Psychometric Properties of the Chinese Version of the M.D. Anderson Dysphagia Inventory for Head and Neck Cancer Patients

**KEY WORDS**
Dysphagia
Head and neck cancer
M.D. Anderson Dysphagia Inventory
Reliability
Validity

**Background:** Dysphagia is a common side effect of anticancer treatments in patients with head and neck cancer (HNC) and can worsen patients’ quality of life. A well-established measure is essential to evaluate dysphagia in HNC patients.

**Objectives:** The aim of this study is to determine the psychometric properties of the Chinese version of the M.D. Anderson Dysphagia Inventory (MDADI-C) for HNC patients.

**Methods:** A total of 220 subjects were included in the study. Reliability was examined by internal consistency (Cronbach’s $\alpha$) and test-retest reliability (intraclass correlation coefficient). Validity was evaluated with Spearman correlations ($r$).

**Results:** The Cronbach’s $\alpha$ and intraclass correlation coefficient of the MDADI-C were .923 and 0.942, respectively. The criterion validity of the MDADI-C was 0.777. The Spearman correlation coefficients of the MDADI-C with the European Organization for Research Into the Treatment of Cancer Quality of Life Questionnaire for Head and Neck Cancer ($r = -0.851$), Hospital Anxiety and Depression Scale ($r = -0.424$), radiotherapy dose ($r = -0.553$), and treatment regimens ($r = -0.407$) demonstrated good construct validity (all $P < .01$).

**Conclusions:** The MDADI-C demonstrated good psychometric properties and would be a valuable tool for clinicians to screen dysphagia rapidly and evaluate its impact on the quality of life of HNC patients.

**Implications for Practice:** The MDADI-C could be used to document and monitor the dysphagia level of HNC patients for clinicians, nurses, and...
Dysphagia is a common side effect of anticancer treatments in patients with head and neck cancer (HNC) and can exist before, during, and after radiotherapy (RT). It is defined as “any disruption in the swallowing process during bolus transport from the oral cavity to the stomach” by Gaziano. Major symptoms of dysphagia include chewing difficulties, oral retention of food bolus, nasal regurgitation, choking, and aspiration. Long-term swallowing disorders can cause functional and social limitations, nutritional deficiencies, and mood disorders and worsen quality of life (QOL). Characterization of this symptom is important in caring for patients with HNC because 50% to 75% patients have some degree of dysphagia during treatment. However, the incidence of dysphagia was often underestimated and the risk of dysphagia was generally neglected. Patients focused more on the threat of cancer recurrence; thus, they paid less attention to the radiation-induced swallowing complication.

Survival rates for patients with HNC have improved as more aggressive and effective treatments have become available. The global QOL in patients with cancer has been incorporated as an important outcome measure. Assessment of dysphagia by means of modified barium swallows or videofluoroscopic swallowing study is valuable in determining the extent of mechanical disability, but these tools cannot address the impact of dysphagia on QOL. Therefore, a well-established measure is essential to improve symptom management and QOL for patients with HNC.

### Background

During the past decade, some validated dysphagia-specific QOL questionnaires have been designed to evaluate the effectiveness of treatment for HNC patients. These questionnaires include the M.D. Anderson Dysphagia Inventory (MDADI), the Swallowing Quality of Life Questionnaire (SWAL-QOL), Deglutition Handicap Index, the Eating Assessment Tool, Dysphagia Handicap Index, and the European Organization for Research Into the Treatment of Cancer Quality of Life Questionnaire for Head and Neck Cancer (EORTC QLQ-H&N35). When a questionnaire is used for research, its psychometric characteristics must be well known and of sufficiently high quality; otherwise, the study results cannot be interpreted or attributed any clinical relevance. However, the psychometric properties of the Chinese version of instruments evaluating dysphagia for HNC patients were not sound. The most established tool, the SWAL-QOL, developed and reported by McHorney et al. in 2000, has shown good psychometric properties with regard to validity and reliability. The SWAL-QOL has been validated in Chinese patients with HNC. However, its application in daily clinical practice was limited because clinicians needed a short, easy-to-administer questionnaire for screening. Compared with the SWAL-QOL, the MDADI, developed by Chen et al., which covered all relevant concepts, might be easier for subjects to complete and for clinicians to score. The MDADI, a validated self-administered inventory, was developed specifically to evaluate the impact of dysphagia on the QOL for English-speaking HNC patients. The MDADI has been translated into multiple languages, facilitating wider application in the world.

The Chinese version of MDADI (MDADI-C) was developed and reported by Zou et al. However, the development and validation of a dysphagia-specific QOL questionnaire for HNC patients in China was still at an early stage and had some limitations (e.g., limited subject selection and small sample size). Therefore, the primary purpose of this study is to evaluate the psychometric properties of the MDADI-C for HNC patients with dysphagia.

### Methods

#### Subjects

The cross-sectional study was conducted in a tertiary hospital in Tianjin, China. Between January 2014 and March 2015, a total of 220 HNC inpatients receiving RT were enrolled. The inclusion criteria were (1) histologically and pathologically confirmed HNC, (2) diagnosed dysphagia by an HNC physician, (3) 18 years or older, (4) able to complete questionnaires independently or with the help of a researcher, and (5) willing to participate in the study and gave signed written informed consent. The exclusion criteria were (1) dysphagia caused by other reasons, (2) patients with impaired alertness, or a (3) Karnofsky Performance Status lesser than 60.

#### Measures

The sociodemographic characteristics included participants’ age, gender, marital status, education level, income, insurance, smoking status, alcohol drinking status, tumor sites, clinical stage, pathological findings, head and neck surgery, neck dissection, RT dose, treatment regimens, and nutritional support.

The MDADI is a self-administered, psychometrically validated and reliable questionnaire originally designed by Chen et al. to evaluate the dysphagia-specific health-related QOL for HNC patients. The questionnaire is composed of 20 questions divided into 4 domains: global (a single question), emotional (6 items), functional (5 items), and physical (8 items). The global domain determines the overall QOL depending on the patients’ swallowing ability. The emotional, functional, and physical domains indicate the patients’ affective response to the swallowing disability, the impact of the swallowing disability on patients’ daily activities, and the patients’ self-perceptions of the swallowing disability, respectively. Each question is rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). All questions,
except question 5 (I do not feel self-conscious when I eat) and question 15 (I feel free to go out to eat with my friends, neighbors, and relatives) are scored in inverse order. The global question is scored individually. The mean score of each subscale is multiplied by 20 to obtain a total score with a range from 0 (extremely low functioning) to 100 (high functioning). A higher MDADI score is indicative of better day-to-day functioning and QOL. The MDADI has been developed and translated into Dutch, Italian, Swedish, Portuguese, Korean, and Chinese. The overall reliability was within the optimum range. The internal consistency and test-retest reliability of the total score for the MDADI ranged from 0.812 to 0.940 and 0.795 to 0.960, respectively. In addition, the overall validity for the MDADI was within the acceptable level. The correlation coefficient for criterion validity was 0.67 to 0.72. Studies have shown good construct validity, including convergent validity (strong/moderate correlations) and discriminant validity (weak correlations), for the MDADI. In the MDADI-C translated by Zou et al., the Cronbach’s α coefficient of MDADI-C was 0.90, the content validity index was 0.94, the criterion validity was 0.72, and the correlation coefficients of the construct validity ranged from 0.11 to 0.71.

The EORTC QLQ-H&N35 was developed by Bjordal et al. for measuring QOL in patients with HNC. It has been translated into many languages and validated in multiple countries. The EORTC QLQ-H&N35 is a 35-item HNC-specific scale addressing various aspects of QOL. It is composed of 18 domains, including 7 multi-item scales and 11 single items. All items use a 4-point Likert scale, with 1 = not at all, 2 = a little, 3 = quite a bit, and 4 = very much, except for 5 items with “yes” or “no.” The standardized scores range from 0 to 100, and a higher score indicates worse QOL. The simplified Chinese version of EORTC QLQ-H&N35 possesses good reliability, validity, and responsiveness, which is suitable for HNC patients in China.

The Performance Status Scale for HNC Patients (PSS-HN), developed by List et al., is a clinician-rated assessment tool that describes the disease-specific performance status that includes 3 subscales regarding normalcy of diet, eating in public, and understandability of speech. Each PSS-HN scale score ranges from 0 to 100, with higher scores indicating better performance. The PSS-HN has good interrater reliability and is able to discriminate levels of functioning. It has been used to measure the disease-specific performance status among HNC patients in China.

The Hospital Anxiety and Depression Scale (HADS) is an instrument for detecting states of depression and anxiety, including in HNC patients. The HADS is composed of 14 items, including 7 items measuring anxiety (HADS-A) and 7 items measuring depression (HADS-D). The total score ranges from 0 to 21, where a higher score indicates higher anxiety and/or depression.

**Results**

**Patients’ Characteristics**

A total of 220 men and women participated, of which 196 were male (89.1%) and 24 were female (10.9%). The mean age was 52.7 ± 12.5 years, with a range of 18 to 77 years; 75.9% were smokers and 61.4% were alcohol drinkers. Nasopharyngeal cancer (NPC), oral cavity cancer, laryngeal cancer, hypopharyngeal cancer, and oropharyngeal cancer accounted for 48.6%, 10.9%, 10.5%, 9.1%, and 7.3%, respectively. Other cancers, including thyroid carcinoma, salivary glands, and cervical metastases of carcinoma, accounted for 13.6%. For clinical stage, 9 (4.1%) patients were stage I, 20 (9.1%) patients were stage II, 96 (43.6%) patients were stage III, and 95 (43.2%) patients were stage IV. A total of 164 (74.5%) patients were squamous cell carcinoma. Sixty (27.3%) patients received head and neck surgery, and 106 (48.2%) patients received the RT combined with chemotherapy. Among 220 patients, 34 (15.5%) patients received nutritional support (Table 1).
Reliability

The overall Cronbach’s α coefficient of the MDADI-C was .923. The Cronbach’s α coefficients of all subscales of the MDADI-C except for the global subscale were within the optimum range (α range, 0.717–0.858; Table 2). The ICC of the MDADI-C based on 19 questions was 0.942. The test-retest coefficients in subscales of the MDADI-C were high (r = 0.842–0.895) (Table 2).

Criterion Validity

There was a strong correlation between the total score of the MDADI-C and the total score of the PSS-HN (r = 0.777, P < .01). The global subscale of MDADI-C had a strong correlation with the normalcy of diet subscale of the PSS-HN (r = 0.733, P < .01). The global subscale of MDADI-C had a moderate correlation with the eating in public subscale of the PSS-HN (r = 0.657, P < .01), as did the emotional and functional subscales (0.622 and 0.610, respectively). The emotional and functional subscales of the MDADI-C had a moderate correlation with the normalcy of diet subscale of the PSS-HN (0.676 and 0.668, respectively). The physical subscale of the MDADI-C had a strong correlation with the normalcy of diet and eating in public subscales (0.763 and 0.709, respectively). The MDADI-C subscales had substantial or strong correlations with the total score of the PSS-HN (r = 0.670–0.764, P < .01) (Table 3).
the MDADI-C had strong correlations with the swallowing subscales of the EORTC QLQ-H&N35 (r = -0.451 to -0.821, P < .01). However, the total score of the MDADI-C showed weak correlations with pain medications and with feeding tube and weight gain subscales of the EORTC QLQ-H&N35 (-0.135, -0.265, and 0.172, respectively). Negative correlations of the MDADI-C with the HADS were confirmed (r = -0.424, P < .01). The correlation coefficient between the emotional subscale of the MDADI-C and the HADS was -0.532 (P < .01) (Table 5). In addition, the correlation coefficients of the MDADI-C with RT dose and treatment regimens were -0.553 and -0.407, respectively.

### Discussion

Dysphagia is a common symptom in HNC patients and can lead to dehydration, malnutrition, and aspiration pneumonia and an increased risk of depression and anxiety and lower self-esteem. All of these consequences can adversely affect general health and QOL. Assessment of dysphagia by means of patient-reported health-related QOL instruments is important. However, the Chinese version of dysphagia-specific questionnaire specifically designed for HNC patients was still at an early stage and had some known limitations. Therefore, this study aimed to validate the MDADI-C and determine its psychometric properties in Chinese HNC patients.

In this study, the internal consistency reliability of the MDADI-C total score was satisfactory (Cronbach's α = .923), consistent with the results obtained in previous studies (Cronbach's α = .90-.96). The Cronbach's α coefficients of 3 subscales

### Construct Validity

The EORTC QLQ-H&N35 total score was negatively correlated with the MDADI-C (r = -0.765 to -0.851, P < .01) (Table 4). The MDADI-C total score showed strong correlations with the swallowing and social eating subscales of the EORTC QLQ-H&N35 (r = -0.821 and -0.765, respectively, P < .01). The substantial correlations of the total score of the MDADI-C with the other subscales, such as pain, opening mouth, dry mouth, sticky saliva, and weight loss, of the EORTC QLQ-H&N35 were found (r = -0.451 to -0.627, P < .01). Each subscale of the MDADI-C had strong correlations with the swallowing subscale of the EORTC QLQ-H&N35 (r = -0.712 to -0.801, P < .01). However, the total score of the MDADI-C showed weak correlations with pain medications and with feeding tube and weight gain subscales of the EORTC QLQ-H&N35 (-0.135, -0.265, and 0.172, respectively). Negative correlations of the MDADI-C with the HADS were confirmed (r = -0.424, P < .01). The correlation coefficient between the emotional subscale of the MDADI-C and the HADS was -0.532 (P < .01) (Table 5). In addition, the correlation coefficients of the MDADI-C with RT dose and treatment regimens were -0.553 and -0.407, respectively.

### Table 3 • Criterion Validity Between the MDADI-C and PSS-HN

<table>
<thead>
<tr>
<th>MDADI-C</th>
<th>Diet</th>
<th>Eating in Public</th>
<th>Total a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>0.733 b</td>
<td>0.657 b</td>
<td>0.732 b</td>
</tr>
<tr>
<td>Emotional</td>
<td>0.676 b</td>
<td>0.622 b</td>
<td>0.679 b</td>
</tr>
<tr>
<td>Functional</td>
<td>0.668 b</td>
<td>0.610 b</td>
<td>0.670 b</td>
</tr>
<tr>
<td>Physical</td>
<td>0.763 b</td>
<td>0.709 b</td>
<td>0.764 b</td>
</tr>
<tr>
<td>Total b</td>
<td>0.775 b</td>
<td>0.715 b</td>
<td>0.777 b</td>
</tr>
</tbody>
</table>

### Table 4 • Correlation Coefficients Between MDADI-C and EORTC QLQ-H&N35

<table>
<thead>
<tr>
<th>EORTC QLQ-H&amp;N35</th>
<th>Total a</th>
<th>Global b</th>
<th>Emotional b</th>
<th>Functional b</th>
<th>Physical b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-0.851 b</td>
<td>-0.808 b</td>
<td>-0.765 b</td>
<td>-0.773 b</td>
<td>-0.797 b</td>
</tr>
<tr>
<td>Pain (HN1-HN4)</td>
<td>-0.627 b</td>
<td>-0.659 b</td>
<td>-0.580 b</td>
<td>-0.505 b</td>
<td>-0.602 b</td>
</tr>
<tr>
<td>Swallowing (HN5-HN8)</td>
<td>-0.821 b</td>
<td>-0.754 b</td>
<td>-0.732 b</td>
<td>-0.712 b</td>
<td>-0.801 b</td>
</tr>
<tr>
<td>Sense problems (HN13 and HN14)</td>
<td>-0.659 b</td>
<td>-0.643 b</td>
<td>-0.558 b</td>
<td>-0.586 b</td>
<td>-0.643 b</td>
</tr>
<tr>
<td>Speech (HN16, HN23, and HN24)</td>
<td>-0.395 b</td>
<td>-0.258 b</td>
<td>-0.392 b</td>
<td>-0.422 b</td>
<td>-0.339 b</td>
</tr>
<tr>
<td>Social eating (HN19-HN22)</td>
<td>-0.765 b</td>
<td>-0.720 b</td>
<td>-0.681 b</td>
<td>-0.674 b</td>
<td>-0.738 b</td>
</tr>
<tr>
<td>Social contact (HN18 and HN25-HN28)</td>
<td>-0.453 b</td>
<td>-0.387 b</td>
<td>-0.424 b</td>
<td>-0.455 b</td>
<td>-0.389 b</td>
</tr>
<tr>
<td>Sexuality (HN29 and HN30)</td>
<td>-0.433 b</td>
<td>-0.474 b</td>
<td>-0.388 b</td>
<td>-0.442 b</td>
<td>-0.392 b</td>
</tr>
<tr>
<td>Teeth (HN9)</td>
<td>-0.096 c</td>
<td>-0.120 c</td>
<td>-0.128 c</td>
<td>-0.153 d</td>
<td>-0.022 c</td>
</tr>
<tr>
<td>Opening mouth (HN10)</td>
<td>-0.533 b</td>
<td>-0.489 b</td>
<td>-0.467 b</td>
<td>-0.489 b</td>
<td>-0.495 b</td>
</tr>
<tr>
<td>Dry mouth (HN11)</td>
<td>-0.543 b</td>
<td>-0.573 b</td>
<td>-0.453 b</td>
<td>-0.496 b</td>
<td>-0.528 b</td>
</tr>
<tr>
<td>Sticky saliva (HN12)</td>
<td>-0.623 b</td>
<td>-0.597 b</td>
<td>-0.600 b</td>
<td>-0.534 b</td>
<td>-0.560 b</td>
</tr>
<tr>
<td>Coughing (HN15)</td>
<td>-0.441 b</td>
<td>-0.355 b</td>
<td>-0.407 b</td>
<td>-0.401 b</td>
<td>-0.424 b</td>
</tr>
<tr>
<td>Feeling ill (HN17)</td>
<td>-0.459 b</td>
<td>-0.375 b</td>
<td>-0.463 b</td>
<td>-0.474 b</td>
<td>-0.382 b</td>
</tr>
<tr>
<td>Pain killers (HN31)</td>
<td>-0.135 d</td>
<td>-0.181 b</td>
<td>-0.115 c</td>
<td>-0.124 c</td>
<td>-0.124 c</td>
</tr>
<tr>
<td>Nutritional supplements (HN32)</td>
<td>-0.083 c</td>
<td>-0.087 c</td>
<td>-0.057 c</td>
<td>-0.097 c</td>
<td>-0.060 c</td>
</tr>
<tr>
<td>Feeding tube (HN33)</td>
<td>-0.265 b</td>
<td>-0.269 b</td>
<td>-0.219 b</td>
<td>-0.211 b</td>
<td>-0.256 b</td>
</tr>
<tr>
<td>Weight loss (HN34)</td>
<td>-0.451 b</td>
<td>-0.398 b</td>
<td>-0.347 b</td>
<td>-0.345 b</td>
<td>-0.494 b</td>
</tr>
<tr>
<td>Weight gain (HN35)</td>
<td>0.172 c</td>
<td>0.222 b</td>
<td>0.155 c</td>
<td>0.059 c</td>
<td>0.195 b</td>
</tr>
</tbody>
</table>

Abbreviations: MDADI-C, Chinese version of the M.D. Anderson Dysphagia Inventory; PSS-HN, Performance Status Scale for Head and Neck Cancer.

1Based on 3 subscales.
2Correlation is significant at the P < .01 level (2 tailed).
3Correlation coefficients did not reach statistical significance (P > .05, 2 tailed).
4Correlation is significant at the P < .01 level (2 tailed).
of the MDADI-C (emotional, functional, and physical subscale) were .757, .717, and .858, respectively. There was slight difference between our study and that of Zou et al\(^{31}\) regarding the functional domain. The Cronbach’s α coefficient of the functional domain in the Zou et al study\(^ {31}\) was .55. This may be because most participants involved in the Zou et al study\(^ {31}\) were patients with NPC receiving RT, whereas the participants in our study had oral cavity cancer, oropharynx cancer, hypopharynx cancer, NPC, larynx cancer, or other types of HNC receiving RT, chemoradiotherapy, or surgery with RT. The Cronbach’s α coefficients of all subscales of MDADI-C obtained in this study were consistent with the other studies.\(^ {18,24,28–30}\) The MDADI-C had a high Cronbach’s α coefficient, which indicated that the questionnaire addressed the same concept reliably. The ICC of the MDADI-C was 0.942 in this study, which was similar to the results in the Carlsson et al study\(^ {28}\) and the Speyer et al study (0.96).\(^ {24}\) The ICC for the global (0.842), emotional (0.853), functional (0.869), and physical (0.895) subscales of the MDADI-C were acceptable.

Criterion validity establishes that the new survey instrument accurately reflects the attitudes of a previously used gold standard.\(^ {18}\) The PSS-HN is widely used and the subscales of diet and eating in public are related to swallowing. Therefore, the PSS-HN accurately reflects the attitudes of a previously used gold standard.\(^ {18}\) The correlation coefficient of the MDADI-C with the PSS-HN, indicating that MDADI-C had good the criterion validity. The total score of the MDADI-C showed weak correlations with pain medications and with the feeding tube and weight gain subscales of the EORTC QLQ-H&N35, which indicated the discriminant validity was good. Compared with the Chen et al study,\(^ {18}\) this study did not choose the Medical Outcomes Study 36-Item Short Form Health Survey to assess construct validity because the Medical Outcomes Study 36-Item Short Form Health Survey is a general QOL scale applied to any disease. The EORTC QLQ-H&N35 has 4 items related to the swallowing function, which made it possible to evaluate the construct validity of the MDADI-C. Negative correlations between the MDADI-C and the HADS were confirmed. There were substantial correlations between the HADS and the subscales of MDADI-C (the global, functional, physical, and emotional subscales), which were consistent with Carlsson et al study.\(^ {28}\) In addition, substantial correlations were found among the MDADI-C, RT dose, and treatment regimens. These results were in accordance with the findings of Jiang et al\(^ {49}\) that the RT dose and treatment regimens had impact on the patients’ dysphagia.

### Limitations

Several limitations were presented in our study. First, it was a cross-sectional study; a longitudinal research would be needed to validate the sensitivity of MDADI-C. Second, the study was limited by a lack of objective assessment instruments to evaluate dysphagia in patients with HNC, such as modified barium swallows, videofluoroscopic swallowing study, functional endoscopic evaluation of swallowing, and transnasal esophagoscopy.\(^ {49}\) Objective assessment instruments will be used in a future study, which might improve the criterion validity. Third, the participants were selected from 1 tertiary hospital and might not be fully representative of the total population of HNC patients with dysphagia in China, which might lead to selection bias. A multicenter study will be conducted in the future. Lastly, 24 (10.9%) patients in our study were women, so attempts should be made...
Conclusions and Implications for Practice

The MDADI-C demonstrated good psychometric properties and will likely be a valuable tool for clinicians to screen dysphagia rapidly and evaluate its impact on the QOL of HNC patients. Meanwhile, this validated questionnaire will allow researchers to compare study results across different countries. One of the most important implications of the study was that the MDADI-C could be used to document and monitor the dysphagia level of HNC patients for clinicians, nurses, and researchers. Another important implication was that HNC patients with a higher level of dysphagia would be associated with lower QOL. In addition, the study supplied further evidence that the higher level of dysphagia in HNC patients is associated with a higher level of depression and anxiety. Therefore, it is crucial for healthcare professionals to be sensitive and knowledgeable about the cancer treatment–related symptoms and their effects on patients’ QOL. Furthermore, it is important for healthcare professionals to provide a long-term follow-up for monitoring and documenting patients’ levels of dysphagia and to develop appropriate and effective interventions with the aim of alleviating symptom severity and promoting the patients’ QOL. A well-established measurement tool for dysphagia is essential before any intervention could be planned and evaluated.

References


