FEASIBILITY and VALIDITY

of the

ACADEMY OF NUTRITION AND DIETETICS

HEALTH INFORMATICS INFRASTRUCTURE (ANDHII)

by

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CERTIFICATE OF APPROVAL

This is to certify that the CAPSTONE project of

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"Feasibility and Validity of the Academy of Nutrition and Dietetics Health Informatics Infrastructure"

has been approved

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Date

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Finally, I thank my partner of 30 years, Eric Chapman, for his patience with my pursuit of this additional master’s degree and the hours, days, and years it took me to complete it.

ABSTRACT

Purpose: To collect and analyze Nutrition Care Process (NCP) data using the Academy of Nutrition and Dietetics Health Informatics Infrastructure (ANDHII), including completion of Nutrition Care Process chains, as well as subject perceptions of ANDHII, and its time-burden.

Methods: Acute care dietitians were recruited through the Dietetics Practice Based Research Network of the Academy of Nutrition and Dietetics for a 5-week study. A subset of each of their patients was randomly selected for nutrition care documentation via either ANDHII or usual care (UC). Dietitians recorded all nutrition care time (NCT) and, at the conclusion of the study, completed an anonymous survey.

Analysis: Performed with SPSS 18, an unpaired t-test compared NCT_{ANDHII} with NCT_{UC}, double reciprocal-transformed linear regression of NCT_{ANDHII} by ANDHII experience (entries completed), controlled for patient familiarity (prior visits), estimated NCT for experienced users (NCT_e), and one sample t-tests compared NCT_{UC} with NCT_e and benefit:time-burden ratio with 1.

Results: Ten dietitians used ANDHII with 46 patients, recorded nutrition care time on 99 visits, and completed the perceptions survey. ANDHII collected 99 assessments, 45 nutrition diagnoses, 117 interventions, and 107 monitoring targets. Of survey responses regarding both ANDHII ease of use and desire to continue use, 90% and 60%, respectively, were neutral or better. The mean ratio of perceived benefit:time-burden was 1.3±0.35 and significantly greater

than neutral (p=0.015). NCT_{ANDHII} was greater than NCT_{UC} (65±32 v. 50±24 minutes, p=.021). A trend towards decreased time burden with ANDHII experience was observed (p_{model}=.004), predicting an NCT_e (52 minutes) not significantly different from NCT_{UC} (p=.565).

Conclusions: ANDHII successfully collected NCP data via automated queries. The majority of subjects felt that ANDHII was easy to use and beneficial to their practice. The increase in time burden with ANDHII use is expected to disappear with experience.

INTRODUCTION

Standardization in clinical practice has long been a goal to ensure consistency in intervention and to help achieve optimal patient outcomes.[1] Use of a formalized clinical care process with an accompanying standardized language is critical for measuring the effectiveness of care and its relationship to patient outcomes, and has long been in place in medicine and nursing[2-4]. In the field of nutrition and dietetics, development and refinement of a standard process for patient nutrition care has spanned nearly three decades. Hammond created a six-step "nutrition care planning cycle" in the context of one-on-one counseling of patients.[5] Splett and Myers[6] developed a five-step nutrition care model and posed the question regarding whether or not the dietetics profession should adopt a common process for nutrition care. In addition, they expressed the need for a standardized language for nutrition research and practice in order to elucidate the exact care provided and to compare study results. Kight[7-8] proposed a nine-step process and advocated for the inclusion of nutrition diagnoses. Lacey[9] also proposed a nine-step process and later chaired the Quality Management Committee of the American Dietetic Association that reviewed all proposed models and ultimately agreed on a four-step Nutrition Care Process (NCP) and Model[10] that included nutrition assessment, nutrition diagnosis, nutrition intervention, and nutrition monitoring and evaluation. Hakel-Smith[11] et al later examined the concept of NCP chains, where all steps of the process are either complete – includes all steps of the NCP in appropriate sequence, incomplete, where steps are omitted at the beginning or end of the chain, or interrupted, where a step is omitted between successive NCP steps. Steiber et al[12] studied the use of a web-based algorithm to help clinicians record complete NCP chains in hemodialysis patients, as well as to identify those patients at risk

and capture outcomes data. In an example from nursing, Hall and Thornton extracted nursing practice pattern data from the enterprise data warehouse of a large, multi-site healthcare system[13].

The first edition of a standardized language for dietetics, the International Dietetics and Nutrition Terminology (IDNT) was published in 2008 after five years of development. Additions to the next three editions included new terms as well as separation of terms in order to include NCP concepts into standardized languages such as the Systematized Nomenclature of Medicine (SNOMED) and Logical Observation Identifiers Names and Codes (LOINC).[14] NCP and IDNT provide dietetics practitioners with the structure and tools needed to clearly and consistently record the nutrition care they provide to patients and clients. Although NCP and IDNT are woven into all didactic and supervised practice program curricula in dietetics education in the United States, in a 2011 survey of American Dietetic Association members, only 8.4 percent reported that the electronic health record (EHR) at their workplace includes structured fields for entry of NCP and IDNT[15].

To respond to this gap, the Academy of Nutrition and Dietetics developed its Health Informatics Infrastructure (ANDHII). ANDHII is a set of web-based tools accessed via a secure, web-based interface, with which dietitians can collect and analyze patient visit data and patient outcomes using IDNT (see Figure 1). A template using NCP steps allows the user to create a customizable plain-text summary note for each visit (see Figure 2). If desired, practitioners can copy and paste these notes from ANDHII into their facility's EHR. While ANDHII is designed to streamline and provide structure to data entry, it nevertheless takes time and therefore

includes time-saving features such as intelligent suggestions for locating appropriate IDNT terms based on data entered in prior steps, and graphs to examine patient outcomes over time.

Patient outcomes in medicine and healthcare in general have been collected for a considerable period of time. For example, the Society of Thoracic Surgeons has developed quality measures for outcomes in adult cardiac surgery, congenital heart surgery, and general thoracic surgery.[16] The Physician Quality Reporting System from the Centers for Medicare and Medicaid Services includes an extensive list of quality measures used by eligible providers in filing claims and in registry-based reporting.[17] Nursing has its National Database of Nursing Quality Indicators.[18] In these respective examples, however, data is collected about a specific condition or a single or narrowly-defined set of events, such as risk-adjusted deep-sternal wound infection rate, an elevated hemoglobin A1C level, or a patient fall. Since nutrition problems are multi-factorial, and adhering to NCP requires entries that state the relationship of various inputs to each other, no reasonable fixed data set could be defined to capture nutrition-related patient outcomes. To address this need, ANDHII was designed to be flexible, allowing dietitians to use their clinical judgment to determine which parameters are of value to a particular patient/client case.

The ANDHII user interface mimics the four NCP steps. First, in the Assessment step, users enter patient parameters as definition-value pairs by selecting the appropriate Assessment (or Monitoring & Evaluation) term and then entering a corresponding value, either numeric or text, to reflect the current state. Next, in the nutrition Diagnosis step, users select from the diagnostic terminology to define the observed nutrition problem, its etiology (term or free text), and then select from Assessment or Monitoring & Evaluation terms to define “Signs

& Symptoms" as evidence for the problem. In the Intervention step, as in Assessment entry, entries are definition-value pairs, with users selecting the appropriate terminology or entering free-text details. In this step, however, the pairs are placed in specific areas that correspond to the diagnoses' etiologies. Finally, in the Monitoring & Evaluation step, the dietitian's goals for tracking patient progress are defined using Assessment and Monitoring & Evaluation terms which are placed in entry areas corresponding to each related nutrition diagnosis, again, in order to indicate their relationships.

Due to the multiple one-to-many relationships inherent to the NCP, and in order to support the entry of an unknown number of data points at each step, ANDHII uses a relational database structure. Its central tables reflect discrete instances of practitioner care (visits), the IDNT term definitions (referenced via foreign key fields in other tables' records), patient parameters (both Assessment and Monitoring & Evaluation), diagnoses, and interventions (Figure 3). In order to protect patient privacy, any data entry fields that could receive protected health information are disabled and a HIPAA-compliant re-identification code is automatically assigned. This code can be used by the dietitian to recall an existing patient's record and enter additional data.

The purpose of this study is threefold: 1) to test collection of NCP data from subjects' patient visits, examining in particular whether or not complete NCP chain information is entered, 2) to query regarding dietitians' perceptions of ANDHII with respect to ease of use and benefit to practice, and 3) to record the time burden associated with ANDHII use.

Specific hypotheses are as follows:

1) The majority of subjects will rate ANDHII as easy to use in the on-line survey.

2) The median ratio of perceived benefit to perceived time-burden as report via the on-line survey will be > 1.0. Predicted care time for experienced users, extrapolated from double-reciprocal transformed regression analysis, will not differ from observed care time for usual care.

3) Automated data extraction methods can be used to examine NCP chains and determine whether or not they are complete. NCP chains that are begun properly with Evidence are more likely to be complete.

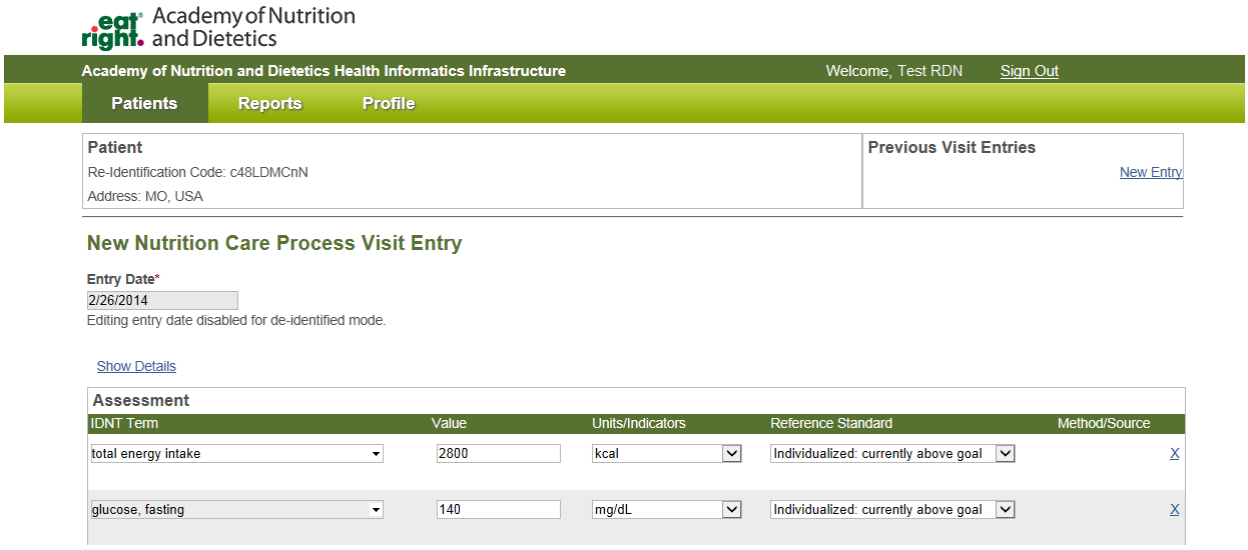

Figure 1. ANDHII de-identified patient visit entry

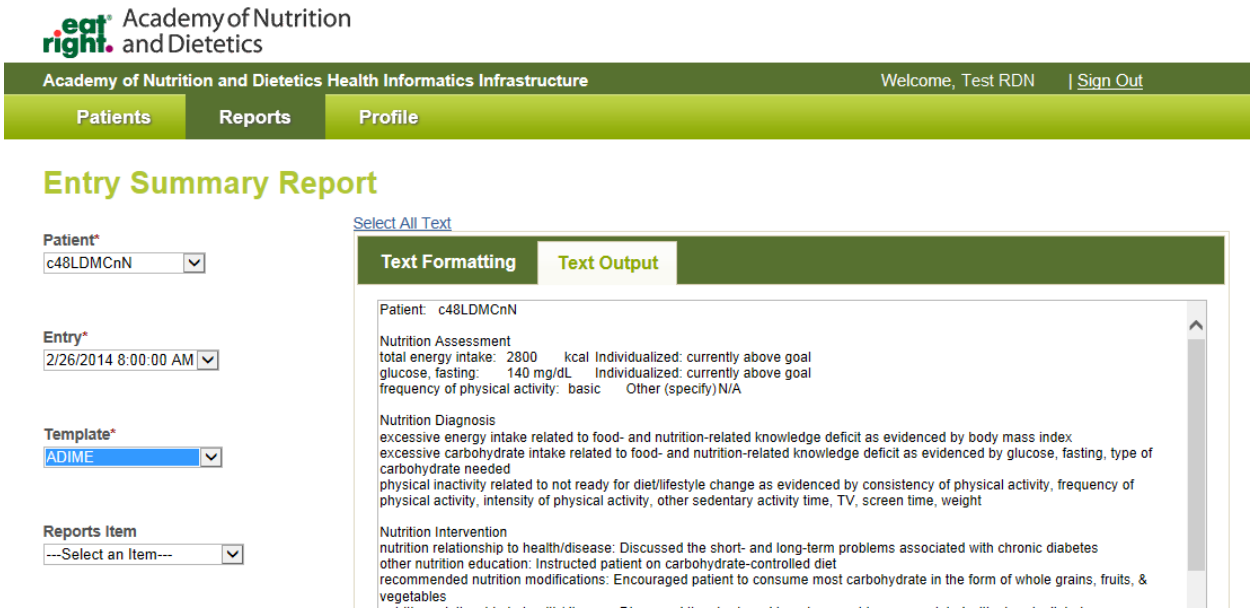

Figure 2. ANDHII de-identified patient visit report

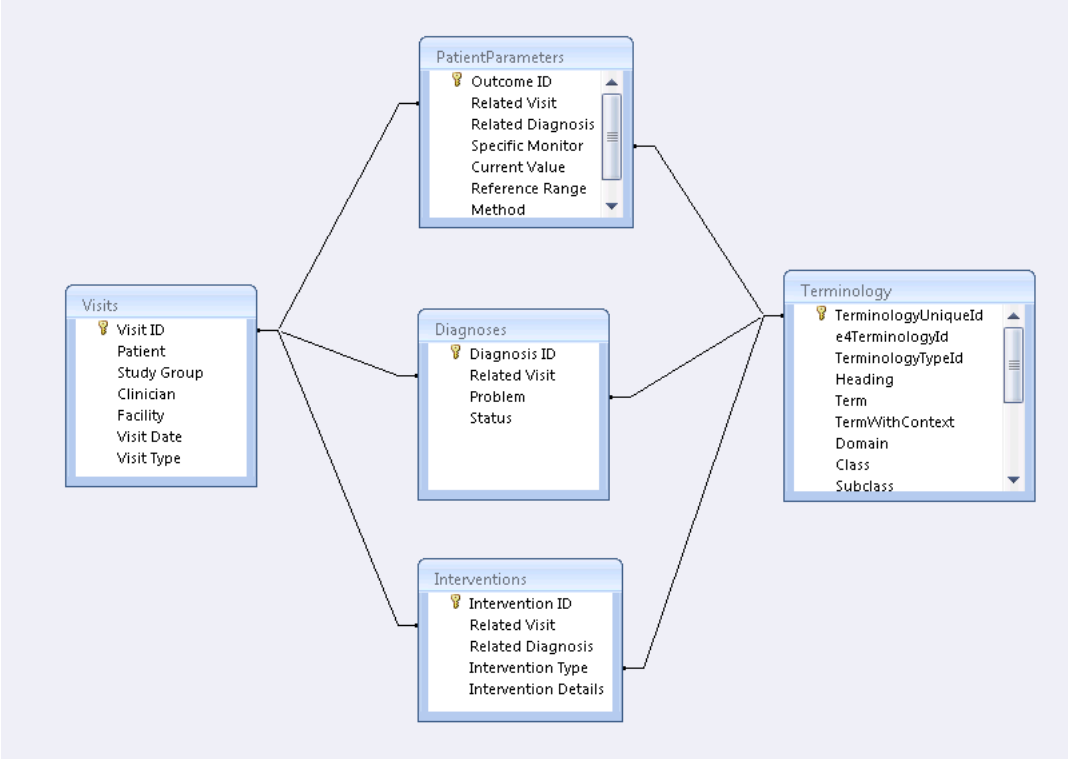

Figure 3: Diagram of the central tables in the ANDHII database structure and their relationships.
The three types of clinical data stored – patient parameters, nutrition diagnoses, and nutrition interventions – are linked with the related instance of nutrition care through the Visits table and linked to an IDNT term through the Terminology table.

METHODS

This was a feasibility study using registered dietitians (RD) or registered dietitian nutritionists (RDN) as subjects. All subjects were participants in the Dietetics Practice-Based Research Network (DPBRN) of the Academy of Nutrition and Dietetics ("the Academy", formerly the American Dietetic Association). Participation in the DPBRN is free and is open to any RD or RDN who is a member of the Academy. Additional inclusion criteria were: 1) subjects must be an RD or RDN in good standing, 2) be a licensed dietitian in good standing (in states where applicable), 3) currently providing nutrition care in an inpatient acute care setting, and 4) have access to a computer with internet access via one of several web browsers (Internet Explorer version 7 or higher, Mozilla Firefox, Google Chrome, Apple Safari).

Exclusion criteria were: 1) inability to access ANDHII and the survey websites due to technical limitations or facility restrictions, and 2) institutional policies that preclude the use of ANDHII to report de-identified health information. Subjects were recruited via e-mail requests from DPBRN directly, as well as invitations included in relevant Academy dietetic practice group e-newsletters. The ANDHII research protocol was submitted to the Institutional Review Board of Oregon Health & Science University (OHSU) and deemed exempt from review and approval in accordance with the Code of Federal Regulations regarding Protection of Human Subjects, 45CFR46.101(b)[2], research involving use of survey or interview procedures.

As each subject was deemed eligible to participate in the study, he or she received orientation to and training on ANDHII via a live or recorded webinar. Subjects also received training regarding the study protocol. Three options for the live web-based training sessions, on various dates and at varied times throughout the day or evening, were offered. Those subjects

who were unable to attend any of those sessions received a link to the recorded webinar as well as a slide deck of all screenshots from the training. Once training was complete, each subject received an activation e-mail to set up his or her ANDHII on-line account. Subjects were notified that they would be compensated for each patient visit entered into ANDHII, if desired, and were sent the appropriate tax forms for this purpose. They were also asked to enter nutrition care time for each visit via an on-line survey instrument. Based on the number of newly-admitted acute care patients that each subject typically saw in one week, each subject's patients were randomized by study collaborators into one of three groups: 1) "Skip" – Provide usual care (UC) without entering visits into ANDHII or entering nutrition care time; 2) "ANDHII" – Use ANDHII for this visit and all subsequent visits for this patient during the current admission, plus enter nutrition care time;
3) "Time Only" – Provide UC without entry in ANDHII but enter nutrition care time. The study length was five weeks.

DATA EXTRACTION

ANDHII data was extracted from the database using Structured Query Language queries (see Appendix D) and classified according to NCP chain status. Completion of each NCP step was determined by the presence (in the patient visit record in ANDHII) of at least one component that met the criteria for a properly linked or complete step. More specifically, the Evidence-Diagnosis link was determined by examining the selected Assessment terms and the specified desirability of respective current values vs. the reappearance of the identical terms in the Signs & Symptoms of a diagnosis from the same visit (see Table 1). The Diagnosis linkage was

considered complete if at least one selection from Signs & Symptoms matched a linked Assessment term and at least one etiology was assigned to the diagnosis (see Table 2). A complete Etiology-Intervention link included at least one nutrition intervention that was entered and assigned to that etiology (see Table 3). With respect to Goals for the patient, the link was considered complete if a goal was specified and properly linked to an intervention, a nutrition diagnosis, and evidence for that intervention (see Table 4). If at least one monitoring parameter was selected and all NCP steps entered, including evidence for that selection, the chain was considered complete and properly terminated (see Table 5).

		Re-appearance of identical term in diagnosis	
		Appears	**Does not appear**
User specification of desirability	**Normal**	Linked, but not abnormal[2]	Normal[1]
	Abnormal	Linked[1]	Unlinked[2]
	Not applicable (text entries)[4]	Linked[1]	Indeterminable[3]
	NULL value	Indeterminable (system error)[3]	Indeterminable (system error)[3]

Table 1. Evidence-Diagnosis link

[1]Desired NCP chain status or termination, [2]Undesirable chain status or termination, [3]Excluded from chain totals, [4]User specification of desirability not collected (text)

		Selection of Etiologies	
		One or more	**No selections**
Selection of Signs & Symptoms	**At least one selection matches a linked assessment term**	Complete[1]	No Etiology[2]
	Either no signs or symptoms selected or no selections match linked assessments	No Evidence[3]	No Etiology[2]

Table 2. Diagnosis linkage

[1]Desired NCP chain status, [2]Undesirable chain termination, [3]Initiation of an incomplete chain

		Selection of Interventions	
		One or more	**No selections**
Status of linked chain	**Complete**	Complete[1]	No Intervention[2]
	No Evidence	No Evidence/Linked[3]	No Intervention[2]

Table 3. Etiology-Intervention link

[1]Desired NCP chain status, [2]Undesirable chain termination, [3]Desired continuation of incomplete chain

		Specification of Goal	
		Text entered	**No text entered**
Status of linked chain	**Complete**	Complete[1]	No Goal[2]
	No Evidence/Linked	No Evidence/Linked[3]	No Goal[2]
	No linked diagnosis	Unlinked[4]	Unlinked[4]

Table 4. Intervention-Goal link

[1]Desired NCP chain status, [2]Undesirable chain termination, [3]Desired continuation of incomplete chain, [4]Undesired isolated intervention

		Selection of Outcomes	
		At least one monitoring parameter selected	**No monitoring parameters selected**
Status of linked chain	**Complete**	Complete[1]	Incomplete-No Outcome[2]
	No Evidence/Linked	Incomplete-No Evidence[3]	Other Incomplete or Interrupted[4]
	All other statuses	Other Incomplete or Interrupted[4]	Other Incomplete or Interrupted[4]

Table 5. Outcome link and chain termination

[1]Complete NCP chain with all steps, [2]Incomplete chain lacking only the final step, [3]Incomplete chain lacking only the initial step, [4]Incomplete chain lacking multiple steps or with skipped step

Multiple entries for evidence, etiology, intervention, goal(s), and outcomes are possible for each NCP chain. Nutrition diagnosis emerges as the central, singular component around which all NCP entries focus.

RESULTS

A total of ten dietitians participated in the study. Eight additional potential subjects who had inquired about participation were deemed ineligible based on exclusion criteria. Another

prospective subject only worked in acute care one day per month and so was excluded. Problems with access to ANDHII impeded participation initially for four subjects. These were resolved as soon as researchers were made aware of the difficulty; however, two subjects withdrew because of it. One subject did not enter patients into ANDHII and so was excluded from further participation. Three subjects who completed training withdrew from the study shortly thereafter, citing various reasons (e.g., workload, job change). (see Figure 4).

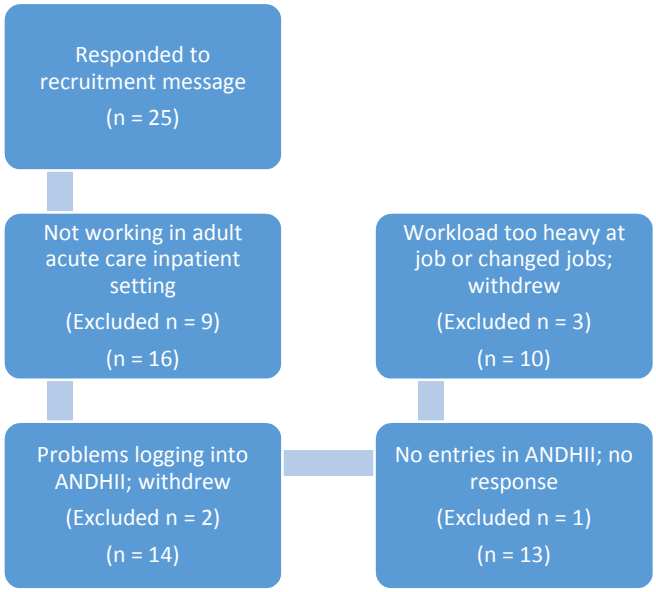

Figure 4. Subject recruitment, exclusion, and withdrawal

All subjects were female and ranged in age from 25 to 59 years, with an average age of 41. Sixty percent had a master's degree. Half of the subjects had been practicing as a dietitian for six years or more, with three of those practicing 31 years or more. All subjects had been using NCP in practice for at least one year, and seventy percent noted that they had been part of DPBRN for less than one year. Subjects used ANDHII with 46 patients and recorded nutrition care time for 38 of those patients. Nutrition care time was recorded for a total 71 patients (38 in ANDHII; 33 time only) and 99 visits. Incomplete nutrition care time recording by some

subjects accounts for the discrepancy between the number of visits and the number of time recordings.

In Figure 5, each NCP chain step is represented as a separate column. Each column begins by listing the number of entries extracted from the database, which were classified according to the tables in the Methods. The middle row (in blue) displays complete links in the NCP chain. In the first column, Assessments, 40 records were excluded from chain completion analysis due either to desirable termination (17) or because they were classified as indeterminable (23). Of those 23, six were excluded because no data was recorded for the user specification of desirability (see Table 1), such as a weight or lab value that should have been noted as being above or below its respective goal. Chains missing Evidence, yet completing all other NCP steps, are displayed in the lower row (in purple). Thirteen Interventions were entered without a corresponding Diagnosis and Etiology, despite an interface designed to not permit such an entry. Four of the thirteen corresponded to the same visit entry that contained the six Assessments with system errors, and an additional five corresponded to that same user, suggesting that the issue may have been related to web browser compatibility errors (although all users with these entries were also able to make error-free entries at other times).

Twenty-four outcomes were specified for chains that were terminated earlier in the process, resulting in an interrupted chain. For chains initiated in the Evidence step, all but one were carried through to completion. For chains without Evidence, 42% terminated early. Distinct chain counts (represented by triangles and octagons) differ from record counts because multiple evidence, intervention, and outcome records can apply to a single nutrition diagnosis. Additionally, since multiple records can apply to a single chain, individual records with

undesired termination do not result in termination of a chain, as long as other linked records exist for that chain.

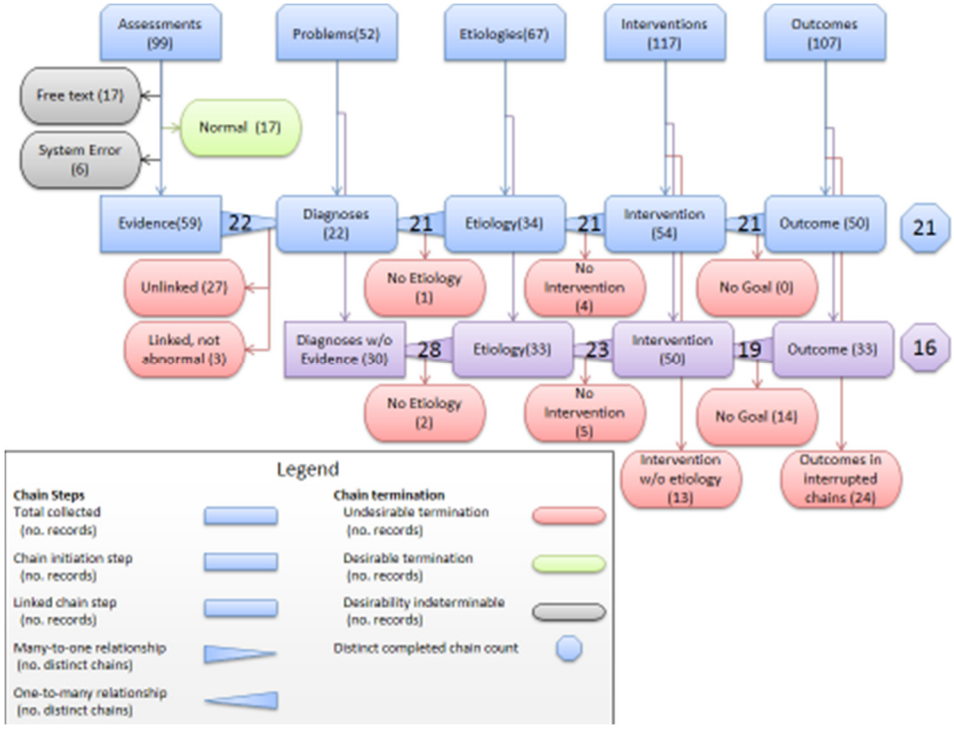

Figure 5. NCP chain results

Figure 6 displays the rate of completion of each step within distinct NCP chains (52 total), whether or not all of the earlier steps were completed (i.e. includes interrupted and incomplete chains). Potential NCP chains were identified using the record in the Diagnosis table as the central link, guaranteeing 100% completion of the Diagnosis step. The presence or absence of Evidence in the record is displayed for each step.

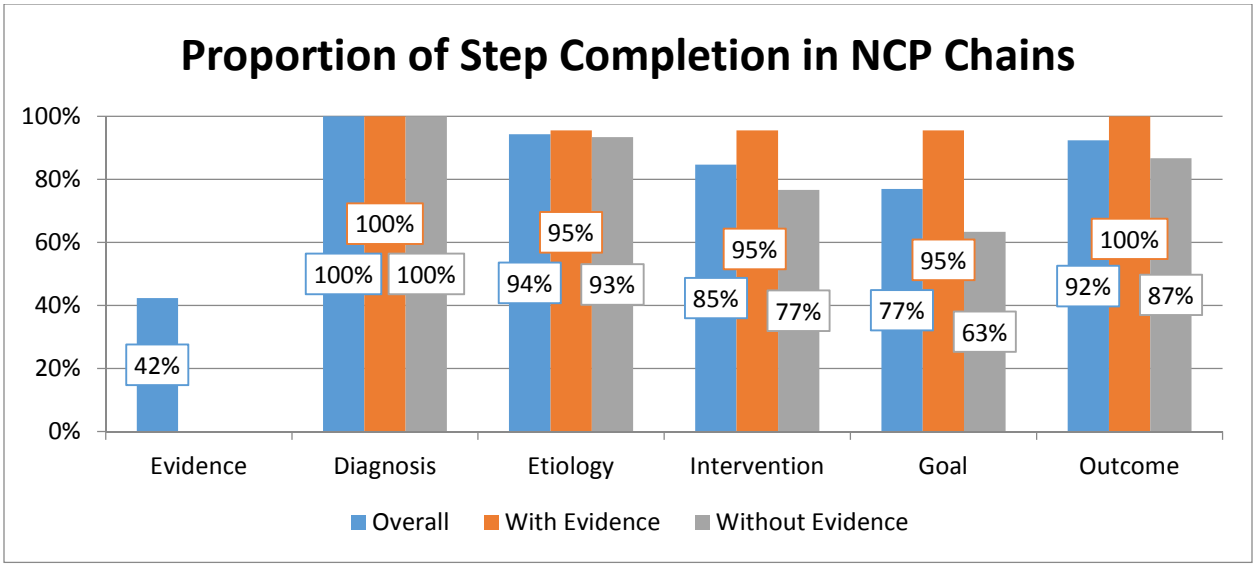

Figure 6. Proportion of chains that include each step, stratified by whether they were initiated in the Evidence step ("With Evidence") or the Diagnosis step ("Without Evidence")

Figure 7 presents the proportion of entries at each step that are linked to their respective next step. Each link corresponds to the matching table in the Methods. The Overall group considers all entries at each step. The other groups consider the subset of entries at each step that were a part of the contiguous NCP chains in Figure 5. Since, in ANDHII, outcomes are linked directly to the Diagnosis record, the Outcomes column examines the proportion of diagnoses that included at least one monitor.

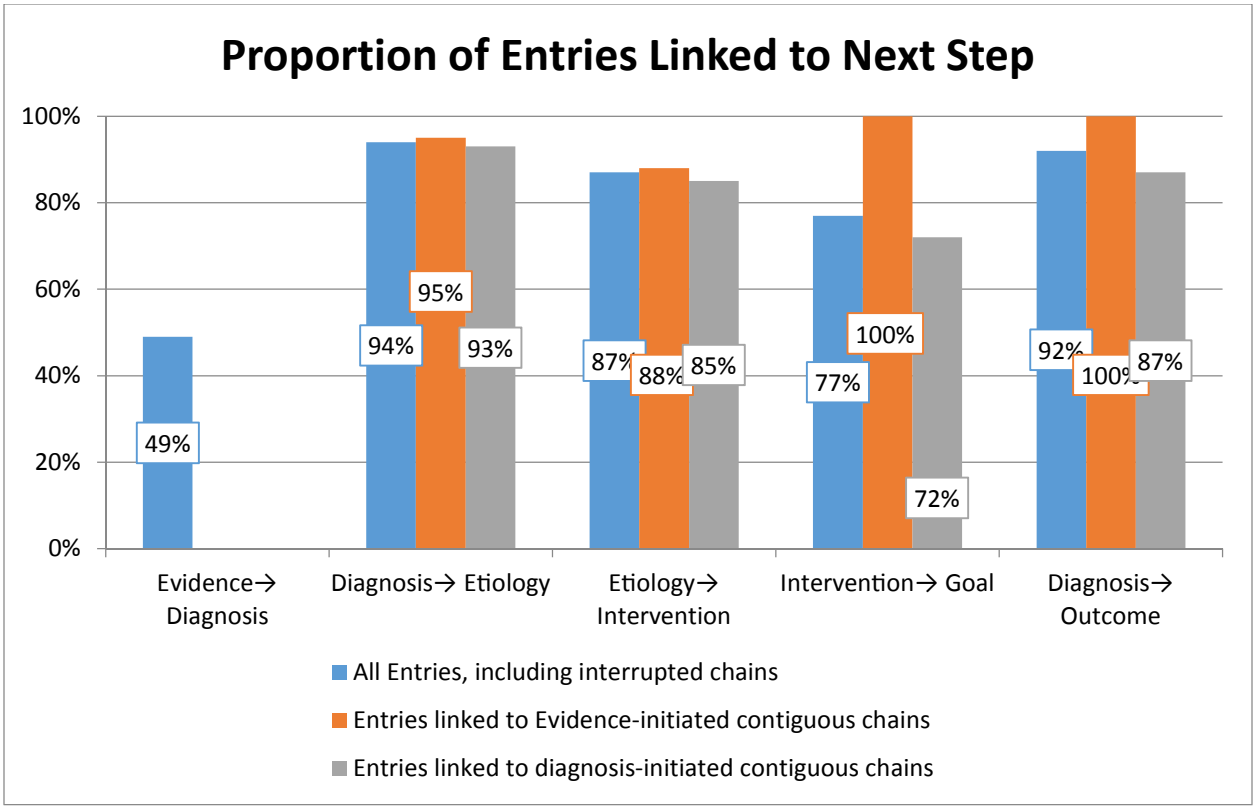

Figure 7. Proportion of entries at each step that were successfully linked to the following step (indicated as current step → following step).

With respect to the ANDHII Perceptions survey provided to each subject at the conclusion of the study, when asked about Ease of Use, the majority of subjects (70 percent) rated ANDHII as Easy (Figure 8). When asked about the extra time requirement for entry of patients into ANDHII, 40 percent rated it as Minor, whereas 30 percent rated it as Moderate (Figure 9). In addition, forty percent responded that ANDHII provided a Moderate Benefit to their practice and to the quality of patient care, with another 30 percent rating it between Moderate and Significant Benefit (Figure 10), and zero subjects rated ANDHII as having No Benefit. By contrast, however, 40 percent responded they would either be Unlikely or

Extremely Unlikely to continue using ANDHII in their practice given the choice, with another 40 percent responding that they would be Likely to continue using it (Figure 11).

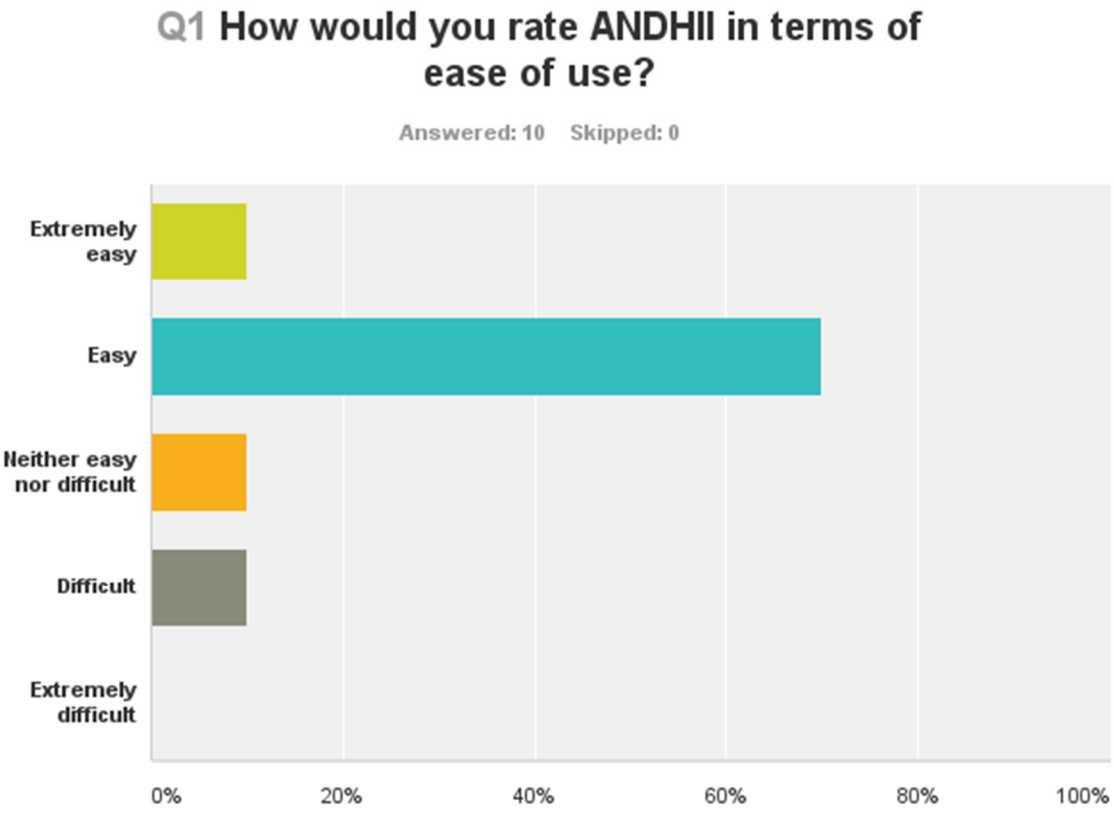

Figure 8. ANDHII ease of use

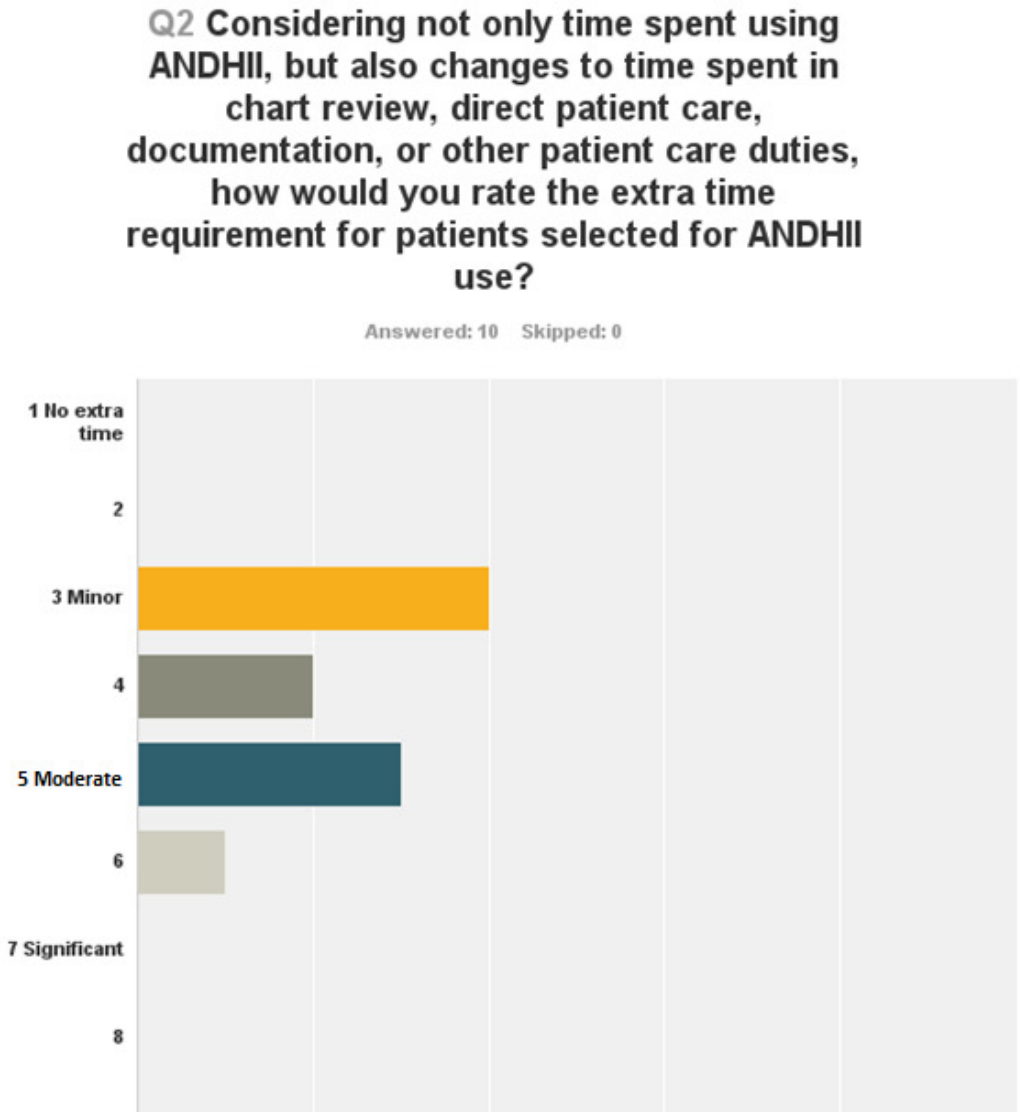

Figure 9. ANDHII time burden

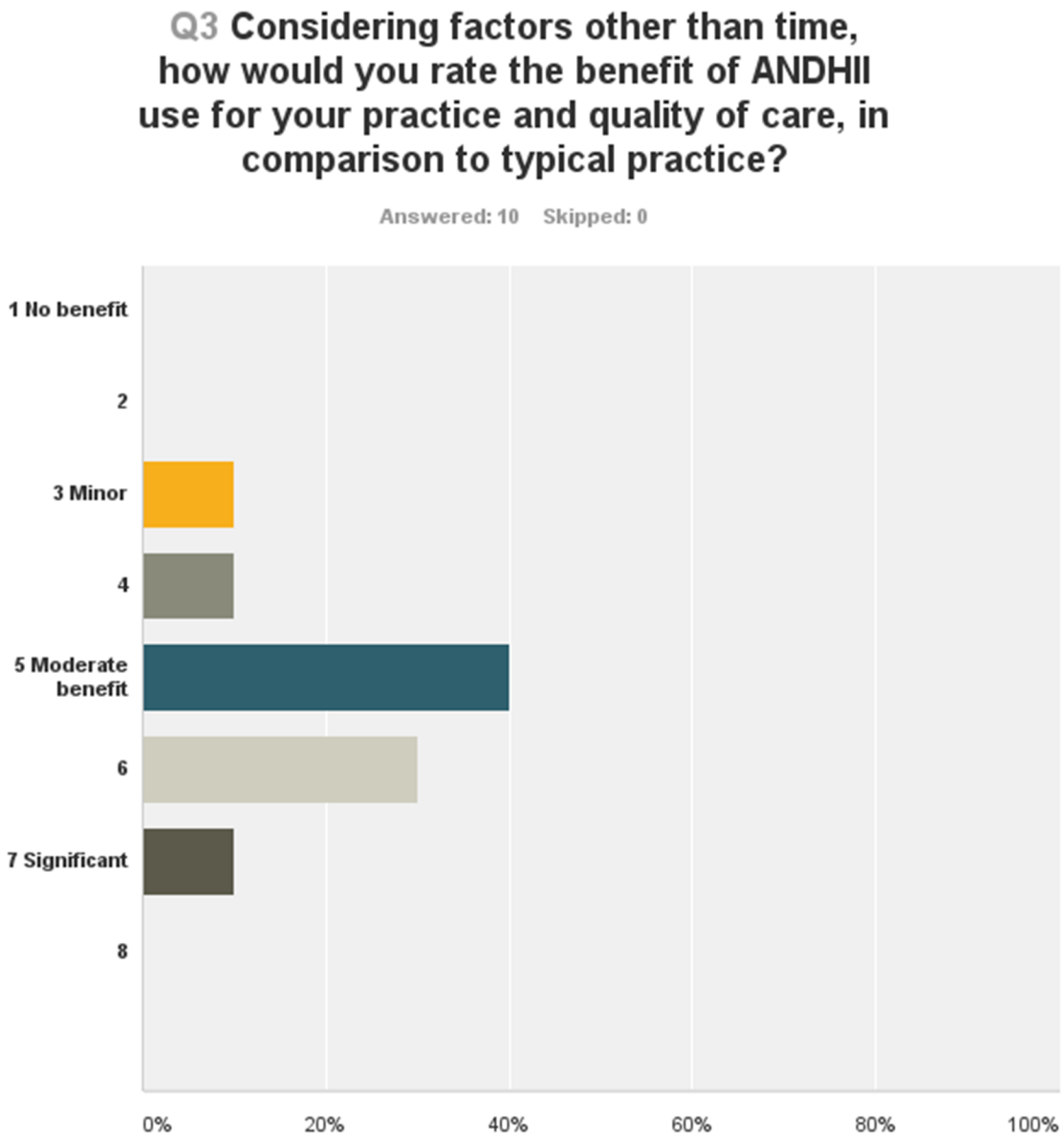

Figure 10. Benefit of ANDHII to practice and quality of care

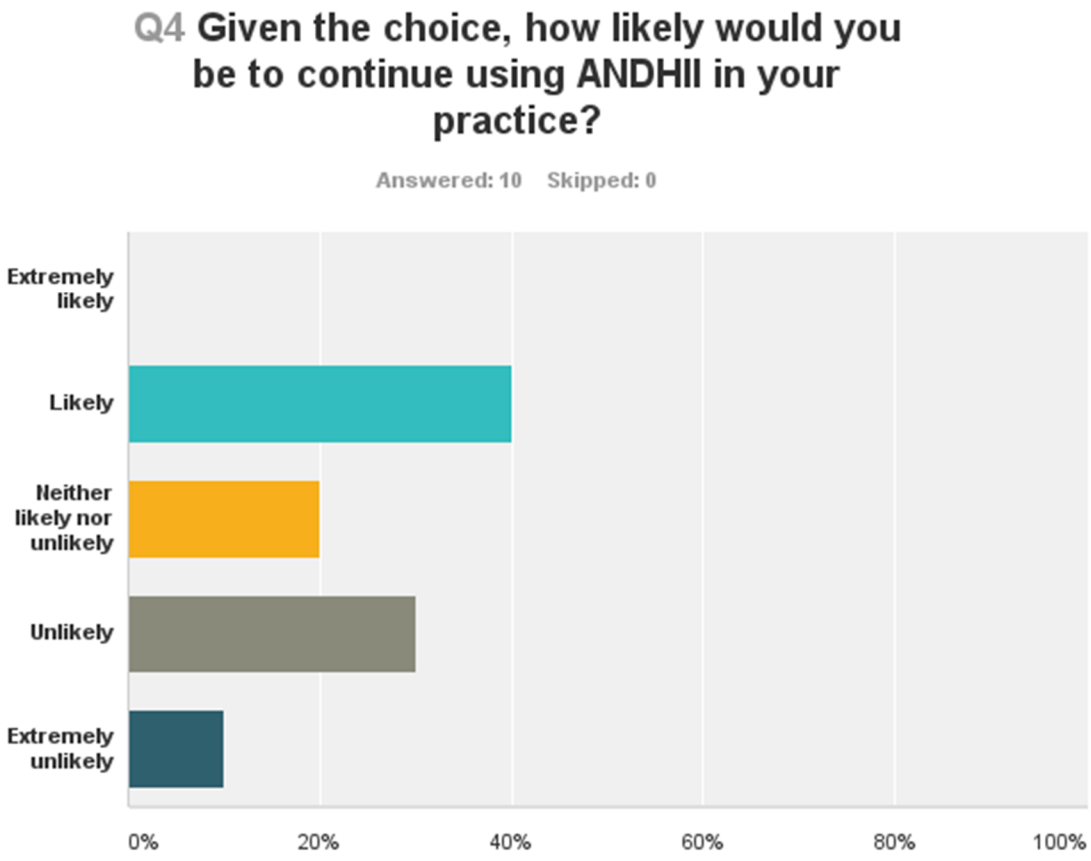

Figure 11. Likelihood to continue using ANDHII in practice

To the open-ended question, “Do you have suggestions to make the ANDHII experience better?” responses were varied (see Table 6).

Q5 Do you have suggestions to make the ANDHII experience better?

Answered: 5 Skipped: 5

#	Responses	Date
1	Moving to a new state and starting a new job didn't allow me the time I needed.	2/17/2014 7:11 PM
2	My organization uses a standard charting format which ANDHII was not useful for plugging into. The grammar and formatting of the ANDHII template was unprofessional and horribly difficult to read. I would never cut and paste from ANDHII into an EMR looking the way it did. My job is demanding with complicated patient cases that require more time than the average RD patient. I don't have time for anything extra that takes me out of the patient chart I'm working on.	2/4/2014 11:36 AM
3	It takes time to search the drop down choices even when I kind of know which terms I'm looking for. Maybe having a popup window where I can see all of the terms at once, instead of one at a time. Then I could check a box for the choices.	1/31/2014 4:15 PM
4	The only issue I had in the beginning was the version of explorer that I work with at my job did not work with some of the ANDHII format, but this was fixed within a day or 2.	12/11/2013 12:28 PM
5	Hard copy of all information to review and become familiar with all terms.	12/11/2013 12:09 PM

Table 6. Suggestions for improvement in ANDHII

STATISTICAL ANALYSIS

With respect to visit length when using ANDHII or providing standard care, using an unpaired Student's t-test, the mean time per visit using standard care was 49.56 minutes (SD = 24.00) and using ANDHII was 65.42 minutes (SD = 31.87), with a mean difference of 15.86 minutes (p = .021). To improve the model, double reciprocal transformation was performed, and the coefficient for familiarity with the patient (number of previous visits completed with the patient) was significant after transformation (see Table 7).

	Intercept β_0 (p value)	ANDHII experience β_1 (p value)	Patient familiarity β_2 (p value)	Overall model F (p value)
Direct	80.2 (<.001)	-3.69 (.292)	-14.1 (.090)	2.87 (0.73)
Transformed	.0192 (<.001)	-4.77×10^{-3} (.274)	6.31×10^{-3} (.003)	6.05 (.003)

Table 7. Comparison of regression models

The ANDHII experience coefficient was not significant in either model. Equation 1 represents the ANDHII learning curve, its double-reciprocal transformation, and the conversion of the regression coefficients.

$$y = \frac{\theta_1 x}{\theta_2 + x} \qquad \frac{1}{y} = \frac{1}{\theta_1} + \frac{\theta_2}{\theta_1}\frac{1}{x} \qquad \theta_1 = \frac{1}{\beta_0} \quad \theta_2 = \frac{\beta_1}{\beta_0}$$

Equation 1. Rational function representing the ANDHII learning curve, its double-reciprocal transformation, and the conversion of regression coefficients

In the rational function, as subject experience with ANDHII (*x*) becomes very large, the predicted time for entry of the visit into ANDHII (*y*) will approach θ_1; θ_1 can be calculated, by taking the reciprocal of the intercept regression coefficient in transformed model, to be 52.0 (see Table 7). This is the predicted nutrition care time for experienced users, and was 2.4 minutes greater than the average usual care time, but not significantly different (p = .565) from a statistical perspective. Using a one-sample Student's t-test, the mean ratio of perceived benefit vs. perceived time cost was 1.300 (SD = .34693, p = .015).

Spearman's rank correlation coefficient was used to examine the relationships with ordinal survey responses, including stated NCP experience vs. difficulty using ANDHII, which was negatively correlated (-.535, p = .111), difficulty vs. benefit ratio (-.189, p = .600), and NCP experience vs. benefit ratio (-0.44, p = .904). This same test was used to estimate likelihood to continue using ANDHII with respect to three separate variables: age, perceived benefit, and time burden, all of which were positively correlated (.668, p = .049), (.608, p = .062), and (.127, p = .727), respectively.

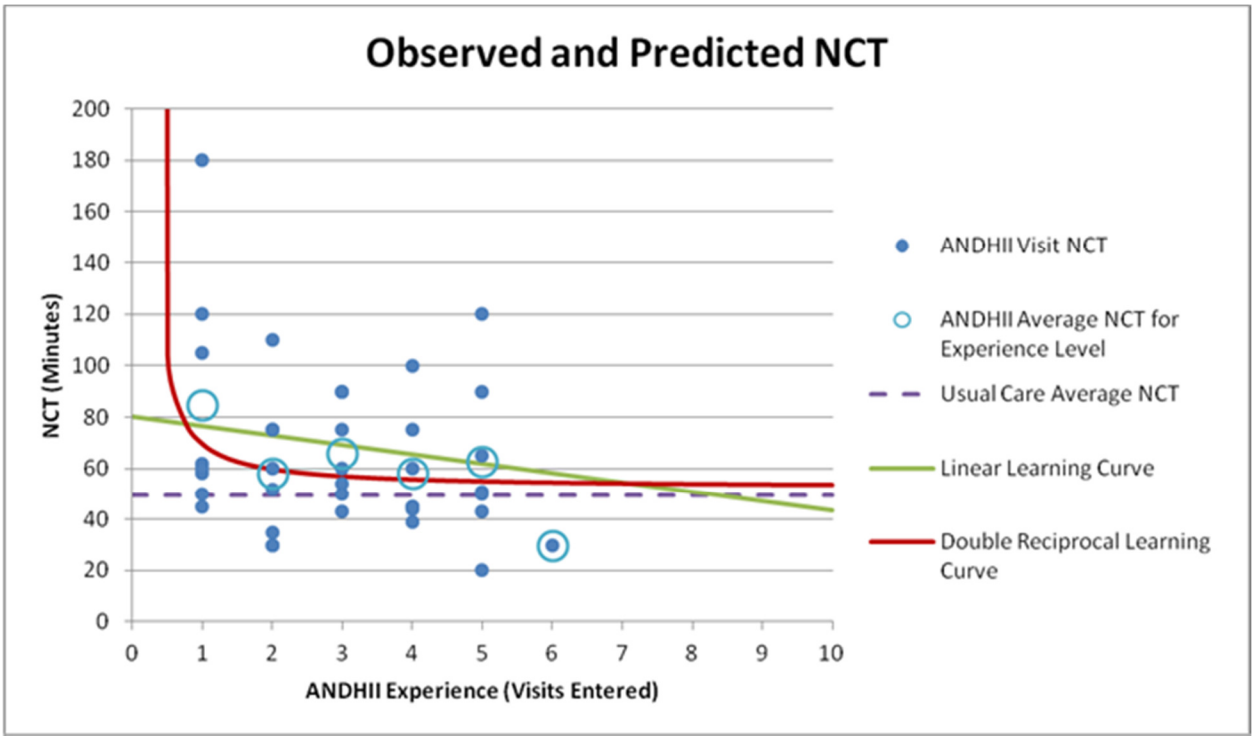

Figure 12. Nutrition care times (observed ANDHII, observed UC, vs. predicted ANDHII with experience)

With respect to NCP chain completion, a Fisher's exact test revealed that chains that included the Evidence step are significantly more likely to be carried through to completion vs. those that began with Diagnosis ($p = .0014$).

DISCUSSION

As noted previously, less than 10 percent of electronic health record systems include discrete fields for entry of both NCP and IDNT[15]. Dietitians using EHRs without NCP and IDNT bear the burden of having to look up standardized language using a reference[14] and risk entry of incomplete or interrupted NCP chains and inexact terms. Dietitians can be assisted by the use of ANDHII because of its inclusion of IDNT along with a structured layout for entry of patient visits using NCP. In this study, despite the longer mean time for entry of a patient visit

using ANDHII as compared to standard care, data suggest that as experience with ANDHII is gained, this difference would be minimized or would disappear entirely. The transformed regression model provided a more practical interpretation of this concept, as predicted nutrition care time could never have a value less than zero.

As far as dietitian acceptance of ANDHII and perception regarding its benefits, the survey responses indicated that the majority of subjects felt that it was easy to use and could be beneficial to their practices. Although the calculated benefit ratio was significantly greater than neutral, the reported low likelihood to continue using ANDHII may suggest that an even higher benefit ratio may be needed to drive adoption of ANDHII.

Use of ANDHII can help dietitians enter complete NCP chains, particularly because of how NCP steps are presented in each ANDHII record with appropriate corresponding IDNT language. This study adds to previous NCP chain analysis studies[11], replacing burdensome paper medical record review with automated SQL queries. Direct comparison with earlier studies is difficult due to variation in criteria used to judge NCP chain completeness. In addition, goals in ANDHII are placed after interventions, because goals are specified individually for each intervention. Outcomes in ANDHII are linked back to their respective diagnoses.

Finally, several comparisons can be made of this study to the Hall and Thornton study[13]. The latter study included a two-dimensional analysis (nursing activity vs. care/patient load vs nursing activity frequency), whereas the ANDHII study used a branching chain analysis of the entire care process. The Hall study involved retrospective data mining, whereas this study included prospective data collection. Finally, the Hall study included a fixed set of patient outcomes and was dependent on other computer systems, whereas the ANDHII study was

flexible and independent. Therefore, we believe this to be a first-of-its-kind demonstration of automated processing and classification of complex clinical practice pattern data.

LIMITATIONS

One assumption of the study is that the learning curve for ANDHI is uni-modal in that the time required to enter a visit decreases with each successive visit entry, until it reaches a point where the curve levels off. Had the study period extended beyond five weeks, this could be stated with more confidence. Some of the problems with access to ANDHII or with saving visits could have negatively affected some subjects' perceptions of ANDHII and their responses to survey questions regarding ease of use or likelihood to use ANDHII in their future practice.

Although several measurements in this study were statistically significant, a larger sample size may have assisted in the confidence with which study findings could be extrapolated to all dietitians in clinical practice. For example, the comparison of predicted nutrition care time for experienced ANDHII users vs. that for usual care was underpowered due to recruitment difficulties, making it difficult to state with confidence that there was no difference. Even though the overall model was significant, the coefficient for ANDHII experience was not, potentially due to a correlation between ANDHII experience and familiarity with individual patients during follow-up visits.

The observed improvement in the likelihood to complete NCP chains when they are initiated properly with evidence may suggest that adherence to NCP can improve consistency of documentation and care. It could also have simply reflected users with more NCP experience or greater technical skills.

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APPENDIX A

Conflict of Interest Disclosure

Co-investigators for this study were Vishnu Mohan, William Murphy, and Alison Steiber.

Mr. Murphy and Dr. Steiber are employees of the Academy of Nutrition and Dietetics, an organization that may have a commercial interest in the results of this research and technology. This potential conflict has been reviewed and managed by OHSU.

APPENDIX B

Time Burden Survey

ANDHII Time Study

1. What is your name?

2. Did you use ANDHII for this patient visit?

- ☐ Yes - used ANDHII
- ☐ No - did not use ANDHII (standard care)

3. How many previous visits with this particular patient have you had, whether using ANDHII or not?

4. How many minutes did you spend providing care to this particular patient during this visit? Include chart review, direct patient care, documentation, and any other time devoted to providing care to this patient today.

5. What is this patient's acuity level?

- ☐ High/Severe Nutrition Risk
- ☐ Moderate
- ☐ Mild
- ☐ No Nutrition Risk

Done

Powered by **SurveyMonkey**

APPENDIX C

Subject Perceptions Survey

ANDHII Subject Perceptions

1. How would you rate ANDHII in terms of ease of use?

- ☐ Extremely easy
- ☐ Easy
- ☐ Neither easy nor difficult
- ☐ Difficult
- ☐ Extremely difficult

2. Considering not only time spent using ANDHII, but also changes to time spent in chart review, direct patient care, documentation, or other patient care duties, how would you rate the extra time requirement for patients selected for ANDHII use?

- ☐ 1 No extra time
- ☐ 2
- ☐ 3 Minor
- ☐ 4
- ☐ 5 Moderate time requirement
- ☐ 6
- ☐ 7 Significant
- ☐ 8
- ☐ 9 Extraordinary time requirement

3. Considering factors other than time, how would you rate the benefit of ANDHII use for your practice and quality of care, in comparison to typical practice?

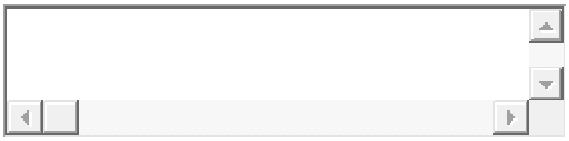
- ☐ 1 No benefit
- ☐ 2
- ☐ 3 Minor
- ☐ 4
- ☐ 5 Moderate benefit
- ☐ 6
- ☐ 7 Significant
- ☐ 8

- [ ] 9 Extraordinary benefit

4. Given the choice, how likely would you be to continue using ANDHII in your practice?

- [ ] Extremely likely
- [ ] Likely
- [ ] Neither likely nor unlikely
- [ ] Unlikely
- [ ] Extremely unlikely

5. Do you have suggestions to make the ANDHII experience better?



6. What is your gender?

- [ ] Female
- [ ] Male

7. What is your age in years?

8. How long have you practiced as a dietitian?

- [ ] 5 years or less
- [ ] 6-15 years
- [ ] 16-30 years
- [ ] 31 years or more

9. How long have you been using the Nutrition Care Process in practice?

- [ ] Less than 1 year
- [ ] 1-4 years
- [ ] 5 years or more

10. What is your highest level of education?

- Bachelor's degree
- Some graduate school
- Master's degree
- Doctoral degree

11. How long have you been part of the Dietetics Practice-Based Research Network (DPBRN)?

- Less than 1 year
- 1-3 years
- More than 3 years

Done

APPENDIX D
SQL queries

Evidence_ChainStatus.sql

```
SELECT V.VisitId, O.OutcomeId, TA.TermWithContext AS Assessment, O.CurrentValue,
UnA.Label, RRA.Description AS RefRange, Dx.DiagnosisId,
TD.TermWithContext AS Diagnosis, P.ReIdentificationCode,
CASE
WHEN RRA.Description = 'Individualized: currently in goal range' AND Dx.DiagnosisId
IS NULL THEN 'Normal'
WHEN RRA.Description = 'Individualized: currently in goal range' AND Dx.DiagnosisId
IS NOT NULL THEN 'Normal-linked'
WHEN RRA.Description = 'N/A' AND Dx.DiagnosisId IS NULL THEN 'N/A'
WHEN RRA.Description NOT IN('Individualized: currently in goal range', 'N/A') AND
Dx.DiagnosisId IS NULL THEN 'Incomplete'
WHEN Dx.DiagnosisId IS NOT NULL THEN 'Complete'
ELSE 'Error'
END As ChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Outcomes AS O ON O.VisitId = V.VisitId
FULL OUTER JOIN (Diagnoses as Dx LEFT OUTER JOIN DiagnosesSignsSymptoms AS DxSS ON
Dx.DiagnosisId = DxSS.DiagnosisId) ON (O.TerminologyId = DxSS.SignSymptomId) AND
(Dx.VisitId = V.VisitId)
--section below resolves keys into human readable forms
--Assessments
LEFT OUTER JOIN ReferenceRanges AS RRA on RRA.ReferenceRangeId = O.ReferenceRangeId
LEFT OUTER JOIN Units AS UnA on RRA.UnitId = UnA.UnitId
LEFT OUTER JOIN Terminology AS TA on O.TerminologyId = TA.TerminologyUniqueId
--Diagnoses
LEFT OUTER JOIN Terminology AS TD on Dx.TerminologyId = TD.TerminologyUniqueId
--To be able to reference in GUI
INNER JOIN Patients AS P ON V.PatientId = P.PatientId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
AND O.DiagnosisId IS NULL --Used to distinguish Assessments from Monitors
ORDER BY P.ReIdentificationCode
```

Diagnosis_ChainStatus.sql

```
SELECT
P.ReIdentificationCode, V.VisitId, Dx.DiagnosisId, --Diagnosis ID as central link
TD.TermWithContext AS Diagnosis,
COUNT(DISTINCT DxE.DiagnosisEtiologyId) AS EtiologyCount, COUNT(DISTINCT
DxSS.DiagnosisSignsSymptomsId) AS SignSymptomCount,
COUNT(DISTINCT O.OutcomeId) AS EvidenceCount, --COUNT(DISTINCT I.InterventionId) AS
InterventionCount,
COUNT(DISTINCT ME.OutcomeId) AS OutcomeCount,
CASE
```

```
WHEN (COUNT(DISTINCT O.OutcomeId) > 0) AND (COUNT(DISTINCT DxE.DiagnosisEtiologyId) >
0) THEN 'Complete'
WHEN (COUNT(DISTINCT O.OutcomeId) < 1) AND (COUNT(DISTINCT DxE.DiagnosisEtiologyId) >
0) THEN 'No Evidence-Etiology'
WHEN (COUNT(DISTINCT O.OutcomeId) < 1) AND (COUNT(DISTINCT DxE.DiagnosisEtiologyId) <
1) THEN 'No Evidence-No Etiology'
WHEN (COUNT(DISTINCT O.OutcomeId) > 0) AND (COUNT(DISTINCT DxE.DiagnosisEtiologyId) <
1) THEN 'Evidence-No Etiology'
ELSE 'Error'
END As ChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Diagnoses as Dx ON V.VisitId = Dx.VisitId
LEFT OUTER JOIN DiagnosesSignsSymptoms AS DxSS ON Dx.DiagnosisId = DxSS.DiagnosisId
LEFT OUTER JOIN DiagnosesEtiologies AS DxE on DxE.DiagnosisId = Dx.DiagnosisId
LEFT OUTER JOIN (Outcomes As O
INNER JOIN ReferenceRanges AS RR ON O.ReferenceRangeId = RR.ReferenceRangeId AND
RR.Description <> 'Individualized: currently in goal range')
--Exclude evidence that was marked as normal via reference range
ON (O.VisitId = V.VisitId) AND (O.TerminologyId = DxSS.SignSymptomId) AND
(O.DiagnosisId IS NULL)
-- Finds linked assessment step entries by looking for outcomes table entries from
the current visit that are marked as signs and symptoms and are not from the
Monitoring&Evaluation step (O.DiagnosisId IS NULL)
LEFT OUTER JOIN Interventions AS I ON I.DiagnosisEtiologyId = DxE.DiagnosisEtiologyId
--Total interventions
--Interventions with details (goals)
LEFT OUTER JOIN Outcomes AS ME ON ME.DiagnosisId = Dx.DiagnosisId
--Monitoring Targets
--section below resolves keys into human readable forms
--Diagnoses
LEFT OUTER JOIN Terminology AS TD on Dx.TerminologyId = TD.TerminologyUniqueId
--To be able to reference in GUI
INNER JOIN Patients AS P ON V.PatientId = P.PatientId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
GROUP BY P.ReIdentificationCode, V.VisitId, Dx.DiagnosisId, TD.TermWithContext
ORDER BY V.VisitId
```

Etiology_ChainStatus.sql

```
WITH Dx_CTE (DiagnosisId,DiagnosisChainStatus)
AS (
SELECT Dx.DiagnosisId,
CASE
```

```
WHEN COUNT(O.OutcomeId) > 0 THEN 'Evidence'
WHEN COUNT(DxSS.DiagnosisSignsSymptomsId) > 0 THEN 'No Evidence'
ELSE 'No Signs'
END AS DiagnosisChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Diagnoses as Dx ON V.VisitId = Dx.VisitId
LEFT OUTER JOIN DiagnosesSignsSymptoms AS DxSS ON Dx.DiagnosisId = DxSS.DiagnosisId
--LEFT OUTER JOIN DiagnosesEtiologies AS DxE on DxE.DiagnosisId = Dx.DiagnosisId
LEFT OUTER JOIN (Outcomes As O
INNER JOIN ReferenceRanges AS RR ON O.ReferenceRangeId = RR.ReferenceRangeId AND
RR.Description <> 'Individualized: currently in goal range')
--Exclude evidence that was marked as normal via reference range
ON (O.VisitId = V.VisitId) AND (O.TerminologyId = DxSS.SignSymptomId) AND
(O.DiagnosisId IS NULL)
-- Finds linked assessment step entries by looking for outcomes table entries from
the current visit that are marked as signs and symptoms and are not from the
Monitoring&Evaluation step (O.DiagnosisId IS NULL)
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
GROUP BY Dx.DiagnosisId
)
SELECT P.ReIdentificationCode, V.VisitId, D.DiagnosisId, DxE.DiagnosisEtiologyId,
TE.Term,
COUNT(I.InterventionId) AS InterventionCount,
(DxCTE.DiagnosisChainStatus + '-'+
CASE
WHEN (COUNT(I.InterventionId) > 0) THEN 'Intervention'
ELSE 'No Intervention'
END) AS ChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Patients AS P ON V.PatientId = P.PatientId
INNER JOIN Diagnoses AS D ON D.VisitId = V.VisitId
INNER JOIN DiagnosesEtiologies AS DxE ON DxE.DiagnosisId = D.DiagnosisId
LEFT OUTER JOIN Interventions AS I ON I.DiagnosisEtiologyId = DxE.DiagnosisEtiologyId
LEFT OUTER JOIN Dx_CTE AS DxCTE on DxCTE.DiagnosisId = D.DiagnosisId
--Resolve Keys
--Etiologies
LEFT OUTER JOIN Terminology AS TE ON DxE.EtiologyId = TE.TerminologyUniqueId
--Interventions
LEFT OUTER JOIN Terminology AS TI ON I.TerminologyId = TI.TerminologyUniqueId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
```

```
GROUP BY P.ReIdentificationCode, V.VisitId, D.DiagnosisId,
DxCTE.DiagnosisChainStatus, DxE.DiagnosisEtiologyId, TE.Term
ORDER BY D.DiagnosisId
```

Intervention_ChainStatus.sql

```
WITH Dx_CTE (DiagnosisId, DiagnosisEtiologyId, DiagnosisChainStatus)
AS (
SELECT Dx.DiagnosisId, DxE.DiagnosisEtiologyId,
CASE
WHEN COUNT(O.OutcomeId) > 0 THEN 'Evidence'
WHEN COUNT(DxSS.DiagnosisSignsSymptomsId) > 0 THEN 'No Evidence'
ELSE 'No Signs'
END AS DiagnosisChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Diagnoses as Dx ON V.VisitId = Dx.VisitId
LEFT OUTER JOIN DiagnosesSignsSymptoms AS DxSS ON Dx.DiagnosisId = DxSS.DiagnosisId
INNER JOIN DiagnosesEtiologies AS DxE on DxE.DiagnosisId = Dx.DiagnosisId
LEFT OUTER JOIN (Outcomes As O
INNER JOIN ReferenceRanges AS RR ON O.ReferenceRangeId = RR.ReferenceRangeId AND
RR.Description <> 'Individualized: currently in goal range')
--Exclude evidence that was marked as normal via reference range
ON (O.VisitId = V.VisitId) AND (O.TerminologyId = DxSS.SignSymptomId) AND
(O.DiagnosisId IS NULL)
-- Finds linked assessment step entries by looking for outcomes table entries from
the current visit that are marked as signs and symptoms and are not from the
Monitoring&Evaluation step (O.DiagnosisId IS NULL)
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
GROUP BY Dx.DiagnosisId, DxE.DiagnosisEtiologyId
)
SELECT
Us.UserId, P.ReIdentificationCode, V.VisitId, I.DiagnosisEtiologyId,
I.InterventionId, TI.TermWithContext, I.Details,
CASE
WHEN (DxCTE.DiagnosisChainStatus = 'Evidence') AND (I.Details IS NOT NULL) THEN
'Complete'
WHEN (DxCTE.DiagnosisChainStatus = 'Evidence') AND (I.Details IS NULL) THEN
'Incomplete'
WHEN (DxCTE.DiagnosisChainStatus = 'No Evidence') AND (I.Details IS NOT NULL) THEN
'No Evidence-Complete'
WHEN (DxCTE.DiagnosisChainStatus = 'No Evidence') AND (I.Details IS NULL) THEN 'No
Evidence-Incomplete'
WHEN (DxCTE.DiagnosisChainStatus = 'No Signs') AND (I.Details IS NOT NULL) THEN 'No
Signs-Complete'
WHEN (DxCTE.DiagnosisChainStatus = 'No Signs') AND (I.Details IS NULL) THEN 'No
Signs-Incomplete'
WHEN (DxCTE.DiagnosisId IS NULL) AND (I.Details IS NOT NULL) THEN 'No Etiology-
Complete'
```

```
WHEN (DxCTE.DiagnosisId IS NULL) AND (I.Details IS NULL) THEN 'No Etiology-
Incomplete'
END AS ChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Patients AS P ON V.PatientId = P.PatientId --To be able to reference in
GUI
INNER JOIN Interventions AS I ON I.VisitId = V.VisitId
LEFT OUTER JOIN Dx_CTE AS DxCTE ON DxCTE.DiagnosisEtiologyId = I.DiagnosisEtiologyId
LEFT OUTER JOIN Terminology AS TI on TI.TerminologyUniqueId = I.TerminologyId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
ORDER BY Us.UserId
```

Outcome_ChainStatus.sql

```
WITH Dx_CTE (DiagnosisId, Classification)
AS (
SELECT
Dx.DiagnosisId,
CASE
WHEN COUNT(DISTINCT O.OutcomeId) > 0 THEN 'Evidence'
ELSE 'No Evidence'
END
+ '-' +
CASE
WHEN (COUNT(DISTINCT DxE.DiagnosisEtiologyId) > 0) THEN 'Etiology'
ELSE 'No Etiology'
END
+ '-' +
CASE
WHEN (COUNT(I.Details) > 0) THEN 'Intervention-Goal'
WHEN (COUNT(DISTINCT I.InterventionId) > 0) THEN 'Intervention-No Goal'
ELSE 'No Intervention-No Goal'
END
AS ChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Diagnoses as Dx ON V.VisitId = Dx.VisitId
LEFT OUTER JOIN DiagnosesSignsSymptoms AS DxSS ON Dx.DiagnosisId = DxSS.DiagnosisId
LEFT OUTER JOIN DiagnosesEtiologies AS DxE on DxE.DiagnosisId = Dx.DiagnosisId
```

```
LEFT OUTER JOIN (Outcomes As O
INNER JOIN ReferenceRanges AS RR ON O.ReferenceRangeId = RR.ReferenceRangeId AND
RR.Description <> 'Individualized: currently in goal range')
--Exclude evidence that was marked as normal via reference range
ON (O.VisitId = V.VisitId) AND (O.TerminologyId = DxSS.SignSymptomId) AND
(O.DiagnosisId IS NULL)
-- Finds linked assessment step entries by looking for outcomes table entries from
the current visit that are marked as signs and symptoms and are not from the
Monitoring&Evaluation step (O.DiagnosisId IS NULL)
--Interventions
LEFT OUTER JOIN Interventions AS I ON I.DiagnosisEtiologyId = DxE.DiagnosisEtiologyId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
GROUP BY Dx.DiagnosisId
)
SELECT
P.ReIdentificationCode, V.VisitId, Dx.DiagnosisId, --Diagnosis ID as central link
TD.TermWithContext AS Diagnosis,
ME.OutcomeId, TME.TermWithContext AS Outcome, ME.CurrentValue, UnME.Label,
RRME.Description,
DxCTE.Classification
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Patients AS P ON V.PatientId = P.PatientId --To be able to reference in
GUI
INNER JOIN Diagnoses as Dx ON V.VisitId = Dx.VisitId
--Outcomes
INNER JOIN Outcomes AS ME ON ME.DiagnosisId = Dx.DiagnosisId
LEFT OUTER JOIN Dx_CTE AS DxCTE ON DxCTE.DiagnosisId = Dx.DiagnosisId
--section below resolves keys into human readable forms
--Diagnoses
LEFT OUTER JOIN Terminology AS TD on Dx.TerminologyId = TD.TerminologyUniqueId
--Outomces
LEFT OUTER JOIN Terminology AS TME ON ME.TerminologyId = TME.TerminologyUniqueId
LEFT OUTER JOIN ReferenceRanges AS RRME ON ME.ReferenceRangeId =
RRME.ReferenceRangeId
LEFT OUTER JOIN Units AS UnME on RRME.UnitId = UnME.UnitId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
ORDER BY ME.OutcomeId
```

Classify_Chains.sql

```
SELECT
Us.UserId, P.ReIdentificationCode, V.VisitId, Dx.DiagnosisId, TD.TermWithContext,
COUNT(DISTINCT O.OutcomeId) AS EvidenceCount, COUNT(DISTINCT DxE.DiagnosisEtiologyId)
AS EtiologyCount,
COUNT(DISTINCT I.InterventionId) AS InterventionCount, COUNT(DISTINCT I.Details) AS
GoalCount, COUNT(DISTINCT ME.OutcomeId) AS OutcomeCount,
CASE
WHEN COUNT(DISTINCT O.OutcomeId) > 0 THEN 'Evidence'
ELSE 'No Evidence'
END
+ '-' +
CASE
WHEN (COUNT(DISTINCT DxE.DiagnosisEtiologyId) > 0) THEN 'Etiology'
ELSE 'No Etiology'
END
+ '-' +
CASE
WHEN (COUNT(I.Details) > 0) THEN 'Intervention-Goal'
WHEN (COUNT(DISTINCT I.InterventionId) > 0) THEN 'Intervention-No Goal'
ELSE 'No Intervention-No Goal'
END
+ '-' +
CASE
WHEN (COUNT(ME.OutcomeId) > 0) THEN 'Outcome'
ELSE 'No Outcome'
END
AS ChainStatus
FROM Visits AS V
INNER JOIN Users AS Us ON V.ClinicianId = Us.UserId
INNER JOIN Diagnoses as Dx ON V.VisitId = Dx.VisitId
LEFT OUTER JOIN DiagnosesSignsSymptoms AS DxSS ON Dx.DiagnosisId = DxSS.DiagnosisId
LEFT OUTER JOIN DiagnosesEtiologies AS DxE on DxE.DiagnosisId = Dx.DiagnosisId
LEFT OUTER JOIN (Outcomes As O
INNER JOIN ReferenceRanges AS RR ON O.ReferenceRangeId = RR.ReferenceRangeId AND
RR.Description <> 'Individualized: currently in goal range')
--Exclude evidence that was marked as normal via reference range
ON (O.VisitId = V.VisitId) AND (O.TerminologyId = DxSS.SignSymptomId) AND
(O.DiagnosisId IS NULL)
-- Finds linked assessment step entries by looking for outcomes table entries from
the current visit that are marked as signs and symptoms and are not from the
Monitoring&Evaluation step (O.DiagnosisId IS NULL)
--Interventions
LEFT OUTER JOIN Interventions AS I ON I.DiagnosisEtiologyId = DxE.DiagnosisEtiologyId
--Outcomes
LEFT OUTER JOIN Outcomes AS ME ON ME.DiagnosisId = Dx.DiagnosisId
--section below resolves keys into human readable forms
```

```
--Diagnoses
LEFT OUTER JOIN Terminology AS TD on Dx.TerminologyId = TD.TerminologyUniqueId
--To be able to reference in GUI
INNER JOIN Patients AS P ON V.PatientId = P.PatientId
WHERE V.StudyGroupId = 3 AND Us.LastName NOT IN ('Dietitian', 'Administrator') --
Limit to ANDHII feasibility project and exclde test/demo users
GROUP BY Dx.DiagnosisId, V.VisitId, Us.UserId, P.ReIdentificationCode,
TD.TermWithContext
                                    ORDER BY Dx.DiagnosisId
```