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Temporal analysis of factors associated with EAT-10 in outpatients with oropharyngeal dysphagia from a tertiary care clinic

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Abstract

Purpose: Self-perception of disease is increasingly recognized as a determinant of health. The Eating Assessment Tool-10 (EAT-10) is a functional health status questionnaire that measures the symptomatic severity of dysphagia from the patient's perspective. The objective of this work was to identify factors (demographics, clinical variables, swallowing physiology, health-related quality of life) associated with longitudinal change in EAT-10 scores in outpatients with oropharyngeal dysphagia at a multi-disciplinary, tertiary care clinic.

Methods: All patients with swallowing concerns that were included in the UW Madison Voice and Swallowing Outcomes database from 12/2012-04/2015 were invited to complete EAT-10 and a general health-related quality of life survey (SF-12v2) at their initial evaluation and six months later. Forty-two patients were included in analysis (n=42).

Results: Weaning from a gastrostomy tube was significantly associated with EAT-10 improvement. Approximately 70% of the sample had mild dysphagia, and floor effects were observed for all EAT-10 items in this sample subset. Mean SF-12v2 Physical Component Summary score was substantially lower than that of the general population. Significant, weak-

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moderate correlations were found between and EAT-10 and SF-12v2 scores for all comparisons except for Physical Health Composite at six months ($r_s = -0.24$ to -0.43).

Conclusion: Weaning from a feeding tube appears to meaningfully improve self-perceived symptoms of dysphagia. Given the floor effects observed, validity of EAT-10 for patients with mild dysphagia should be examined. Future research should address contributors to self-perceived symptom change across the range of dysphagia severity.

Keywords

deglutition; deglutition disorders; oropharyngeal dysphagia; EAT-10; SF-12v2; patient-centered outcomes

INTRODUCTION

Symptoms of oropharyngeal dysphagia can cause significant disability that pervades one's physical, psychological, and social well-being. Dysphagia can restrict mealtime options and enjoyment, and over half of patients who have dysphagia report that they are unable to eat certain foods[1]. Approximately one-third of patients with dysphagia feel embarrassment or anxiety during meals, and prefer to eat alone[1, 2]. These restrictions lead up to half of patients to eat less during meals, and 33% of patients to experience thirst or hunger after a meal is completed[1, 3, 4]. Furthermore, patients with dysphagia often report weight loss[1, 5]. Despite a national shift toward patient-centered healthcare[6], few investigations have focused on dysphagic symptoms from the patient's perspective[7].

Self-perception of illness can influence behavior, treatment adherence, adjustment to chronic conditions, and outcomes[8–10]. Using clinical tools that allow patients to self-report symptoms is one strategy to promote communication and shared decision-making in patient-centered medicine[11]. In 2008, the Eating Assessment Tool (EAT-10) was introduced as a functional health status (FHS) questionnaire to evaluate the symptomatic severity of dysphagia from the patient's perspective[12]. The instrument was constructed with input from a multi-disciplinary group of swallowing experts and has been validated for patients with dysphagia[12]. To date, EAT-10 investigators have primarily focused on clinician-driven outcomes such as the identification of patients at risk for oropharyngeal dysphagia, aspiration, and malnutrition at a single time point[13–17]. The use of EAT-10 as a tool to support patient-centered care has largely been unexplored in the literature. As a self-report tool, EAT-10 may have the potential to elucidate the factors that influence patient-perceived dysphagic symptoms.

Several functional health status questionnaires that rely on patient-report for all-comers with oropharyngeal dysphagia and various subpopulations (e.g., EAT-10, Swallowing Disturbance Questionnaire, Sydney Swallowing Questionnaire- SSQ, Swallowing Outcome after Laryngectomy, Dysphagia Short Questionnaire, Dysphagia in Multiple Sclerosis Questionnaire) exist[18]. These tools are often used clinically to track symptom changes over time, but few research investigations have included longitudinal study designs or repeated administrations of questionnaires to better understand contributors to score evolution over time. An exception is that the SSQ, EAT-10, and Dysphagia Short

Questionnaire have been used to track pre- to post-treatment change in patients with stroke[19], esophageal dysphagia[12, 20], and degenerative disk disease [21]. These studies have largely focused on using the self-report questionnaires to detect a shift in swallowing symptoms following a specific treatment, rather than to better understand the clinical and demographic factors that influence treatment response. Ultimately, longitudinal studies of patient-perceived swallowing change may assist with identifying meaningful treatment targets for various subpopulations within patient-centered medicine.

In the present study, our objective was to identify factors associated with six-month change in EAT-10 scores in outpatients with oropharyngeal dysphagia. EAT-10 was originally designed to assess “symptom severity, quality of life, and treatment efficacy”[12]. As such, we hypothesized that longitudinal EAT-10 change would be associated with dysphagia severity factors and treatment completion (i.e., behavioral, medical, or surgical). Several factors related to dysphagia severity were included in the analysis, such as penetration or aspiration during instrumental swallow evaluation, recommendation for meal supervision, and recommendation for altered consistencies of liquids or solids. A generic health-related quality of life (HRQoL) instrument, the 12-Item Short-Form Survey (SF-12v2), was also completed by patients at baseline and six months to further characterize the study sample and to evaluate self-reported HRQoL status within the context of self-reported dysphagic symptoms. Given that EAT-10 was designed to assess quality of life[12] and has items that can be considered to assess HRQoL (“Swallowing is stressful.”) [22], we hypothesized that EAT-10 scores would correlate to SF-12v2 scores.

METHODS

Patient data were obtained from University of Wisconsin Voice and Swallow Clinics Outcomes Database in accordance with an approved Institutional Review Board (IRB) protocol. The database contains data from outpatients seen at UW Health Voice and Swallow Clinic who have provided informed consent. The database was created in 03/2009. Collection of EAT-10 and SF-12v2 surveys began in 12/2012 and were added to the database in 01/2013 with IRB approval. Presently, there are approximately 5000 patients with swallowing and/or voice concerns in the database.

For this prospective study, patients presenting to the UW Health Voice and Swallow Clinic with swallowing concerns were considered for inclusion. Patients whose sole dysphagia diagnosis was esophageal in origin, and those who underwent radiotherapy to the head or neck during the inclusion period were excluded. All patients were initially seen by a speech-language pathologist (SLP) and otolaryngologist. Prior to the initial visit, the swallowing intake form, EAT-10[12] and SF-12v2 questionnaires were mailed to patients and completed at home or during the appointment. All patients had an instrumental swallow evaluation (videofluoroscopic swallow study- VFSS, or fiberoptic endoscopic evaluation of swallowing- FEES) at the beginning of the study. Treatment (behavioral, medical, surgical) was offered as clinically indicated, and treatment type and frequency were not modified because of study inclusion. Follow-up EAT-10 and SF-12v2 surveys were sent six months after the initial evaluation to patients who were not offered treatment or who did not pursue

treatment. Follow-up EAT-10 and SF-12v2 surveys were sent six months after treatment completion to patients that underwent behavioral, medical, or surgical treatment.

Data Collection Timeline

Data collected at baseline and six months included EAT-10 and SF-12v2 responses. Data collected at baseline only included instrumental swallow evaluation results (including baseline dysphagia severity, penetration and/or aspiration, number of swallowing strategies recommended, recommendation for supervision during meals, recommendation for SLP therapy), age, sex, body mass index (BMI), mean per capita income, educational attainment, smoking history, dentition, dysphagia type, and presence of percutaneous endoscopic gastrostomy (PEG). Data collected at six months, following review of all relevant documentation in the database, included Charlson Comorbidity Index calculations, number of medications taken by the patient, recommendation or history of consuming alternate consistencies of liquids or solids, and treatment completed during the study (SLP, medical, surgical, none). Further description is provided below.

EAT-10

Six-month change in EAT-10 score was the primary outcome of interest. The EAT-10 is a ten-item questionnaire designed to assess “symptom severity, quality of life, and treatment efficacy”[12]. With respect to quality of life, EAT-10 includes items that target FHS as well as HRQoL[18]. The EAT-10 requires the patient to rate several swallowing issues (e.g., weight loss, coughing during meals, loss of pleasure during meals) on a five-point scale (0 = no problem, 4 = severe problem). Overall scores range from 0 to 40 points. The EAT-10 can generally be completed by the patient in less than two minutes and is easy to score. The EAT-10 has high internal consistency (Cronbach alpha = 0.96), high test-retest reliability, and criterion-based validity for patients with oropharyngeal dysphagia[12]. A total score of three or higher is considered abnormal based on normative data from healthy volunteers[12].

SF-12v2

The SF-12v2 Health Survey was included as a measure of general HRQoL. The SF-12v2 is a revised, abbreviated version of the Medical Outcomes Study 36-Item Short-Form Health Survey[23]. The revised 12-item tool is a single page survey that can typically be filled out in 2 minutes[24]. Subjects rate how often in the past month they have encountered various problems (e.g., reduced productivity at work, interference with social activities) because of mental or physical health limitations. Physical Component Summary (PCS) scores and Mental Component Summary (MCS) scores are derived from subject responses through a computerized algorithm from QualityMetric. For subjects who did not answer all SF-12v2 questions, QualityMetric’s default settings (Maximum Data Recovery Option) for SF-12 estimation were used when appropriate. In this algorithm, PCS and MCS scores were estimated for respondents who provided data for at least seven of the eight health domain scales, as long as the relevant scale scores were not missing. The SF-12v2 was selected for inclusion in this study due to its brevity, criterion-based validity, reliability, availability of normative data, and applicability to diverse populations[23, 25–28].

Clinical variables

Subject age, sex, BMI, and medication list were obtained from University of Wisconsin Voice and Swallow Clinics Outcomes Database. Vitamins, supplements, and medication duplicates were excluded from the medication counts. Smoking history (in past, never, currently smokes) and dentition status (own teeth, partial or full dentures, no dentition) were acquired from the intake form completed during the initial office visit. Comorbidities were gleaned from past medical history listed in the database and intake form. Charlson Comorbidity Scores were calculated with an electronic tool that uses published International Classification of Disease coding algorithms[29]. Presence of PEG at baseline was obtained from SLP/otolaryngology documentation within the database and from the intake form. Given the significant findings associated with patients with PEG, post-hoc database inquiry of the evolving dysphagia severity and liquid/solid consistencies intake over the study period was completed for this group.

Instrumental swallowing evaluation (VFSS, FEES) reports in the database provided baseline swallowing severity, penetration, and aspiration data. Ordinal ratings of baseline swallowing severity were provided by speech-language pathologists (i.e., “mild”, “moderate”, “severe”) based on observations during instrumental swallow evaluation. Intermediate terms were collapsed into the more severe category (e.g., “mild-moderate” became “moderate”). Dysphagia type (oropharyngeal, or oropharyngeal and esophageal) was obtained from SLP/otolaryngology documentation in the database and evaluation reports. Reports were also searched for the number of swallowing strategies (e.g., postures and maneuvers) recommended during meals, recommendations for meal supervision, and recommendations for swallowing therapy. Swallowing reports and intake forms were searched for recommendation or history of consuming alternate consistencies of liquids or solids. Treatment (SLP, medical, surgical, none) data were obtained from SLP and otolaryngology documentation in the database, and from timeline corroboration between medication prescription date and the subject’s inclusion period.

Income and educational attainment data were obtained from American Community Survey (ACS) from the U.S. Census Bureau. The ACS is a nationwide survey of demographic, social, economic, and housing characteristics of the U.S. population. Mean per capita income was obtained from five-year estimates from the 2014 ACS dataset by subject zip code tabulation areas. Data from the total population, without race or gender modifiers, were used. Mean income was defined as the average yearly per capita earnings estimated to occur in the subject’s zip code tabulation area. Education attainment was obtained from five-year estimates from the 2014 ACS dataset by subject zip code tabulation areas using age and gender modifiers. Educational attainment was defined as the estimated percentage of individuals within a zip code tabulation area that had earned a Bachelor’s degree or higher.

Statistical Analysis

To better understand the patient cohort, descriptive statistics (means, standard deviations) were calculated for the clinical variables, EAT-10 scores, and SF-12 scores. Baseline to six-month differences in EAT-10 and SF-12v2 scores were evaluated using paired t-tests. Six-month EAT-10 change was calculated by subtracting the baseline score from the six-month

score. Correlation coefficients were calculated to describe the relationships between SF-12v2 summary scores (MCS, PCS) and swallowing symptoms (EAT-10). Baseline to six-month differences in EAT-10 scores were compared with other factors using Pearson's correlation coefficients for continuous variables, and t-tests or analysis of variance (ANOVA) for categorical variables. An alpha level of 0.05 was considered significant.

RESULTS

Patients that provided consent for inclusion in the University of Wisconsin Voice and Swallow Clinics Outcomes Database from 12/2012 through 04/2015 were considered eligible for study ($n = 1786$). Patients with no swallowing concerns, no dysphagia on instrumental evaluation, or whose dysphagia type (esophageal vs oropharyngeal) was unknown were excluded ($n = 1673$). Of the remaining 113 patients, 39 were excluded because they had esophageal dysphagia only, 31 were excluded because they had not completed EAT-10 questionnaires at baseline and six months, and one was excluded due to receiving radiotherapy to the head or neck during their inclusion period. The EAT-10 response rate was 80.8% at baseline, and 63.3% at six months.

Ultimately, forty-two outpatients with EAT-10 scores available at baseline and six months were included in this analysis from a large, multi-disciplinary tertiary care clinic ($n = 42$). The mean age of the subject cohort was 66 years and 50% of the cohort was female (Table 1, 2). Most patients had mild dysphagia at baseline and were not treated during the study period (Table 3). Additional demographic and clinical variables are reported, with footnotes denoting when a reduced sample size was analyzed due to missing data (Tables 1, 2, and 3). Ten of the 42 subjects had missing data for one of the ten EAT-10 questions. In these cases, missing data fields were counted as zero during EAT-10 calculations. EAT-10 scores of outpatients with oropharyngeal dysphagia at six months did not differ from baseline ($p = 0.99$, Table 4). Symptom improvement is shown on EAT-10 by a lowering of the score on the 40-point scale. Four of the 42 subjects (9%) received overall EAT-10 scores of zero, the lowest possible score on the EAT-10, suggesting that a small floor effect was found for the survey. The percentage of subjects with mild dysphagia with scores of zero on individual EAT-10 items ranged from 36–79% ($n = 29$; Q1: 79%, Q2: 71%, Q3: 57%, Q4: 32%, Q5: 41%, Q6: 69%, Q7: 63%, Q8: 36%, Q9: 54%, Q10: 57%) (Figure 1).

The variable that was associated with six-month EAT-10 difference from baseline was presence of a percutaneous endoscopic gastrostomy (PEG) tube at baseline (Table 3, $p = 0.03$). Factors that were not associated with six-month difference in EAT-10 scores were age at study inclusion, gender, smoking history, dentition status, body mass index (BMI), mean per capita income, education level, Charlson Comorbidity Index, and number of medications. Continuous variables are reported in Table 1, and categorical variables are reported in Table 2. Swallowing-related variables that were not associated with six-month difference in EAT-10 scores included dysphagia type, dysphagia severity at the beginning of the study, penetration or aspiration during instrumental swallow evaluation, treatment completed, number of strategies (postures, maneuvers) recommended following instrumental swallow assessment, and several SLP recommendations (alternate solid consistency, alternate liquid consistency, meal supervision, swallow therapy) (Table 3).

For the SF-12v2, 38/42 subjects had no missing data. Four subjects did not answer one to two SF-12v2 questions. As a result, PCS calculated for 38 subjects and MCS was calculated for 40 subjects according to the QualityMetric algorithm (Table 4). SF-12v2 PCS at six months and MCS at six months did not differ from baseline ($p = 0.28, 0.63$, respectively). Improved health on PCS and MCS is shown by higher scores. Data are shown with respect to normative SF-12v2 data from the general U.S. population in Figure 2[24]. There was a statistically significant, moderate correlation between MCS and EAT-10 scores at baseline ($r = -0.40, p = 0.01$) and six months ($r = -0.43, p = 0.01$). There was a statistically significant, weak to moderate correlation between PCS and EAT-10 scores at baseline ($r = -0.33, p = 0.04$). At six months, the correlation was weak and not statistically significant ($r = -0.24, p = 0.14$).

DISCUSSION

Self-perception of disease is increasingly recognized as a determinant of health behaviors and outcomes, yet it is infrequently scrutinized by healthcare professionals [8–10, 30]. Understanding the factors that drive self-perception could assist clinicians in the management of dysphagia. Modifiable factors (e.g., swallowing postures) could be treatment targets, and non-modifiable factors to (e.g., age, sex) could guide prognostic decision-making. The objective of this investigation was to identify the contributors to six-month change in self-perceived dysphagic symptoms in patients seen at a multi-disciplinary, tertiary-level care institution. Presence of PEG tube was the only significant factor associated with EAT-10 score improvement over six months. Presence of PEG tube has been linked to dysphagia severity in the literature[31]. We hypothesized that dysphagia severity would be a driver of EAT-10 change, but baseline dysphagia severity was not statistically significant in the analysis. As there was only one subject in the study with severe dysphagia at baseline, it would have been difficult to achieve statistical significance with this variable. In our HRQoL analyses, the study cohort was found to have a mean SF-12v2 Physical Component Summary score that was substantially lower than that of the general population[24]. EAT-10 scores were moderately correlated to SF-12v2 MCS at baseline and six months, but only weak to moderately correlated to PCS at each time point. These data suggest that EAT-10 and SF-12v2 provide some unique, and some overlapping clinical data in patients with oropharyngeal dysphagia.

Longitudinal EAT-10 Change

There was no significant six-month change in EAT-10 scores for this outpatient cohort with oropharyngeal dysphagia (Table 4). The mean EAT-10 score at six months, 11.05, was within the range of previously reported scores (7 – 23) for patients with oropharyngeal dysphagia[12, 13, 28, 32]. Two potential contributors to the stagnant EAT-10 scores were the high score variability of the sample and floor effects for patients with mild dysphagia. The relatively large standard deviation of EAT-10 scores at baseline and at six months suggests that patients varied widely in their dysphagic perceptions during the study period (Table 4). A larger or a more homogenous sample (e.g., outpatients with Parkinson disease), may have yielded EAT-10 scores with a smaller standard deviation, and potentially a clearer understanding of the contributors to EAT-10 change.

Floor effects in the EAT-10 could have made it more difficult to detect meaningful change in symptoms over time[33]. A small floor effect is considered to occur when 1–15% of a sample receives the best possible score on a survey, and a moderate floor effect is considered to occur when greater than 15% of a sample receives the best possible score on a survey[34, 35]. Using this criterion, our data suggest that there was a small floor effect for the EAT-10 survey, given that 9% of the subjects received the lowest possible overall score ($n = 42$). The percentage of subjects with mild dysphagia with scores of zero on individual EAT-10 questions ranged from 36–79% (Figure 1), suggesting that there were moderate floor effects for all ten EAT-10 items in patients with mild dysphagia ($n = 29$). The EAT-10 questions most concerning for floor effects were Q1 (“My swallowing problem has caused me to lose weight.”), Q2 (“My swallowing problem interferes with my ability to go out for meals.”), and Q6 (“Swallowing is painful.”). Floor effects in clinical tools are known to be population dependent[36]. There is some preliminary evidence that EAT-10 scores increase with greater severity of oropharyngeal dysphagia[32], however, further exploration into EAT-10 validity in patients with mild dysphagia is warranted[22]. Further evaluation of other psychometric properties of EAT-10 have also been suggested, such as responsiveness, the ability of a tool to detect a clinically important change [22, 37].

Presence of PEG tube at baseline was the only significant contributor to EAT-10 change in the study cohort (Table 3). Literature suggests that the effect of PEG tube use on FHS and HRQoL is population dependent[38–42]. In patients with head and neck cancer (HNC), PEG use had a more negative effect on FHS and HRQoL than all other variables analyzed, including chemotherapy treatment and tracheostomy tube use[38]. As this HNC sample had variable amounts of time since diagnosis, the findings may have related to long-term PEG use in some patients. Major PEG-related contributors to poorer FHS ratings in the HNC population have been reported to be interference with social life, intimate relationships or hobbies[39]. On the other end of the spectrum, improved HRQoL was found in all-comers who received a PEG at a gastrointestinal clinic[40]. Improved HRQoL was also found in their caregivers[40]. HRQoL was also preserved in HNC patients that received a PEG prior to undergoing radiotherapy, as compared to patients without enteral nutrition[41]. In pediatric patients with severe neurological impairment, PEG tube usage was rated by caregivers as improving their children’s health and ease of medication administration[42]. Though, it should be noted that proxy ratings of HRQoL can be biased[43]. Collectively, these data suggest that the effect of PEG use on FHS and HRQoL is influenced by population characteristics such as likelihood for short-term use and interference with other life activities.

In our study, two of the four patients with PEG at baseline had dramatic improvements in EAT-10 scores over the study period. Per SLP documentation, these individuals had improvements in dysphagia severity, transitioned toward less restrictive liquid and solid consistencies, and reduced the volume of daily enteral feedings during the study period. These data may add to the existing literature[38–42] by suggesting that reducing one’s nutritional dependence on a PEG tube is a meaningful contributor to one’s perception of their functional health status, though a larger sample size is necessary.

Correlation between EAT-10 and SF-12v2

HRQoL was described for the study sample using the SF-12v2, and the relationship between patient-perceived dysphagic symptoms and HRQoL was investigated. HRQoL is increasingly recognized as an important clinical outcome, on par with traditional targets such as eliminating disease[44]. Several factors contribute to one's conceptualization of HRQoL, including personal health values, and the social and economic supports available for life activities[44]. Despite the complexity of this construct, many clinical instruments designed to assess HRQoL are valid, reliable and sensitive to clinical changes[45, 46]. Dysphagic participants in our study had similar SF-12v2 MCS scores as the general U.S. population ($n = 2,329$), but substantially lower PCS scores (Figure 2). In the general population, PCS scores tend to decrease over the lifespan[24]. The average age of our study participants was 66 years. When age-based normative SF-12v2 data were considered, the average PCS score in our subjects was still lower than the U.S. population (age 65–74) (Figure 2)[24]. As individuals with dysphagia often have comorbidities such as limb weakness associated with stroke, the lower PCS scores of the study subjects could have been influenced by other health issues. Regardless, these findings underscore the significance of diminished physical health perceptions in patients with dysphagia.

Greater correlation was found between EAT-10 scores and SF-12v2 MCS than between EAT-10 and SF-12v2 PCS. Similar findings were reported for the M.D. Anderson Dysphagia Inventory (MDADI), an instrument used to evaluate the psychosocial aspects of dysphagia and HRQoL in patients with head and neck cancer. Correlations between MDADI and SF-36 were higher for MCS than for the PCS ($r_s = 0.44, 0.25$, respectively)[47]. SWAL-QOL, a longer, 44-item tool that assesses HRQoL in patients with dysphagia, also showed high correlation when mental health items from the Medical Outcomes Study were compared to relevant survey items[48]. Physical health items were not analyzed. Potential contributors to the weak-moderate correlation between EAT-10 and SF-12v2 (PCS) in our study include that there were comorbidities that confounded the SF-12v2 data, that SF-12v2 may not be sensitive to the unique physical health considerations of patients with oropharyngeal dysphagia, or that EAT-10 and SF-12v2 measure related, but different constructs. Collectively, these data speak to the challenge of designing tools that capture the complexity of physiological and psychophysical phenomena, while remaining brief[44].

Limitations

Several limitations related to the sample warrant mention. First, the sample size was modest ($n = 42$) and there were potential sources of sample variation which were not controlled (e.g., time since dysphagia onset). As we were interested in all-comers with oropharyngeal dysphagia, there were few exclusionary criteria. For example, the sample contained many more subjects with mild dysphagia than moderate or severe dysphagia. Second, the subject cohort included outpatients seen at a large, tertiary level care teaching hospital, so findings may not be translatable to dysphagic patients seen in other environments. The cohort may have included patients that were referred from other facilities with recalcitrant symptoms, and these patients might be less amenable to improvement than patients without a referral.

Limitations related to the research design also warrant mention. First, an instrumental swallow evaluation (VFSS or FEES) could have been included at six months for comparison to the baseline evaluation. These data would have determined if EAT-10 was responsive to observed clinical changes. Second, despite the many strengths of database studies (e.g., real-world treatment settings, unselected populations, long observation periods, study of disease subpopulations), there are also inherent weaknesses[49]. Potential issues specific to the current study include clinical management inconsistencies, variation in clinical ratings of dysphagia severity, and missing data due to multiple clinicians being involved. Third, the primary outcome of interest relied on patient self-report. Self-report is part of patient-centered healthcare, but can be challenging due to issues such as poor introspection of patients, exclusion of patients with weak reading and writing skills, and inconsistent interpretation of rating scales[50]. Last, use of American Community Survey data to investigate the effects of education level and income relied on zip code tabulation areas which may have not fairly represented individuals in the sample. Spatiotemporal data mismatch and lack of granularity are two of the concerns that can affect the reliability of zip code tabulation area data [51, 52].

CONCLUSION

Despite a shift toward patient-centered healthcare, dysphagia research has rarely focused on symptoms from the perspective of the patient. No change in EAT-10 scores was observed in this cohort of outpatients with oropharyngeal dysphagia seen at a large, multi-disciplinary, tertiary-level care clinic over six months. The sample was largely composed of patients with mild dysphagia at baseline, and meaningful change may have been difficult to detect due to floor effects for EAT-10 items or high score variability. Presence of PEG tube at baseline was the only variable that was associated with EAT-10 change. The dysphagic subjects had substantially poorer physical HRQoL than a large, normative sample of similarly aged peers. Given the mild severity of the cohort, these data may underscore the seriousness of oropharyngeal dysphagia. Future research should focus on identifying the contributors to self-perceived and clinician-observed changes in patients across a range of oropharyngeal severity, with the overarching goal of helping patients thrive.

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Fig 1. EAT-10 score frequencies in subjects with mild dysphagia.

The number of subjects with mild dysphagia to report each score (0 – 4 points) is shown for each of the ten EAT-10 questions ($n = 29$). The percentage of subjects with mild dysphagia who received the lowest possible score (zero) on individual EAT-10 items ranged from 36-79%, suggesting that moderate floor effects were found for all ten items on the EAT-10 survey in this population subset.

Fig. 2. Mental Component Summary (MCS) and Physical Component Summary (PCS) scores did not differ at six months from baseline for subjects.

Short-Form Health Survey v2 (SF-12v2) data are shown as means $\pm$ standard deviation ($p < 0.05$). The dotted line marks average MCS and PCS scores for the general U.S. population from published normative data (MCS = 50.04, PCS = 50.12)[24].

Table 1.

Six-Month EAT-10 Difference Correlation by Demographic Variables (n = 42)

	Mean (SD)	Correlation coefficient (r)	<i>p</i>
Age	66.67 (12.68)	0.04	0.59
Body Mass Index (BMI) ^a	27.24 (5.01)	−0.12	0.50
Mean per capita income	31143.33 (7714.40)	0.05	0.73
Bachelor's degree	31.01 (16.20)	0.03	0.85
Charlson Comorbidity Index ^a	3.54 (2.19)	−0.09	0.60
No. of medications ^a	11.38 (8.36)	0.12	0.50

^a
n = 37*Abbreviations:* SD, standard deviation

Table 2.

Six-Month EAT-10 Difference by Demographic Variables (n = 42)

	n (%)	Six-month EAT-10 Difference^a; Mean (SD)	DF	F/t Value^b	p
Sex			40	0.02	0.99
Female	21 (50.0)	0.00 (8.23)			
Male	21 (50.0)	-0.05 (10.11)			
Smoking history			2	0.74	0.48
In past	21 (50.0)	0.14 (10.64)			
Never	20 (47.6)	0.35 (7.29)			
Currently smokes	1 (2.3)	-11.00 (NA)			
Dentition			4	0.55	0.70
Own teeth	24 (57.1)	-0.75 (10.09)			
Partial dentures	7 (16.7)	-0.29 (2.69)			
Full set dentures	4 (9.5)	-3.00 (16.08)			
None	1 (2.3)	3.00 (NA)			
Unknown	6 (14.3)	4.67 (3.08)			

^aEAT-10_{Six month} - EAT-10_{baseline}^bF values provided for smoking history, dentition; t value provided for gender

Abbreviations: SD, standard deviation; DF, degrees of freedom

Table 3.

Six-Month EAT-10 Difference by Clinical Variables (n = 42)

	n (%)	Six-month EAT-10 Difference ^a ; Mean (SD)	DF	F/t/r Value ^b	p
Dysphagia type			40	-0.73	0.47
Oropharyngeal	24 (57.1)	0.88 (10.22)			
Oropharyngeal + esophageal	18 (42.9)	-1.22 (7.49)			
Baseline dysphagia severity			2	2.30	0.11
Mild	29 (69.0)	1.83 (7.78)			
Moderate	12 (28.6)	-3.67 (11.06)			
Severe	1 (2.3)	-10.00 (NA)			
No. of swallowing strategies		NA	NA	-0.29	0.07
	3.03 (mean) 1.41 (SD)				
Alternate solids consistency			40	1.45	0.16
No	15 (35.7)	2.67 (8.37)			
Yes	27 (64.3)	-1.52 (9.30)			
Alternate liquid consistency			40	0.68	0.50
No	34 (81.0)	0.44 (8.77)			
Yes	8 (19.0)	-2.00 (10.85)			
Supervision recommendation			40	1.33	0.19
No	38 (90.5)	0.58 (9.22)			
Yes	4 (9.5)	-5.75 (6.02)			
PEG at baseline ^c			39	2.24	0.03
No	37 (90.2)	1.22 (8.22)			
Yes	4 (9.8)	-9.00 (12.75)			
Penetration ^d			37.31	-1.54	0.13
No	11 (27.5)	-2.00 (4.22)			
Yes	29 (72.5)	1.45 (9.91)			
Aspiration ^d			38	-0.15	0.88
No	31 (77.5)	0.39 (9.01)			
Yes	9 (22.5)	0.89 (8.55)			
SLP therapy recommended			40	-0.71	0.48
No	33 (78.6)	-0.55 (8.55)			
Yes	9 (21.4)	1.89 (11.27)			
Treatment completed			3	0.48	0.70
SLP	5 (11.9)	1.00 (13.73)			
Medical	7 (16.7)	-1.14 (4.41)			
Surgical	3 (7.1)	-5.67 (15.31)			
None	27 (64.3)	0.70 (8.63)			

^aEAT-10Six month - EAT-10baseline

^bF value provided for baseline dysphagia severity, treatment completed; *t* value provided for dysphagia type, alternate solids/liquids consistency, PEG during study, penetration, aspiration, SLP therapy recommended, *r* value provided for No. of swallowing strategies

^c_n = 41

^d_n = 40

Abbreviations: SD, standard deviation; DF, degrees of freedom; PEG, percutaneous endoscopic gastrostomy; SLP, speech- language pathology

Table 4.

EAT-10 and SF-12v2 Scores (n = 42)

	Baseline (SD)	Six months (SD)	Six-month EAT-10 Difference ^a ; Mean (SD)	Student's <i>t</i> value	<i>p</i>
EAT-10	11.07 (9.63)	11.05 (10.27)	-0.02 (9.11)	-0.02	0.99
PCS ^b	37.53 (12.02)	38.86 (11.40)	1.50 (8.59)	1.09	0.28
MCS ^c	50.28 (10.84)	51.91 (10.98)	0.69(10.40)	0.49	0.63

^aEAT-10Six month - EAT-10baseline^b
n = 38^c
n = 40*Abbreviations:* SD, standard deviation; SF-12v2, Short-Form Health Survey v2; PCS, Physical Component Summary; MCS, Mental Component Summary