

## A Comparison of Two Versions of the General Health Questionnaire Applied in a COPD Population

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### Abstract

**Objectives:** To compare responsiveness, screening performances and internal consistency between version 20 and 12 of the General Health Questionnaire (GHQ), and concurrent validity of the GHQ-12 through agreement with The Hospital Anxiety and Depression Scale (HADS) in patients with Chronic Obstructive Pulmonary Disease (COPD) prior to and after pulmonary rehabilitation.

**Methods:** Consecutive COPD patients with a mean age of 65, comprising 161 patients at baseline and 136 at 4-weeks follow-up. Responsiveness was analyzed through Paired Sample T-test, screening performances by Mc Nemar Test, internal consistency through Cronbach's alpha, and concurrent validity by The Bland-Altman technique.

**Results:** The GHQ mean score was significantly reduced by the GHQ-20 and GHQ-12 after rehabilitation, with score differences of -4 and -3.9 using Likert format ( $p < 0.001$ ), and -3.3 and -1.9 using bimodal GHQ scoring ( $p < 0.001$ ), respectively. The two GHQ versions differed significantly in responsiveness through bimodal GHQ scoring ( $p < 0.001$ ). The prevalence of psychological distress was significantly reduced both by GHQ-20 and GHQ-12, using Likert format (48 to 30% and 64.3 to 40.3%,  $p < 0.001$ , respectively), as well as bimodal GHQ scoring (36.4 to 19.3% and 41.1 to 21.7%,  $p < 0.001$ , respectively). The two GHQ versions differed significantly in screening performances through Likert format, both at baseline ( $p < 0.001$ ) and after 4 weeks ( $p = 0.004$ ). Irrespective of scoring methods and time, the internal consistency was  $> 0.9$  for both versions. The concurrent validity of the GHQ-12 is considered low assessed through agreement with the HADS, with mean values of the difference of 4.1 at baseline ( $p < 0.001$ ) and 1.3 at follow-up ( $p = 0.010$ ).

**Conclusions:** The two GHQ versions vary along with different scoring methods regarding responsiveness and screening performances. As for internal consistency, the observed differences were only marginal irrespective of scoring methods. Assessed through agreement with the HADS, the concurrent validity of the GHQ-12 is considered low.

**Keywords:** General health questionnaire; COPD; Psychological distress; Inpatient pulmonary rehabilitation; Scoring methods

### Introduction

In addition to physical problems, chronic obstructive pulmonary disease (COPD) is a considerable source of psychological distress such as anxiety and depression [1]. The prevalence of psychological distress has been reported to be higher among COPD patients compared to age-matched control populations and patients suffering from other chronic diseases [2]. Anxiety and depression cause deterioration in social functioning and quality of life and are correlated with a high level of subjective dyspnoea and disease progression [3]. Psychological distress in COPD patients is also related to longer hospital stays and early withdrawal from pulmonary rehabilitation programs [4]. Thus, detection of psychological distress in COPD patients is of great importance.

An established and well documented non-pharmacologic treatment for COPD patients is pulmonary rehabilitation, which has proven to be an effective treatment that enhances exercise capacity and quality of life and reduce psychological distress [5]. An efficient way to detect pre- and post-rehabilitation levels of psychological distress in COPD patients is through patient reported outcomes, provided by reliable, valid, and standardized questionnaires. A widely used questionnaire for such use is the General Health Questionnaire (GHQ), originally designed to identify psychological distress in primary care settings and among general medical outpatients [6]. Although disease-specific questionnaires may be better tailored and more valid for detection of psychological distress in COPD patients, additional use of a generic form, such as the GHQ, makes comparisons with the general population and other patients groups possible.

The original version of the GHQ consisted of 60 items. Shorter versions with 30, 20 and 12 items were developed by omitting those items often endorsed by physically ill people (Goldberg and Williams, 1988). The different GHQ versions, e.g. GHQ-20 and GHQ-12, can be scored by at least two types of methods. Originally, a bimodal GHQ scoring method (0-0-1-1) was suggested by Goldberg; in which higher sum scores (0-20) represent higher level of psychological distress (Goldberg and Williams, 1988). It can also be scored using the Likert format (0-1-2-3), which produce a less skewed distribution of the total GHQ scores (0-60) and is recommended for longitudinal studies [7]. In clinical settings, however, using extensive questionnaires such as the GHQ-20 may be too time-consuming. A shorter version, the GHQ-12, may therefore be preferable.

To the best of our knowledge, no studies have so far compared different GHQ versions through different scoring methods in COPD patients. Hence, the aims of this study were to compare responsiveness, screening performances and internal consistency between the GHQ-

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20 and GHQ-12 applied in COPD patients at inpatient pulmonary rehabilitation. An additional aim was to assess the concurrent validity of the GHQ-12 through agreement with a previously validated questionnaire for measurement of psychological distress.

## Materials and Methods

### Study population

The participants consisted of 161 consecutive male and female COPD patients aged 40+ with COPD stages I-IV, who attended a 4-week inpatient multidisciplinary rehabilitation program during the period from March 2007 till December 2007 in mid and eastern Norway. The patients had no present exacerbations.

### Data collection procedure

In the present study, oral and written information about the purpose of the study was given to the participants a few days after attending the rehabilitation center. Those who wanted to participate returned the signed written consent form in a pre-paid postage envelope along with the GHQ questionnaires to the researcher. The GHQ baseline data were collected during the first week of the rehabilitation program and the GHQ follow-up were collected a few days before discharge. There was no overlap for the different data collection time points.

### Classification of COPD

Lung function, expressed by post-bronchodilator forced expiratory volume in 1 second (FEV1), was assessed by spirometric tests carried out the first day after admission by trained personnel at the rehabilitation centres. Classification of severity and COPD stages (I-IV) was carried out in accordance with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) Guidelines [8].

### Questionnaires

**GHQ:** The GHQ was developed by Goldberg in the 1970's [6]. It has been translated into many languages and it is extensively used in different settings and different cultures [7,9]. It was translated into the Norwegian language in 1978, and has been validated and used in various samples of chronically ill people [10-13]. Validation studies of the Norwegian version have shown GHQ to be multidimensional with a variety of different concepts [12,13]. In COPD inpatients, the GHQ-20 appeared to be two-dimensional, comprising anxiety/depression and coping [12], whereas GHQ-12 yielded three dimensions in patients with stroke, named coping, anxiety and satisfaction [13]. Higher total scores reflect higher levels of psychological distress in both questionnaires, comprising twenty items in GHQ-20 and twelve items in GHQ-12 (Table 1). The responses range over a 4-point scale, from "less than usual" to "much more than usual", which also includes symptoms compared with what is normal for the patient [10]. The scale includes both positively phrased items (agreement with which indicates psychological health), and negatively phrased items (agreement with which indicates psychological distress) [14]. Both GHQ versions focus on two major areas within the concept of psychological distress: 1) the inability to carry out normal functions and 2) the appearance of new and distressing phenomena [15]. In the present study, the chosen cut-off scores using bimodal GHQ scoring and Likert format of the GHQ-12 was 5/6 and 12/13, respectively, whereas corresponding cut-off scores of the GHQ-20 was 10/11 and 23/24.

**The Hospital Anxiety and Depression Scale (HADS):** In this study, the concurrent validity of the GHQ-12 was assessed through agreement with The Hospital Anxiety and Depression Scale (HADS).

The HADS comprise two separate components, the anxiety (HADS-A) and depression (HADS-D), each with seven items that are rated on a four point scale: 0 (not present) to 3 (significant symptoms) [16]. The scores range from 0 to 21 for anxiety and 0 to 21 for depression. Scores for the two components can also be added together to give a composite anxiety-depression score with a maximum of 42 points (Total score). Higher scores indicate more severe symptomatology. Various cut-offs have been used, although we chose a cut-off score of  $\geq 15$  for HADS Total to include all possible cases, as recommended by Zigmond and Snaith [16]. More details about the HADS, including mean scores and prevalence of anxiety and depression assessed by the HADS in the present population, are reported elsewhere [17].

### Ethics

The study was approved by the Regional Committee for Medical Research Ethics, Health Region IV, Norway (project no.: 4.2006.3150) and the Parliamentary Commissioner for privacy in research, supervised by the Norwegian Social Science Data Services (project no.: 15845). Participation was voluntary and those who agreed to participate signed a consent form. All participants received a letter of information about the study, including their right to deny participation or to withdraw from the study at any time. The participants were also informed that such decisions would not hinder their present or future medical treatment. Additionally, they were assured confidentiality. The researcher kept the signed forms in a locked safe until they were maculated after the termination of the study.

### Statistical analyses

The analyses were carried out using the SPSS version 20.0 for Windows. Scoring procedure, calculation methods, item weights and handling missed items were treated according to recommendations by the author of the GHQ [15]. For comparison between responders and non-responders, two-sided T-test for independent samples, Pearson Chi Square test and Mann Whitney U-test were used. Drop-outs analyses were undertaken by the use of a two-sided T test for independent samples, Mann Whitney U-test and a Pearson Chi Square test. Mean scores and pre- and post-rehabilitation score differences within and between the GHQ-20 and GHQ-12 were analyzed through Paired Sample T-test. Potential differences within and between the two GHQ versions regarding the prevalence of "normal" and "possible cases" with psychological distress from baseline to follow-up was analyzed by the Mc Nemar Test.

The internal consistency of the scales was assessed through Cronbach's alpha coefficients, with an alpha value of 0.70 as the least satisfactory level. The concurrent validity of the GHQ was analyzed

1. able to concentrate <sup>§</sup>	11. enjoy day-to-day activities <sup>§</sup>
2. lost sleep over worry <sup>§</sup>	12. taking things hard
3. able to keep oneself busy and occupied	13. capable of face up problems <sup>§</sup>
4. getting out of house as usual	14. everything on top of you
5. doing things well	15. unhappy and depressed <sup>§</sup>
6. satisfied with carrying out task	16. losing confidence <sup>§</sup>
7. playing a useful part <sup>§</sup>	17. thinking of yourself as worthless <sup>§</sup>
8. capable of making decisions <sup>§</sup>	18. feeling reasonable happy <sup>§</sup>
9. constantly under strain <sup>§</sup>	19. nervous and strung-up
10. couldn't overcome difficulties <sup>§</sup>	20. nerves too bad

\*Items presented in order in which they appear in the Norwegian version of the GHQ-20/12; <sup>§</sup>The GHQ-12 items.

**Table 1:** Items of the GHQ-20 and GHQ-12 versions\*.

Characteristics	Responders (n=161)	Non-responders (n=83)	p value
Age	65.0 (±9.1)	68.1 (±10.1)	0.015*
Males/females	79/82	39/44	0.788#
Prevalence of GOLD COPD stage, %:			
I (Mild)	6.2	3.6	0.393#
II (Moderate)	34.2	34.9	0.904
III (Severe)	25.5	43.4	0.004
IV (Very severe)	34.2	18.1	0.009

Data are presented as mean ± SD, n, and n (%); GOLD: Global Initiative for Chronic Obstructive Lung Diseases; COPD I: FEV<sub>1</sub> ≥ 80%; COPD II: 50% ≤ FEV<sub>1</sub> < 80%; COPD III: 30% ≤ FEV<sub>1</sub> < 50%; COPD IV: FEV<sub>1</sub> < 30%; FEV<sub>1</sub>: forced expiratory volume in 1 second; \*two-sided T-test for independent samples; # Pearson Chi Square test; #Mann Whitney U-test.

**Table 2:** Baseline characteristics of responders vs. non-responders.

GHQ versions and scoring methods	n	Baseline	4 weeks	Score differences	p value
<b>GHQ-20</b>	129	25 (±11)	21 (±11)	-4	<0.001 (CI: -2.4; -5.8) <sup>§</sup> <0.001 (CI: -2.3; -4.3)
Likert format		7.9 (±6.7)	4.6 (±6.1)	-3.3	
Bimodal GHQ scoring					
<b>GHQ-12</b>	129	16.3 (±7.2)	12.4 (±6.6)	-3.9	<0.001 (CI: -2.9; -5.1) <0.001 (CI: -1.3; -2.6)
Likert format		4.6 (±4.2)	2.7 (±3.8)	-1.9	
Bimodal GHQ scoring					

\*Data are presented as n, mean ± SD; Score differences are given as post minus pre-pulmonary rehabilitation; <sup>§</sup>Paired Sample T-test with 95% CI of mean.

**Table 3:** Pre- and post-rehabilitation mean scores with score differences of GHQ-20 and GHQ-12 in COPD inpatients\*.

through Bland-Altman technique, using the total scores of GHQ-12 and HADS to assess agreement between the questionnaires in a scatterplot. The GHQ-12 version was chosen since the number of items is approximately in line with the HADS. A One Sample T test was used to investigate the mean value of difference between the total scores of GHQ-12 and HADS. A p-value ≤ 0.05 was considered as statistically significant. Finally, complete data between baseline and follow-up were required, thus the number of patients included in the different analyses varied.

## Results

A comparison of characteristics between responders and non-responders at baseline is presented in Table 2, showing significant higher mean age (68.1 vs. 65.0, p=0.015) and prevalence of severe COPD (43.4 vs. 25.5%, p=0.004) in non-responders. The prevalence of very severe COPD, however, was significantly higher in responders than in non-responders (34.2 vs. 18.1%, p=0.009).

Figure 1 illustrates the flow of patients throughout the study. At baseline, 170 of 253 potential participants responded - a response-rate of 67%. Nine patients were excluded because they had pure asthma or had not filled out the forms, which lead to a study sample of 161 patients.

At follow-up, 25 patients had dropped out from the study due to withdrawal, death, discontinued stay or unknown reasons, leaving us with a study sample of 136 patients. However, drop-outs analyses showed no significant differences between drop-outs and completers in age, gender, COPD stages and level of psychological distress (data not shown).

The pre-and post-rehabilitation GHQ mean scores using different scoring methods are shown in Table 3. According to the table, the mean score of psychological distress was significantly reduced in both GHQ versions, the GHQ-20 and GHQ-12, after rehabilitation. There were no differences in score reductions between the two GHQ versions using the Likert format (p=0.747), whereas significant differences were

found using bimodal GHQ scoring (p<0.001) (data not shown).

Pre-and post-rehabilitation prevalence of normal and possible cases of psychological distress, measured by GHQ-20 and GHQ-12 with different scoring methods, are shown in Table 4. As shown in the table, the prevalence of possible cases of psychological distress was significantly reduced after rehabilitation both by GHQ-20 and GHQ-12 using Likert format as well as bimodal GHQ scoring. Using Likert format, the prevalence of possible cases measured by the GHQ-12 was higher than in GHQ-20, both at baseline (p<0.001) and after 4 weeks (p=0.004) (data not shown). No differences, however, were seen between the two versions using bimodal GHQ scoring, nor at baseline (p=0.109) or after 4 weeks (p=0.375) (data not shown).

Table 5 presents internal consistency of the GHQ-20 and GHQ-12 at baseline and 4-weeks follow-up. According to the table, the two scoring methods resulted in an internal consistency > 0.9 for both GHQ versions, and the observed differences between them were small.

The agreement between the two questionnaires, the GHQ-12 and the HADS, are shown in Figure 2 (baseline) and Figure 3 (follow-up). Both plots indicate systematic differences between the measurements, including outliers. The presence of such fixed bias was underpinned by a mean value of the difference of 4.1 at baseline (p<0.001, 95% CI: 3.2-4.9), and correspondingly 1.3 at follow-up (p=0.010, 95% CI: 0.3-2.4).

## Discussion

As previously stated, the use of a generic form such as the GHQ enables comparisons across different patient populations. In patients with inflammatory rheumatic joint diseases, the pre and post-intervention GHQ-20 mean scores with Likert format were found to be 19.9 and 15.7, respectively [11]. Hence, the performance of GHQ-20 with Likert format in Table 3 is in accordance with previous findings, suggesting a higher level of psychological distress in COPD patients than in other patients with chronic diseases [2,18]. Moreover, the psychometric performance of the GHQ-12 with bimodal GHQ scoring in Table 3 is in line with former studies of psychological distress in

GHQ versions	Likert format <sup>#</sup>		p value	Bimodal GHQ scoring <sup>§</sup>		p value
	Baseline	4 weeks		Baseline	4 weeks	
GHQ-20	(n=127)			(n=129)		
Normal cases	66 (52 %)	89 (70 %)	<0.001 <sup>#</sup>	82 (63.6 %)	104 (80.7 %)	<0.001
Possible cases	61 (48 %)	38 (30 %)		47 (36.4 %)	25 (19.3 %)	
GHQ-12	(n=129)			(n=129)		
Normal cases	46 (35.7 %)	77 (59.7 %)	<0.001	76 (58.9 %)	101 (78.3 %)	<0.001
Possible cases	83 (64.3 %)	52 (40.3 %)		53 (41.1 %)	28 (21.7 %)	

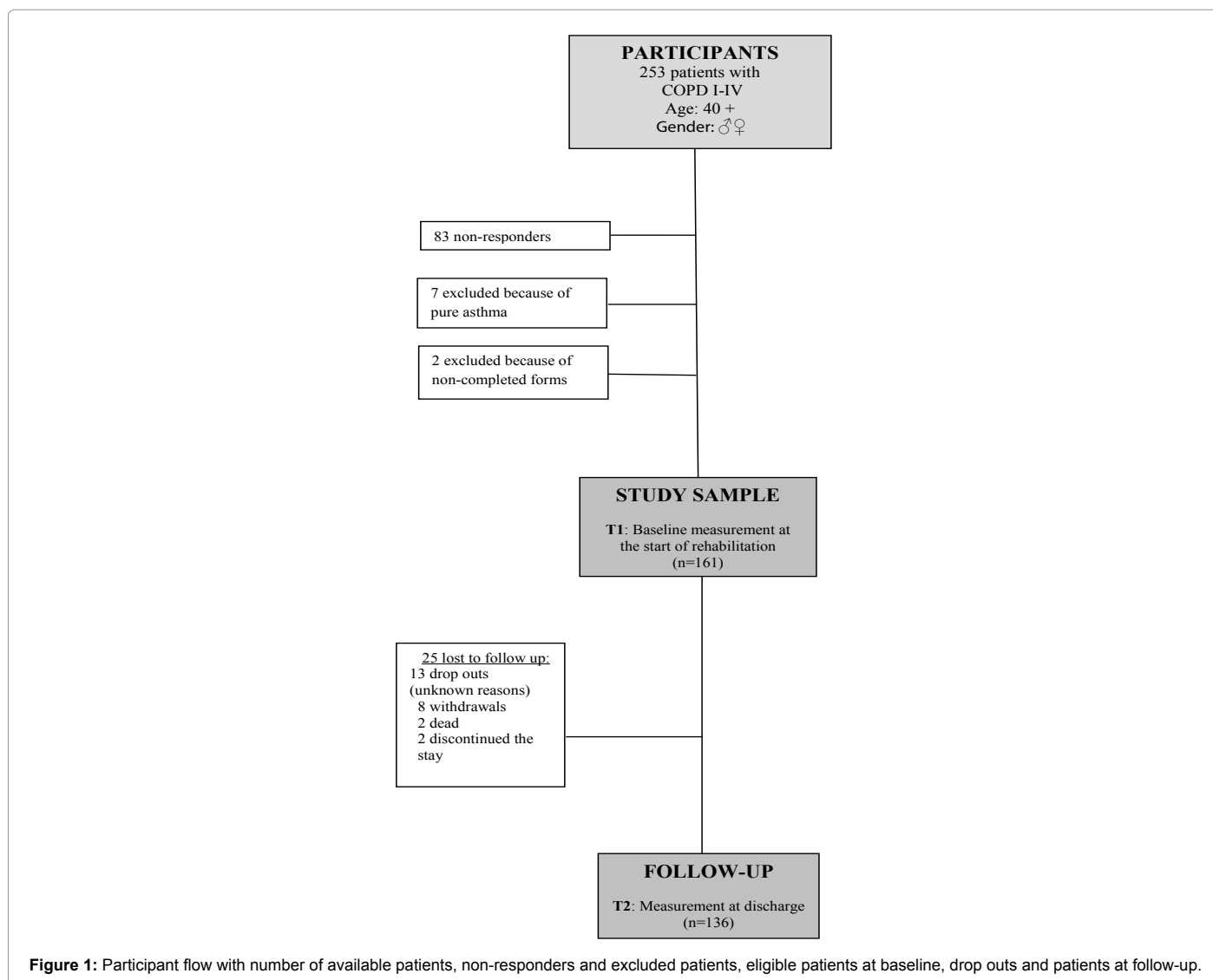
\* Data are presented as n and n (%); <sup>#</sup> Cut-off scores GHQ-20:23/24, GHQ-12:12/13; <sup>§</sup> Cut-off scores GHQ-20:10/11, GHQ-12:5/6; <sup>#</sup> Mc Nemar Test.

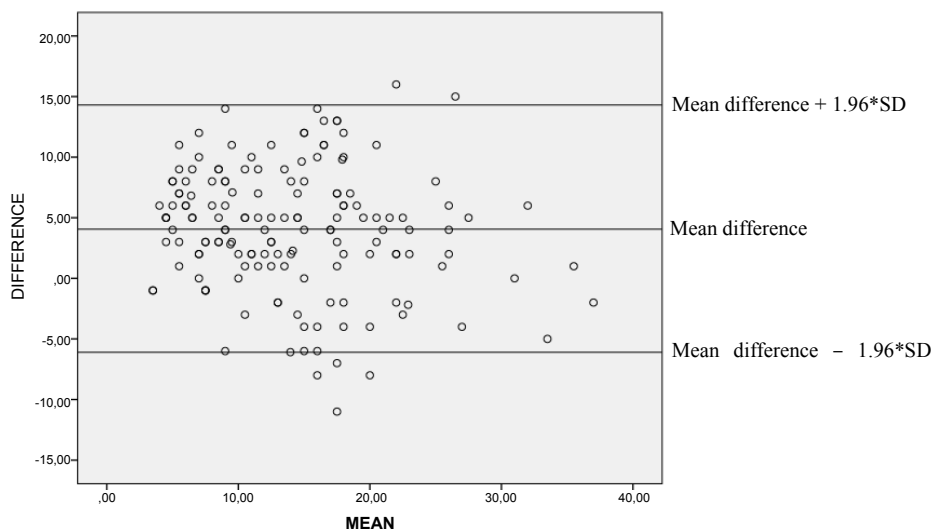
**Table 4:** Prevalence of normal and possible cases of psychological distress before and after rehabilitation in COPD patients measured by GHQ-20 and GHQ-12\*.

GHQ versions and scoring methods	Internal consistency <sup>#</sup>	
	Baseline	4 weeks
<b>GHQ-20</b>	(n=146)	(n=124)
Likert format	94.1	94.7
Bimodal GHQ scoring	94.1	95.4
<b>GHQ-12</b>	(n=147)	(n=128)
Likert format	92.3	92.2
Bimodal GHQ scoring	91.5	93.2

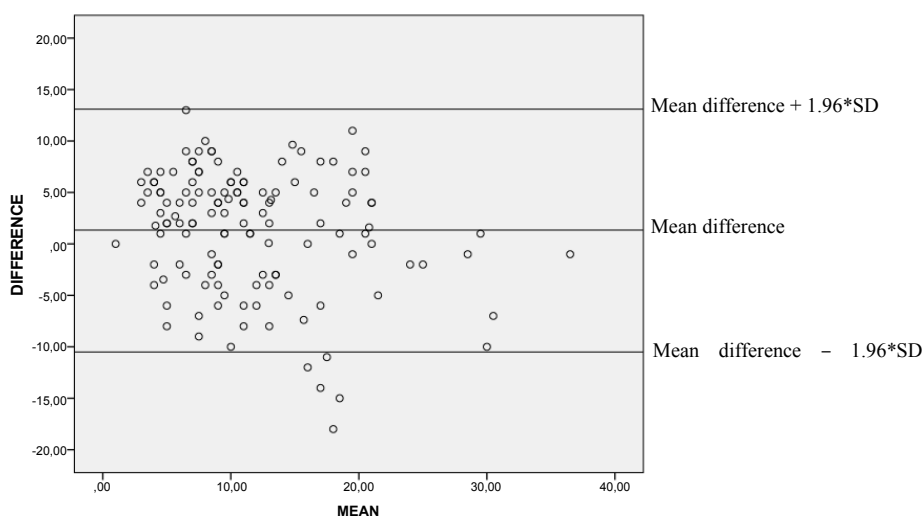
<sup>#</sup>Cronbach's Alpha coefficients.

**Table 5:** Internal consistency of the GHQ-20 and GHQ-12 at baseline and 4-weeks follow-up.





**Figure 2:** Scatterplot at baseline with Bland-Altman technique, showing systematic variation with the mean of difference of the GHQ-12 and HADS total scores in COPD inpatients.



**Figure 3:** Scatterplot at follow-up with Bland-Altman technique, showing systematic variation with the mean of difference of the GHQ-12 and HADS total scores in COPD inpatients.

COPD patients measured through the same GHQ procedure [19]. Using the Likert format or the bimodal GHQ scoring method, the responsiveness of both versions can be regarded as satisfactory in terms of significant changes in psychological distress from baseline to 4-weeks follow-up, suggesting that the GHQ versions, GHQ-20 and GHQ-12, are reliable measures for detecting post-rehabilitation changes of psychological distress in COPD patients. However, there are no clear recommendations in the literature on clinically relevant changes in the GHQ-20 and GHQ-12 [11]. Thus, we cannot know whether the score differences in the present study was perceived beneficial by the patients, indicating an important change of their condition. Clinically, using changes in GHQ mean scores to evaluate the outcome of rehabilitation on psychological distress in COPD patients may therefore be of less relevance. In addition, the post rehabilitation

GHQ scores should be viewed in the light of the duration of the current rehabilitation program, suggesting that a 4-week program may be too short to modify important changes in psychological health in COPD patients. In general, modifying behavioral patterns and coping styles to achieve long-term lifestyle adjustment in COPD patients requires probably much more time and effort [20]. Hence, longer programs (e.g. 8 weeks) may produce greater gains and improved maintenance of complex behavioral change through longer exposure to interventions and reinforcement, encouragement and coaching from staff [21].

A matter of concern regarding the GHQ is the most appropriate cut-off scores to determine possible cases of psychological distress. The cut-off scores for the GHQ-20 and 12 not only vary with scoring methods but also across populations [22]. Using bimodal GHQ scoring method



in the GHQ-12 version, cut-off scores of 5/6 was most applicable in a COPD population [19]. In other studies than in COPD patients, an optimal cut-off score for GHQ-12 using Likert format was 12/13, and for the GHQ-20 the optimal threshold using bimodal GHQ scoring was 10/11 and 23/24 for the Likert format [11,23]. Irrespective of scoring methods, the screening performances of the two GHQ versions may be considered satisfactory in terms of significant reductions in the prevalence of psychological distress from baseline to 4 weeks follow-up (Table 4). In addition, the results show that the choice of scoring procedure has significant impact on the detection of possible cases of psychological distress. When using the Likert format in both GHQ versions, a baseline difference of 16.3% in the prevalence of possible cases was found, whereas no significant differences was seen using the bimodal GHQ scoring method. The prevalence of psychological distress at baseline using the Likert form ranges from 48 to 64.3%. These figures are not in line with previous studies, showing that 20-40% of COPD patients referred to pulmonary rehabilitation have symptoms of psychological distress [24,25]. Thus, our results (Table 4) may be overestimated, with elements of false positive cases. Using the bimodal GHQ scoring method resulted in a prevalence of possible cases between 36.4 and 41.1%, estimates that are more in line with previous studies [24,25]. Choosing the bimodal GHQ scoring method rather than the Likert format for the GHQ versions may therefore provide a better screening performance in detecting psychological distress in COPD patients referred to inpatient pulmonary rehabilitation.

As shown in Table 5, the internal consistency of the two GHQ versions does not differ by using different scoring methods. A Cronbach's alpha coefficient >0.9 indicates excellent psychometric reliability for both GHQ versions, suggesting multiple items within both scales to be consistent in sense of measuring the same underlying phenomenon, i.e. psychological distress. These results are in line with previous findings [26,27]. Even though eight items are omitted in the GHQ-12 version (Table 2), its internal consistency is still in line with GHQ-20, with only marginal differences between the two versions. This is worth noting, given the fact that more items lead to higher alpha [28]. Based on these results, the eight omitted items from GHQ-20 are possible redundant in order to measure psychological distress in COPD inpatients.

Assessed through agreement with the HADS, the concurrent validity of the GHQ-12 in the present study may be regarded as low. In other words, the relationships between the two measurements are weak, underpinned by the two scatterplots (Figures 2 and 3) and the mean values of difference unequal to 0. The results may be due to the fact that the GHQ-12 and HADS are measuring different concepts of psychological distress. According to Hankins [26], the GHQ-12 measures psychological distress in three domains, social dysfunction, anxiety and loss of confidence, whereas the HADS measures exclusively symptoms of general anxiety and depression (anhedonia) [16]. In general, psychological distress is seldom defined as a distinct concept [29], which may create confusion for clinicians attempting to manage the care of COPD patients experiencing psychological distress. Hence, clarifying the conceptual differences between the GHQ-12 and HADS is of great importance.

Some limitations of the study must be taken into account. The sample size was relatively small, and the selection of patients was not random. Therefore, the results must be interpreted with caution, as they cannot be fully generalized for the entire COPD population. Also, due to lack of an external criterion standard, i.e. a clinical interview, the psychometric properties of the GHQ-20 and GHQ-12 cannot be fully

understood in terms of sensitivity and specificity. Furthermore, more comprehensive research studies including an external "gold standard", used in a larger COPD population, is needed.

In conclusion, this study found that the performances of the two GHQ versions vary along with different scoring methods, with regards to responsiveness and screening performances. As for internal consistency, the observed differences were only marginal irrespective of scoring methods. Assessed through agreement with the HADS, the concurrent validity of the GHQ-12 is considered low, probably due to different concepts measured. As shorter instruments are less time-consuming and less stressful for participants to use, the brevity and simplicity of the GHQ-12 version along with a bimodal GHQ scoring method may be considered preferable to GHQ-20 in an inpatient rehabilitation setting for COPD patients.

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