



The Relationship Between Equipment Downtime and Types of Maintenance Service Agreements

Context

Routine equipment maintenance can minimize downtime, prevent patient delays,¹ and extend the projected life expectancy of advanced medical imaging equipment.² Planned downtime is performed to ensure equipment is safe, to upgrade and update systems, and to ensure that devices are performing as intended.^{1,3} Effective scheduling of planned downtime can avoid interruptions to patient care.

Unplanned downtime, on the other hand, due to unexpected failures or breakdown, can contribute to rising wait times for patients and costs for imaging departments.³⁻⁶ It has been estimated that an imaging department can lose between US\$60,000 and US\$120,000 for one MRI and/or CT unit with an average downtime of 60 to 120 hours.⁶ The Canadian Medical Imaging Inventory (CMII) reported an average of 50 hours per year of unplanned downtime per CT and MRI unit in 2019–2020,⁵ indicating significant costs to the health care system.

The price of some advanced medical imaging equipment has doubled since the start of the pandemic.⁷ Supply chains are unable to meet the demand for new equipment due to the backlog from COVID-19 lockdowns,⁷ and shipping costs have increased in parallel with fuel prices.⁷ Given these growing expenses, and general limited health care resources, decision-makers may feel more incentivized to ensure that their maintenance service agreements (MSAs) minimize downtime and optimize equipment life expectancy.

Different types of MSAs with varying service offerings and prices are available for medical imaging equipment. The most commonly available MSAs in Canada include full vendor agreements, third party contracts, in-house or shared services, and warranties and insurance policies.⁸ When considering equipment downtime, the type of MSA may potentially represent an opportunity for imaging departments to save on health care costs and improve efficiencies in the delivery of care.

Objective

This report summarizes and analyzes information from the 2019–2020 CMII on the use of MSAs for CT and MRI across Canada. The report is intended to investigate if there is a relationship between MSA type and unplanned equipment downtime. Other factors that may influence unplanned downtime are also considered, such as age of equipment and exam volume.

Methods

Data on MSAs and unplanned downtime from facilities with at least 1 MRI or CT unit was extracted from the 2019–2020 CMII survey.⁵ Any facility that did not provide information on MSAs and/or unplanned downtime for the CMII survey was excluded. CMII collects data on MSAs at the modality level by facility rather than the unit level. It has been noted that in some health care facilities with more than 1 CT or MRI unit, different types of MSA may be used. For example, the most common type of situation where this occurs is at a site with 2 CT units, where 1 is newly installed and the new unit is usually under a warranty, while the maintenance of the older unit is managed under an alternative MSA; however, only 1 type of service agreement could be reported. In these instances, it was assumed that the most commonly used MSA at the facility was most applicable. The type of service model may also be different between modalities at a single facility. Data on unplanned downtime was also collected at the modality level, so the units that downtime hours were specific to are not known.

MSAs included in this report are full vendor, in-house or shared services, insurance, and warranty. Facilities receiving advice from the Canadian Medical Equipment Protection Plan (CMEPP) on imaging equipment repair were considered “other” for this report.

The average unplanned downtime for MRI and CT was calculated for each MSA, and then compared to investigate a potential relationship between MSAs and downtime ([Table 1](#)). Equipment age and exam volume were considered in this report and these data were also extracted from the 2019–2020 CMII report.⁵ Exam volume was only available at the modality level, whereas equipment age was collected at the unit level.⁵ To ensure consistency, equipment age was adapted by tallying the proportion of facilities that met European Coordination Committee of Radiological, Electromedical and Healthcare IT Industry’s (COCIR) golden rule number 3.² This rule states, “No more than 10% of the age profile of medical technology should be more than 10 years old.”²

The number of units and location of sites (e.g., rural, urban, or remote) were not accounted for when comparing downtime hours between maintenance service types.

Results

A total of 165 sites with at least 1 or more CT and/or MRI unit(s) provided data on MSAs used and unplanned downtime. Of these, 145 sites have at least 1 CT unit, whereas 88 of the 165 sites have at least 1 MRI unit. Most of the sites (81.5%) included in this report use a full vendor service agreement, accounting for 78.6% and 86.5% of data for CT and MRI, respectively. In-house or shared services represent the second most commonly used MSA (13.7%), and account for 16.5% of CT MSAs and 9% of MRI MSAs. Insurance, warranty, third party and “other” MSAs account for less than 5% of the overall dataset, which limited comprehensive analysis for this report.

Table 1: Annual Unplanned Downtime at Sites With CT and MRI Units by Type of MSA

Maintenance service type (number of sites)	Average downtime in hours per year (range)	Average exam volume per year (range)	Percentage of sites that meet COCIR’s golden rule number 3 ^{a,b}
CT (n = 145)			
Full vendor (114)	42.49 (0 to 359)	12,842 (1 to 58,324)	62.24% (61 of 98)
In-house or shared (24)	69.83 (0 to 300)	18,833 (1,333 to 76,711)	60% (12 of 20)
Insurance (3)	56.33 (24 to 81)	10,600 (5,000 to 16,700)	50% (1 of 2)
Warranty (2)	20.50 (20 to 21)	5,063 (27 to 10,100)	50% (1 of 2)
Third party (1)	300	68,273	0 (0 of 1)
Other (1)	32	3,250	100% (1 of 1)
MRI (n = 88)			
Full vendor (76)	81.39 (0 to 496)	9,166 (145 to 50,047)	47.56% (39 of 82)
In-house or shared (8)	84.56 (0 to 185)	17,971 (1,784 to 66,000)	45.45% (5 of 11)
Insurance (2)	19.50 (4 to 35)	8,367 (7,500 to 8,900)	33.33% (1 of 3)
Warranty (2)	26.0 (21 to 31)	4,919 (3,600 to 6,783)	66.66% (2 of 3)
Third party	—	—	—
Other	—	—	—

^a COCIR golden rule number 3: No more than 10% of the age profile of medical technology should be more than 10 years old.

^b Any sites that did not provide data on equipment age were excluded.

Between the 2 MSAs that accounted for more than 95% of the data, full vendor agreements had a lower average annual unplanned downtime for CT (42.49 hours per year) compared to in-house or shared services (69.83 hours per year). Although the average annual unplanned downtime between in-house or shared services and full vendor agreements are comparable for MRI, the maximum unplanned downtime hours reported was 496 hours for full vendor agreements and 185 hours for in-house or shared. There were 5 MRI facilities that reported 496 hours of annual unplanned downtime, all of which share a single mobile unit. Mobile MRI units typically require more downtime compared to their fixed counterparts because of greater servicing and quality assurance needs.⁹ If the 5 sites sharing the mobile unit are excluded from the analysis, the average downtime for facilities using full vendor agreements is 52.19 hours (range = 0 to 320), which is notably less than in-house or shared MSAs.

The extent of the use of imaging equipment and its age can influence unplanned downtime.² Notably, the average volume of exams conducted at facilities with in-house or shared agreements was at least 42% higher than all other MSA types operating at multiple sites. The average number of annual CT and MRI exams, respectively, was 19,556 and 17,971 for facilities that reported in-house or shared agreements, and 13,745 and 9,166 for facilities with full vendor MSAs. In terms of equipment age, full vendor and in-house or shared service agreements had similar proportions of both CT and MRI units that meet COCIR's golden rule number 3.

Computed Tomography

For CT, among the 317 facilities with 1 or more CT units, 145 facilities provided information on both MSA type and unplanned downtime ([Table 1](#)).

Full Vendor

Full vendor agreements are used by 114 facilities for maintaining CT units. The average annual unplanned downtime was 42.49 hours, and the average annual exam volume was 12,842. Sixty-two percent of these sites met COCIR's golden rule number 3 ([Table 1](#)).

In-House or Shared Services

In-house or shared services agreements are used by 24 facilities for maintaining CT units. The average annual unplanned downtime was 69.83 hours, and the average annual exam volume was 18,833. Sixty percent of these sites met COCIR's golden rule number 3 ([Table 1](#)).

Insurance

Insurance contracts are used by 3 facilities for maintaining CT units. The average annual unplanned downtime for these sites was 56.33 hours, and the average annual exam volume was 10,600. Half of these sites met COCIR's golden rule number 3 ([Table 1](#)).

Under Warranty

Warranties are used by 2 facilities for maintaining CT units. The average annual unplanned downtime for these sites was 20.5 hours, and the average annual exam volume was 5,063. Half of these sites met COCIR's golden rule number 3 ([Table 1](#)).

Third Party

The third party MSA is used by 1 facility for maintaining CT units. The annual unplanned downtime for this facility was 300 hours, with an annual exam volume of 68,273. This facility did not meet COCIR's golden rule number 3 ([Table 1](#)).

Other

One facility indicated that they used a maintenance service type identified as "other" for a single CT unit. The annual unplanned downtime was 32 hours, and the annual exam volume was 3,250. The only CT unit at this facility is under 10 years old ([Table 1](#)).

Magnetic Resonance Imaging

For MRI, among the 213 facilities with 1 or more MRI units, 88 facilities provided information on both MSA type and unplanned downtime ([Table 1](#)). No facilities reported using third party or other MSAs. Similar to CTs, the number of facilities that reported using insurance and warranty agreements was limited for MRI units.

Full Vendor

Full vendor agreements are used by 76 facilities for maintaining MRI units, representing 80% of the maintenance service market for this modality. The average annual unplanned downtime was 81.39 hours, and the average annual exam volume was 9,166. As mentioned previously, the maximum unplanned downtime was 496 hours, reported by 5 facilities that share 1 mobile MRI unit. The average downtime when these 5 facilities are excluded from the analysis decreases to 52.19 hours per year (range = 0 to 320). Slightly less than half of the sites (48%) met COCIR's golden rule number 3 ([Table 1](#)).

In-House or Shared Services

In-house or shared service agreements are used by 8 facilities for maintaining MRI units. The average annual unplanned downtime was 84.56 hours, and the average annual exam volume was 17,971. Slightly less than half of the sites (45%) met COCIR's golden rule number 3 ([Table 1](#)).

Insurance

Insurance contracts are used by 2 facilities for maintaining MRI units. The average annual unplanned downtime was 19.5 hours, and the average annual exam volume was 8,367. Approximately one-third of the facilities met COCIR's golden rule number 3 ([Table 1](#)).

Under Warranty

Warranties are used in 2 facilities for maintaining MRI units. The average annual unplanned downtime was 26 hours, and the average annual volume of exams was 4,919. Approximately two-thirds of the facilities met COCIR's golden rule number 3 ([Table 1](#)).

Conclusion

The majority of the facilities in this report use full vendor or in-house or shared service agreements for CT and MRI, whereas the number of facilities using other types of agreements is limited in comparison. The average downtime per year for full vendor agreements was found to be less compared to in-house or shared MSAs, indicating that there may be a potential relationship between MSAs and unplanned downtime. However, it is widely acknowledged that age and use of equipment are factors that influence equipment downtime and may confound this relationship. For the facilities included in this report, exam volume was found to be higher for in-house or shared service agreements compared to full vendor agreements, and may account for this observed relationship. There was a similar proportion of CT and MRI units across sites that meet COCIR's golden rule number 3. The data limitations mean it is unclear to what extent exam volume and age impact the findings in this report and make it challenging to draw meaningful conclusions regarding the relationship between MSAs and downtime. Larger datasets with data reporting at the unit level, as well as consideration of other factors (e.g., location) that impact equipment downtime, are required for a comprehensive analysis.

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