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Finding Specialists Using Interface Terminology and Concept-Based Hierarchical Reference Terminology
The General Problem:

- Researchers often struggle to locate and communicate with collaborators across fields and outside rigidly defined organizational confines.

The General VIVO Solution:

- VIVO will help create the collaborations that are crucial in science by facilitating communication and collaboration across interdisciplinary and institutional boundaries NOT ONLY for scientists but also for administrators, students, faculty, donors, funding agencies and the public.
A More Specific Problem in Academic Medical Centers:

- Patients, Students, Physicians, as well as Researchers often struggle to locate and communicate with clinicians, clinician-scientists, and medical researchers.

Searching by Expertise:

- Patients and peers both may search by expertise but the terms they use to describe similar concepts may differ.
  - Heart Attack versus Myocardial Infarction
  - Patients and peers may have different notions of what constitutes an “expert”
**VIVO versus POPS**

**VIVO** is an open source, semantic web application that enables the discovery of research and scholarship across disciplines in an institution.

**VIVO** is populated with detailed profiles of faculty and researchers; displaying items such as publications, teaching, service, and professional affiliations.

**VIVO** brings together publicly available information on the people, departments, graduate fields, facilities, and other resources that collectively make up the research and scholarship environment at the institution.

**POPS** is a custom application designed for one medical center to help patients and physician find other physicians. It was extended to help researchers find other researchers.

**POPS** is populated with detailed profiles of clinical and research faculty; displaying items such as areas of interest, publications, professional affiliations and practice details for clinicians such as insurance accepted.

**POPS** brings together information from various systems of record such as Human Resources and Faculty Affairs, as well profile details entered by the faculty member or their staff.
Finding a Medical Expert: Why is this so hard?

• Figuring out what a user is looking for ... is hard.
  – Is this a patient looking for a physician?
  – Is this a physician creating a referral?

• Mapping search words to a terminology... is hard.

• Clinical terminology domains are many:
  – Specialty terminology
  – Diagnosis terminology
  – Procedure terminology
  – Medication terminology
  – ...
• Faculty categorization...is hard:
  – Physicians, Physician-Scientists, Basic Researchers all may be “experts” in the same domain.
  – Initial board certification may not be current area of interest.
  – Categorization is both at a high level – e.g. specialty – and at a low level – e.g. a specific diagnosis or procedure.
  – Physician profiling is both for inclusions and exclusions.
    • E.g. A ‘pediatric cardiologist’ is a pediatrician but might not see ‘general pediatric’ patients.
  – Synonyms abound so an ontology is desirable
    • E.g. HIV vs AIDS

• A standard terminology is necessary.
Searching Without an Ontology for Expertise
A Priori Mapping of Faculty to Areas of Interest

- Faculty (or their staff) identify their areas of interest
- Faculty are uneven in their interpretation of “expertise”
- Updating profiles is uneven
- Some feel immodest calling themselves an “expert” in a setting were expertise is relative.
- Therefore we seek methods or automating population of the their profiles.

Personal Sub-Specialization
- Recognized among peers as an expert
- Hope faculty will self-identify
- Perhaps derive from publications

Core Sub-Specialization
- “Bread & Butter” Expertise
- Every day part of their job
- Derive from billing data

Basic Competency
- General domain of the specialty
- Required part of training
- Implied from board certifications
How is this managed?

Globally, the administration tool presents a list of physicians including physician profile details of specialty and experience items by physicians. Administration consists of managing physician profile information for inclusions and exclusions by…
Need for Physician Ranking

A physician profile may have many specialty and experience items. "Finding" physicians, how do we rank physicians by best fit?

Concept of Semantic Distance

What the user is looking for might not be exactly what is part of physician profiles: how do we figure out search term to physician profile semantic distance?

Concept X (green sphere) is compared to Provider A profile (red spheres) and Provider B profile (blue spheres). Provider B will be ranked first as one profile concept of B is closer to Concept X than any of Provider A profile concepts.
First examination of the algorithm is simple. What can go wrong?

Further examination reveals data cross products preventing commercial database implementations: intermediate steps are extremely large data intersections.

The difficulty is real: combined with sheer magnitude of data.
Practically, How can this be done...?

- Create a result set by expanding the physician codes to physician information that will be displayed at the user.
- The database of physicians.
- Physicians

Result!
Practically, how this is done:

Internals

Search String

Specialty Data Source

Expertise Data Sources

Expertise Search Results

Specialty Search Result

Physician Search Results
Find a Medical College of Wisconsin Practitioner

Search by last name...

...or find a physician based on these criteria:

Patient Care Emphasis:
asthma (e.g., headache)

Department:

Doctor's Gender:
Either

Ages Seen:

Languages Spoken:

Clinic Location:

Center:

Search

Clear Form
Why is this important and useful?

• VIVO’s goal is to connect scientists
  – AMC’s want to connect physicians, patients, physician scientists, researchers, and research subjects
  – VIVO’s ontology stops at the point of SubjectArea
  – VIVO has a non-semantic list of SubjectAreas
  – If this is replaced by a standard ontology, searches by expertise could be more precise and utilize more powerful semantic search logic.
The Role of Interface Terminologies

• Interface terminologies, such as IMO’s, can help institutions map existing internal lists (like VIVO’s) to reference terminology with concept hierarchies

• Interface terminologies provides search flexibility by cross mapping different terminologies such as consumer and professional terms
  – ‘tummy pain’ is mapped to ‘abdominal pain’ mapped to SNOMED CT®
  – ‘heart doctor’ is mapped to ‘cardiology’ mapped to SNOMED CT®

• Using a concept based terminology mapped to a reference terminology, concept semantic distances can be computed to find the most relevant faculty match.
Institutional Architecture

Institutional systems of record

Data ingest ontologies (RDF)

User input

VIVO Extended by Expertise Terminology

Shared as RDF

National sources