ICD-9 to ICD-10 mapping for database research in biologics and biosimilars

Mengdong He[1], MHS; Adrian J. Santiago Ortiz[1], BS; James Marshall[2], MPH; Aaron B. Mendelsohn[2], PhD, MPH; Jeffrey R. Curtis[3], MD, MPH; Charles E. Barr[4], MD, MPH; Catherine M. Lockhart[4], PharmD, PhD; Seoyoung C. Kim[1], MD, ScD, MSCE

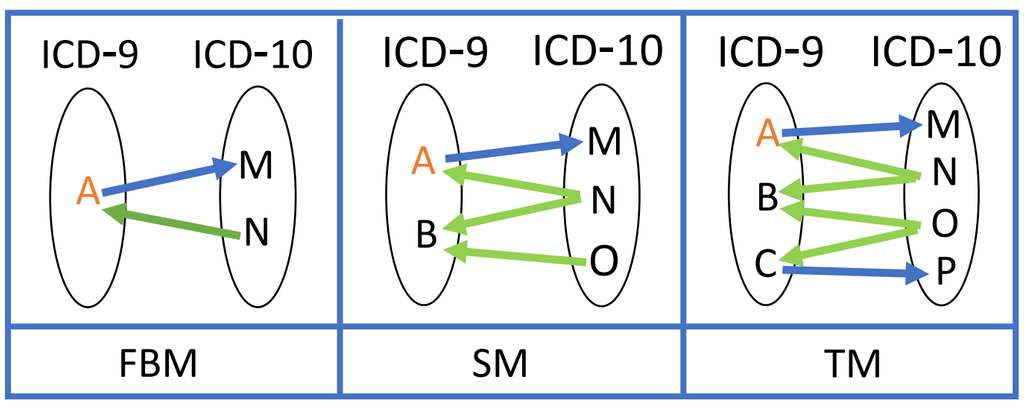
1. Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital and Harvard Medical School, Boston, MA; 2. Harvard Pilgrim Health Care Institute and Harvard Medical School, Boston, MA; 3. University of Alabama at Birmingham, Birmingham, AL, USA; 4. AMCP Biologics and Biosimilars Collective Intelligence Consortium, Alexandria, VA.

INTRODUCTION

- As of October 1st, 2015, the Centers for Medicare and Medicaid Services (CMS) mandated the transition from ICD-9 to ICD-10 codes.
- Post-marketing surveillance of newly marketed drugs such as biologics and biosimilars requires a robust approach to convert ICD-9 to ICD-10 codes used to define study populations, covariates and outcomes.
- The objective of this study is to convert from ICD-9 to ICD-10 diagnostic and procedure codes for various health conditions of the Biologics & Biosimilars Collective Intelligence Consortium (BBCIC)'s interest and compare their incidence before and after October 1, 2015.

METHODS

- 108 BBCIC's interested health conditions related to 3 disease areas:
  - Hematologic/oncologic conditions
  - Systemic inflammatory diseases
  - Diabetes
- Using the General Equivalence Mappings (GEMs) developed by CMS, we explored 3 mapping methods:
  - Forward Backward Mapping (FBM): The simplest, using the direct links of forward and backward GEMs.
  - Secondary Mapping (SM): More complex, based on the ICD-10 codes identified by FBM.
  - Tertiary mapping (TM): The most complicated method based on an iteration of the SM.
  - FMB was applied to all the 108 conditions and SM and TM were tested in 7 pre-specified conditions.



- Physician expert (S.C. Kim) reviewed the relevance of ICD-10 codes from the 3 mapping methods.
- Incidence of ICD-9 and ICD-10 codes from FBM were calculated in the pre- and post-ICD-10 implementation period (9/1/2012-3/31/2018).
- Harvard Pilgrim Health Care Institute team conducted the analyses in distributed databases of 5 data partners and provided pooled results.
- We visually assessed incidence trends of these health conditions and applied a threshold of 20% level change in ICD-9 versus ICD-10 incidences.

RESULTS

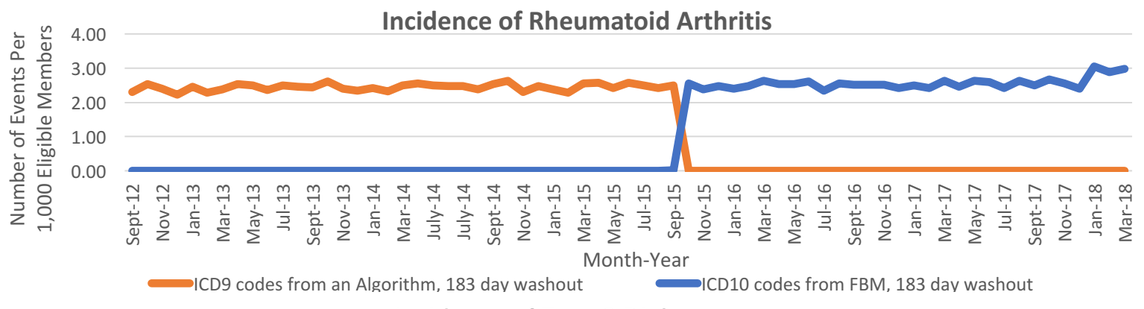
- Nearly 4 times more codes mapped via SM and TM than FBM.
  - Most were not relevant or specific.
  - E.g. Type 1 diabetes: Additional ICD-10 codes were identified for other types of diabetes and atherosclerosis.
- For conditions such as MI, RA and breast cancer, no additional ICD-10 codes were found by SM or TM.

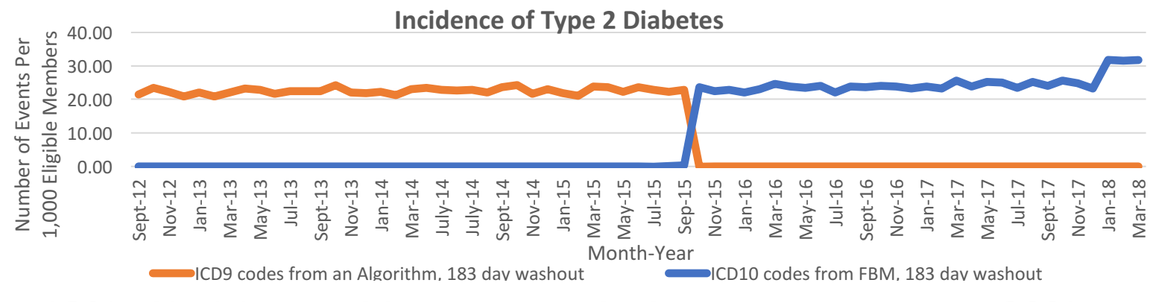
Condition	N of ICD-9 codes in the algorithm	N of ICD-10 codes from FBM	N of ICD-10 codes from SM*	N of ICD-10 codes from TM*
Type 1 Diabetes	20	84	327	281
Hypoglycemia	5	17	34	54
Tuberculosis	426	57	54	80
IBD	13	78	16	26
MI	30	17	0	0
RA	11	451	0	0
Breast Cancer	11	54	0	0

* Unique addition of ICD-10 codes beyond codes identified by FBM

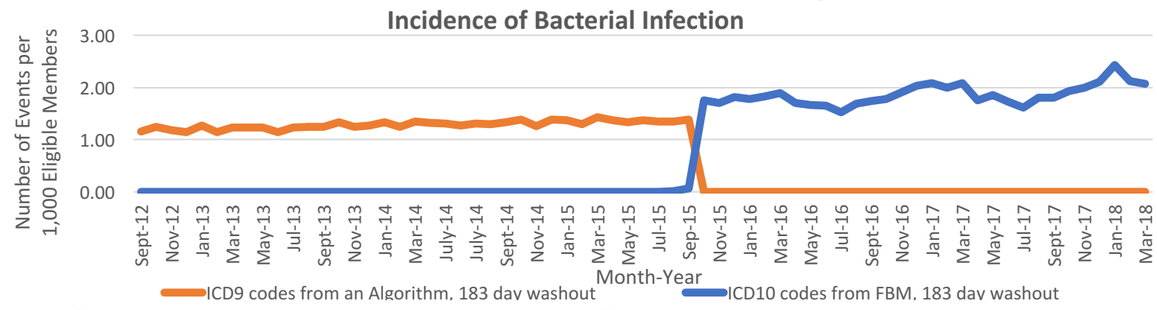
Acronyms: IBD = Inflammatory Bowel Disease; MI = Myocardial Infarction; RA = Rheumatoid Arthritis.

- 24% (N=26) conditions were considered mapped to problematic ICD-10 codes via FBM, for reasons including:
  - ICD-10 codes were too non-specific or unrelated
  - ICD-10 codes for relevant conditions/procedures were missing.
- 80% (N=86) conditions had visually comparable ICD-9 and ICD-10 trends after manual revisions of ICD-10 codes from FBM.

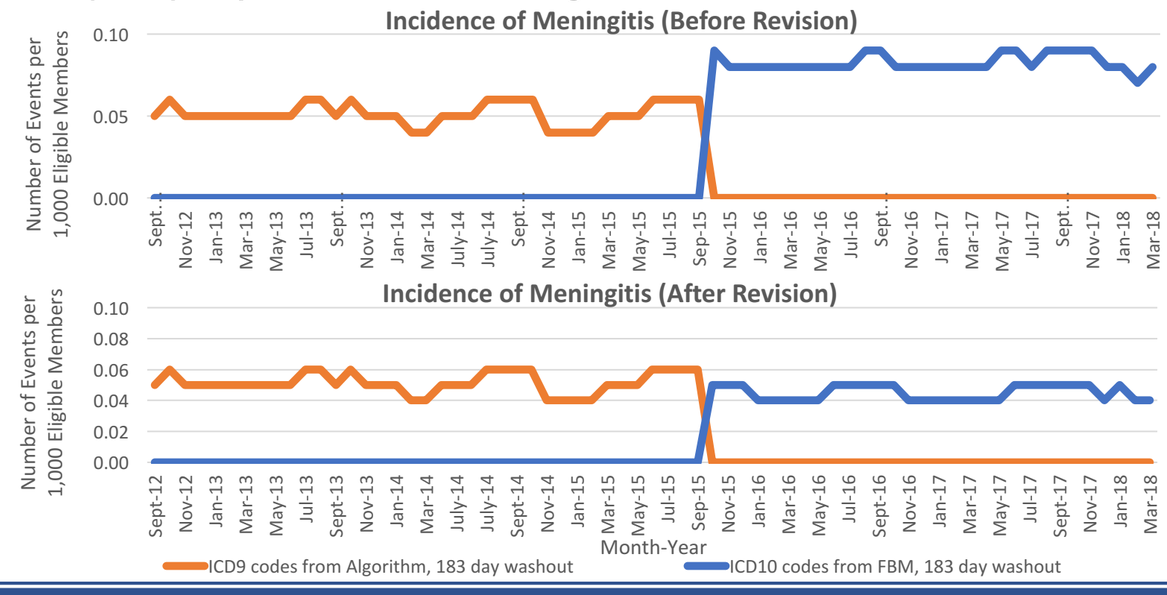




- 13% (N=14) conditions had an incidence change >+/-20% on 10/1/2015, in addition to visual inconsistency



  - Some were caused by inherent differences between the two coding systems, so no further revisions were conducted.
  - E.g. Sigmoidoscopy: ICD-9-PCS 45.24 "Flexible sigmoidoscopy" <-> ICD-10-PCS 0DJD8ZZ "Inspection of Lower Intestinal Tract, Via Natural or Artificial Opening Endoscopic"
  - 3 conditions (meningitis, chronic liver disease, and ankylosing spondylitis) had their ICD-10 algorithms further refined.



CONCLUSIONS

- Forward backward mapping (FBM) is generally the most efficient automated way to convert ICD-9 to ICD-10 codes; secondary and tertiary mapping may identify more ICD-10 codes, but the additional codes may not be relevant to capture the condition of interest.
- Manual review of the converted codes is recommended for all 3 methods.
- With manual review, most ICD-10 algorithms from FBM achieved consistent incidence trends compared to ICD-9 algorithms and had less than 20% level change in ICD-9 versus ICD-10 incidences.
- Challenges present to empirically determine the quality of conversions due to a lack of guidance on comparing the performance of ICD-9 versus ICD-10 codes.

DISCLOSURES AND ACKNOWLEDGEMENTS

Dr. Seoyoung Kim received research grants to the Brigham and Women's Hospital from Pfizer, Bristol-Myers Squibb and Roche for unrelated studies. Other authors have no conflict interest to disclose. This project is fully funded by the BBCIC. Aetna, Healthcore, Health Partners, Harvard Pilgrim, and Kaiser Permanente Washington all contributed data. Katie King, Annemarie Kline, Kevin Walsh, and Sophie Zhang are members of ICD-10 mapping workgroup.

Presented At: ISPOR, New Orleans LA, May 21, 2019