

# Data Impact Challenge Answer Submission Template

## Answer to Question 2

Submitted by: Access to Care Analytics, Cancer Care Ontario

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- Question 2:

**What is the rate of repeated diagnostic imaging tests within a ninety (90) day period?**

- Team and list of all team member names:

Access to Care Analytics – Surgery and Diagnostic Imaging Team

1. Gener Austria
2. Jason Dang
3. Penny Wang
4. Jenny Li
5. Sarah Suh
6. Sulin Shakya
7. Hyerin Kim
8. Lilyanna Trpeski
9. Cory Russell

## Describing the Data and Analysis

- **Data Custodian Organization(s) and data sources:**

Cancer Care Ontario (CCO), Wait Time Information System (WTIS)

- **List of Datasets Used (e.g. names of database and/or data origins):**

Diagnostic Imaging Wait Time dataset

- **Inclusions:**

1. MRI and CT performed scans that were completed on Ontario Ministry of Health and Long Term Care (ministry) funded facilities reported to CCO through the WTIS between October 1, 2013 and December 31, 2014.
2. The subset from January 1, 2014 to December 31, 2014 was used to identify repeat scans.
3. All patients regardless of age

- **Exclusions:**

1. No Exclusions - All emergency and elective scans that were reported to the WTIS by facilities are included

- **Nature and Size of Cohort (e.g. geographic area covered, number of patients included):**

For calendar year 2014, there were 766,047 MRI scans and 1,188,733 CT scans reported by Ontario facilities. Most patients who had scans in Ontario facilities were Ontario residents but a small percentage of the cohort comes from other provinces. Priority Level 1 – Emergency MRI/CT scans are not mandatory to report to the WTIS, however for facilities that do submit these scans, their data has been included in the analysis. Scans funded through WSIB may not be reported if they are not completed on a Ministry-funded machine. It is unknown what percentage of scans are not reported in these two scenarios. All scans that were reported to the WTIS as completed during the time frame of interest are included in the analysis.

- **Data timeframe:**

Performed MRI/CT Scans completed from January 1, 2014 to December 31, 2014.

**Please provide a brief summary of the analysis methodology:**

A record level dataset of patients that had MRI/ CT scans performed on ministry funded machines during the calendar year 2014 was extracted from the WTIS. The WTIS collects data pertaining to Surgical and Diagnostic Imaging procedures from Ontario facilities.

The data extract included: patient identifiers, the scan type (MRI/CT), the body parts scanned and the date of the scan for performed scans from October 1, 2013 to December 31, 2014. The initial 3 months of data (October to December, 2013) was included to identify potential primary scans and enable the full identification of repeat scans that were performed in early 2014.

SAS was used to perform the analysis on the dataset and a summary table was prepared to show both the volume of the numerator and the denominator as well as the percentage rate for both MRI and CT combined as well as by body part (see Table 1.)

## **Describing the Findings**

The numerator is defined as the number of repeat scans (similar modality) within 90 days of the previous scan, during the calendar year 2014. The repeat scan had to be the same type (MRI/CT), patient, and body part. For MRI, there were a total of 60,444 repeat scans, while for CT there were a total of 176,871 repeat scans.

The denominator is the total count of scans completed within the same calendar year. For MRI, the total scans included in the analysis was 766,047, and for CT the number of scans was 1,188,733.

Overall, the rate of repeat MRI scans within 90 days was found to be 7.9% in 2014. The rate of CT scans was found to be higher, at 14.9%. The repeat rate varied by body part of interest, as cardiac and peripheral vascular scans tended to not be repeated, whereas repeat scans of the head (brain) tended to be more common, across both types of scans.

The rate of repeat scans was also examined by the fourteen Local Health Integration Network (LHIN) level, with varying rates across the province of Ontario. The expectation of rural areas having lower repeat rates tended to be unsupported by the data, however major referral centres (Toronto and Ottawa) did tend to have higher rates of repeat scans.

With regard to age, it was found that seniors (over the age of 65) tended to have a higher rate of repeat CT scans, whereas the paediatric population had the highest rate of repeat MRIs.

A review of similar studies was conducted to determine if the results found within the analysis were similar to those found in other jurisdictions. Of particular interest, the CADTH study reported that repeat imaging is another cause of increasing diagnostic imaging. There are estimates that between 7% and 15% of all diagnostic imaging tests are unnecessary duplications because pre-existing images are available. A 2007 study by the Commonwealth Fund reported that 20% of all patients surveyed claimed they had undergone repeat imaging. The number of Canadian patients who reported repeat imaging was 8%. In the UK, 9% of participants reported repeat imaging, in New Zealand it was 10%, in Australia it was 15%, and in Germany it was 16% (Morrison, 2013). The majority of other studies reported similar statistics.

## **Key Limitations**

There were a small subset of patients with abnormally high numbers of repeat MRI/CT scans. For CT, 0.4% of patients had over 10 repeat scans, and for MRI only 0.01% of patients had over 10 repeat scans.

Duplicate records may be an issue within the dataset submission, however by looking only at closed cases (those cases that are completed and verified), the repeat scans should not be an artifact of duplicate records.

Granular detail on specific body parts is not currently available within the WTIS, meaning that MRI/CTs performed on an ankle and a knee would be considered a repeat under Extremity, while not necessarily

being a true repeat scan. Please see Table 1.0 for a complete list of how body parts are currently captured.

Additionally, the reason for the scan is not captured, and a scan may be considered a repeat while actually being necessary for a different purpose.

Priority Level 1 – Emergency MRI/CT scans are not mandatory to be reported to the WTIS and may decrease the ability to identify repeat scans, should the initial scan identified for the patient actually be a follow-up or repeat of a priority 1 scan.

Combination scans (scans of multiple body parts during the same encounter) may be counted as individual scans or only one by largest body part due to technical limitations at participating facilities. This may limit the ability to identify the number of repeat scans and may increase the denominator of scans performed (ie, it is number of scans, not number of patient encounters).

### **Future Considerations**

Further descriptive analysis could delve into the actual period of time between the repeat scans, and summarize by time delay (1-3 days, once a month, etc). Additionally, clinical indication for scan is included for scans related to cancer imaging. It may be interesting to profile repeat scans for the subset of patients diagnosed with cancer.

Table 1. Rate of repeated MRI and CT scans within a ninety (90) day period for scans performed in calendar year 2014.

Diagnostic Type	Body Part	Numerator - Count of repeat scans within 90 days of previous scan - same patient, same body part	Denominator - Total Count of Scans Completed	Rate of Repeat Scans within 90 days
MRI	Abdomen	2,640	54,657	4.8%
	Breast	1,269	18,444	6.9%
	Cardiac	199	7,692	2.6%
	Extremities	15,767	212,102	7.4%
	Head (Brain)	22,015	219,157	10.0%
	Head and Neck	1,947	23,933	8.1%
	Pelvis	976	27,895	3.5%
	Peripheral Vascular	29	1,594	1.8%
	Spine	15,481	197,471	7.8%
	Thorax	121	3,102	3.9%
	<b>Overall</b>		<b>60,444</b>	<b>766,047</b>
CT	Abdomen	56,149	373,626	15.0%
	CT Guidance of Biopsy	882	8,970	9.8%
	Cardiac	135	9,564	1.4%
	Extremities	1,709	32,566	5.2%
	Head (Brain)	53,956	301,625	17.9%
	Head and Neck	6,275	75,476	8.3%
	Pelvis	6,048	38,494	15.7%
	Peripheral Vascular	427	8,319	5.1%
	Spine	3,458	52,129	6.6%
	Thorax	47,832	287,964	16.6%
	<b>Overall</b>		<b>176,871</b>	<b>1,188,733</b>

## Related Literature

Chen, R. *et al.* (2012, Apr). Association of Hospital Characteristics and Diagnosis With the Repeat Use of CT and MRI: A Nationwide Population-Based Study in an Asian Country. Retrieved July 3, 2015 from

<http://www.ajronline.org/doi/pdf/10.2214/AJR.11.6475>

- A Taiwan-based study that found 90-day repeat scan rates ranging from 13-25% depending on size of hospital

Coburn, N. *et al.* (2005, Dec). Utilization of CT and MRI Scanning Among Cancer Patients in Ontario, 1993–2002.

Retrieved July 3, 2015, from <http://www.ices.on.ca/flip-publication/utilization-of-CT-and-MRI/files/assets/basic-html/index.html#45>

- Ontario-based study, that found an 8% repeat rate within four weeks

Kung, P. *et al.* (2005). Determinants of computed tomography and magnetic resonance imaging utilization in Taiwan.

Retrieved July 3, 2015, from [http://www.asia.edu.tw/main\\_pages/academics/teacher\\_research/pk\\_kung/17.pdf](http://www.asia.edu.tw/main_pages/academics/teacher_research/pk_kung/17.pdf)

- Taiwan-based study that found repeat rates at one month were close to 11%, but were able to be reduced to under 5%.

Morrison, A. Appropriate Utilization of Advanced Diagnostic Imaging Procedures: CT, MRI, and PET/CT [Environmental Scan, Issue 39]. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2013. Retrieved July 5<sup>th</sup>, from [https://www.cadth.ca/media/pdf/PFDIESLiteratureScan\\_e\\_es.pdf](https://www.cadth.ca/media/pdf/PFDIESLiteratureScan_e_es.pdf)

- The number of Canadian patients who reported repeat imaging was 8%. In the UK, 9% of participants reported repeat imaging, in New Zealand it was 10%, in Australia it was 15%, and in Germany it was 16%.