CPEG Fellowship (2019-2020) Summary Report

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Project Title: The Impact of Hospital Surgical Volume on Healthcare Utilization and Clinical Outcomes after Paediatric Thyroidectomy

I am extremely grateful to the Canadian Paediatric Endocrine Group for supporting my third year of fellowship - based at The Hospital for Sick Children, Toronto, under the supervision of Jonathan Wasserman - to pursue research into clinical outcomes after paediatric thyroidectomy. Here, I present a summary of the project; my role in the project; and the learning opportunities this has provided.

Project summary

Surgical complications following thyroidectomy are more frequent in children when compared to adults. The established relationship between high individual surgical volume and improved thyroidectomy outcomes has influenced management guidelines and recommendations for minimum annual surgeon case load. The impact of overall *hospital* surgical volume, however, is understudied, particularly within paediatrics. Additionally, healthcare utilization outcomes are infrequently reported.

We aimed to describe the patterns of surgical care for children undergoing thyroidectomy in Ontario and to investigate the relationship between hospital volume, and clinical and healthcare utilization outcomes using population-level data. In Ontario, our access to numerous linked administrative and healthcare related provincial databases provided a unique opportunity to address these research aims, strengthen the generalizability of our results, and will inform the provision of care for children undergoing thyroidectomy.

A population-based cohort was established at ICES of 1,908 patients who underwent first thyroidectomy before age 18, between April 1, 1993 and March 31, 2017. ICES is an independent, non-profit research institute that collects and analyzes healthcare and demographic data for health system evaluation and improvement - numerous datasets are linked using unique encoded identifiers. Hospital thyroidectomy volume was defined, per case, as the number of paediatric thyroidectomies (patients aged under 18 years) completed within the preceding year. Our clinical outcomes were hematoma and disease-free survival (DFS); and our healthcare utilization outcomes were length of stay (LOS), readmission, and emergency department (ED) visits. The Chi-squared and one-way analysis of variance (ANOVA) tests were used, as appropriate, for univariate analysis. Demographic and clinical secondary variables were also collected and included in multivariate models - time-to-event multi-level Cox proportional hazard regression or linear regression analysis, as appropriate.

We found that children undergoing thyroidectomy at low surgical volume hospitals do not have inferior clinical outcomes or increased healthcare utilization. Thyroidectomy at a high-volume centre was associated with younger age and greater co-morbidity. We propose these findings, in our healthcare context, reflect appropriately utilized referral pathways based on the needs of individual patients without a strict top-down policy.

Hematoma rate was low (1.7%); despite this, we found an increased rate amongst higher volume hospitals. Also, we found a longer LOS at higher volume hospitals. These findings could be explained by the difference in case mix and complexity in high-volume hospitals. Although we adjusted for co-morbidity, cancer diagnosis and demographics, we could not account for other confounders, such as

Graves' disease or extent of neck dissection. Nevertheless, these associations are cause for reflection into differences in approach and immediate post-operative monitoring between hospitals.

Hospital volume was not associated with DFS (overall 76.3%) in a sub-cohort of children with differentiated thyroid cancer (DTC). We show that variables associated with material deprivation and poorer access to healthcare did not affect DFS, which supports an equitable access to care for children with DTC across Ontario.

Specific demographic features - male sex, increased material deprivation, and increased rurality - were associated with increased post-operative ED visits. This highlights a focus for how we could allocate healthcare resources and discharge planning for these groups. Readmission rate did not vary by hospital volume.

Hypoparathyroidism and recurrent laryngeal nerve injury are not variables captured by these administrative data and remain important outcomes to consider in future studies. Clinical decision-making is also not captured by administrative data therefore the reason for ED visits, readmission, and referral are unknown.

In conclusion, low-volume hospitals were not associated with poorer clinical or healthcare outcomes that we measured. For younger patients and those with medical complexity (such as metastatic carcinoma or Graves' disease), facilitating access to appropriate surgical expertise should be a priority. Our findings, together with future work, can help inform the future provision of care for children needing thyroidectomy - and may impact approaches to care more broadly - in a region with an extremely varied sociodemographic and geographical landscape.

My role and learning opportunities

My development as a clinical researcher benefitted – in addition to Jonathan's outstanding supervision and mentorship – from collaboration with the project's other authors through their expertise in head and neck surgery and health system evaluation research utilizing population-level administrative data. I learnt new research methodology, and its strengths and limitations. I significantly contributed to data interpretation, and the synthesis and presentation of our findings into a conference poster and submitted manuscript.

Project outcome – presentation and publication

I am first author for the manuscript that is undergoing peer review at the Journal of Clinical Endocrinology & Metabolism. I had an abstract accepted for poster presentation at the American Society for Pediatric Otolaryngology conference 2020 (held virtually).

Abstract (as submitted to the Journal of Clinical Endocrinology & Metabolism)

Background: Higher volume surgeons are linked to better clinical outcomes after thyroidectomy in children and adults. Outcomes in pediatrics related to hospital volume and healthcare utilization are infrequently reported. We investigated the associations between hospital volume, and clinical and healthcare utilization outcomes following pediatric thyroidectomy in Ontario, Canada.

Methods: Retrospective analysis of administrative and health-related population-level data from 1993 to 2017. A cohort of 1,908 pediatric (<18 years) index thyroidectomies was established. Hospital volume was defined per-case as thyroidectomies performed in the preceding year. Healthcare utilization outcomes: length of stay (LOS), readmission, emergency department (ED) visits. Clinical outcomes: hematoma and disease-free survival. Multivariate analysis adjusted for patient-level, disease and hospital-level co-variates.

Results: The lowest volume quartile, accounting for 30% of thyroidectomies, performed 0-1 thyroidectomies/year. The highest volume quartile performed 19-60 cases/year. LOS was 0.64 days longer in the highest, versus the lowest quartile. Hospital volume was not associated with readmission or ED visits. Increased ED visits were associated with male sex, increased material deprivation, and rurality. Hematoma rate (overall rate 1.7%) was increased in the highest, versus the lowest, quartile. Hospital volume was not associated with disease-free survival in those with cancer (overall 76.3%).

Conclusions: Low hospital volume was not linked to poorer clinical or healthcare utilization outcomes; however, these may still be impacted by surgeon volume. Hematoma rate and LOS were increased at higher volume hospitals, which may reflect patient complexity. Further study of groups disproportionately accessing the ED post-operatively may help direct resources to these populations.