PRIMARY RESEARCH

Comparing the Pre-COVID-19 Pandemic and During-Pandemic Hospitalizations of Youth Ages 5-24 for Mental Health Disorders in Canada

Beatriz Rigo Moises, BHSc Student [1,2], Claire L. Johnson, BHSc Student [1,2], Jonathan Tung, BHSc Student [1,2], Taylor Zhang, BHSc Student [1,2]*

 Youreka Kingston, Youreka Canada, Kingston, Ontario, Canada K7L 3N6
 Bachelor of Health Sciences Program, Queen's University, Kingston, Ontario, Canada K7L 3N6

*Corresponding Author: taylor.zhang003@gmail.com

Abstract

Introduction: The COVID-19 pandemic exacerbated mental health issues in children due to the anxiety and fear it propagated worldwide. This study aims to compare the instances of youth hospitalizations for mental health disorders across Canada before and during the COVID-19 pandemic. This paper also compares the differences in rates of youth hospitalizations due to mental health disorders per 100,000 in Western, Eastern, and Northern regions of Canada. Thus, the impact of discrepancies in COVID-19 pandemic restrictions on the prevalence of mental health disorders in youth in different regions of Canada is examined.

Methods: The data used in this study was obtained from the Canadian Institute for Health Information (CIHI) database. Data was sorted into the pre-pandemic or during-pandemic period and into Eastern, Western, and Northern provinces and territories. A Wilcoxon Signed Rank Test was conducted to compare the differences in hospitalization rates. A Kruskal-Wallis Test was conducted to compare the differences in pre-pandemic rates between the geographic regions.

Results: Overall, results indicate that the pandemic significantly decreased the prevalence of hospitalizations for mental health disorders in youth in Canada. The results of Wilcoxon Signed Rank Test were statistically significant (p<0.001). The results of the Kruskal-Wallis Test were not statistically significant (p=0.2682).

Discussion: Across all regions of Canada, there was a statistically significant decrease in hospitalizations during the pandemic. One possible reason for this decrease is that fear of attending hospitals was exacerbated by the COVID-19 pandemic. Limitations include: data on rates of hospitalizations of youth do not take into account more than 1 hospitalization per child, non-hospitalized cases were not considered, fear of seeking help, lack of extensive coverage, as well as the ongoing nature of the pandemic. The only demographic or social factor covered in this paper is geographic location.

Conclusion: Further research is needed to better understand the specific factors contributing to the decrease in hospitalizations for mental health disorders among youth in Canada during the pandemic and to identify effective interventions that can address these issues.

Keywords: COVID-19; pandemic; youth; mental health; mental disorder; hospitalization

Introduction

Mental health disorders are characterized by a clinically significant behavioral or psychological syndrome or pattern that occurs in an individual [1]. Mental illnesses have been prevalent in Canada for decades; in 2015, one in seven Canadians used a mental health service annually [2]. Although Canada has a publicly funded health care system, only 6% of total health funding is allocated to mental health care [3]. Barriers to accessing mental health services across Canada include long wait times, culture and language barriers, inaccessibility in remote and rural residential areas, and cost of services not covered by private insurance plans, such as multiple ongoing therapy sessions surpassing

the annual coverage value [4]. Mental health in youth has been a longstanding concern in Canada; from 2011 to 2018, there was a growing need for youth mental health services [5]. Suicide is the second leading cause of death among Canadian children, yet 75% of Canadian children living with mental disorders do not have access to the treatment services that they need [6, 7].

On March 11, 2020, the World Health Organization declared COVID-19 a pandemic [8]. Provinces across Canada put their own restrictions into place, which included banning indoor dining and shopping malls operating at 50% capacity in Ontario, and completely closing non-essential business following the declaration of a public health



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emergency in Quebec [9, 10]. The COVID-19 pandemic and subsequent restrictions disrupted factors associated with social well-being such as safe, structured, and predictable environments in the youth population of Canada [5]. School closures, additional family stress, and related trauma have caused an increase in mental health problems [5]. This is an important issue since mental health problems in the early years of life have been associated with significant family, social, and academic impairment later in life [5]. Multiple studies have found that adolescent emotional problems may have an inverse relationship with future mental well-being and life satisfaction [11, 12]. It should also be noted that the pandemic was accompanied by an increase in virtual healthcare initiatives that allowed many people to access mental health services outside of a hospital setting [13].

This study aims to compare the rate of hospitalizations for mental health disorders in youth across Canada before and during the pandemic, and further to compare the differences in hospitalization rate changes during the pandemic between three regions of Canada. This gives an indication as to which restriction policies in which areas were most effective in supporting youth mental health, and which areas were most negatively impacted by pandemic restrictions. This can reveal which regions in Canada are in the most need of improved mental health services for youth, and whether the pandemic significantly impacted youth mental health. The null hypothesis was that youth hospitalizations for mental health disorders in Canada remained the same between pre- and during-pandemic and therefore the differences between pre- and during-pandemic youth hospitalization rates per region in Canada is the same. The alternative hypothesis was that youth hospitalizations for mental health disorders in Canada did not remain the same between pre- and during-pandemic and that the differences between pre- and during-pandemic rates were not the same between Canadian regions.

Methods

Data was acquired through the Canadian Institute for Health Information (CIHI), a publicly available database. The CIHI obtained this data through the Discharge

Abstract Database and Ontario Mental Health Reporting System from 2019 to 2021 [14]. The rates of youth ages 5 to 24 hospitalized for mental disorders per 100,000 population was sorted by province or territory and by preor during-pandemic times, vielding a total of 26 observations for 13 areas of Canada [14]. The mental disorders included in the data were: organic, substancerelated. schizophrenic, psychotic, mood, anxiety, personality, and eating and feeding disorders [14]. The prepandemic period was defined as the period of time between March of 2019 and March of 2020, before any COVID-19 restrictions were put into place. The during-pandemic period was defined as the period of time after initial restrictions were put into place, depending on the province or territory, ranging until September 30th of 2021. Due to the restricted sample size of 13 provinces and territories, outliers were not removed. Shapiro-Wilk tests were conducted to determine the normality of both the prepandemic and during-pandemic samples. A Wilcoxon Signed Rank test was then conducted to compare the median pre-pandemic and during-pandemic hospitalization rates for all of Canada. The data was sorted into three regions of Canada for further analysis. The regions were described as Eastern provinces, Western provinces, and Northern Territories. Eastern provinces were defined as Ontario, Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador. Western provinces were defined as British Columbia, Alberta, Saskatchewan, and Manitoba. The Northern Territories are Yukon, Nunavut, and the Northwest Territories. A Shapiro-Wilk test was conducted to determine the normality of the differences in pre-pandemic and duringpandemic rates for each region. The non-parametric Kruskal-Wallis Test was conducted due to the low number of observations to compare the differences in pre-pandemic and during-pandemic rates between the Eastern provinces, Western provinces, and Northern Territories. Outliers were not removed before analysis due to a restricted sample size of only 13 provinces and territories. A p-value of 0.05 was set as significant with a 95% confidence interval for all statistical tests. All statistical testing was conducted using R Studio.

Results

Province	Pre-Pandemic (rate per 100 000)	During-Pandemic (rate per 100 000)
Newfoundland	460	401
Prince Edward Island	733	569
Nova Scotia	342	298
New Brunswick	562	557
Quebec	378	335
Ontario	461	424
Manitoba	359	324
Saskatchewan	635	520
Alberta	462	449
British Columbia	531	501
Yukon	830	720
Northwest Territories	1305	1192
Nunavut	942	836

Table 1. Rates per 100 000 youth hospitalizations for mental health disorders in Canada per province and territory prior to the pandemic (2019-2020) and during the pandemic (2020-2021)

Note: Data was retrieved from the CIHI database.

Table 2. Differences and percent differences in pre- and during-pandemic rates of youth hospitalizations for mental health disorders per 100 000 in Canadian provinces and territories divided in their respective regions

Region	Provinces	Differences (rate per 100 000)*	Percent Differences (%)
Western Region	Alberta	13	2.81
	British Columbia	30	5.65
	Manitoba	35	9.75
	Saskatchewan	115	18.11
Eastern Region	Newfoundland	59	12.83
	Prince Edward Island	164	22.37
	Nova Scotia	44	12.87
	New Brunswick	5	0.89
	Quebec	43	11.38
	Ontario	37	8.03
Northern Territories	Yukon	110	13.25
	Northwest Territories	113	8.66
	Nunavut	106	11.25

Note: Differences were calculated based on data of Table 1, retrieved from the CIHI database.

 Table 3. Average percent differences between western, eastern, and northern territories

Region	Average Percent Differences (%)
Western Region	12.11
Eastern Region	11.16
Northern Territories	11.05

Note: Differences were calculated based on data of Table 2.

The rates of youth mental disorder hospitalizations per 100,000 people before and during the pandemic are shown in <u>Table 1</u>. Figure 1 depicts the changes in hospitalizations before and during the pandemic for each province and territory, showing that rates decreased in all regions. To

compare pre-pandemic and during-pandemic for all provinces and territories across Canada, a Shapiro-Wilk Normality test was conducted for pre- and during-pandemic data, showing that the samples were not normally distributed (p = 0.03876 and p = 0.0259, respectively).

Thus, the non-parametric Wilcoxon Signed Rank Test was conducted and found that the differences in hospitalizations pre- and during-pandemic was statistically significant (p<0.001). This is visualized in Figure 2 depicting a

statistically significant decrease in overall hospitalizations during pandemic. Additionally, the confidence interval does not include 0 (35.0-103.5), supporting the statistically significant result.



Figure 1. Bar graph depicting the rates of hospitalizations due to mental health disorders in youth pre-pandemic and during the pandemic. Produced using Microsoft Excel.



Figure 2. Boxplot depicting the median, interquartile range (IQR), maximum and minimum adjacent values, and outliers for pre-pandemic and during-pandemic rates of youth mental disorder hospitalizations per 100,000 in all of Canada. Outliers were kept due to limited observations and to take all Canadian provinces' hospitalization data into account. Produced using R Studio.

The differences between the three regions (Eastern Provinces, Western Provinces, and Northern Territories) are shown in <u>Table 3</u>. Figure 3 depicts the rates of hospitalization pre- and post-pandemic, showing a decrease during the pandemic. The Shapiro-Wilk normality test comparing the change in rates from pre- to during-pandemic between the three regions found that data was normally distributed (p=0.1576). Due to the small number

of observations, a Kruskal-Wallis Test was conducted, and found that the differences between groups were not statistically significant (p=0.2682). The differences between pre and post pandemic rates are shown in <u>Table 2</u>. Output from the Wilcoxon Signed Rank Test and Kruskal-Wallis Rank Sum Test performed in R Studio are included in the <u>Appendix</u>.



Figure 3. Bar graph showing the average percent differences between pre- and during-pandemic rates of youth hospitalizations for mental health disorders per 100,000 in Western Canada, Eastern Canada, and Northern Territories. Outliers were kept due to limited observations and to take all Canadian provinces' hospitalization data into account. Produced using Microsoft Excel.

Discussion

The Northwest Territories had the highest rate per 100,000 of youth hospitalizations before and during the pandemic compared with all the provinces in Canada, despite its relatively small population, as seen in <u>Table 1</u> [14]. Interestingly, Ontario, one of the most populated provinces of Canada, had nearly the same rates of hospitalizations as Alberta, while Quebec had a similar rate of hospitalizations to British Columbia [15].

Across all regions of Canada, there was a statistically significant decrease in hospitalizations during the pandemic. One possible reason for this decrease is that fear of attending hospitals was exacerbated by the COVID-19 pandemic [16]. During the pandemic, some members of the general public developed a fear of contracting COVID-19 which led to the avoidance of emergency departments [16]. In general, emergency department visits for children and youth declined during the pandemic, which could be due to less schoolrelated accidents and illness, supporting the idea that the decline in hospitalizations observed may be a result of fear of hospitals [17]. Thus, while hospitalization rates of mental health disorders decreased during the pandemic, it should not be inferred that instances of mental health disorders decreased in the same way. While this study aims to understand the impact of the COVID-19 pandemic on youth hospitalizations across Canada, certain limitations should be acknowledged. Limiting factors that might have been present in this correlation are the fact that data on rates of hospitalizations of youth do not take into account more than 1 hospitalization per child. This could have led to inaccuracies in the actual rate of hospitalizations per province. Another barrier was the lack of comprehensive data in certain provinces, restricting the depth of our analysis and limiting the ability to perform betweenprovince comparisons. In addition, race, socioeconomic status and other demographics or factors other than geographic location were not considered. Furthermore, as the pandemic is

still ongoing at the time of this paper, trends and rates of hospitalizations are subject to change due to the evolving nature of the crisis.

The results of the Kruskal-Wallis Test showed that the differences in hospitalizations before and during the pandemic per 100,000 children and youth between the Western Region, Eastern Region and the Northern Territories was not statistically significant. This indicates that, despite different provincial and territorial responses and interventions to the COVID-19 pandemic, the decrease in hospitalizations of youth pre-pandemic and duringpandemic was not significantly different between provinces and territories of Canada. These interventions included different approaches to quarantine, self-isolation and masking policies, contact tracing, and economic support programs [18]. The first wave of COVID-19 in 2020 mostly impacted Quebec and Ontario, which were quick to implement COVID-19 travel restrictions, employment insurance, and health care funding [19]. Northern Territories had little to no COVID-19 provincial restrictions in the beginning of the pandemic, due to their few COVID-19 cases [19]. This discrepancy in COVID-19 responses per province is a result of Canada's decentralized government that puts all of healthcare under provincial governance, where provinces enact policies depending on local context [19]. According to the findings of this study, individual provincial responses to the pandemic resulted in similar rates of youth hospitalization due to mental disorders throughout Canada.

Knowing that there are more youth hospitalizations for mental health disorders in Northern Territories could incentivize a greater investment in the increase of mental health services in that region and a greater emphasis on the creation of mental health awareness programs. This could increase children's access to mental health services and mental health education, which might decrease their

hospitalization rates due to mental disorders. Future research should focus on identifying causes for the increase in hospitalizations in Northern Territories and comparing intervention initiatives for effectiveness in resolving this discrepancy.

This analysis may not accurately represent the proportion of youth who experienced mental health crises during the COVID-19 pandemic. The pandemic caused an increase in fear of contracting COVID-19, which may have prevented people from seeking medical assistance in a primary care setting [20]. Additionally, nurse and physician shortages in hospitals forced many institutions to temporarily close their emergency departments [13]. This indicates that the number of hospitalizations recorded may not reflect the total number of youth who developed mental health issues during the pandemic. Though hospitalizations for mental health disorders decreased, it is unclear whether the prevalence of mental health issues in youth decreased during the pandemic or if these youth were just less inclined to attend a hospital [16].

It should also be noted that the prevalence of online resources for mental health care increased significantly during the pandemic. In response to the COVID-19 pandemic, many mental health services that previously did not provide virtual care implemented new online programs [21]. Programs include telepsychiatry, video-call support groups, hotlines, and distribution of digital mental health care resources [21]. Research into online mental health programs has shown their success in increasing attendance at appointments and improving mental health outcomes [22, 23]. Increasing online access to mental health care may have decreased the demand for hospital visits due to mental health disorders by improving health outcomes and allowing youth to access mental health care without attending a hospital. It can be hypothesized that this could have contributed to the decrease in hospitalizations observed by increasing access to preemptive intervention to treat mental health conditions without hospitalization.

Outliers were not removed before analysis due to a restricted sample size of only 13 provinces and territories. Outliers were kept so that the results most accurately represented the entirety of Canada. It is likely that access to mental health supports, food, schooling, and social interaction differed between provinces and territories, which may have had major impacts on youth mental health [24]. Removing outlier values in this data would neglect to recognize the diversity of youth mental health across all of Canada.

The definitions of pre-pandemic and during-pandemic might have also been flawed. COVID-19 restrictions were mandated under provincial law and varied by province and territory [25]. Not all regions put restrictions into place at the beginning of March of 2020, and thus the study definition of the during-pandemic period may not be accurate for all regions [26]. Furthermore, the data analyzed in this study is gathered from the limited timeframe of 2019 to 2021. This 3-year timeframe does not represent the

extent of pre-pandemic and during-pandemic Canada, since the effects of COVID-19 are still ongoing [27].

Future studies should focus on identifying how varying COVID-19 restriction policies per province and territories change the prevalence of mental disorders in youth. This can be conducted on data other than the hospitalization rates used in this study, since this data may be an underrepresentation of the actual prevalence of youth mental health disorders. Additionally, future research should focus on why hospitalization rates decreased and ways to encourage at-risk youth to seek appropriate professional care when needed.

Conclusions

The findings of this study demonstrate the impact of the COVID-19 pandemic on youth mental health in Canada. The results showed a significant decrease in hospitalizations of youth due to mental disorders during the pandemic compared to pre-pandemic rates per 100,000 people. The Wilcoxon Signed Rank Test was used to compare the pre-pandemic and during-pandemic rates. The results, supported by the confidence interval not including 0 (35.0-103.5), suggest that the decrease was significant. Therefore, the null hypothesis that there was no significant difference in hospitalization rates pre- and during-pandemic was rejected, since youth hospitalization rates pre and during the pandemic did not remain the same. The analysis of differences between Eastern, Western, and Northern Canada showed no statistically significant differences in hospitalization rates between pre-pandemic and duringpandemic periods between the regions. Therefore, statistical analysis failed to reject the null hypothesis that the differences in youth hospitalization rates between pre- and during-pandemic per region in Canada were not statistically different from one another. This suggests that the impact of the pandemic on mental health hospitalizations was similar across all of Canada. Overall, the findings of this study emphasize the importance of continued monitoring and research into the long-term impacts of the pandemic on access to resources for youth mental health.

List of Abbreviations Used

CIHI: Canadian institute for health information COVID-19: coronavirus disease of 2019

Conflicts of Interest

The authors declare that they have no conflict of interests.

Ethics Approval and/or Participant Consent

This study did not require ethics approval as no human participants or identifying information were used. All data used is publicly available.

Authors' Contributions

BRM: made contribution to the study design, discussion, and conclusions of the study and was responsible for the statistical analysis, aided in data visualization, assisted in drafting the poster and manuscript and gave approval of the final version to be published.

JT: made contributions to the study design, sorted data for relevance, created data visualizations, aided in data analysis, drafting the poster and manuscript and gave approval of the final version to be published.

CLJ: made contributions to the study design, literature searching, helped to sort and interpret data, assisted in drafting the poster and manuscript and gave approval of the final version to be published.

TZ: made contribution to the study design, helped to sort and interpret data, assisted in drafting the poster and manuscript and gave approval of the final version to be published.

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