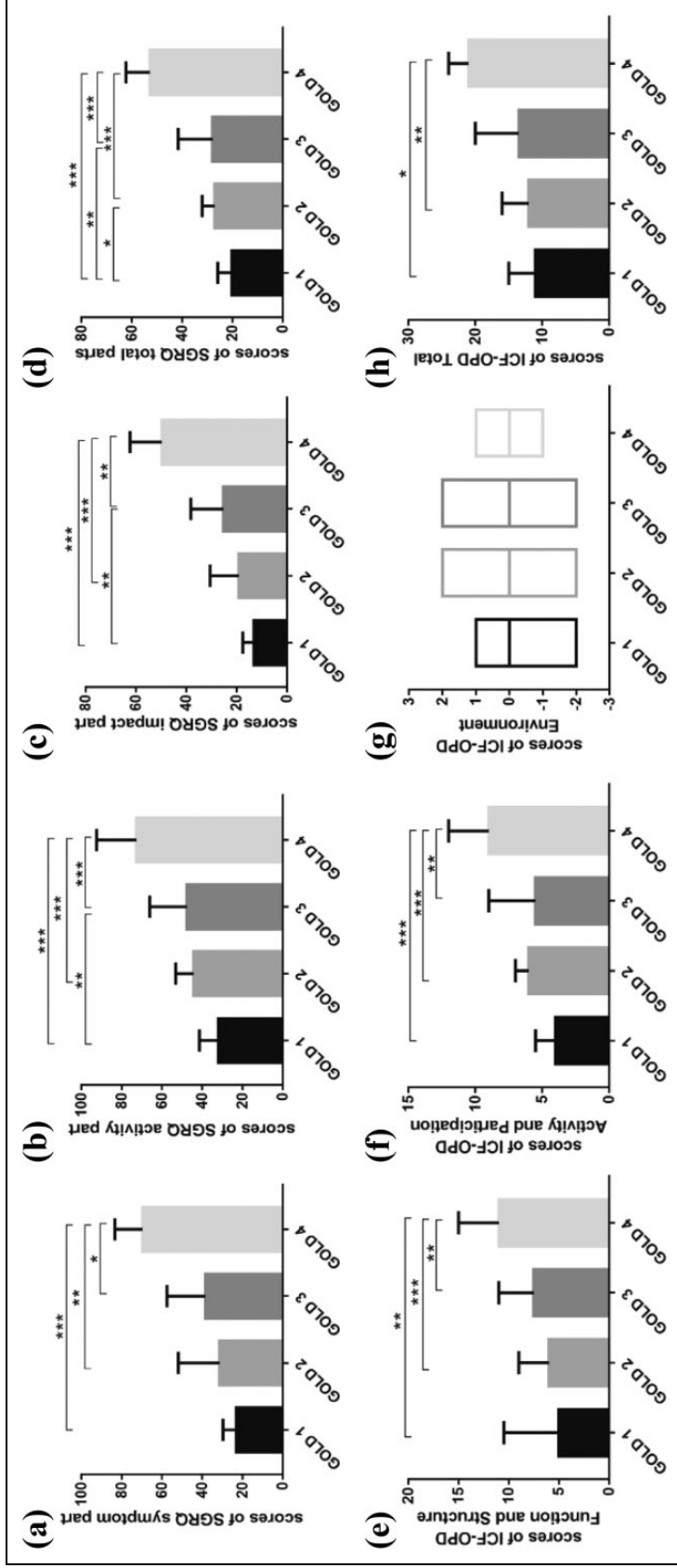


Figure 1. The scores of SGRQ and the Brief ICF-OPD Core Set in COPD patients based on GOLD classification. Data are presented as median \pm IQR, while (g) is presented as a floating bars (line at median). Statistical significant values are identified with * ($\alpha = 0.05$), ** ($p < 0.01$), *** ($p < 0.001$), **** ($p < 0.0001$). SGRQ: St George's Respiratory Questionnaire; ICF-OPD: International Classification of Functioning, Disability, and Health brief Core Set for Obstructive Pulmonary Disease; COPD: Chinese chronic OPD; GOLD: Global Initiative for Chronic Obstructive Lung Disease; IQR: interquartile range.

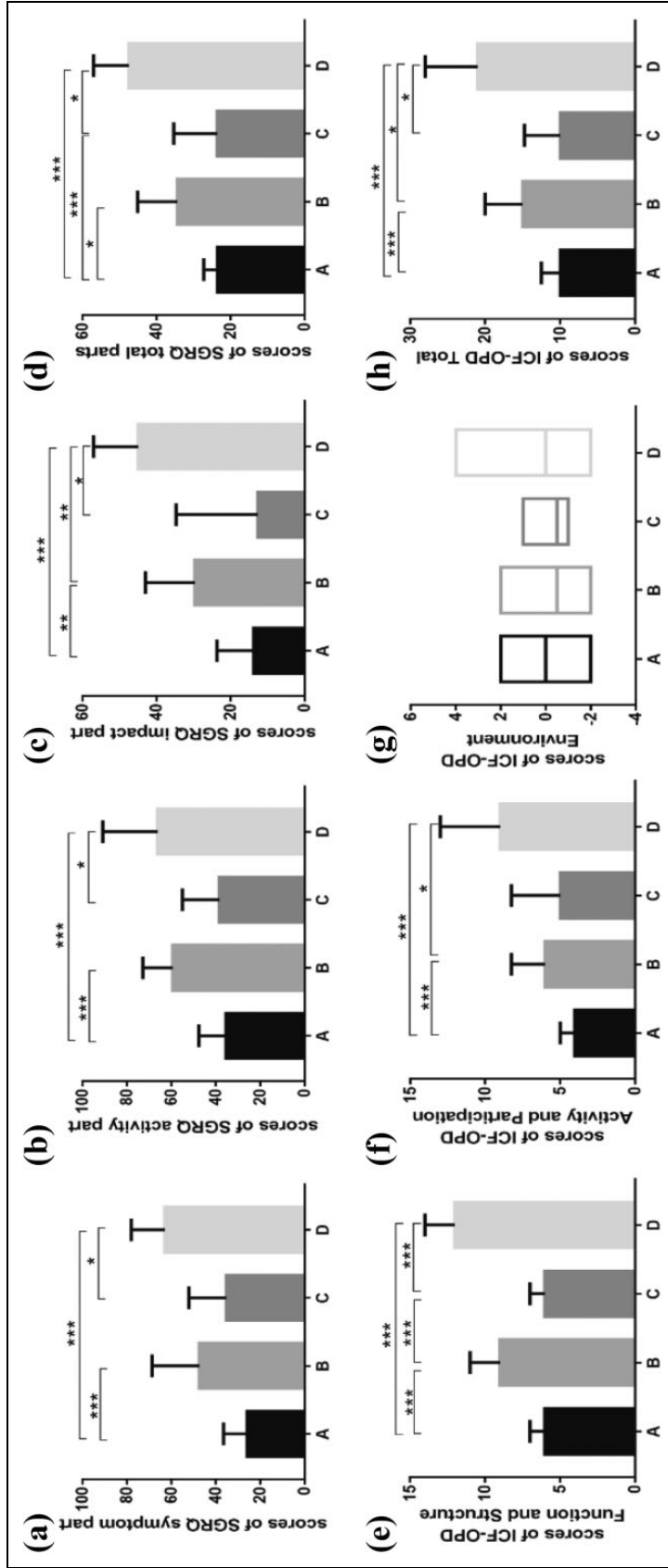


Figure 2. The scores of SGRQ and the Brief ICF-OPD Core Set in COPD patients based on ABCD classification. Data are presented as median \pm IQR, while (g) is presented as a floating bars (Line at median). Statistical significant values are identified with $^{*}(p < 0.05)$, $^{***}(p < 0.001)$, $^{*}p < 0.01$, $^{*}p < 0.05$. SGRQ: St George's Respiratory Questionnaire; ICF-OPD: International Classification of Functioning, Disability, and Health brief Core Set for Obstructive Pulmonary Disease; COPD: Chinese chronic OPD; IQR: interquartile range.

Table 3. Frequency and extent of the participants' impairments in the component of the Brief ICF-OPD Core Set based on GOLD Classification.

Code	Category title	GOLD 1 (n = 9)		GOLD 2 (n = 38)		GOLD 3 (n = 38)		GOLD 4 (n = 15)		Total (n = 100)			
		n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	p ^a	p ^b
b440	Respiration functions	5 (55.6)	1 [0,1.5] ^c	29 (76.3)	1 [0.75,2.25] ^{c,d}	29 (76.3)	1 [0.75,2.25] ^{c,d}	14 (93.3)	2 [1,3] ^d	77 (77)	1 [1,2]	0.045^f	0.012^f
b450	Additional respiratory functions	5 (55.6)	1 [0,1] ^c	21 (55.3)	1 [0,1] ^c	25 (65.8)	1 [0,2] ^{c,d}	13 (86.7)	2 [1,3] ^d	64 (64)	1 [0,1]	0.029^f	<0.001^g
b455	Exercise tolerance functions	9 (100)	1.5 [1,2]	34 (89.5)	2 [2,3]	37 (97.4)	2.5 [2,3]	14 (93.3)	3 [2,3]	94 (94)	2 [2,3]		0.113
b460	Sensations associated with cardiovascular and respiratory functions	5 (55.6)	1 [0,1]	18 (47.4)	0 [0,1]	16 (42.1)	0 [0,1]	10 (66.7)	1 [0,2]	49 (49)	0 [0,1]		0.052
s410	Structure of cardiovascular system	7 (77.8)	1 [0.5,2]	15 (39.5)	0 [0,1]	17 (44.7)	0 [0,1]	8 (53.3)	1 [0,1]	47 (47)	0 [0,1]		0.408
s430	Structure of respiratory system	9 (100)	2 [1,2.5] ^{c,d}	34 (89.5)	1 [1,2] ^c	36 (94.7)	2 [1,3] ^{c,d}	15 (100)	2 [2,3] ^d	94 (94)	2 [1,2]		0.008^h
d230	Carrying out daily routine	5 (55.6)	1 [0,1] ^c	21 (55.3)	1 [0,1] ^c	20 (52.6)	1 [0,2] ^c	15 (100)	2 [1,3] ^d	61 (61)	1 [0,2]	0.020^f	0.004^h
d450	Walking	5 (55.6)	1 [0,1.5] ^c	28 (73.7)	1 [0,2] ^c	28 (73.7)	1 [0,2] ^c	15 (100)	2 [2,3] ^d	76 (76)	1 [1,2]	0.017^f	0.003^f
d455	Moving around	8 (88.9)	3 [1,3.5] ^c	36 (94.7)	3 [2,3] ^{c,d}	38 (100)	3 [2.75,3] ^{c,d}	15 (100)	3 [3,4] ^d	97 (97)	3 [2,3]	0.057	0.047^f
d640	Doing household work	3 (33.3)	0 [0,1] ^c	17 (44.7)	0 [0,1] ^c	17 (44.7)	0 [0,2] ^c	13 (86.7)	2 [1,3] ^d	50 (50)	1 [0,1]	0.009^h	0.003^h
e110	Products or substances for personal consumption	8 (88.9)	-1 [-1,-1]	31 (81.6)	-1 [-1,-1]	29 (76.3)	-1 [-1,0]	15 (100)	-1 [-1,-1]	83 (83)	-1 [-1,-1]		0.130
e115	Products and technology for personal use in daily living	4 (44.4)	0 [-1,0]	9 (23.7)	0 [-0.25,0]	12 (31.6)	0 [-1,0]	9 (60)	-1 [-1,0]	34 (34)	0 [-1,0]		0.083
e225	Climate	5 (55.6)	1 [0,1]	20 (52.6)	1 [0,1]	15 (39.5)	0 [0,1]	12 (80)	1 [1,1]	52 (52)	1 [0,1]		0.085
e260	Air quality	3 (33.3)	0 [0,1]	21 (55.3)	0 [0,1]	15 (39.5)	0 [0,1]	10 (66.7)	1 [0,1]	49 (49)	0 [0,1]		0.233

M: median; IQR: interquartile range [p25, p75]; ICF-OPD: International Classification of Functioning, Disability, and Health Brief Core Set for Obstructive Pulmonary Disease; COPD: Chronic Obstructive Pulmonary Disease.

^aDifferences in the frequency of impairments among COPD grades.

^bDifferences in the extent of impairments among COPD grades

^{c-e}Statistically significant difference in column proportions at the 0.05 level.

^fp < 0.05.

^gp < 0.001.

^hp < 0.01.

Note: c-e suggested that post-hoc tests were also significant at the 0.05 level if the overall test was significant in the extent of impairments. Different superscript indicates a statistically significant difference in column proportions at the 0.05 level, while the same superscript indicates no significant difference.

Table 4. Frequency and extent of the participants' impairments in the component of the Brief ICF-OPD Core Set based on ABCD classification.

code	Category title	A (n = 41)			B (n = 29)			C (n = 10)			D (n = 20)			Total (n = 100)		
		n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	n (%)	M [IQR]	p ^a
b440	Respiration functions	27 (65.9)	1 [0,1] ^c	25 (86.2)	1 [1,3] ^d	8 (80)	1 [0.75,2] ^{c,d}	18 (90)	3 [1,3] ^e	78 (78)	1 [1,2]	0.020^f	< 0.001^g			
b450	Additional respiratory functions	22 (53.7)	1 [0,1] ^c	23 (79.3)	1 [1,2] ^d	5 (50)	0.5 [0,1] ^c	15 (75)	1.5 [0.25,3] ^d	65 (65)	1 [0,1]		< 0.001^g			
b455	Exercise tolerance functions	38 (92.7)	2 [1,2.5] ^c	27 (93.1)	3 [2,3] ^d	10 (100)	2.5 [2.3,2.5] ^d	19 (95)	3 [2.25,4] ^d	94 (94)	2 [2,3]		< 0.001^g			
b460	Sensations associated with cardiovascular and respiratory functions	19 (46.3)	0 [0,1] ^c	16 (55.2)	1 [0,2] ^{c,d}	3 (30)	0 [0,1] ^c	13 (65)	1 [0,2] ^d	51 (51)	1 [0,1]		0.01^h			
s410	Structure of cardiovascular system	19 (46.3)	0 [0,1]	16 (55.2)	0 [0,2]	4 (40)	0 [0,1]	10 (50)	0.5 [0,1]	49 (49)	0 [0,1]		0.577			
s430	Structure of respiratory system	40 (97.6)	1 [1,2] ^c	26 (89.7)	2 [2,3] ^{c,d}	9 (90)	2 [1,2] ^c	20 (100)	2.5 [2,3] ^d	95 (95)	2 [1,2]		0.001^h			
d230	Carrying out daily routine	15 (36.6)	0 [0,1] ^c	21 (72.4)	1 [0,2] ^d	8 (80)	1 [0.75,2] ^d	18 (90)	2 [1,3] ^e	62 (62)	1 [0,2]		< 0.001^g			
d450	Walking	25 (61)	1 [0,1] ^c	27 (93.1)	2 [1,2] ^d	8 (80)	1.5 [0.75,2] ^d	18 (90)	2 [1,3] ^d	78 (78)	1 [1,2]		0.006^h			
d455	Moving around	39 (95.1)	3 [2,3] ^c	28 (96.6)	3 [3,3] ^{c,d}	10 (100)	3 [2.75,3] ^{c,d}	20 (100)	4 [3,4] ^d	97 (97)	3 [2,3]		< 0.001^g			
d640	Doing housework	8 (19.5)	0 [0,0] ^c	19 (65.5)	1 [0,2] ^d	7 (70)	1 [0,2] ^d	18 (90)	2 [1,3] ^e	52 (52)	1 [0,1.5]		< 0.001^g			
e110	Products or substances for personal consumption	29 (70.7)	-1 [-1,0]	27 (93.1)	-1 [-1,-1]	8 (80)	-1 [-1,-0.75]	17 (85)	-1 [-1,0]	81 (81)	-1 [-1,-1]		0.190			
e115	Products and technology for personal use in daily living	8 (19.5)	0 [0,0] ^{c,d}	16 (55.2)	-1 [-1,0] ^c	9 (90)	0 [0,0] ^d	12 (60)	-1 [-1,0] ^{c,d}	45 (45)	0 [-1,0]		< 0.001^g			
e225	Climate	20 (48.8)	0 [0,1]	16 (55.2)	1 [0,1]	3 (30)	0 [0,1]	15 (75)	1 [0.25,1]	54 (54)	1 [0,1]		0.09			
e260	Air quality	19 (46.3)	0 [0,1]	14 (48.3)	0 [0,1]	2 (20)	0 [0,0.25]	14 (70)	1 [0,1]	49 (49)	0 [0,1]		0.066			

M: median; IQR: interquartile range [p25, p75]; ICF-OPD: International Classification of Functioning, Disability, and Health brief Core Set for Obstructive Pulmonary Disease; COPD: Chronic obstructive pulmonary disease.

^aDifferences in the frequency of impairments among COPD grades.

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^{c-e}Statistically significant difference in column proportions at the 0.05 level.

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^gp < 0.001.

^hp < 0.01.

Note: c-e suggested that post-hoc tests were also significant at the 0.05 level if the overall test was significant in the extent of impairments. Different superscript indicates a statistically significant difference in column proportions at the 0.05 level, while the same superscript indicates no significant difference.

Table 5. The correlation of SGRQ overall score and component scores with the respective scales of the Brief ICF-OPD Core Set.^a

	SGRQ symptom	SGRQ activity	SGRQ impact	SGRQ total scores
ICF-OPD Function and Structure	0.6059 ^b	0.6201 ^b	0.5629 ^b	0.5716 ^b
ICF-OPD Activity and Participation	0.5451 ^b	0.6787 ^b	0.7067 ^b	0.6799 ^b
ICF-OPD total	0.5861 ^b	0.6329 ^b	0.6842 ^b	0.6023 ^b

SGRQ: St George's Respiratory Questionnaire; ICF-OPD: International Classification of Functioning, Disability, and Health brief Core Set for Obstructive Pulmonary Disease.

^aStatistically significant values are identified with different alphabets ($\alpha = 0.05$).

^b $p < 0.001$.

^c $p < 0.01$.

^d $p < 0.05$.

Table 6. The correlation of lung function parameters with the scores of the Brief ICF-OPD Core Set and SGRQ.^a

	ICF-OPD Function and Structure	SGRQ symptom	ICF-OPD Activity and Participation	SGRQ activity	ICF-OPD Environment	SGRQ impact	ICF-OPD total	SGRQ total
FEV1%	-0.384 ^b	-0.3982 ^b	-0.3789 ^b	-0.4756 ^b	—	-0.383 ^b	-0.3647 ^c	-0.4682 ^b
FEV1/ FVC	-0.2478 ^d	-0.2497 ^d	-0.3393 ^c	-0.3202 ^c	—	-0.2849 ^c	-0.3077 ^c	-0.3118 ^c

FEV1: forced expiratory volume in 1 s; FVC: forced vital capacity; SGRQ: St George's Respiratory Questionnaire; ICF-OPD: International Classification of Functioning, Disability, and Health brief Core Set for Obstructive Pulmonary Disease.

^aStatistically significant values are identified with different alphabets ($\alpha = 0.05$).

^b $p < 0.001$.

^c $p < 0.01$.

^d $p < 0.05$.

qualifiers, provides the basis for a respective measurement tool.^{18,19,25} In the present study, we validated the Brief ICF-OPD Core Set for the Chinese context. While all except one category of the Brief ICF-OPD Core Set were confirmed in our evaluation of its content validity, we found a high prevalence of problems in eleven categories that were not considered in the Brief ICF-OPD Core Set. The functioning related components of the Brief ICF-OPD Core Set largely performed similarly to SGRQ in terms of differentiating between patients with different disease severity. Moreover, we found high correlations of the Brief ICF-OPD Core Set overall score and component scores with the respective SGRQ scales and moderate correlations between the Brief ICF-OPD Core Set overall score and component scores and lung function parameters which were largely similar to respective correlations in SGRQ scores.

In this study, we chose the ICF checklist to identify the most common problems across ICF categories encountered by Chinese COPD patients and to evaluate the content validity of the Brief ICF-OPD Core Set.¹⁷ As a result, all concepts covered by the Brief ICF-OPD Core Set except e260 (air pollution) were

identified, suggesting that the Set could describe the typical spectrum of problems in functioning in Chinese COPD patients. Some additional categories, which are not currently included in the Brief ICF-OPD Core Set, were also identified. Three of these additional ICF categories lacked face validity and might have rather come up because of the high average age of our sample: b210 (seeing), s2 (structures of eye and ear), and d455 (driving). In turn, we found 8 categories that could be added to the Brief ICF-OPD Core Set for the assessment of functioning and environmental factors in the future. *These categories were* b134 (sleep), b280 (pain), s5 (structure related to the digestive, metabolic, and endocrine systems), d440 (lifting and carrying objects), e310 (support and relationships of immediate family), e355 (support and relationships of Health professionals), e410 (individual attitudes of immediate family members), and e450 (individual attitudes of health professionals). Many studies have reported that sleep quality is reduced in people with COPD as compared to healthy individuals.²⁶ Cigarette smoke causing airway mucosal inflammation, hyperinflation or air-trapping caused by thoracic structure change, and lower

baseline oxygen partial pressure (pO₂) together can cause oxygen desaturations and lower sleep quality in COPD patients.²⁷ In addition, symptom-related depression and anxiety may disturb the sleep quality of COPD patients,^{28,29} though we did not find obvious emotional dysfunction in the study. Similar to a study by Ewert and colleagues,²⁰ b280 (pain) was also identified as a common problem from the perspective of Chinese COPD patients. Indeed, pain is a common problem in the majority of all chronic conditions and thus covered by the ICF Generic Set. Therefore, it may also be important to assess this category in patients with COPD. Other categories identified were s5 (structure related to the digestive, metabolic, and endocrine systems) and support, relationships, and attitudes of immediate family and health professionals (e310, e410, e355, and e450). The former finding is supported by previous literature that suggests that patients with COPD have concomitant impairments in these systems.^{30–32} However, dysfunctions of digestive, metabolic, and endocrine systems were not common in our included COPD patients. We speculated that the high prevalence of s5 could be caused by other physical and environmental factors rather than COPD. When it comes to interpersonal interactions and relationships, many patients have implied that they gradually reduced social activities in professional organizations or clubs and were more focused on family along with the duration of the disease, which is in consistent with findings from Marques and coworkers.³³ Moreover, medical maintenance and acute exacerbation causing hospitalization were frequent episodes in our COPD patients, leaving little doubt that health professionals occupied an important role from the perspective of these patients.

When comparing the scores of SGRQ with the Brief ICF-OPD Core Set among COPD grades, we found the highest scores in patients of the GOLD 4 and D group. This indicated that with the progression of COPD, its impact on health-related QoL as well as function became more problematic. Therapeutical interventions in the early stage of COPD seem more important and studies have reported that therapies have limited effects when the condition becomes more severe.³⁴ Taken the analysis of the frequency and extent of the impairments of COPD patients, there were no significant effects of cardiovascular impairments, e110 (products or substances for personal consumption), and extent of e260 (air quality) on health-related QoL and function. It may be a plausible explanation that severe cardiovascular illness

occurred more often during acute COPD exacerbations while our results were carried out in COPD patients in stable conditions.^{35,36} When it comes to the effects of products or substances for personal consumption, we mainly identified the effects of medical therapy. Medical maintenance is aimed to alleviate symptoms of COPD, thus its effect was recognized by most COPD patients. Air quality, in turn, might have affected any patient independently of disease severity and thus not have contributed to differences between different severity groups.

Through the analysis of content validity and known group validity of the multi-dimensional characteristics of the ICF-OPD measurement, we got meaningful and specific health-related problems on Chinese COPD patients. The influence of the certain component was synthesized from the patients' self-feeling.³³ Therefore, it is possible to alleviate disease burden more efficiently by identifying the problem that has the greatest impact on the patients.

In the analysis of convergent validity of the brief ICF-OPD Core Set, When comparing the correlations between the assessment of Brief ICF-OPD Core Set and the common QoL tool of COPD, SGRQ, we found significant positive correlations between the overall and component scores of the Brief ICF-OPD Core Set and SGRQ. However, 4/12 *r* values were significant but below 0.6. These moderate correlations were probably because of the difference between the calculation method of SGRQ and the Core Set. SGRQ applies a measure of weighted mean in each section, while the score of ICF is simply added up the category scores.¹⁴ In addition, there was a significant but relatively low correlation between SGRQ symptom scores and the scores of the ICF-OPD Activity and Participation components. This finding could probably be explained by the Activity and Participation components of the Brief ICF-OPD core set just included one relatively high-intensity activity, d455 (moving around), while tolerance was more likely to occur in the other daily activities. In addition, several previous studies have demonstrated that the correlations of SGRQ with clinical symptoms and lung function in COPD patients are significant.^{22,23} Significantly positive correlations between overall and component scores of the Brief ICF-OPD Core Set and SGRQ and similar correlations of lung function parameters with the respective scores of the Brief ICF-OPD Core Set and SGRQ suggested that the assessment of Brief ICF-OPD Core Set could in a

sense evaluate the life quality of Chinese COPD patients.

A potential limitation of our study was that some individual, clinical, and etiological factors were difficult to be adequately described with the ICF checklist. Many patients were also accompanied by families in interviews and may thus have concealed their true health status. Another limitation was that to match the assessment of SGRQ, we combined structural impairments with functional impairments for the ICF-OPD. The absence of a valid operationalization of the ICF categories potentially introduced some bias in the results of this study.

In conclusion, this study largely confirmed content, known group, and convergent validity of the Brief ICF-OPD Core Set. For the Chinese context, it is however suggested that the ICF categories b134 (sleep), b280 (pain), s5 (structure related to the digestive, metabolic and endocrine systems), d440 (lifting and carrying objects), e310 (support and relationships of immediate family), e355 (support and relationships of health professionals), e410 (individual attitudes of immediate family members), and e450 (individual attitudes of health professionals) should be considered in addition to the original set.

Clinical messages

- The assessment of the Brief ICF-OPD Core Set can reflect disease severity of Chinese COPD patients similar to SGRQ.
- In the patient's perspective, there were some additional categories not included in the current Brief ICF-OPD Core Set, which should be added when applied to the Chinese context.

Acknowledgment

The authors thank all participants involved in this investigation. The authors are also grateful for the support from the partners and student assistants of Department of Pulmonary and Critical Care Medicine in Ruijin Hospital and Innovative research team of high-level universities in Shanghai.

Authors' contribution

Jingwen Huang and Jan D Reinhardt contributed equally to this work.


Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was funded by grants from National Natural Science Foundation of China (award number: 81570029), Ministry of Science and Technology of the People's Republic of China (no.2017YFC1309700), and Shanghai Key Discipline for Respiratory Diseases (2017ZZ02014).

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