E-prescriptions and Problem Lists: Looking for Indications Using the Open-Source MEDI Medication-Indication Matching Resource

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Introduction
When performing medication reconciliation and medication therapy management, it is critical that prescribed medications are reconciled with indications on the patient’s problem list and that untreated diagnoses are re-evaluated. However, these reconciliation processes are dependent completeness of the medication and problem lists, and could be aided by automated matching. The purpose of this study was to estimate the proportion of e-prescribed medications at our facility with a potential indication listed on the patient’s problem list using the open-source medication-indication matching resource MEDI (MEDication Indication) to infer probable matches.

Methods
We analyzed a de-identified dataset of medications e-prescribed from 1/1/2015 to 6/30/2015 at Vanderbilt University Medical Center (VUMC). To be included in the study, patients have to have established care at VUMC, defined as ≥ 2 visits in the past year and ≥ 1 e-prescribed medication. We matched e-prescriptions to potential indications on the problem list using MEDI (MEDI_01212013), which integrates medication indication information from four public medication resources: RxNorm, Side Effect Resource (SIDER) 2, MedlinePlus, and Wikipedia. To improve precision of the medication-indication pairs, we separately analyzed the MEDI High Precision Subset (HPS) (MEDI_01212013_HPS), which is a smaller set of medication-indication pairs found within RxNorm, or at least two of the other three resources. We mapped prescription medication codes from First Databank to RxNorm generic drug ingredient names (RxCUI, TTY=IN). Prescriptions were excluded if they consisted of multiple ingredients or did not map to RxNorm. In order to match diagnoses on the problem list to the MEDI dataset, we mapped SNOMED CT problems to ICD-9 codes. We established a gold-standard to evaluate the MEDI precision and recall by having two pharmacists independently manually review e-prescriptions and problem lists from 30 randomly selected patients. Disagreements were resolved by discussion and consensus. For analysis, we calculated precision, recall, and descriptive statistics.

Results
Out of 62,191 patients included in the study, there were 270,045 electronic prescriptions sent. Using MEDI, 61.3% of electronic prescriptions had a diagnosed indication match within the patient problem list, whereas only 37.5% had a match using MEDI-HPS. For the gold-standard comparison, the reviewers had an inter-rater reliability of 0.81. The precision of MEDI compared to the gold standard was 47.0%, with a recall of 57.4%; whereas MEDI-HPS had a precision of 79.2% and recall of 95.5%. The top 20 most frequently e-prescribed medications had a indication match 61% (n=47,892) of the time using MEDI, with only 36.8% (n=28,735) having an indication using MEDI-HPS. Secondary analysis excluding medication prescribed with a day supply <14 days gave slightly better, yet similar results (data not shown).

Conclusions
We were not able to match indications from the patient problem list for the majority of e-prescribed medications with an acceptable level of precision (MEDI-HPS). Manual review showed that MEDI-HPS has a higher precision and recall than MEDI. This marks the first use of MEDI-HPS matching e-prescribed medications with indications. Given its high precision and recall after manual review, this study suggests that many problem lists (and potentially medication lists) are incomplete in the EHR, emphasizing the difficulty, and potential beneficial use cases, of using an automated medication-indication matching resource such as MEDI-HPS.

References
Abstract
This study examines the extent to which e-prescribed medications have documented indications within EHR problem lists. Probable medication-indication matching was performed using the open-source matching resources MEDI and MEDI High Precision Subset. Results were compared to a manual review of a random sample of the dataset. The low rate of medication-indication matching has implications for current EHR use and future design.