CHAPTER 7

THE CONTENT VALIDITY OF THE PEARLIN MASTERY SCALE IN SUB-SAHARAN AFRICA USING ITEM RESPONSE THEORY

SUBMITTED

Marike Alferink
Rob R. Meijer
Chantal Agossadou
Willemina Foppen
Sandor Klis
Ahmed M. Bello
Tjip S. van der Werf
Ymkje Stienstra
Maya J. Schroevers
Adelita V. Ranchor
Chapter 7

ABSTRACT

The Pearlin mastery scale measures personal control; an important psychological resource. The scale has been used in African populations without validation. This study examined the content validity of the Pearlin mastery scale in Sub-Saharan Africa, using item response theory. Cross-sectional interviews were used in four African countries (Benin, the Democratic Republic of Congo, Ghana, and Nigeria, total N=421), and questionnaires in the Netherlands (N=1736). Four items (1, 2, 3, 5) were informative in measuring personal control; two items (4, 6) were uninformative in both the African and the Dutch group. Item 7 was only informative in the Dutch group.
INTRODUCTION

In the past three decades, numerous studies have consistently shown the importance of personal control as a psychological resource, with high personal control related to better psychological [1] and physical health outcomes [2,3], while a perceived lack of control has been related to psychological distress [4].

Several closely related descriptions of control exist in the literature, such as Pearlin’s concept of mastery [5], and Rotter’s locus of control (LOC, [6]. Pearlin et al. (1981) focused on the extent to which people perceive a sense of control over circumstances which are important to their lives. This is related, but slightly different from the description by Rotter et al. (1966), referring to the perceived controllability of circumstances (internal control) as opposed to the feeling that factors outside of one’s own control cause an event (external control).

In research on personality and health, the Pearlin mastery scale is one of the most widely used instruments to measure mastery [2,7-11]. The scale includes seven items, five negatively formulated items measuring low mastery, e.g., *I have little control over things that happen to me*, and two reversed formulated and coded positive items measuring high mastery, e.g., *I can do just about anything I really set my mind to*. The Pearlin mastery scale was developed and generally used in western countries, and its psychometric properties have not been tested in non-western, African countries.

The concept of control across cultures

Pearlin et al. (2007) thought of mastery as an important self-concept that grows out of the structure of experience, and can change with important life events [12]. Self-concepts differ from personality traits, which are known to have a strong biological basis, and are remarkably similar across cultures [13]. Mastery could have a different meaning across cultures, because of cross-cultural differences in the social context [7]. Indeed, a recent review showed that while external control is associated with unfavorable outcomes in individualistic cultures, it does not seem to have the same negative consequences in collectivistic cultures. This suggests potential cross-cultural differences in valuing and obtaining personal control [14].
In order to examine cross-cultural differences in the relation between mastery and (health) outcomes, the validity of the used instrument has to be established first. This is important, because ‘validity must refer to a context and a construct, not to a test, and is relevant to the interpretation of scores on a test’ [15]. Despite this, the Pearlin mastery scale has been used in African populations without investigating its psychometric properties [16,17].

Psychometric analyses usually include the examination of the criterion, convergent, and divergent validity of a scale. However, when testing the Pearlin Mastery scale in Sub-Saharan Africa, these analyses are hampered by the lack of validation of related constructs. Therefore, this study focused on the content validity, which is the extent to which an instrument covers important aspects of the latent trait that the instrument is supposed to measure. Thereby, we focused on whether all items of the Pearlin mastery scale reflect the latent trait. This is recommended to be examined by using item response theory (IRT) [28,34,35].

The use of item response theory

IRT has recently gained more attention as a useful addition to classical test theory methods, such as Cronbach’s alpha, and principal component analyses [18]. With IRT it is possible to describe the relationship between a latent trait, mastery (denoted by θ), and people’s responses to the items of a scale. Each respondent has his or her own true location on this dimension, based upon the responses of this person to the items. Similarly, each item has its own location (the difficulty of the item), referring to whether the items measure severe or mild levels of mastery. The relationship between the person’s location on the latent trait and the probability of responding positively to an item is the item response function (IRF). IRF’s are assumed to be monotonically increasing, which means that when an individual’s mastery score increases, the probability of responding positively to an item should also increase. The extent to which this is true is proportionate with how informative the item is in measuring mastery.

To date, only two studies used IRT to study the Pearlin mastery scale, in a Chinese and a Swedish sample [19-21]. In both studies, all items were found to be informative in measuring mastery. However, item difficulty was different for the two positively and subsequently reversed scored items (4 and 6) showing that
these items were most easily endorsed, thus, measured the lowest levels of the latent trait.

This study is the first to examine the content validity of the Pearlin Mastery Scale in Sub-Saharan Africa. Moreover, results from the African group were compared to a Dutch group, to examine the equivalence of the scale across both cultures.

**METHODS**

**Participants and sampling**

Five groups were included in this cross-sectional study: three community-based groups (from Benin, the Democratic Republic of Congo, and Ghana), a group of tuberculosis (TB) patients from Nigeria, and a community-based group from the Netherlands (Table 1). The data from the four African groups were collected between January 2010 and November 2011, as part of a larger study on psychological factors and delay in Buruli ulcer [33] or TB. Data from the Dutch group were collected between January 2010 and October 2012 as part of a study on wellbeing after cancer diagnosis.

The community-based participants in Africa were aged ≥ 18 years, currently not diseased with or treated for any kind of disease, and living in rural, remote areas. Selection of participants was systematically done by use of a multi stage sampling procedure [22]. The group from Northern Nigeria consisted of tuberculosis patients, aged between 16 and 65 years. Patients were included during a routine visit at the Kano State Hospital - Infectious Disease Hospital. The response rate ranged from 95-99% in the African groups.

Participants in the Dutch control group were aged ≥ 18 years, and living in the north and east of the Netherlands. A number of 7492 people were randomly selected and approached via mail. Of those, 24.4% returned the questionnaire. Patients with >15% of data missing were excluded, leading to data from 1736 participants to be included.

**Data collection, interviewers and procedures**

In Sub-Saharan Africa, data were collected by a semi-structured interview. All interviews were held in private settings in villages (Benin, Congo, Ghana) or in a room attached to the hospital (Nigeria). All interviewers were native, experienced
interpreters, and trained in administering the interview in the local language. They engaged in an interview-training program covering the study procedures, general interview skills, and possible biases in interviewing. The interviews were performed either in one of the native local languages (Fon or Adjia in Benin, Twii in Ghana, Kikongo or Lingala in Congo, and Hausa in Nigeria) or the official national language (French in Benin and Congo, and English in Ghana and Nigeria). Before interviews were conducted, discrepancies in translation were resolved through discussion among the interviewers, local supervisor, and researcher to retain the meaning of the original questions. On a regular basis, an independent health worker listened to the interviews to ensure accuracy of translation.

In the Dutch control group, data were collected with paper-pencil questionnaires. Information about the study was sent together with an informed consent and a return envelope. After receiving the informed consent from the participant, the investigator sent the questionnaire with return envelope to the participant.

**Measures**

**Personal control**

Pearlin and Schooler developed a mastery scale that measures the extent to which people feel they are in control of their own life [5]. This scale is composed of five negatively formulated items (fatalistic) and two positively formulated items (control). Answers are rated on a five-point Likert scale, coded from 1 = strongly agree; to 5 = strongly disagree (and reversed for the two positive items). A total score is calculated (range 7–35), with higher scores indicating higher levels of control. Good internal consistency reliability was found in previous studies [11,23,24]. Only one study examined the reliability of a 4-item version of the test among South African adults, which was good (Cronbach’s alpha was .82) [16].

**Statistical analysis**

SPSS version 20 was used to present descriptive statistics. IRT analyses were performed with IRT PRO 4.54 and MSPWIN 5.0 [25]. Data were checked for missing values. Since IRT analyses allow no missing values, all cases were removed resulting in two samples of 404 African and 1710 Dutch participants.

Two IRT models were used: the non-parametric Mokken model of monotone homogeneity [26] and the parametric graded response model [27]. The models
were used to examine the *scalability* and *item difficulty* of the Pearlin mastery scale.

Scalability was examined using the item and scale’s $H$ values from the Mokken model. $H_i$ values < .30 were removed, however, the decision was made incorporating information on the item content. Since the Dutch control group was older, higher educated and less often employed compared to the groups from Africa, the Mokken analyses was performed for the whole Dutch group, and repeated on a selection of the Dutch group with age and level of education similar to the African groups to see the influence of these factors on the IRT results.

Scalability and item difficulty were further examined in the Sub-Saharan African group, by examining the item parameters under the graded response model. The steepness of the slope ($a$) indicates the strength of the relationship between the item and the latent trait, with alpha values > 1 indicating a sufficiently strong relationship (scalability). The intercepts ($b$) provide information on whether the item measured a low or a higher level of personal control (item difficulty).

Assumptions were checked by examining the $S$-$\chi^2$ item level diagnostics from the graded response model. Observed and expected response functions were compared, and showed for most items an acceptable fit at a 0.01 level. However, for items 2, 3, and 7, the differences between observed and expected proportions were relatively large. Moreover, the marginal fit and the standardized local dependence ($\chi^2$-statistic) were inspected. Values > 5 are suspicious, and values > 10 point at misfit. The majority of values was within the required range and only some were larger than 5 or 10. Therefore, we conclude that the model gave a sufficient description of the data.

**RESULTS**

**Scalability**

Scalability among most of the items in the African group ($N = 404$) was sufficient with $H_i$ values >.30 for items 1, 2, and 3, and a value very close to .30 (.29) for item 5. Items 4, 6, and 7 were rejected because $H_i$ values were low (respectively .09, .06 and .12, see Table 2). The average $H$ of the final scale was .33 in the African group.
In the Dutch group \((N = 1710)\), most \(H\) values were > .30, except for item 4 (.26) and item 6 (.20). The overall scale \(H\) value was .51. Hence, items 4 and 6 were unscalable in both groups, while item 7 was unscalable only in the African group. We repeated the Mokken analysis for a selection of the Dutch group (with similar age and education level to the African group), and similar results were found, suggesting that differences in age and level of education were not responsible for the different IRT results in both groups.

**Scalability for each of the Sub-Saharan African groups separately**

Scalability of the items for each of the Sub-Saharan African countries was performed separately to verify whether the results for the total group hold for each group. The results of the total Sub-Saharan African group were similar for Ghana and Nigeria, while in the Democratic Republic of Congo, only the \(H_i\) values of items 4 and 6 were low. For Benin, all items were rejected. The fit of items set together was acceptable in the Democratic Republic of Congo \((H = .44)\), Ghana \((H = .40)\) and Nigeria \((H = .40)\), and low in Benin \((H = .20)\). Thus, the results for the total Sub-Saharan African group were replicated in the groups from the Democratic Republic of Congo, Ghana and Nigeria, but not in Benin.

**Item difficulty and discriminative ability in the Sub-Saharan African group.**

Table 2 presents the item parameters under the graded response model in the Sub-Saharan African group. The slopes \((a)\) and intercepts \((b)\) form the basis for the Information Functions presented in Figure 1. Item 1, 2, 3, and 5 had \(a\) values > 1, indicating that these items have sufficient discriminative power. The \(a\) parameter of items 4, 6, and 7 were < 1, which is depicted by the flat slopes in figure 1, indicating that these items do not differentiate well between different levels of mastery. When looking at the first intercept \((b_1)\), items 4 and 7 have higher negative values, compared to the items 1, 2, 3, 5 and 6, indicating that these items measured the lowest mastery levels.
DISCUSSION

This study showed that four negatively formulated items of the Pearlin mastery scale (items 1, 2, 3 and 5) were informative in measuring mastery among adults from Sub-Saharan Africa. The two positively worded items 4 and 6, as well as the negatively formulated item 7, were uninformative. Results were almost similar to a Dutch group (except for item 7 being informative in the Dutch, but not in the African group). Hence, the Pearlin mastery scale may be used as a 4-item version in Sub-Saharan Africa.

When examining the content of the informative items, There is really no way I can solve some of the problems I have (1), Sometimes, I feel that I’m being pushed around in life (2), I have little control over things that happen to me (3), and I often feel helpless in dealing with the problems of life (5) respectively, it becomes clear that these items are similarly negatively formulated, and measure low levels of mastery. This could be an explanation why they fitted well with each other and were informative in both groups. In contrast, the two uninformative items are positively worded and measure high levels of mastery I can do just about anything I really set my mind to (4) and What happens to me in the future mostly depends on me (6). This explanation regarding the type of formulation is supported by two previous IRT studies on the mastery scale [19,20]. The first study by Chen et al. (2008) showed similar results as our study, while Eklund and colleagues suggested to only remove item 6, because it measured a different construct. Generally, the reverse wording of items is often a reason for lower factor loadings in factor-analytic studies [28].

A possible solution would be to only use items which are worded in a similar direction. Whether this should be positive or negative, is depending on the conventional way of thinking about and framing events related to the concept in the study group. It might be that the meaning of the positively formulated items, measuring high levels of mastery, was less clear to the respondents, compared to the items measuring low mastery levels, especially in the African group. When assuming that low mastery is related to an external locus of control, support is found from the review by Cheng et al. (2013), in which Ghanaian participants reported more external sources of influence, and were more willing to accept that external control had an influence on them [14]. Since the extent to which people place trust on powerful others is culturally bounded, the conceptualization of
control, and not the wording of the item, could have been a reason for the unscalability of item 4 and 6 in the African group.

Item 7 *There is little I can do to change many of the important things in my life* was uninformative in the Sub-Saharan African, but not in the Dutch group. This item is also negatively worded, but it is also a more abstract item, referring to a more global issue in life than solving problems. It might be that such a general description of mastery was less meaningful to the respondents. An alternative explanation, suggested by Fok et al. (2012), is that cultural assumptions about the nature of mastery play a role. They found that some of their Antarctic respondents noted that sometimes ‘everything happens for a reason’, irrespective of one’s own actions and behavior [29]. If this also played a role in our African group, item 7 might have had a different meaning, by believing that one cannot change certain events in life, because things happen for a reason.

Therefore, future research should examine the conceptualization of mastery in a Sub-Saharan African context. Work by Heckhausen et al. (1995, 1999) and McCrae et al. (2013) suggest that the concept of mastery is universal. They claim that, from an evolutionary perspective, the strive for mastery, or control, is the result of a basic motivational mechanism favoring an active engagement with the environment, which is a universal trait of mankind. In other words, each person has, to some extent, the basic motive to strive for control, regardless of the (cultural) environment or experienced life events [13,30,31].

When interpreting our study, some limitations should be considered. First, our samples were rather small, since it was very difficult to gather large samples from rural, remote area’s in Sub-Saharan Africa. Therefore, all African samples were combined for our analyses. However, as a check, we repeated the IRT analyses for each country separately. Second, the translation of the Pearlin mastery scale into the local languages in Africa was an oral translation, since it is nearly impossible to write these local languages down. Although interviewers were thoroughly trained and an independent assistant listened to the translations regularly, it is possible that formulations differed between interviews. Third, differences in data gathering (i.e. interviews in Africa, and paper-pencil questionnaires in the Netherlands) may have influenced the results. However, high correlations between these two methods have generally been found [32].
Concluding, this study is a unique and first contribution on the content validity of the Pearlin mastery scale, used in rural Sub-Saharan Africa. By using advanced statistical analyses, results clearly demonstrated the usefulness of four items (1, 2, 3, and 5) as they were informative in measuring mastery in a population from rural Sub-Saharan Africa.
Table 1: Sample characteristics of the five study groups

<table>
<thead>
<tr>
<th>Sample</th>
<th>N</th>
<th>Description</th>
<th>Female sex N (%)</th>
<th>Age M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>421</td>
<td>173 (41.3)</td>
<td>35 (29)</td>
<td></td>
</tr>
<tr>
<td>Benin</td>
<td>130</td>
<td>Community members</td>
<td>52 (40.0)</td>
<td>36 (13)</td>
</tr>
<tr>
<td>Democratic Republic of Congo</td>
<td>99</td>
<td>Community members</td>
<td>30 (31.0)</td>
<td>36 (10)</td>
</tr>
<tr>
<td>Ghana</td>
<td>64</td>
<td>Community members</td>
<td>37 (57.8)</td>
<td>40 (19)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>128</td>
<td>Tuberculosis patients</td>
<td>54 (42.5)</td>
<td>32 (13)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1736</td>
<td>Community members</td>
<td>949 (54.7)</td>
<td>56 (17)</td>
</tr>
</tbody>
</table>
Table 2: Descriptive statistics and IRT parameters of the mastery scale for the Sub-Saharan African and the Dutch group

<table>
<thead>
<tr>
<th>Item</th>
<th>Sub-Saharan African group</th>
<th>Dutch group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Descriptive and Mokken</td>
<td>GRM parameters</td>
</tr>
<tr>
<td></td>
<td>statistics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M (SD)</td>
<td>r^it</td>
</tr>
<tr>
<td>1. There is really no way I can solve some of the problems I have</td>
<td>2.96 (1.17)</td>
<td>.34</td>
</tr>
<tr>
<td>2. Sometimes I feel that I'm being pushed around in life</td>
<td>2.38 (1.07)</td>
<td>.30</td>
</tr>
<tr>
<td>3. I have little control over the things that happen to me</td>
<td>2.68 (1.05)</td>
<td>.27</td>
</tr>
<tr>
<td>4. I can do just about anything I really set my mind to (recoded)</td>
<td>3.33 (1.09)</td>
<td>.23</td>
</tr>
<tr>
<td>5. I often feel helpless in dealing with the problems of life</td>
<td>2.78 (1.12)</td>
<td>.44</td>
</tr>
<tr>
<td>6. What happens to me in the future mostly depends on me (recoded)</td>
<td>3.68 (1.15)</td>
<td>.21</td>
</tr>
<tr>
<td>7. There is little I can do to change many of the important things</td>
<td>2.65 (1.21)</td>
<td>.25</td>
</tr>
</tbody>
</table>

H value final scale

| Sub-Saharan African group | H = .33 |
| Dutch group              | H = .51 |

Note: R^it = item-test correlation. GRM = graded response model
Figure 1: IRFs per Mastery item for the Sub-Saharan African group

Note: y-axis represents θ, x-axis reflects the probability of responding to each answering category 0, 1, 2, 3, 4 (each category has a separate line)
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