

Increase in utilization of afterhours medical imaging: a study of three Canadian academic centres

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Disclosures/Consent

- No disclosures.
- There is no commercial interest of the authors in the subject of the study.
- No patient informed consent was required.
- Approval for this study was obtained from the St. Michael's Hospital and University Health Network Research Ethics Boards.

Background Information

- Medical imaging has perhaps been one of the most influential factors in patient care over the recent years, particularly in the ED.
- Many studies performed in a variety of healthcare settings in the United States demonstrate increasing usage of CT during patient visits to the ED over the past ten years.
- No similar studies have been performed in the Canadian healthcare setting.

Objectives

- The objectives of our study were to assess trends in afterhours radiology utilization for emergency department (ED) and inpatient (IP) patient populations from 2006-2013, including analysis by modality and specialty and with adjustment for patient volume.

Hypothesis

- We hypothesize that medical imaging has also been increasing at our institutions.
- While it is likely that patient volumes are also increasing, we hypothesize that there is a statistically significant increase in the amount of medical imaging being performed per patient.

Methods

- For this retrospective study, we reviewed the number of CT, MRI, and ultrasound studies performed for the ED and IP patients during the afterhours time period (5pm – 8am on weekdays and 24 hours on weekends and statutory holidays) from 2006-2013 at three different Canadian academic hospitals.

Methods

- We used the Jonckheere-Terpstra (JT) test to determine statistical significance of imaging and patient volume trends. A regression model was used to examine whether there was an increasing trend over time in the volume of imaging tests per 1,000 patients.

Methods

- We chose to limit our evaluation to the on-call time period as it provides an additional educational point of consideration, given that the hospitals in our study are all academic centers.
- Trends in the volume of on-call medical imaging from 2006-2013 are a direct reflection of the changing workload for the on-call radiology resident as there was consistently single resident physician coverage afterhours for the years studied.

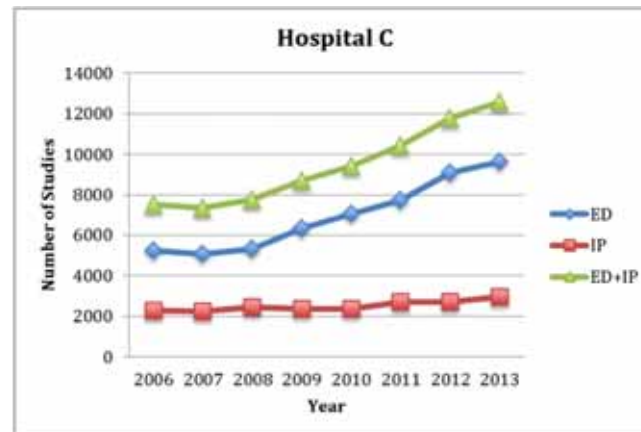
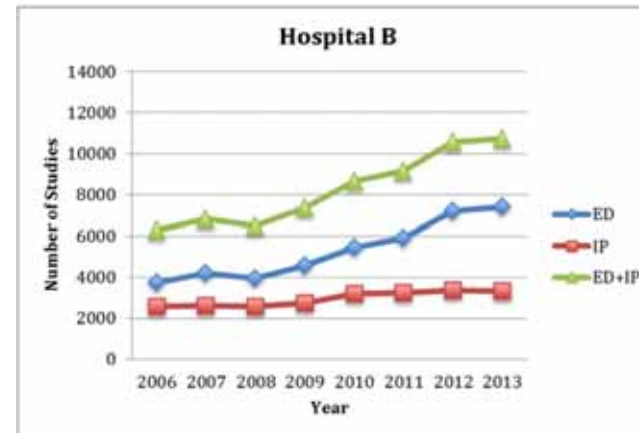
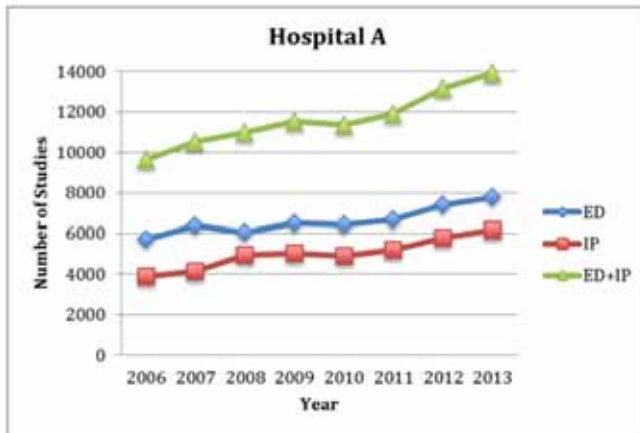
Results

- For all three sites from 2006-2013 during the afterhours time period:
- There was a statistically significant increasing trend in total medical imaging volume, which also held true when the volumes were assessed by modality and by specialty.

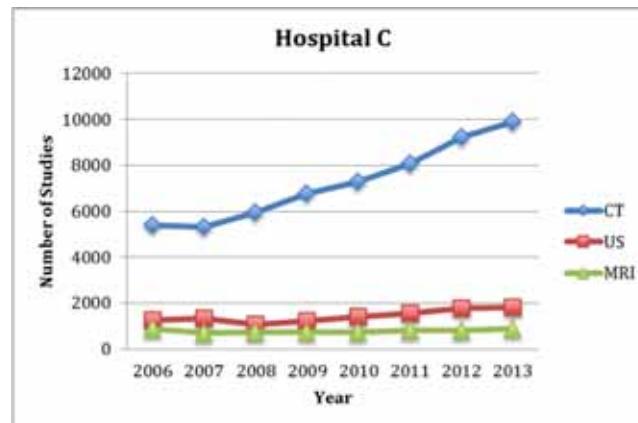
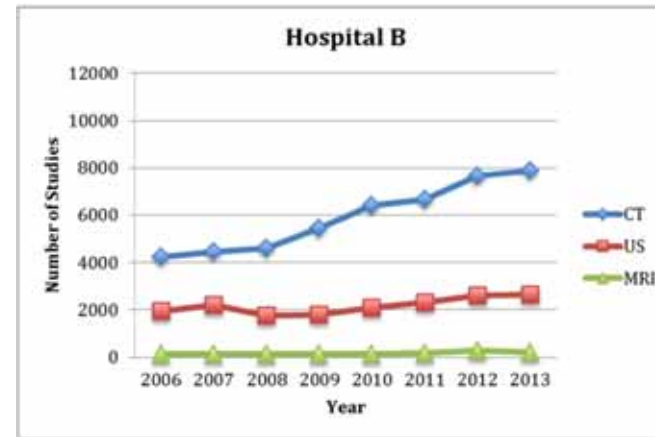
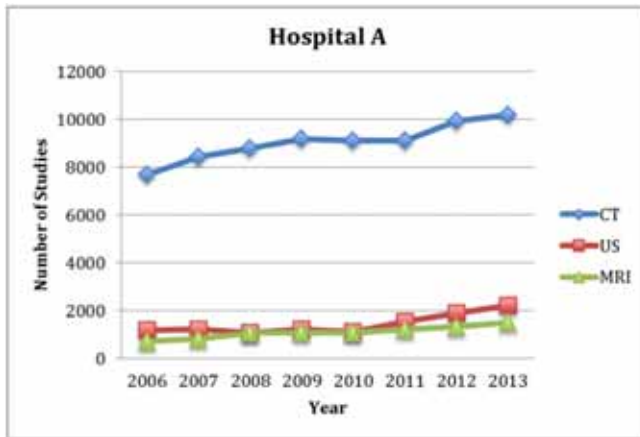
Results

- There was a statistically significant increasing trend in ED and IP patient volume.
- When medical imaging volumes were adjusted for patient volumes, there was a statistically significant increasing trend in imaging being performed per patient.

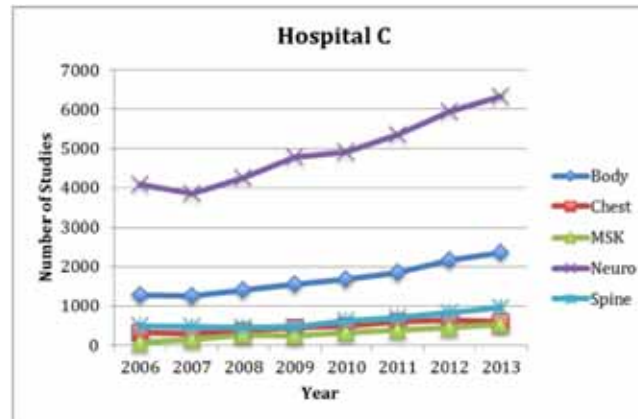
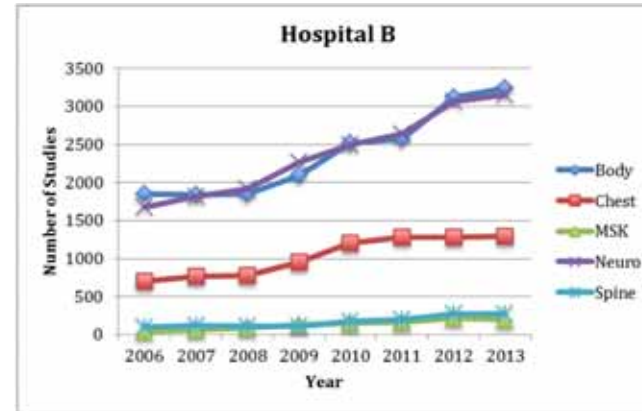
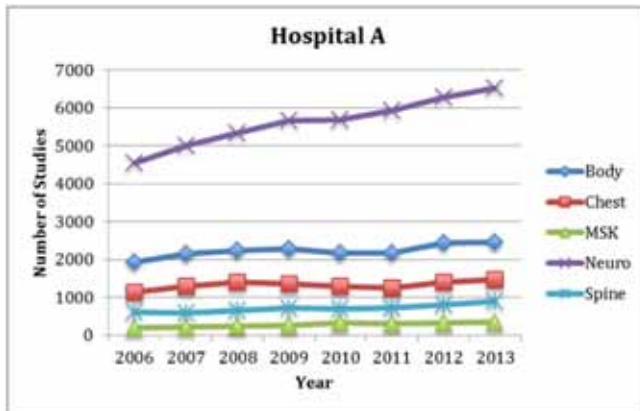
Total number of afterhours imaging studies performed per year by patient population for Hospital A, B, and C



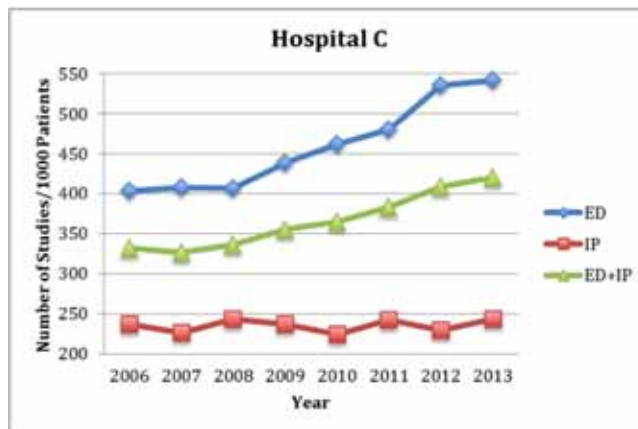
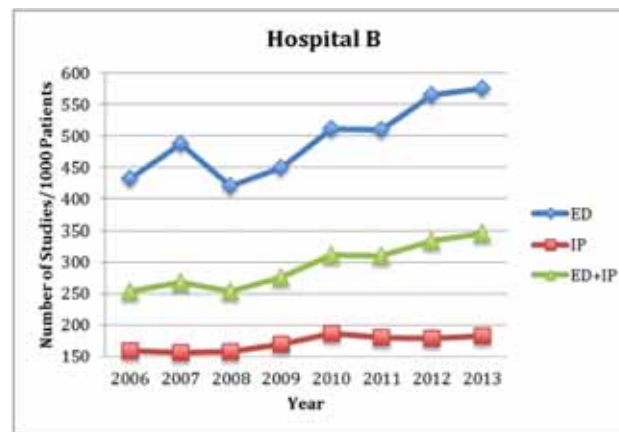
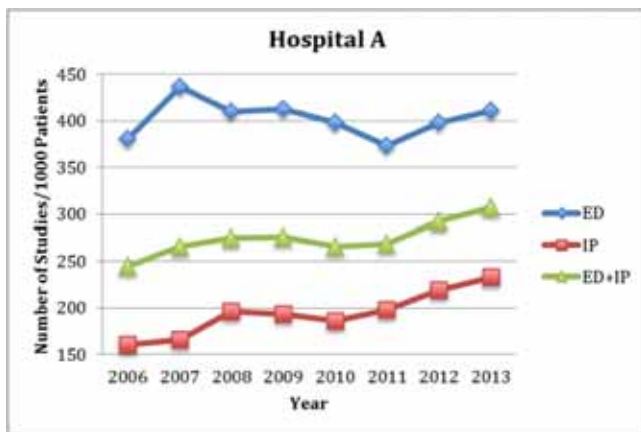
Total number of afterhours imaging studies performed per year by modality for Hospital A, B, and C



Total number of afterhours imaging studies performed per year by specialty for Hospital A, B, and C



Total number of afterhours imaging studies performed per 1000 patients per year by patient population for Hospital A, B, and C



Discussion

- Causes for increased utilization:
 - Growing clinical indications for imaging usage
 - Increased sensitivity, specificity and diagnostic capability of imaging
 - Increased speed and availability of imaging
 - Correlation of imaging use with decreased morbidity/mortality (i.e. significant reduction in the negative appendectomy rate & number of appendectomies accompanied with a significant increase in the use of preoperative abdominal CT)

Discussion

- According to the Canadian Institute for Health Information (CIHI), the Emergency Room Wait Times Strategy, which was launched in 2008 in Ontario, was designed to reduce total ED length of stay, with use of financial incentives.
- Our results demonstrate rising ED imaging correlating with the launch of the provincial wait time strategy in 2008.
- The CIHI report indicates that in recent years, all jurisdictions across Canada have worked toward shortening ED wait times with pay-for-performance incentives – resultant generalized increased medical imaging trends?

Discussion

- While medical imaging is indicated and beneficial in many clinical settings, it is important to recognize the issues of:
 - Increased cost
 - Increased radiation risk
 - Lack of consistent correlation of imaging with improved patient outcome

Conclusion

- Afterhours medical imaging volumes demonstrated a statistically significant increasing trend at all three sites from 2006-2013 when assessed by total volume, modality, and specialty.
- During the same time period and at all three sites, the ED and IP patient volumes also demonstrated a statistically significant increasing trend with more medical imaging, however, being performed per patient.

Conclusion

- Our study is the first to formally study trends in afterhours medical imaging in the ED and IP setting in recent years in Canada.
- We suspect that the trends may be generalizable to other parts of Canada, but this requires further study.
- Additional study is also needed to evaluate the appropriateness of medical imaging over the recent years in our country, given that there are serious implications associated with its rise.

Conclusion

- Finally, the trends in the volume of on-call medical imaging from 2006-2013 are a direct reflection of the changing workload for on-call radiology residents.
- Further study into the impact of these trends is required for issues of patient and resident safety and resident education.

References

- [1] Broder J, Warshauer DM. Increasing utilization of computed tomography in the adult emergency department, 2000-2005. *Emerg Radiol* 2006; 13: 25-30.
- [2] Larson DB, Johnson LW, Schnell BM, et al. National trends in CT use in the emergency department: 1995-2007. *Radiology* 2011; 258(1): 164-73.
- [3] Larson DB, Johnson LW, Schnell BM, et al. Rising use of CT in child visits to the emergency department in the United States, 1995-2008. *Radiology* 2011; 259(3): 793-801.
- [4] Hess EP, Haas LR, Shah ND, et al. Trends in computed tomography utilization rates: a longitudinal practice-based study. *J Patient Saf* 2014; 10(1): 52-8.
- [5] Benjamini Y, Hochberg Y. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J. R. Statist. Soc. B* 1995; 57(1): 125-33.
- [6] Raja AS, Wright C, Sodickson AD, et al. Negative appendectomy rate in the era of CT: an 18-year perspective. *Radiology* 2010; 256(2): 460-5.
- [7] Canadian Institute for Health Information. Health care in Canada 2012: A focus on wait times. Chapter 2: Waits for emergency department care. <https://secure.cihi.ca/estore/productFamily.htm?locale=en&pf=PFC1984>
(Last accessed: October 30, 2014)
- [8] Chen J, Moir D. An estimation of the annual effective dose to the Canadian population from medical CT examinations. *J. Radiol. Prot.* 2010; 30: 131-7.
- [9] Lee CI, Haims AH, Monico EP, et al. Diagnostic CT scans: assessment of patient, physician, and radiologist awareness of radiation dose and possible risks. *Radiology* 2004; 231: 393-8.

References

- [10] Kalra M, Maher M, Saini S. CT radiation exposure: rationale for concern and strategies for dose reduction. Proceedings from the SCBT/MR. Appl Radiol 2003; 7: 45-54.
- [11] Prologo JD, Gilkeson RC, Diaz M, et al. CT pulmonary angiography: a comparative analysis of the utilization patterns in emergency department and hospitalized patients between 1998 and 2003. Am J Roentgenol 2004; 183: 1093-6.
- [12] Oguz KK, Yousem DM, Deluca T, et al. Effect of emergency department CT on neuroimaging case volume and positive scan rates. Acad Radiol 2002; 9: 1018-24.
- [13] Korley FK, Pham JC, Kirsch TD. Use of advanced radiology during visits to US emergency departments for injury-related conditions, 1998-2007. JAMA 2010; 304(13): 1465-71.
- [14] Berdahl CT, Vermeulen MJ, Larson DB, et al. Emergency department computed tomography utilization in the United States and Canada. Ann Emerg Med. 2013; 62(5): 486-94.
- [15] Raja AS, Ip IK, Sodickson AD, et al. Radiology utilization in the emergency department: trends of the past 2 decades. AJR 2014; 203: 355-60.
- [16] Raja AS, Ip IK, Prevedello LM, et al. Effect of computerized clinical decision support on the use and yield of CT pulmonary angiography in the emergency department. Radiology 2012; 262(2): 468-74.
- [17] Mayo JR, Munk PL. Towards clarity: what does "inappropriate imaging" really mean? CARJ 2010; 61: 250-1.