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Evaluation of the Pain Impact Index for Community-Dwelling Older Adults Through the Application of Rasch Modelling

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Title Page

**Evaluation of the Pain Impact Index for community-dwelling older adults
through the application of Rasch modelling**

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Conflict of interest

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Running head

Pain Impact Index

Significance and Innovations

1. This study reports on the evaluation of the Pain Impact Index through the application of Rasch modelling.
2. The Pain Impact Index is a simple, brief, easy-to-use and novel tool to assess pain impact in community-dwelling older adults.
3. The Pain Impact Index successfully differentiated between respondents with different levels of pain, but has the highest measurement precision for respondents with the average level of pain.
4. It should be explored whether the Pain Impact Index requires further refinement to improve discrimination between respondents whose pain falls at the extremes of the pain continuum.
- 5.

Abstract

Objective

Evaluate the Pain Impact Index, a simple, brief, easy-to-use and novel tool to assess the impact of chronic pain in community-dwelling older adults.

Methods

A Rasch modelling analysis was undertaken in Stata using a partial credit model suited to the Likert-type items that comprised the Index. The Index was evaluated for: ordering of category thresholds; unidimensionality; overall fit to the Rasch model; measurement bias (Differential Item Functioning, DIF); targeting; and construct validity.

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Results

The four-item Pain Impact Index was self-completed by 6454 community-dwelling Australians who were aged at least 70 years and experienced pain on most days. Two items showed evidence of threshold disordering and this was resolved by collapsing response categories (from five to three) for all items. The re-scored Index conformed to the unidimensionality assumption and had satisfactory fit with the Rasch model (analyses conducted on a reduced sample size to mitigate the potential for overpowering: $n=377$, $p>0.0125$, $\text{power}>77\%$). The most frequent sources of measurement bias were age, knee pain, and upper back pain (when considering uniform DIF) and knee pain (when considering non-uniform DIF). The Index had good ability to differentiate between respondents with different levels of pain impact and had highest measurement precision for respondents located around the average level of pain impact in the study sample. Both convergent and discriminant validity of the Index were supported.

Conclusion

The Pain Impact Index showed evidence of unidimensionality, was able to successfully differentiate between levels of pain impact, and had good evidence of construct validity.

Introduction

Chronic pain management is a significant public health concern in Australia.¹⁻³ Chronic pain management is particularly challenging in older adults as clinicians must carefully tailor available management strategies to the ageing person to improve quality of life while preventing adverse outcomes.⁴⁻⁸ Older adults are particularly vulnerable to analgesic adverse effects, an important consideration as opioid medications feature prominently in older adult hospitalisations.^{9,10} Australian older-person specific resources available to guide chronic pain management include those for people living in residential aged care,¹¹ people with dementia¹² and older Australians in general.¹³ Other available resources include the Australian Therapeutic Guidelines,¹⁴ and guidelines from the American Geriatrics Society,¹⁵ the National Guideline Clearinghouse¹⁶ and reviews of relevant published literature.¹⁷⁻

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Older person specific tools designed to assess the severity and impact of chronic pain and effectiveness of management strategies would be of benefit in addressing this public health concern of chronic pain management. Providing a quantitative measure for an otherwise subjective patient symptom would aid clinicians in their thresholds for therapy, choice of therapy and assessment of response to therapy. These tools would target the Australian Government's 2019 National Strategic Action Plan for Pain Management, specifically the goal: "outcomes in pain management are improved and evaluated on an ongoing basis to ensure consumer-centred pain services are

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provided that are best practice and keep pace with innovation.”²⁰ Currently available tools to assess pain in older adults either have not been specifically designed to assess chronic pain, focus on magnitude (rather than frequency) of pain impact, or have not been specifically validated in community-dwelling Australians.²¹

Pain assessment tools may be either uni- or multidimensional, where one or multiple aspects of pain are assessed respectively.^{19, 22} Tools may rely on self-report or observation, where either the individual experiencing pain or an observer describes the pain. Tools may include numerical rating scales and/or verbal descriptors of pain, and they can explore pain location or intensity, as well as magnitude or frequency of impact on life. An important consideration when selecting a tool includes the individual’s cognitive and communicative abilities, which could impact their ability to read, hear and understand instructions associated with using the tool.¹⁷

Commonly used unidimensional tools designed to assess self-reported pain intensity in older adults include:²³ the Faces Pain Scale-revised, which uses facial expressions to indicate increasing pain severity;²⁴ the Verbal Descriptor Scale, which uses words to describe pain severity e.g. no pain, mild pain, moderate pain, severe pain, very severe pain, worst possible pain;¹¹ and the Iowa Pain Thermometer-revised, which uses both words (seven pain levels) and numbers aligned to a vertical thermometer to describe pain severity.²⁵ Commonly used multidimensional tools designed to assess self-reported pain intensity and impact include:²¹ the nine item Brief Pain Inventory-Short Form, which includes numerical rating scales assessing pain intensity over different periods of time, a diagram of a body to indicate site of pain, a question regarding success of pain relief, and questions regarding how much pain interferes (does not interfere, to completely interferes) with general activity, mood, walking, work, relationships, sleep and enjoyment of life;²⁶ and the twelve item Geriatric Pain Measure-Short Form, which includes ten yes/no questions concerning impact of pain on moderate activities, climbing, walking, work, accomplishments, sleeping, social/recreational activities, general activities, and two pain scales (zero=no pain, ten=worst pain) assessing pain severity.²⁷

A specialised tool designed to assess self-reported pain impact on function includes the Functional Pain Scale, where numbers (zero to five) are aligned with words (no pain, to intolerable) and a brief description of the type of impact (i.e. impact of pain on activities, using the telephone, watching television, reading and verbal communication).²⁸ Finally, a commonly used observational tool designed to assess pain in people with severe cognitive impairment includes the Abbey Pain Scale,¹¹ where six items concerning vocalisation, facial expression, body language, behaviour, physiological and physical signs are rated on a zero (absent) to three (severe) point scale.²⁹

Desirable characteristics in a new tool to assess pain include being simple, brief, and easy-to-use, having good measurement precision, and being suitable for use with a wide range of population subgroups. The Pain Impact Index is a simple, brief, easy-to-use and novel tool with promising measurement properties, designed to evaluate the frequency at which pain experienced on most days impacts different aspects of life in community-dwelling older adults. The Pain Impact Index was developed for use in the self-completed 14-page Medical Health Questionnaire

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administered as part of the ASPirin in Reducing Events in the Elderly (ASPREE) Longitudinal Study of Older Persons (ALSOP).³⁰ While the Index includes items that are relevant to adults of all ages who are experiencing chronic pain, it is more applicable to older adults as the overall structure of the Index (few items) and item wording (simple, and does not refer to impact of pain on paid work or employment) was specifically designed for ease of readability and interpretation amongst an older cohort.

The Pain Impact Index was specifically developed for older adults who can self-report their pain impact, is brief, easy to administer and score, and assesses pain impact. Although there are pain assessment tools that have been specifically designed for older adults to self-report their pain (such as the Geriatric Pain Measure-Short Form),²⁷ or that are brief (such as the Faces Pain Scale-revised,²⁴ Verbal Descriptor Scale,¹¹ and Iowa Pain Thermometer-revised²⁵), easy to administer and score (such as the Brief Pain Inventory-Short Form),²⁶ or that assess pain impact (such as the Functional Pain Scale)²⁸, the Pain Impact Index is a combination of all of these features and therefore fulfils a unique niche.

The Index would benefit from rigorous psychometric evaluation, which it has not yet undergone, to assess utility in clinical practice. This study aimed to evaluate measurement properties of the Pain Impact Index, including ordering of category thresholds, dimensionality, overall fit to the Rasch model, measurement bias (Differential Item Functioning, DIF), targeting (item and test characteristics), and construct validity.

Methods

The ALSOP is a sub-study of the ASPirin in Reducing Events in the Elderly (ASPREE) randomised controlled trial of aspirin for primary prevention,³¹⁻³³ which involved community-dwelling Australians aged at least 70 years.

The ALSOP Medical Health Questionnaires were posted (along with a postal paid return envelope) to eligible ASPREE participants (those who were still alive and allowed active researcher contact) after they were randomised to ASPREE (recruitment 2010 to 2014), mostly in the year following randomisation.³⁰ Participants who had not returned their ALSOP questionnaire were prompted at the annual ASPREE study face-to-face clinic visits and three-monthly follow-up phone calls.

Measures

The Pain Impact Index was intended to assess pain impact among community-dwelling older adults who were experiencing pain on most days. The Pain Impact Index was developed for use in the self-completed 14-page Medical Health Questionnaire administered as part of the ALSOP.³⁰ Participants of the ALSOP were asked to complete the Pain Impact Index if they experienced pain on most days of the week. The Pain Impact Index was developed in

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English by an Australian-based study group comprising health care professionals with medical, pharmacological, and/or geriatric medicine backgrounds. The Index was based on a review of existing pain measurement instruments such as numerical pain rating scales³⁴ and the Brief Pain Inventory.³⁵

The Index analysed in the present study comprised four items with responses measured on a five point (polytomous) Likert scale including: 1=never, 2=rarely (less than once a month), 3=sometimes (1-3 times a month), 4=often (once a week or more), and 5=always (most days). The four items included:

1. Does your pain upset your sleep?
2. Does your pain make some day to day activities hard (such as lifting and carrying groceries, cleaning the house or making the bed)?
3. Does your pain make walking difficult?
4. How often do you take medication for pain?

There were no out-of-range responses, all items were scaled in the same direction, and there were no highly inter-correlating items (correlation range: 0.25-0.46 between item pairs). Although, the Index showed signs of having suboptimal internal consistency reliability (Cronbach's alpha=0.64), all items had substantive correlations with the overall Index, where item-test correlations (the correlation between an item and the Index that is formed by all the items) ranged between 0.64-0.75, and item-rest correlations (the correlation between an item and the Index that is formed by all other items) ranged between 0.35-0.49.

Construct validity of the Index was assessed using data collected from three questionnaires, which were administered by researchers during the ASPREE study. Specifically, convergent validity, the extent to which the Index correlated with established measures of pain,³⁶ was assessed using responses to Question eight from the 12-item Short Form Survey (SF-12) health-related quality of life questionnaire.³⁷ Question eight asked "During the past four weeks, how much did pain interfere with your normal work (including both work outside the house and housework)? Not at all, a little bit, moderately, quite a bit, extremely".³⁷ Discriminant validity, the extent to which the Index did not correlate with established measures of constructs unrelated to pain,³⁸⁻⁴⁰ was assessed using total scores derived from the SF-12,³⁷ the Modified Mini-Mental State (3MS) cognitive test⁴¹ and Center for Epidemiologic Studies Depression Scale (CES-D).⁴²

Statistical Analyses

Rasch modelling was used to examine the structure and measurement properties of the Pain Impact Index and particularly how each item and its responses contributed to the measurement of pain impact.⁴³ Rasch modelling is commonly used to develop and evaluate measurement properties of health-related questionnaires.⁴⁴⁻⁴⁶ The Partial Credit Model (PCM) was used.⁴⁷ The PCM is used for polytomous response categories, such as the five response categories (never to always) associated with the Pain Impact Index. The PCM is an extension of the Rasch model, This article is protected by copyright. All rights reserved

which was originally developed for the assessment of dichotomous items. The PCM was used in preference to other polytomous item extensions of the Rasch model, such as the Rating Scale Model (RSM), as it allowed an evaluation of threshold ordering of individual items, which would not be possible with the RSM.

In the first instance, threshold disordering was assessed for the four items comprising the Index. Threshold ordering was assessed via Category Characteristic Curves (CCCs), which graph the probability of choosing (as a function of pain impact) each response category for a specific item. Threshold disordering was indicated by the presence of response categories that did not systematically have the highest probability of being selected along the pain impact continuum (indicated via a clear CCC peak), that is, some response categories were never the most likely response categories along the pain impact continuum.⁴⁵ Response categories that covered the smallest and largest portion of the pain impact continuum for each item were also identified. If threshold disordering was identified for any of the items comprising the Index, all items were re-scored to collapse adjacent response categories (if conceptually justifiable), and threshold disordering was re-assessed. This process was repeated until threshold disordering was eliminated. The re-scored items were then used in subsequent analyses.

The rescored Index was subjected to Rasch modelling analyses and construct validity assessment. Stata 15 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP) was used for all analyses.

Dimensionality

Since a fundamental assumption of the Rasch model is unidimensionality, where a single characteristic such as pain impact explains the response pattern,⁴⁸ Principal Components Analysis (PCA) was used to evaluate the number of potential dimensions represented by the four items of the Index.⁴⁵ The smallest number of components (principal components) that explained the most variance in the dataset were then identified. The decision on the number of principal components present in the data was guided by Kaiser's Criterion, which suggests retaining components with Eigenvalues (the amount of total variance explained by a component) ≥ 1.0 ; a Scree Plot, which visually plots the Eigenvalues against the factor numbers and visually displays a break between large and small Eigenvalues; and Parallel Analysis (also undertaken via Stata), which suggests retaining Eigenvalues if they are larger than those generated from a random dataset with the same number of items and participants.

Rasch modelling

In addition to threshold disordering, Rasch modelling analyses aimed to assess the following item measurement properties: item fit with the Rasch model, measurement bias (such as Differential Item Functioning, which occurs when sample subgroups respond differently to an item despite equal overall pain impact scores),⁴⁸ and targeting (the level of pain impact that the Index provides the most information about, as determined by item and test characteristics). Item discrimination parameters were examined, to understand how well items differentiated

between respondents with high and low levels of pain impact. Item threshold locations were also examined to identify the lowest and highest difficulty parameters (item locations along the pain impact continuum),⁴⁸ which corresponded to response categories that required the smallest and highest level of pain impact to be selected.

Item fit

The fit of a PCM can be tested via the R1m global test of fit and Si item-oriented tests, which are available in Stata Rasch modelling module `pcmodel` and `pcmtest`.⁴⁹ The R1m global test of fit is based on a chi-square statistic and assesses the overall fit of the Rasch model to the data by testing the assumption of monotone increasing item responses among the individuals with progressively higher levels of the characteristic of interest (i.e. pain impact).⁴⁹ The Si item-oriented tests assessed the contribution of each item to a possible lack of fit.⁴⁹ Possible lack of fit was indicated by $p < 0.0125$ (Bonferroni adjusted for four tests on four items).⁵⁰ Initial analyses used the complete sample size to assess global fit. Due to the large sample size, rejection of the null hypothesis of good fit with the Rasch model could have been due to either the detection of a clinically meaningful misfit, or detection of minimal misfit that had become statistically significant.⁴⁹ Therefore, subsequent analyses assessed if sample size contributed to the detection of misfit.⁴⁹ Subsequent analyses, inbuilt within `pcmtest`, were undertaken to estimate a chi-square statistic for the R1m global test for a sample size weighted to achieve >0.70 to detect a significant misfit.⁴⁹ Guidance regarding the size of misfit was not provided.⁴⁹

Differential Item Functioning

Differential Item Functioning (DIF) analyses assessed measurement bias, by examining whether sample subgroups responded differently to an item despite equal overall pain impact scores.^{45, 47, 50} Subgroups included: males vs females; 70 < 80 years of age vs ≥ 80 years (where the minimum age of 70 years corresponded with the minimum age of ALSOP participants); ≤ 11 years of education vs 12-21 years; living alone vs living with others; and presence or absence of pain in the lower back, knees, and upper back. Uniform DIF occurred when there was a constant difference in subgroup responses along the pain impact continuum, as opposed to non-uniform DIF, where the magnitude of differences between the subgroups varied along the pain impact continuum (Bonferroni adjusted $p < 0.0125$).^{51, 52}

Item Information Function

The Item Information Function (IIF) was used to assess the amount and precision of information about pain impact that was captured by each item. Tall and narrow IIFs indicated highly discriminating and precise/reliable items respectively. The distance of the IIF peak from the mean pain impact level in the study sample (denoted as zero on the pain impact continuum) was assessed in terms of the number of standard deviations (SD).

Test characteristics

The location of the Test Information Function (TIF, a combination of the IIFs) peak along the pain impact continuum indicated the level of pain impact that the Index provided most information about.

The Test Characteristic Curve (TCC) was used to assess how closely the expected total Index scores (predicted by the Rasch model) aligned with the actual total Index scores (derived from the observed data). A steep TCC indicated close alignment and high Index discriminability.

Index construct validity

The Pearson's product moment correlation coefficients were used to assess if the Index specifically measured pain impact. It was pre-determined that convergent validity (the extent to which the Index total score correlated with established measures of pain) would be demonstrated if there was at least a moderate positive correlation (≥ 0.4).³⁶ However, discriminant validity (the extent to which the Index did not correlate with established measures of constructs unrelated to pain) would be demonstrated if there was a low correlation (≤ 0.3).³⁸⁻⁴⁰

Missing data

The proportion of missing responses for each item of the Index was very low (<4%). In analyses that utilised individual items (PCA, threshold ordering, item fit with the Rasch model, measurement bias, and CCCs), missing data were handled with pairwise exclusion, where responses with missing data were excluded on an item by item basis. In analyses involving the total Index scores (e.g. deriving the TCC, assessing Index construct validity), missing data were imputed via mean substitution (following standard practice in scale score calculations), as long as a respondent provided responses to at least two of the four items that comprised the Index.

Ethical considerations

ALSOP is being conducted in accordance with the Declaration of Helsinki 1964 (including 2008 revision) and the NHMRC Guidelines on Human Experimentation. ALSOP has been reviewed and approved by the Monash University Human Research Ethics Committee (project numbers CF11/1100 and CF11/1935) and ALSOP participants provided written informed consent to participate.

Results

Of 16,439 posted ALSOP Medical Health Questionnaires, the Pain Impact Index was completed by 6454 respondents. Of the 6454 respondents, 59% were female (n=3803), aged on average 75 years (range=70-96), had less than 12 years of education (52%, n=3349), and lived at home with family, friends or a spouse (67%, n=4347). Most common pain sites included the lower back (55%, n=3573), knees (37%, n=2380), and upper back (32%, n=2080).

Threshold ordering

The original Index exhibited threshold disordering for the response category 'often' in two items. This was resolved by combining 'often' with the adjacent response category 'always' for all items. Threshold disordering was subsequently identified for the response category 'sometimes' in one item. This was resolved by combining the response category 'sometimes' with 'rarely' for all items. The re-scored Index included three response categories (1='never', 2='rarely/sometimes' and 3='often/always') for each of the four items.

Dimensionality

There was good indication that all items were measuring a single construct, and this was supported by the Scree Plot (not shown). The first extracted component explained almost half of the variance in the original dataset (48%). Only one component was present according to both Kaiser's Criterion and Parallel analysis (Eigenvalues from actual dataset: 1.92, 0.81, 0.73, 0.54 and Eigenvalues from Parallel analysis: 1.03, 1.01, 0.99, 0.97).

Rasch modelling

All items discriminated between high and low levels of pain impact to the same extent (common discrimination parameter of 1.20, $p < 0.001$) and there was no threshold disordering observed in the rescored Index (Figure 1). A relatively small level of pain impact was needed for it to affect analgesic use 'rarely/sometimes' (compared to 'never') while a relatively high level of pain impact was needed for it to affect sleep 'often/always' (compared to 'rarely/sometimes').

Item fit

R1m global test of fit analyses and Si item-oriented tests conducted using the complete case sample size (n=5954) indicated a lack of Rasch model fit to the data ($p < 0.001$). However, item fit assessment conducted using the reduced sample size (n=377) indicated that the Rasch model was adequate for the data and each item adequately fit the Rasch model ($p > 0.0125$).

Differential item functioning

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When considering non-uniform DIF, knee pain was the most frequent source of measurement bias (in three items - pain impact on sleep, day to day activities, or walking), while only one item (pain impact on walking) showed measurement bias according to upper back pain (all $p < 0.0125$).

When considering uniform DIF, the most frequent sources of measurement bias (at three items each) were: age (according to pain impact on sleep, day to day activities, or walking); knee pain (according to pain impact on day to day activities, walking, or analgesic use), and upper back pain (according to pain impact on sleep, day to day activities, or walking). Two items each showed measurement bias according to living arrangements (pain impact on sleep, or analgesic use), years of education (pain impact on day to day activities, or analgesic use), gender (pain impact on walking, or analgesic use) or lower back pain (pain impact on sleep, or day to day activities) (all $p < 0.0125$).

Item characteristics

According to IIFs, all four items had a good capacity to discriminate between different levels of pain impact and good precision and reliability when measuring at each level of the pain impact continuum (Figure 2). The item assessing pain impact on walking, and the item assessing pain impact on sleep, were the most and least discriminating, precise or reliable items respectively. Both items targeted respondents who had pain impact that matched the mean level of pain impact in the study sample. The item that assessed pain impact on day to day activities, and the item that assessed analgesic use, targeted respondents who were 0.25 SD or 1 SD, respectively, below the mean level of pain impact in the study sample.

Test characteristics

According to the TIF, the Index targeted respondents who were 0.25 SD below the mean level of pain impact in the study sample (Figure 3). Less information was captured by the index about respondents who had pain impact that was 2.5 SD below or 2 SD above the mean level of the sample.

According to the TCC (Figure 4), the Index discriminated well between respondents who had close to the mean level of pain impact in the study sample. However, the Index under- and over-discriminated between respondents who had very high (≥ 0.5 SD from the mean) or very low (≤ 0.5 SD from the mean) levels of pain impact respectively.

Index construct validity

As expected, there was a moderate positive correlation between the Index total score and Question eight from the SF-12 ($r = 0.45$).³⁷ There was little to no correlation between the Index total score and the total scores of the SF-12,³⁷ 3MS⁴¹ or CES-D⁴² ($r = -0.27, -0.04$ and 0.24 respectively).

Discussion

Application of the Rasch measurement model has supported the reliability and precision of the four item Pain Impact Index for assessing pain impact in community-dwelling older adults. The Index successfully differentiated between respondents positioned at different locations along the pain impact continuum, but with the highest measurement precision for respondents with the average level of pain impact.

The presence of DIF has implications for Index interpretation and use when comparing subgroups of individuals. For example, the Index should not be used to compare males and females because any comparisons will be contaminated by measurement bias. Future research should explore the reasons why pain impact differed by age and site of pain, and whether these differences can be explained by item wording, or real differences in the experience of pain impact by these population subgroups. In future, consideration should be given to whether item wording requires adjustment to address DIF.

The utility of the Index total score lies in the clinical setting. It can be used to compare the pain impact of *different respondents at a point in time*. When comparing Index total summated scores, where total scores can range from a minimum of four to a maximum of 12, there is an understanding about the order and magnitude of the score (i.e. a higher score relates to a higher level of pain impact). In the calculation of the total summated score, at least two of the four items in the Pain Impact Index must be completed by respondents and missing item scores must be imputed using the average, rounded item score from non-missing responses.

It is important to compare the present study to those evaluating commonly used and validated pain assessment tools including: the unidimensional Faces Pain Scale-revised, Verbal Descriptor Scale, and Iowa Pain Thermometer-revised; The Functional Pain Scale specialised tool, which assesses pain impact; the multidimensional Brief Pain Inventory-Short Form and Geriatric Pain Measure-Short Form; and the observational Abbey Pain Scale. These comparisons are useful because the present study is the first formal psychometric evaluation of the Pain Impact Index, and in older adults there is no established standard that pain assessment tools can be compared with.²⁷

Ware et al's assessment of the reliability and validity of four unidimensional pain intensity scales found that 68 US participants aged at least 60 years were capable of using the Iowa Pain Thermometer, Verbal Descriptor Scale, Numeric Rating Scale and Faces Pain Scale Revised.⁵³ Similar to Ware et al's study, future evaluation of the Pain Impact Index should include test-retest reliability assessment, as well as assessment in minority adult groups (such as those with cognitive impairment).⁵³ The Functional Pain Scale is similar to the Pain Impact Index with regards to its focus on assessing pain impact.²⁸ Gloth et al's evaluation of the Functional Pain Scale in 100 US participants aged older than 65 years included assessment of validity (and showed high correlations) with the Visual Analog Scale, the Present Pain Intensity, the McGill Pain Questionnaire-Short Form, and the Numeric Pain Scale.²⁸ Similar to Gloth et al's study, the Pain Impact Index should be evaluated against established pain assessment tools.²⁸ Gloth et al also

highlighted key features of the Functional Pain Scale that may increase its utility in practice, including that it is short, simple and can be used in the setting of visual impairment, where Visual Analog Scales cannot be used.²⁸ Therefore, the Pain Impact Index's short and simple structure may lend itself to be used in people with cognitive and communicative challenges.²⁸

With respect to multidimensional tools, Blozik et al's evaluation of the Geriatric Pain Measure Short Form in 1059 European participants and subsequent shortening of the tool from 24- to 12-items, highlighted the usefulness of short pain assessment tools, such as the Pain Impact Index.²⁷ As occurred in Keller et al's longitudinal evaluation of the Brief Pain Inventory in 250 US participants experiencing arthritis or low back pain over time, future evaluation of the Pain Impact Index should include longitudinal study designs to assess its sensitivity to changes in pain over time.²⁶ Similarly to the present study's use of the SF-12, construct validity was assessed by exploring the correlation between the Brief Pain Inventory scores and the SF-36.²⁶ Finally, although the Abbey Pain Scale is an observer-completed pain assessment tool, as opposed to the self-reported Pain Impact Index, similarities in the development principles of the two tools exist. In Abbey et al's evaluation of the Abbey Pain Scale in 113 Australian aged care home residents, the authors highlight the advantage of developing and testing assessment tools for the particular population in which the assessment is needed, and for ease of use and interpretation in clinical settings.²⁹ Similarly to the Pain Impact Index, when developing the Abbey Pain Scale, Abbey et al sought expert opinion, ensured the scale was simple, and development was guided by the published literature.²⁹ The Pain Impact Index would benefit from qualitative evaluation such as that undertaken by Abbey et al, including seeking feedback from users of the scale to assess time taken to use the scale, perceived usefulness and effectiveness.²⁹

The Pain Impact Index is a unique and potentially useful tool to add to the limited resources available when clinicians assess pain impact in community-dwelling older adults. The Index is brief, yet assesses important aspects of daily life, and was designed for ease of readability and interpretation amongst an older cohort. Commonly used, multi-dimensional questionnaires validated to assess pain impact in older individuals either have not been specifically designed to assess chronic pain impact, focus on magnitude rather than frequency of pain impact, or have not been specifically validated in community-dwelling Australians.²¹ These questionnaires include the: 15-item Brief Pain Inventory-Short Form, which assesses the magnitude of pain impact over the last 24 hours on a scale from zero (does not interfere) to ten (completely interferes);⁵⁴ 12-item Geriatric Pain Measure-Short Form, which assesses current pain impact via yes/no response categories;²⁷ and the 3-item Pain Intensity, Enjoyment in Life, and General Activity questionnaire, which assesses pain impact over the last week on a scale from zero (no pain) to ten (completely interferes).⁵⁵

The Pain Impact Index is unique due to its combination of five characteristics that encompass important principles of pain assessment in older populations.¹⁹ It is this combination of characteristics that differentiates the Pain Impact Index from commonly used and validated pain assessment tools. Firstly, the Index was specifically designed for ease of use and readability among an older cohort to facilitate self-report,⁵⁶ which is the gold standard in pain

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assessment.⁵⁷ By comparison, the Brief Pain Inventory was originally developed to assess pain in people with cancer²⁶ and the Abbey Pain Scale is not designed to be completed by the person experiencing pain.²⁹ Secondly, the Index uses verbal descriptors of pain, which may be preferred by older adults with cognitive impairment,⁵⁸ an important consideration as dementia is becoming more prevalent.⁵⁹ By comparison, the Faces Pain Scale-revised assess pain using pictures of faces.⁶⁰ Thirdly, the Index is a specialised tool that assesses pain impact, which is important as older people may find it easier to rate their pain based on its impact on function as opposed to on a linear scale.^{28, 61} By comparison, the Verbal Descriptor Scale and Iowa Pain Thermometer-revised only assess pain severity.⁵³ Fourthly, the Index is brief and only includes four items, which may facilitate regular pain assessment, which has been said to be critical to pain management.⁶² This is compared to tools that include more than four items such as the Geriatric Pain Measure Short Form.²⁷ Lastly, the Index assesses the impact of pain on four important aspects of daily life. This can help focus individuals and their health care team on strategies to reduce pain impact and in turn improve function,^{19, 63, 64} an important consideration for allowing older people to maintain independence for longer.⁶⁵ By comparison, the Functional Pain Scale includes one item and therefore doesn't allow an assessment of the varying impact of pain on different aspects of life,²⁸ while the Faces Pain Scale-revised, Verbal Descriptor Scale, and Iowa Pain Thermometer-revised only assess pain severity.⁶⁶

It is a strength that a large, community-based sample of older adults was included in analyses (n=6454) and only a small proportion of responses were missing for each item (<4%). It is a limitation that the Index has only been evaluated using cross-sectional data, therefore, it can only be used to assess pain impact at a point in time. Further evaluation is required to understand how well the Index can assess changes in pain impact over time. It is a limitation that information regarding whether respondents were married, widowed or single was not available and therefore could not be considered when assessing DIF. However, a number of other subgroups were explored for DIF including categories of gender, age, years of education, living arrangements (which encompassed living alone or living with others), and presence of pain in three common pain sites. Future research should quantitatively compare the Pain Impact Index with commonly used and validated tools that assess pain impact, such as the Brief Pain Inventory-Short Form,⁵⁴ the Geriatric Pain Measure-Short Form,²⁷ the Pain Intensity, Enjoyment in Life, and General Activity questionnaire,⁵⁵ and the Functional Pain Scale.²⁸ If the Pain Impact Index compares favourably to commonly used and validated tools, then it can be added to the clinician's pain assessment toolkit. The Pain Impact Index may then potentially be used as a first-line tool when needing to assess self-reported pain impact quickly and easily in an older adult. Such comparisons were not within the scope of the present study, which focused on conducting the initial psychometric evaluation of the Pain Impact Index.

In future, it may be advisable to add items to the Index or adjust wording of existing items to increase discriminability. Care should be given to response category wording, as the existence of disordered thresholds in the original Index indicated that respondents were selecting response categories in a manner inconsistent with their underlying level of pain impact. This may have occurred due to difficulty discriminating between response categories

or having too many, or poorly defined response categories. Future research could also explore if the Pain Impact Index would be suitable for assessing pain impact in different socioeconomic or cultural groups.⁶⁷

Conclusion

The Pain Impact Index can be used to assess pain impact in older community-dwelling adults. The Index successfully differentiated between respondents with different levels of pain impact, but had the highest measurement precision for respondents with the average level of pain impact. It should be explored whether the Index requires further refinement to improve discrimination between respondents whose experiences fall at the extremes of the pain impact continuum.

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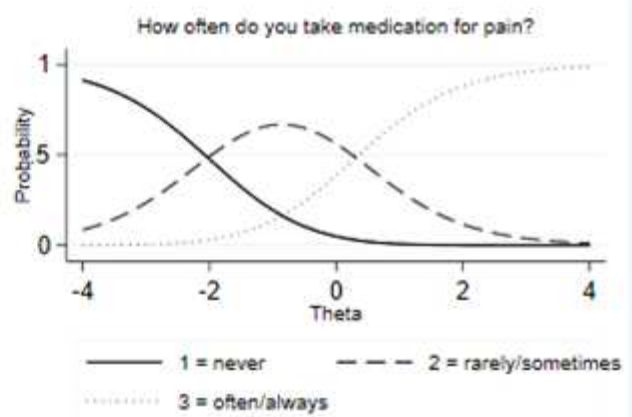
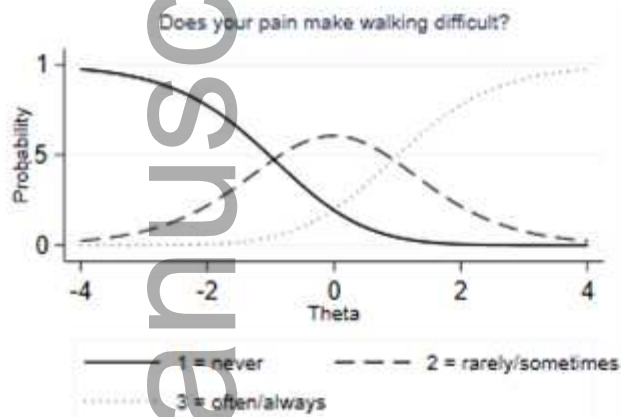
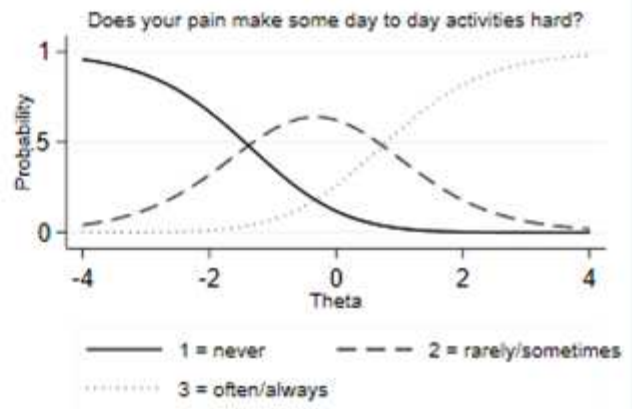
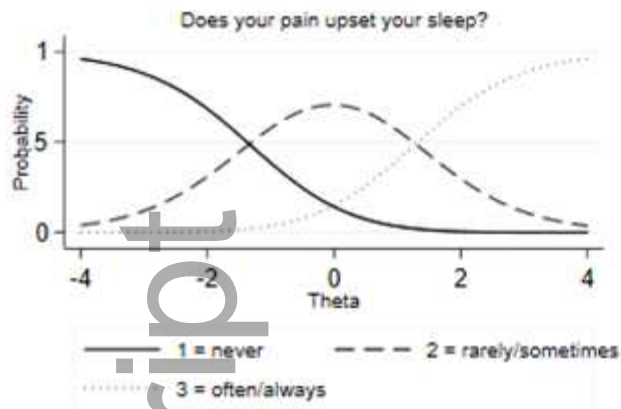
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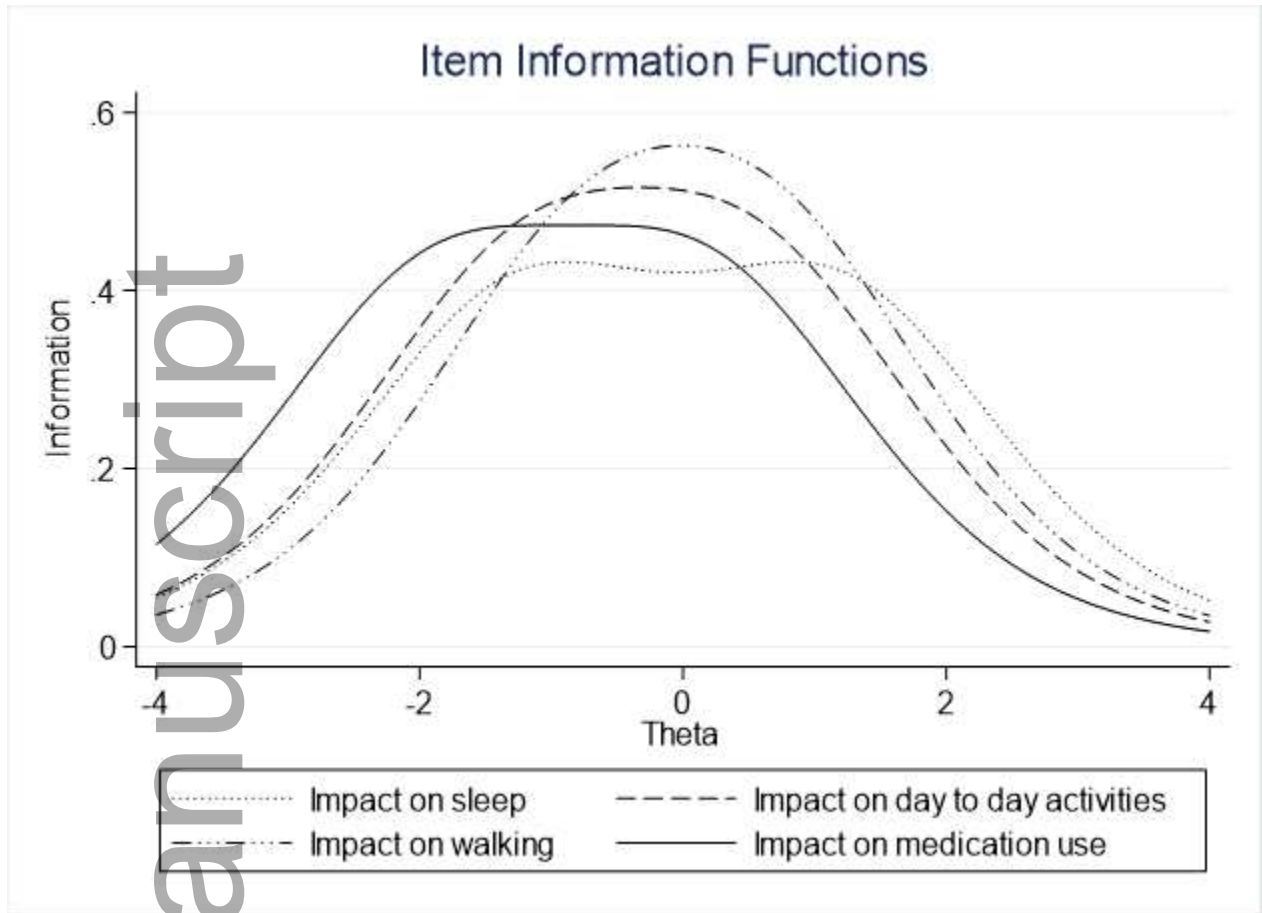
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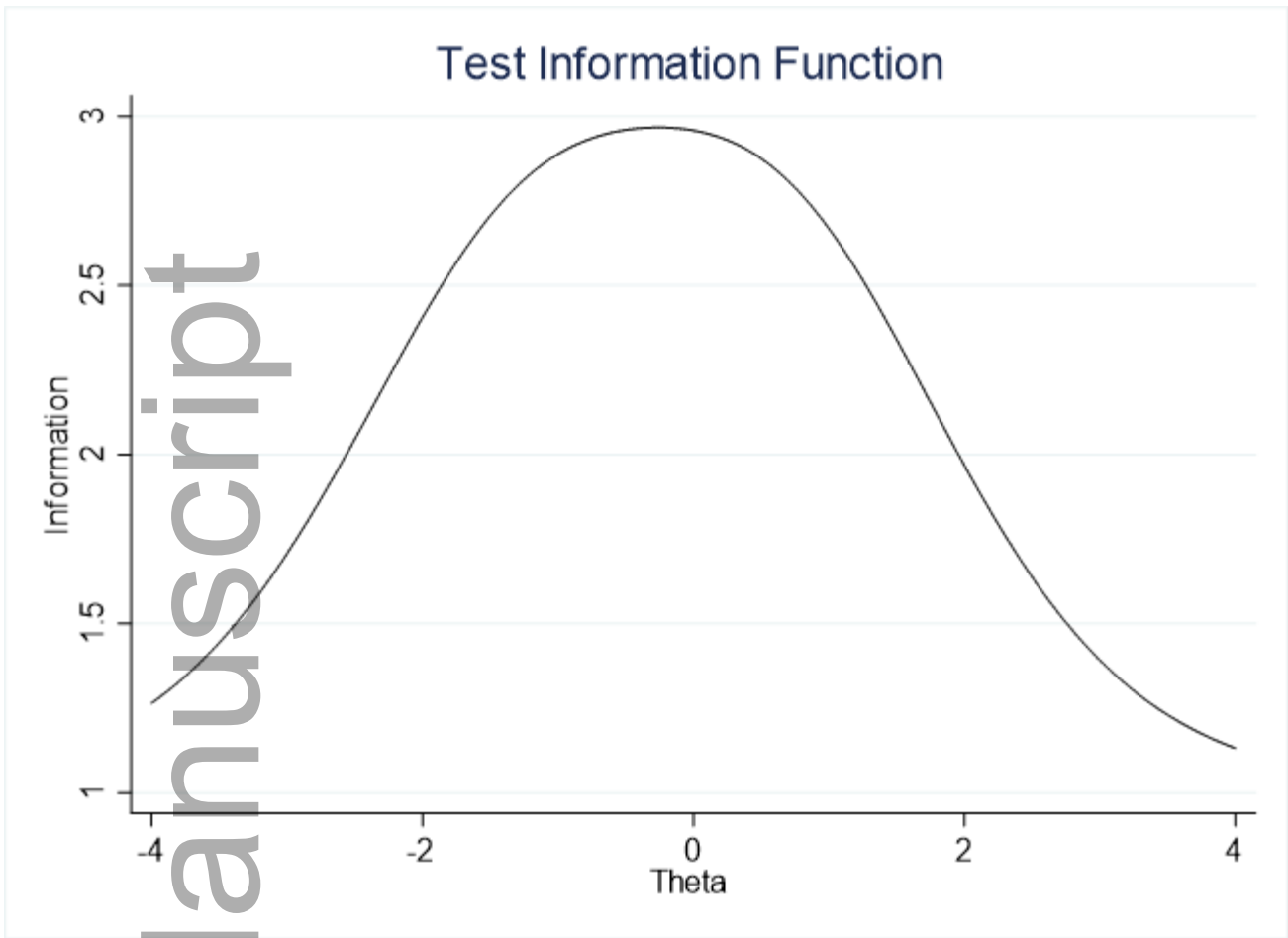
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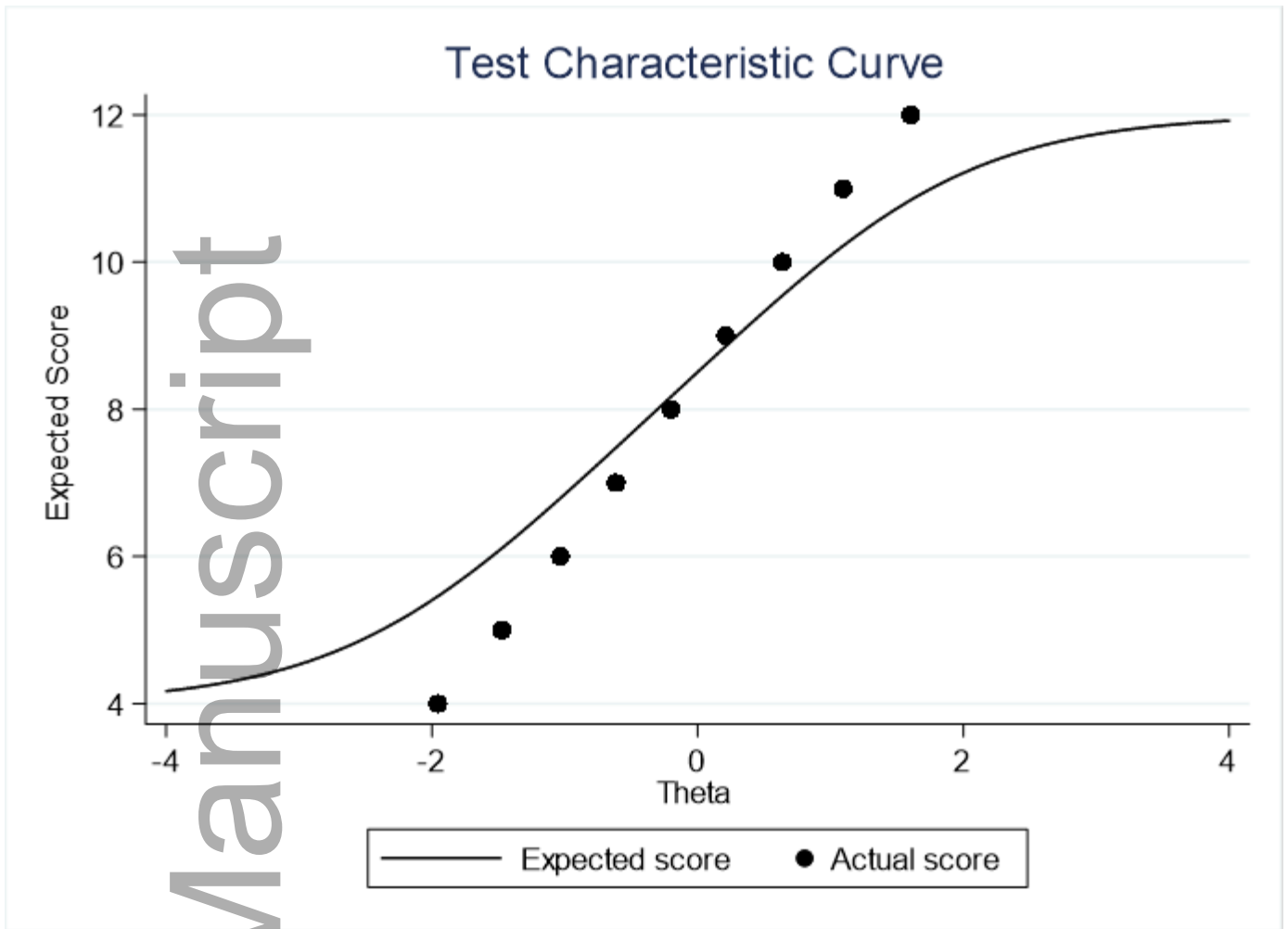


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