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Development and psychometric evaluation of the Birmingham Relationship Continuity Measure for
acquired brain injury

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Abstract

Objective: Relationship continuity/discontinuity refers to whether a spouse/partner experiences their current relationship with someone with an acquired brain injury (ABI) as a continuation of their loving pre-injury relationship or as radically changed. The aim of this study was to adapt a questionnaire measure of continuity/discontinuity from dementia research for use in an ABI context and to evaluate the psychometric properties of this adaptation.

Method: The questionnaire was adapted in response to feedback from a focus group of ABI caregivers. Its psychometric properties were then evaluated in two studies involving partners of people with ABI.

Results: The measure showed high internal consistency ($\alpha = .956$ in Study 1 and $.963$ in Study 2), test-retest reliability (intra-class correlation = $.960$ in Study 1) and discriminative power (Ferguson's $\delta = .975$ in Study 1 and $.963$ in Study 2). Evidence of construct validity was provided by a predicted pattern of correlations with other relationship questionnaires. Exploratory factor analysis suggested that the questionnaire is unidimensional.

Discussion: A valid and reliable quantitative measure of relationship continuity/discontinuity will enable more robust evaluation of suggestions about this construct that have been made in qualitative studies (e.g. that discontinuity is associated with a greater sense of caregiver burden).

Keywords: acquired brain injury, marital relations, family caregivers, psychometrics, relationship continuity

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Introduction

Strong family relationships are critical to good outcomes after acquired brain injury (ABI). Relationships are intrinsically valuable to those involved; they protect and enhance the psychological wellbeing of both parties (1-3); and they facilitate the progress of the person with the ABI because of the important role the family plays in the rehabilitation process (4-6). However, ABI can put significant strain on these relationships. For example, in terms of spousal relationships, low levels of relationship satisfaction and high rates of separation have frequently been reported after ABI (7-11). It is important to investigate in more detail the challenges that ABI presents to family relationships, how people respond to those challenges, the factors that can undermine or facilitate the relationship, and the processes whereby family relationships can influence outcomes such as psychological wellbeing and progress in rehabilitation.

Qualitative studies have generated a range of ideas about how family relationships (particularly spousal relationships/partnerships) are challenged by ABI and the potential impact of those challenges (e.g. 12-16). For example, one challenge highlighted by this research is that some caregiving partners experience radical change in the identity of the person with the ABI, who is described in such terms as 'a stranger' and 'not the man I married' (10, 12, 13, 17). Except for some studies that have used grounded theory (18-19), these ideas have generally not been integrated into broader theories, and this limits their usefulness (18). Qualitative research in this area is also divorced from quantitative research on relationships, which has primarily focused on issues such as the frequency of dissatisfaction and breakdown, and their association with demographics and ABI symptoms (9). Corroborating the findings of qualitative studies with evidence from quantitative or mixed-methods studies can enhance generalisability and provide more robust conclusions (20). In short, research on relationships could be advanced by integrating ideas from qualitative research into broader theoretical frameworks and by using quantitative methods to corroborate these ideas.

One theoretical framework that has been proposed as a way of integrating some of the ideas about relationships arising from qualitative research is *relationship continuity/discontinuity* (21). This framework derives from qualitative research on spousal relationships in dementia which found that some caregiving partners experience their relationship as a continuation or strengthening of the loving relationship they shared before the onset of the dementia, whereas for others the pre-dementia relationship has been lost and replaced with something very different (e.g. 22-25). Based on a review of this qualitative research, Riley et al. (26) suggested five closely interlinked dimensions of the continuity/discontinuity experience: *relationship redefined* (in continuity, the relationship is experienced as a continuation of the pre-dementia relationship; in discontinuity, the pre-dementia relationship is viewed as finished and the new relationship feels very different, typically characterised by the giving and receiving of care); *same/different feelings* (in continuity, the caregiving partner continues to feel the same love and affection for their partner; in discontinuity, these feelings have been replaced with other feelings such as protectiveness, resentment or emotional detachment); *same/different person* (in continuity, the person is perceived as essentially the same person, despite dementia-related changes; in discontinuity, the person is experienced as fundamentally changed); *couplehood* (in continuity, the sense of being part of a couple is retained; in discontinuity, the spouse views themselves from a more individualist perspective) and *loss* (in discontinuity, there is a sense of loss for the pre-dementia person and relationship, but this is minimal or absent in continuity). These five dimensions are held to be highly interdependent such that someone who experiences continuity (or discontinuity) on one dimension will strongly tend towards continuity (or discontinuity) on the other dimensions. For example, the experience of the person with dementia as radically changed (*same/different person*) is expected to undermine the experience of the current relationship as a continuation of the pre-dementia one (*relationship redefined*), since it is difficult to experience the relationship as the same if the other person in the relationship is felt to be ‘a stranger’; and experiencing the relationship as very different (*relationship redefined*) is expected to alter perceptions of the other person (*same/different person*) since how we characterise and conceptualise others is shaped by the relationships we have with them (27). Riley et al. (26) devised and evaluated a

questionnaire (the *Birmingham Relationship Continuity Measure*) to evaluate relationship continuity/discontinuity. This incorporated five subscales addressing each of the five dimensions. Evidence of the high interdependence amongst the dimensions was provided by the high correlations amongst the subscales and by a factor analysis indicating that the questionnaire was unidimensional.

Whether the spousal caregiver experiences continuity or discontinuity has been linked in qualitative dementia research to the caregiver's psychological wellbeing and the quality of the care and support they provide. For example, it has been suggested that continuity is associated with fewer negative emotional reactions to the caregiving role, such as feeling less subjective burden and being less distressed by challenging behaviours shown by the person with dementia (22, 25, 28); and with a more person-centred approach to delivering care and support (22, 25, 29). Recent quantitative studies using the *Birmingham Relationship Continuity Measure* have corroborated these suggestions (30-32).

It is worth emphasizing that the theory relating to continuity/discontinuity is about the persistence or otherwise of a loving pre-dementia relationship. It does not apply if the pre-injury relationship was unsatisfactory. For example, caregivers are not expected to feel a sense of *loss* for a pre-injury relationship in which they were unhappy, and *couplehood* will not be an experience associated with continuity if this was not a feature of the pre-dementia relationship.

Villa and Riley (21) argued that the continuity/discontinuity framework can also be usefully applied to the experience of spouses/partners supporting someone with ABI. They reviewed previous qualitative studies in ABI about relationships and found evidence of all five dimensions that constitute continuity/discontinuity (although previous studies had not connected the different experiences to one another in the way that the continuity/discontinuity framework does). In their own qualitative study, the experiences described by the participants could also be mapped onto all five dimensions. Furthermore, the responses tended to go together in the pattern predicted by the continuity/discontinuity framework: Those who reported continuity (or discontinuity) in respect of one dimension were likely to report continuity (discontinuity) in other dimensions as well. Consistent with the dementia research, participants experiencing discontinuity reported a greater sense of burden and distress, and were less person-centred in their approach to providing care. They also reported thoughts about wanting to end the relationship, which were absent from the accounts of participants

experiencing continuity. Other qualitative studies applying the continuity/discontinuity framework in ABI have reported similar findings (17, 33).

In summary, it is suggested that research on spousal relationships after ABI can be facilitated by integrating ideas from qualitative research into broader theoretical frameworks and by corroborating the ideas using quantitative approaches. Relationship continuity/discontinuity is proposed as a framework for understanding a range of experiences described by ABI caregivers in qualitative studies. The construct has been linked to the psychological wellbeing of the caregiver and the quality of the care they provide. In order to use the framework in quantitative studies and to corroborate these suggestions about its link to wellbeing and care quality, a quantitative measure of the construct is required. The aim of the present study, therefore, was to develop and psychometrically evaluate a measure of relationship continuity/discontinuity in the context of ABI.

Given the overlap between the experiences of partners in ABI and those in dementia in relation to continuity/discontinuity (21), the questionnaire that was developed by Riley et al. (26) to measure this construct in the context of dementia was used as the starting point for developing one for use in ABI. The dementia measure has 23 items measuring each of the five dimensions of continuity/discontinuity (specifically, *same/different person*, *relationship redefined*, *same/different feelings*, *couplehood* and *loss*). High levels of internal reliability (0.947) and test-retest reliability (0.932) were reported, and evidence of construct validity was provided by predicted correlations with a scale measuring caregiver grief and a scale measuring changes in positive and negative feelings since the onset of the dementia (26). A focus group of current ABI family caregivers gave feedback about how applicable each of the measure's items was to an ABI context, and suggested some changes. The psychometric properties of the revised version were then evaluated in two studies. Approval for the research was provided by the ethics committee of the University of Birmingham.

Development of the questionnaire

Development of the questionnaire involved a focus group consisting of five people who were currently living with, and providing care for, a family member who had experienced ABI at least nine months previously. The participants were recruited from a charitable organization providing advice

and support to people with an ABI and their families. Participants were shown the original *Birmingham Relationship Continuity Measure* (BRCM) for dementia and asked for their general comments about its clarity and applicability in an ABI context. For each item of the questionnaire they were also asked:

- Is this statement clearly worded?
- Do you think it is a good way of asking about [whatever aspect of relationship continuity/discontinuity the item was intended to measure – e.g. changes in feeling towards the person with the ABI]?
- From your own experience, can you imagine some partners of people with a brain injury will agree with the statement, but others will disagree?

The focus group was facilitated by one of the authors. Suggestions about changes to the questionnaire were acted on only if all five participants were in agreement about the change.

On the basis of the feedback from the group, a short introductory paragraph was added to the instructions to clarify that the questionnaire asks about changes in the partner and the relationship since the ABI, and requesting that the respondent reflects on how things were before the ABI and how they are presently. The group identified two items which they thought were less reflective of the experiences of partners of someone with an ABI. These items were changed accordingly. “He’s in a world of his own most of the time” was replaced with “He is more interested in himself now than he is in me or our relationship”; and “He’s a shadow of his former self” was replaced with “Since the brain injury, his personality is very different”. No items were added or deleted. Appendix 1 provides the amended version, the *Birmingham Relationship Continuity Measure (Acquired Brain Injury)* (BRCM-ABI), as well as instructions for calculating subscale totals (relating to each of the five dimensions) and an overall total.

Psychometric evaluation of the BRCM (ABI)

The psychometric properties of the BRCM (ABI) were evaluated in several ways. In terms of reliability, Cronbach's alpha was used to assess its internal consistency and the intraclass correlation coefficient to assess its test-retest reliability. Internal consistency is an indicator of the extent to which scores on individual items in a questionnaire are correlated with one another, and therefore the extent to which the items are measuring the same variable (34). The internal consistency of the total score on the BRCM (ABI) therefore provides an evaluation of the claim that the five dimensions of continuity/discontinuity represent highly interdependent experiences, such that someone who reports continuity on one dimension is highly likely to report continuity on the other dimensions. Test-retest reliability evaluates whether scores remain the same between two completions of the questionnaire, separated by a given period of time. On the assumption that the underlying variable being measured does not change over that period, then test-retest reliability provides an indication of the extent to which completion of the questionnaire is affected by variables other than the construct that the questionnaire is intended to measure – in other words, the extent to which it is affected by measurement error (34). The range of possible values for Cronbach's alpha and for the intraclass correlation coefficient is -1.0 to +1.0 and values above +0.7 are usually considered to indicate that the questionnaire has satisfactory reliability (34).

The questionnaire's discriminative power (not to be confused with discriminant validity) was evaluated using Ferguson's δ (34, 35). By comparing the observed number of differences between individual scores in the sample with the maximum possible number of differences that could occur with that sample size, Ferguson's δ provides a measure of the likelihood that individuals who are different in respect of the underlying construct being measured will obtain different scores on the questionnaire. This is an important consideration because the questionnaire would be less useful if individuals who differed in terms of continuity/discontinuity nevertheless obtained the same score. Possible values on Ferguson's δ range from 0 to +1 and a value above 0.9 is recommended for satisfactory discriminative power (34).

The evaluation of the construct validity of a questionnaire involves testing a series of predictions based on theory about the construct being measured (34). Failure to confirm these predictions casts doubt on whether the questionnaire is measuring what it is intended to measure. In

the present study, the predictions were that scores on the BRCM-ABI would correlate with scores on a range of other questionnaires that measure overlapping constructs (e.g. caregiver grief) and with scores on questionnaires that measured other aspects of relationships that continuity/discontinuity would be expected to be associated with (e.g. satisfaction with the relationship); but would be uncorrelated with scores on a questionnaire that has no theoretical connection with continuity/discontinuity (specifically, a questionnaire about the quality of the pre-injury relationship).

Finally, exploratory factor analysis was used to investigate the factor structure of the questionnaire. The samples from the two studies were combined to provide a more suitable sample size for this analysis. The analysis provided a further test of the claim that, although the five dimensions of continuity/discontinuity are conceptually distinct, they represent highly interdependent experiences, such that someone who reports continuity on one dimension is highly likely to report continuity on the other dimensions. If this claim is correct, then the factor analysis should show that just one underlying construct/factor explains most of the variance in the scores; in other words, it should show that the questionnaire is unidimensional.

Study 1

Method

A convenience sample was recruited through three charitable organizations in the UK providing information and support to families of those affected by ABI. Participants opted into the research in response to advertising posters, presentations given about the research or invitation letters distributed by the organization. Participants were required to be the partner of someone with a brain injury that happened at least 1 year previously, but no more than 15 years; to be currently living with this person and providing some degree of care and support; and to have lived with the person for at least 1 year prior to the ABI. Additionally, the person with the ABI was required to have received therapeutic input from a ABI service following their discharge from hospital (e.g. therapy from a physiotherapist, occupational therapist or psychologist). This was to minimise the inclusion of people with milder injuries whose relationships are presumably comparatively less affected by ABI. The aim was to

recruit a sample of at least 44 participants. This target was based on the fact that Riley et al. (26) reported a correlation of 0.4 between the BRCM (dementia) and the *Closeness and Conflict Scale* used in that paper (and this) to evaluate the construct validity of the scale. Power analysis indicated that, with the alpha set at .05 and power at 0.80, a sample of 44 would be required to detect a correlation of 0.4. A sample of 44 is also adequate to evaluate internal consistency and test-retest reliability (36).

[Table 1 about here]

Fifty participants took part. Demographic details and information related to the brain injury are contained in Table 1. All participants were in a heterosexual relationship with the person with the ABI for whom they were a caregiver. Because of an administrative error, data were missing in some cases about the employment status of the participant and the nature of the brain injury sustained. No information was gathered about the severity of the injury. However, as noted earlier, all were required to have undergone some degree of rehabilitation following discharge from hospital, and to be still receiving care and support from their partner at least 1 year after the ABI.

As well as the BRCM (ABI), participants completed the *Heartfelt Sadness and Longing* (HSL) subscale of the *Caregiver Grief Inventory* (37) and the *Closeness and Conflict Scale* (CCS) (38). These were selected because they were used in the psychometric evaluation of the dementia version of the BRCM (26). The former is a measure of feelings of loss about the other person that can occur in caregivers, and was expected to overlap particularly with the *loss* dimension of the BRCM (ABI); the latter is a measure of changes in feeling towards the care recipient since taking on the caregiving role and was expected to overlap with the *same/different feelings* dimension of the BRCM (ABI). On the BRCM (ABI) lower scores indicate perceptions of greater discontinuity; on the HSL they indicate less grief; and on the CCS they indicate an increase in negative feelings and a decrease in positive feelings since taking on the caregiving role. So the expectation was that the BRCM (ABI) total score would show at least a moderate negative correlation with the HSL and at least a moderate positive correlation with the CCS.

Participants first completed the three questionnaires and provided the demographic and injury-related information. Following an interval of between 7 and 14 days, participants completed the BRCM (ABI) a second time for the purpose of evaluating test-retest reliability.

Results

The means, ranges and standard deviations of the questionnaire totals are provided in Table 2. Internal consistency was high (Cronbach's alpha = .956, 95% confidence intervals = .942 to .974; lowest item-total correlation = .488). Test-retest reliability was evaluated using the intra-class correlation coefficient using a two-way random model, focused on single measures and absolute agreement (39). This, too, was high (ICC = 0.960; 95% confidence intervals = 0.926 to 0.977; $p < 0.001$). Ferguson's δ (the index of discriminative power) was 0.975, which is above the 0.9 recommended for satisfactory discriminative power (34). Appendix 2 shows the mean, range, standard deviation and Cronbach's alpha for the subscale totals. Alphas were above the benchmark of 0.7 for all the subscales apart from *relationship redefined*.

[Insert Table 2 about here]

Table 3 shows the correlations between the BRCM (ABI) and the HSL and the CCS. As expected, the correlations were at least moderate in size (i.e. above 0.3) and thus provide some evidence for the construct validity of the BRCM (ABI). In fact, the correlations, particularly between the BRCM and the CCS, were large. This raises the question whether the BRCM (ABI) is simply measuring the same construct as the CCS, and therefore whether this new questionnaire is needed. This issue is given further consideration in the Discussion.

[Table 3 about here]

An additional analysis was conducted to see whether the questionnaire scores were related to demographic and injury-related variables. Pearson's correlation was used to evaluate the associations with continuous variables (participant age, length of relationship and time since injury), and a one-way ANOVA to compare groups within categorical variables (type of injury, ethnicity and religion). There were no significant findings, although it should be noted that some of the comparisons were

under-powered because of small numbers in some of the demographic groups and missing data about the type of injury.

Study 2

Method

Participants completed the BRCM (ABI), a pre-injury version of the *Relationship Assessment Scale* (RAS) (40), a post-injury version of the RAS, and the *Dyadic Adjustment Scale* (DAS) (41). The DAS measures dyadic satisfaction, dyadic cohesion, dyadic consensus, and the expression of affection within the dyad. A higher score indicates a better relationship. It was expected that this scale would show at least a moderate positive correlation with the BRCM (ABI) because dyadic cohesion and consensus in the DAS overlap with the dimension of *couplehood* assessed by the BRCM (ABI). Dyadic satisfaction was also expected to be associated with the BRCM (ABI) because continuity is about the continuation of a loving pre-injury relationship, with which the person is likely to be satisfied; whereas discontinuity is associated with a sense of loss for the pre-injury relationship, a greater sense of burden and thoughts of wanting to end the relationship (17, 21), all of which are likely to create dissatisfaction.

The RAS is a measure of the perceived global quality of the relationship, covering such items as satisfaction with the relationship, experiencing problems within the relationship and wishing that one was not in the relationship. Higher scores indicate a better relationship. In the pre-injury version, participants were asked to rate the relationship as it was prior to the brain injury; and in the post-injury version they were asked to rate their current relationship. It was expected that the BRCM (ABI) would show at least a moderate positive correlation with the post-injury RAS, again because of the expectation that discontinuity would be associated with less relationship satisfaction and thoughts of wanting to end the relationship (17, 21).

The pre-injury version of the RAS was included as a screen for unsuitable participants. As explained in the Introduction, the theory underlying continuity/discontinuity is about the persistence of a loving pre-injury relationship. It does not apply if the pre-injury relationship was unsatisfactory. The fact that questionnaire is about the persistence of a loving relationship is reflected in the wording

of some items on the BRCM (ABI). For example, the item “I care for him, but I don’t love him the way I used to” assumes that the respondent did love his/her partner before the injury. The inclusion of participants whose pre-injury relationship was unsatisfactory would undermine the validity of the questionnaire. To exclude such participants, a cut-off score of below 21 for the pre-injury RAS was adopted. A score below 21 represents a mean score, across the seven items of the scale, of less than three on the five-point likert scale that ranges from 1=poor, through 3=average, to 5=excellent. Descriptive statistics for the pre-injury RAS are shown in Table 2. The lowest actual obtained score was 24, and so no participant was excluded from the analysis on this basis.

The pre-injury RAS also served as a way of further evaluating the construct validity of the BRCM (ABI). It was predicted that there would be no correlation between the two questionnaires. Qualitative research suggests that the main determinant of differences in continuity/discontinuity may be the impact of the injury on the person with ABI, with changes such as increased aggression and losing the ability to communicate and express positive feelings contributing to a sense of discontinuity (17, 21); and there is no obvious theoretical reason why the global quality of the pre-injury relationship should have an impact. Furthermore, the difference between the pre and post injury RAS provides a measure of the extent to which the relationship has changed since the injury, which one would expect to be closely related to the extent of discontinuity in the relationship. It was therefore predicted that this difference would show a negative correlation with BRCM (ABI) scores.

A convenience sample of 53 participants was recruited using the same methods, inclusion/exclusion criteria and charitable organizations as Study 1. Demographic and injury-related information about the sample is contained in Table 1. Participants also completed the *Activities of Daily Living Questionnaire* (ADLQ) (42). This is an informant-based assessment that evaluates functioning in the areas of self-care, household care, employment, recreation, shopping, money, travel, and communication. A higher total score indicates more severe functional impairment. Participants completed it with reference to their partner with an ABI. Table 1 shows the descriptive statistics for the ADLQ which provide an indication of the level of disability in the people with ABI to whom the participants were providing care. Using the categories suggested by Johnson et al. (42), one person with ABI fell into the ‘mild’ category, 18 into the ‘moderate’ category and 34 into the

‘severe’ category. The mean for the group was on the cut-off point between the ‘moderate’ and ‘severe’ categories.

Results

The means, ranges, standard deviations and Cronbach’s alpha of the questionnaire totals are provided in Table 2. The BRCM (ABI) again showed good internal consistency (Cronbach’s alpha = .963, 95% confidence intervals = .943 to .974; lowest item-total correlation = .438) and good discriminative power (Ferguson’s $\delta = 0.971$). There was also further evidence of its construct validity. As predicted, it showed significant positive correlations with both the post-injury RAS and the DAS, but was uncorrelated with the pre-injury RAS (Table 3). The BRCM (ABI) also had a significant negative correlation with the difference between the pre and post injury RAS scores: As expected, those who reported greater change in their relationship on the RAS were more likely to report discontinuity on the BRCM (ABI).

An analysis was conducted to see whether the questionnaire scores were related to demographic and injury-related variables. Pearson’s correlation was used to evaluate the associations with continuous variables (participant age, length of relationship and time since injury), and a one-way ANOVA to compare groups within categorical variables (diagnosis, ethnicity and religion). It should be noted that some of the comparisons were under-powered because of small numbers in some of the demographic groups and missing data about the type of injury. The only statistically significant findings were positive correlations between time-since-injury and the BRCM (ABI) ($r=.340$; $p=.013$) and time-since-injury and the post-injury RAS ($r=.318$; $p=.020$) (i.e. a longer time-since-injury was associated with perceptions of more continuity and better global quality of the current relationship); and negative correlations between time-since-injury and the pre-injury RAS ($r=-.313$; $p=.038$) (i.e. a shorter time since injury was associated with perceptions of better global quality of the pre-injury relationship), between the ADLQ and the BRCM (ABI) ($r=-.337$; $p=.014$) and between the ADLQ and the DAS ($r=-.327$; $p=.017$) (i.e. the greater the functional disability of the person with ABI, the more likely the participant was to report discontinuity and a poorer relationship). The positive correlations of time-since-injury with the BRCM (ABI) and RAS need to be interpreted with some caution

because an inspection of the scatter plots suggested that the association was not linear: In cases in which there was a much longer time post-injury (i.e. more than 8 years), the participants tended to report perceptions of less continuity and poorer relationship quality.

Exploratory factor analysis

It was expected that the BRCM (ABI) would be unidimensional because of the close interdependence of the five components of continuity/discontinuity (21) and because of the evidence for the unidimensionality of the dementia version of the BRCM (26). To assess this, an exploratory factor analysis was carried out on the combined data from Studies 1 and 2 ($N=103$) to determine how many reliable factors could be extracted from the data. Assessment indicated a high degree of factorability in the data set, suggesting that factors could be meaningfully extracted (Kaiser-Meyer-Olkin measure = 0.860; Bartlett's test of sphericity, approximate chi-squared (253 df) = 2338; $p < .001$). Following the recommendations of Costello and Osborne (43), principal axis factoring was used for factor extraction because of the non-normal distribution of scores on several items, direct oblimin for the method of rotation, and the Scree test for deciding which factors were reliable. Consistent with expectation, only one reliable factor was extracted, which explained 54% of the variance in scores (initial eigenvalues: factor 1=12.49; factor 2=1.77; factor 3=1.39; factor 4=1.15). The results should be treated with some caution because of the relatively small sample size (ratio of participants to items was 4.48:1) (43). However, the solution is more reliable when, as in the present analysis, fewer factors are extracted and the communalities are not too low (44) (communalities ranged from 0.457 to 0.833, mean=0.675).

Discussion

The psychometric properties of the BRCM (ABI) were evaluated in two studies. The measure showed high internal consistency ($\alpha = .956$ in Study 1 and $.963$ in Study 2), test-retest reliability (intra-class correlation = $.960$) and discriminative power ($\delta = .975$ in Study 1 and $.963$ in Study 2). Evidence of its construct validity was provided by significant correlations with the HSL and CCS (Study 1) and with the DAS, the post injury RAS, and the difference between pre and post injury RAS

scores (indicative of greater perceived change in the relationship) (Study 2). Study 2 also confirmed the prediction that there would be no correlation with the pre-injury RAS. The absence of this correlation reduces the likelihood that the high correlations between the BRCM (ABI) and the other measures can be explained in terms of some response bias, such as the tendency to agree or disagree with all statements on the questionnaires. Exploratory factor analysis suggested that the measure is unidimensional. Along with the high internal consistency of the questionnaire, this supports the theoretical claim that the five dimensions of relationship continuity/discontinuity assessed by the measure are all highly interdependent such that continuity on one aspect is highly likely to be accompanied by continuity on another aspect and likewise for discontinuity (17, 21, 26).

Some limitations of the psychometric evaluation should be noted. Convenience samples were used, and it is unclear how representative they were of the population of spouses/partners providing care to people with ABI. Because of the relatively small sample sizes, a more in-depth exploration of the relevance of demographic and injury-related factors was not possible, and there is reason to be cautious about the results of the factor analysis.

Some issues about the questionnaire itself also need to be considered. First, it is intended as a measure of the persistence of a loving pre-injury relationship. Its administration should therefore be supplemented by another questionnaire, such as the pre-injury RAS, to establish that there was a loving pre-injury relationship. The questionnaire and underlying theoretical framework do not have any clear application to relationships that were dysfunctional before the ABI. A second issue is raised by the high correlations that were obtained between the BRCM (ABI) and some of the other questionnaires used for validation, particularly the post-injury RAS and the CCS (Table 3). Such high correlations raise the question of whether the questionnaires are simply measuring the same construct and, if this is the case, why a new questionnaire is needed. All three questionnaires (the BRCM (ABI), the post-injury RAS and the CCS) do provide a measure of whether there is currently a loving relationship. However, in contrast to the other two questionnaires, the BRCM (ABI) links the current relationship to the pre-injury one, and is based a theoretical deconstruction of what is involved in the persistence of the pre-injury relationship, providing a measure of five dimensions hypothesised to be implicated. Thus, rather than just being a measure of whether there is currently a loving relationship,

the BRCM (ABI) may capture more fully the complexity of the experience and therefore provide a more effective measure. Through use of its subscale totals, it also offers the opportunity to explore these five dimensions individually. This may be of use in future investigations of the experience of retaining or losing a loving relationship. A third issue about the BRCM (ABI) is the very high estimates of its internal consistency obtained in Studies 1 and 2. Such high internal consistency can arise if the construct being measured is too narrow or if the items are asking the same question, albeit in a slightly different form (34). This seems an unlikely explanation in the present case. The five dimensions measured by the questionnaire are conceptually quite distinct and diverse. A more likely explanation is the interdependence of the five dimensions that the questionnaire measures.

Future studies could seek to develop the BRCM (ABI) further. The high internal consistency, along with the evidence of unidimensionality from the factor analysis, suggests that a shorter version could be produced without compromising its reliability. A longer version that provides better coverage of some of the five dimensions could also be considered. Although the Cronbach's alphas for the internal consistency of the subscale totals were generally good (Appendix 2), they were lower for *relationship redefined* and *loss*. In part, this is likely to be due to the fact that these two dimensions were assessed using only three items. Adding more items might improve their reliability. It would also be useful in a future study to collect normative data using larger samples that were representative of defined populations of caregiving spouses/partners. Normative data would increase the value of the questionnaire in a clinical context. Given that discontinuity may have a negative impact on psychological wellbeing and the quality of care provided, it would be advantageous to be able to identify those whose scores fall at the more extreme end of the continuity/discontinuity spectrum so that they can be given help and support in coming to terms with the changes in their relationship.

In a research context, the BRCM (ABI) provides a reliable and valid measure of relationship continuity/discontinuity that can be used in quantitative studies to corroborate claims made about this construct in the qualitative literature. Some of these claims concern why partners differ in their experiences of continuity/discontinuity. For example, it has been suggested that aggression and reduced expressions of emotional warmth on the part of the person with ABI make it more difficult to

maintain a sense of continuity (17, 21). In Study 2 there was a modest correlation between discontinuity and the severity of the functional disability of the individual with ABI. Future studies should investigate whether this factor makes a unique contribution to continuity/discontinuity or is only correlated with the BRCM (ABI) because of its overlap with other more specific factors such as aggression. Other claims from the qualitative literature concern the impact of continuity and discontinuity. It has been suggested that discontinuity may be associated with a greater sense of burden from the caregiving role, negative emotional reactions to challenging care needs, and ambiguous feelings about remaining within the relationship; whereas continuity may be associated with a more person-centred understanding and management of challenging care needs (17, 21, 22, 25, 28, 29). A recent mixed-methods study in ABI that used the BRCM (ABI) provided support for the claim that continuity is associated with a more person-centred approach (45).

Strong family relationships are critical to good outcomes after acquired brain injury and it is important to understand the challenges that ABI presents to family relationships and how people respond to those challenges. Much of the work on this issue has been qualitative but there has been a lack of integration of the ideas arising from this research. Relationship continuity/discontinuity offers a framework that links together a range of caregiver responses to the challenges presented by ABI. The BRCM (ABI) appears to offer a reliable and valid measure of this. Its development will enable the more robust quantitative evaluation of several suggestions arising from the qualitative literature about the construct. It will also be useful in other investigations of continuity/discontinuity. For example, it could be used to evaluate whether relationship therapy, focused on reconnecting the couple with their pre-injury relationship, results in change to a partner's experience of discontinuity. It would also be of interest to explore if the notion of relationship continuity/discontinuity applies to the experience of the person with ABI. Differences in the experience of the caregiving partner and the person the ABI in this respect could itself have a damaging effect on the relationship.

Conflict of Interest

The authors report no conflict of interest.

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Appendix 1

Birmingham Relationship Continuity Measure (ABI)

This questionnaire is about changes in your husband (partner), and in your relationship with him, since the brain injury happened. In deciding on your answer, please think about how things were before the brain injury and how things are now.

Please read each question carefully. Circle or otherwise mark the response that best expresses your view (as shown in the example). Please answer ALL the questions.

Example

	Caring for my partner can be difficult	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
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1	He is more interested in himself now than he is in me or our relationship.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
2	The brain injury has brought us closer together emotionally.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
3	I miss having someone to turn to when I need some comfort or support.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
4	I care for him, but I don't love him the way I used to.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
5	We still do things together that we both enjoy.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
6	I feel like his carer now, not his wife (partner).	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
7	Since the brain injury, his personality is very different.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
8	I don't feel about him the way I used to.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
9	Our relationship has changed beyond recognition since the brain injury happened.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
10	Despite all the changes, he's still his old self.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
11	The bond between us isn't what it used to be.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
12	I miss having someone to share my life with.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
13	Sometimes I feel it's like living with a stranger.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
14	I feel shut off from him.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
15	We face our problems as a couple, working together.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
16	Despite all the changes, our relationship has	Strongly agree	Agree	Not sure	Disagree	Strongly disagree

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	remained much the same as it was.					
17	Compared to how he used to be, he's a different person altogether now.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
18	I feel like I've lost the person I used to know.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
19	It's like there's a barrier between us now.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
20	I don't feel I really know him anymore.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
21	The bond between us is as strong as ever.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
22	He still has many of the same qualities that first attracted me to him.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
23	It doesn't feel like a partnership anymore.	Strongly agree	Agree	Not sure	Disagree	Strongly disagree

This is the version for use where the person with ABI is male. An alternative version is available for when the person is female which involves changing the pronoun as necessary.

Scoring:

'Strongly agree' scored as '1'; 'Agree' as '2'; and so on up to 'Strongly disagree' scored as '5'.

Scores are reversed on items 2, 5, 10, 15, 16, 21, 22

Higher scores indicate a greater sense of relationship continuity.

Overall total obtained by summing across all items.

Subscale totals can be obtained by summing the items as follows:

- Relationship redefined: items 6,9,16
- Same/different feelings: items 2,4,8,11,14,19, 21
- Same/different person: items 7, 10, 13, 17, 20, 22
- Couplehood: items 1, 5, 15, 23
- Loss: 3, 12, 18

APPENDIX 2: Descriptive statistics for subscale totals of BRCM (ABI)

	Mean	SD	Obtained range	Cronbach's alpha
Relationship redefined (3 items)				
Study 1	7.4	3.1	3 to 13	.660
Study 2	6.9	3.3	3 to 15	.785
Same/different feelings (7 items)				
Study 1	20.5	7.3	7 to 35	.893
Study 2	19.7	7.8	7 to 35	.913
Same/different person (6 items)				
Study 1	16.9	6.7	6 to 30	.880
Study 2	14.8	6.7	6 to 30	.876
Couplehood (4 items)				
Study 1	12.2	4.4	4 to 20	.832
Study 2	10.8	4.6	4 to 20	.840
Loss (3 items)				
Study 1	6.4	3.0	3 to 15	.749
Study 2	5.7	3.2	3 to 15	.829

Table 1. Demographic information about the participants and their partners

	Study 1 (N=50)		Study 2 (N=53)	
	Participants	Person with ABI	Participants	Person with ABI
Gender	Male = 30 Female = 20	Male = 20 Female = 30	Male = 28 Female = 25	Male = 25 Female = 28
Age	Mean= 59.4 SD= 12.3 Range= 33 to 81	Mean= 61.66 SD= 12.29 Range= 35 to 85	Mean= 57.11 SD= 12.70 Range= 36 to 81	Mean= 57.91 SD= 13.15 Range= 35 to 85
Ethnicity	White British = 32 British Asian=9 Other = 9	White British= 36 British Asian= 6 Other = 8	White British= 35 British Asian= 10 Other = 8	White British= 32 British Asian= 14 Other = 7
Religious belief	None = 16 Christian= 14 Muslim= 9 Hindu = 1 Missing = 11	None = 16 Christian= 14 Muslim= 9 Hindu = 1 Missing = 11	None = 20 Christian = 18 Muslim= 6 Missing= 9	None = 20 Christian = 18 Muslim= 6 Missing= 9
Employment status	Employed= 28 Unemployed= 11 Missing = 11	Unemployed= 50	Employed= 36 Unemployed= 8 Missing = 9	Employed = 8 Unemployed= 36 Missing = 9
Type of brain injury		Traumatic = 14 Stroke= 18 Missing = 18		Traumatic = 19 Stroke = 20 Missing = 14
Time since injury (in months)	Mean = 50.8 SD = 33.7 Range = 14 to 144		Mean = 43.8 SD = 30.4 Range = 12 to 144	
Duration of partnership (in years)	Mean= 33 SD= 13 Range= 7 to 55		Mean= 30 SD= 13 Range= 5 to 55	
Activities of Daily Living Questionnaire				Mean=66.6 SD=12.0 Range= 31 to 87 (possible range 0 to 100)

Table 2: Descriptive statistics for questionnaire measures in Studies 1 and 2

	Mean	SD	Possible range	Obtained range	Cronbach's alpha
Study 1 (N=50)					
CCS	9.1	2.5	6 to 18	6 to 14	.793
HSL	46.1	14.7	15 to 75	20 to 73	.953
BRCM (ABI)	63.2	22.1	23 to 115	23 to 112	.956
BRCM Retest	61.5	20.5	23 to 115	29 to 97	.956
Study 2 (N=53)					
RAS pre-injury	29.1	2.8	7 to 35	24 to 35	.849
RAS post-injury	12.2	4.8	7 to 35	7 to 28	.906
DAS	62.2	32.1	0 to 151	22 to 137	.967
BRCM (ABI)	57.8	23.4	23 to 115	23 to 113	.963

CCS = Closeness and Conflict Scale

HSL = Heartfelt Sadness and Longing subscale of the Caregiver Grief Inventory

BRCM (ABI) = Birmingham Relationship Continuity Measure for Acquired Brain Injury

RAS = Relationship Assessment Scale

DAS = Dyadic Adjustment Scale

Table 3: Correlations in Studies 1 and 2

Study 1				
	BRCM	CCS		
HSL	r= -.732 p<.001	r= -.666 p<.001		
CCS	r=.911 p<.001			
Study 2				
	BRCM	RAS (pre- injury)	RAS (post- injury)	RAS difference
RAS (pre- injury)	r=.056 p=.717			
RAS (post- injury)	r=.854 p<.001	r=.025 p=.870		
RAS difference	r=-.693 p<.001	r=.491 p<.001	r=-.858 p<.001	
DAS	r=.669 p<.001	r=.080 p=.608	r=.670 p<.001	r=-.520 p<.001

CCS = Closeness and Conflict Scale

HSL = Heartfelt Sadness and Longing subscale of the Caregiver Grief Inventory

BRCM (ABI) = Birmingham Relationship Continuity Measure for Acquired Brain Injury

RAS = Relationship Assessment Scale

RAS difference = pre-injury RAS minus post-injury RAS

DAS = Dyadic Adjustment Scale