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Validity and reliability of the MD Anderson dysphagia inventory in English and Chinese in head and neck cancer patients

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Abstract

Aims: Patient-reported outcome measures are important in assessing the impact of dysphagia on quality of life. Our aim was to adapt and examine the cultural validity and reliability of a swallowing-related quality of life measure, the MD Anderson Dysphagia Inventory (MDADI), in English and Chinese, with head and neck cancer patients.

Methods: We adapted the MDADI to Chinese through formal forward-backward translation. Sixty-six head and neck cancer survivors completed the MDADI, Swallowing Quality of Life (SWAL-QOL) questionnaire and Hospital Anxiety and Depression Scale (HADS) in English or Chinese. Swallowing status was scored on the Functional Oral Intake Scale (FOIS). Seventy-four percent ($n = 49$) of participants completed a repeat administration of the MDADI for test–retest reliability analysis.

Results: The MDADI showed high internal consistency reliability (Cronbach's α, $0.82 \leq \alpha \leq 0.94$), and test–retest reliability in both English (intraclass correlation coefficient, ICC = 0.81) and Chinese (ICC = 0.72). Criterion validity was established through moderate to strong correlations with relevant SWAL-QOL domains. Convergent validity was determined by significant correlations to the HADS and FOIS. Divergent validity was determined by nonsignificant association to the SWAL-QOL Sleep domain. The MDADI also presented as hypothesised to most known-group theoretical constructs.

Conclusions: The MDADI showed good psychometric properties in English and Chinese. This avails a reliable and psychometrically valid MDADI for Chinese speakers.

KEYWORDS
dysphagia, HRQoL, psychometric validation, quality of life, swallowing

1 | INTRODUCTION

Dysphagia is a common side effect of head and neck cancer and its treatment. Dysphagia can be a direct consequence of tumor growth,[1] or a side effect of cancer treatment, such as surgery and/or chemotherapy and radiation therapy.[2] Within 3 years of completing head and neck cancer treatment, as many as 40% of patients experience dysphagia.[3] Dysphagia can lead to aspiration and related pulmonary complications, dehydration and malnutrition. Beyond health complications, it can also cause functional and social limitations associated with worsening quality of life.[4,5]

Speech and language therapists typically are an integral part of the head and neck cancer care team. They evaluate head and neck cancer patients before and after treatment and manage their dysphagia. Clinical bedside assessments and instrumental evaluations are part of clinical measures of swallowing ability. While these provide a good measure of functional swallow status, they do not adequately assess the quality of life impact of swallowing difficulties. To plan rehabilitation and

community support services for survivors of head and neck cancer, it is important to consider the impact of swallowing difficulties on quality of life.

The MD Anderson Dysphagia Inventory (MDADI) is a 20-item self-administered questionnaire developed to measure swallowing-related quality of life in head and neck cancer patients.[6] Since its development, it has been included as an outcome measure in multiple clinical studies and many cooperative group trials for head and neck cancer.[7] Compared with other swallowing-related quality of life measures, such as the 44-item Swallowing Quality of Life questionnaire (SWAL-QOL),[8-10] the MDADI is shorter and quicker to administer in a clinical setting. The MDADI has been adapted and found to be a psychometrically valid and reliable measure of swallowing-related quality of life in multiple European and Asian languages.[11-17] Although 12% of all new cases of head and neck cancers worldwide are from Chinese-speaking regions in east and south-east Asia,[18] a Chinese version of the MDADI has not yet been developed to measure swallowing-related quality of life in Chinese head and neck cancer survivors.

Singapore is a south-east Asian country where head and neck cancers are among the most prevalent cancer types.[19] Head and neck cancer incidence in 2018 was 12.2 per 100 000 in Singapore, similar to that in the United States, United Kingdom and Australia.[18] Although English is the official language for education and work, 32% of the Singaporean population speak English at home whereas 50% speak Mandarin-Chinese or other Chinese dialects.[20] A validated swallowing-related quality of life instrument for head and neck cancer patients does not currently exist in Singapore. A modified English and a translated Chinese version of the SWAL-QOL questionnaire were previously used in a study of quality of life in nasopharyngeal cancer patients,[5] but the psychometric properties of the adapted questionnaires were not examined.

Our study aimed to develop a Chinese version of the MDADI that can be used to measure swallowing-related quality of life in Chinese-speaking head and neck cancer patients. Second, we aimed to evaluate the reliability and validity of the MDADI in English and Chinese in patients treated for head and neck cancer in Singapore.

2 | MATERIALS AND METHODS

2.1 | Participants

Head and neck cancer patients on follow-up for dysphagia at the Speech Therapy Department at Singapore General Hospital were recruited at their clinic visit. They were all Singapore residents who had completed head and neck cancer treatment and were Chinese or English speaking. Patients were excluded if they: had existing or recurrent disease, were illiterate, or had other conditions contributing to communication or swallowing difficulties unrelated to head and neck cancer (e.g. neurological disorders). As the MDADI has specific questions about dining in the community, we also excluded patients who were living in a residential institution at the time of the study (e.g. acute or community hospital, nursing home or hospice). All study participants provided written informed consent. The study was approved by the SingHealth Centralised Institutional Review Board (Ref: 2016/2113).

2.2 | Procedures

All participants completed a set of three questionnaires in either English or Chinese based on their preferred language: the MDADI, SWAL-QOL and the Hospital Anxiety and Depression Scale (HADS). Questionnaires were presented in a randomized order to minimize the effects of respondent fatigue. Functional swallow status was rated by their attending speech and language therapist on the Functional Oral Intake Scale (FOIS). After completion, participants all received an additional copy of the MDADI in the same language by mail. They were instructed to complete this 14 days after initial administration to examine test–retest reliability. The questionnaires administered and measures obtained are described below.

2.3 | Measures

2.3.1 | MD Anderson Dysphagia Inventory

The MDADI[6] consists of one global assessment item, and 19 items divided into three subscales: emotional (six items), functional (five items) and physical (eight items). Each item is a statement describing an experience related to swallowing, eating and drinking. Respondents are asked to rate how well these statements describe their experience in the past 1 week. Response options include "strongly disagree," "disagree," "no opinion," "agree," "strongly agree" and are scored on a 5-point Likert scale. All except two items on the original MDADI have "strongly agree" denoting a poorer score of one and "strongly disagree" denoting a highest score of five. The two items that are scored reversely are E7 ("I do not feel self-conscious when I eat") and F2 ("I feel free to go out to eat with my friends, neighbors, and relatives"). Previous studies have suggested that these items can be confusing to respondents.[13] In keeping with other MDADI validation studies,[16,17] we amended these questions grammatically in our study (E7, "I feel self-conscious when I eat"; F2, "I do not feel free to go out to eat with my friends, neighbors, and relatives" to avoid respondent confusion. The global assessment item is scored individually. Subscale scores are obtained by multiplying the mean score of all items within the subscale by 20. A total composite score is calculated by multiplying the mean score of all other 19 subscale items by 20. Higher global item, subscale and total scores on the MDADI indicate better swallowing-related quality of life.

2.3.2 | Translation and cross-cultural adaptation of the MDADI in Chinese

Internationally-accepted guidelines[21,22] were used in the translation and cross-cultural adaptation of the MDADI to Chinese. The questionnaire was first translated from English to Chinese by the first

author and then verified by an English-Chinese bilingual Singaporean not from the study team. Back-translation was completed by another bilingual Singaporean with no medical training. An expert panel of bilingual head and neck surgeons, nurses, and speech and language therapists was convened to discuss ambiguities among the two translations. Pretesting and cognitive debriefing was conducted by the first author with two Chinese-speaking head and neck cancer patients who had completed curative treatment. Finally, the study team completed the final proof-reading. The final version used in this study is shown in Appendix 1. Similar to the English MDADI, higher total and global item scores on the Chinese version of the MDADI indicated better swallowing-related quality of life.

2.3.3 | SWAL-QOL

The SWAL-QOL[8-10] is 44-item self-administered questionnaire. It is a widely-used measure of swallowing-related quality of life, consisting of 11 domains (burden, eating desire, eating duration, symptoms, food selection, communication, fear, mental health, social functioning, fatigue and sleep). Items are responded to on a 5-point Likert scale. The questionnaire total score ranges from 0 to 100, with a higher score indicating a better swallowing-related quality of life. The original English version and a Chinese version[23] validated on the Hong Kong Chinese-speaking population were used in this study. The MDADI was referenced against the SWAL-QOL to establish criterion validity. We hypothesized that MDADI scores correlate well with SWAL-QOL scores as they measure the same concept of swallowing-related quality of life.

2.3.4 | HADS

The HADS[24] is a 14-item self-administered questionnaire of psychological distress. It has two seven-item subscales: Depression and Anxiety subscales that are responded to on a four-point Likert scale. Higher scores represent greater degrees of depression and anxiety. A score of eight or above on each subscale signifies possible depression or anxiety[25]. In this study, HADS subscale scores were interpreted in two categories: no mood disorder (score of 0–7) and possible mood disorder (score of 8–21). The English and Chinese[26] versions that were psychometrically validated in the Singapore population[27] were used in this study. The MDADI was referenced against the HADS to establish convergent validity. We hypothesized that participants with higher Depression or Anxiety subscale scores will score lower on the MDADI. A negative correlation between the MDADI and HADS scores would thus provide evidence for convergent validity.

2.3.5 | FOIS

The FOIS[28] grades a person's oral intake on a seven-level scale, from complete nonoral intake (FOIS 1) to full oral intake without restriction (FOIS 7). In this study, we further categorized the scale into functional diet types: fully or partially dependent on tube feeding (FOIS 1–3), full oral diet of modified consistencies (FOIS 4–5) and regular oral diet (FOIS 6–7). The MDADI was referenced against the FOIS to establish convergent validity. We hypothesized that participants who rated higher on the FOIS will score higher on the MDADI. A positive correlation between the MDADI and FOIS scores would thus provide evidence for convergent validity.

2.4 | Statistical Analysis

2.4.1 | Test–retest reliability

Intraclass correlation coefficient (ICC, two-way mixed effects) was calculated to establish test-retest reliability in total score between the first and second administration of the MDADI. An ICC of 0.70 was taken to be the minimal acceptable level of test-retest reliability.[29]

2.4.2 | Internal consistency reliability

Internal consistency indicates how closely each item within a subscale measures the same concept. To determine this, Cronbach's α was calculated for the 19 MDADI items that make up the total score, and each of the emotional, functional and physical subscales in each language. Reliability estimates of more than 0.70 were considered to be the minimal satisfactory correlation for group-level comparisons.[30] Item-total correlation coefficients were also determined. Items below the acceptable correlation coefficient of 0.30 may be deemed to be poorly correlated with the construct of the entire scale.[31]

2.4.3 | Criterion validity

To determine criterion validity, SWAL-QOL total and domain scores were regarded as the reference standard. MDADI total score was correlated with SWAL-QOL total score in each language using Pearson's correlation. By treating subscale and domain scores as ordinal variables, Spearman's correlations were conducted to examine associations between MDADI subscale scores with each SWAL-QOL domain score in each language. A correlation coefficient of less than 0.30 was considered to be a weak correlation, from 0.30 to 0.70 moderate correlation and more than 0.70 a strong correlation.[32]

2.4.4 | Construct validity

The expected presentations of the MDADI were tested on various theoretical constructs related to functional and/or psycho-emotional status measured by the HADS, SWAL-QOL and functional oral intake status. To demonstrate convergent validity, the MDADI total and emotional subscale scores were correlated to the subscales of the HADS using Spearman's correlation, and the MDADI total, physical

TABLE 1 Participant demographics

Demographics (n = 66)	*n* (%)
Language	
English	40 (60.6)
Chinese	26 (39.4)
Gender	
Male	41 (62.1)
Female	25 (37.9)
Age	
29–79 (median: 61.5)	
Age at end of treatment	
29 – 78 (median: 57.0)	
Site of disease	
Oral	18 (27.3)
Nasopharynx	36 (54.5)
Oropharynx	7 (10.6)
Larynx	5 (7.6)
Treatment received	
Surgery	8 (12.1)
(Chemo)radiation therapy	41 (62.1)
Surgery and (chemo)radiation therapy	17 (25.8)
T-stage	
T1	23 (34.8)
T2	10 (15.2)
T3	11 (16.7)
T4	13 (19.7)
Unknown	9 (13.6)
Recurrent disease	
Yes	9 (13.6)
No	57 (86.4)
Years since last treatment	
< 1 year	33 (50.0)
1–5 years	13 (19.7)
5–10 years	7 (10.6)
> 10 years	13 (19.7)
Diet types	
Partial enteral feeding(FOIS[a] 1–3)	7 (10.6)
Modified full oral(FOIS 4–5)	28 (42.4)
Regular diet (soft/full)(FOIS 6–7)	31 (47.0)

[a]Functional oral intake scale.

and functional subscale scores were correlated to the FOIS. To demonstrate divergent validity, the MDADI total and subscale scores were correlated to the SWAL-QOL Sleep domain score using Spearman's correlation. Mean MDADI total scores of known groups (possibly depressed and not depressed; possibly anxious and not anxious; diet types) were also compared through analysis of variance, after fulfilling parametric testing criteria. Nonparametric Kruskal–Wallis one-way analysis of variance was used when distribution of MDADI scores did not meet normality estimates.

All statistical analyses were performed using IBM SPSS Statistics for Macintosh, Version 22.0 (Released 2013. Armonk, NY: IBM Corp). All analysis were two-tailed and statistical significance was set at 0.05.

TABLE 2 Cronbach's α of the MDADI in English and Chinese

		Cronbach's α [95% CI]	
	No. of items	MDADI (English)	MDADI (Chinese)
Emotional	6	0.86 [0.79, 0.92]	0.84 [0.72, 0.92]
Functional	5	0.88 [0.81, 0.93]	0.82 [0.69, 0.91]
Physical	8	0.85 [0.77, 0.91]	0.83 [0.70, 0.91]
Total score	19	0.94 [0.92, 0.97]	0.93 [0.88, 0.96]

3 | RESULTS

3.1 | Participants

A total of 66 head and neck cancer patients participated in this study. Median age was 62 years, with a range of between 29 and 79 years. A majority of these participants (55%) were treated for nasopharyngeal cancer, followed by oral cancers (27%). Most participants (62%) had radiation therapy with or without chemotherapy. Table 1 summarizes other participant characteristics.

3.2 | Test–retest reliability

74% ($n = 49$) of participants returned the repeat MDADI questionnaire completed within 14 days after initial administration. Test–retest reliability was found to be acceptable for the total score of the English MDADI (ICC = 0.83; CI, 0.68–0.91; $n = 32$) and the translated Chinese MDADI (ICC = 0.72; CI, 0.39–0.89; $n = 17$). This is above the minimal acceptable level of 0.70.[29]

3.3 | Internal consistency reliability

The Cronbach's α of the English MDADI ranged between 0.85 and 0.94, and the Chinese MDADI between 0.82 and 0.93 (Table 2). This demonstrates high internal consistency of the English and Chinese MDADI. Item-total correlation of the English MDADI ranged between 0.43 and 0.85, and the Chinese MDADI between 0.17 and 0.89. Item P3 and P4 of the Chinese MDADI had an item-total correlation of 0.19 and 0.17. These were the only items below the acceptable correlation coefficient of 0.30.[31] However, the removal of these individual items did not increase the Cronbach's α of the total score significantly. The removal of P3 increased Cronbach's α from 0.925 to 0.930, and removal of P4 increased Cronbach's α from 0.925 to 0.929.

TABLE 3 Correlations between MDADI and SWAL-QOL total and subscale scores

	MDADI (Chinese)				MDADI (English)			
SWAL-QOL (in respective languages)	Total score	Emotional	Functional	Physical	Total score	Emotional	Functional	Physical
Total score	0.78**,[a]	0.70**	0.72**	0.68**	†0.72**	0.72**	0.78**	0.59**
Burden	0.55**	0.45*	0.57**	0.53**	0.59**	0.66**	0.66**	0.49**
Eating desire	0.68**	0.63**	0.69**	0.48*	0.50**	0.44**	0.41**	0.49**
Eating duration	0.38	0.28	0.28	0.32	0.61**	0.59**	0.58**	0.52**
Symptoms	0.68**	0.52**	0.53**	0.59**	0.43**	0.45**	0.48**	0.39*
Food selection	0.52**	0.49*	0.53**	0.40*	0.48**	0.47**	0.41**	0.39*
Communication	0.69**	0.59**	0.61**	0.73**	0.46**	0.40**	0.48**	0.48**
Fear	0.47*	0.41**	0.56**	0.51**	0.46**	0.51**	0.53**	0.41**
Mental Health	0.58**	0.62**	0.52**	0.52**	0.62**	0.70**	0.67**	0.53**
Social	0.63**	0.63**	0.72**	0.52**	0.79**	0.81**	0.87**	0.58**
Fatigue	0.43*	0.45*	0.47*	0.43*	0.39*	0.41**	0.41**	0.44**

*Correlation is significant at 0.05 level (two-tailed).
**Correlation is significant at 0.01 level (two-tailed).
[a]Pearson's correlation used.

3.4 | Criterion validity

The MDADI total score was strongly correlated with the SWAL-QOL total score in each language (Chinese $r = 0.78$, $P < 0.001$; English $r = 0.72$, $P < 0.001$, Table 3). All subscale scores on the MDADI in each language showed moderate to strong correlations with SWAL-QOL domain scores (Spearman's ρ $R = 0.39–0.87$; $P < 0.05$, Table 3). The only exception was the SWAL-QOL Eating Duration subscale; that did not correlate with any of the subscales in the Chinese MDADI ($R = 0.28–0.32$; $P > 0.05$, Table 3). However, on further analysis, the Chinese SWAL-QOL Eating Duration subscale showed a significant moderate correlation with Item P7 on the Chinese MDADI ("It takes me longer to eat because of my swallowing problem.") measuring the same concept of eating duration ($R = 0.45$; $P = 0.02$).

3.5 | Construct validity

3.5.1 | Convergent validity

The total and emotional subscale scores of the MDADI correlated moderately and negatively with HADS Anxiety and Depression subscale scores, providing evidence for convergent validity ($R = -0.44$ to -0.53, Table 4). The total, functional and physical subscale scores of the MDADI also correlated moderately with the FOIS ($0.41 \leq R \leq 0.43$).

3.5.2 | Divergent validity

Sleep is a concept that is not measured by the MDADI. As expected, the SWAL-QOL sleep subscale correlated poorly ($R = 0.26–0.40$) with the total and subscale scores of the MDADI.

TABLE 4 Spearman's ρ for the relationships between MDADI, HADS, FOIS and SWAL-QOL

	MDADI			
	Total score	Emotional	Functional	Physical
HADS anxiety	−0.47**	−0.44**	−0.42**	−0.39**
HADS depression	−0.53**	−0.49**	−0.61**	−0.39**
FOIS	0.43**	0.45**	0.41**	0.41**
SWAL-QOL sleep	0.31*	0.28*	0.40**	0.26*

*Correlation is significant at 0.05 level (two-tailed).
**Correlation is significant at 0.01 level (two-tailed).

3.5.3 | Known-group validity

Participants who were screened to be possibly depressed ($F(1,64) = 7.59$; $P < 0.01$; $n = 9$) or anxious ($F(1,64) = 8.66$; $P < 0.01$; $n = 7$) on the HADS had lower MDADI total scores than those who were not.

Participants presenting with less severe dysphagia on regular diet (FOIS 6–7, 64.2 ± 12.5) presented with higher MDADI total scores than the others (FOIS 1–5; 54.4 ± 13.5; $F(1,64) = 9.29$; $P = 0.003$). As expected, participants with different functional oral intake levels presented with differing MDADI total scores ($F(2,63) = 5.15$; $P < 0.01$, Figure 1). A Bonferroni post-hoc test revealed that participants on regular diet had higher MDADI total scores than those on modified oral diets (FOIS 4–5; 55.5±13.4; $P = 0.039$) and those who were dependent on enteral feeding (FOIS 1–3; 50.0±13.6; $P = 0.034$). There was no statistically significant difference between the MDADI total scores of those on modified oral diets and those dependent on enteral feeding ($P = 0.95$).

MDADI total scores were not found to be associated with dependence on tube feeding ($P = 0.088$), age ($P = 0.11$), gender ($P = 0.062$),

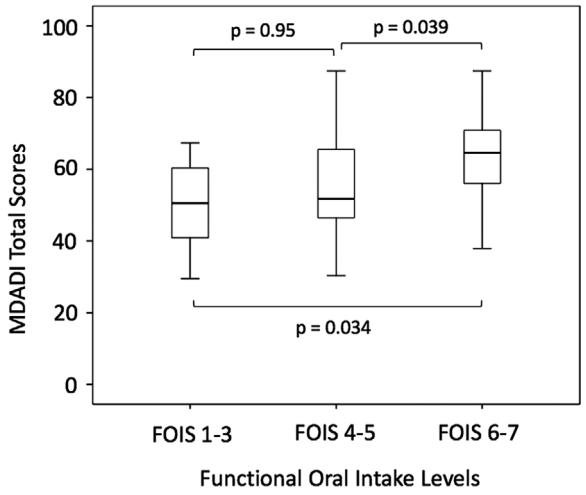

FIGURE 1 Distribution of MDADI total scores across functional oral intake levels, with Bonferroni *post hoc* test statistics

primary disease site ($P = 0.14$), type of treatment they had undergone ($P = 0.12$) and time since treatment ($P = 0.36$).

4 | DISCUSSION

With advancements in medical and surgical care, many survivors of head and neck cancer are living longer and with side effects of cancer treatment. For head and neck cancer survivors with dysphagia, a measure of swallowing-related quality of life is important in their holistic management. In this study, we cross-culturally adapted the MDADI into Chinese, and completed full psychometric validation of both the original English and translated Chinese versions of the MDADI with head and neck cancer patients in Singapore. This is the first time that a swallowing-related quality of life measure is validated in this population.

Reliability evaluation establishes the consistency of an instrument, and is typically measured with test–retest reliability and internal consistency measures.[33] The ICC coefficients of both the English and Chinese MDADI exceeded the established standard of acceptability.[29] The Chinese MDADI's Cronbach's α values of 0.82–0.93 were above the minimum satisfactory level of 0.70, and fall within the range of 0.67–0.92 reported by the original authors and other translated versions of the MDADI.[6,12–17] The item-total correlation of most items of the MDADI fall above the minimum satisfactory level of 0.30. Removal of the two items that did not meet this level (P3 and P4 of the Chinese MDADI did not significantly improve the Cronbach's α value of the Chinese MDADI. These items were also not remarked upon as confusing or redundant in the cognitive interviews conducted for the adaptation of the Chinese MDADI. To maintain measurability of the instrument, we decided to retain these items in the Chinese version of the MDADI.

Validity evaluation establishes how much a tool is able to measure what it intends to. This is typically analyzed by content, criterion and construct validity.[33] Content validity of the original English MDADI was addressed during its original development.[6] We addressed the content validity of the Chinese version through systematic translation and the cognitive interviewing process in our cross-cultural adaptation of the Chinese MDADI.

Criterion validity was established through comparing MDADI scores with the relevant subscales of the SWAL-QOL as a reference standard. This process was similarly undertaken in the adaptation of the Dutch[12] and Brazilian-Portuguese[17] versions of the MDADI. Our coefficients of between 0.39 and 0.87 show moderate to strong correlation between the MDADI and the SWAL-QOL. These coefficients are also comparable to the Dutch and Brazilian studies.

Construct validity was determined through the analysis of convergent, divergent and known-group validity. Depressed head and neck cancer patients are known to score significantly lower on the MDADI compared with nondepressed patients.[34] This was demonstrated in this study through the moderate negative correlation between MDADI scores and HADS scores.

Dysphagia is a known primary factor of reduced swallowing-related quality of life. A control group of nondysphagic participants were recruited in a previous study[13] to demonstrate known-group validity of an adapted version of the MDADI. We chose to use the FOIS as an indication of dysphagia severity, as it has been shown to be significantly associated with physiologic measures of swallowing.[28] We found that the mean total MDADI scores of participants on normal diet levels (FOIS 6–7 were 9.8 points higher from those on other diet levels FOIS 1–5). This difference is sufficient to be associated with clinically meaningful between-group differences in swallowing function.[7] There was also a moderate positive correlation between MDADI scores and FOIS. This reflects the trend shown in the Japanese MDADI,[15] and correlation values are comparable to those reported in the comparison of the Dutch MDADI to the FOIS.[12]

Interestingly, our study found that participants dependent on tube feeding (either fully or partially) did not present with significantly poorer swallowing-related quality of life than those on full oral feeding. This is contrary to previous findings that the presence of a feeding tube significantly lowered swallowing-related quality of life.[7,13]. On further analysis, we found that swallowing-related quality of life did not differ between participants who were dependent on enteral feeding (FOIS 1–2) and those taking an oral diet of modified consistencies (e.g. pureed foods, thickened fluids, FOIS 3–4; Figure 1). This reflects the findings of Rinkel *et al.* in head and neck cancer patients after chemoradiation therapy,[35] and may indicate that any deviation from taking a regular oral diet (FOIS 6–7) is associated with a poorer swallowing-related quality of life. This observation requires further study on a larger scale.

In our study, MDADI total scores were not found to be associated with patient, disease or treatment factors. Although some of these factors have been described as risk factors for post-treatment dysphagia,[36,37] severity of dysphagia is more likely caused by a combination of these factors. This may explain why in this study, swallowing-related quality of life scores did not show significant between-group differences in these individual factors. Future studies could explore the multivariate impact of these factors on swallowing-related quality of life in a larger sample of post-treatment head and neck cancer patients.

This hypothesis was not tested in our study as our current sample size was not sufficiently powered for multiple regression analysis.

One limitation of the original MDADI is that in some circumstances, the respondent may be unsure of the difference between the responses "no opinion" and "strongly disagree." For example, for item F5 "My swallowing difficulty has caused me to lose income.", a homemaker who does not receive income may choose either "no opinion" (as in, not applicable or "strongly disagree") (as in, it has not caused them to lose income). This implicates the scoring of the MDADI as "no opinion" scores a 3, whereas "strongly disagree" scores a 5. It is our recommendation to standardize choice of response for items that are not applicable to the user in questionnaire administration instructions.

Our study is limited by coverage bias, as participants were recruited from a speech and language therapy clinic in a tertiary hospital. These patients are likely more aware of their swallowing function, and are also more likely to be concerned about this. Although most posttreatment head and neck cancer patients in Singapore receive their speech and language therapy services from tertiary health care settings, the results of our study may not be generalizable to patients outside of this setting, such as those who are lost to speech therapy follow-up, especially those of low socioeconomic status.[38]

In conclusion, our study established adequate reliability and validity of a translated Chinese version of the MDADI that can be used to measure swallowing-related quality of life in Chinese-speaking head and neck cancer survivors. Together with the validated English MDADI, this avails a validated swallowing-related quality of life questionnaire in English and Chinese for routine clinical use in Singapore.

FUNDING

No funding was received for this study.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of SingHealth Centralised Institutional Review Board (Ref: 2016/2113), and with the 1964 Helsinki declaration and its later amendments. This article does not contain any studies with animals performed by any of the authors.

INFORMED CONSENT

Written informed consent was obtained from all individual participants included in the study.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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