Creation and Initial Validation of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale

Catriona M. Steele, PhD, Ashwini M. Namasivayam-MacDonald, PhD, Brittany T. Guida, BA, Julie A.Y. Cichero, PhD, Janice Duivestein, MRSc, Ben Hanson, PhD, Peter Lam, RD, CFE, Luis F. Riquelme, PhD

PII: S0003-9993(18)30085-6

DOI: 10.1016/j.apmr.2018.01.012

Reference: YAPMR 57146

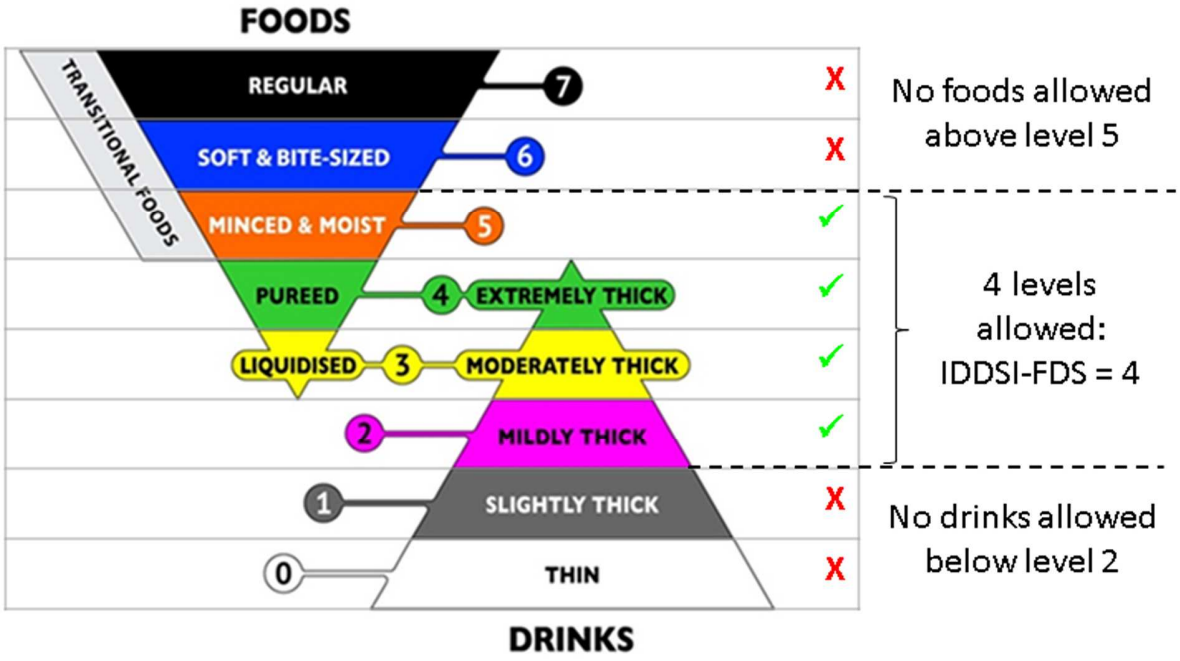
To appear in: *ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION*

Received Date: 31 August 2017

Revised Date: 22 December 2017

Accepted Date: 4 January 2018

Please cite this article as: Steele CM, Namasivayam-MacDonald AM, Guida BT, Cichero JAY, Duivestein J, Hanson B, Lam P, Riquelme LF, Creation and Initial Validation of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale, *ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION* (2018), doi: 10.1016/j.apmr.2018.01.012.



Running Header: *IDDSI-FDS*

Title: Creation and Initial Validation of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale

Authors: Catriona M. Steele, PhD[1,2,3]

Ashwini M. Namasivayam-MacDonald, PhD[1,2, 3]

Brittany T. Guida, BA[1]

Julie A. Y. Cichero, PhD[4,5,6]

Janice Duivestein, MRSc[4,7,8]

Ben Hanson, PhD[4,9]

Peter Lam, RD, CFE[4,8,10]

Luis F. Riquelme, PhD[4,11,12]

Author Affiliations:

1. Toronto Rehabilitation Institute – University Health Network, Toronto, Canada
2. Rehabilitation Sciences Institute, Faculty of Medicine, University of Toronto, Toronto, Canada
3. Dept. of Communication Sciences and Disorders, Adelphi University, Garden City, New York
4. International Dysphagia Diet Standardisation Initiative, Brisbane, Australia
5. School of Pharmacy, University of Queensland, Brisbane, Australia
6. School of Clinical Sciences, Queensland University of Technology, Brisbane, Australia
7. Access Community Therapists, Vancouver, Canada
8. University of British Columbia, Vancouver, Canada
9. University College London, London, UK

10. Peter Lam Consulting, Vancouver, Canada

11. New York-Presbyterian Brooklyn Methodist Hospital, Brooklyn, NY.

12. New York Medical College, Valhalla, New York.

Previous Presentations of this Material: The project described in this manuscript was presented as an oral presentation at the 2017 Dysphagia Research Society meeting (March, 2017) in Portland, Oregon

Funding: Funding for this study was provided through an RO1 grant from the National Institute on Deafness and Other Communication Disorders DC011020 to the first author.

Conflicts of Interest: Six of the authors (PL, JAYC, CMS, BH, JD and LFR) are members of the board of directors for the International Dysphagia Diet Standardisation Initiative (www.iddsi.org).

Corresponding Author and Reprint Contact:

Catriona M. Steele

Toronto Rehabilitation Institute – University Health Network

550 University Avenue, 12th floor

Toronto, ON, M5G 2A2 Canada

Tel: 416 597 3422 X 7603

E-mail: catriona.steele@uhn.ca

Creation and Initial Validation of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale

Objective: To assess consensual validity, inter-rater reliability and criterion validity of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale (IDDSI-FDS), a new functional outcome scale intended to capture the severity of oropharyngeal dysphagia, as represented by the degree of diet texture restriction recommended for the patient.

Design: Participants assigned IDDSI-FDS scores to 16 clinical cases. Consensual validity was measured against reference scores determined by an author reference panel. Inter-rater reliability was measured overall and across quartile subsets of the dataset. Criterion validity was evaluated versus Functional Oral Intake Scale (FOIS) scores assigned by survey respondents to the same case scenarios. Feedback was requested regarding ease and likelihood of use.

Setting: Web-based survey.

Participants:170 respondents from 29 countries.

Interventions: N/A

Main Outcome Measures: Consensual validity (% agreement, Kendall's tau), criterion validity (Spearman rank correlation), inter-rater reliability (Kendall's concordance and intra-class coefficients).

Results: The IDDSI-FDS showed strong consensual validity, criterion validity and inter-rater reliability. Scenarios involving liquid-only diets, transition from non-oral feeding or trial diet advances in therapy showed the poorest consensus, indicating a need for clear instructions on how to score these situations. The IDDSI-FDS showed greater sensitivity than the FOIS to

specific changes in diet. The majority (> 70%) of respondents indicated enthusiasm for implementing the IDDSI-FDS.

Conclusions: This initial validation study suggests that the IDDSI-Functional Diet Scale has strong consensual and criterion validity and can be used reliably by clinicians to capture diet texture restriction and progression in people with dysphagia.

Key words:

deglutition;

deglutition disorders;

dysphagia;

texture modification;

functional outcome scales

Abbreviations:

IDDSI	International Dysphagia Diet Standardisation Initiative
IDDSI-FDS	International Dysphagia Diet Standardisation Initiative – Functional Diet Scale
FSS	Functional Status Scale
PSS	Performance Status Scale
DOSS	Dysphagia Outcome and Severity Scale
FIM	Functional Independence Measure
ASHA	American Speech-Language Hearing Association
ASHA-NOMS	American Speech-Language Hearing Association National Outcome Measures Scale
FCM	Functional Communication Measure
FOIS	Functional Oral Intake Scale
UK TOM	United Kingdom Therapy Outcome Measurement Scale
AusTOMS	Australian Therapy Outcome Measurement Scale
N/A	Not applicable
NPO	nil-per-oris, i.e. nothing by mouth

Diet texture modification is the most commonly-used intervention for people with dysphagia [1]. Although the extent of dietary modification may be seen as a proxy measure of dysphagia severity, functional outcome scales for dysphagia are vague on this point. The goal of this study was to conduct preliminary validation of a new scale, designed to capture and communicate the degree of diet texture restriction recommended by clinicians for patients with dysphagia according to the new International Dysphagia Diet Standardisation Initiative (IDDSI) framework [2]. This new scale is known as the IDDSI-FDS (International Dysphagia Diet Standardisation Initiative – Functional Diet Scale).

Table 1 provides an overview of existing functional outcome scales for swallowing. Most commonly, higher scores indicate less severe impairment, consistent with the conventions of the Functional Independence Measure (FIM) [12]. Although reference may be made to the extent of diet texture restriction recommended for a patient, these references lack context. Terms like "levels below a regular diet status" imply knowledge of a diet framework with commonly understood levels of consistency, yet no such framework is identified. Around the world, different conventions have been in place with respect to the number of diet texture levels used in dysphagia management, as well as the directionality and terminology for labelling these levels [13]. Recognition of the lack of a common framework for diet texture classification became the driving impetus behind development of the International Dysphagia Diet Standardisation Initiative (IDDSI) Framework [2], a new scheme for describing and categorizing foods and drinks according to their texture or flow characteristics. The framework includes 8 levels, organized in two intersecting pyramids (Figure 1), with the outer levels (0 and 7) representing unmodified drinks and foods and intervening levels representing progressively greater degrees of texture modification. A novel aspect of the IDDSI Framework is the overlap zone at levels 3 and 4, in

which the characteristics of foods and drinks are equivalent. Internationally, several national professional associations and guidelines bodies (including those in the United States, Canada, and Australia) have formally announced intent to adopt the IDDSI Framework [14-16].

The IDDSI-FDS (IDDSI Functional Diet Scale) was developed as an accompaniment to the IDDSI Framework to capture the degree of diet texture restriction recommended for a patient based on assessment by a qualified clinician. The scale does not indicate the specific textures that are recommended, rather it classifies dysphagia severity according to the degree of diet limitation, i.e. the number of levels on the IDDSI Framework that a patient can consume. Lower numbered scores on the IDDSI-FDS reflect tighter diet texture restriction. The scale captures clinician recommendation rather than the results of a standardized measure of swallowing physiology or function or the actual behavior of the patient, which may or may not be consistent with the clinician's recommendation.

Each level on the IDDSI framework is identified by a descriptive name (e.g. mildly-thick), a color, and a number. Detailed descriptors and methods for testing foods and drinks to confirm their place in the framework are provided at the IDDSI website (www.iddsi.org). In clinical practice, a modified texture diet order is expected to comprise two levels from the IDDSI framework: first the food level and then the drink level. This is consistent with clinical conventions for specifying diets, beginning with the nutritional specification (e.g. low sodium), followed by food texture and terminating with liquid consistency [17,18]. The IDDSI-FDS score is intended as an accompaniment to the diet texture prescription and can be derived using a matrix similar to a mileage chart (see Figure 2). The IDDSI-FDS score corresponds to the number in the

intersecting cell of the column showing the food level and the row showing the drink level recommended for the patient. An IDDSI-FDS score of "0" applies for recommendations of nothing-by-mouth (NPO) with exclusive non-oral feeding. Similarly, an IDDSI-FDS score of "1" applies when oral intake is restricted to any single level on the IDDSI framework. The specific level(s) recommended cannot be understood from the IDDSI-FDS score alone. This is similar to the convention of other functional outcome scales such as the FIM [12], which specifies the degree of assistance or supervision required (e.g., minimal, moderate, maximal, total) for an activity such as grooming or mobility, without identifying the specific types of assistance provided (e.g. wheelchair versus walker). With respect to diet texture modifications, certain combinations of food and drink levels are not allowed on the IDDSI-FDS and are marked "N/A" in Figure 2 because they represent errors of logic in the overlap zone of Levels 3 and 4. It is not logical to specify a food texture at Level 3 – liquidised while permitting Level 4 – extremely thick drinks. Similarly, it is not logical to permit liquidised or pureed foods for patients who are considered unable to tolerate any oral intake of liquids, or to permit moderately or extremely thick liquids for patients who are considered unable to tolerate any oral intake of foods.

An assumption of the IDDSI-FDS scale is that the two levels specified in a diet texture prescription bracket a range of food and drink levels that is suitable for the person with dysphagia to consume. For example, Figure 3a illustrates a recommendation for Level 5 - Minced and Moist Foods with Level 2 - Mildly thick Liquids; it follows that the clinician would also be comfortable with the patient receiving Level 4 – Pureed foods/Extremely thick liquids and Level 3 – Liquidised foods/Moderately thick liquids. The IDDSI-FDS score would be "4", indicating that four levels on the IDDSI Framework (i.e., levels 2, 3, 4 and 5) are permitted for

the patient. Figure 3b shows a second example: for a recommendation of Level 3 – Liquidised foods/Moderately thick liquids and Level 1 – Slightly thick liquids, the IDDSI-FDS score would be "3", capturing the fact that Level 2 - Mildly thick liquids would also be allowed.

The purpose of the current study was to conduct initial evaluation of the psychometric properties of the IDDSI-FDS scale. The specific scale properties of interest were consensual validity, inter-rater reliability and criterion validity. The study aims also included obtaining feedback regarding perceived scale utility, determining the degree of consensus regarding the concept of expressing diet recommendations as a bracketed range of IDDSI levels, and exploring the possible addition of a diacritic ("+") to denote therapeutic introduction of food or drink items from a more advanced IDDSI framework level.

Methods

A Google Survey was developed and launched on September 1, 2016. Ethics approval was obtained from the local institutional review board. The survey introduction stated clearly that participation was voluntary and responses would remain non-identifying in all reports arising from the project. Participants were free to withhold responses at any stage without penalty. Notices advertising the survey were distributed to dysphagia clinicians via social media and on the IDDSI and principal investigator websites. The survey was organized in three sections:

- Demographic questions regarding the respondent's country of residence, profession, level of education, years of clinical practice with dysphagia, and caseload.
- 16 case scenarios (infant through geriatric) in which a diet texture recommendation was specified (see Appendix for examples of 10 of these cases). Respondents were asked to

review each case scenario and assign both an IDDSI-FDS score and a FOIS score. These were compared to reference scores previously established by consensus among a subgroup of the authors (CMS, AMN, LFR and JD); this subgroup comprised dysphagia clinicians with 4 to > 20 years' experience with acute, rehabilitation and community based patients across the age span.

- Questions requesting input regarding IDDSI-FDS scale scoring rules (5-point Likert scales with comment boxes).

After 3 1/2 weeks, the 3-day moving average for survey response frequency dwindled to 4. Strong response stability for the IDDSI-FDS scoring was shown across quartile batches of the responses received to date. Therefore, a decision was made to close the survey.

Analysis

Statistical analyses were performed in SPSS version 24.0. Frequency counts were tabulated for categorical and ordinal responses (demographics, qualitative questions). Consensual validity was measured based on the agreement in IDDSI-FDS scores for the 16 case scenarios between the survey responses and the author panel reference scores (% agreement, Kendall's tau). Inter-rater reliability was calculated across successive quartile batches of the response pool using Kendall's concordance (W) and intra-class coefficients (ICCs). Criterion validity was measured by comparing the IDDSI-FDS scores selected by survey respondents to the corresponding FOIS scores selected for the same case scenarios (Spearman rank correlation analysis).

Qualitative analysis was performed on the comments provided in response to the perceived utility and feedback questions. One team member (BTG) reviewed all of these comments and prepared a thematic coding system. A second team member (AMN) then independently reviewed

and coded all comments. A consensus meeting was then held to resolve discrepancies and finalize coding.

Results

Survey Respondents:

In total, 170 responses were received from 29 countries, as summarized in Table 2. The professional profile of respondents included speech-language pathologists (80%), dietitians (10%), physicians (7%) and smaller numbers of representatives from other professions: occupational therapists (n = 2); physical therapist (n = 1); dentist (n = 1); food technologist (n = 1). Almost half of the respondents (49%) reported having more than 10 years of clinical experience, with a further 42% reporting 3-10 years of experience. Inquiries regarding caseload revealed that 25.5% of respondents worked with adults, 41.8% with seniors and 6% with children. The remaining 26.6% reported working with caseloads of mixed age. Figure 4 illustrates respondents' work settings; slightly more than one third of participants reported working in more than one type of setting.

Consensual Validity:

Figure 5 illustrates the distribution of IDDSI-FDS scores selected by the survey respondents for six of the case scenarios. Overall, the respondents achieved 73% agreement with the author panel reference scores (R = 0.92, Kendall's tau-b = 0.84). Post-hoc exploration showed no differences in the frequency of agreement/discrepancy with the reference scores as a function of the respondent's years of clinical experience (<1, 1-2, 3-5, 6-10 or > 10 years), $\chi^2(df = 4) = 5.22$, p = 0.27. For most of the case scenarios the distributions show strong consensus and mode scores

were selected by ≥ 77% of respondents. Where consensus was weaker, three patterns were observed. For three cases (e.g., appendix case h), a broader distribution of scores was seen, with a skew in scores to the left or right of the mode. For two cases (e.g., appendix case j), survey response consensus was high but the mode score of 1 differed from the author panel reference score of 0. This appears to reflect respondent uncertainty regarding scoring in cases of primary non-oral feeding where small amounts of oral intake are permitted in a therapeutic context. Finally, three cases (e.g., appendix cases d and e) showed bimodal distributions; these split opinions are thought to reflect uncertainty regarding scoring for patients requiring primary non-oral nutrition and a lack of familiarity with purely liquid diets.

Inter-rater Reliability:

IDDSI-FDS scores showed strong response stability and high inter-judge reliability across successive quartile batches of the dataset (n = 43 responses per batch). Kendall's concordance was W = 0.873 overall, and W = 0.88, 0.884, 0.896, 0.819, respectively for the four batches. The average ICCs for each batch were 0.965, 0.966, 0.971 and 0.939, respectively, with the corresponding 95% confidence interval boundaries ranging from 0.872 to 0.976.

Criterion Validity:

Overall, there was strong correspondence between IDDSI-FDS scores and FOIS scores for the case scenarios (Spearman correlation: R = 0.84, p = 0.000). In Figure 6, the means and 95% confidence intervals of the FOIS scores that were assigned by respondents to the case scenarios are mapped as a function of the corresponding IDDSI-FDS score responses. It can be seen that

FOIS scores of 3-6 map to a broader range of IDDSI-FDS scores (1 to 7) and FOIS scores clustered between 4 and 5 mapped to an IDDSI-FDS range of 2-6.

Questions about perceived IDDSI-FDS utility:

The number of valid responses on the qualitative section of the survey ranged from 100-114; incomplete responses are attributed to the survey being administered exclusively in English. Respondents indicated general agreement with the bracketed range concept (59% in favor). Slightly more than one quarter (28%) of respondents recommended that tolerance of consistencies between the bracketed boundaries on the IDDSI framework should not be assumed, but confirmed during assessment on a case-by-case basis. There was strong agreement (77%) that the IDDSI-FDS score should reflect the main diet recommendation and not reflect therapeutic advancement. Comments from 62% of respondents indicated that therapeutic trials should be annotated separately from diet texture recommendations and 84% of respondents agreed with the idea of annotating therapeutic advancement with a '+' diacritic.

Discussion

It was encouraging to receive survey responses from a wide geographical distribution over a short time frame and to confirm that clinicians around the world with a variety of professional backgrounds found the IDDSI-FDS easy to apply to case scenarios describing different diet texture recommendations. The author panelists and the survey respondents showed strong agreement in FOIS scoring (81% in perfect agreement; ICC of 0.973, 95% CI: 0.971-0.975). This level of agreement on the FOIS is similar to the 85% agreement reported by the scale developers in their original psychometric validation study [7]. The strong correspondence with

238 FOIS scores shows good criterion validity for the IDDSI-FDS. For case scenarios with FOIS
239 scores of 4 and 5, corresponding IDDSI-FDS scores spanned a larger range from 2 to 6,
240 suggesting that the IDDSI-FDS was better able to capture gradations of diet texture restriction.
241
242 The participants in this survey found it straightforward to assign IDDSI-FDS scores to the
243 majority of the case scenarios developed for the validation study. Most of the scenarios with
244 poorer agreement involved a primary recommendation for non-oral nutrition with limited oral
245 intake on a trial or therapeutic basis. Based on the survey responses received in the survey, it has
246 been decided that IDDSI-FDS scores will reflect the main diet prescription and that therapeutic
247 diet advances should be annotated using a "+" diacritic. To illustrate, incorporating this decision
248 into the scoring of appendix case e, leads to a recommended IDDSI-FDS score of "0+", as noted
249 in the appendix. The "+" diacritic has the potential to be added to any score on the IDDSI-FDS
250 to indicate progress towards tolerance of a greater variety of diet texture levels. For example, if a
251 patient has a prescription for pureed foods and moderately thick liquids (IDDSI-FDS score of 2,
252 capturing items at both levels 3 and 4 of the IDDSI framework), several different scenarios might
253 justify annotation with the "+" diacritic, including (but not limited to) as introduction of mildly-
254 thick liquids on a time-limited and closely-monitored basis, or the trial introduction of water
255 between meals. The diacritic is simply intended to indicate that some progress away from the
256 specified restriction is being introduced and monitored.
257
258 This preliminary validation of the IDDSI-FDS explored the ability of clinicians to accurately
259 determine scores based on pre-specified diet recommendations. In order for the IDDSI-FDS to
260 have true validity to reflect dysphagia severity, it will be necessary to determine whether IDDSI-

FDS scores vary across groups of patients with different degrees of physiologic or functional impairment. A goal for the IDDSI-FDS is that it would have broad utility for different patient populations and across different age groups. We are aware of one exploration of this type to date, in a large study of 638 adults residing in long-term care institutions in Canada. In that study, IDDSI-FDS scores were derived based on diet orders and compared between residents with and without "dysphagia risk" (a composite variable determined on the basis of failing a standard dysphagia screening test, signs of coughing during meal observations, and/or prescription of thickened liquids) [19]. IDDSI-FDS scores for residents without dysphagia risk ranged from 4 to 8, reflecting an absence of severe diet texture restrictions. The probability of having an IDDSI-FDS score < 5 was significantly higher in individuals with dysphagia risk.

Study Limitations

A limitation of using social media and web-based communications as a means of inviting survey responses is that the response pool was a voluntary, self-selected convenience sample. In this study, the number of eligible respondents is unknown, as is the number of individuals who became aware of the survey. There was no opportunity to control whether respondents completed the survey independently or in consultation with colleagues. Given that 80% of the responses came from speech-language pathologists, it cannot be assumed that the response patterns are representative of all professions involved in dysphagia management. The sample sizes of professional subgroups were not large enough to allow comparisons by profession. Future studies should engage purposively-sampled participants from a variety of professions and health settings.

The design of the case studies was skewed such that one third involved non-oral diets, or transition from non-oral feeding. Notably, these were also the cases where the greatest discrepancy in scoring was seen. A larger pool of cases, balanced for variety of diet and liquids recommendations may demonstrate even better validity and inter-rater reliability than seen in this preliminary study. Importantly, the qualitative questions in the current study provided guidance regarding scoring instructions for non-oral diets and therapeutic introduction of limited oral intake.

Conclusions

In this preliminary validation study, the new IDDSI Functional Diet Scale was shown to have strong consensual and criterion validity. A broad sample of 170 clinicians from 29 countries showed that it is straightforward to reliably determine IDDSI-FDS scores and that they perceived the scale to have good utility for capturing the degree of diet restriction associated with typical diet combinations used in clinical practice across the age spectrum. The IDDSI-FDS captures the degree of diet texture restriction recommended for a patient within the context of the 8-levels of food and drink texture in the IDDSI framework and is suitable for use from infant to geriatric populations. The next step in evaluating the validity of the scale will be to apply the scale to data from larger patient samples to confirm whether IDDSI-FDS scores based on diet recommendations capture dysphagia severity in different populations in a clinically meaningful way based on standard metrics of physiologic impairment.

References

1. Robbins J, Nicosia MA, Hind JA, Gill GD, Blanco R, Logemann JA. Defining physical properties of fluids for dysphagia evaluation and treatment. *Perspectives on Swallowing and Swallowing Disorders (Dysphagia).* 2002;11:16-19. DOI: 10.1044/sasd11.2.16
2. Cichero JA, Lam P, Steele CM, et al. Development of International Terminology and Definitions for Texture-Modified Foods and Thickened Fluids Used in Dysphagia Management: The IDDSI Framework. *Dysphagia.* 2017;32(2):293-314. DOI: 10.1007/s00455-016-9758-y.
3. Pollack MM, Holubkov R, Glass P, et al. Functional Status Scale: new pediatric outcome measure. *Pediatrics.* 2009;124(1):e18-28. DOI: 10.1542/peds.2008-1987.
4. Salassa JR. A functional outcome swallowing scale for staging oropharyngeal dysphagia. *Digestive Diseases.* 1999;17(4):230-234. DOI: 16941.
5. O'Neil KH, Purdy M, Falk J, Gallo L. The Dysphagia Outcome and Severity Scale. *Dysphagia.* 1999;14(3):139-145. DOI: 10.1007/PL00009595.
6. Rao N, Brady SL, Chaudhuri G, Donzelli JJ, Wesling MW. Gold standard? Analysis of the videofluoroscopic and fiberoptic endoscopic swallow examinations. *Journal of Applied Research in Clinical and Experimental Therapeutics.* 2003;3(1): 5. http://www.jrnlappliedresearch.com/articles/Vol3Iss1/BRADY.htm
7. Crary MA, Mann GD, Groher ME. Initial psychometric assessment of a functional oral intake scale for dysphagia in stroke patients. *Archives of Physical Medicine and Rehabilitation.* 2005;86(8):1516-1520. DOI: 10.1016/j.apmr.2004.11.049.
8. John A. Therapy outcome measures: Where are we now? *International Journal of Speech-Language Pathology.* 2011;13(1):36-42. DOI: 10.3109/17549507.2010.497562.

9. Enderby P, John A. *Therapy Outcome Measures for Rehabilitation Professionals, 3rd Edition.* Guildford, UK: J & R Press; 2015.

10. Perry A, Morris M, Unsworth C, et al. Therapy outcome measures for allied health practitioners in Australia: the AusTOMS. *International Journal of Quality in Health Care.* 2004;16(4):285-291. DOI: 10.1093/intqhc/mzh059.

11. Skeat J, Perry A. Outcome measurement in dysphagia: not so hard to swallow. *Dysphagia.* 2005;20(4):390-399. DOI: 10.1007/s00455-004-0028-z.

12. Functional independence measure (FIMTM). http://www.udsmr.org/

13. Cichero JA, Steele C, Duivestein J, et al. The Need for International Terminology and Definitions for Texture-Modified Foods and Thickened Liquids Used in Dysphagia Management: Foundations of a Global Initiative. *Current Physical Medicine and Rehabilitation Reports.* 2013;1:280-291. DOI: 10.1007/s40141-013-0024-z.

14. Johnson T, Stapleton N. New IDDSI Framework Endorsed. Dietitians Association of Australia 2017; https://daa.asn.au/2016/12/new-iddsi-framework-endorsed/

15. Marcason W. From the Academy: Question of the Month. What is the International Dysphagia Diet Standardisation Initiative? *Journal of the Academy of Nutrition and Dietetics.* 2017;117(4):652. http://jandonline.org/article/S2212-2672(17)30116-8/pdf

16. Banzet, E. Support for IDDSI in Canada. Speech-Language Audiology Canada. April 12, 2017; http://us4.campaign-archive2.com/?u=702bf2bc76b4efd8d465b76e9&id=2a28d63447

17. Academy of Nutrition and Dietetics. Electronic Nutrition Care Process Terminology (eNCPT). Chicago, Illinois. 2016. http://www.eatrightpro.org/resources/practice/nutrition-care-process

18. Winnipeg Regional Health Authority Nutrition and Food Services. Adult Diet Criteria for Menu Database. 2008; http://www.wrha.mb.ca/extranet/nutrition/files/Manuals-WRHAAdultDietCriteriaforMenuDatabase.pdf

19. Namasivayam-MacDonald AM, Keller HH, Steele CM. Do Modified Diets Influence Mealtime Duration in Residents of Long Term Care? Poster presentation. 7th European Society of Swallowing Disorders Congress; 2017; Barcelona, Spain.

Figure Captions

Figure 1. The IDDSI Framework.

Figure 2. Scoring chart for the IDDSI Functional Diet Scale (IDDSI-FDS). To determine the IDDSI-FDS score for a patient, a clinician must find the intersecting cell for the column showing the patient's food texture recommendation and the row showing the patient's drink consistency recommendation. For example, if a patient has a recommendation for a Level 5 - Minced and Moist food texture and Level 2 – Mildly thick drinks, the intersecting cell shows an IDDSI-FDS score of 4, as indicated by the dashed line arrows and square.

Figure 3a. Illustration of IDDSI-FDS score derivation for a diet texture recommendation of Level 5 – Minced & Moist foods and Level 2 – Mildly thick liquids.

Figure 3b. Illustration of IDDSI-FDS score derivation for a diet texture recommendation of Level 3 – Liquidised foods and Level 1 – Slightly thick liquids.

Figure 4. Work settings reported by survey respondents.

Figure 5. Histograms showing the distributions of IDDSI-FDS scores assigned by survey respondents to 6 examples from the 16 case scenarios used in the study. Expected IDDSI-FDS scores are shown by asterisks. Details for these examples are as follows: a) Diet texture prescription: Level 5 - Minced & Moist foods and Level 2 - Mildly thick drinks. The expected IDDSI-FDS score (i.e., 6) was selected by 77% of the survey respondents . b) Diet texture

prescription: nil-per-oris (NPO), i.e., no oral intake of foods or drinks. The expected IDDSI-FDS score (i.e., 0) was selected by 90% of the survey respondents. c) Diet texture: Level 7 - Regular foods and Level 0 - Thin drinks. The expected IDDSI-FDS score (i.e., 8) was selected by 97% of the survey respondents. d) Diet texture prescription: a liquid-only diet spanning Level 0 - Thin to Level 3 - Moderately thick drinks. Given that Level 3 also captures a food level on the IDDSI Framework, this prescription would correctly be written as Level 3 - Liquidised foods and Level 0 - Thin drinks. The expected IDDSI-FDS score (i.e., 4) was selected by 51% of the survey respondents. e) Diet texture prescription: NPO. The expected IDDSI-FDS score (i.e., 0) was selected by 52% of the survey respondents. The finalized IDDSI-FDS scoring instructions capture the additional allowance of ice chips in therapy with a '+' diacritic, such that the correct score would be 0+. f) Diet texture prescription: no oral intake of foods with Level 1 - Slightly thick drinks. The expected IDDSI-FDS score (i.e., 1) was selected by 87% of the survey respondents.

403

404

405

406

407

408 *Figure 6.* Mapping between Survey Respondent IDDSI-FDS scores and corresponding FOIS

409 scores for the case scenarios used in the survey.

410

411

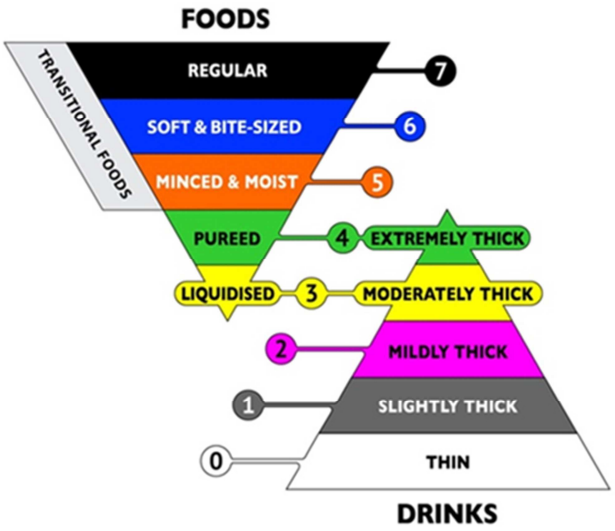
Table 1. Characteristics of Previously Published Functional Outcome Scales for Swallowing

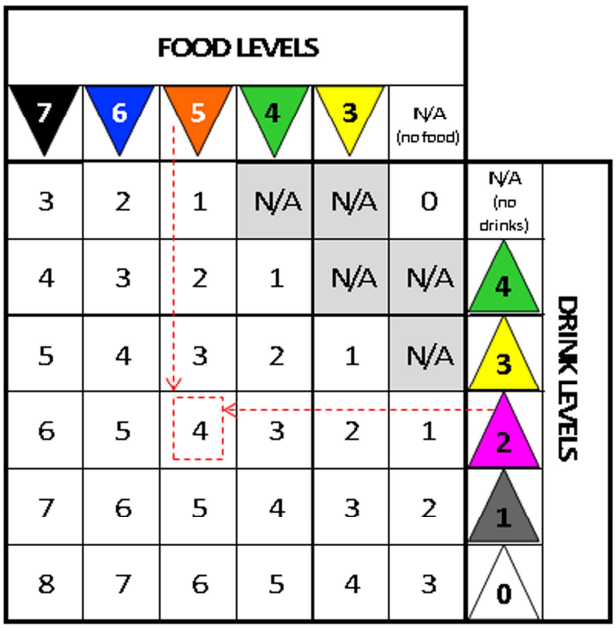
Scale Name	Target Population	Number of Levels	Direction	Diet Restriction Specifications
Functional Status Scale (FSS)[3]	Pediatrics	5	1 = normal function; 5 = severe dysfunction	Total oral feeding to progressive degrees of assistance, tube-feeding or parenteral nutrition.
Swallowing Performance Status Scale (PSS)[4]	General	7	1 = normal function; 7 = severe dysfunction	Not described
Dysphagia Outcome and Severity Scale (DOSS)[5]	General	7	7 = normal function; 1 = severe impairment	Number of consistencies tolerated or restricted
American Speech-Language Hearing Association National Outcome Measures Scale (ASHA-NOMS) Functional Communication Measure (FCM) for Swallowing[6]	General	7	7 = normal function; 1 = severe impairment	Number of levels below a regular diet status in either solid or liquid consistency
Functional Oral Intake Scale (FOIS)[7]	Stroke	7	7 = total oral diet; 1 = exclusive tube feeding	Number (single vs multiple) of consistencies taken orally
UK Therapy Outcome Measurement Scale (UK TOM)[8,9]	General	6	5 = least severe impairment; 0 = most severe impairment. Half-point scaling permitted.	Oral vs non-oral nutrition and range of consistencies allowed (limited; modified; most; full).
Australian Therapy Outcome Measurement Scale (AusTOMS)[10,11]	General	6	5 = least severe impairment; 0 = most severe impairment.	Oral vs non-oral nutrition and range of consistencies allowed (limited; modified; most; full).

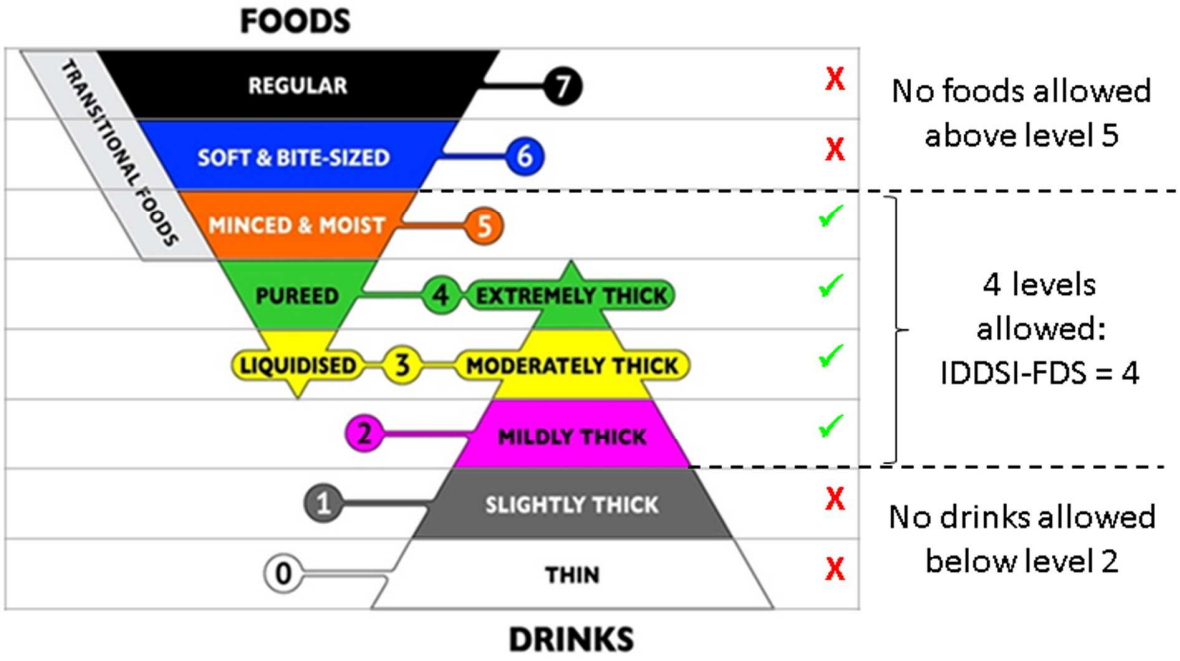
Table 2. Response frequency by geographic region.

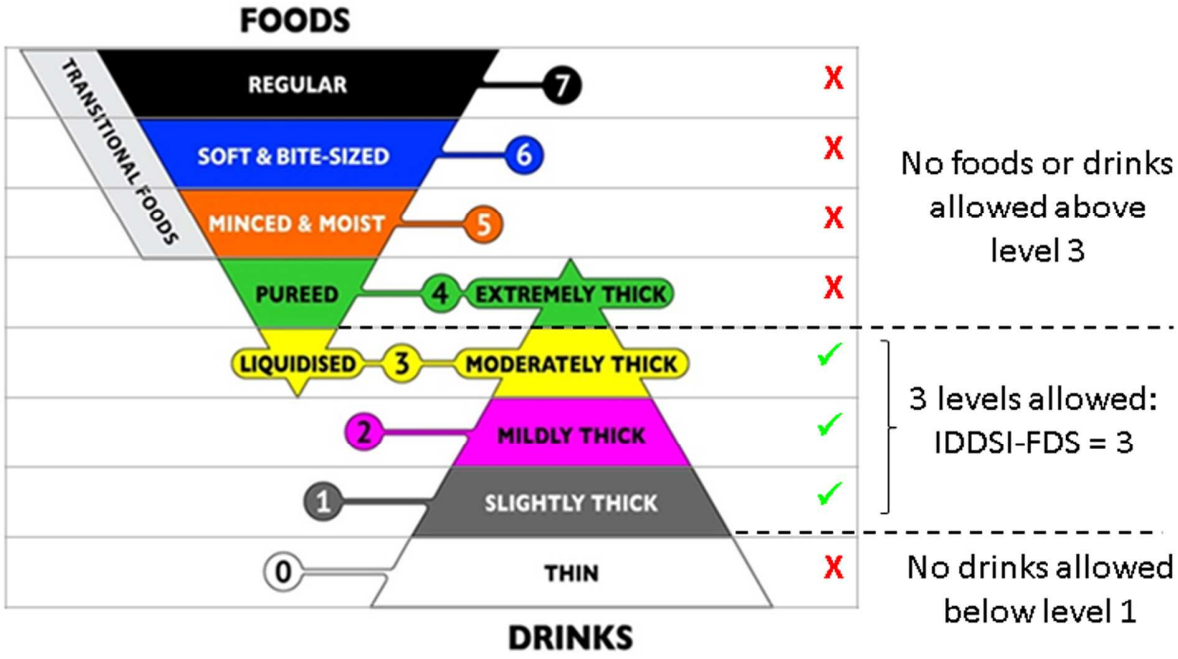
Region	Country	Frequency	Percent
North America (n = 67)	United States	36	21.2
	Canada	31	18.2
Europe (n = 40)	Ireland	11	6.5
	United Kingdom	6	3.5
	Turkey	4	2.4
	France	3	1.8
	Italy	3	1.8
	Portugal	3	1.8
	Austria	2	1.2
	Germany	2	1.2
	Sweden	2	1.2
	Finland	1	0.6
	Netherlands	1	0.6
	Norway	1	0.6
	Spain	1	0.6
Oceania (n = 30)	Australia	29	17.1
	New Zealand	1	0.6
South America (n = 13)	Brazil	11	6.5
	Argentina	1	0.6
	Colombia	1	0.6

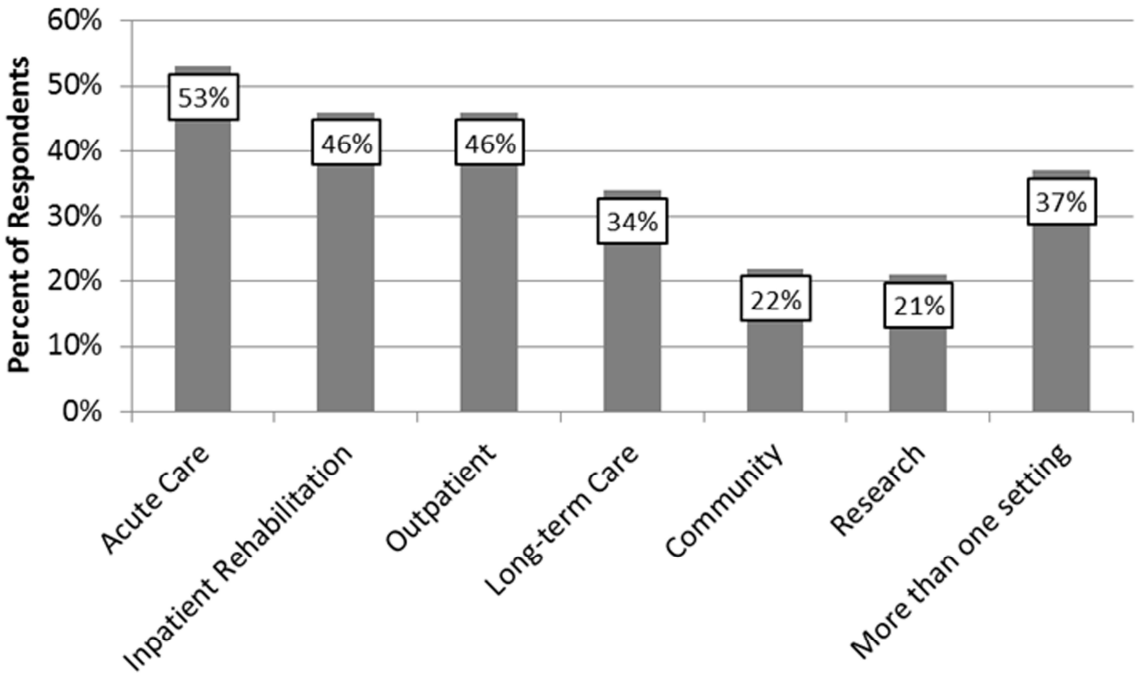
Asia (n = 13)	Japan	6	3.5
	India	2	1.2
	Singapore	2	1.2
	Iran	1	0.6
	Philippines	1	0.6
	Thailand	1	0.6
Africa (n = 6)	South Africa	4	2.4
	Algeria	1	0.6
	Egypt	1	0.6
Missing	Missing	1	0.6
Total		170	100.0

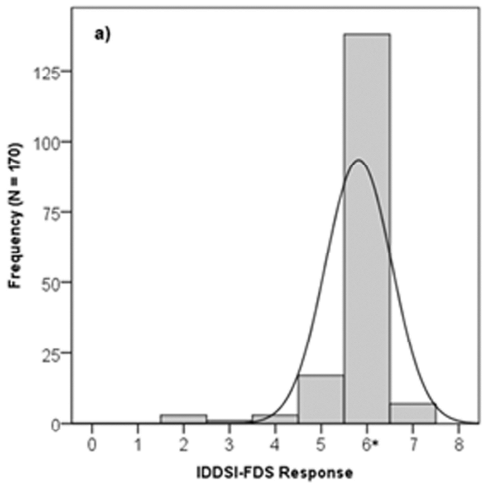


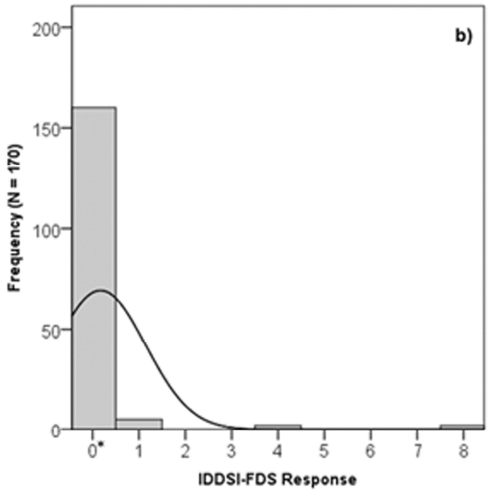


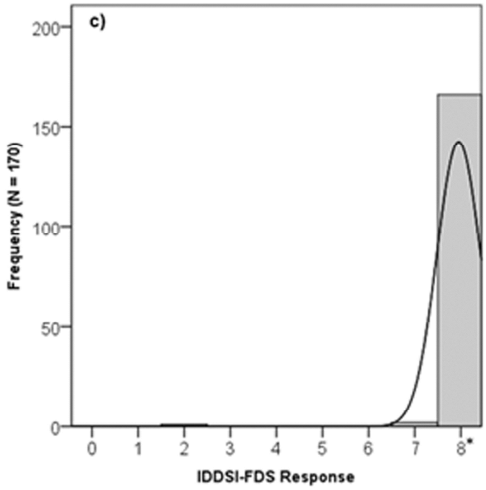


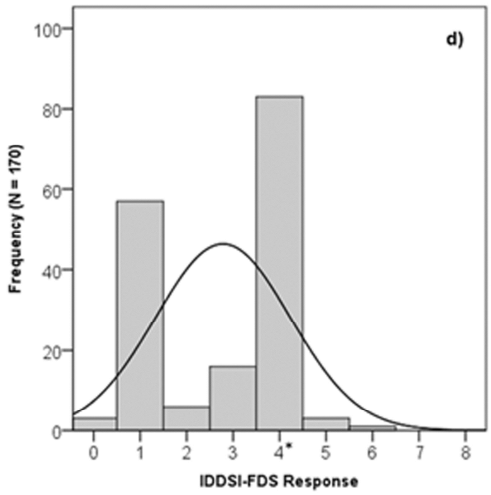


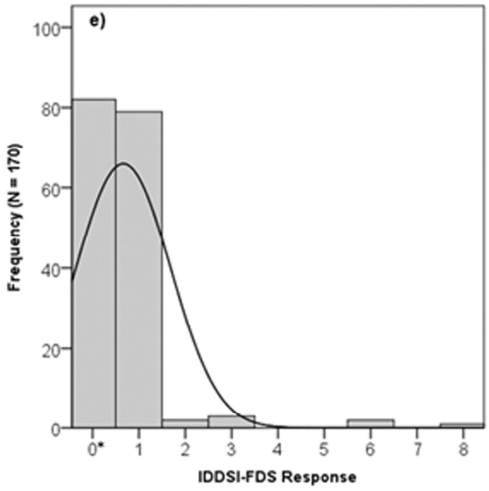


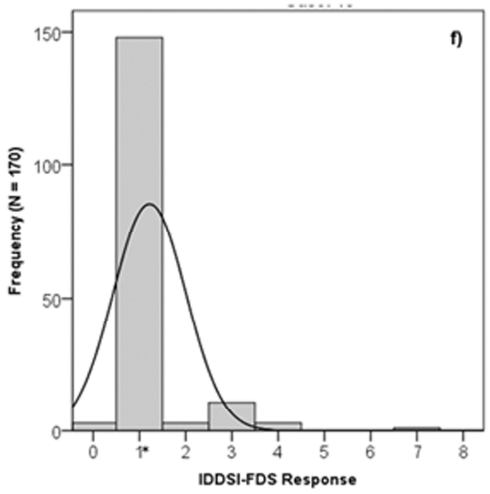

a)
Frequency (N = 170)
125
100
75
50
25
0
0 1 2 3 4 5 6* 7 8
IDDSI-FDS Response

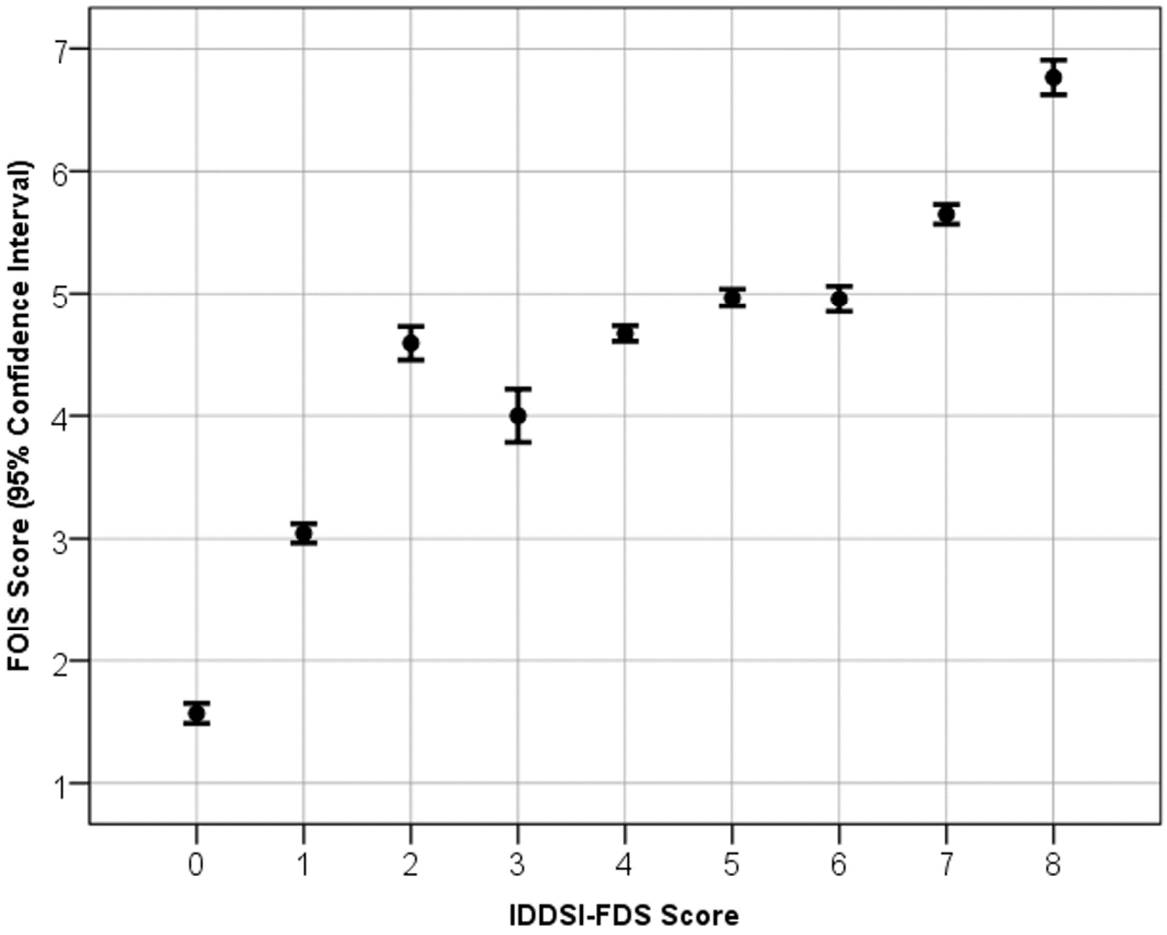

b)
Frequency (N = 170)
200
150
100
50
0
0* 1 2 3 4 5 6 7 8
IDDSI-FDS Response


c)
Frequency (N = 170)
200
150
100
50
0
0 1 2 3 4 5 6 7 8*
IDDSI-FDS Response


d)
Frequency (N = 170)
100
80
60
40
20
0
0 1 2 3 4* 5 6 7 8
IDDSI-FDS Response


e)
Frequency (N = 170)
100
80
60
40
20
0
0* 1 2 3 4 5 6 7 8
IDDSI-FDS Response


f)
Frequency (N = 170)
150
100
50
0
0 1* 2 3 4 5 6 7 8
IDDSI-FDS Response


FOIS Score (95% Confidence Interval)
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
IDDSI-FDS Score

Highlights:

- Current dysphagia outcome scales do not specify diet texture modifications.
- A new scale capturing nature and degree of diet texture modification was developed.
- Scoring of the new IDDSI-FDS scale was field tested with clinicians via an online survey.
- The new IDDSI-FDS has strong criterion validity and consensual validity.
- The new IDDSI-FDS scale can be easily used with high reliability by clinicians.

Appendix: Case Scenarios

a) A 60-year-old woman comes to your outpatient swallowing clinic describing a two-year history of solid foods "getting stuck" in her throat once or twice per week. She is currently eating regular solids at home and is drinking thin liquids without any reported difficulty. During an instrumental swallowing assessment, you determine that thin liquids are travelling through the oropharynx safely and efficiently, but regular solids are causing large amounts of residue, and require 3-4 swallows per bolus to get everything down. Soft and bite-sized foods also cause a fair amount of pyriform sinus residue, but minced and moist solids appear to go down safely and efficiently. You decide to temporarily recommend a diet of minced and moist solids with thin liquids, while additional work-up in search of a causal factor is found.

- Food Prescription: Level 5 – Minced and Moist
- Drink Prescription: Level 0 – Thin
- IDDSI-FDS Score: 6

b) An 85-year-old man is having severe difficulties swallowing. Upon assessment you find the patient is aspirating all food and liquid consistencies, and the chin tuck position does not improve his swallowing safety. The patient also has extremely poor upper esophageal sphincter opening leading to large amounts of residue on all consistencies. He is even unable to swallow his saliva.

- Food Prescription: N/A. No food level is safe. Non-oral feeding would be appropriate.
- Drink Prescription: N/A. No food level is safe. Non-oral feeding would be appropriate.
- IDDSI-FDS Score: 0

c) A 25-year-old woman comes to you following a traumatic brain injury. She was having difficulties with her swallowing immediately after her accident, but now reports improvement with no issues. Upon assessment you find that she is able to safely and efficiently drink all liquid consistencies and all regular textures.

- Food Prescription: Level 7 – Regular
- Drink Prescription: Level 0 – Thin
- IDDSI-FDS Score: 8

d) A 52-year-old man has a diagnosis of multiple sclerosis and is having difficulty swallowing, which he thinks is mostly due to fatigue. Upon evaluation you determine that he has significant residue with most food textures and even with extremely thick liquids but that he seems to be able to swallow liquids in the thin to moderately thick range without residue. He does not seem to experience any issues of aspiration. You decide to recommend a liquid diet including thin, slightly thick, mildly thick and moderately thick liquids.

- Food Prescription: Level 3 – Liquidised
- Drink Prescription: Level 0 – Thin
- IDDSI-FDS Score: 4
- Comment: A recommendation for moderately thick liquids implies that Level 3 – Liquidised foods are also appropriate for this patient, due to the equivalence of texture and flow characteristics for foods and drinks at level 3.

e) You have been working with a 27-year old woman who is recovering from a double lung transplant. She has been NPO (nothing by mouth) for 1 month and fed by gastrostomy tube, but

medically she is now doing well and the team is keen for her to begin transitioning back to an oral diet. Your clinical assessment suggests that she may not be fully ready to begin oral intake, but is ready to begin practising swallows with a safe, starter item (e.g., ice chips [or in Japan, dysphagia jelly]).

- Food Prescription: N/A. The primary source of nutrition is by gastrostomy tube.
- Drink Prescription: N/A. The primary source of nutrition is by gastrostomy tube.
- IDDSI-FDS Score: 0+
- Comment: The primary source of nutrition is by gastrostomy tube. The '+' diacritic reflects the recommendation for trial oral intake of ice chips in a therapeutic context.

f) You are working with a mother of a baby who has been having difficulty tolerating thin liquids without aspiration. You determine that the baby is able to swallow slightly thick liquids safely, but that if too much thickener is added, the baby has difficulty expressing fluid through the nipple of the bottle and seems to fatigue very quickly.

- Food Prescription: N/A. This baby is not ready for any solid foods.
- Drink Prescription: Level 1 – Slightly thick
- IDDSI-FDS Score: 1

g) A 45-year-old man is referred to you for a follow up assessment 3 months after discharge from a stroke rehabilitation center. He is on a minced and moist food texture with mildly thick liquids. Assessment shows that he aspirates thin liquids, but slightly thick liquids prove to be safe. With minced and moist food textures, there is quite significant residue in his pharynx. You decide to recommend a diet change to pureed foods and slightly thick liquids.

- Food Prescription: Level 4 – Pureed
- Drink Prescription: Level 1 – Slightly thick
- IDDSI-FDS Score: 4

h) An 11-year old child with spastic cerebral palsy has been on your caseload for several years, and has been managing well on a soft and bite-sized diet with mildly thick liquids. The child is moving to a new school, where a lunch program is available. On the soft lunch diet at this school, sandwiches are frequently offered containing things like egg salad or tuna salad, with the crusts removed. Your re-evaluation of this child suggests that they will not be able to tolerate these sandwiches unless they are pre-cut into bite sized pieces.

- Food Prescription: Level 6 – Soft and bite-sized
- Drink Prescription: Level 2 – Mildly thick
- IDDSI-FDS Score: 5
- Comment: Note that bread is not permitted on IDDSI Level 6 – Soft and bite-sized.

i) You are working with a 7-year old child with cerebral palsy who has been NPO and on a gastrostomy feeding tube for total nutrition for the past year. In therapy, you have been working on oral feeding skills using foods that dissolve easily in the mouth with minimal chewing, such as arrowroot biscuits and cheese puffs. This has been going well, and you decide to recommend that the child eat some of these items twice a day in addition to their tube feeding.

- Food Prescription: N/A. The primary source of nutrition is by gastrostomy tube.
- Drink Prescription: N/A. The primary source of nutrition is by gastrostomy tube.
- IDDSI-FDS Score: 0+

- Comment: The primary source of nutrition is by gastrostomy tube. The '+' diacritic reflects the recommendation for trial oral intake of transitional foods in a therapeutic context.

j) You have been asked to assess a 56-year old man who has completed a recent course of radiation therapy with chemotherapy to treat laryngeal cancer. A gastrostomy feeding tube was placed prior to this patient's cancer treatment and he has been using the g-tube as his primary source of nutrition. Your assessment shows that he is feeling very unwell and experiencing a great deal of pain at this stage of his recovery secondary to mucositis. He is aspirating thin and slightly thick liquids silently. You decide to recommend that he stay on the gastrostomy tube feeding, but try to swallow small amounts of mildly thick liquid throughout the day as a way of trying to maintain regular swallowing. You recognize that this oral intake will likely not happen every day, depending on how the patient is feeling.

- Food Prescription: N/A. The primary source of food will be by gastrostomy tube.
- Drink Prescription: N/A. The primary source of nutrition is by gastrostomy tube.
- IDDSI-FDS Score: 0+
- Comment: The primary source of nutrition is by gastrostomy tube. The '+' diacritic reflects the recommendation that the patient try to maintain oral intake of mildly-thick liquids.