

Translation and cross-cultural adaptation of the self evaluation of breathing questionnaire (SEBQ) into Danish

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ABSTRACT

Background and Purpose: Dysfunctional breathing (DB) with or without an underlying medical condition is associated with impaired quality of life. DB-related symptoms can be measured with the 25-item Self Evaluation of Breathing Questionnaire (SEBQ). However, the SEBQ is not available in Danish.

The aim of the present study was to translate and cross-culturally adapt the SEBQ into Danish and to assess the face validity of the Danish version of the questionnaire in individuals with DB-related symptoms.

Materials and Methods: The SEBQ was translated and cross-culturally adapted into Danish using an internationally acknowledged six-step forward-backward translation guideline in an interactive process with an expert committee of clinicians, translators, methodologists and the SEBQ developer. Face validity was explored through semi-structured interviews with 24 adult individuals with DB-related symptoms (age 20–70 years, female $n = 14$).

Results: The SEBQ was successfully translated and cross-culturally adapted into Danish. Three major modifications were made following the translation process and participant interviews. First, an introductory paragraph, including a recall period of the previous seven days, was added. Second, the administration of the questionnaire was changed from a paper to an electronic version. Finally, adaptations regarding semantic equivalence, especially concerning being 'breathless' and 'short of breath', were performed. The participants expressed that the final version of the SEBQ embraced their DB-related symptoms, was understandable, and easy to complete.

Conclusion: The SEBQ is the first available Danish questionnaire to measure DB-related symptoms, following an internationally acknowledged cross-cultural adaptation and face validity evaluation approach. This promising validation should be followed by an assessment of measurement properties in individuals with DB-related symptoms to investigate the adequacy of the SEBQ in a Danish context.

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Introduction

Dysfunctional breathing (DB) is associated with a negative overall well-being [1–4]. The definition and understanding of DB is debated. [5,6] The spectrum of definitions range from an alteration in the biomechanical pattern of breathing, resulting in chronic or intermittent (respiratory or non-respiratory) symptoms, [5] to a continuum of adaptability of breathing depending on individual and context

[6]. DB exists both with and without an underlying medical condition, [1,3,5] but most often DB may co-exist with a known respiratory or non-respiratory disease e.g. asthma, anxiety, obesity, and further relates to poor overall health, symptom control, and quality of life (QoL). [1,7–9] DB is associated with inadequate breathing pattern, which may result in chronic or intermittent symptoms such as dyspnea, chest tightness, hyperventilation, thoracic-

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dominated breathing, erratic breathing, or yawning. These symptoms may limit physical activity and impaired QoL. [4,10–12] Associated exercise-induced dyspnea is common, which often may result in prescription of asthma medication despite no confirmed asthma diagnosis. [1,4,8,9,13,14]

The increased recognition of DB as a potential independent comorbidity warrants a specific tool able to quantify the symptoms related to DB [8,15,16]. However, there is currently no available tool to establish the diagnosis of DB. [10,14,17]

The Nijmegen Questionnaire (NQ) is widely used to measure DB-related symptoms, but was developed to measure hyperventilation syndrome. [3,9,11,18–21] The adequacy of the NQ to measure DB-related symptoms has been questioned since NQ includes questions on symptoms observed in uncontrolled asthma, heart disease and back pain. [9,22] Further, NQ has poor discrepancy concerning DB changes, [22] and no translation into Danish has been cross-culturally validated.

DB is a treatable condition [15,22,23] and clinicians need a valid, reliable, and responsive tool to identify those who will benefit from targeted treatment such as breathing retraining and to monitor effects of treatment in individuals with DB-related symptoms. [24]

During the last 20 years, the Breathing Pattern Assessment Tool [25]; Manual Assessment of Respiratory Motion [26]; capnography [27,28]; plethysmography [26,29]; hyperventilation provocation [4]; and progressive exercise testing [4,17] have been used as objected tools to detect DB. Yet, these tools are either costly, time-consuming, or require special equipment or staff training. In contrast, a self-reported questionnaire can be completed quickly by most individuals and at a low cost. [30]

The Self Evaluation of Breathing Questionnaire (SEBQ) was developed by Courtney and Greenwood in 2009, and measures the self-reported experience of breathing-related symptoms [31]. The SEBQ is a reliable and validated Australian questionnaire. [30] However, there is no Danish version of the SEBQ.

The aim of the present study was to translate and cross-culturally adapt the SEBQ into Danish and to assess the face validity of the Danish version of the questionnaire in individuals with DB-related symptoms.

Materials and methods

The SEBQ

We used the most recent version of the SEBQ (version 2 from 2009), which consists of 25 items scored on

a 4-point scale defined as follows: 0 (never/not true at all), 1 (occasionally/a bit true), 2 (frequently/mostly true) and 3 (very frequently/very true). [31] A higher SEBQ score indicates more severe symptoms. The identification of the SEBQ is described in Supplementary File 1.

Translation and cross-cultural adaptation

We translated and cross-culturally adapted the SEBQ into Danish in accordance with the systematic and internationally acknowledged guideline by Beaton et al. [32] (Figure 1). The developer of the SEBQ (RC) provided written approval prior to initiating the process.

Step 1: forward translation

Two native Danish-speaking translators independently performed the forward translation of the SEBQ from English into Danish creating forward translation 1 and 2 (FT1 and FT2). The uninformed translator (MGH) has a Master of Arts in International Business Communication and no medical or clinical background, and is not aware nor informed of the concepts being translated, offering a translation reflecting the language used by the Danish population. The informed translator (KHA) is a health professional with a PhD degree and clinical knowledge of the concepts translated, providing equivalency from a clinical perspective. The two translators drafted a written report for each translation to document the rationale behind choices and challenging phrases.

Step 2: synthesis of the forward translation

The two forward translations, FT1 and FT2, were synthesized into an FT12 version at a meeting with the attendance of the two forward translators (MGH and KHA), a methodologist with a PhD degree and extensive experience in translation and cross-cultural validation (JSJ), and a facilitator with a PhD degree (AMS), and a Public Health Science student (ALE) who documented the results of the meeting. We reviewed the original SEBQ, FT1, FT2, and the written reports and created a synthesized FT12 version. All issues arising in the process were documented in a written report.

Step 3: backward translation

Two back translators blinded to the original version of the SEBQ independently back-translated the synthesized FT12 version into versions 1 and 2 (BT1 and BT2). The back translators are native English speakers and have lived in Denmark for more than 20 years.

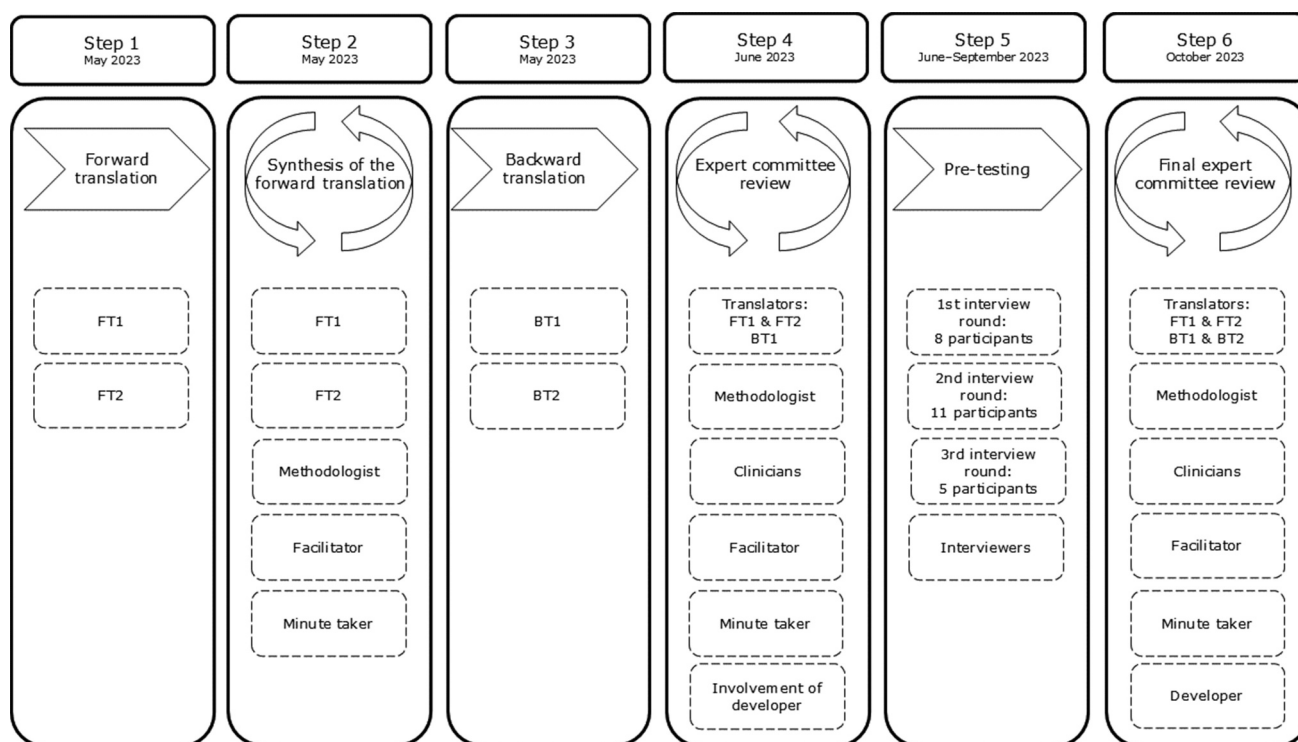


Figure 1. Overview of the 6-step translation and cross-cultural adaptation process, persons involved and timeline. FT = forward translator, BT = backward translator.

Both were uninformed of the concepts explored and had no clinical experience with individuals with DB-related symptoms. One back translator (AB) is a data manager and with a BSc (Hons) in Chemistry; the other (EDSC) has a Master of Public Health. The back translators each documented their comments in a written report.

Step 4: expert committee review

An expert committee meeting was held with the participation of the forward translators (MGH and KHA), the methodologist (JSJ), one back translator (EDSC), three pulmonologists with a PhD degree and insights into the clinical area (CH, CSU and UB), one physiotherapist specialised in respiratory physiotherapy (LS), the facilitator (AMS), and a person documenting the discussions and decisions in writing (minute taker) (ALE). The expert committee reviewed the original and all translated versions (FT1, FT2, FT12, BT1 and BT2) and the written documentation reports before developing a pre-final version of the SEBQ. Decisions were documented in a written report. Before field-testing, the developer, an osteopath with a PhD degree (RC), discussed interpretations and clarified all questions relevant to the pre-final version together with KHA, AMS and ALE.

Step 5: pre-testing

To assess face validity, the comprehensibility and interpretation of the Danish version of the SEBQ we interviewed individuals with DB-related symptoms. Participants were recruited by five physiotherapists at four hospitals (Copenhagen University Hospital Bispebjerg, Naestved-Slagelse-Ringsted Hospitals, Silkeborg Regional Hospital, and Zealand University Hospital Roskilde). We recruited adult individuals with DB-related symptoms referred to physiotherapy.

Table 1. Characteristics of the 24 participants with dysfunctional breathing-related symptoms participating in the pre-test of the self evaluation of breathing questionnaire (step 5).

| | Participants (n = 24) |
|--|-----------------------|
| Sex, n (%) (female) | 14 (58) |
| Age | |
| Median (IQR) | 47 (38; 62) |
| Range | 20-70 |
| Physical activity level, time spent per week, n (%) | |
| <30 minutes | 4 (17) |
| 30-90 minutes | 7 (29) |
| 90-150 minutes | 7 (29) |
| 150-300 minutes | 2 (8) |
| >300 minutes | 4 (17) |
| Referral hospital, n (%) | |
| Copenhagen University Hospital Bispebjerg | 5 (21) |
| Naestved-Ringsted-Slagelse Hospital | 5 (21) |
| Silkeborg Regional Hospital | 13 (54) |
| Zealand University Hospital Roskilde | 1 (4) |

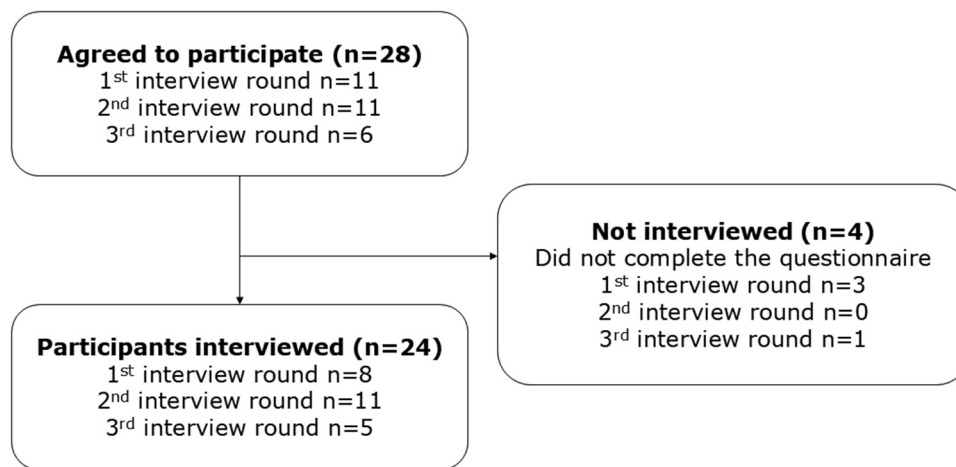


Figure 2. Flowchart of participants with dysfunctional breathing-related symptoms agreeing to participate in step 5.

Purposeful sampling was used to ensure maximal variation concerning sex, age, and physical activity level. After recruitment and interview of 24 participants (aged 20–70 years), data saturation was achieved, meaning that no new insights were obtained during the last interviews (Table 1 and Figure 2). After obtaining written and oral information about the present study, the participants gave informed consent. Research Electronic Data Capture (REDCap) was used to email a survey link to the participants with the pre-final Danish version of the SEBQ, a free text item where they could comment on the version, and demographic data.[33]

If practically possible, we contacted the participants by phone within one day after completing the SEBQ. The participants were encouraged to share reflections on and understanding of the SEBQ items. The individual interviews were based on a semi-structured interview guide (Supplementary File 2). Only minor alterations were made in the interview guide between the three interview rounds to include issues of importance raised by the participants. We conducted three rounds of interviews with different participants in each round. The participants were asked to elaborate on their comments after completing the SEBQ, and on specific questions pointed out by the expert committee and/or participants in a previous interview round. Interview data were documented in detail in a written report. After each interview round, we analysed the interview data and adapted the SEBQ according to issues reported by the participants until no new issues were reported.

Step 6: final expert committee review

A written report documenting each step of the translation and cultural adaptation process and all versions of

the SEBQ were forwarded to the expert committee and the developer (RC).

Ethics and legislation

This study complies with the Declaration of Helsinki. The study was registered but needed no approval by the local ethics committee in accordance with Danish law (no. 1-10-72-6-23). [34] The study was listed in the Central Denmark Region's internal list of research projects (no. 1-16-02-175-23). Central Denmark Region was the data controller, and data processing agreements were made between with hospitals in Region Zealand and Capital Region of Denmark.

Results

During steps 1–4, we primarily discussed semantic equivalence. Consensus was obtained and adjustments made to the SEBQ version to be pre-tested in step 5 among 24 participants.

In step 5, we conducted three interview rounds beginning with eight participants from Naestved-Slagelse-Ringsted Hospitals and Silkeborg Regional Hospital. Only Q9 was adjusted following in round one. In round two, the 11 participants from Copenhagen University Hospital Bispebjerg, Naestved-Slagelse-Ringsted Hospitals, Silkeborg Regional Hospital, and Zealand University Hospital Roskilde were overall very satisfied with the SEBQ. Before round three, we added an introduction paragraph, and the developer (RC) approved the adjustments and changes before the SEBQ was tested among the last five participants from Copenhagen University Hospital

Bispebjerg, Naestved-Slagelse-Ringsted Hospitals, and Silkeborg Regional Hospital. In this round, we did not ask any specific questions but asked whether the SEBQ seemed understandable and relevant in general. No further adjustments were made following round three. Finally, in step 6, the expert committee approved the process. After each of the three interview rounds, we adjusted the SEBQ based on their comments. Table 2 provides a detailed overview of the 6 steps. Overall, the participants expressed satisfaction with the SEBQ as it targeted their DB-related symptoms, and it was easy to understand and complete. The final version of the Danish version of the SEBQ is presented as Supplementary File 3.

Discussion

The SEBQ was successfully translated and cross-culturally adapted from English into Danish using a systematic and internationally accepted six-step guideline. [32] The participants expressed that the questionnaire embraced their DB-related symptoms and was easy to understand. However, three major modifications were made. We added an introductory paragraph including a recall period of the previous seven days, the administration of the questionnaire was changed from a paper version to an electronic version, and finally, we performed semantic equivalence adaptations concerning being *breathless* and *short of breath*.

To the best of our knowledge and according to the developer (RC), no scientific papers have previously been published about the translation and cross-cultural adaptation of the SEBQ.

Our first modification concerned the recall period.

Recall periods in respiratory questionnaires vary considerably from none to the previous four weeks (i.e. none [35,36], currently [35,37], these days [38], recently [18], previous seven days [39], previous two weeks [40], previous four weeks [41]). Consequently, there is no universally accepted gold standard for the recall period in this context. [42] A review of 83 studies highlighted the critical impact of the recall period on measurement errors, which can hinder the detection of treatment effects. [42] Therefore, the recall period must align with the concept being measured to ensure the validity of the measurement tool. [42] When selecting an appropriate recall period, factors such as the ability to capture specific and intermittent symptoms, as well as their frequency, duration, and severity, should be considered, particularly in the context of DB-related symptoms, which can persist or fluctuate. [1,4] Longer recall periods are known to reduce accuracy

and influence the dimensions of patient recall. [42,43] Daily reports have been found to be superior in capturing adverse events since shorter recall periods result in more accurate reporting. [44] However, a review including 57 studies found that recall periods of one day versus seven days tended to result in overestimation of single symptoms and underestimation of broader concepts such as quality of life. [43] Furthermore, the severity and duration of symptoms, and symptom fluctuation, can introduce recall bias. Based on the literature, [42,44] expert committee discussions, and participant interviews, a recall period of the previous seven days was deemed appropriate to minimize recall bias and capture symptom variability comprehensively.

The second modification from paper to electronic version was made to reduce missing data and eliminate ambiguous data as well as efforts and errors involved with entering paper completed versions into electronic systems. [45,46] Moreover, electronic administration has been shown to increase satisfaction and compliance and ensure real-time data capture and availability at lower costs. [45,46] A review including 46 studies on several different scales in various populations has documented that questionnaires completed electronically provide scores equal to those obtained when the same questionnaires are completed on paper. [46] In respiratory medicine, agreement between paper versions and electronic versions of the Asthma Control Questionnaire [39], and the Asthma Quality of Life Questionnaire [40] is high with intraclass correlation coefficient scores of 0.94 and 0.95, respectively. [47] Thus, we have no reason to believe that the electronic version should be less valid than the paper version.

The last modification concerned semantic differences in different ways to denote breathlessness. In the forward and backward translations, we discussed differences and similarities between being *breathless* and *short of breath* several times. The pre-testing process showed that participants understood both terms and used them interchangeably. Likewise, *breathlessness* and *shortness of breath* are interchangeable in the literature [48]; however, *shortness of breath* is often but not consistently related to activity. [49] Supported by The Danish Language and Literature Society, the expert committee decided to use *shortness of breath* in relation to physical activity [50], and *breathlessness* in other situations, [51] as a distinction between the two is clinically useful in Danish.

The present study has some limitations. Decisions made during the translation process may have altered the original intention of certain items, such as the translation of expressions related to being

Table 2. Comments and adjustments to the Danish version of the self evaluation of breathing questionnaire based on results from translators, expert committee meetings and interviews with 24 participants with dysfunctional breathing-related symptoms.

| | Original version | Comments and adjustments Step 1-4 | Comments and adjustments Step 5 | Final Danish version |
|-----------|---|--|---|---|
| Title | The Self Evaluation of Breathing Questionnaire (SEBQ) | The original title of the questionnaire was kept, and followed a Danish translation of the title | | Questionnaire for evaluation of your breathing – the Self Evaluation of Breathing Questionnaire |
| Intro | | | <p>Comment: Interview round one and two lack a response option such as 'Not relevant'. This was discussed but was not changed to stay true to the original. Inspired by similar questionnaires we added the frame of a 7-day recall period as an introduction paragraph. This change was approved by the developer (RC). Adjustment: This questionnaire contains questions about how you have experienced your breathing in the past week. Please answer the questions by choosing the answer that applies the most to you. If a question is not relevant to you or you have not experienced it within the last 7 days, please choose the answer that is closest to your experience'.</p> | <p>This questionnaire contains questions about how you have experienced your breathing in the past week. Please answer the questions by checking the answer that applies the most to you. If a question is not relevant to you or you have not experienced it within the last 7 days, please check the answer that is closest to your experience.</p> |
| Score | (0) never/not true at all (1) occasionally/a bit true (2) frequently/mostly true (3) very frequently/very true | | | (0) never/not true at all (1) occasionally/a bit true (2) frequently/mostly true (3) very frequently/very true |
| Questions | | | | |
| 1 | I get easily breathless out of proportion to my fitness | Comment: Different Danish terms for being 'breathless' and 'short of breath' were discussed. We agreed to ask the participants how they understood the two terms. It was also discussed whether the Danish translation of 'fitness' made sense. | Comment: During interview round one and two the participants were asked how they understood, the terms 'breathless', 'short of breath' and 'fitness'. The terms were well understood but we decided to use 'short of breath' in relation to physical activity. | I easily get short of breath considering my fitness |
| 2 | I notice myself breathing shallowly | | | I notice that I breathe shallowly |
| 3 | I get short of breath reading and talking | Comment: It was discussed if 'reading' and 'reading aloud' were understood as the same. Consensus was reached to change 'reading' to 'read aloud'. Adjustment: 'I get short of breath when I read aloud or talk'. | | I get breathless when I read aloud or talk |
| 4 | I notice myself sighing | | | I notice myself sighing |
| 5 | I notice myself yawning | | | I notice myself yawning |

(Continued)

Table 2. (Continued).

| | Original version | Comments and adjustments Step 1-4 | Comments and adjustments Step 5 | Final Danish version |
|----|---|--|--|--|
| 6 | I feel I cannot get a deep or satisfying breath | Comment: It was discussed whether the Danish translation of 'satisfying' made sense to the participants. To make the wording more accessible, 'a proper breath' was used. Adjustment: 'I feel I cannot breathe deeply enough or get the air down properly.' | Comment: In round one the participants were asked about the expression 'a proper breath' and if 'satisfying breath' made sense. Both were well understood. No further adjustments were made. | I feel I cannot breathe deeply enough or get the air down properly |
| 7 | I notice that I am breathing irregularly | | | I notice that I am breathing irregularly |
| 8 | My breathing feels stuck or restricted | Comment: We chose to use the word 'blocked' as this word was more commonly used among participants. Adjustment: 'My breathing feels blocked or restricted'. | Comment: During interview round two, one participant found this question difficult to answer. Since only one participant commented on this, no adjustment was made. | My breathing feels blocked or restricted |
| 9 | My ribcage feels tight and cannot expand | Comment: It was considered if it would make more sense to shorten the question. Thus, participants were asked about a shorter version in round one (step 5). | Comment: Both the shortened version and the longer version made sense to the participants. After round two we decided on the shortened version. Adjustment: 'My ribcage feels like it cannot expand'. | My ribcage feels like it cannot expand |
| 10 | I notice myself breathing quickly | | | I notice that I am breathing quickly |
| 11 | I get breathless when I'm anxious | Comment: 'anxious' was translated to 'nervous' since it seemed more semantically equivalent in Danish. Equally to Q1, the term 'breathless' was discussed. | | I get breathless when I am nervous |
| 12 | I find myself holding my breath | Comment: Since the developer (RC) did not emphasize the change from 'I notice myself' to 'I find myself', the Danish version used 'I notice myself'. | | I notice that I am holding my breath |
| 13 | I feel breathlessness in association with other physical symptoms | See Q1 and Q11 | | I get breathless in association with other physical symptoms |
| 14 | I have trouble coordinating my breathing when I am speaking | | | I have trouble coordinating my breathing when I am speaking |
| 15 | I can't catch my breath | Comment: The severity of the question was discussed, but wording was maintained to be tested in Step 5. | Comment: The majority of participants understood the question as a 'feeling' of not being able to breathe. Adjustment: 'I feel like I can't breathe'. | I feel like I can't breathe |
| 16 | I feel that the air is stuffy, as if not enough air in the room | | | I feel that the air is stuffy, as if not enough air in the room |
| 17 | I get breathless even when I am resting | | | I get breathless even when I am resting |

(Continued)

Table 2. (Continued).

| | Original version | Comments and adjustments Step 1-4 | Comments and adjustments Step 5 | Final Danish version |
|----|---|---|---|---|
| 18 | My breath feels like it does not go in all the way | Comment: It seemed more semantically equivalent in Danish to start a sentence with 'it feels'. Therefore, the order of the words was changed, and approved by RC. Adjustment: 'It feels like my breath does not go in all the way'. | | It feels like my breath does not go in all the way |
| 19 | My breath feels like it does not go out all the way | | | It feels like my breath does not go out all the way |
| 20 | My breathing is heavy | Comment: The question seemed abrupt, as 'more' was not related to anything. Consensus was achieved on adding 'than necessary'. | | My breathing is heavy |
| 21 | I feel that I am breathing more | Adjustment: 'I feel I am breathing more than necessary'. | | I feel I am breathing more than necessary |
| 22 | My breathing requires work | Comment: It was discussed whether Q22 and Q23 were too similar. The expert committee agreed to ask the participants whether they were able to distinguish. See Q22 | Comment: The majority of participants understood Q22 and Q23 as two different questions. Hence, both questions were kept in the final version. See Q22 | It requires work to breathe |
| 23 | My breathing requires effort | | | It takes effort to breathe |
| 24 | I find myself breathing through my mouth during the day | | | I notice that I breathe through my mouth during the day |
| 25 | I breathe through my mouth at night while I sleep | Comment: Since the distinction between sleeping and awake was the essential part of the questionnaire, 'at night' was not included in Danish version. This was discussed with and approved by the expert committee and RC. Adjustment: 'I breathe through my mouth while I sleep'. | | I breathe through my mouth while I sleep |

breathless, i.e. a subjective feeling of the inability to breathe sufficiently, [52] versus being *short of breath* when understood as induced by exercise as an expression of deconditioning, thus, physiologically different. Another limitation is the absence of a gold standard definition of DB, which may lead to criticism regarding the present study population when assessing face validity. The present study has several strengths. First, we used a systematic and rigorous six-step internationally accepted guide in the translation and cultural adaptation of the SEBQ. [32] Second, five clinicians with exhaustive knowledge of DB were involved, and 24 participants with DB-related symptoms and diverse characteristics were interviewed. This ensured a clinically relevant perspective on the Danish version of the SEBQ. Further, we interviewed the participants shortly after completion of the SEBQ questionnaire to avoid sub-optimal recall. Finally, the developer (RC) was involved in all steps and decisions.

In conclusion, the face validity of the Danish version of the SEBQ was acceptable. Knowledge is lacking on the validity of the questionnaire in a larger population. Thus, additional assessment of measurement properties in a Danish context are warranted.

Acknowledgments

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data supporting the findings of the present study are available from the corresponding author upon reasonable request.

Ethics approval statement

According to Danish legislation and the Act on Biomedical Research Ethics Committee System in Denmark, studies focusing on translation of questionnaires do not require a formal evaluation by the regional ethical committee (§14 section 2).

Patient consent statement

Participants gave written informed consent after being informed of the present study. This included information about the voluntary nature of participation, the anonymisation of all personal identifiable information, and that participants had the right to withdraw from the study at any time.

Permission to reproduce material from other sources

The SEBQ was translated and cross-culturally adapted in agreement with the developer and first author Rosalba Courtney.

Study registration

Open Science Framework: <https://osf.io/fvcnq/>

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