Improving Patients' Understanding of Radiology Reports: Comparing Coverage of a Lay-Language Radiology Glossary to MedlinePlus

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Background & Significance

- The "patient portal" is an increasingly popular feature of electronic health record (EHR) systems allowing patients to view their radiology reports.
  - A large cross-sectional study found that 51% of patients with access viewed their reports online.
  - In a separate survey, 88% of patients reported that their ability to access radiology reports was important.
- Despite their strong interest, patients often find radiology reports to be complex, highly technical and difficult to understand.

Background & Significance

- The increasingly ready access to radiology reports online and continued efforts to undertake patient health literacy gaps call for the development of effective resources which help patients understand medical terms and concepts in their reports.
  - The average U.S. adult reads at an 8th grade level
- MedlinePlus is a highly popular medical information resource maintained by the U.S. National Library of Medicine that is currently incorporated into many EHR systems.
  - > 200 million page views
  - Up to 117 million unique visitors per quarter in 2016
  - In one study, 94% of patients said the information on the site would help them make better health decisions

Objective

Using MedlinePlus as a reference standard, we sought to assess if a lay-language radiology glossary developed at our institution could provide better coverage of the vocabulary of radiology reports.

Materials & Methods

- Approved by our health system's Institutional Review Board (IRB).
- In compliance with the Health Insurance Portability and Accountability Act (HIPAA).
- Informed consent was waived.
- 10,000 radiology reports were randomly selected from reports generated at our institution in December 2016.
- Report authors: 157 attending radiologists, 85 radiology residents/fellows
- Our health system:
  - Four hospitals and 10 outpatient sites
  - 60% subspecialty academic radiologists
  - 40% community-based general radiologist

Materials & Methods

- As of December 2016:
  - MedlinePlus had a total of 975 concepts and 2,324 terms.
  - Our lay-language radiology glossary contained 3,734 concepts and a total of 10,729 terms.
- A “concept” was defined as the main entry in MedlinePlus or the radiology glossary
- A “term” was defined as one of the names used to reference that concept (abbreviations, plural forms, adjectival and alternate forms), including the concept itself.
  - For example, the MedlinePlus concept "Aortic Aneurysm" had three terms: "Aortic Aneurysm," "AAA," and "Abdominal Aortic Aneurysm."

Materials & Methods

- Natural language processing techniques were used to tally how frequently terms from MedlinePlus and the radiology glossary were found in radiology reports.
- Algorithm maximized the length of the matching string.
  - For example, it would match only "medial meniscus" even if the vocabulary also contained the terms "medial" and "meniscus."
- **Data analysis**
  - Chi-square test : Assess differences in the appearance of a term from the two vocabularies in a report.
  - Student *t*-test : Assess the mean number of terms per report.

Sample Report

CLINICAL STATEMENT: 66 year old woman with squamous cell carcinoma of the epiglottis.

IMPRESSION:

1. No focal consolidation is seen.

2. Mild upper lobe predominant interstitial opacities, associated with areas of emphysema seen on PET/CT January 18, 2015. These findings likely represent smoking-related interstitial lung disease.

ADDITIONAL COMMENTS:

Comparison: Chest radiograph on June 2, 2015.

Lungs and Pleural Spaces: As above. No pneumothorax is seen.

Cardiovascular and Mediastinum: Cardiac size and mediastinal contours are within normal limits.

Skeleton: There are mild degenerative changes of the thoracic spine.

Other: A tracheostomy is present within the airway. Surgical clips are seen overlying the neck.

Technique: PA and lateral views of the chest.

Figure 1. Sample chest radiograph report.

- MedlinePlus (blue boxes)
  - 5 matching terms
- Radiology glossary (red underline)
  - 36 matching terms

**Note the algorithm matched the MedlinePlus term "carcinoma" and the radiology glossary term matched "squamous cell carcinoma."

Results

- At least one MedlinePlus concept was identified in 9,302 reports (93%); the radiology glossary had at least one concept in all reports (100%)
  - The difference was statistically significant ($p<.00001$)
- On average, MedlinePlus matched 3.8 concepts per report and the radiology glossary matched 42.0 concepts per report.
- The radiology glossary had 4.6 times as many terms to start with, but matched 11.1 times the number of terms as MedlinePlus.

Results

Modality	No. of Reports	Mean No. of Concepts per Report: MedlinePlus	Mean No. of Concepts per Report: Glossary	Ratio
Radiography	3,676	2.2	23.1	10.6
Computed Tomography (CT)	1,600	6.1	76.9	12.7
Ultrasound	1,528	3.8	40.4	10.6
Mammography	1,115	5.0	37.1	7.4
Magnetic Resonance Imaging (MRI)	1,061	3.7	65.1	17.7
Interventional Radiology	260	3.3	32.9	9.9
Dual-Energy Xray Absorptiometry (DEXA)	237	7.9	43.4	5.5
Fluoroscopy	225	1.7	23.1	13.4
Nuclear Medicine	142	4.0	32.0	8.0
PET-CT	126	6.3	72.7	11.5
Angiography	16	8.3	72.1	8.7
Positron Emission Tomography (PET)	12	6.7	40.6	6.1
SPECT-CT	2	4.5	44.5	9.9
Total	10,000	3.8	42.0	11.1
	Concepts	975	3,734	3.8
	Terms	2,324	10,729	4.6

All of the differences were statistically significant ($p<.00001$).

Table 1.

Mean number of matching concepts per report for MedlinePlus and the radiology glossary by imaging modality.

*The ratio is the radiology glossary's mean number of concepts per report divided by that for MedlinePlus.

Results

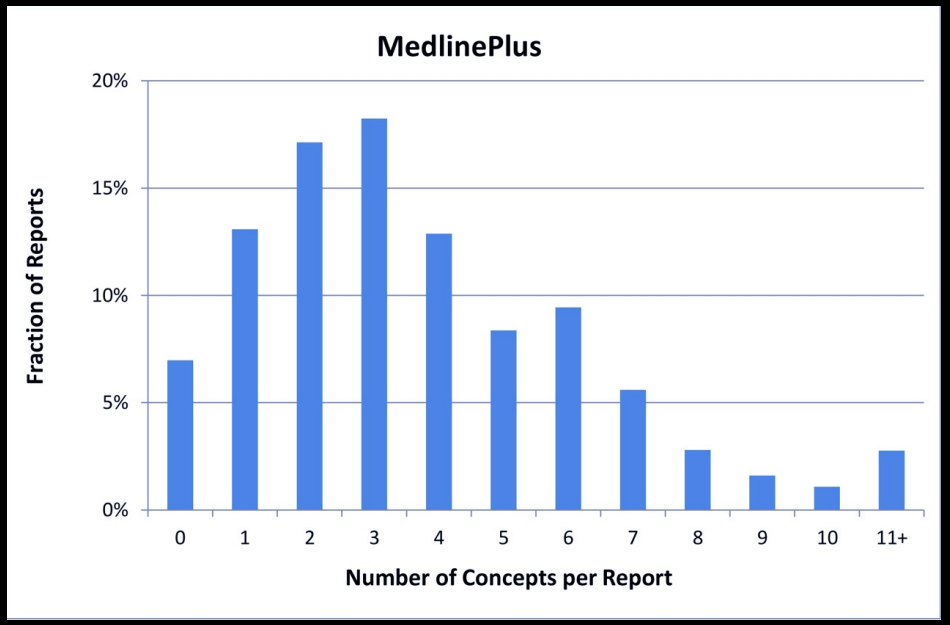

Figure 2. Histogram of the number of MedlinePlus concepts matched to the text of radiology reports.

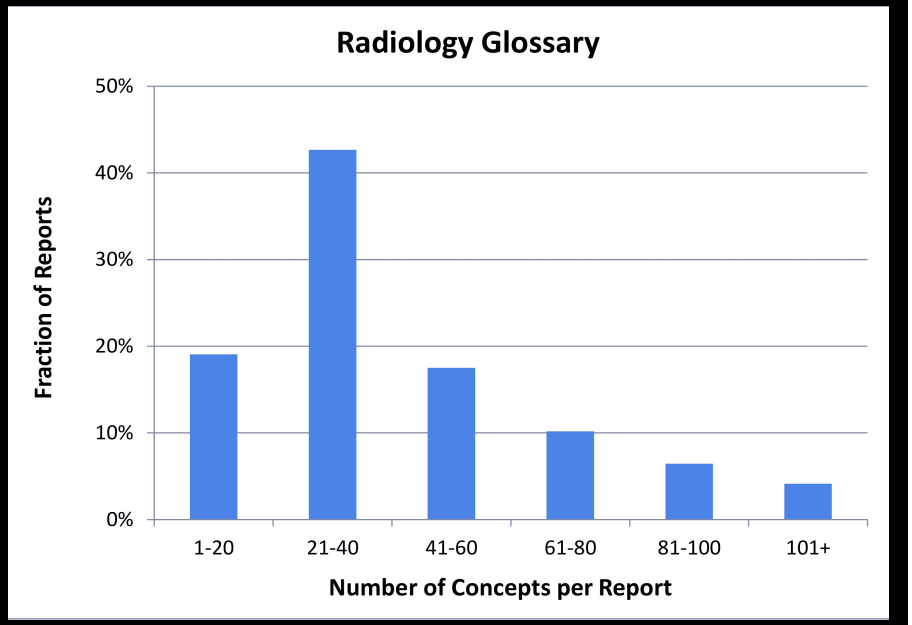

Figure 3. Histogram of the number of radiology glossary concepts matched to the text of radiology reports.

Limitations

- Radiology reports from a single health system.
- Tallied terms in reports that matched to MedlinePlus or the radiology glossary, but did not address report terms that were unmatched to either vocabulary.

Conclusion

- The lay-language radiology glossary covered significantly more of the vocabulary of radiology reports than MedlinePlus.
  - Our study emphasizes the need for a domain-specific glossary tailored to the terms used in radiology reports.
- Incorporating this glossary into EHR portals to annotate online radiology reports may help patients better understand the results of their imaging procedures.
- An early version of the radiology glossary, limited to magnetic resonance imaging (MRI) examinations of the knee, underwent preliminary evaluation in a patient-care setting.
  - > 70% of patients who used the system found it helped them better understand their radiology reports
- The radiology glossary can also serve as a useful adjunct to MedlinePlus.

Thank you!

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