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The factor structure of the Revised Illness perception Questionnaire in a Population of
Oesophageal Cancer Survivors

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Abstract

Objectives

To determine whether the proposed 7-factor structure of the Illness Perception Questionnaire-Revised (Timeline Acute/Chronic, Timeline Cyclical, Consequences, Personal Control, Treatment Control, Illness Coherence and Emotional Representations) is appropriate among a population of oesophageal cancer survivors.

Methods

Everyone registered with the Oesophageal Patients' Association in the UK (n=2185) was mailed a questionnaire booklet which included the Illness Perception Questionnaire-Revised. Responses from 587 oesophageal cancer survivors (27%) were subjected to a confirmatory factor analysis.

Results

The proposed 7 factor structure provided a reasonable fit of the data. Modification indices suggested that a significantly better fit could be provided if one of the items on the Timeline Acute/Chronic factor loaded on the Treatment Control factor and an error covariance was added between 2 other items on the Timeline Acute/Chronic factor.

Conclusions

The model fit for the 7 factor structure proposed by Moss-Morris et al. (2002) was found to be adequate in our study. However, the structure of the timeline acute/chronic factor needs to be considered, particularly when the IPQ-R is to be used among older people with a potentially life-threatening illness or those receiving palliative care.

Keywords:

Cancer; oncology; oesophagus; factor analysis, illness perceptions

Introduction

Illness perceptions are the cognitive and emotional representations of illness held by an individual. Within Leventhal's Self-Regulatory Model [1], illness perceptions are considered to affect and be affected by coping strategies and this bidirectional process is considered to be an important pathway in explaining adjustment to illness. Leventhal's Self-Regulatory Model (SRM) suggests that when an individual is confronted with an illness or condition, they will attempt to assign meaning to this illness by accessing their perceptions about the illness. These illness perceptions will be influenced by the individual's emotional state and their emotional state will be influenced by their perceptions of the illness. The SRM proposes that, in an effort to restore normal functioning, individuals will develop coping strategies (based on their illness perceptions and emotional state), which will then be evaluated in terms of their success in restoring equilibrium. The result of this evaluation may be a change in coping strategy and/or a change in perceptions about the illness. In summary, the model suggests that a person's perceptions about an illness and their coping strategies can have an impact on their psychological well-being.

Illness perceptions have been shown to explain a significant proportion of the variance in psychological well-being in head and neck cancer [2,3] and in breast cancer [4,5]. The nature of the relationships between psychological well-being and specific illness perceptions are important to consider in the design of interventions to improve well-being among these populations. Therefore, employing an instrument that provides a valid assessment of illness perceptions is crucial.

In all the studies cited above, the measurement instrument used was the Illness Perception Questionnaire-Revised (IPQ-R) [6]. The IPQ-R is a revised version of the Illness Perception Questionnaire (IPQ) [7]. The IPQ assessed 5 illness perceptions: identity (perceptions of symptoms associated with the illness), controllability/curability of the illness, timeline for the illness, consequences of the illness and cause of the illness. The IPQ-R added items designed to assess illness coherence (the person's perceptions of the extent to which they understand the illness) and emotional representations (the extent to which the person's illness makes them experience symptoms of anxiety or depression). The authors of the IPQ-R also divided the timeline dimension into 2 factors (timeline cyclical and timeline acute/chronic) and divided the cure/control dimension into 2 factors (personal control and treatment control). Timeline cyclical refers to the perception of the cyclical nature of the illness across time; timeline acute/chronic is the person's perception about the illness passing quickly or not. Personal control refers to perceptions of the person's ability to control the illness, whereas treatment control refers to perceptions about the effectiveness of any treatment or the effectiveness of medical personnel to control the illness.

Moss-Morris et al. [6] provide evidence for the validity and reliability of these dimensions when tested among a group of 711 people from 8 different illness populations and, although this evidence is convincing, people with cancer were not included in the study. This is an issue of concern for anyone wishing to use the IPQ-R among people with cancer as the factor structure of the IPQ and the IPQ-R has been shown to differ among different illness populations [8-14]. Clearly, then, it is important that the validity of the proposed factor structure for the IPQ-R is demonstrated at the specific population level before the instrument can be recommended for use among this population.

The present study aims to examine the validity of the proposed factor structure of the IPQ-R among a population of oesophageal cancer survivors. The incidence of oesophageal cancer has been increasing for several decades [15]. Symptoms of oesophageal cancer

include: difficulty in swallowing (dysphagia); unexplained weight loss; pain in the form of pressure or a burning sensation as the food goes down the oesophagus; hoarseness or a chronic cough; vomiting; hiccups. Overall the prognosis for oesophageal cancer is poor, with the 5 year survival rate currently at 8%, although survival rates are increasing and are higher among people who are able to have an oesophagectomy [16].

This prognosis is an obvious potential cause of distress for the patient with oesophageal cancer. Furthermore, the potential consequences of living with oesophagectomy, such as difficulty eating and regurgitation of food can impact on the quality of life of oesophageal cancer survivors [17,18]. There are unique difficulties faced by people depending on the location of their cancer [19] and, in the case of oesophageal cancer, these are related to the poor survival rates and the problems experienced after oesophagectomy, which can impact adversely on social functioning [20].

The assessment of the factor structure of the IPQ-R within this population will be conducted using a confirmatory factor analysis approach. Previous research [6,12,14] has used principal components analysis for this purpose. Principal components analysis identifies which items in a questionnaire assess the same constructs. This means that the scores for particular items which correlate most strongly with each other are considered to load on the same factor. Given that principal components analysis could suggest a range of slightly different solutions, all of which could be equally valid, confirmatory factor analysis is required to add further weight to the chosen solution. Confirmatory factor analysis is a means of testing and confirming the factors proposed by the principal components analysis, i.e. it tests the fit of the model proposed. Previous research has advocated the use of confirmatory factor analysis in assessing the factor structure of the IPQ-R [8-11]. No previously published research exists which has examined the factor structure of the IPQ-R when used among a population of oesophageal cancer survivors and no previously published research exists which has used a confirmatory factor analysis approach to test the hypothesised factor structure of the IPQ-R when used among a population of cancer survivors.

Method

Participants were recruited via the Oesophageal Patients' Association (OPA) UK database. The OPA is a patient support group formed to help patients and their families cope with the difficulties arising from the treatment associated with oesophageal cancer. All oesophageal cancer survivors on the OPA database were mailed a questionnaire booklet containing the IPQ-R. Items on the IPQ-R are separated into nine dimensions: timeline acute/chronic (items 1-5, 18), timeline cyclical (items 29-32), personal control (items 12-17), treatment control (19-23), consequences (items 6-11), cause (items 39-56), illness coherence (items 24-28), emotional representations (items 33-38) and identity. The items relating to the identity dimension were omitted from this analysis, as they are a symptom checklist and have a different scoring system and purpose from the remaining items. Furthermore, the items relating to causes are not considered to be a single dimension but in any study using the questionnaire are either treated as separate items or subjected to an exploratory factor analysis. Consequently, there is no suggested factor structure imposed on these items and, therefore, a hypothesised model cannot be tested. Therefore, the 18 items relating to causes were omitted from the analysis presented here. This left a total of 38 items. Each item is scored 1 to 5 on a 5 point response scale ranging from strongly disagree to strongly agree.

Comparison of scores obtained in a sample with scores obtained in previous research is one method of highlighting potential bias in the sample. Unfortunately, no previously

published research has used the IPQ-R among oesophageal cancer survivors and, therefore, it was not possible to compare scores on this measure with scores from other samples. However, illness perceptions have been shown to be strongly related to psychological health [2-5]. Therefore, in order to compare the level of psychological distress reported by the sample with similar samples from previously published research, participants were also asked to complete the Hospital Anxiety and Depression Scale (HADS) [21]. This is a 14 item scale which is divided into two dimensions – anxiety (7 items) and depression (7 items). Respondents choose one from four responses to each item. Their responses are then summed within dimensions and a total score for each dimension is obtained, with higher scores representing higher levels of anxiety and depression. The HADS is the most frequently used screening tool for psychological distress in cancer care [22].

Statistical Analysis

Confirmatory factor analysis of the data was conducted using LISREL version 8.8 [23] to test the 7 factor structure proposed by Moss-Morris et al. [6]. Modification indices were then assessed to determine if the model fit could be improved, on the basis that the suggested modifications were justifiable in terms of content validity. Suggested models were then compared to the original factor structure using a range of indices [24]. The goodness of fit for each model was assessed using a range of fit indices including chi-square, the Adjusted Goodness of Fit Index (AGFI) [25], and the Comparative Fit Index (CFI) [26]. For the CFI, values greater than 0.95 are considered to reflect acceptable model fit [27]. Model fit is better when values of the chi-square statistic are smaller and values of the AGFI are greater, with an AGFI value of 1 indicating a perfect fit. In addition, the Root Mean Square Error of Approximation (RMSEA) [28] with 90% confidence intervals (90% CI) were reported, where a value less than 0.05 indicates close fit and values up to 0.08 indicating reasonable errors of approximation in the population [29]. The standardized root-mean-square residual (SRMR) [30] has been shown to be sensitive to model mis-specification and its use is recommended [27]. Values less than 0.08 are considered to be indicative of acceptable model fit [27]. The comparative fit of the models was also assessed using the Parsimony Goodness of Fit Index (PGFI) [31], an index used for the purposes of model comparison which takes into account the number of parameters being estimated, with the largest value (closest to 1) being indicative of the best fitting model.

Results

Of the 2,185 people who were mailed questionnaires, 587 responded (27% response rate). Respondents were, on average, 65 years old ($SD = 9.94$; range = 33 to 90 years) and approximately 66% (387/587) were male. They had received a diagnosis of oesophageal cancer for a median time of 45 months prior to completing the questionnaire (16% diagnosed less than 1 year ago; 17% 1 to 2 years; 10% 2 to 3 years; 9% 3 to 4 years; 11% 4 to 5 years; 8% 5 to 6 years; 5% 6 to 7 years; 24% beyond 7 years and up to 40 years). Length of time since diagnosis was correlated only weakly with scores on the IPQ-R (magnitude of the correlation coefficients ranged from 0.001 to 0.164).

The sample is similar, in terms of gender, to available statistics about oesophageal cancer in the UK in 2006 (64% male) (Cancer Research UK, 2009). Furthermore, the HADS scores (Mean (SD): anxiety 6.42 (4.90); depression 4.91 (4.10)) were similar to that reported for people with other head and neck cancers [2,32].

The 7 factor structure proposed by Moss-Morris et al. [6] provided a reasonable fit of the data (model 1), however, modification indices suggested that reasonable and important changes could be made by adding a path from the treatment control factor to item 18 from the timeline acute/chronic factor (model 2) and, additionally, by adding a covariance path between the error terms for items 1 and 4 from the timeline acute/chronic factor (model 3). All other suggested modification indices would have resulted in considerably smaller changes to the chi-square statistic and therefore were deemed unworthy of consideration. The fit indices for the 3 models are reported in Table 1.

- Table 1 here -

For all models, the chi-square value is large and statistically significant. However, the RMSEA, CFI and SRMR indicate that all models provide a reasonably good fit of the data. All the fit indices show that the third model in Table 1 provides the best fit of the data. Using the difference in the chi-square statistics, each model is a significant improvement on the previous one, but the confidence intervals for the RMSEA suggests that only model 3 differs from model 1.

Figure 1 presents the factor loadings for model 1. All the factor loadings are greater than 0.4, indicating that the items load at least adequately on the factors to which they have been ascribed. The lowest factor loading in model 1 is for item 18, which loads on the timeline acute/chronic factor. Figure 1 also presents the modified factor loadings (in parentheses) for the timeline acute/chronic and treatment control factors for model 3 (all other factor loadings in model 3 are the same as those in model 1). Again, the lowest factor loading is the loading for item 18 on the timeline acute/chronic factor. All other factor loadings are well above 0.4, including the factor loading for item 18 on the treatment control factor. This suggests that item 18 is more closely associated with the other items on the treatment control factor than with the other items on the timeline acute/chronic factor. In model 3 the coefficient for the error covariance between items 1 and 4 was 0.31.

- Figure 1 here -

Table 2 shows the intercorrelations between the factors in model 1. The magnitude of the correlation coefficients presented in Table 2 suggest that the personal control and treatment control factors are moderately correlated, as are the emotional representations and consequences factors. All other factor intercorrelations are weak. Only very small changes are apparent to any of these correlation coefficients in model 3.

- Table 2 here -

Discussion

The research presented here aimed, for the first time, to examine the hypothesised factor structure of the IPQ-R among a population of oesophageal cancer survivors. Our findings suggest that although the hypothesised factor structure provides a reasonable fit of the data, the fit can be improved by making 2 adjustments to the timeline acute/chronic domain.

Firstly, item 18 appears to be more related to the treatment control factor than the timeline acute/chronic factor. Item 18 assesses the belief that the illness/condition “will improve in time”. The other items on the timeline acute/chronic scale refer to the length of time the illness/condition will last and make no reference to improvement or deterioration of the condition. Perhaps the reference to improvement made by item 18 elicits thoughts about the controllability of the condition rather than thoughts about chronicity. It is also possible that item 18 is related to the treatment control factor because it is placed just before the other

treatment control items in the questionnaire and separate from the other timeline items. Previous research has found that item 18 did not load significantly on the timeline acute/chronic factor and the researchers suggested that it be removed [9]; and that item 18 had the lowest factor loading of all the IPQ-R items included in their final model [12].

Secondly, items 1 and 4 from the timeline acute/chronic factor appear to share a significant proportion of their variance which is not explained by the timeline acute/chronic factor. Items 1 and 4 refer to the belief that the illness/condition “will last a short time” and “will pass quickly”, respectively. The remaining items on the timeline acute/chronic factor refer to the belief that the illness/condition “is likely to be permanent rather than temporary”, “will last for a long time”, and will be present “for the rest of my life”. Therefore, the items on the timeline acute/chronic factor show a tendency to divide into timeline acute and timeline chronic. This indicates that, to some extent, respondents can hold the belief that their condition is likely to be permanent but also to last for a short time. Perhaps this is a population-specific finding in that people who are diagnosed with oesophageal cancer generally have poor survival rates and tend to be older. Therefore, it may be that our respondents believed that the condition would remain with them for the rest of their lives, but that would be a short time. This highlights the need to carefully consider the structure of the timeline acute/chronic factor when the IPQ-R is used among older people with potentially life-threatening chronic illnesses or people receiving palliative care.

Our analysis also found that the personal control and treatment control factors were moderately correlated ($r = 0.57$), as were the emotional representations and consequences factors ($r = 0.53$). All other factor intercorrelations were weak. Correlation coefficients of a similar strength between the 2 control factors have been reported previously in a study of people diagnosed with cancer [12] and Chen et al. [9] suggested that a higher order control factor could be created from the treatment control and personal control factors, in a study among people with hypertension. On the other hand, a weak correlation between these 2 factors has been reported when the IPQ-R was administered to women attending cervical screening [10]. Therefore, the overlap between these factors may be population-specific.

The degree of overlap between the emotional representations and consequences factors, however, has been found in all published studies examining the factor structure of the IPQ-R. The correlation found in the present study was the same as that reported previously [6]. Other researchers have found a correlation between these factors as high as 0.82 [10]; have suggested that the consequences and emotional representations factor contribute strongly to a higher order factor labelled negative illness representations [9]; and have proposed that the items from these 2 factors should be combined and treated as a single factor [12]. These findings raise questions about the distinctiveness of the constructs purportedly assessed by these items, which the Transactional Model of Stress [33] may help us to understand. Within the Transactional Model, cognitive appraisal represents a consideration of the person’s ability to cope with a stressor. If the outcome of the appraisal process is that the person feels unable to cope with the stressor, then this can have an adverse impact on health outcomes, such as psychological distress. Given the consistently-found relationship between perceptions of severe consequences and negative emotions, then it may be the case that the items on the consequences factor represent the outcomes of an appraisal process, i.e. perception of the consequences after a consideration of the resources available to cope with these consequences.

This distinction has important implications for interpreting research using the IPQ-R. A considerable amount of research has employed the IPQ-R in an effort to test hypotheses derived from Leventhal’s Self-Regulatory Model (SRM). Specifically, researchers often

attempt to determine whether a measure of coping mediates the relationship between illness perceptions and psychological well-being. This approach appears to use illness perceptions, such as perceptions of consequences, as a representation of the outcome of the primary appraisal process (in the terms of the Transactional Model). The majority of research in this area has found no mediating role for coping and, in fact, has found that coping adds little to the explanation of variance in psychological well-being after we have accounted for illness perceptions, especially where the consequences scale is found to be related to well-being [34-36]. However, if we were to consider the assessment of consequences as a measure of the outcome of an appraisal process, then we are suggesting that coping has already been considered before the responses are provided to the items on the consequences scale, i.e. the measure of consequences is confounded with the measure of coping. In fact, the SRM proposes that the relationship between coping and illness perceptions is bidirectional and, therefore, it could be argued that the IPQ-R is an appropriate operationalisation of the illness perceptions component of the SRM, but, it would not be possible to tease out the true mediating effect of coping using the IPQ-R.

Although some of the findings of the present study are shared with previous research and, consequently, are helpful in discussions of the structure and purpose of the IPQ-R in general, the findings of the present study are restricted to the population of oesophageal cancer survivors. More particularly, the study findings are limited because they are based on a minority (27%) of the oesophageal cancer survivors who had registered with a patient support group (the Oesophageal Patients' Association). It is possible that patients involved with a support group may differ from other patients, in terms of important psychological constructs and it is possible that our response rate resulted in a bias sample in terms of the psychological constructs assessed. Unfortunately, no previous research exists which has assessed the illness perceptions of oesophageal cancer survivors and, therefore, it is not possible to establish the likelihood of bias in our sample by comparison with other findings. However, illness perceptions have been shown to be strongly related to psychological health [2-5] and the sample in the present study had similar scores on an assessment of psychological health when compared with survivors of other head and neck cancers [2,32].

In summary, the model fit for the 7 factor structure proposed by Moss-Morris et al. [6] was found to be adequate in our study, with goodness of fit indices similar to those found in previous research [9,10]. However, as with this previous research, we have suggested some modifications to the factor structure which improves the model fit. These modifications and the conceptual issues raised by our analysis should be considered by clinicians and researchers who intend to use the IPQ-R, particularly among a population of cancer survivors.

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Table 1
Fit Indices for Hypothesised Models

	Model 1	Model 2	Model 3
χ^2 (df) p	2387.07 (644) < .001	2205.72 (643) <.001	2042.80 (642) < .001
RMSEA (90% CI)	0.068 (0.065, 0.071)	0.064 (0.061, 0.067)	0.061 (0.058, 0.064)
CFI	0.94	0.95	0.95
SRMR	0.070	0.061	0.060
AGFI	0.80	0.81	0.82
PGFI	0.72	0.72	0.73

Table 2
Factor Intercorrelations for Model 1

	Consequences	Personal Control	Treatment Control	Illness Coherence	Timeline Cyclical	Emotional
Timeline A/C	0.40***	-0.16***	-0.32***	0.10*	0.19***	0.13**
Consequences		-0.24***	-0.22***	-0.08 [†]	0.37***	0.53***
Personal Control			0.57***	0.20***	0.10*	-0.27***
Treatment Control				0.28***	-0.18***	-0.24***
Illness Coherence					-0.25***	-0.42***
Timeline Cyclical						0.30***

***p < .001; **p < .01; *p < .05; [†]p = .053

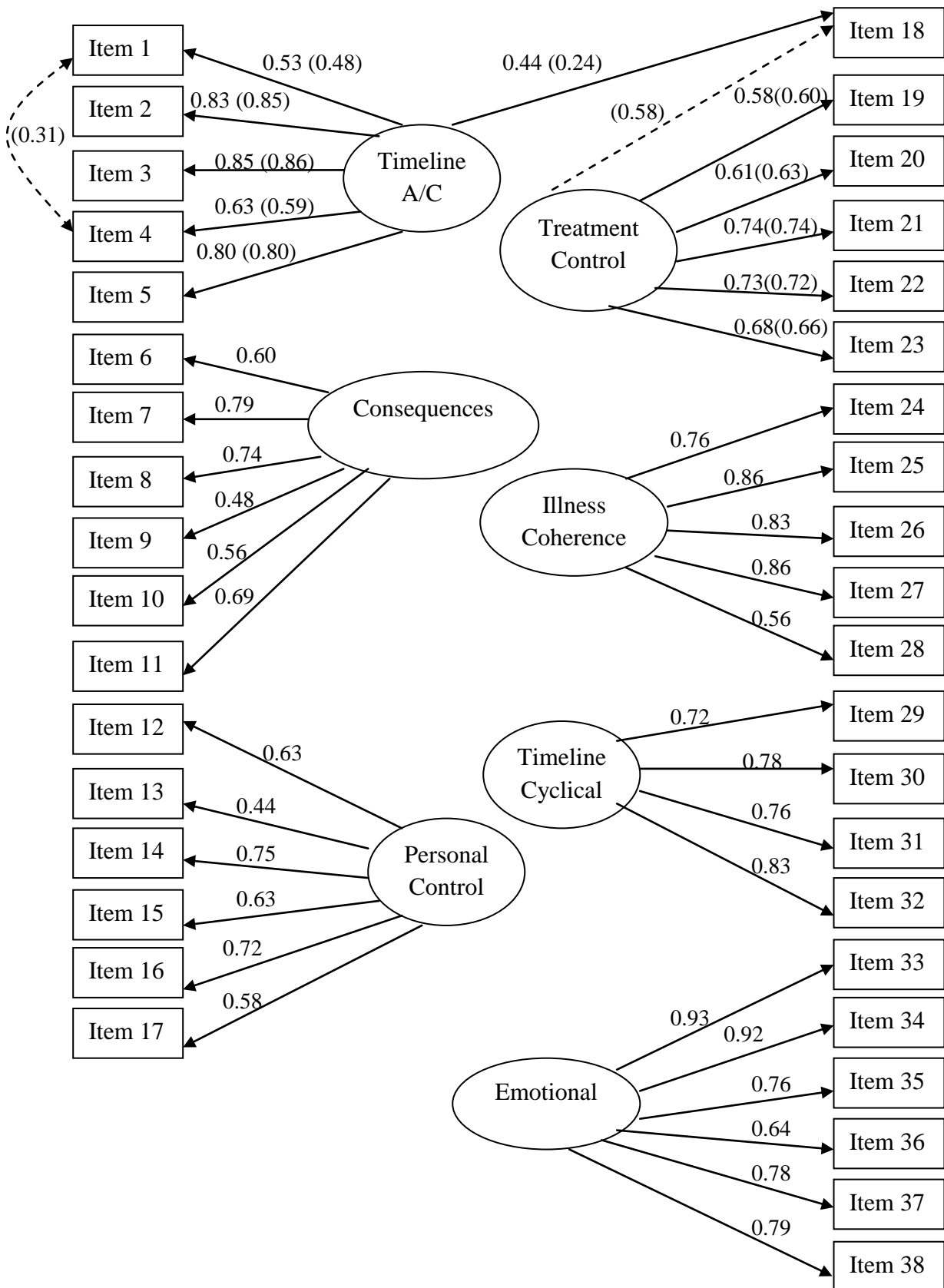


Figure 1: Factor loadings for the IPQ-R

The circles indicate the 7 factors that represent the subscales of the IPQ-R. The solid lines with arrows point to the item number on the questionnaire that is hypothesised (by the authors of the IPQ-R) to comprise each subscale, with the accompanying value representing the factor loading for that item. The modified factor loadings under the revised model are shown in parentheses. The dashed line pointing to item 18 indicates that item 18 is hypothesised to load on the Treatment Control factor under the revised model. The dashed curve between item 1 and item 4 indicates that there is a hypothesised error covariance of 0.31 between these items under the revised model.