Original Research

COVID-19 and head, neck, and thyroid cancer diagnoses in Newfoundland and Labrador: Changes in incidence and severity

Zachary Visser, MD,[1] Brandon Collins, MD,[1] Alexandra Hodder, MD,[1] Heather Barry, BKin (Hons), MSc PT,[1] & Angus Hartery, MD[2,3]

1. Faculty of Medicine, Memorial University, St. John's, NL, Canada
2. Discipline of Radiology, Memorial University, St. John's, NL, Canada
3. Mayfair Diagnostics, Calgary, AB, Canada

ABSTRACT

Purpose: This study examined the changes in diagnosis patterns of head, neck, and thyroid cancers in Newfoundland and Labrador before, during, and after the onset of the COVID-19 pandemic.
Methods: A retrospective population-based study analyzed new diagnoses from April 2019 to March 2022, divided into pre-COVID (2019–20), peak-COVID (2020–21), and post-COVID (2021–22) periods. Chi-square tests evaluated differences in cancer type and stage, Poisson regression compared population-adjusted advanced cancer incidence, and Kruskal-Wallis testing compared monthly case distribution differences.
Results: Among 592 patients, monthly case counts remained stable across periods ($p = 0.423$). The proportion of thyroid cancers decreased significantly over time ($\chi^2(2) = 8.55$, $p = 0.014$), dropping from 58.1% pre-COVID to 46.1% post-COVID; however, year-to-year differences were not statistically significant. Non-thyroid head and neck cancer proportions were stable ($p = 0.593$). The proportion of advanced-stage cancers rose significantly during the pandemic compared to the previous year ($\chi^2(1) = 6.54$, $p = 0.011$), but population-adjusted incidence rates of advanced cancers showed no significant change (IRR 1.28; 95% CI 0.84–1.93; $p = 0.245$).
Conclusions: Head, neck, and thyroid cancer diagnoses remained overall stable during the pandemic. Delays mainly affected early-stage detection, while advanced cases were prioritized. Maintaining timely diagnostic access and public education during disruptions is critical. Future studies should examine long-term outcomes and barriers to care during healthcare crises.

Keywords: COVID-19; Oncology; Head and neck cancer; Thyroid cancer; Cancer diagnosis; Newfoundland and Labrador.

COVID-19, a novel coronavirus not previously identified in humans, was discovered in Wuhan, China, early in 2019.[1] The virus is primarily transmitted in humans through respiratory droplets and typically presents as an acute respiratory syndrome, causing fever, cough, and fatigue.[2,3] The virus was declared a global pandemic in April 2019 and had many economic, social, and healthcare implications, provoking prompt multi-level government and healthcare authority action responses to manage the spread of the virus.[4,5] Due to the unexpected rate of global spread, lack of preparedness, and risk to healthcare providers and the public, many health authorities implemented measures in an attempt to reduce transmission and protect the public.[6,7] These measures included the reduction of staff volume to "essential operation" levels and a reduction of in-person, outpatient, and non-urgent services.[6,7] As such, these measures resulted in an overall decrease in the provision of public healthcare as well as decreased rates of emergency room patient attendance.[8–10]

The Centers for Disease Control and Prevention (CDC) cited an overall decline in emergency department visits of approximately 42%, even with significantly increased numbers of patients with COVID-19.[11] Similar declines were observed in Newfoundland and Labrador (NL), Canada; cumulative monthly visits in the capital city, St. John's, decreased by nearly 50% from March to June of 2020.[12] One survey from Johns Hopkins University in Baltimore, Maryland, indicated that 41% of respondents had forgone medical care from March to July of 2020, as compared to 79% of respondents who indicated that they required care.[13]

Due to significant reductions in emergency department and primary care clinic visits, many potential cancer cases did not receive timely screening or diagnostic evaluation. General trends indicated decreased volumes of imaging studies worldwide.[14–17] These decreases in imaging volumes are speculated to have deleterious effects on disease prevalence and severity. This was true for acute abdominal pathologies at one center in Toronto, Canada, where increases in proportion, severity, and requirement for surgical intervention were observed.[18] Similar findings were also expected for cancer diagnoses. One study predicted that due to decreased screening, approximately 1400 cancerous and precancerous lesions were missed during the primary pandemic period (three months in March to June of 2020) at one American hospital.[19]

Head and neck cancers are defined as malignant tumours arising in the oral cavity, oropharynx, hypopharynx, nasopharynx, lip, larynx, paranasal sinus, and salivary glands,

and are the 7th most frequently occurring cancer worldwide.[20] Risk factors for these cancers include exposure to tobacco, alcohol use, and viruses, including human papillomavirus and Epstein-Barr virus, and they have a high mortality rate due to the lack of treatment options and the natural history of disease progression.[20,21] Thyroid cancer is a cancer of the endocrine system that occurs most commonly in young women aged 20 to 55 years in the form of papillary or follicular cancer and is the 10th most common cancer in Canada.[22] Risk factors for thyroid cancers include non-cancerous conditions of the thyroid (such as hyperthyroidism), inherited cancers, exposure to ionizing radiation, and obesity, and have a net 5-year survival rate of 97% in Canada.[23]

The Canadian Association of Head and Neck Surgical Oncology (CAHNSO) issued recommendations for managing head and neck cancers during the COVID-19 pandemic; these were helpful for current diagnoses, yet the pandemic appeared to affect undiagnosed cancers disproportionately.[24] Fewer cancer diagnoses were reported during the COVID-19 pandemic in Slovenia, England, the Netherlands, the United States, and Brazil at the beginning of the pandemic.[25–29] Unfortunately, timely diagnosis of cancer is one of the most significant factors contributing to prognosis and treatment options available to patients.[30] Due to the high mortality rates, lack of treatment options available for head and neck cancers, the increased incidence of these cancers nationwide, and the global effects of the COVID-19 pandemic, this study aims to provide further insight into the impacts of the pandemic on these cancers in NL.

This study hypothesized that head, neck, and thyroid cancer incidence would reflect global patterns of delayed detection and increased rates of advanced-stage cancers at diagnosis during and after the COVID-19 pandemic. Thus, this study aimed to explore changes in diagnostic patterns and cancer staging at presentation of these cancers, associated with healthcare disruptions and service access during the COVID-19 pandemic in NL, Canada.

METHODS

This retrospective review included all patients diagnosed with a primary head and neck or thyroid cancer in NL from April 2019 to March 2022. Thyroid cancers were also included to increase the comprehensiveness of analyses of cancers diagnosed in this body region; these were analyzed with head and neck cancers for all analyses besides total yearly case counts.

Data were obtained from the NL Cancer Care Registry following ethical and regulatory approval from the registry, the local Health Research Ethics Board (HREB), and the local Research Proposals Approval Committee (RPAC). The cancer registry used in this study is a legislated, population-based database authorized under provincial privacy legislation to collect, use, and share health data; it receives comprehensive data from across the province, including screening results, diagnoses, and treatment information from multiple healthcare settings. Data access and collection were performed using the NL Centre for Health Information (NLCHI) Provincial Data Lab repository within a secure virtual environment to collect the relevant data variables, including age, gender, positively identified cases of head and neck cancer, date of cancer diagnosis, head and neck cancer subtype (thyroid; non-thyroid), and cancer stage.

Analyses were conducted across three time periods: pre-COVID (April 2019 to March 2020), peak COVID (April 2020 to March 2021), and post-COVID (April 2021 to March 2022).

Cancer severity was classified using the TNM Classification of Malignant Tumours staging system.[31] Early-stage cancers were defined as primary tumour stage T2 or less (≤T2) without nodal or metastatic involvement, while advanced-stage cancers were defined as T3 or greater (≥T3), any nodal involvement (≥N1), or the presence of metastatic disease (≥M1).[31] Proportions of advanced-stage diagnoses were calculated for April to December 2019 and 2020; staging data for 2021 and 2022 were not available within the local registry at the time of data collection and thus could not be included in this analysis.

Statistical analyses were performed using R version 4.4.2 (The R Foundation for Statistical Computing, Vienna, Austria). Patient demographics and outcomes were summarized across the three defined periods. Descriptive statistics were calculated for age and biological sex. Chi-square tests of independence, the Kruskal-Wallis test, and Poisson regression analyses were used to evaluate differences in incidence and stage at diagnosis between periods, with post-hoc testing and corrections applied where appropriate. Statistical significance was set at $p<0.05$.

RESULTS

Between April 2019 and March 2022, 592 patients diagnosed with head and neck cancers, including thyroid cancers, in NL were included in the final data analysis. The sample had a mean patient age of 61.4 ± 13.2 years, with the majority of patients aged 60-79 years, and a nearly even sex distribution (299 males and 293 females). Patient demographics are summarized in Table 1.

From April 2019 to March 2020 (pre-COVID), 215 cancers were diagnosed, the majority comprising thyroid cancers (58.1%), and non-thyroid cancers comprising 41.9%. During the COVID-19 peak (April 2020 to March 2021), 184 cancers were diagnosed, with 95 (51.6%) non-thyroid and 89 (48.4%) thyroid cancers. In the post-COVID period (April 2021 to March 2022), 193 cancers were diagnosed: 104 (53.9%)

non-thyroid and 89 (46.1%) thyroid (see Table 2).

Table 1. *Patient demographics for head/neck and thyroid cancer diagnoses.*

Demographic Variable	n (%)
Total Patients	592
Sex	
Male	299 (50.5%)
Female	293 (49.5%)
Mean Age ± SD (Years)	61.4 ± 13.2
Age Group	
<20 Years	3 (0.5%)
20–39 Years	29 (4.9%)
40–59 Years	213 (36.0%)
60–79 Years	311 (52.5%)
80+ Years	36 (6.1%)

A Chi-square test of independence revealed a statistically significant decrease in thyroid cancer diagnoses across the three time periods ($\chi^2(2) = 8.55$, $p = 0.0140$), with proportions declining from 58.1% in 2019-20 (n = 125; 95% confidence interval (CI), 51.5%-64.7%) to 46.1% in 2021-22 (n = 89; 95% CI, 39.1%-53.1%). Post-hoc pairwise comparisons using Chi-square tests with Bonferroni correction (adjusted $\alpha = 0.0167$) showed that no individual year-to-year comparison reached statistical significance. However, the largest observed difference was between 2019-20 and 2021-22 ($p = 0.0199$), suggesting a potential downward trend. In contrast, the incidence of non-thyroid head and neck cancers remained stable across the time periods ($\chi^2(2) = 1.05$, $p = 0.593$), comprising 41.9% in 2019-20 (n = 90; 95% CI, 35.3%–48.5%) and 53.9% in 2021-22 (n = 104; 95% CI, 46.9%-60.9%) (see Table 2).

Table 2. *Number and proportion of head/neck versus thyroid cancer diagnoses by year.*

Year (April–March)	Head/Neck Cancers, n (%) (95% CI)	Thyroid Cancers, n (%) (95% CI)	Total Cases, n
2019–2020	90 (41.9) (35.3–48.5)	125 (58.1) (51.5–64.7)	215
2020–2021	95 (51.6) (44.4–58.9)	89 (48.4) (41.1–55.6)	184
2021–2022	104 (53.9) (46.9–60.9)	89 (46.1) (39.1–53.1)	193

Monthly observed head/neck and thyroid cancer case counts from April 2019 to March 2022 were compared across three time periods: 2019-2020, 2020-2021, and 2021-2022 (see Figure 1). Kruskal-Wallis testing revealed no significant difference in monthly case distributions across the three years ($\chi^2(2) = 1.72$, $p = 0.423$), indicating that overall case counts of all three cancers remained stable over the study period.

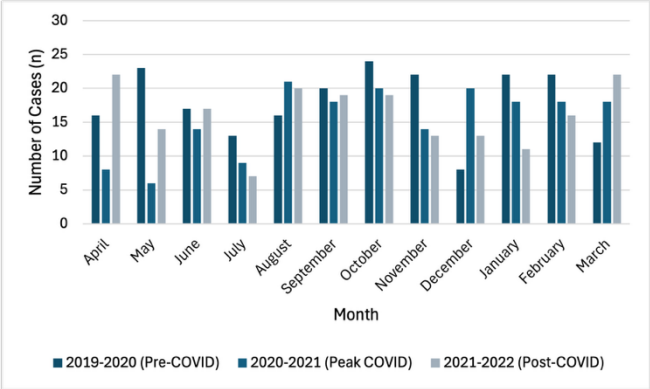

Figure 1. *Monthly head/neck and thyroid cancer cases before, during, and after the COVID-19 peak.*

Finally, to evaluate changes in cancer severity, the monthly proportion of advanced-stage head/neck and thyroid cancers from April to December 2019 was compared with the same months in 2020 (see Figure 2). A Chi-square test of independence confirmed a significant increase in the proportion of advanced cases during the pandemic ($\chi^2(1) = 6.54$, $p = 0.011$). Proportions fluctuated monthly but were consistently higher in 2020; for example, April 2019 had 19% advanced cases (SE = 9.6%; 95% CI, 0.2%-38.2%) versus 38% in April 2020 (SE = 17.2%; 95% CI, 4.4%-71.6%). Similarly, June 2019 had 29% advanced cases (SE = 10.9%; 95% CI, 7.7%-50.3%) compared to 50% in June 2020 (SE = 13.4%; 95% CI, 23.8%-76.2%).

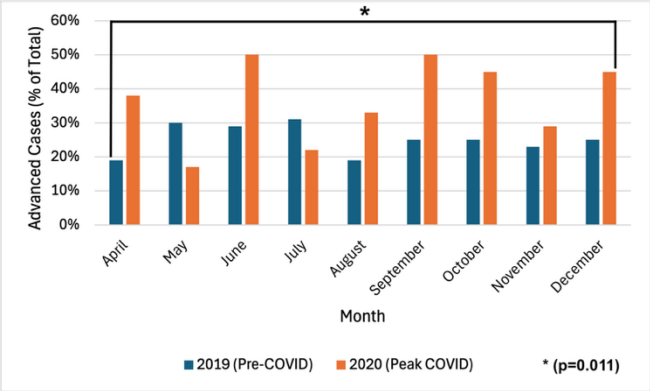

Figure 2. *Monthly proportions of advanced head/neck and thyroid cancers before and during the COVID-19 peak.*

While the monthly proportions of advanced-stage cancers among diagnosed cases increased significantly during the pandemic, this analysis does not account for changes in the underlying population or in total case detection rates.

Therefore, population-standardized incidence rates of advanced cancers were subsequently calculated; due to the unavailability of advanced cancer staging data beyond March 2021 at the time of analysis, only the pre-COVID and peak-COVID periods were included. Poisson regression modelling, adjusted for month and population size, showed a non-significant increase in the rate of advanced cancer diagnoses in 2020-21 compared to 2019-20 (incidence rate ratio (IRR) = 1.28, 95% CI 0.84 - 1.93, p = 0.245), suggesting stability in population-adjusted advanced cancer incidence despite observed changes in relative proportions.

DISCUSSION

This population-based study evaluated patterns of head, neck, and thyroid cancer diagnosis in NL across three distinct periods: pre-COVID (2019-20), peak COVID (2020-21), and post-COVID (2021-22). Overall, the total number of diagnosed cases of head and neck cancer remained stable over the three years. In addition, although the proportion of advanced-stage presentations increased during the pandemic, the population-adjusted incidence of advanced cancers did not change significantly.

The observed decrease in the proportion of thyroid cancers – from 58.1% in 2019-20 to 46.1% in 2021-22 – was statistically significant when analyzed across all three time periods. However, post-hoc pairwise comparisons with Bonferroni correction did not identify significant year-to-year differences, likely due to reduced statistical power after adjustment. Still, the largest decline occurred between 2019-20 and 2021-22, suggesting a possible downward trend in thyroid cancer detection. These findings are consistent with international reports documenting reduced diagnoses of low-risk or subclinical thyroid cancers during the COVID-19 pandemic, likely reflecting the deferral of non-urgent investigations such as neck ultrasound and fine-needle aspiration, reduced provision of public healthcare, and reduced healthcare-seeking behaviour during periods of heightened public health restrictions.[11,27,32–38] In contrast, non-thyroid head and neck cancer diagnoses remained stable across the three years. These cancers tend to present with more acute or disruptive symptoms, such as hoarseness, dysphagia, or visible lesions, which may prompt more urgent investigation and referral even amid healthcare system disruptions.[39] The consistency in head and neck cancer diagnoses suggests that patients with symptomatic disease were still able to access diagnostic services during the pandemic.

A significant increase in the proportion of advanced-stage cancers among diagnosed cases was observed during the pandemic peak (April-December 2020) compared to the same months in 2019. Monthly data showed higher proportions of advanced disease in nearly every month of the 2020 period, supporting concerns about delayed presentations. However, when adjusted for population size and month using Poisson regression, the incidence rate of advanced cancers in 2020-21 was not significantly different from 2019-20. This suggests that while the proportion of advanced cases increased among those diagnosed, the overall population-level burden of advanced disease remained relatively stable. These findings suggest that the observed rise in advanced-stage proportions may be due to a decrease in the detection of early-stage cancers, rather than a true increase in advanced disease incidence. This indicates that during a time of considerable strain on the healthcare system and resource scarcity, more advanced cancers were likely still appropriately triaged and prioritized for investigation above less advanced cancers.

The demographic distribution of our cohort reflects the predominance of head and neck cancer diagnoses among older adults, consistent with prior epidemiological studies.[40,41] While monthly case counts remained statistically stable, visual inspection of the data revealed a decrease in diagnoses during April and May 2020, aligning with the onset of public health restrictions. These patterns may reflect temporary interruptions in routine care and changes in healthcare-seeking behaviour related to fear of COVID-19 exposure and reprioritization of diagnostic services. Similar disruptions in cancer diagnostic pathways and delays in presentation have been reported globally, reinforcing the need for resilient cancer care systems during public health crises.[27,32–38]

These results underscore the importance of maintaining access to diagnostic services during times of healthcare disruption, particularly for cancers like thyroid cancer that often depend on elective imaging and asymptomatic detection. The rise in the proportion of advanced-stage presentations among diagnosed patients emphasizes the potential downstream consequences of diagnostic delays, even when total case volumes appear unchanged.

Several limitations should be noted surrounding this study. First, advanced staging data were only available through March 2021, limiting assessment of post-pandemic trends. Further, survival and long-term outcomes were not evaluated, which limits the interpretation of the clinical significance of delayed presentations. Additionally, as a retrospective observational study, the results may inherently be influenced by documentation or coding inconsistencies. As well, analyses were limited by the grouping of head and neck cancers with thyroid cancers based on the data available within the registry for use. Ideally, given the differences between these types of cancers, future studies would analyze these entities separately.

In terms of strengths, this population-based study contains a comprehensive analysis and presentation of data by leveraging the use of the provincial cancer registry, showcasing real-time data during a global pandemic and

healthcare crisis. Similarly, the study offers a comparison of trends over multiple time periods (pre-, peak-, and post-), thoroughly investigating both mid-pandemic as well as the periods immediately preceding and following it. Finally, given the relatively small population of NL, very little data exists for patients in the areas under study. This allows novel insights into healthcare trends in a location with limited representation in the literature.

CONCLUSION

This study demonstrated that during the COVID-19 pandemic, population-level diagnoses of head, neck, and thyroid cancers in NL remained stable, reflecting a healthcare system that prioritized the detection of cancers with greater morbidity and mortality risk. The decreased detection of primarily low-risk thyroid cancers likely represents appropriate triaging during a period of constrained resources. However, the increased proportion of advanced-stage cancers underscores the potential risks associated with delayed early detection and the need for vigilant follow-up. Maintaining access to timely diagnostic care and public education during healthcare disruptions is critical to mitigating indirect harms from pandemics. Future research should focus on long-term outcomes, including survival and recurrence, as well as exploring patient and provider perspectives to identify and address barriers to care. These efforts are essential to ensure resilient cancer care systems capable of balancing urgent clinical needs with the prevention of delayed diagnoses during times of crisis.

ACKNOWLEDGEMENTS

We extend our sincere thanks to Lauren Gosse, Research Coordinator, for her support in preparing a formal conference presentation of this study. We are grateful to the Newfoundland and Labrador Centre for Health Information, as well as Michele Butler, the Cancer Care Registry, Jeff Dowden, Michelle Simms, Chigozie Chibuzo, Jeffery Flemming, and Yanqing Yi for their contributions to data access and support throughout the project.

DISCLOSURES

None. This research received no external financial or non-financial support. There are no additional relationships or patents to disclose. The preliminary results of this research were published at the Conference of Atlantic Medical Students in Halifax, Nova Scotia (April 2024).

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