Developing a Controlled Vocabulary for Education as a Health Care Intervention

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Objectives of Project

Investigate Two Approaches for the Development of a Controlled Vocabulary for Education as a Health Intervention in Chronic Disease.
Chronic Disease in US

- Affects over 100 million people
  - 75% of the 1.4 trillion dollars of national health care expenditures (IOM report)

- Patient self-management
  - is a cornerstone of chronic disease care

- Patient education
  - is an intervention “that imparts knowledge, attitudes and skills with the specific goal of changing behavior, increasing compliance with therapy and, thereby, improving health.” (The Consumer and Patient Health Information Section of the Medical Library Association, 1996)
EDUCATION as an Health Intervention: A Systems View

- **Levels of care system**
  - Individual – provider or recipient of education
  - Program – organization of services for an entity
  - National – aggregate of programs

- **Components** within each level
  - Structure – organization of system components
  - Process - function of system
  - Outcomes – objective of system

- **Perspectives** (stakeholders)
  - Patient, Provider, Payer
  - Administrator, Regulators, Policy Makers
Problem

- What is the evidence that education is effective?
  - What settings, what dose, what frequency?
  - Which methods?
  - Which providers?
  - What are the key outcomes?

- Poorly defined means that it is difficult to evaluate or measure outcomes.
A Solution: “10 year Project”

NDEOS Architecture

Data Acquisition

Web Services

Analytical Services

National Data Repository
Hypothesis

A structured, controlled vocabulary of education as a health intervention will support:

- Electronic outcomes reporting
- Literature indexing (evidence gathering)
- Common approach to support patient-provider communication
- Integration of education into the electronic medical record and other entities
Pilot Project: Test Vocabulary

- **Purpose:** To develop a controlled vocabulary to support *education program outcomes reporting*.

- **Scope:** A Diabetes Self-Management Education (DSME) program is the use case and the *perspective* is that of the *program manager*.
Methods

- UMLS: “Top-down”
  explore the UMLS for concepts and relationships

- MedLine: “Bottom up”
  text-based searching of biomedical literature for concepts
Methods: UMLS

1. Search the UMLS for concepts
2. Manual review of the concepts
3. Categorize the concepts
4. Sort the concepts
5. Obtain the hierarchical relationships
6. Review the relationships for relatedness to vocabulary purpose
UMLS: Search for Concepts

- Identified 26 candidate concepts
  - domain expert
  - perspective of DSME program manager

- Mapped to UMLS
  - 16 seed concepts were identified
  - 2038 concepts found in hierarchical or associative relation
UMLS: Manual Review of Concepts

2038 concepts for relatedness to education programs

- Deleted 402 non-relevant concepts
- Used semantic types for clarification - most common were *Health Care Activity* and *Educational Activity*
- “Interesting” terms were archived for later review
UMLS: Categorize concepts

1636 Concepts

Levels

Individual

Program

National

Structure

Process

Outcomes
### UMLS: Sort Concepts

<table>
<thead>
<tr>
<th>Levels</th>
<th>Structure</th>
<th>Process</th>
<th>Outcomes</th>
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<tr>
<td>National</td>
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</table>
UMLS: Hierarchical Relationships

70 concepts

Direct
Indirect

Program Outcomes
UMLS: Review Hierarchies
UMLS: Review Hierarchies

Quality of Health Care

Outcome and Process Assessment (Health Care)

Health Status Indicators

Interinstitutional Relations
Motivation: Biomedical literature is a good source of concepts for a controlled vocabulary.

Goal: To determine if this “bottom-up” method can assist with identification of missing terms for vocabulary.

Results: A methodology and concepts to enhance the vocabulary — especially at the “leaf level.”
Methods: Medline

1. Search SEE using key concepts
2. Obtain relevant abstracts based on strings of text
3. Markup abstracts using SPO framework
4. Review for inclusion in vocabulary
Medline: Search Concepts

Objective: To assess the persistence of outcomes for up to 5 years following the initiation of community-based pharmaceutical care services (PCS) for patients with diabetes. DESIGN: Quasi-experimental, longitudinal pre-post cohort study. SETTING: Twelve community pharmacies in Asheville, N.C. PATIENTS AND OTHER PARTICIPANTS: Patients with diabetes covered by self-insured employers' health plans. Community pharmacists trained in a diabetes certificate program and reimbursed for PCS. INTERVENTIONS: Education by certified diabetes educators, long-term community pharmacist follow-up using scheduled consultations, clinical assessment, goal setting, monitoring, and collaborative drug therapy management with physicians. MAIN OUTCOME MEASURES: Changes in glycosylated hemoglobin (A1C) and serum lipid concentrations and changes in diabetes-related and total medical utilization and costs over time. RESULTS: Mean A1C decreased at all follow-ups, with more than 50% of patients demonstrating improvements at each time. The number of patients with optimal A1C values (<5%; 7%) also increased at each follow-up. More than 50% showed improvements in lipid levels at every measurement. Multivariate logistic regressions suggested that patients with higher baseline A1C values or higher baseline costs were most likely to improve or have lower costs, respectively. Costs shifted from inpatient and outpatient physician services to prescriptions, which increased significantly at every follow-up. Total mean direct medical costs decreased by $1,200 to $1,872 per patient per year compared with baseline. Days of sick time decreased every year (1997-2001) for one employer group, with estimated increases in productivity estimated at $18,000 annually. CONCLUSION: Patients with diabetes who received ongoing PCS maintained improvement in A1C over time, and employers experienced a decline in mean total direct medical costs.
Evaluation

Structural Approach for completeness and consistency
• Hierarchical consistency – missing relations
• Missing concepts – indirect inheritance
Evaluation

Quality -- Semantic properties

- Only a limited range of semantic types is expected to be found within each S-P-O group of concepts

- Concepts with outlier semantic types should be reviewed
  - Program Outcome:
    C0001811 Aging … Organism Function Temporal Concept
Future Work

- Completion of Education Program Vocabulary
  - Refine UMLS method
  - Meta Map and automation of concept extraction
  - EBM markup for PMOT for diabetes care
  - other stakeholder perspectives
- Evaluation of vocabulary by stakeholder groups
- Integration into NDEOS
- Apply methods to other chronic diseases such as asthma
Limitations

- Method is based on assumption that concepts exist in UMLS and biomedical literature

- Other methods for completing vocabulary will need to be addressed
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