科技部補助專題研究計畫成果報告
期末報告

中風病人職能治療參與度之研究：評估工具之發展與相關影響因素驗證(第3年)

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中 華 民 國 106 年 10 月 31 日

中 文 摘 要 ： 背景／目的：幾乎所有職能治療介入都需要個案主動參與。但，目前並沒有針對職能治療參與度所特別設計的評量表，現有評量復健參與度的量表有些沒有能夠涵蓋職能治療參與的所有概念，因此必須在臨床使用前進行修訂。本研究的目的在發展職能治療參與度量表(occupational therapy engagement scale, OTES)，並驗證其單向度、信度以及預測效度。

方法：透過檢視類似的量表、專家意見、認知訪談以及先導性研究以發展OTES；使用羅序模型配適以及主成分分析驗證單向度；使用皮爾森相關係數檢驗OTES的羅序分數以及病人的平衡功能及日常生活活動功能分數間的相關性，以驗證預測效度。

結果：共253為中風病人及22位治療師使用OTES進行評量。OTES的12題項的infit 與out MNSQ介於0.62至1.34；主成分分析之首要向度之未解釋變異量為4.0%；OTES平均個別信度為0.88；OTES分數與病人的平衡功能與日常生活活動表現之相關係數各為0.42及0.37。

結論：OTES為單向度，應用於中風病人有充分的個別信度及預測效度。

中 文 關 鍵 詞 ： 職能治療，病人參與，羅序分析

英 文 摘 要 ： Background/Aim: Almost all interventions of occupational therapy require the active engagement of patients. However, no scale has been specifically designed for assessing engagement in occupational therapy, and the scales used to assess engagement in rehabilitation may not cover comprehensive concepts of engagement in occupational therapy or need to be revised before applying them in the occupational therapy setting. The purposes of this study were to develop the Occupational Therapy Engagement Scale (OTES) and to examine its unidimensionality, reliability, and predictive validity.

Methods: The OTES was developed through reviewing similar scales, experts' opinions, cognitive interviews and pilot testing. The unidimensionality was validated with Rasch model fitting and principle component analysis. The Pearson correlation coefficient (r) was used to validate the predictive validity by examining the association between the Rasch scores of the OTES and patients' balance ability and performance of activities of daily living (ADL).

Results: A total of 253 patients with stroke were rated by 22 therapists using the OTES. The infit and outfit MNSQ of the 12 items of the OTES ranged from 0.62 to 1.34. The unexplained variance of the first dimension of the PCA was 4.0%. The mean person reliability of the OTES was 0.88. The Pearson's rs between the OTES and patients' balance ability and ADL performance were 0.42 and 0.37, respectively.

Conclusions: The OTES was unidimensional and had sufficient person reliability and predictive validity in patients with

stoke.

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中風病人職能治療參與度之研究：評估工具之發展與

相關影響因素驗證

Stroke patients' engagement in occupational therapy:

Development of a questionnaire assessing engagement and

investigation of factors affecting engagement

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中　華　民　國　106　年　10　月　31　日

中文摘要

<u>背景</u>：幾乎所有職能治療介入都需要個案主動參與。但，目前並沒有針對職能治療參與度所特別設計的評量表，現有評量復健參與度的量表有些沒有能夠涵蓋職能治療參與的所有概念，因此必須在臨床使用前進行修訂。

<u>研究目的</u>：本研究的目的在發展職能治療參與度量表(occupational therapy engagement scale, OTES)，並驗證其單向度、信度以及預測效度。

<u>研究方法/程序</u>：透過檢視類似的量表、專家意見、認知訪談以及先導性研究以發展 OTES；使用羅序模型配適以及主成分分析驗證單向度；使用皮爾森相關係數檢驗 OTES 的羅序分數以及病人的平衡功能及日常生活活動功能分數間的相關性，以驗證預測效度。

<u>結果</u>：共 253 為中風病人及 22 位治療師使用 OTES 進行評量。OTES 的 12 題項的 infit 與 out MNSQ 介於 0.62 至 1.34；主成分分析之首要向度之未解釋變異量為 4.0%；OTES 平均個別信度為 0.88；OTES 分數與病人的平衡功能與日常生活活動表現之相關係數各為 0.42 及 0.37。

<u>結論</u>：OTES 為單向度，應用於中風病人有充分的個別信度及預測效度。

關鍵詞：職能治療，病人參與， 羅序分析，中風

Abstract

Background: Almost all interventions of occupational therapy require the active engagement of patients. However, no scale has been specifically designed for assessing engagement in occupational therapy, and the scales used to assess engagement in rehabilitation may not cover comprehensive concepts of engagement in occupational therapy or need to be revised before applying them in the occupational therapy setting.

Purpose: The purposes of this study were to develop the Occupational Therapy Engagement Scale (OTES) and to examine its unidimensionality, reliability, and predictive validity.

Methods: The OTES was developed through reviewing similar scales, experts' opinions, cognitive interviews and pilot testing. The unidimensionality was validated with Rasch model fitting and principle component analysis. The Pearson correlation coefficient (r) was used to validate the predictive validity by examining the association between the Rasch scores of the OTES and patients' balance ability and performance of activities of daily living (ADL).

Results: A total of 253 patients with stroke were rated by 22 therapists using the OTES. The infit and outfit MNSQ of the 12 items of the OTES ranged from 0.62 to 1.34. The unexplained variance of the first dimension of the PCA was 4.0%. The mean person reliability of the OTES was 0.88. The Pearson's rs between the OTES and patients' balance ability and ADL performance were 0.42 and 0.37, respectively.

Conclusions: The OTES was unidimensional and had sufficient person reliability and predictive validity in patients with stoke.

Key words: occupational therapy, patient participation, Rasch analysis, stroke

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Introduction

      Almost all interventions of occupational therapy require the active engagement of patients. Patients' engagement in occupational therapy is defined as patients' commitment in therapeutic activities during occupational therapy sessions in this study. According to the model for therapeutic engagement in rehabilitation (Lequerica & Kortte, 2010), patients' engagement in rehabilitation can be affected by the patients' willingness, capability, and their social and physical environments. Moreover, a patient with higher engagement in occupational therapy may make more effort, show better compliance and want to engage in therapeutic activities more actively. Poor engagement in occupational therapy can result in less functional gain and longer length of stay (Fiedler, Granger, & Russell, 2000; Lenze et al., 2004a). Monitoring the engagement of patients in occupational therapy will help therapists adjust the therapeutic activities to better fit the patients' characteristics (e.g., needs, ability, and values) to improve engagement and outcomes accordingly. To monitor patients' engagement in occupational therapy accurately, a scale with sound validity and reliability to assess engagement is crucial.

      To the best of our knowledge, engagement in therapy in a rehabilitation context can be assessed with 3 scales: the Pittsburgh Rehabilitation Participation Scale (PRPS) (Lenze et al., 2004b), the Hopkins Rehabilitation Engagement Rating Scale (HRERS) (Kortte, Falk, Castillo, Johnson-Greene, & Wegener, 2007), and the Rehabilitation Therapy Engagement Scale (RTES) (Lequerica et al., 2006). However, the PRPS has only one item and the ratings combine multiple aspects of engagement (e.g., attendance, effort, completion of activities, need for encouragement), making it difficult to obtain comprehensive information on patients' engagement. The HRERS has only 5 items, a number too small to cover all the important domains of engagement in occupational therapy (e.g., cooperating with therapist and following the therapists' instructions). The RTES has 15 items and good inter-rater reliability (Lequerica et al., 2006). However, some items on the RTES have similar/redundant concepts (e.g., "Focuses concentration intensely on therapy exercises during the session" and "Sustains attention to follow through on tasks until completed"), and some items contain more than one question in a single item. For example, "Puts forth effort, works diligently and strives for accuracy on all tasks" (item 8 of the RTES) could contain three questions: 1) puts forth effort on all tasks, 2) works diligently on all tasks, and 3) strives for accuracy on all tasks. These items need to be revised to avoid confusing raters. In addition, two items of the RTES do not belong to the same construct as other items when applied in an occupational therapy setting (Lequerica et al., 2006), so it would be inappropriate to sum the scores of these two items with the other items of the RTES. Other measures developed for the occupational therapy

setting tend to be more general performance measures that may include engagement within their items (Brayman, Kirby, Misenheimer, & Short, 1976; Margolis, Harrison, Robinson, & Jayaram, 1996). However, no scale has been specifically designed for assessing engagement in occupational therapy, and the scales used to assess engagement in rehabilitation may not cover comprehensive concepts of engagement in occupational therapy or have issues that may require revision to more appropriately reflect engagement in occupational therapy settings.

A number of different issues can contribute to poor engagement, and many of these can easily be targeted for treatment once identified. Without a valid and reliable scale to evaluate patients' engagement in occupational therapy, occupational therapists cannot accurately monitor the engagement of patients with stroke in occupational therapy and further influence the outcomes of patients. Thus, the purposes of this study were to develop the Occupational Therapy Engagement Scale (OTES) and to validate the unidimensionality (one type of construct validity), reliability, and predictive validity of the OTES in patients with stroke.

Method

Research design

The study was conducted in two phases. Phase 1 was the development of the OTES. In Phase 2, we conducted a cohort study to examine the unidimensionality, person reliability, and predictive validity of the OTES. The predictive criteria of the OTES were patients' performance of activities of daily living (ADL) and balance ability. Promoting patients' ADL performance and balance ability are often the main occupational therapy goals of both therapists and patients with subacute stroke. Therefore, we assumed that patients would have better ADL performance and balance ability after actively engaging in occupational therapy programs. This study was approved by the Institutional Review Board of National Taiwan University Hospital and Chung Shan Medical University Hospital.

Phase 1: Development of the OTES

Subjects

The participants included occupational therapists and their patients with stroke. Occupational therapists were recruited if they met the following criteria: (1) more than 6 months of experience in working in adult physical dysfunction settings; and (2) experience in treating patients with stroke. Inpatients with stroke were recruited if they met the following criteria: (1) diagnosis of stroke; (2) history of at least 6 occupational therapy treatments with a therapist; and (3) ability to follow one-step verbal instructions. Patients with stroke were excluded if they had other major

comorbidities (e.g., cancer, Alzheimer's disease).

Procedure

The development of the OTES included three steps:

(1) item construction: We primarily adopted the items of the RTES, which contained more comprehensive concepts of patients' engagement compared with other rehabilitation engagement scales. The revision was approved by the developer of the RTES. We revised the items according to three principles: (a) the items reflect the patients' engagement in occupational therapy, (b) the items fit the local culture and occupational therapy settings, and (c) each item contains only one question. The items constructed in this step were named the OTES draft-1;

(2) expert committee review: Eight occupational therapists served on an expert committee to review the OTES draft-1 to ensure whether the items (a) fit the contexts of occupational therapy and local culture, (b) included the entire scope of patients' engagement in occupational therapy programs, (c) described observable behaviors, and (d) were easy to understand. The experts were asked to add new items to complement the scope of the patients' engagement in occupational therapy according to their clinical observations and experiences. All items were designed to reflect patients' engagement in occupational therapy. Two authors (the first author and third author) revised the items of the OTES draft-1 according to the committee's suggestions and discussed the revisions with the committee until the committee agreed with the revisions (named the OTES draft-2);

(3) cognitive interview: We recruited 14 occupational therapists who did not participate in the previous two steps to test the OTES draft-2 to find difficulties in evaluating patients' occupational therapy engagement (e.g., any confusion caused by the descriptions of the items, format of the questionnaire, or rating criteria). Before the therapists administered the OTES draft-2, we provided them with the manual of the OTES draft-2 to help them understand the scoring criteria and have sufficient knowledge in patient engagement. The authors (the first author and corresponding author) conducted cognitive interviews to determine the therapists' interpretations to the OTES draft-2 and to collect suggestions for revising the OTES draft-2 during field testing (Christodoulou, Junghaenel, DeWalt, Rothrock, & Stone, 2008; Irwin, Varni, Yeatts, & DeWalt, 2009). After revising the OTES draft-2, we conducted further pilot testing to ensure that no further revision comments were proposed.

Phase 2: Validation of the OTES

Subjects

Patients

We recruited a convenience sample of patients with stroke who received occupational therapy services at two medical centers from January 2, 2015, to January 31, 2016. The criteria of recruiting and excluding patients were the same as those in Phase 1.

<u>Raters</u>

Occupational therapists in the department of physical dysfunction in two medical centers were included in the study. Occupational therapists were included if they met the following criteria: (1) at least 6 months of experience of in working in adult physical dysfunction settings; and (2) experience in treating patients with stroke.

Procedure

The recruited patients were evaluated with the OTES by their occupational therapists after one week of daily intervention sessions. All therapists were provided with the manual of the OTES, so that they had sufficient knowledge in rating the scores. Regarding the timing of predictive criteria evaluations, the patients were evaluated by one of the four research assistants with the Balance Computerized Adaptive Testing system (Balance CAT) (Hsueh et al., 2010) at discharge from the hospital, and with the Activities of Daily Living Computerized Adaptive Testing system (ADL CAT) (Hsueh et al., 2010) two months after discharge. The patients' demographic data and medical history were collected from medical charts. All occupational therapists who participated in this study received 2 hours of training on how to administer the OTES.

Measurement tools

The Occupational Therapy Engagement Scale (OTES). The OTES was developed as described previously.

Balance Computerized Adaptive Testing system (Balance CAT). The Balance CAT assesses balance function in patients with stroke (Hsueh et al., 2010) and is performed by raters (*e.g.*, research assistants). The Balance CAT contains 34 items in its item bank. The Balance CAT has sufficient reliability and concurrent validity in patients with stroke (Hsueh, Jeng, Lee, Sheu, & Hsieh, 2011).

Activities of Daily Living Computerized Adaptive Testing system (ADL CAT). The ADL CAT is a computerized adaptive test of performance of ADL (i.e., basic self-care activities, such as bathing or dressing) and instrumental ADL (i.e., advanced living skills, such as preparing meals) in patients with stroke (Hsueh, Chen, Wang, Hou, & Hsieh, 2013). The ADL CAT contains 34 items in the item bank and can be administered on a digital device via the internet (e.g., a smart phone). It has been shown that the ADL CAT has good reliability and good concurrent validity with the

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combined score of the Barthel Index and the Frenchay Activities Index (Hsueh et al., 2013).

Measurement scheme to classify aphasia

To characterize the participants' level of aphasia, the authors developed a measurement scheme was used to classify aphasia using the following criteria: (1) Comprehension impairment: normal - no difficulty in understanding the conversation; mild - a few difficulties in comprehending the conversation (e.g., inability to understand long sentences or faster talking); moderate - comprehension of only short sentences or key words in the conversation; severe - no comprehension of the conversation. In addition, the patients with severe comprehension impairment still can engage in therapeutic activities through therapists' demonstrations and repeated practices. (2) Expression impairment: normal - no difficulty in expressing themselves; mild - a few difficulties in expressing themselves (e.g., inability to talk fluently or to recall several words); moderate - ability to say only short sentences or key words in the conversation; severe - inability to talk. Although patients with severe expression impairment cannot talk, they can still understand the meaning of conversation.

Data analysis

Descriptive analysis

The score range and distribution of the OTES were examined. The floor and ceiling effects were also examined. The floor effect was the percentage of patients with the lowest possible score, whereas the ceiling effect was the opposite extreme (van der Putten, Hobart, Freeman, & Thompson, 1999). Floor or ceiling effects exceeding 20% were significant (Holmes & Shea, 1997).

Validation of the OTES

Unidimensionality and reliability

The partial credit model of Rasch analysis was applied to investigate the unidimensionality of the OTES because the descriptions of the response categories were different in several items (Linacre, J. M., 2006; Wright & Masters, 1982). We assumed that patients' engagement in occupational therapy was unidimensional because the patients' engagement in rehabilitation was validated as unidimensional in a previous study (Lequerica et al., 2006). Infit and outfit mean square (MNSQ) were used to ascertain data-model fitting. The item would be removed if the infit or outfit MNSQ value was outside the appropriate range (0.6 -1.4) (Linacre, J. & Wright, 1994). If any item was removed, we re-conducted the Rasch analysis. In addition, we employed principle component analysis (PCA) of residuals to further determine the unidimensionality of the OTES. The variance of residuals of the PCA was used to

determine whether other dominant dimensions existed in the OTES. The PCA of a residual was acceptable when no other dimensions explained > 10% variance of the residuals (Smith, 2002).

Person reliability coefficients were also calculated from the Rasch analysis. A coefficient ≥ 0.7 was considered adequate for using the sum score of the OTES for group comparisons (e.g., comparison of groups' mean scores of the OTES), whereas a coefficient ≥ 0.9 was adequate for individual comparisons (e.g., comparison of two individuals' sum scores of the OTES) (Aaronson et al., 2002).

The raw sum scores of the OTES could be transformed into Rasch scores (also known as logit scores) if its items fit the Rasch model's expectations. Every raw sum score would have a corresponding Rasch score no matter what the combination of the responses was. All Rasch analyses were performed in the Winsteps computer program (Version 3.64.2).

Appropriateness of response categories

We examined the appropriateness of the response categories of each item of the OTES by checking the order of the step difficulties (the threshold for two adjacent response categories) for each item. The response categories were considered appropriate when the step difficulties fit the two criteria: (1) the step difficulties were in the same order as the intended response category order (i.e., no disordering); (2) the difference between adjacent step difficulties were 1.4-5.0 logits (Linacre, Jonathan M, 2002).

Person-item mapping

We estimated the levels of patients' engagement in occupational therapy and the difficulty of the OTES items by Rasch analysis. We verified whether the items of the OTES matched the patients' levels of engagement in occupational therapy (person-item mapping) by using two examinations. First, we compared the range of levels of patients' engagement in occupational therapy levels and that of the item response difficulties. The range of item difficulties was sufficient when it covered the full range of patients' levels of engagement in occupational therapy. Second, we examined whether substantial gaps existed between the item difficulties. A gap was notable when a difference in item difficulty between two adjacent items' response categories was equal to or larger than 0.5 Rasch score (the unit of item difficulty) (Lai & Eton, 2002).

Predictive validity

Predictive validity was examined using Pearson's *r* to examine the relationship between the Rasch scores of the OTES and scores of the Balance CAT administered at

discharge from hospital and those of the ADL CAT at 2 months after discharge. To demonstrate acceptable predictive validity, the scores of OTES should have at least low correlation (Pearson's $r > 0.3$) with those of the Balance CAT and the ADL CAT.

Results

Phase 1: the development of the OTES

In step 1 (item construction), we rephrased all 15 items of the RTES and added the words "therapeutic activities" and/or "therapist" to some items. Although 2 items (i.e., coping skill and frustration tolerance) of the RTES did not have the same construct as the other items in a previous study (Lequerica et al., 2006), we still rephrased them ("Willing to take the therapist's advice to correct his or her movements or other performances" and "Can tolerate discomfort during therapeutic activities") and added them to the OTES draft-1 because they seemed to reflect patients' engagement in occupational therapy. We further simplified the descriptions of seven items by keeping the core question such that each item contained only one question. Because two of the seven simplified items each contained two valuable questions, we split them into four items. In total, the OTES draft-1 had 17 items.

In step 2 (expert committee review), eight occupational therapists reviewed the OTES draft-1. The experts added three new items (i.e., "Executes at least one home program or bedside activity recommended by the therapist", "Continues practicing in a wrong way after therapists' instruction", and "Attends the therapeutic sessions on time without absence for no reason"). The experts suggested the deletion of four items on proposed behaviors that might not be easy to observe (i.e., "Recognizes their accomplishments of occupational therapy" and "Has sufficient self-efficacy for occupational therapy") or did not fit the daily clinical contexts of occupational therapy (i.e., "Actively asks more challenging activities" and "Can tolerate discomfort during therapeutic activities"). After deletion of the four items, the remaining 16 items were named the OTES draft-2. Fourteen occupational therapists tested the OTES draft-2 and suggested revisions of the wording, format, and timing to record patients' performance. After revisions, the 16 items of the OTES were validated. All items were rated on a 4-point scale (0: never, 1: $< 50\%$ of the time, 2: $\geq 50\%$ of time, and 3: always; 0: sometimes, 1: about 50% of the time, 2: often, and 3: always; 0: resist doing so, 1: not be willing to do so, 2: be willing to do so, 3: be glad to do so). Before scoring patients' engagement, users needed to observe the patients' behaviors for five consecutive days/sessions.

Phase 2: Validation of the OTES

A total of 22 occupational therapists rated the patients' engagement in

occupational therapy programs. The majority of the occupational therapists were female (68.2%), and the average age of all therapists was about 40 years. The average number of years of experience as an occupational therapist was about 17 years. A total of 253 patients with stroke were rated by 22 therapists using the OTES. The majority of the patients were male (65.2%). The average age was about 62 years (SD = 13.2). The mean number of months after stroke was 2.1 months (SD=1.5). The demographic and clinical characteristics of the occupational therapists and patients are shown in Table 1.

Unidimensionality and reliability

Twelve of the 16 items of the OTES fit the Rasch model's expectations. The 4 non-fitting items were "attends the therapeutic sessions on time without absence for no reason", "executes at least one home program or bedside activity recommended by the therapist", "continues practicing in a wrong way after therapists' instruction", and "voluntarily discusses with the therapist the latest personal progress or changes in the patient's condition" (infit MNSQ>1.58, outfit MNSQ>1.83). After the four items were removed, the infit and outfit MNSQ of the remaining 12 items ranged from 0.62 to 1.34 (Table 2). The PCA of the residual showed that the unexplained variance of the first dimension was 4.0% (<10%).

The person reliability of the 12-item OTES (OTES) was 0.88. One hundred and eighty-eight patients (74.3%) had values of person reliability > 0.90. The patients who had values of reliability < 0.90 had Rasch scores of the OTES ≥ 6.0 or ≤ -6.0.

Because the OTES fit the Rasch model's expectations, we transformed the raw sum scores of the OTES into Rasch interval scores. Table 4 shows the raw sum scores of the OTES, the corresponding Rasch interval scores, and standard errors. Higher scores imply higher engagement in occupational therapy programs. The Rasch scores, a type of standardized score, ranged from -8.0 to 7.3.

Appropriateness of response categories

No items exhibited disordering in step difficulty. All differences between adjacent step difficulties were within 1.4-5.0 logits except Item 8 (the difference between step 1 and 2 was 1.29). We retained the response categories of Item 8 for two reasons: (1) the difference was close to 1.4, and (2) we wanted to keep all items on a 4-point scale. The step difficulty for each item of the OTES is listed in Table 2. The item step difficulty ranged from -4.49 to 3.94.

Person-item mapping

The mean item difficulty for each item of the OTES is listed in Table 2, and the person-item map is shown in Figure 1. The range of patients' engagement in occupational therapy programs (-8.0 to 7.3) was larger than the range of item response

difficulty (-5.8 to 4.5). In terms of mean item difficulty, the item "Willing to attempt new or unfamiliar therapeutic activities" was the least observed behavior, and the item "Tries his or her best to participate in all therapeutic activities" was the behavior most often observed.

Three significant gaps were noted. The first gap was between Step 3 of Item 9 (Cooperates with the therapist and follows the therapist's instructions; i.e., a Rasch score of 2.6 on engagement or 2.6 logits) and Step 2 of Item 3 (Adopts positive or pleasant attitude towards therapeutic activities; i.e., 0.8 logits); 25.3% (n=64) of the patients were scored within the gap and had person reliability = 0.963-0.966. The second gap was between Step 2 of Item 9 (i.e., -1.4 logits) and Step 1 of Item 5 (Listens to the therapist's instructions carefully; i.e., -2.2 logits), where 1.6% of the patients (n=4) scored within the gap with person reliability = 0.973-0.974. The third gap was between Step 1 of Item 2 (Sustains attention until the end of one therapeutic activity; i.e., -3.9 logits) and Step 1 of Item 11 (Tries his or her best to participate in all therapeutic activities; i.e., -5.8 logits), and none of the patients scored within the gap.

No patient had the lowest possible score of the OTES (raw sum score=0), and 20.2% (n=51) of the patients had the highest possible score (raw sum score=36). Thus, a significant ceiling effect was found.

Predictive validity

The Pearson correlation coefficient (r) between the OTES and the Balance CAT scores before discharge was 0.42 (p<0.001). The Pearson's r between the OTES and the ADL CAT scores was 0.37 (p<0.001).

Discussion

This is the first study to develop a rating scale to assess patients' engagement levels in occupational therapy. By revising the items of the RTES and adding the recommendations of occupational therapists and experts, we developed a draft of the OTES with 16 items. Rasch analysis was used to determine the final OTES version with 12 items and a 4-point scale.

In validating the data-model fitting, we found that the infit and outfit MNSQ of the final 12 items of the OTES were within the acceptable range (0.6-1.4) (Linacre, J. & Wright, 1994). These results indicated that all 12 items of the final OTES fitted the assumptions of the Rasch model and were unidimensional. The four removed items (i.e., being on time, doing home programs, improper practice, and discussion with therapists) were thought to be components of "engagement" based on occupational therapy experience; however, the results showed that these items did not fit the Rasch

model's assumptions. This might be because these four items may be influenced by caregivers, patients' progress in recovery, or other factors that are separate from the construct of engagement. Thus, we kept only the 12 fitting items.

To validate the unidimensionality of the OTES, in addition to the Rasch model fitting, PCA of the residuals were calculated and found to be acceptable (no other dimensions explained > 10% variance of residuals) (Smith, 2002). These results demonstrated that the unidimensionality of the OTES was highly supported. Therefore, the score of each item in the OTES can be summed up to represent a person's engagement level. A higher sum score indicates a higher level of engagement. Additionally, the results showed that the OTES contained proper response categories and that the items of the OTES matched most participants' engagement levels. Thus, the OTES appears applicable to the assessment of engagement in patients with stroke who are receiving occupational therapy.

Because the 12 items of the OTES fit the Rasch model's assumptions, we can transform the raw sum scores of the OTES into Rasch scores (an interval scale). In comparison with the raw sum score of the OTES (an ordinal scale), the Rasch score of the OTES has at least two advantages. First, for use in clinical contexts, the Rasch score is useful for quantifying differences and changes in engagement level because the Rasch score has equal intervals of adjacent score points. For example, clinicians can demonstrate exactly the amount of change (or difference) in the engagement level of patients, rather than presenting the change as simply higher or lower. Second, for use in research contexts, Rasch scores are more useful than raw sum scores for arithmetic (e.g., multiplication and division), parametric statistical methods, and statistical inference. For example, researchers can compare the means of Rasch scores of the OTES between two groups of patients in different occupational therapy programs and infer the treatment effectiveness. Thus, the Rasch scores provided in our study are useful to clinicians and researchers for quantifying, analyzing, and interpreting patients' OTES scores.

The results showed that the mean person reliability (0.88) of the OTES was higher than the common criterion (0.7) for group comparison. The person reliability represents the level of standard error of a respondent's ability (i.e., random measurement error of the engagement estimation in this study), and higher reliability indicates lower standard error. Particularly, for individual comparisons, such as comparing individual scores of a person's engagement level, the standard needs to be more stringent because the standard error of an individual score is critical for score interpretation. Our results showed that the person reliability of the OTES was close to the criterion (0.9) for individual comparison. Therefore, occupational therapists can employ the Rasch interval scores to compare the engagement in occupational therapy

within an individual patient (e.g., repeated measurements) and between patients with stroke.

We further reviewed the distribution of the person reliability of the patients. The results showed that about 75% of the participants had person reliability > 0.90. Those having person reliability < 0.90 had Rasch scores of the OTES $\geq$ 6.0 or $\leq$ -6.0. However, a patient with a Rasch score of the OTES $\geq$ 6.0 would have strong engagement in occupational therapy. For such a patient, clinicians may not need to differentiate the strength of engagement. If a patient's engagement in occupational therapy programs is sufficiently strong, improving the patient's occupational therapy engagement will be of little concern. On the other hand, if a patient has an OTES score $\leq$ -6.0, the main issues are to identify what is going wrong and to address the issue. Clinicians or even researchers would not prioritize the determination of the strength of such a patient's engagement. Thus, the 12 items of the OTES appear sufficient to assess the patients' level of engagement in occupational therapy for research and clinical purposes.

In terms of the person-item mapping in this research, the range of item response difficulties was smaller than that of the participants' engagement level. Additionally, ceiling effects were noted. It seems that the items of the OTES for assessing rather high engagement were insufficient for the participants. However, differentiating the various levels of patients with high engagement is not a main issue in clinical settings. Patients with acceptable engagement levels might be sufficient for their recovery. Furthermore, the ceiling effects may result from a selection bias: patients with low engagement tend to refuse participation in this study. The ceiling effects may diminish when applying the OTES in daily clinical practice. Besides, three gaps existed. The first gap was located between 0.8 and 2.6 logits; the second, between -2.2 and -1.4 logits; and the third, between -5.8 and -3.9 logits. The first gap was of concern because 25.3% of the participants' estimated engagement levels fell within this gap. The second and third gaps may not be of concern because few participants (1.6%) had scores within these two gaps. However, the average person reliabilities of patients in the first and second gaps were about 0.96 and 0.97, respectively. The very high person reliability of the participants should ease concerns about the gaps. Many items located on both sides of the first and second gaps may contribute to the high person reliabilities of the patients in these two gaps. Thus, the person-item mapping further supports the result that the items of the OTES are sufficient for assessing the level of engagement of patients with stroke.

We found that the OTES scores had substantial association with those of the Balance CAT assessed at discharge (Pearson's $r = 0.42$) and with those of the ADL CAT assessed at 2 months after discharge (Pearson's $r = 0.37$). These findings

indicate that the predictive validity of the OTES is acceptable. Prospective users are recommended to explore and deal with possible factors which decrease the engagement when a patient has a low sum score of the OTES. Thus, the patient may have more improvement in ADL and balance function.

Limitations and Directions for Future Research

Our study has three limitations. The first is that we recruited only hospitalized patients with stroke onset within 6 months. Such a recruitment bias may hamper the generalization of the results to all patients with stroke receiving occupational therapy. Future research recruiting inpatients and outpatients with various intervals after stroke onset to verify our results is warranted. The second limitation is that we did not recruit patients with severe cognitive and/or communication deficits because we were unsure whether they were unable or unwilling to follow therapists' instructions. The third limitation is that we used Pearson correlation coefficients to estimate the predictive validity of the OTES, which might have over- or underestimated the relationship between engagement and outcomes (i.e., patients' ADL performance and balance ability). The predictive power of the OTES would be better examined using regression analysis to control for confounders (e.g., motor and cognitive impairment). Unfortunately, we could not collect sufficient data in the medical records related to other predictors of patients' ADL performance and balance ability, such as motor impairment severity, presence of depression, and cognitive impairment at admission. Therefore, we could not conduct regression analysis. Future studies could use different statistical methods to validate our results.

Conclusion

The OTES was developed through reviewing similar scales, considering experts' opinions, and field testing. The OTES is unidimensional and has sufficient person reliability and predictive validity in patients with stroke. The OTES could help clinicians and researchers to determine accurately the levels of engagement of patients with stroke. Future researchers can identify the factors influencing the scores of the OTES to improve the integrity of the theories of engagement and motivation.

Acknowledge

Key points for occupational therapy

1. The Occupational Therapy Engagement Scale (OTES) has sufficient reliability and validity in patients with stroke.

2. Using the OTES could help therapists and researchers grade the patients' engagement in occupational therapy.

3. Identifying the factors influencing scores of the OTES would be helpful to improve patients' engagement.

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Figure 1. The map of person-item response difficulty locations

Table 1: *Demographic and clinical characteristics of the patients and occupational therapists rating the OTES*

Characteristic	
Occupational therapists rating the OTES (N=22)	
Gender (male/female)	7/15
Age (year) ; Mean ± SD	40.2±7.2
Degree of education (bachelor/ master)	15/7
Years working as an occupational therapist; Mean ± SD	17.4±7.5
Patients (N=253)	
Gender (male/female)	165/88
Age (year)	62.3±13.2
Level of education	
Not educated	20 (7.9%)
≤ 6 years	62 (24.5%)
≤ 9 years	96 (38.0%)
10-12 years	27 (10.7%)
13-16 years	33 (13.0%)
>16 years	11 (4.3%)
Missing	4 (1.6%)
Months after stroke; Mean ± SD	2.1±1.5
Side of brain lesion	114/132/7
Left	114 (45.1%)
Right	132 (52.1%)
Both	7 (3.8%)
Incidents of stroke (1/≥2)	205/48
Aphasia: comprehension impairment	
Normal	172 (68.0%)
Mild	54 (21.3%)
Moderate	26 (10.3%)
Severe	1 (0.4%)
Aphasia: expression impairment	
Normal	147 (58.1%)
Mild	51 (20.2%)
Moderate	42 (16.6%)
Severe	13 (5.1%)
Raw OTES Total scores; Mean ± SD	39.3±8.0

Table 2: *The infit and outfit mean square (MNSQ) statistics, mean item difficulties, standard error (SE) of mean difficulty, and step parameters of the Occupational Therapy Engagement Scale (OTES)*

	Item	Infit MNSQ	Outfit MNSQ	Mean difficulty	SE	Step 1	Step 2	Step 3
1	**Commits** in therapy activities **without being urged**	1.01	0.96	0.06	0.14	-2.72	-0.30	3.02
2	**Sustains attention** until the end of one therapeutic activity	0.99	0.98	-0.16	0.14	-3.78	0.13	3.65
3	**Adopts positive or pleasant attitude** towards therapeutic activities	1.29	1.33	0.49	0.14	-3.95	0.29	3.66
4	**Is easily encouraged** by the therapist to engage more in therapeutic activities	0.82	0.72	-0.12	0.14	-3.01	0.29	2.72
5	**Listens** to the therapist's instructions **carefully**	0.86	0.87	0.42	0.14	-2.58	-0.77	3.34
6	**Correctly executes** the therapeutic activities designed by the therapist without arbitrary adjustment of the activity content	1.01	1.05	-0.29	0.15	-3.08	-0.71	3.79
7	**Accepts** physically or mentally **challenging activities**	0.89	0.87	0.77	0.14	-3.42	-0.28	3.7
8	**Willing to take the therapist's advice** to correct his or her movements or other performances	0.83	0.78	0.06	0.14	-2.32	-1.03	3.35
9	**Cooperates with the therapist** and follows the therapist's instructions	0.76	0.62	-0.59	0.15	-2.33	-0.85	3.18
10	**Completes** the number of times or duration of **activity** recommended by the therapist before the end of each therapy session	1.34	1.20	-0.19	0.14	-2.11	-0.64	2.75
11	**Tries his or her best** to participate in all therapeutic activities	0.97	0.96	-1.34	0.15	-4.49	0.55	3.94

| 12 | **Willing to attempt new** or unfamiliar therapeutic **activities** | 1.11 | 1.10 | 0.87 | 0.14 | -3.2 | -0.45 | 3.65 |

† The Items "attends the therapy sessions on time without absence for no reason", "executes at least one home program or bedside activity recommended by the therapist", "continues practicing in a wrong way after therapists' instruction", and "voluntarily discusses with the therapist the latest personal progress or changes in the patient's condition" were not included because their infit and outfit MNSQ were misfit.

Table 3: *Raw sum scores, Rasch scores and standard errors of the Occupational Therapy Engagement Scale (OTES)*

Raw sum score	Rasch score	Standard error
0	-8.0	1.7
1	-6.0	1.2
2	-4.9	0.8
3	-4.3	0.7
4	-3.9	0.6
5	-3.5	0.6
6	-3.2	0.6
7	-2.9	0.5
8	-2.6	0.5
9	-2.4	0.5
10	-2.1	0.5
11	-1.9	0.5
12	-1.7	0.5
13	-1.4	0.5
14	-1.2	0.5
15	-1.0	0.5
16	-0.7	0.5
17	-0.5	0.5
18	-0.2	0.5
19	0.1	0.5
20	0.3	0.5
21	0.6	0.5
22	0.9	0.6
23	1.2	0.6
24	1.6	0.6
25	1.9	0.6
26	2.2	0.6
27	2.5	0.6
28	2.8	0.6
29	3.2	0.6
30	3.5	0.6
31	3.8	0.6
32	4.2	0.6
33	4.6	0.7
34	5.2	0.8
35	6.0	1.1
36	7.3	1.9

† No patients had scores of zero or within the range of 2-5; thus, we applied the maximum likelihood method to simulate the Rasch scores of the corresponding raw sum scores.

PERSONS - MAP - ITEMS - 50% Cumulative probabilities (Rasch-Thurstone thresholds)

```
    High engagement|
  6 ############## +
                  |
                  |
                  |
                  |
      .###        |
  5              +
                  |
      .## S|  16. Willing to attempt new activities        .3
         |   7. Accepts challenging activities             .3
      .#  |   3. Adopts positive or pleasant attitude      .3
  4      +
       .# |   5. Listens carefully                          .3
         |   2. Sustains attention until the end            .3
         |   6. Correctly executes                          .3
      ## |   8. Willing to take the therapist's advice      .3
       # |   1. Commits in therapy activities               .3
  3      +
      .## |
      .## |  10. Completes the activity                     .3
         |  11. Tries his or her best to participate        .3
         |   4. Is easily encouraged                        .3
         |   9. Cooperates with the therapist               .3
         |
      .## M|
  2      +
      .## |
      .## |
         |
       .# |T
  1    .# +
         |   3. Adopts positive or pleasant attitude        .2
       # |S  7. Accepts challenging activities              .2
       # |  16. Willing to attempt new activities           .2
         |   4. Is easily encouraged                        .2
  0    .  +M  2. Sustains attention until the end           .2
       . S|   1. Commits in therapy activities              .2
         |   5. Listens carefully                           .2
       . |
         |S 10. Completes the activity                      .2
       .# |  11. Tries his or her best to participate       .2
         |   8. Willing to take the therapist's advice      .2
 -1   .# +   6. Correctly executes                          .2
      .# |T  9. Cooperates with the therapist               .2
       . |
       . |
       . |
 -2      +
       . |   5. Listens carefully                           .1
       . |  10. Completes the activity                      .1
         |  16. Willing to attempt new activities           .1
         |   8. Willing to take the therapist's advice      .1
       . |T  7. Accepts challenging activities              .1
         |   1. Commits in therapy activities               .1
 -3   .  +   9. Cooperates with the therapist               .1
       . |   4. Is easily encouraged                        .1
         |   3. Adopts positive or pleasant attitude        .1
         |   6. Correctly executes
         |
 -4      +   2. Sustains attention until the end            .1
         |
         |
         |
         |
 -5      +
         |
         |
         |
         |  11. Tries his or her best to participate        .1
         |
 -6    . +
    Low engagement|<frequ>
EACH '#' IS 5.
```

Figure 1. The map of person-item response difficulty locations
[†]Each '#' is 5 people and each '.' is 1-5 people.
[‡]The number at the end of each item means the step number of an item. For example, '3' means the third step.

103年度專題研究計畫成果彙整表

計畫主持人：呂文賢				計畫編號：103-2314-B-040-006-MY3			

計畫名稱：中風病人職能治療參與度之研究：評估工具之發展與相關影響因素驗證

成果項目				量化	單位	質化（說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等）	
國內	學術性論文	期刊論文		0	篇		
		研討會論文		3	篇	楊秋萍、王怡晴、呂文賢（2016）。職能治療參與度量表發展—以中風病人為例。臺灣職能治療學會第 35 次學術研討會。台北：台灣職能治療學會。2016.11.06。王怡晴、呂文賢（2016）。中風病人之職能治療參與經驗探討。臺灣職能治療學會第 35 次學術研討會。台北：台灣職能治療學會。2016.11.06。范馨文、楊秋萍、王怡晴*、呂文賢(2015)。中風病人職能治療參與之職能治療師觀點。臺灣職能治療學會第34次學術研討會，台北：台灣職能治療學會。2015.12.12-13。	
		專書		0	本		
		專書論文		0	章		
		技術報告		0	篇		
		其他		0	篇		
	智慧財產權及成果	專利權	發明專利	申請中	0	件	
				已獲得	0		
			新型/設計專利		0		
		商標權		0			
		營業秘密		0			
		積體電路電路布局權		0			
		著作權		0			
		品種權		0			
		其他		0			
	技術移轉	件數		0	件		
		收入		0	千元		
國外	學術性論文	期刊論文		0	篇	投稿中	
		研討會論文		0			
		專書		0	本		
		專書論文		0	章		
		技術報告		0	篇		

		其他			0	篇	
智慧財產權及成果		專利權	發明專利	申請中	0	件	
				已獲得	0		
			新型/設計專利		0		
		商標權			0		
		營業秘密			0		
		積體電路電路布局權			0		
		著作權			0		
		品種權			0		
		其他			0		
	技術移轉	件數			0	件	
		收入			0	千元	
參與計畫人力	本國籍	大專生			0	人次	
		碩士生			1		共1人次
		博士生			0		
		博士後研究員			0		
		專任助理			3		共3人次
	非本國籍	大專生			0		
		碩士生			0		
		博士生			0		
		博士後研究員			0		
		專任助理			0		
其他成果 （無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）							

科技部補助專題研究計畫成果自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現（簡要敘述成果是否具有政策應用參考價值及具影響公共利益之重大發現）或其他有關價值等，作一綜合評估。

---

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估
   ■達成目標
   □未達成目標（請說明，以100字為限）
   　　　□實驗失敗
   　　　□因故實驗中斷
   　　　□其他原因
   說明：

---

2. 研究成果在學術期刊發表或申請專利等情形（請於其他欄註明專利及技轉之證號、合約、申請及洽談等詳細資訊）
   論文：□已發表　■未發表之文稿　□撰寫中　□無
   專利：□已獲得　□申請中　■無
   技轉：□已技轉　□洽談中　■無
   其他：（以200字為限）

---

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性，以500字為限）
   一、在臨床應用方面：
   本研究研發之職能治療參與度量表(occupational therapy engagement scale, OTES)具有良好建構效度，包括12題項且，題項精簡適合臨床上使用，有助於臨床職能治療師對於個案職能治療參與度的評量。臨床上應用OTES評量的結果，有助於職能治療人員對於病人OT參與度之掌握與追蹤，進而改善影響個案OT參與度之因素，有效提升治療品質與成效；另一方面，具有信效度之OTEM，有潛力可以取代目前臨床上使用的參與度評量項目。
   二、在學術應用方面
   1. 職能治療參與度可以作為中風病人出院時平衡功能，以及出院二個月時日常生活活動功能表現之預測因子。
   2. 初步職能治療參與度相關因子探討發現，中風病人的平衡能力影響病人的職能治療參與度。

4. 主要發現

本研究具有政策應用參考價值：■否　□是，建議提供機關

（勾選「是」者，請列舉建議可提供施政參考之業務主管機關）

本研究具影響公共利益之重大發現：□否　□是

說明：（以150字為限）