The German Version of the Herth Hope Index (HHI-D): Development and Psychometric Properties

Franziska Geiser\textsuperscript{a}  Katharina Zajackowski\textsuperscript{a}  Rupert Conrad\textsuperscript{a}  Katrin Imbierowicz\textsuperscript{a}  Ingo Wegener\textsuperscript{a}  Kaye A. Herth\textsuperscript{b}  Anne Sarah Urbach\textsuperscript{a}

\textsuperscript{a}Clinic for Psychosomatic Medicine and Psychotherapy, University of Bonn, Germany;  \textsuperscript{b}Dean Emerita, Minnesota State University, Mankato, MN, USA

Introduction

Using the method of concept analysis, hope has been defined as ‘a multidimensional, dynamic, empowering state of being, that is central to life, related to external help and caring, oriented towards the future and highly personalized to each individual’ [1]. The importance of hope in oncological care is intuitively and clinically evident for physicians, nurses, patients and relatives. Loss of hope goes along with lower functioning in both physical and psychological domains [2–5]. Although a lack of hope is associated with depression and anxiety [6, 7] hope as a multidimensional concept represents more than the absence of clinically relevant depressive and/or anxious symptoms. In a survey among oncologists, 58% declared ‘being honest but not taking away hope’ a major difficulty when discussing bad news with their patients [8]. Hope has been found to foster coping, psychological adjustment, and life satisfaction in groups as different as women with breast cancer, patients with advanced/terminal cancer, or family caregivers of cancer patients [9–11]. However, there is a lack of German-language instruments measuring hope that have a sound theoretical basis, sufficient psychometric properties and are suitable for clinical settings.

The Herth Hope Scale (HHS) and its short version, the Herth Hope Index (HHI), have been developed for clinical use, especially in oncological care [3]. They are based on the multidimensional concept of hope by Dufault and Martocchio [12], which makes a distinction between generalized and particularized hope and describes 6 dimensions of hope: affective (emotions and sensations), cognitive (thinking, interpreting, and desiring), behavioral (actions to affect hope and outcome), affiliative (relations to self, others, and a higher being), temporal (experience of time), and contextual (person life situation). Factor analysis revealed a 3-factor structure of the HHS compatible with the theoretical background, with the subscales ‘temporality and future’, ‘positive readiness and expectancy’, and ‘interconnectedness’. In the HHI, the number of items is re-
duced from 30 to 12, scaled on a 4-point Likert scale (see www.npcrc.org/files/news/herth_hope_index.pdf). The concurrent criterion-related validity with the HHS is high (r = 0.92). Scores range from 12 to 48, with higher scores indicating more hope. Its psychometric features as determined in a sample of 172 adult patients were more than satisfactory (Cronbach’s alpha 0.97, test-retest reliability within 2 weeks 0.91) [3]. Concurrent validity with other scales ranged from r = 0.92 with the Nowotny Hope Scale [13] to r = −0.73 with Beck’s Hopelessness Scale [14]. The 3-factor structure was retained and accounted for 41% of the total variance. The HHI has been widely used in research and clinical practice in different settings, especially in cancer patients from diagnosis to end-of-life care. Hope has been measured in relation to a variety of physical and psychological factors such as pain, fatigue, psychological distress, spiritual well-being, quality of life, and family support (e.g. [15–17]). Translations of the HHI into Swedish, Norwegian, Portuguese, Spanish, Italian, Dutch, Iranian, Japanese, and Chinese have been published, with satisfactory psychometric properties (e.g. [18–20]; for more information and request for use, please contact kaye.herth@mnsu.edu). However, the dimensionality turned out to be unstable across patient groups and cultures [20, 21]. No authorized German translation has been published up to date.

Material and Methods

The German Version of the HHI (HHI-D)
The translation was performed with permission of the constructor of the HHI. Each item was first translated into German by 4 native-speaking physicians and psychologists with over 15 years of clinical experience in psychooncology. All items were then translated back by an independent approved German-English translator blinded to the original English version. In a consensus conference, the final German items were selected by the clinicians following the criteria of comprehensibility in the clinical situation, face validity with regard to the inherent meaning of the original items, and closeness of the re-translation to the original item. Translation proved to be most challenging for items with figurative language. For item 4, ‘I can see light in a tunnel’, which in German is associated with near-death experiences, we chose a more liberal translation (literally: ‘I can see something at the end of the tunnel’). For item 10, ‘I have a sense of direction and “worth living”’. There is no literal translation for ‘I have a sense of direction and “worth living”’. In item 12, we used 2 adjectives: ‘full of worth’ and ‘deeply rooted’. For item 14, ‘I can see the light at the end of the tunnel’, which in German is associated with near-death experiences, we chose a more liberal translation (literally: ‘I can see the light at the end of the tunnel’). For item 4, ‘I can see light in a tunnel’, which in German is associated with near-death experiences, we chose a more liberal translation (literally: ‘I can see something at the end of the tunnel’).

Procedure and Subjects
The study was conducted with the agreement of the local ethics committee. After informed consent, the new 12-item German HHI-D scale and further questionnaires were presented to 231 consecutive cancer patients who were in chemotherapy or radiotherapy treatment at the University Hospital of Bonn, Germany (T1). Patients were recruited consecutively over 8 months on 3 days a week. Inclusion criteria were age > 18 years, sufficient German language skills, and the ability to complete the questionnaires without help. 13 patients refused to participate, 204 patients (88.3%) sent back the questionnaire. 12 questionnaires were eliminated due to missing data. Therefore, the final data set comprises 192 patients (83.1%). The low dropout rate indicates the high practicability of the scale. For reliability analysis, a subsample of 51 patients completed the HHI-D a second time after 2–3 weeks (T1). For patient characteristics see table 1.

Table 1. Sample description (n = 192)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>112 (58.3%)</td>
</tr>
<tr>
<td>Female</td>
<td>80 (41.7%)</td>
</tr>
<tr>
<td>Age, years</td>
<td></td>
</tr>
<tr>
<td>&lt; 40</td>
<td>14 (7.3%)</td>
</tr>
<tr>
<td>40–70</td>
<td>134 (69.8%)</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>44 (23.0%)</td>
</tr>
<tr>
<td>Living with partner</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>157 (81.8%)</td>
</tr>
<tr>
<td>No</td>
<td>35 (18.2%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Secondary school</td>
<td>126 (65.6%)</td>
</tr>
<tr>
<td>A levels/college</td>
<td>66 (34.3%)</td>
</tr>
<tr>
<td>Primary or recurrent cancer</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>153 (79.7%)</td>
</tr>
<tr>
<td>Recurrent</td>
<td>39 (20.3%)</td>
</tr>
<tr>
<td>Tumor localization</td>
<td></td>
</tr>
<tr>
<td>Brain</td>
<td>23 (12.0%)</td>
</tr>
<tr>
<td>Head/neck</td>
<td>33 (17.2%)</td>
</tr>
<tr>
<td>Lung</td>
<td>11 (5.7%)</td>
</tr>
<tr>
<td>Breast/ovarian</td>
<td>39 (20.3%)</td>
</tr>
<tr>
<td>Skin/musculoskeletal</td>
<td>12 (6.3%)</td>
</tr>
<tr>
<td>Hematological</td>
<td>45 (23.4%)</td>
</tr>
<tr>
<td>Gastrointestinal/urogenital</td>
<td>24 (12.4%)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (2.6%)</td>
</tr>
<tr>
<td>Duration of illness, years</td>
<td></td>
</tr>
<tr>
<td>&lt; 1</td>
<td>155 (80.7%)</td>
</tr>
<tr>
<td>1–3</td>
<td>30 (15.6%)</td>
</tr>
<tr>
<td>&gt; 3</td>
<td>7 (3.5%)</td>
</tr>
</tbody>
</table>

Validating Instruments
Convergent validity was determined by correlations with the Life Orientation Test Revised (LOT-R, German Version [22]) and the Hospital Anxiety and Depression Scale German Version (HADS-D [23]). Previous studies have shown an association of low levels of hope with higher scores for depression [19–21, 24]. Hope should be positively correlated with optimism and negatively correlated with pessimism in the LOT-R [7, 25]. For divergent validity (low associations with diverging constructs), correlations were calculated with the Dealing with Illness Inventory German Version (DWI-G [26]). Hope is conceptualized as a basic attitude that influences ways of coping, but is not directly associated with specific coping strategies. Therefore, we hypothesized low to medium correlations with the DWI-G scales.

The LOT-R [22] is a 10-item self-assessment scale to access dispositional optimism. Dispositional optimism is defined as a generalized expectation that good things will happen [27]. The questionnaire contains 6 scale items to measure optimism and pessimism and 4 filler items. The scale has an acceptable reliability (Cronbach’s alpha 0.78, test-retest correlations 0.68–0.79).

The HADS-D [23] has been designed to measure anxiety and depression in patients with somatic illnesses. It comprises an anxiety and a depression scale, with 7 items each. It is a very well-established instrument for a brief assessment of anxious-depressive syndromes, with good psychometric properties. The DWI-G [26, 28] is a 32-item self-report instrument measuring attitudes and coping styles of patients related to their diseases and problems. The questionnaire consists of 6 subscales, measuring cognitive coping and reappraisal (COR), depressive coping (DEP), active emotion-oriented coping (EMO), active problem-oriented coping (APR), avoidance (AVO) and religiosity (REL). 4 out of 6 factors show a good reliability (Cronbach’s alpha = 0.74–0.79) while the 2 factors APR and AVO have poor reliability, with Cronbach’s alpha = 0.55–0.59 [26].
**Statistical Analysis**

Reliability analysis comprised the calculation of Cronbach’s alpha for internal consistency separately at T0 and T1 and a test-retest correlation. Furthermore, item-total correlations and item difficulty were calculated. For construct validity, a factor analysis was conducted. We decided first to perform a confirmatory factor analysis (CFA) in order to examine whether the original 3-factorial solution by Herth [3] could be confirmed. Additionally, the 2-factor model by Benzein and Berg [18] was tested. Both models were developed on a sample of cancer patients. In case that these models should not show a good fit, we planned, as a second step, an exploratory factor analysis (EFA) to determine the best-fitting factor structure.

In addition to the chi-square fit index, different supplementary indices were chosen to assess the goodness-of-fit between the hypothetical model and the study sample data: the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), the normed fit index (NFI) and the non-normed fit index (NNFI). The following criteria were used for evaluation: the ratio of the chi-square to its degrees of freedom ($\chi^2$/df ratio) < 5 [29] and preferably < 2 [30], SRMR < 0.11 [31], RMSEA < 0.08 [31], CFI ≥ 0.95 [31], NFI ≥ 0.90 [32], and NNFI > 0.90 [33]. To get a more detailed evaluation of the appropriateness of the model structure, estimates for the correlations between the resulting factors and factor loadings for each item were calculated. Reliability analyses were performed for resulting factors and for the entire test using Cronbach’s alpha as a measure of internal consistency.

In order to prove the suitability of the data for EFA, the Kaiser-Meyer-Olkin (KMO) coefficient for common variance was calculated. Additionally, Bartlett’s test of sphericity was used, testing the null hypothesis that the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. To determine the most appropriate number of factors in EFA, we used the scree test and the eigenvalue criterion. The maximum likelihood (ML) extraction method was chosen to adjust the statistical procedures to those used in CFA [31]. The resulting factors were rotated obliquely to a promax solution. Statistics were performed with the German version of the software packages SPSS (Statistical Package for Social Science, version 20.0.0) and AMOS (Analysis of Moment Structures, version 20.0.0).

**Results**

The HHI scores lay between 24 and 48, with $M = 41.63$, $SD = 4.85$. This is comparable to scores obtained from cancer patients with the Portuguese HHI version [34] ($M = 41.57$, $SD = 4.60$), but higher than the scores from the original English HHI version [3] ($M = 34.49$, $SD = 9.61$), with scores from the Italian version lying in-between [19].

**Reliability**

Cronbach’s alpha for the whole scale (12 items) was satisfactory with 0.82. For standardized items, Cronbach’s alpha was 0.84. At retest (T1) with $n = 51$, Cronbach’s alpha was 0.80. The test-retest correlation of the total HHI score within 2–3 weeks was $r = 0.81$. The corrected item-total correlation ranged from $r = 0.29$ for item 3 and 6 to $r = 0.69$ for item 12. Item difficulty ranged from $p_3 = 69.34$ to $p_{12} = 92.34$ with a mean of 82.22. Although slightly lower than in the original version, the reliability of the German HHI version as shown by these results is satisfactory and within the range of other existing translations.

**Convergent and Divergent Validity**

Correlations of the HHI-D sum score with the LOT subscale optimism were significant with $r = 0.57$ ($p < 0.001$), and with the LOT subscale pessimism, with $r = –0.37$ ($p < 0.001$). The total score of the HHI-D showed a correlation of $r = –0.65$ ($p < 0.001$) with the total score of the HADS-D. Correlations with the HADS-D anxiety and depression subscales were $r = –0.56$ ($p < 0.001$) and $r = –0.64$ ($p < 0.001$), respectively. Moderate to high positive correlations with optimism and negative correlations with pessimism, depression, and anxiety are in agreement with our hypotheses. As we expected, the correlations with the coping styles are rather weak. A significant association ($p < 0.05$) is found with cognitive coping and reappraisal ($r = 0.28$), active problem-oriented coping (0.15), and religiosity (0.20) (other scales: DEP –0.12, EMO 0.14, AVO 0.07, not significant). This is consistent with the concept of hope as a positive appraisal of future states, enhancing goal-oriented behavior, and connected to religious faith.

**Factor Analysis**

We started with a CFA for the 3-factor structure proposed by Herth [3] and the 2-factor model by Benzein and Berg [18]. Mar- dia’s test was used to evaluate the multivariate skewness and kurtosis. Regarding the thresholds recommended by West et al. [35] for interpretation of the results (univariate index of skewness < 2.0 and kurtosis < 7.0), our data exceeded these limits only with item 3 (skewness = 2.71 and kurtosis = 7.05). Therefore, Bollen-Stine bootstrapping was investigated with corrected p-values for the chi-square statistic. Using a conventional significance level of 0.05, the 3-factor model by Herth [3] shows an acceptable fit at this point of analysis ($p = 0.06$). The factorial solution by Benzein and Berg [18] fits worse ($p = 0.04$). This result leads to a rejection of the 2-factor model. As in the validation study of the Italian HHI version [19], estimates of factor correlations were $> 1$ in the Herth model [3], meaning that estimates were outside the admissible range and, consequently, that this model is not acceptable either. The SRMR and RMSEA were below the cut-offs, but the values of CFI, NFI, and NNFI did not imply a good fit in both models.

As we could not confirm the proposed factor structures, in a second step an EFA was performed. The KMO coefficient for common variance was 0.87, indicating suitability of the data for factor analysis. Similarly, the hypothesis of no intercorrelation of items was rejected by Bartlett’s test of sphericity ($\chi^2 = 676.5$, df = 66, $p < 0.001$).

The scree test criterion indicated a single-factor structure. EFA with eigenvalue-one criterion resulted in 3 factors, which accounted for 56.4% of the total variance. The 12-item German version of the HHI-D with assignment of items to this new factor structure is shown in table 2. However, the observed factors are difficult to interpret. All 3 factors have at least 2 items in common with the factors of the Herth model [3], but neither are the factor denominations by Herth (temporality and future, positive readiness and expectancy, interconnectedness) satisfactory for the new factors nor did we achieve to find new suitable and distinct factor descriptions for our factors. In agreement with Ripamonti et al. [19], we therefore propose to adopt a single-factor model, which is a suitable model for a short screening instrument.
Conclusions

Hope is an important construct in patient care, especially in oncology. However, instruments to measure hope are scarce. The HHI has proven to be a useful and valid instrument in clinical settings and in research. Although translated into a great number of languages, an authorized and validated German version was still missing. In our study, we present the validation of the HHI-D, which showed high practicability, good reliability indexes, and a solid concurrent validity.

When adapting a questionnaire to a different cultural context, the specific understanding of items and their intercorrelations can change due to the translation process and because of different cultural and medical settings [21]. Presumably, this is the reason why previous translations into other languages yielded very diverging factor solutions. In our study, this applies especially to item 4, which could not be translated literally. The chosen translation has a more cognitive meaning than the original metaphorical wording and could therefore be closer to the concept of self-efficacy than to hope/hopelessness. Nevertheless, even though the translators of the HHI into Swedish described similar problems with item 4 but chose to translate it literally, they could also not replicate the original 3-factor structure [18].

Our attempt to replicate the original 3-factor structure did not lead to a fitting model in our sample. A 2-factor model found in patients with cancer by Benzein and Berg [18] fitted even worse. Instead, we found a new 3-factorial solution by EFA. However, the found factors were difficult to interpret as regards the content of the items. As mentioned, this may be due to translation and to cultural differences in the understanding of the concept of hope, which should be discussed further in the future. The scree plot in our model showed only one factor. Aish et al. [36] showed for Beck’s Hopelessness Scale that a multidimensional concept can be measured by a very short 1-factorial scale. For the present, we therefore advise to use only the HHI-D total score as an indicator of the individual patient’s level of hope until further research gives more insights into possible factor structures.

The study has limitations typical of clinical field studies. No randomization or representative sampling was performed and the sample consisted only of cancer patients. However, the ranges of age, tumor entity, and stage of illness were wide and the dropout rate was low. The sample size was sufficient for the purpose of the study (for validation studies, sample sizes of 10/item are recommended), but further research should enlarge the database in different patient populations, in order to compare different groups, seek more clarification of the factor structure and to develop normative data.

Hope as a central human feature is too important to be neglected in clinical settings – we hope to have contributed to future research in this field.

Disclosure Statement

The authors declare no conflict of interest.

References


