

Measuring resilience using Strong Souls in the Longitudinal Study of Indigenous Children: Evaluating psychometric properties using a Rasch measurement approach



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Abstract

Purpose Rigorously evaluated psychometric instruments are necessary to measure constructs relevant to wellbeing, such as resilience. The availability of high-quality instruments for use with Aboriginal young people in Australia is growing but remains limited. This study used data from the Longitudinal Study of Indigenous Children (LSIC) to psychometrically evaluate the Resilience subscale from the social and emotional wellbeing (SEWB) instrument, Strong Souls, for a nationwide sample of Aboriginal adolescents, using alternative psychometric methods to previous research.

Methods Using a Rasch measurement approach, cross-sectional data from Wave 9 of LSIC were used to ascertain the psychometric properties of the Resilience subscale from Strong Souls. Using the responses from 516 Aboriginal young people (age 11.5 to 13 years) to the 12-item scale, Rasch techniques were applied to determine item independence, response category adequacy, differential item functioning (DIF), person and item reliability, item fit and unidimensionality. Two versions of the instrument were evaluated: the full 12-item version, as completed by participants, and an 8-item version, as recommended for use by previous research based on different psychometric methods.

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<https://doi.org/10.1016/j.fnhli.2024.100037>





Main findings Both versions of the instrument met several Rasch model requirements for reliable measurement, including demonstrations of unidimensionality (first off factor construct < 2), item independence (all items $Q_3^* < 0.30$), and item fit statistics within an acceptable range ($0.60 < X < 1.40$). However, both instrument versions displayed less adequate person separation (PSI) and reliability (PRI) statistics (12-item scale: PSI = 1.18, PRI = 0.58; 8-item scale: PSI = 0.71, PRI = 0.33).

Principal conclusions Using a Rasch measurement approach to psychometrically evaluate the Strong Souls Resilience subscale in a sample of Aboriginal young people from LSIC, this study provided novel evidence of the functioning of this popular instrument from an alternative psychometric perspective. With mixed results regarding meeting Rasch recommendations, these findings provide a strong evidence base for psychometric strengths as well as opportunities to improve the robustness of this instrument, and ultimately offer a tool that can more accurately inform services, policy and practice to effectively support resilience and wellbeing in Aboriginal young people.

Keywords: Aboriginal; Resilience; Youth; Rasch; Measurement; Psychometrics

Highlights

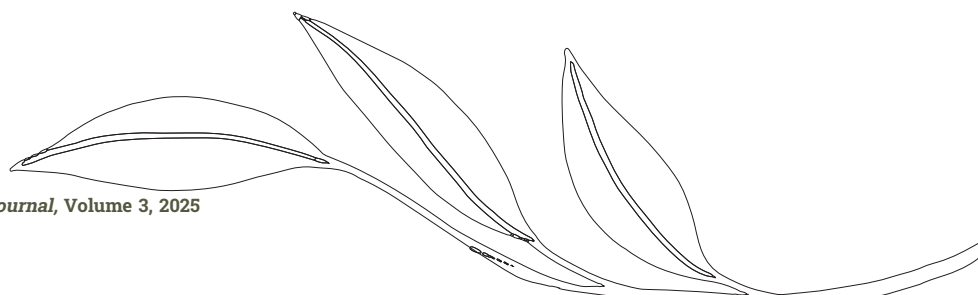
- Using a Rasch modelling approach provides new insights into Strong Souls functioning.
- The psychometric functioning of Strong Souls Resilience for the Longitudinal Study of Indigenous Children cohort can be improved.
- Defining resilience from an Aboriginal perspective is integral to good measurement.

Introduction

The use of culturally appropriate notions of mental health and wellbeing relevant to Aboriginal and Torres Strait Islander peoples is crucially important for effective and decolonised approaches to healthcare, policy and program planning. Social and emotional wellbeing (SEWB) is widely recognised as a culturally relevant and holistic concept of wellbeing that spans a wider scope than that of Western notions of biomedical health and illness. Social and emotional wellbeing encompasses seven interrelated domains involving connection to Country (land), culture, spirituality, family and kinship, community, body, and mind emotions, all of which are inseparably interlinked with the conception of the individual self (Gee et al. 2014). This conceptualisation also

recognises the impact that social, political and historical factors have in shaping SEWB for Aboriginal peoples.

Having the means to measure the construct of SEWB accurately and reliably is vital to the processes of creating good healthcare models, policies, programs and practices designed to support SEWB. Using the concept of SEWB to inform practice, policy and program design aligns with a strength-based approach to Aboriginal health and wellbeing. This contributes to a shift from a historically deficit-focused discourse in public, political and research spaces, which is recognised as a barrier to improving health outcomes (Bullen et al. 2023; Fogarty et al. 2018; Foley and Schubert 2013; Thurber et al. 2020). As Dudgeon and





colleagues (2014) point out, regarding the current state of policy making in Australia:

There is a strong focus on formulating policy and programs around risk and protective factors linked through a program logic to a set of measurable outcomes – an approach that seldom takes account of the broad range of interconnected factors contributing to the mental health and wellbeing of Indigenous people. (p. 10)

Strong Souls is one of the few examples of an instrument designed to measure SEWB with cultural perspectives held at the forefront of its conceptualisation (Thomas et al. 2010). Strong Souls is a self-reported psychometric instrument originally developed as a quantitative tool to measure the SEWB of a cohort of Aboriginal young people (age 16 to 21 years) participating in the Aboriginal Birth Cohort Study in the Northern Territory (Thomas et al. 2010). The final full scale consists of 25 items across four identified factors: Depression (seven items), Anxiety (six items), Suicide risk (three items) and Resilience (nine items).

Resilience, specifically, is a pertinent concept to consider for Aboriginal young people, with it recognised as an approach that aims to identify and support factors that contribute to young peoples' strength, despite adversity (Fogarty et al. 2018; Zimmerman 2013). The construct of resilience was not explicitly defined in the original study where Strong Souls was created by Thomas et al. (2010), but subsequent analysis of the subscale (Thurber et al. 2019) has used the seminal resilience definition from Ungar et al. (2008):

In the context of exposure to significant adversity... both the capacity of individuals to navigate their way to the psychological, social, cultural, and physical

resources that sustain their well-being, and their capacity individually and collectively to negotiate for these resources to be provided in culturally meaningful ways. (p. 225)

This definition highlights the fact that resilience is not only a concept that applies to the individual, but also encompasses the availability of accessible external resources. Incorporating the importance of external factors in this definition of resilience aligns with the holistic nature of the SEWB conceptualisation. Resilience is a particularly salient concept not only for young people, who are experiencing a period that lays a critical foundation for their own life trajectory, but also for their potential future children (Patton et al. 2016; Sawyer et al. 2012). As the next generation to parent, the resilience, health and wellbeing of adolescents can determine a healthy start (or not) to life for their children, which can include interrupting or mitigating patterns of intergenerational trauma (Isobel et al. 2019; Patton et al. 2016; Roy 2014). With unique cultures, strengths and circumstances, the pathways to resilience and wellbeing for Aboriginal young people are distinctive, especially when compared with the experiences of non-Aboriginal young people and resilience conceptualisations, which are rooted in dominant-culture perspectives (Usher et al. 2021). As explored by Aboriginal scholars, resilience conceptualisations relevant to Aboriginal peoples expand well beyond individualistic notions of resilience, with a focus on collective experiences of adversity linked to the legacies of invasion and colonisation, intergenerational trauma, and structural inequities and discrimination (Fleming and Ledogar 2008; Gee et al. 2023; Kickett 2011; Smallwood et al. 2023; Usher et al. 2021). In turn, land and language reclamation, and connection to community, family and ancestry, are distinctive, culturally meaningful





protective factors, and are distinctive to pathways to resilience for Aboriginal people (Usher et al. 2021).

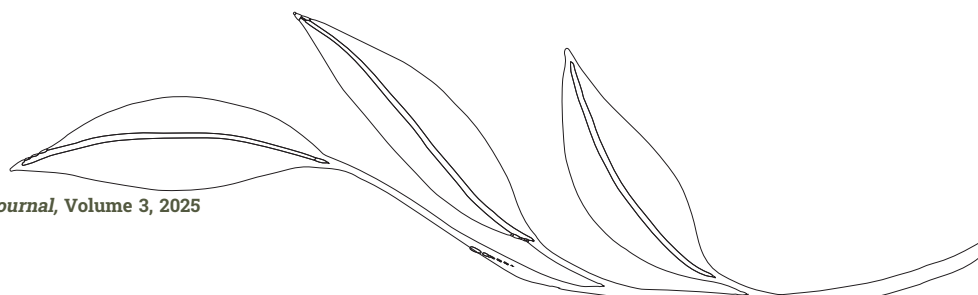
The Longitudinal Study of Indigenous Children (LSIC) is a major study that includes the use of the Resilience subscale from Strong Souls. The LSIC is an ongoing national longitudinal study annually collecting data from Indigenous children and families in select communities across Australia (see Thurber et al. 2015 for further details). The LSIC survey covers a broad range of topics relevant to the health, development and diverse environments of the participants. It features several measures relevant to SEWB, including a preliminary version of the Resilience subscale from Strong Souls (a version developed prior to the original Strong Souls publication; Thomas et al. 2010), which is the focus of the current article. As identified by recent literature reviews (e.g. Le Grande et al. 2017), there is a dearth of robust and adequately investigated wellbeing-relevant instruments appropriate for use with Aboriginal peoples. Even fewer are specifically designed for children or young people. It is believed that only one report has examined the psychometric properties of the Resilience subscale with the LSIC sample (Thurber et al. 2019).

Thurber et al. 2019 investigated reliability and validity characteristics of the Resilience subscale from Strong Souls using a principal components analysis (PCA) approach. The original 12-item scale returned two- and three-component solutions, despite the designers' intention for the measure to be unidimensional – that is, only measuring a singular construct of resilience. However, an 8-item solution using only items from the final published version of the Resilience subscale supported a one-component solution. Therefore, the authors' recommendations were that an 8-item version of the Resilience subscale, rather than the whole 12-item subscale, was most valid and reliable

for use with the sample. As a measure of internal consistency between items, a Cronbach's alpha (α) of 0.69 was found for the 8-item scale and interpreted as approaching acceptable for group-level research. Pearson's correlations between the 8-item Resilience scale scores (computed by summing response scores across all eight items) and the Strengths and Difficulties Questionnaire (SDQ) Prosocial subscale scores were examined to assess convergent validity ($r = .28$). Divergent validity was quantified by correlating Resilience scores with the SDQ Total Difficulties score ($r = -.20$). Both were weak correlations, but were hypothesised by the authors to be so, given the distinct constructs they measured, and were thus concluded to demonstrate acceptable convergent and divergent validity.

While an α of 0.69 can be interpreted as approaching acceptable, others suggest that higher values may be warranted for confident scale use in applied research (e.g. higher than 0.8; Nunnally 1978). This is particularly relevant, given the potential for a resilience measure such as Strong Souls to be used as a screening tool for mental health and SEWB support in Aboriginal young people (Thomas et al. 2010). Additionally, the evidence for convergent and divergent validity could be improved upon, with several studies raising concerns regarding whether the SDQ is a psychometrically sound and appropriate measure of SEWB for Aboriginal children and young people (Chau et al. 2023; Santiago et al. 2021; Williamson et al. 2014). It is suggested that the above findings of Thurber et al. 2019 provide an excellent basis for further psychometric investigation, perhaps with alternative methods to provide a different psychometric perspective.

While the authors of this previous work (Thurber et al. 2019) used PCA as the basis of their inquiry, alternative





analytic approaches can provide different, complementary perspectives. The PCA is a statistical technique that aims to identify data patterns by transforming observed variables into a smaller set of uncorrelated components, thereby reducing dimensionality in the dataset. However, PCA assumes that all observed variables are measured without measurement error, which is unrealistic in psychological research (Fabrigar and Wegener 2011). A different approach to psychometric analysis and instrument validation is Rasch measurement modelling, which is an example of an Item Response Theory (IRT) approach to measurement. Rasch techniques aim to assess data for fit with the Rasch model as demonstration of a well-functioning instrument (Petrillo et al. 2015; see Appendix B for further explanation of different analytical techniques). Rasch modelling is designed to evaluate the unidimensionality of scales and to assist with their refinement, thus enabling a summed score to provide an accurate quantitative description of the latent construct intended to be measured. The Rasch approach proposes that a response to an item is an outcome of the linear probabilistic interaction between a person's construct level (their 'ability' in Rasch terminology – in this case, a person's resilience level) and the 'difficulty' of the item (what level or 'how much' resilience the item assesses; Bond and Fox 2015). Items and respondents are hierarchically ordered on a single logit scale continuum from low to high, to assess how well the items fit and describe respondents in the sample, and how respondents differ from one another in the sample. Unlike statistical approaches such as PCA or factor analysis, Rasch modelling outcomes are not dependent on the specific sample chosen from a population or on the specific items included in the scale; this independency is a fundamental Rasch principle known as *specific objectivity* (Hambleton and Jones 1993).

The Rasch modelling approach presents several advantages over other latent variable models, such as factor analysis or other IRT approaches (e.g. two- or three-parameter logistic models), as a method to determine psychometric properties and find evidence for aspects of the validity and reliability of instruments. As mentioned, unlike other latent variable approaches, Rasch modelling adopts the principle of specific objectivity, which refers to the idea that the measurement properties of an instrument should be invariant across different groups and contexts. Based on this, from a Rasch perspective, the probability of a person endorsing an item is solely determined by their level of the latent construct being measured, and the 'difficulty' or level of construct the item is measuring, independent of other factors, such as particular sample characteristics or administration contexts. With a greater focus on item-level rather than test-level statistics, a Rasch approach offers a means to check for differential item functioning (DIF) – bias between participant subgroup (e.g. gender) responses at the item level, where item responses are influenced by variables outside the construct intended to be measured; and item dependence – when one item's function depends on the functioning of another item (Bond and Fox 2015). While examining DIF and item dependence is possible using other approaches, absence of DIF and of item dependence are requirements for robust measurement under Rasch modelling assumptions (see Appendix B for further details on DIF and item dependence). Additionally, Rasch techniques allow for the examination of how participants use Likert response categories, and the investigation of whether participants assign similar meaning to response category anchors and are therefore using them consistently and as intended.

Therefore, this study aimed to further the work of Thurber et al. (2019) by employing Rasch modelling to





examine the psychometric structure and validity of the Strong Souls Resilience subscale for use with a sample of Aboriginal adolescents from the LSIC. It assessed both the 12-item scale and the previously recommended 8-item scale against Rasch measurement guidelines, evaluating the evidence for a psychometrically sound and unidimensional instrument.

For further context, this study formed part of a broader Australian Research Council-funded study: the Young Indigenous Peoples' Resilience and Wellbeing (YIPRaW) project. This mixed-methods project aimed to investigate manifestations and definitions of resilience and wellbeing as relevant to young Aboriginal peoples living on Whadjuk Noongar (Perth, Western Australia) and Gamilaroi (Tamworth, New South Wales) countries, which included the validation and evaluation of existing resilience and SEWB measurement instruments for the sample. One of these instruments included the full Strong Souls instrument (see [Gorman et al. 2021b](#) for this psychometric evaluation).

Method

Participants

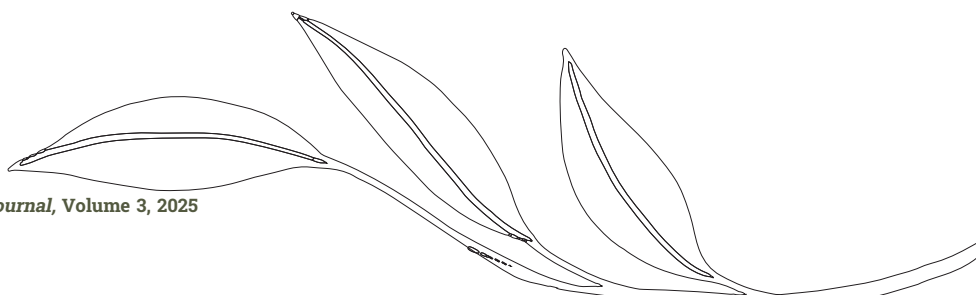
The sample used in this study was sourced from Wave 9 of LSIC. This was the same data and sample used by [Thurber et al. \(2019\)](#). The LSIC is a program funded by the Australian Government and facilitated by the Department of Social Services, with data publicly available upon request (see [Thurber et al. \[2015\]](#) for further details). The LSIC participants include two cohorts of children, a younger and an older group, aged from 6 months to 2 years and 3.5 to 5 years at the study's commencement of Wave 1 in 2008. Only the older cohort, aged 11.5 to 13 years in Wave 9, were administered Strong Souls items. Thus, the sample size of the current study was 516: 260 males (50.4%) and 256 females (49.6%). The LSIC employed a non-random purposive sampling design in 11 study sites

across Australia. These study sites included various urban, regional and remote locations in New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory. While not nationally representative, these study sites were chosen to reflect the distribution of Aboriginal and Torres Strait Islander children across the country. See [Appendix A](#) for a visual illustration and further details of the LSIC sample distribution across the country.

Instrument Strong Souls Resilience Scale

Strong Souls is an instrument that was originally developed for use as a measure of SEWB for Aboriginal children and young people for the Aboriginal Birth Cohort project in the Northern Territory (see [Thomas et al. \[2010\]](#) for details). This instrument comprises four factors – Anxiety, Depression, Suicide risk and Resilience – with a total of 25 items. Only the Resilience subscale was used in the LSIC. While [Thomas et al.'s \(2010\)](#) final published version of this subscale in the original work comprised nine items, the version used in LSIC employed an older, pre-publication 12-item version, eight of which were in the final published subscale (the only item not used in LSIC that appears in [Thomas et al. \(2010\)](#) is the item 'You know lots about whitefella ways'). Using the prompt question, 'How much is this like you?' each item asked participants to rate their response from 1 to 4 (1: always/lots; 2: most times/fair few/fair bit; 3: sometimes/not many/little bit; and 4: not really/no one/not much/not really/none/never). See [Appendix C](#) for the full and LSIC version items and wording.

Prior to data analysis, the coding direction used in [Thurber et al. \(2019\)](#) was matched by employing reverse scoring on the Resilience scale's item scores. This meant that lower scores corresponded with lower resilience (i.e. category 1 = not really/no one/not much/not really/none/never to 4 = always/lots).



Data analysis

As the anchors of the response categories differed between items, a partial credit Rasch model was used as the basis of analysis (Masters 1982). Using Winsteps software (Version 5.2.4; Linacre 2022), similar analytical steps employed in an analysis with the Rasch model by Gorman et al. (2021a) were followed in the current examination of the Resilience subscale of the Strong Souls, including using the conditional maximum likelihood estimation method. See Appendix B for a summary table of Rasch modelling explanations and guidelines for interpretation used in this article. Each version of the measure was evaluated for fit against the Rasch model: the full 12-item variant presented in the LSIC and the 8-item variant described later by Thurber et al. (2019). The four items omitted in the 8-item version were Items 1 ('When you get sad you can find something that makes you happy'), 3 ('You get used to big changes fast. Like changing schools or moving house'), 8 ('You know a lot about your Aboriginal/Torres Strait Islander family history and culture [e.g. family stories and relationships]'), and 9 ('People say that you are really good at something. Sports or fishing or looking after kids.').

Results

Polarity

Correlation coefficient directions were examined for each item to ensure that all items were aligned in the same direction. All correlations were positive, confirming that all items were consistently aligned on the scale construct.

Twelve-item scale

Local item independence

No residual correlations (Yen's Q3*) were $> .30$; therefore, there were no concerns regarding local item dependence (Christensen et al. 2017).

Response category functioning

While four items met guidelines for expected use of the response categories, eight out of the 12 items did not. The violated Rasch guidelines included < 10 observations in a category, disordered categories, and outfit mean-square coefficient > 2.0 (Linacre 2002). Items 2, 4, 6, 7, 9, 10 and 11 all displayed < 10 observations for response category 1 (not really/not much/no one/none/never). Disordered categories were observed for Items 6, 10 and 11 (all between response categories 1 and 2). An outfit mean-square value > 2.0 was observed for Item 11 (MnSq = 2.53). Collapsing categories is one method to consider when attempting to remedy the issues found in the response categories (Linacre 2002). As indicated by the minimal usage of response Category 1, this category was not being used meaningfully in the seven previously mentioned items. Thus, it was justifiable to collapse Categories 1 and 2 for the remainder of the analyses, leaving these seven items with a three-category rating scale. While this was not a solution without drawbacks (i.e. collapsing categories 1 ['not really'] and 2 ['sometimes'] with anchors that were not necessarily semantically equivalent), the issues of low observations in response Category 1, disordered thresholds and large outfit mean-square value were all remedied by collapsing Categories 1 and 2 for Items 2, 4, 6, 7, 9, 10 and 11 (see Appendix D).

Differential item functioning

Differential item functioning was assessed between male and female participants (no participants selected 'other' for their gender). One item (Item 8 – 'You know a lot about your Aboriginal/Torres Strait family history and culture') displayed evidence of DIF (contrast = -0.45 ; $P = .002$). This indicated that male participants found the item harder to endorse than female participants, once their overall resilience was accounted for. However, removing this item



compromised the item and person separation and reliability. Item removal can also diminish construct and content validity, where items cover important aspects of a construct (Lynn 1986; Messick 1987). Cultural connection is recognised as an integral element of Aboriginal resilience conceptualisations (Usher et al. 2021). Thus, it was decided to retain this item in the scale, while acknowledging that DIF compromises the comparability of scale scores across groups. There was no evidence for gender-related DIF in any other items.

In addition, DIF was assessed based on the geographical remoteness of participants' home addresses. Participants' Level of Relative Isolation (LORI - a classification system originally developed based on the Accessibility/Remoteness Index for the Western Australian Aboriginal Child Health Survey; see Zubrick et al. 2004 for further details) ranged from none, low, moderate to high/extreme. A binary variable was created from this classification, grouping together none-low and moderate-high/extreme LORI. Evidence for DIF based on LORI was identified for five out of the 12 items in the scale: Item 4 ('You know someone who is a really good person'), Item 6 ('You are really into something [like music, football, clothes]'), Item 7 ('You are a good son/daughter to your family'), Item 11 ('You have a lot of friends'), and Item 12 ('When you're sad you have a person you can talk to'). Items 4 (DIF contrast = $-.91$; $P = .00$), 6 (DIF contrast = $-.60$; $P = .01$) and 12 (DIF contrast = $-.57$; $P = .001$) were more difficult for participants living in more remote areas to endorse compared with participants in less remote areas. In contrast, participants living in less remote areas found Items 7 (DIF contrast = $.72$; $P = .005$) and 11 (DIF contrast = $.50$; $P = .05$) more difficult to endorse compared with participants in more remote areas. As with the DIF found between male and female participants for Item 8, and particularly given the

considerable number of items and the array of construct aspects they cover, these five items were retained in the scale, despite the evidence for DIF, and acknowledging that this presents some shortcomings in the comparability of the scale across groups of different geographical remoteness.

Dimensionality

Unexplained variance in the first contrast was < 2 (first off-factor contrast = 1.62). Thus, no evidence for multidimensionality was found.

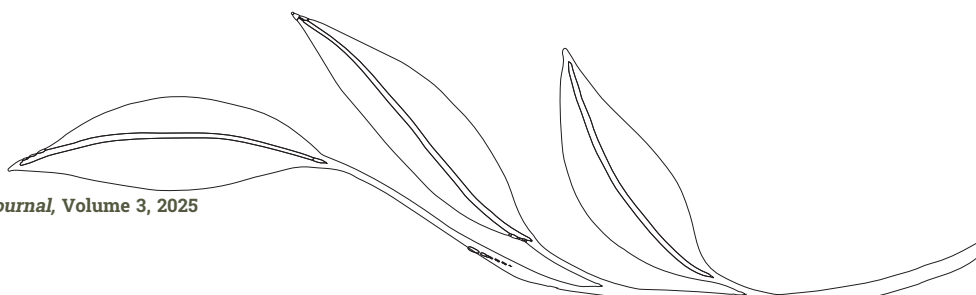
Item fit

All items had acceptable fit statistics, where mean-square values were all within the recommended range: $0.60 < X < 1.40$ (Wright and Linacre 1994). Infit statistics ranged 0.86 to 1.25, while Outfit statistics ranged 0.76 to 1.24.

Person and item separation and reliability

Neither the person separation index (PSI = 1.18) nor the person reliability index (PRI = 0.58) met Rasch modelling assumptions. This indicated that the measure was not reliably able to order or separate participants' resilience scores into accurate strata of high/average/low resilience. Poor item targeting is visually illustrated in Figure 1, where items on the right-hand side of the person-item map cluster towards the lower end of the map, targeting low levels of resilience, while participants are further up the map, displaying higher levels of resilience. Interestingly, Items 1, 3 and 8 clustered as items measuring higher resilience in participants (relative to other items) were three of the four items not included in the 8-item version of the scale.

However, the item separation index (ISI = 5.80) and item reliability index (IRI = 0.97) met Rasch assumptions, with values well above recommended standards (Linacre 2021). This suggested that the items



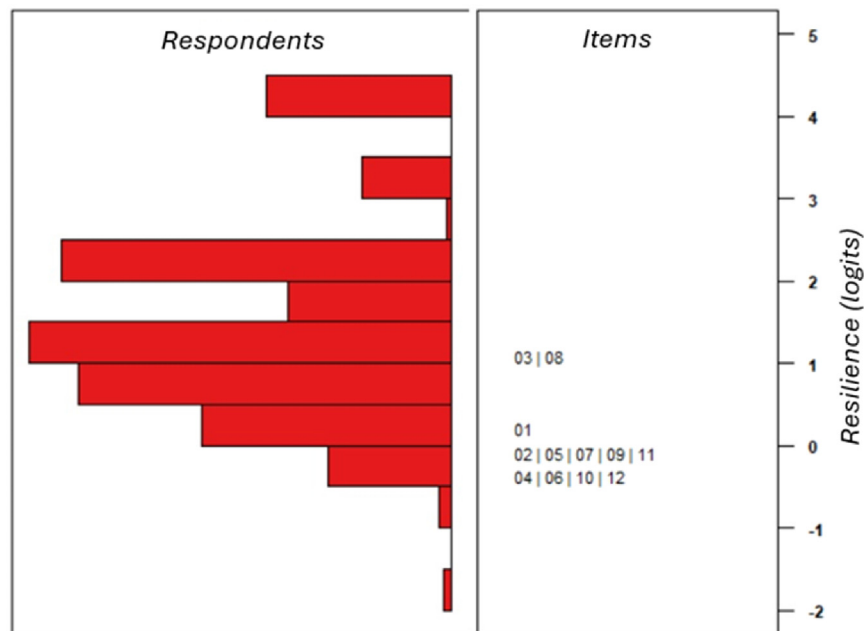


Figure 1: Person-item Wright map of 12-item Strong Souls Resilience scale.

in the measure covered an adequate breadth of the construct and could be reliably ordered from measures of lower to higher resilience.

The low person reliability and separation statistics were supported by an omega (ω_r) value of 0.54.

Eight-item scale **Local item independence**

No evidence for local item dependence was found; all Yen's Q3* residual correlation coefficients were < 0.3 .

Response category functioning

Six of the eight scale items had response categories that were not used as expected by the Rasch model. All six of these items had response categories with < 10 observations in the first category (Items 2, 4, 6, 7, 10 and 11). Additionally, Item 11 demonstrated category disorder between Categories 1 and 2. As with the 12-item scale, it was therefore justified to collapse Categories 1 (not really/not much/no one/none/never)

and 2 (sometimes/little bit/not many) together for these six items. This action remedied both the limited number of observations for Category 1 in these items and the category disorder noted in Item 11.

Differential item functioning

There was no evidence of DIF between male and female participants (all DIF contrasts $< |0.43|$). As with the 12-item scale, evidence for DIF was found between participants in less remote areas compared with those in more remote locations. Differential item functioning was evident in the same five items, with the same directional pattern in terms of which group found the item more difficult to endorse: Item 4 (DIF contrast = $-.90$; $P = .000$); Item 6 (DIF contrast = $-.53$; $P = .03$); Item 7 (DIF contrast = $.93$; $P = .001$); Item 11 (DIF contrast = $.67$; $P = .01$); Item 12 (DIF contrast = $-.52$; $P = .01$). As previously explained for the 12-item scale, despite the flaws of a scale containing items that exhibit DIF, the five items were retained in the scale,



mainly so that the scale retained sufficient items to cover the breadth of the resilience construct.

Dimensionality

The first off-factor construct had an eigenvalue of < 2 (1.68); thus provided no evidence for multidimensionality in the scale.

Item fit

All items had acceptable fit statistics, with mean-square outfit and infit values all within acceptable range ($0.60 < X < 1.40$). Outfit statistics ranged 0.85 to 1.16 and infit statistics ranged 0.93 to 1.15.

Person and item separation and reliability

The pattern of results for the separation and reliability coefficients of the 8-item scale were similar to those reported for the 12-item scale. Person separation (PSI = 0.71) and person reliability (PRI = 0.33) values did not meet the Rasch guidelines considered for a scale to be able to reliably order participants by resilience score and distinguish between participants with different construct levels. An ω_h value of 0.46 supported the low PSI/PRI coefficients. The poor targeting of scale items to participant construct levels is illustrated in [Figure 2](#), where, as with the 12-item scale, items cluster around the lower end of the person-item map, misaligned with the distribution of participant resilience levels on the map. On the other hand, item separation (ISI = 3.87) and item reliability (IRI = .94) were above the thresholds expected to verify a sound item hierarchy (ISI > 3 , IRI > 0.90 ; see [Appendix B](#)).

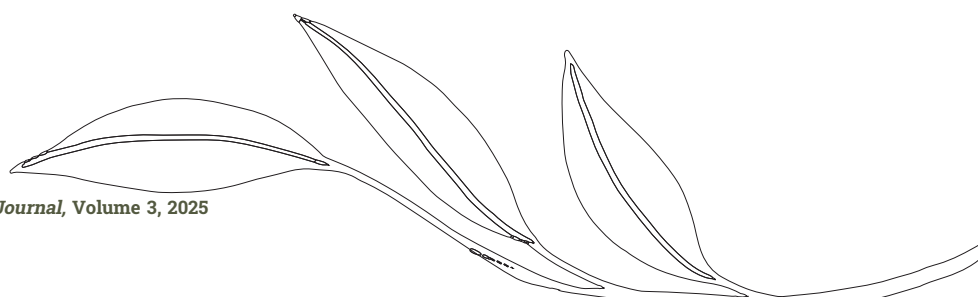
Discussion

This study extends the work of [Thurber et al. \(2019\)](#) by providing a Rasch modelling approach to investigating the validity and structure of the Resilience subscale from Strong Souls, as used with a sample of Indigenous adolescents in the LSIC. In this sample,

who were slightly younger than those who have used the measure in previously published work (e.g. see [Gorman et al. 2021b](#); [Thomas et al. 2010](#)), the current results demonstrate a scale that met many Rasch requirements for good measurement but requires some further consideration before it can be used with confidence with a similar cohort. The following discussion will present a summary of this study's key findings, what these findings mean in the context of previous work and the broader research space, and the application of these findings to future research and practice.

Both the 12-item and 8-item versions of the instrument met several aspects of the Rasch model requirements. Neither version demonstrated concern for item dependency. Both versions also demonstrated unidimensionality, which is a key requirement of Rasch measurement. This contrasts with the PCA results of [Thurber et al. \(2019\)](#) that suggested the 12-item version did not fit a unidimensional, one-component model. No DIF between male and female participants was detected in the 8-item version, and one item demonstrated differences between male and female participants in the 12-item version. Additionally, all items from both scale versions had good item fit statistics, and adequate item separation and reliability statistics.

Despite meeting these aspects of the Rasch properties, both the 12-item and 8-item versions of Strong Souls Resilience also demonstrated similar pitfalls, primarily concerned with their very low person separation and reliability statistics. This implies that neither version of the scale was sensitive enough to distinguish between them at, a minimum, high and low levels of the construct. This is visually illustrated in the person-item Wright maps, [Figures 1 and 2](#), where it is clear that scale items are not targeting the resilience



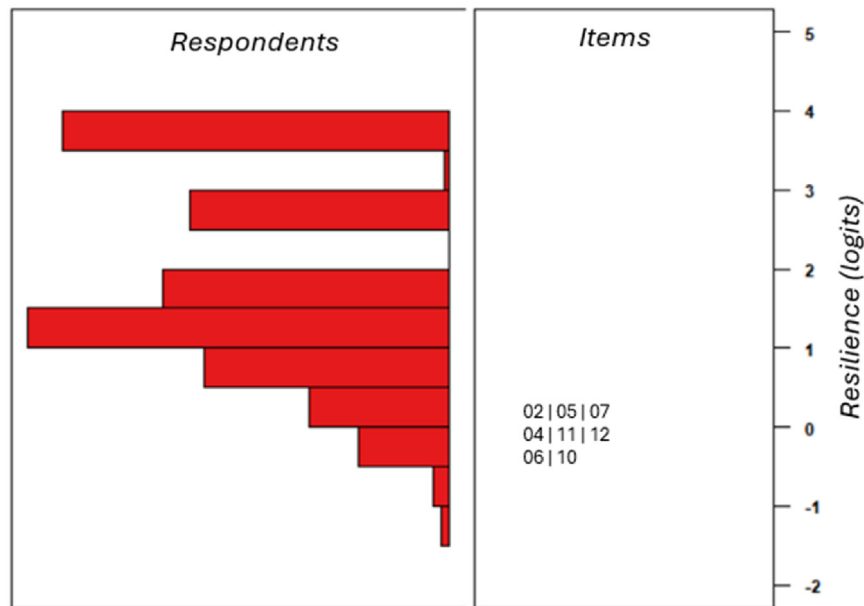


Figure 2: Person-item Wright map of 8-item Strong Souls Resilience scale.

construct levels of the participants. A ceiling effect is particularly noted, whereby the capacity for either instrument version to reliably measure resilience in more resilient respondents is not apparent. Additionally, for most items in both scales, the original item response categories were not being consistently used and as expected by the Rasch model.

Using an arguably more rigorous item-level approach such as Rasch modelling has highlighted the impact that analysis methods can have on subsequent outcomes and recommendations, with different analysis methods shedding light on different scale properties, potentially leading to different conclusions. While [Thurber et al. \(2019\)](#) concluded with a recommendation of the 8-item scale, the current results indicate that the 8-item scale fit the Rasch model slightly less well than the 12-item scale in terms of person reliability statistics. The four extra items may have slightly inflated the reliability results for the

12-item scale. Regardless, the Rasch findings indicate that there are areas for potential improvement to both versions of the scale before it can be considered a targeted and robust measure of resilience in this sample of Aboriginal adolescents and tested further as a useful screening tool.

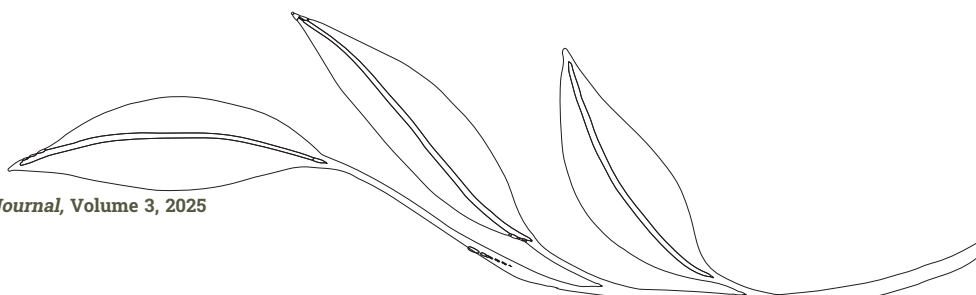
While the scale struggled to meet person reliability and separation expectations for either the current sample or the sample used in [Gorman et al. \(2021b\)](#), the PRI and PSI for the current study were somewhat lower: PRI = 0.59, PSI = 1.20 in [Gorman et al. \(2021b\)](#); compared with PRI = 0.33 (8-item scale)/0.58 (12-item scale) and PSI = 0.71 (8-item)/1.18 (12-item) in the current study. Importantly, it should be noted that there was an age difference between the two samples – the current study's sample age range being 11.5 to 13 years, while [Gorman et al.'s \(2021b\)](#) sample age ranged 15 to 25 years. While both samples fit within the scope of the World Health Organization's definition of 'young



people' (World Health Organization 2001), the current sample is clearly at an earlier stage of adolescence, while Gorman et al.'s (2021b) sample ranged from middle adolescence into young adulthood. There are key developmental differences between early and late adolescence to young adulthood, including older participants having an increased capability for abstract thinking and examination of their inner experiences (Sawyer et al. 2012). Older adolescents and young adults also tend to have a firmer sense of their own identity within their peer group or community, and heightened capacity for emotional regulation. (Erikson 1994; Theurel and Gentaz 2018). Additionally, from a developmental stage perspective, for younger adolescents, this rudimentary sense of identity and self is coupled with the experience of a different range of problems compared with older adolescents and young adults (Erikson 1994). While the Strong Souls Resilience items do not appear to be beyond a typical early adolescent's comprehension (and survey interviewers were present to help with clarifications as needed), it could be the case that these differences in cognitive and psychosocial development led to items being less consistently answered or with less insight capability than older participants, resulting in a poorer match between the scale's ability to detect resilience levels (hence, poorer reliability indices for the current study). This might suggest that Strong Souls Resilience is less appropriate for use with younger adolescents. Indeed, the original development and use of the complete Strong Souls instrument involved participants from the ages of 16 to 20.5 years (Thomas et al. 2010). Investigating age-related DIF could be a useful task for future researchers to further investigate the impacts of age on the use of the instrument.

Evidence for DIF, which was identified in five items when comparing participants who lived in none/low

isolated areas with participants who lived in moderate/high/extremely isolated areas, can be explained, at least partly, by the vast and diverse population that the LSIC samples. As displayed in Appendix A, the sampled population covers a huge geographical area ranging from metropolitan state capitals to very remote communities like Ardyaloon (One Arm Point). By extension, this highlights the diversity of the broader Aboriginal and Torres Strait Islander population. Rather than indicative of the quality or functionality of the Strong Souls instrument, DIF in the five items can be interpreted as a reflection of the context in which the instrument has been used. Given the diversity within the sample, the experiences of and relevant pathways to resilience and wellbeing are likely to look different in some ways for a young person from, for example, coastal urban Gold Coast compared with a young person from remote, inland Fitzroy Crossing. For example, Item 6 'You are really into something (like music, football, clothes)' demonstrated DIF, with participants from areas of moderate/high/extremely isolation finding the item harder to endorse given the same level of resilience than those from areas of none/low isolation. This could be explained by the simple fact that children and young people in more remote areas typically have fewer organised activities available for participation due to the isolated location and small populations. Thus, different connotations are associated with this item when presented to more and less isolated participants. The similar finding for Item 11 ('You have a lot of friends'), which was more difficult for participants in none/low isolation areas to endorse, may reflect that those living in smaller and more isolated communities more likely to live, work, play and go to school with a familiar, close-knit group of peers, which potentially contrasts the more disparate and diffuse experiences of peer relations in urban areas.





Irrespective of sample characteristics that may have impacted on the Rasch fit of the scale, clear opportunities for improvement remain, particularly regarding the structure of the scale and its items and content. Given the ceiling effect seen in both scale versions, potential future efforts in new item generation are warranted, particularly items that distinguish respondents at the upper range of the resilience construct. This exercise would also have the potential to improve poor person separation and reliability estimates. The consideration of generating new items also highlights the necessity of a clear, measurable definition of the construct. Without a well-defined construct, the boundaries of what item content is valid and reliable against the intended construct are unspecific or unclear (Boateng et al. 2018). This may be the case with Strong Souls Resilience, where there was no clearly stated definition of resilience through the conception and development of the instrument and items (Thomas et al. 2010). This is of particular importance with the construct of resilience, as it has complex and differing pathways and factors involved, depending on what definition or conceptualisation is used (Windle et al. 2011). Similar psychometric findings from other studies of resilience instruments mirror the current study's mismatch in item targeting to participant resilience, where participants with higher resilience do not have items that target their resilience levels (see Figures 1 and 2; for other studies see Gorman et al. [2021a]; Heritage et al. [2021]; Papini et al. [2021]). This could be indicative of the understanding of recognising low level resilience (or what factors might contribute to such a scenario), but less clarity in identifying the factors that contribute to high resilience in young people, particularly how high and very high resilience can be distinguished between and how this manifests in Aboriginal young people. As surmised by Usher et al. (2021), resilience conceptualisations are distinctive for Aboriginal

peoples, with issues of culture and community being particularly salient (see Gee [2023]; Kickett [2011]). While aspects of these factors do appear in Strong Souls item content, a clear definition of what the scale intends to measure is necessary to support the development of a psychometrically robust, relevant and appropriate measure of resilience for Aboriginal adolescents and young people.

Resilience is a complex construct that requires a clear definition for use in research and practice, particularly prior to creating robust psychometric measurement that can be useful in supporting Aboriginal young people and their wellbeing. This study has demonstrated that the Strong Souls Resilience subscale, in 8-item and 12-item forms, demonstrates several good measurement properties via the Rasch model, but also that there are opportunities to improve the instrument so that it can be used with confidence in this population of Aboriginal adolescents. Future research should aim to further develop the instrument's ability to discriminate between different resilience levels in participants. In addition, future work on this scale could usefully focus on hinging item content to a clear, operationalised definition of resilience that is relevant and useful for determining and measuring improvements in health and wellbeing outcomes in Aboriginal adolescents and young people in Australia (e.g. as surmised in Usher et al. [2021]), while particularly focusing on items that are able to reliably measure high level resilience in respondents.

Author contributions

E. Gorman: conceptualisation, methodology, formal analysis, data curation, writing – original draft, writing – review and editing, visualisation. R. Walker: writing – review and editing, supervision. H. Davis: formal analysis, writing – review and editing. C. Shepherd: conceptualisation, writing – review and editing. R.





Marriott: conceptualisation, writing – review and editing, supervision, project administration, funding acquisition.

Declaration of interests

Co-authors (RM and RW) have working relationships with *First Nations Health and Wellbeing – The Lowitja Journal's* Editor-in-Chief Cath Chamberlain. All other authors declare no competing interests.

Funding

This work was supported by the Australian Government through the Australian Research Council's Discovery Indigenous funding scheme (project number IN170100008). The first author was a recipient of an Australian Government Research Training Program (RTP) Scholarship.

Acknowledgements

We wish to acknowledge the contribution of the Aboriginal and Torres Strait Islander children and families who participated in the LSIC study and thank the Australian Government Department of Social Services for providing access to this dataset.

Additionally, we also thank Dr Brody Heritage, who was instrumental in the original design of the current study, providing data analyses guidance for the first author, and providing feedback on early manuscript drafts. We also respectfully acknowledge the cultural guidance of the Whadjuk Noongar and Gamilaroi Elders and senior Aboriginal men and women, and broader project support of the YIPRaW project research investigators.

Positionality statement

Authors one, two, three and four are all non-Indigenous Australian researchers, working in varied disciplines on Whadjuk Noongar Country. As non-

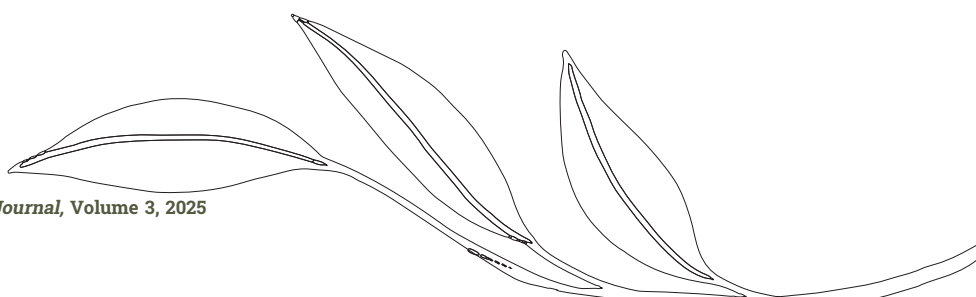
Indigenous researchers, we are committed to approaching discussions about Aboriginal and Torres Strait Islander wellbeing with respect, understanding and an acknowledgement of our differing worldviews and biases. Last (senior) author is a Nyikina woman who holds a wealth of experience and knowledge as a senior, highly respected Aboriginal researcher, nurse and midwife.

Supplementary material

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.fnhli.2024.100037>.

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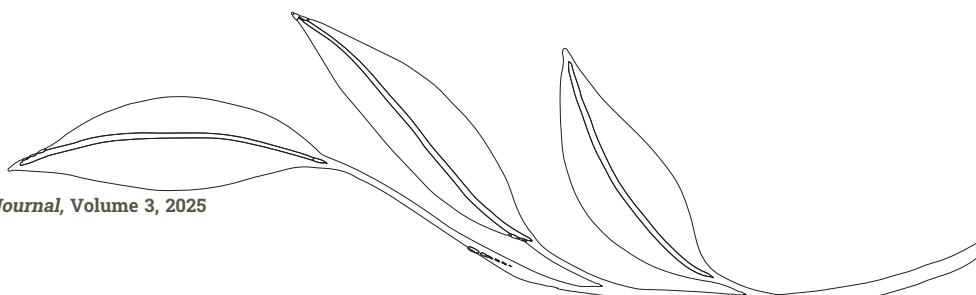
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