Terminology information loss and gain: mapping ICD9CM to OMOP with eMERGE case study

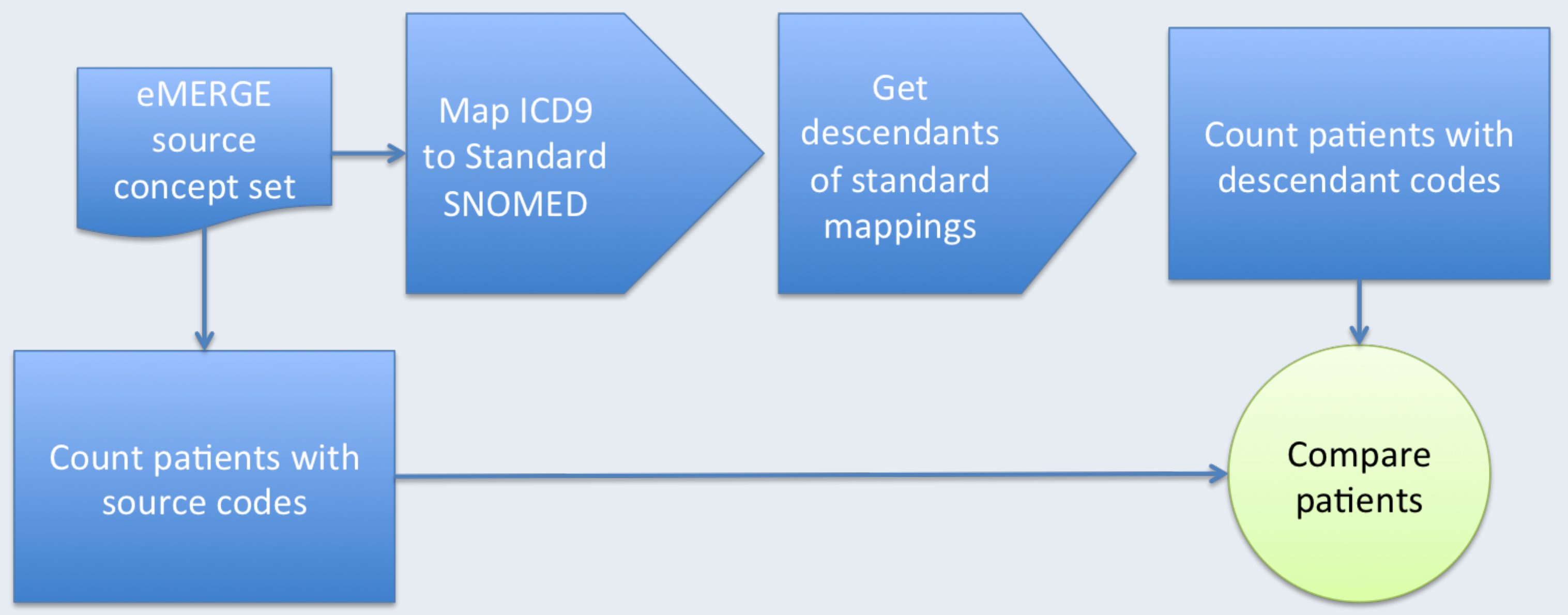
Matthew Levine and George Hripcsak

Department of Biomedical Informatics, Columbia University; Observational Health Data Sciences and Informatics

The problem: Characterizing information loss and gain when mapping into standard OMOP terminologies.

- The benefits of the CDM are abundantly clear—just look around!!
- In addition, OMOP standard terminologies, like SNOMED, nicely facilitate concept set definitions.
- BUT, terminology mapping involves some information loss.
- Possible information loss may be a perceived barrier to potential new members of the OHDSI community.
- By more deeply studying multiple and missed mappings between standard and non-standard terminologies in the CDM, we can:
  - Further improve the CDM
  - Identify pitfalls and trustworthy uses of terminology mapping

Experimental Overview


eMERGE source concept set

Map ICD9 to Standard SNOMED

Get descendants of standard mappings

Count patients with descendant codes

Count patients with source codes

Compare patients

1. We examine eMERGE phenotype condition concept sets (ICD9 only)
2. Identify ICD9 codes with null/invalid/multiple standard mappings
3. Identify patients with `condition_source_concept_id` in each set of eMERGE ICD9s.
4. Map ICD9 codes to standard SNOMED concepts, and take all the standard descendants of the mapping.
5. Identify patients with `condition_concept_id` in mapped descendants.
6. Count how many patients are returned ONLY after mapping vs returned ONLY via source codes vs returned from either mapped OR source codes.

ICD9 to SNOMED mappings

N	eMERGE ICD codes with N mappings	ICD codes with N mappings
0	0.6%	1.0%
1	97.5%	97.8%
2	1.8%	1.2%
3	0.1%	0.03%

The data

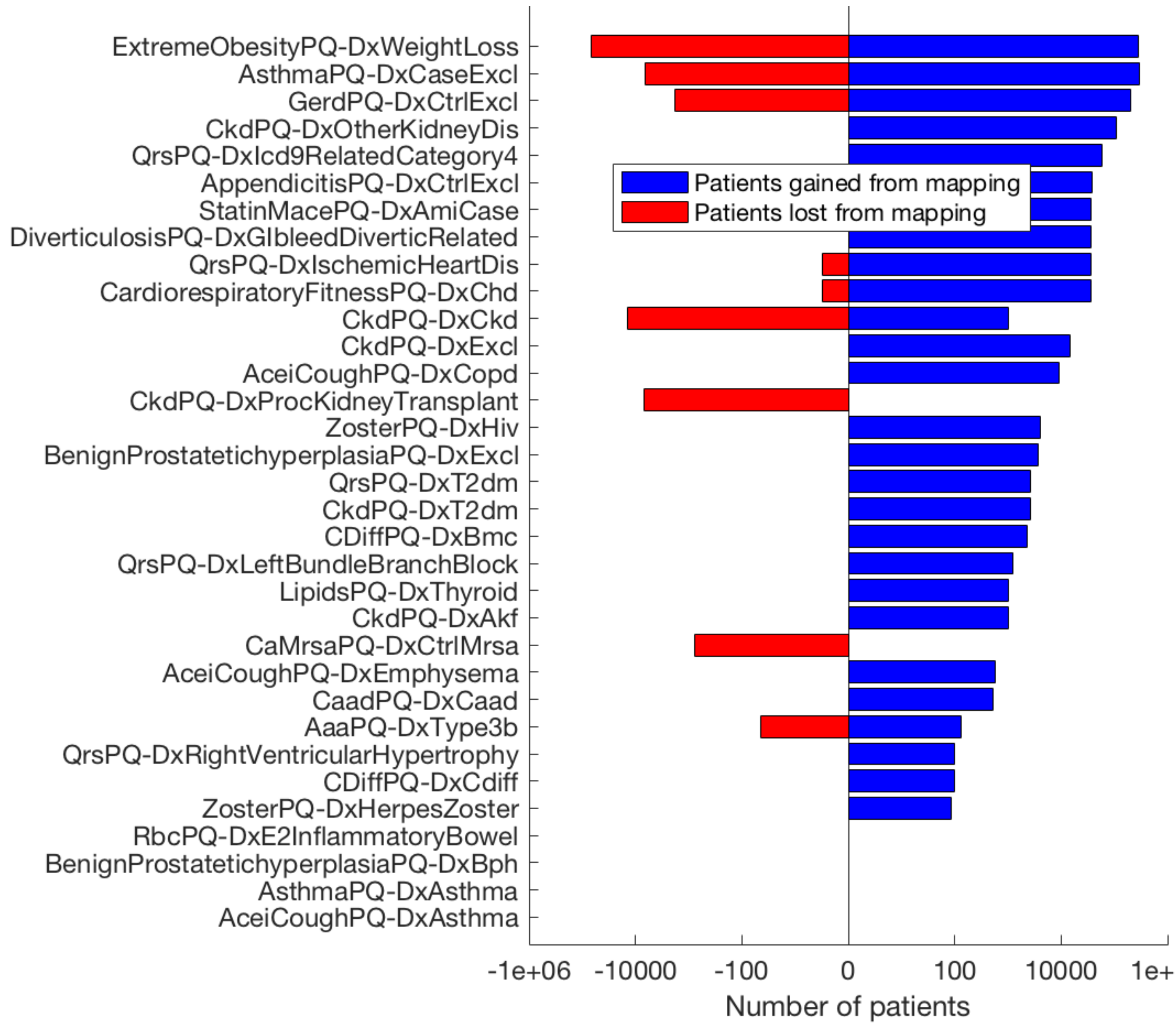
NewYork-Presbyterian Hospital clinical data warehouse

- OMOP CDMv5
- Over 3 million patients
- 30 years old

We acknowledge NLM R01 LM06910 for financial support.

Patient gain/loss when mapping eMERGE concept sets

Patients are dropped and added from eMERGE cohorts when mapping ICD9 to SNOMED.

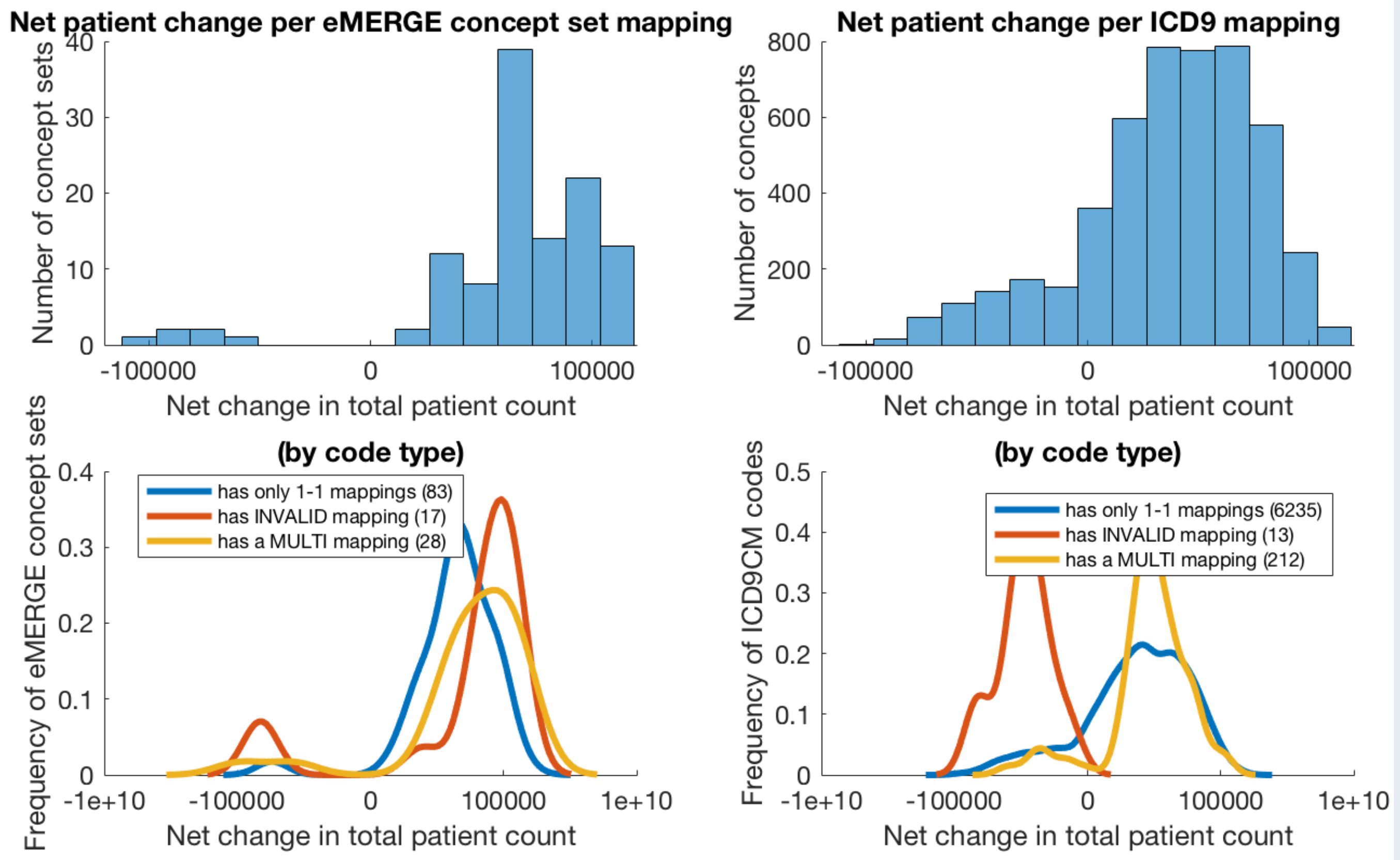


Mapping to SNOMED causes some concepts to:

- gain some patients, and lose other patients (e.g. CKD diagnosis)
- only lose patients (e.g. MRSA control)
- only gain patients (e.g. C-diff diagnosis)

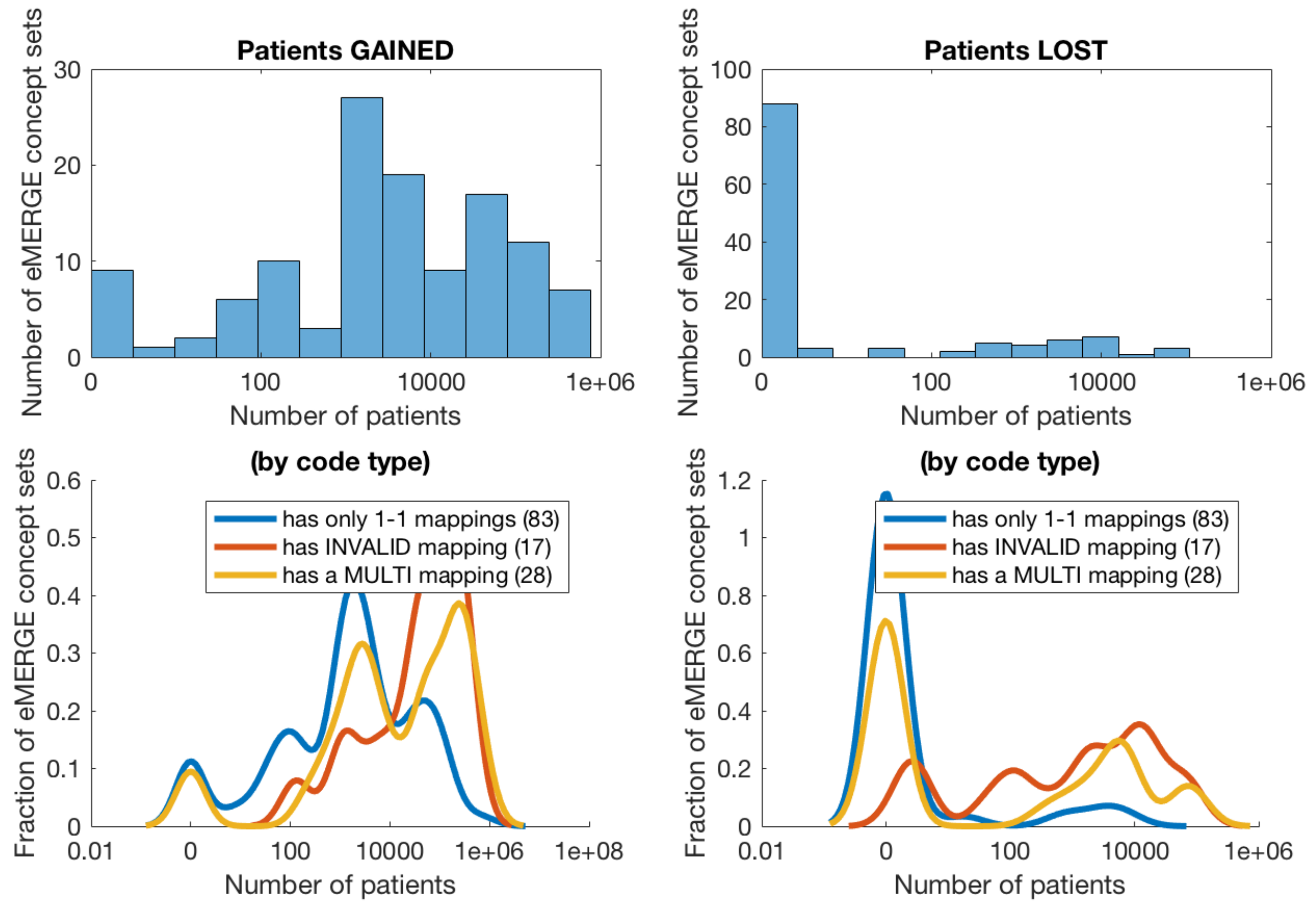
Net change in cohort size due to ICD9 to SNOMED mappings

Mapping concept sets to SNOMED typically induces a net increase in cohort size.



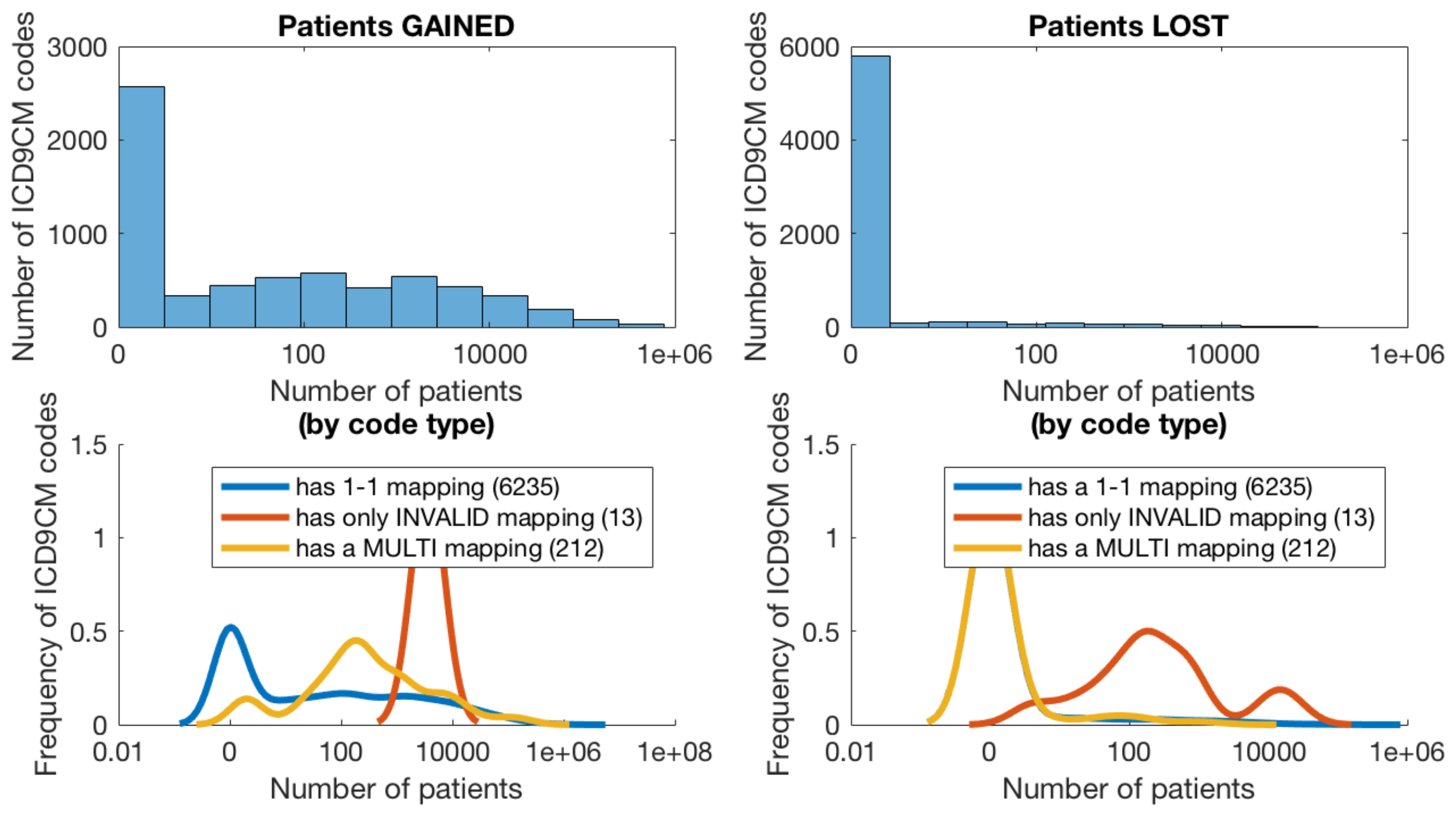
1. Mapping ICD9 to SNOMED usually brings in more patients
2. But, ICD9 codes with only invalid mappings typically lose patients
3. These invalidly-mapped ICD9 codes often decrease cohort size, but not always (effect may be counteracted by other codes in eMERGE concept set)
4. ICD9 codes with multiple mappings are more likely to increase cohort size.

Distributions of patient gain/loss when mapping eMERGE concept sets



1. 70% of cohorts lost 0 patients
2. 17% of cohorts lost >1000 patients
3. 93% of cohorts gained patients
4. Concept sets that contained ICD9 codes that had INVALID or MULTIPLE mappings both GAINED and LOST more patients.

Distributions of patient gain/loss when mapping ICD9 concepts to SNOMED



1. 88% of eMERGE ICD9 codes mappings lose 0 patients.
2. 2% of eMERGE ICD9 codes mappings lose >1000 patients
3. 65% of eMERGE ICD9 code mappings gain patients
4. eMERGE ICD9 codes with only INVALID mappings both GAINED and LOST more patients.
5. eMERGE ICD9 codes with MULTIPLE mappings GAINED more patients, but rarely LOST patients.

Conclusions and Future Directions

- **We observe changes in cohort size, but we do not yet know whether these are information LOSSES or GAINS**
- The next step is to do manual clinical review to determine whether patients should be dropped or added.