

Data Impact Challenge Answer Submission Template

Question: What is the rate of repeat diagnostic imaging tests within a ninety day period?

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Introduction: In today's budget conscious healthcare environment, an important potential area of cost containment is reducing redundant medical investigations. In the United States, redundant radiologic tests are estimated to cost 3.2 billion dollars annually¹. Cross sectional imaging (CT scans, ultrasounds and MRI scans) are being used with increasing frequency, and are some of the most costly radiologic tests². There are potential risks associated with some of these procedures due to radiation exposure and contrast use. The number of repeated, and potentially redundant cross sectional imaging tests in Canada has not been well studied.

Describing the Data and Analysis

- *Data Custodian Organization(s) and data sources:* Data sources were analysed through the Institute for Clinical Evaluative Sciences (ICES) Western (London, Ontario). Data sources included: 1) Ontario Health Insurance Plan (OHIP) database, which contains all physician billing claims for the province; 2) the Registered Persons Database (RPDB) which contains demographic and vital statistics for all people in the province; and 3) the Canadian Institute for Health Information discharge abstract database (CIHI-DAD) which contains information on all hospitalised patients in Ontario.
- *List of Datasets Used (e.g. names of database and/or data origins):* OHIP, RPDB and CIHI-DAD
- *Exclusions:* We excluded people who had invalid unique identifier, missing sex, date of birth in the RPDB, or those who died prior to the initial imaging test date.
- *Nature and Size of Cohort (e.g. geographic area covered, number of patients included):* Our cohort included all people in the province of Ontario who underwent cross-sectional imaging of the head, chest, abdomen or pelvis. Ontario's population in 2013 was 12.8 million, which accounts for over a 1/3 of Canada's overall population. We identified 7.1 million cross-sectional imaging tests among 2.2 million Ontario residents.
- *Data timeframe:* Imaging procedures were captured between January 1, 2013 and December 31, 2013 with a maximum follow-up until March 31, 2014.

Please provide a brief summary of the analysis methodology

People undergoing a common cross-sectional imaging test (CT or MRI of the head, chest, abdomen, or pelvis or an ultrasound of the abdomen or pelvis) were identified using specific OHIP fee codes which are billed by radiologists for the interpretation of all imaging tests performed on patients (both inpatient and outpatient tests). The date of the first occurrence of one of the imaging tests for an individual was identified, and any repeated imaging tests (defined as the same imaging site (such as chest) and modality (such as CT)) within 90 days were identified. Patients were eligible to be included multiple times for different imaging modalities and/or body areas. Patient characteristics were reported based on the date of their initial imaging procedure.

In order to better assess if there was a proportion of repeat imaging tests that are potentially redundant we conducted a secondary analysis of patients who live in southwestern Ontario compared to the rest of the province. Since 2007, 11 hospitals in Southwestern Ontario have shared a single, linked, online radiology system (Centricity PACS). This system allows all hospital-based physicians, and many family physicians, to access radiology reports (and the actual images from the study) if it was done at one of these participating hospitals. Using the postal code field in RPDB, we identified people whose place of residence was within one of the 11 areas with a participating Centricity PACS hospital. Our hypothesis was that the linked radiology system would result in less repeat imaging due to the convenience and availability of both radiology reports and actual images. This is important as patients may present to different emergency rooms, or be referred or transferred for care elsewhere in the region; the ability to access this imaging information may reduce the likelihood of physicians ordering repeat imaging. We used a chi square test to assess for a significant change in repeat imaging between these two groups (two tailed p-value<0.05 considered statistically significant). All analyses were conducted using SAS 9.4.

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Describing the Findings

- Of the imaging tests identified in our study, 909,168/7,112,331 (12.8%) were repeat tests done on the same person's body part with the same modality within 90 days.
- These imaging tests were carried out on 2,156,704 unique patients. The median age of these patients was 52 years (interquartile range (37-67)) and the majority were female (62.3%). Approximately one tenth of the patients (N=238,342, 10.8%) had at least one Charlson Index comorbidity identified within the previous 3 years.
- The most commonly repeated imaging study was CT Chest (66,087/347,988, 19.0%)
- Across all of the specific body parts, the most frequently repeated modalities were
 - CT (326,956/1,828,966, 17.9%)
 - Ultrasound (531,636/4,659,103, 11.4%)
 - MRI (50,576/624,262, 8.1%)
- Across the specific imaging modalities, the body parts with the most frequent repeated imaging tests were:
 - Chest (66,712/373,988, 17.8%)
 - Head (133,097/936,779, 14.2%)
 - Pelvis (355,977/2,550,553, 14.0%)
 - Abdomen (353,382/3,251,001, 10.9%)
- We identified 245,756 imaging tests that were carried out on people who live in the same city as a participating Centricity PACS hospital. Among people living around one of these hospitals utilising a shared, linked radiology system, 27,455/245,756 (11.2%) had repeat imaging of the same body part with the same modality within 90 days. Among people living elsewhere in the province, 881,713/6,866,575 (12.8%) had repeat imaging of the same body part with the same modality within 90 days. This represents a significant reduction in the 90 day rate of repeat imaging among people who live in an area sharing a linked radiology system (relative risk 0.87, 95% CI 0.86-0.88, p<0.0001).

Strengths & Limitations

- Our strengths include the use of a large, contemporary sample of imaging procedures carried out in the largest Canadian province. Accuracy of physician billing records for procedure is high³. We focused on the most common and costly imaging tests. In addition to answering the challenge question, we have generated preliminary data suggesting that the use of a linked radiology systems should be further studied as a potential mechanism to reduce repeat imaging tests.
- Our limitations include the lack of clinical details surrounding each patients imaging test: some repeat tests may have been indicated or clinically necessary. The results of the initial test likely influence the likelihood of a repeat test, as would the radiologist's report, and these details are not available in administrative data records. Although the hospitals using the linked Centricity PACS system include a mix of primary to tertiary care hospitals, there may be another explanation for why repeat imaging is done less often compared to the rest of the province. Further analysis adjusting for case mix, population demographics and practise patterns would be necessary to more definitely support this result.

Conclusion: Among individuals that had a cross sectional imaging of the head, chest, abdomen or pelvis, 12.8% had the same area reimaged with the same modality within 90 days. The frequency of repeat imaging is lower in a geographical subset of Ontario, where a shared a single, linked, online radiology system is employed.

References

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2. Medical Imaging in Canada 2012. http://www.cihi.ca/CIHI-ext-portal/pdf/internet/MIT_SUMMARY_2012_en
3. Raina, P., Torrance Rynard, V., Wong, M. & Woodward, C. Agreement between Self-reported and Routinely Collected Health-care Utilization Data among Seniors. *Health services research* 2002 **37**, 751–774.