Improving Patients’ Understanding of Radiology Reports Using a Lay-language Glossary of Radiology

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Introduction
- The average American adult reads at an 8th grade level, and 90 million Americans have difficulty understanding health information.
- Poor health literacy contributes to poor compliance, uncontrolled chronic disease, and escalating health care costs.
- In an effort to improve care and patient engagement, many health systems have instituted patient electronic health portals.
- Patients have indicated a strong interest in viewing their medical records and radiology reports online.
- Radiology reports are often complex, contain highly technical vocabulary, and can be difficult for patients to understand.
- Health portals often incorporate MedlinePlus, a patient-oriented medical reference. However, this reference may not provide enough relevant information to address the content of radiology reports.

Purpose
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.

Methods
- Natural language processing techniques were used to tally how frequently terms from MedlinePlus and the radiology glossary were found in radiology reports. The algorithm maximized the length of the matching string.
- A random sample of 10,000 radiology reports from our institution was selected in December 2016. Reports were authored by 157 attending radiologists, and 85 radiology residents and fellows at four hospitals and 10 outpatient sites.
- 975 concepts and 2,324 terms were abstracted from MedlinePlus as of 9 December 2016.
- The radiology glossary contained 3,734 concepts and a total of 10,729 terms.
- A “concept” was defined as a preferred term (main entry) in the glossary. A “term” is one of the names used to reference that concept (abbreviations, plural forms, adj- ectival and alternate forms), including the concept itself.
- Chi-square test was used to assess differences in the appearance of any term from the two vocabularies in a report.
- Student t-test was used to test the mean number of terms per report.

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<0.0001).
- On average, MedlinePlus matched 3.8 concepts /report and the radiology glossary matched 42.0 concepts /report.
- Greatest differences by modality were observed in MRI, fluoroscopy, and CT (Table 1).
- The radiology glossary had 3.8 times as many concepts and 4.6 times as many terms to start with, but matched 11.1 times the number of terms as MedlinePlus in radiology reports.
- All of the differences were statistically significant (p<0.0001).

Table 1. Mean number of matching concepts per report for MedlinePlus and the radiology glossary by imaging modality.

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<th>Modality</th>
<th>Number of Concepts/Report MedlinePlus</th>
<th>Radiology Glossary</th>
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| Total        | 0.0%
| 1-3          | 22.0%
| 3-5          | 32.0%
| 5-9          | 19.0%
| 9 or more    | 2%

Discussion
- The ready access to online portals requires that radiologists consider the impact of their reports on the patient as well as the referring provider.
- Our radiology-specific glossary matched significantly more terms in radiology reports than MedlinePlus.
- The results suggest that a domain-specific glossary may help explain significantly more of the content of radiology reports, and could augment resources such as MedlinePlus.
- An early version of the radiology glossary, limited to magnetic resonance imaging (MRI) examinations of the knee, has undergone preliminary evaluation in a patient-care setting. More than 70% of patients who used the system found it helped them understand their radiology report.
- Incorporating such a glossary into health portals may serve to address health literacy disparities, promote health equity, and allow patients to better understand their radiology reports.

Future Directions
- Ongoing development of the glossary includes links to Wikipedia articles and public-domain illustrations.
- The authors will explore linking glossary terms to MedlinePlus and to other consumer-oriented health information sites.

References
Available upon request.
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