Canadian Nursing Workforce Analysis

DATA 604 Project report
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INTRODUCTION

Nurses undeniably constitute the bedrock of the healthcare system, assuming a multifaceted role that spans health advocacy, patient and public education on preventive measures, active participation in care and recovery, rehabilitation facilitation, and the provision of essential support. In a landscape where no other healthcare professional boasts such a comprehensive and far-reaching impact, the criticality of the nursing profession is underscored by projections indicating that Canada will face a staggering demand for 117,600 additional nurses by the year 2030 (Scheffler and Arnold, 2018). Compounding this challenge is the demographic reality that one-third of registered nurses directly involved in patient care are aged 50 or above, on the precipice of retirement, as evidenced by data from 2020 (Registered Nurses' Association of Ontario, 2021).

Findings from a 2019 survey conducted by the CFNU in collaboration with researchers from the University of Regina paint a concerning picture of the state of healthcare in Canada. A resounding 73% of nurses reported that their institutions frequently operated beyond capacity, while an overwhelming 83% expressed the belief that the core healthcare staff within their institutions was insufficient to adequately address patient needs (Stelnicki et al., 2020). This pre-existing strain on Canada's healthcare system was further exacerbated when the COVID-19 pandemic struck, magnifying the challenges and underscoring the urgent need for a comprehensive examination of the supply and demand dynamics within the nursing profession.

The palpable shortage of nurses is not a mere statistical concern; it manifests tangibly in the working conditions of these healthcare professionals. Escalating workloads steadily erode the capacity of nurses to deliver the quality of care they aspire to provide for their patients, leading to a profound psychological burden. As this healthcare challenge continues to burgeon in Canada, our investigation delves into a nuanced exploration of the intricacies surrounding the supply and demand dynamics within the nursing profession, seeking to unravel the complexities of this pressing issue.

This project report encompasses a thorough investigation into the nursing workforce dynamics in Canada.

1. **Workforce Planning Strategy:** The primary objective of this project is to conduct an extensive evaluation of staffing requirements. The aim is to ensure that the Canadian healthcare system is adequately equipped with the appropriate number of skilled nursing professionals, contributing to effective workforce planning.

2. **Prioritizing Patient Safety:** Addressing the potential repercussions of understaffing, particularly in terms of medical errors and adverse patient outcomes, this initiative will explore the relationship between nursing workforce levels and patient safety. The goal is to proactively identify and prevent avoidable incidents through informed workforce management.

3. **Enhancing Resource Allocation:** Our focus will extend to optimizing the allocation of nursing staff. By aligning the skills and expertise of nurses with the specific demands of healthcare units and shifts, we aim to improve resource utilization and overall operational efficiency. This strategic approach to resource allocation will be a key component of our project report.

DATASETS

The datasets encompass a wealth of information spanning supply, workforce, demographic characteristics, education, and employment trends within Canada's nursing workforce.
Source of every dataset used: "Canadian Institute for Health Information. Nursing in Canada, 2022" uses data from CIHI's Health Workforce Database provided by provincial and territorial regulatory bodies. Freely usable and reproducible for education (CIHI, 2023)
Time-Span: 2013 to 2022

Details of Datasets:
Table 1: Supply of regulated nurses, by type of professional and jurisdiction, provinces/territories with available data, 2013–2022.

- Key features of interest: Year, Jurisdiction, Type of professional, Supply: number of nurses
- Supply refers to all registrants who were eligible to practice in the given year (including those employed and those not employed at the time of registration).
- Dataset size: 45 columns * 465 rows

Table 2: Workforce of regulated nurses, by type of professional and jurisdiction, provinces/territories with available data, 2013–2022.

- Key features of interest: Year, Jurisdiction, Type of professional, Workforce: number of nurses
- Workforce refers to only those registrants who were employed in the profession at the time of annual registration, including those on leave who submit an active practicing registration.
- Dataset size: 25 columns * 465 rows

Table 3: Regulated nursing workforce employed in direct care, by health region and jurisdiction, provinces/territories with available data, 2013–2022.

- Key features of interest after transforming specific column data to row data: Province/territory, Health Region, Type of professional, Year, Number of nurses in direct care
- The term employed in direct care refers to only those registrants who provide services directly to clients. Examples: medicine/surgery, psychiatry/ mental health, paediatrics, maternity/newborn, geriatric/long-term care, critical care, community health, ambulatory care, home care, occupational health, operating room/ recovery room, emergency care, several clinical areas, oncology, rehabilitation, public health, telehealth, and other areas of direct service.
- Dataset size: 84 columns * 114 rows

Table 4: Population estimates, by peer group, health region code and name, and jurisdiction, Canada, 2013 to 2021

- Key features of interest: after transforming specific column data to row data: Province/territory, Region name, Year, Population
- To facilitate comparisons among health regions, Statistics Canada developed a methodology that groups health regions with similar socio-economic and socio-demographic characteristics; these are referred to as peer groups.
- Dataset size: 13 columns * 114 rows

Table 5: Number of return-to-practice regulated nurses,* by type of professional and jurisdiction, provinces/territories with available data, 2020–2022.

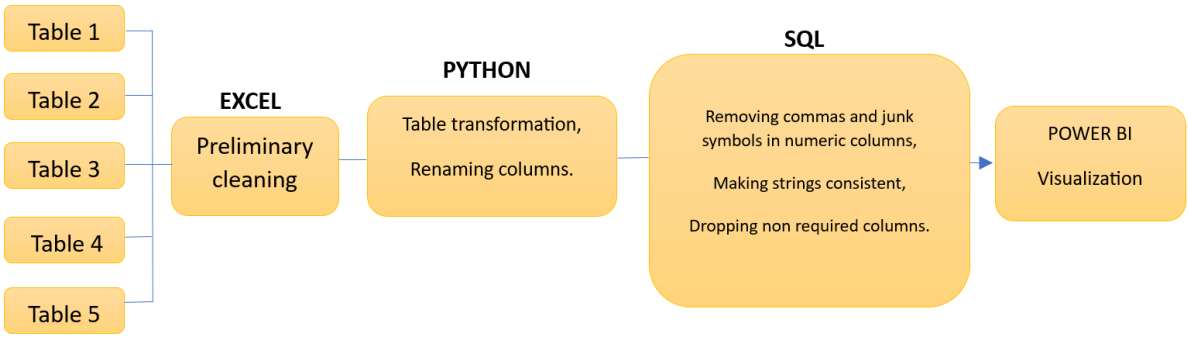
- Key features of interest: year, jurisdiction, type of professional, and number of nurses.
- Dataset size: 4 columns * 111 rows

Regulated Nursing professionals in Canada:

There are 4 groups of regulated nursing professionals in Canada:

1. **Nurse practitioners (NPs):** practice nurses
2. **Registered nurses (RNs):** health care professionals, RNs deliver direct health care services to those at all stages of life and in all situations of health, illness, injury and disability; they also coordinate care and support clients in managing their own health.
3. **Registered psychiatric nurses (RPNs):** health care professionals, RPNs focus on mental and developmental health, mental illness and addictions, while integrating physical health and utilizing bio-psycho-social and spiritual models for a holistic approach to care.
4. **Licensed practical nurses (LPNs):** health care professionals, LPNs assess clients and work in health promotion and illness prevention. They assess, plan, implement and evaluate care for clients.

PROCESS



DATA CLEANING

In the initial stages of data preparation, Excel was employed for preliminary cleaning tasks. Subsequently, pandas was utilized to transform tables, rename columns, and ensure consistency in strings. To refine the numeric columns, SQL was employed to remove commas and extraneous symbols. Additionally, non-essential columns were dropped using SQL, resulting in a streamlined and cleaned dataset for further analysis.

Preliminary Cleaning Using Excel:

- Removed duplicate entries.
- Corrected the formatting inconsistencies.
- Standardized date formats.

Transformed Tables Using Pandas:

- Performed transformations such as reshaping the data to meet analysis requirements.

Dropped Non-Required Columns Using SQL:

- Wrote SQL queries to drop unnecessary columns using the DROP COLUMN statement.
- Ensured that dropping columns did not impact the overall integrity of the dataset for analysis.

Removed Commas and Junk Symbols in Numeric Columns Using SQL:

- Wrote SQL queries to replace the columns with numeric data containing commas or junk symbols using the REPLACE() function to eliminate unwanted symbols from numeric columns.

Made Strings Consistent Using SQL:

- Utilized SQL functions like LOWER(), UPPER(), or INITCAP() to standardize string formats that lacked consistency..

DATA EXPLORATION

1. Workforce to Supply Analysis - SRINANDHINI

The objective of this analysis is to examine the trends in the workforce-to-supply ratio across various health regions and jurisdictions in Canada spanning the years 2013 to 2021. The datasets employed for this exploration include Table 1, focusing on the supply of regulated nurses, and Table 2, detailing the workforce of regulated nurses, both categorized by the type of professional and jurisdiction within provinces/territories with available data during the period from 2013 to 2022.

To facilitate a comprehensive analysis, the datasets from Table 1 and Table 2 have been meticulously cleaned and subsequently joined. This integration is achieved through key parameters such as "Year," "Jurisdiction," and "Type of Professional," ensuring a cohesive dataset that captures both the supply and workforce aspects of the nursing profession.

To present the findings in a visually intuitive manner, the integrated dataset was connected with POWER BI, a powerful business intelligence tool. Leveraging the capabilities of POWER BI, a dynamic and insightful dashboard was crafted. This dashboard serves as a visual representation of the trends in the workforce-to-supply ratio across health regions and jurisdictions from 2013 to 2021. It provides a user-friendly interface, allowing stakeholders to interact with and glean valuable insights from the data effortlessly.

FINDINGS:

Analysis was done based on two perspectives:

1) Based on Jurisdiction
2) Based on Year

BASED ON JURISDICTION - KEY QUESTION 1.1:

What variations exist in the nurse-to-supply ratio across different jurisdictions? Which regions exhibit a favorable nurse-to-supply ratio, indicating an adequate workforce, and which regions have the lowest ratios, suggesting a potential shortage?

Analyzing nurse-to-supply workforce ratios informs efficient healthcare planning, resource allocation, and policy development. Regions with an optimal ratio ensure quality care, while those with a minimal ratio may require targeted interventions to address workforce shortages, particularly during health crises. This analysis aids in enhancing overall healthcare system preparedness and effectiveness.

BASED ON JURISDICTION - KEY QUESTION 1.2:

How does the experience distribution of nurses vary across different provinces and what insights can be gained from the detailed breakdown of experience groups, including those experience from 0 to 10 years, 11 to 20 years, 21 to 30 years and above 31 years?

Analyzing the experience distribution of nurses across provinces, particularly in distinct experience groups, informs strategic workforce planning, facilitates targeted resource allocation, and aids policymakers in tailoring interventions to address the unique needs of different career stages. This nuanced approach ensures a balanced and sustainable nursing workforce, impacting the overall quality of patient care.

Both guiding questions were answered by the following SQL query.

SQL QUERY :

```
with ct1 as (
select t1.Jurisdiction,t1.`Type of professional`,
sum(t1.Supply_number_of_nurses) as total_supply_nurses,
sum(t2.`Workforce_ number_of_nurses`) as total_workforce_nurses,
sum(t1.Supply_years_since_graduation_0_to_10) as y_supply_0_to_10,
sum(t1.Supply_years_since_graduation_11_to_20) as y_supply_11_to_20,
sum(t1.Supply_years_since_graduation_21_to_30) as y_supply_21_to_30,
sum(t1.Supply_years_since_graduation_31_and_more) as y_supply_31_and_more,
sum(t1.Supply_years_since_graduation_not_stated) as y_supply_notstated
from
table1 t1
join
table2 t2
on t1.Year = t2.Year and t1.Jurisdiction = t2.Jurisdiction
group by t1.Jurisdiction,t1.`Type of professional`)

select ct1.Jurisdiction,
ct1.`Type of professional`,
ct1.total_supply_nurses,
ct1.total_workforce_nurses,
round((ct1.total_workforce_nurses/ct1.total_supply_nurses),2) as workforce_to_supply_ratio,
ct1.y_supply_0_to_10,
ct1.y_supply_11_to_20,
ct1.y_supply_21_to_30,
ct1.y_supply_31_and_more,
ct1.y_supply_notstated,
round((ct1.y_supply_0_to_10/ct1.total_supply_nurses),2) as exp_0_to_10_supply_ratio,
round((ct1.y_supply_11_to_20/ct1.total_supply_nurses),2) as exp_11_to_20_supply_ratio,
round((ct1.y_supply_21_to_30/ct1.total_supply_nurses),2) as exp_21_to_30_supply_ratio,
round((ct1.y_supply_31_and_more/ct1.total_supply_nurses),2) as exp_31_to_more_supply_ratio,
round((ct1.y_supply_notstated/ct1.total_supply_nurses),2) as exp_notstated_supply_ratio
from ct1
```

VISUALISATON:

POWER BI has been linked to SQL Workbench to construct a dashboard using the results obtained from the preceding query.

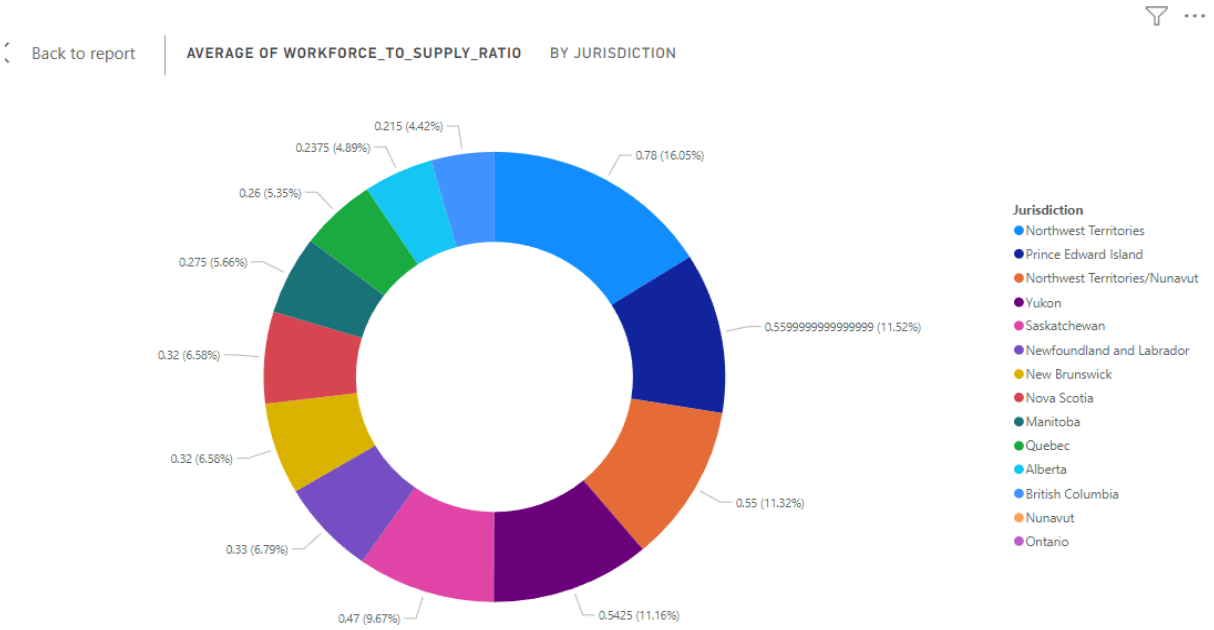


Figure 1.1: Average of Workforce to Supply ratio – Jurisdiction wise

The donut chart highlights a significant presence of Northwest Territories, Prince Edward Island, Nunavut, and Yukon, occupying a substantial portion. Conversely, Alberta, British Columbia, and Ontario exhibit a comparatively lower ratio. It is crucial for these regions to intensify efforts in maintaining an optimal workforce-to-supply ratio, especially for handling medical emergencies. Given their significance in Canada, special attention is warranted for these three regions. On the other hand, New Brunswick, Nova Scotia, and Manitoba maintain a moderate workforce-to-supply ratio.

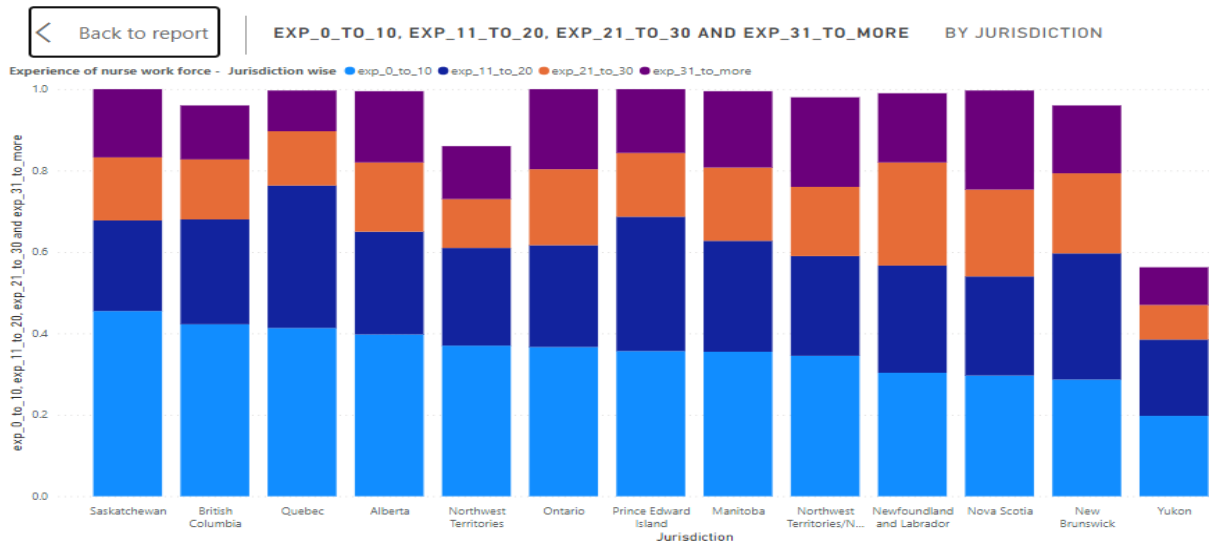


Figure 1.2: Nurse workforce experience distribution – Jurisdiction wise

The distribution of the nurse workforce across provinces is depicted in the stacked bar chart, revealing a consistent trend. Generally, each province exhibits a higher ratio of less experienced nurses with less than 10 years of experience, followed by nurses with 11-20 years of experience, 21-30 years

of experience, and the smallest segment representing the most experienced nurses. A noteworthy exception is observed in Nova Scotia, where all experience levels have equal workforce ratios.

BASED ON YEAR – KEY GUIDING QUESTION 1.3

What variations exist in the nurse-to-supply ratio across over years? Which year exhibit a favorable nurse-to-supply ratio, indicating an adequate workforce, and which year have the lowest ratios, suggesting a potential shortage?

Monitoring nurse-to-supply ratio variations over the years is crucial for healthcare planning. Identifying years with favorable ratios ensures an adequate workforce, while recognizing low ratios signals potential shortages, prompting proactive measures to maintain a balanced and effective healthcare system.

BASED ON YEAR - KEY QUESTION 1.4:

How does the distribution of nurses across different work types change over the years, and what insights can be derived from the detailed breakdown of the contributions of part-time and full-time nurses to the overall nurse workforce?

Both guiding questions were answered by the following SQL query.

SQL QUERY:

```
with ct1 as (
select t1.Year,t1.`Type of professional`,
sum(t1.Supply_number_of_nurses) as total_supply_nurses,
sum(t2.`Workforce_ number_of_nurses`) as total_workforce_nurses,
sum(t2.`Workforce_ employed_full time`) as y_workforce_employed_fulltime,
sum(t2.`Workforce_ employed_part_time`) as y_workforce_employed_parttime,

from table1 t1
join table2 t2
on t1.Year = t2.Year
and t1.Jurisdiction = t2.Jurisdiction
group by t1.Year,t1.`Type of professional`
)

select ct1.Year,
ct1.`Type of professional`,
ct1.total_supply_nurses,
ct1.total_workforce_nurses,
round((ct1.total_workforce_nurses/ct1.total_supply_nurses),2) as workforce_to_supply_ratio,
ct1.y_workforce_employed_fulltime,
ct1.y_workforce_employed_parttime,
round((ct1.y_workforce_employed_fulltime/ct1.total_workforce_nurses),2) as
workforce_fulltime_to_total_workforce_ratio,
round((ct1.y_workforce_employed_parttime/ct1.total_workforce_nurses),2) as
workforce_parttime_to_total_workforce_ratio

from ct1
```

VISUALISATON:

POWER BI has been linked to SQL Workbench to construct a dashboard using the results obtained from the preceding query.

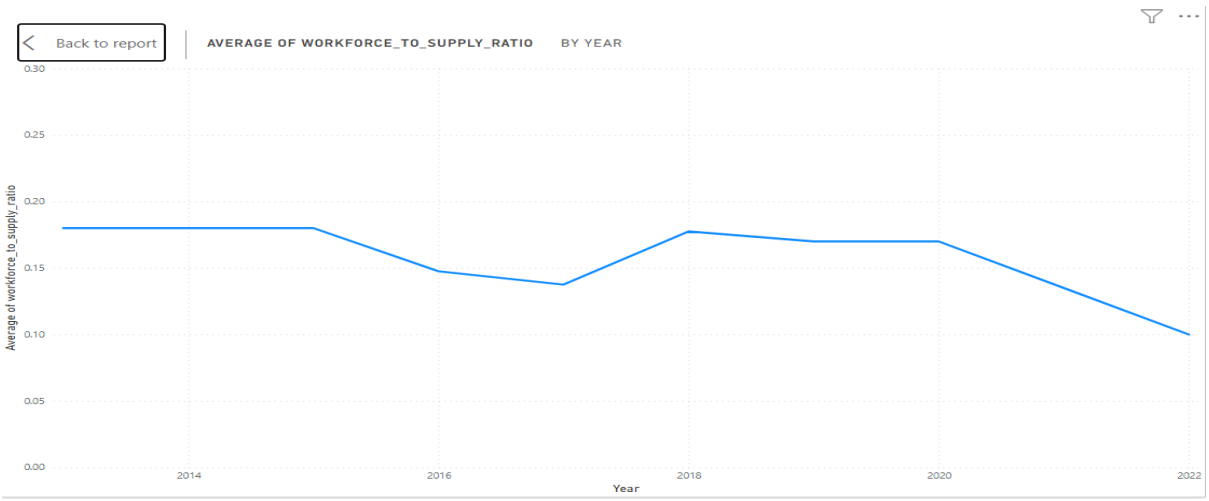


Figure 1.3: Average of Workforce to Supply ratio –Year wise

This line graph illustrates the trend in the average workforce-to-supply ratio of nurses across Canada from 2013 to 2022. The ratio remained consistent from 2013 to 2015 but experienced a slight decline in 2016, persisting until 2017. Subsequently, there was an increase in the ratio, maintaining stability until 2020. However, post-2020, a sudden decrease indicates a crisis in the nursing workforce, possibly attributed to the implementation of stringent policies in the nursing sector.

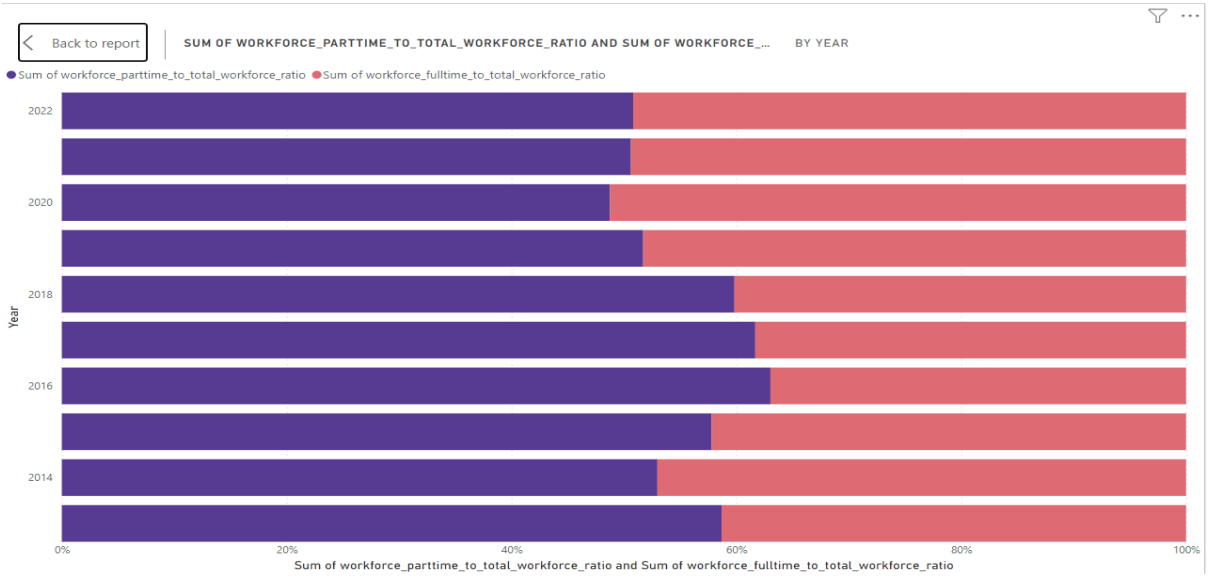


Figure 1.4: Work type distribution –Year wise

Upon detailed examination presented in a horizontal stacked bar chart depicting worktypes, a consistent trend emerges: part-time nurses consistently range between 40% to 50%, and full-time nurses account for 40% to 50% of the total workforce across all professions. However, this pattern shifts over time. In 2016, 2017, and 2018, part-time nurses exceed full-time nurses, whereas in 2014,

2021, and 2022, both part-time and full-time nurses contribute equally to the workforce. This pattern may be influenced by various factors such as recruitment trends within the nursing profession.

DASHBOARD:

The integration of POWER BI with SQL Workbench facilitated the creation of an interactive dashboard, depicted below, featuring the four previously described charts.

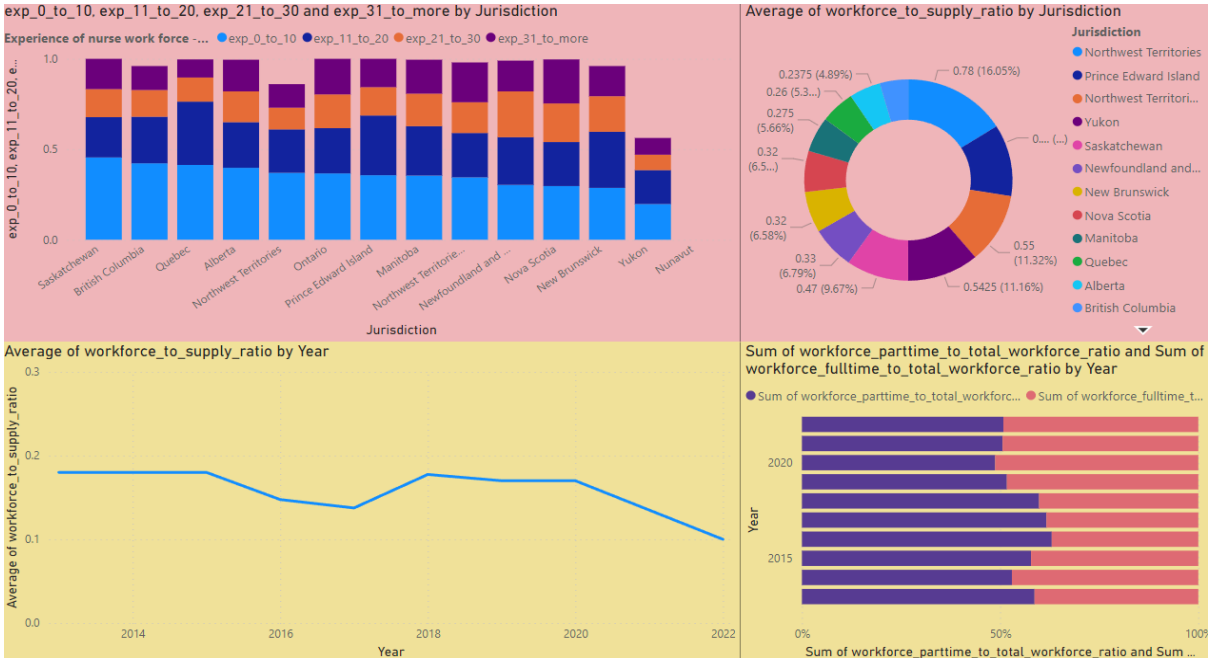


Figure:1.5 snapshot of interactive dashboard

2. Nursing Supply Analysis based on Age, Gender and Urban/Rural Distribution - ROCHANA

In undertaking this task, our aim is to comprehensively explore pivotal aspects of the data, focusing specifically on the gender distribution of nurses, gaining insights into the age demographics of the supplied nursing workforce, and closely examining the geographic dispersion of nursing professionals.

When it comes to the Gender Distribution of Nurses, our approach involves a meticulous examination of the data to comprehend how genders are distributed among nurses. The goal is to unveil any noticeable patterns, imbalances, or trends within the gender composition of the nursing profession.

Turning our attention to the Age Demographics of Supply Nurses, our analysis delves into the age composition within the supply nursing workforce. The objective is to identify insights into generational aspects, potential gaps, or shifts in the age distribution among supply nurses.

In the context of the Geographic Distribution of Nursing Workforce, our investigation entails scrutinizing the spatial distribution of nurses across regions, states, or countries. This exploration aims to uncover insights into accessibility, regional disparities, and any geographic factors influencing the composition of the nursing workforce.

The analysis centres on two primary datasets, specifically Table 1 and Table 2. Table 1 offers perspectives on the Supply of regulated nurses, furnishing data on professional type, jurisdiction

within provinces/territories, and demographic details such as age and gender from 2013 to 2022. Concurrently, Table 2 explores the Workforce of regulated nurses, providing information on professional types and jurisdictions within provinces/territories over the same timeframe, incorporating geographical data such as urban and rural distinctions.

KEY QUESTION 2.1:

What is the distribution of regulated nurses based on gender, professional type, and jurisdiction (province) across different years, as reflected in Table 1, and how does it vary from year to year?

Assessing the distribution of male and female nurses by calculating the percentage relative to the total supply offers a rapid overview of gender distribution in the workforce.

SQL QUERY:

```
SELECT
   Year,
   Jurisdiction AS Province,
   `Type of professional`,
   SUM(Supply_sex_female) AS Female_Count,
   SUM(Supply_sex_male) AS Male_Count,
   SUM(Supply_sex_not_stated) AS Not_Stated_Count
FROM
   rochana_ramanathan.table1
GROUP BY
   Year, Jurisdiction, `Type of professional`
ORDER BY
   Year, Jurisdiction, `Type of professional`;
```

VISUALIZATION:

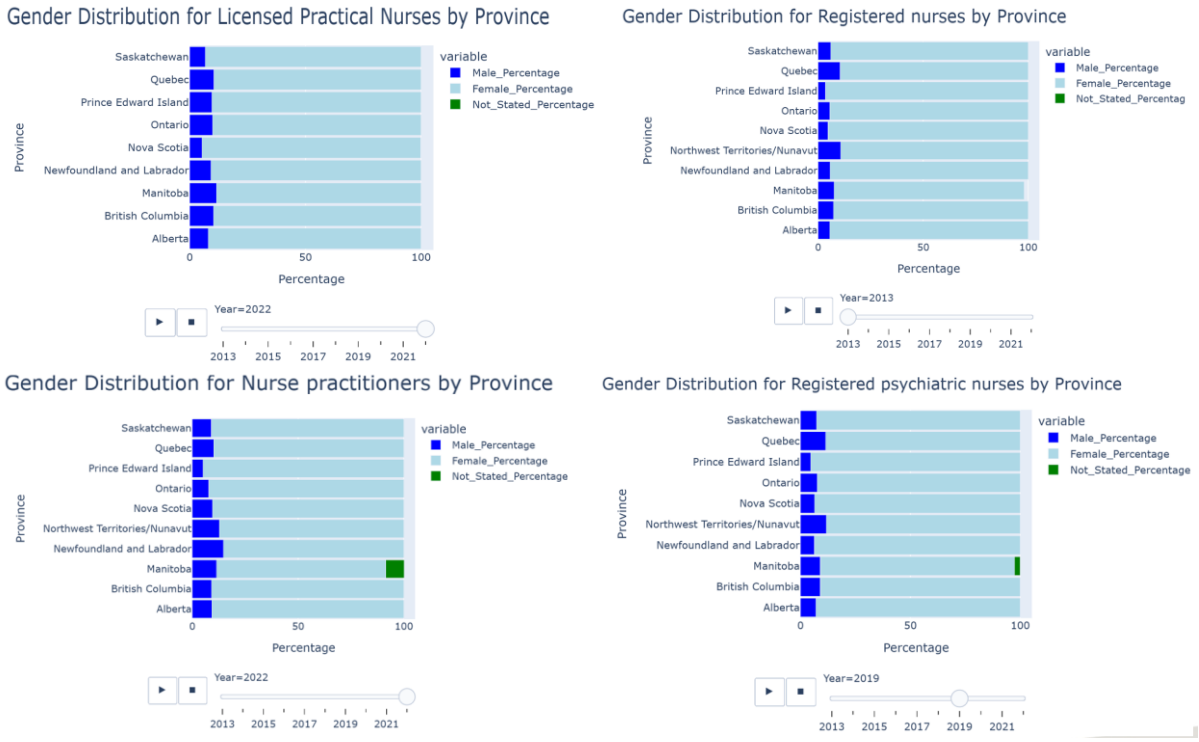


Fig: 2.1 Gender Distribution for four types of professional nurses

In a detailed examination depicted in a bar chart across four professional types, a consistent trend is observed, revealing that the proportion of male nurses consistently falls within the range of 10% to 20%, while females consistently dominate, comprising 80% to 90% of the total in all professions. This pattern may be influenced by various factors such as historical gender norms, societal perceptions, and recruitment trends within the nursing profession. Further research and analysis are warranted to explore the underlying reasons and potential implications of this gender disparity across different professional types within the nursing field.

KEY QUESTION 2.2:

How does the age distribution of nurses vary across different professional types, provinces, and years, and what insights can be gained from the detailed breakdown of age groups, including those younger than 30, between 30 and 59, 60 and above?

Examining the age demographics of nurses in relation to their professional types involves consolidating the count of supply nurses across various age groups to understand the workforce's age distribution.

SQL QUERY:

```
SELECT
   Year,
   Jurisdiction AS Province,
   `Type of professional` AS Professional_Type,
   Supply_number_of_nurses AS number_of_supply_nurses,
   SUM(Supply_age_younger_than_30) AS Age_Less_Than_30,
   SUM(Supply_age_30_to_39 + `Supply_age_40_to_ 49` + `Supply_age_50_to_ 59`) AS
Age_30_to_59,
   SUM(Supply_age_60_to_64 + `Supply_age_65_to_ 69` + Supply_age_70_and_older) AS
Age_60_and_above,
   SUM(`Supply_age _not_stated`) AS Age_Not_Stated
FROM
   rochana_ramanathan.table1
GROUP BY
   Year, Jurisdiction, `Type of professional`
ORDER BY
   Year, Jurisdiction, `Type of professional`;
```

VISUALIZATION:

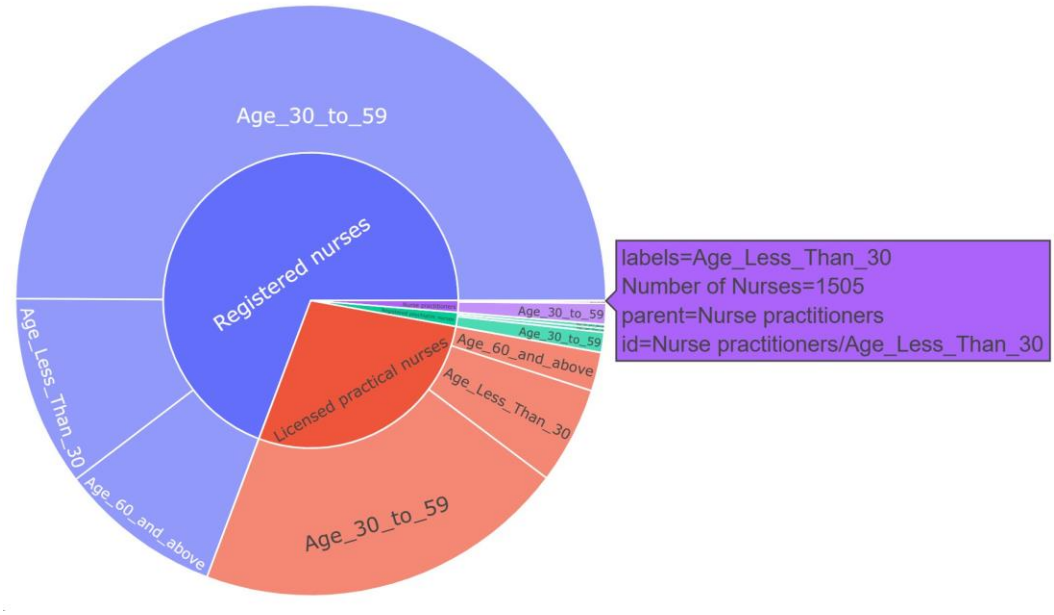


FIG 2.2 Age Distribution of Nurses across different Professional Types

In the sunburst chart, a conspicuous recurring pattern emerges: the prevailing segment within the workforce consists of mid-aged nurses (30-59), with nearly equivalent percentages observed among nurses under 30 and those aged 60 and above. This consistent trend remains consistent across all professional types. Noteworthy is the fact that registered nurses hold the highest numerical presence within this diverse age group, surpassing licensed practical nurses and underscoring their greater numerical representation. Conversely, psychiatric and practitioner nurses exhibit a lower numerical presence, indicating a distinctive pattern within this diverse age context.

KEY QUESTION 2.3:
How does the composition of the nursing workforce vary across the geographical distribution between urban and rural/remote areas?

SQL QUERY:

```
SELECT
   Year,
   Jurisdiction AS Province,
   `Workforce_ number_of_nurses` AS Total_workforce_Nurses,
   `Type of professional` AS Professional_Type,
   `Workforce_ geography_ urban` AS Geo_Urban,
         `Workforce_ geography_ rural/remote` AS Geo_rural_remote,
         `Workforce_ geography_ not stated` AS Geo_not_stated

FROM
   rochana_ramanathan.table2
GROUP BY
   Year, Jurisdiction, `Type of professional`
ORDER BY    Year, Jurisdiction, `Type of professional`;
```

VISUALIZATION:

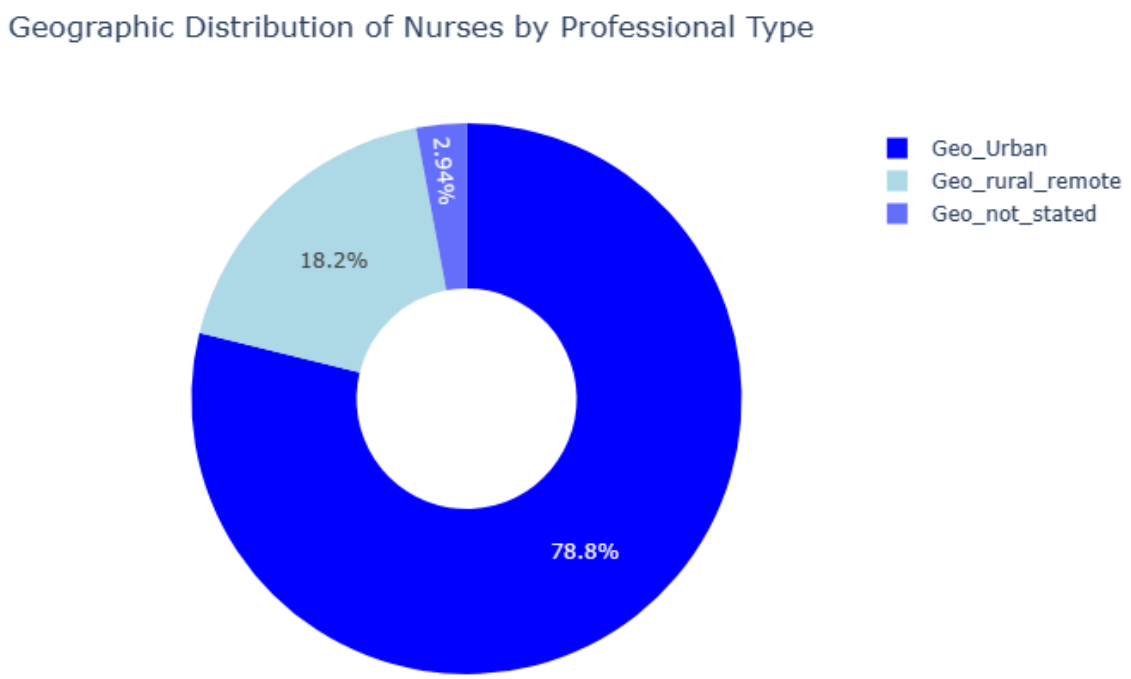


FIG 2.3 Geographic Distribution of Nurses by Professional Type

Displayed in a donut chart, the prominence of the nursing workforce is evident in urban areas, constituting 78.8%, notably surpassing the 18.2% observed in rural settings. Even when considering instances where the data is not stated and assumed as rural, the percentage remains lower than that in urban areas, emphasizing a notable difference in nurse availability between urban and rural settings.

3. Direct Care Workforce per 100,000 population - KARUNAKAR

In the context of direct care, the term "employed in direct care" specifically refers to registrants who offer services directly to clients. For LPs, RNs, and LPNs, the practice areas encompass medicine/surgery, psychiatry/mental health, paediatrics, maternity/newborn, geriatric/long-term care, critical care, community health, ambulatory care, home care, occupational health, operating room/recovery room, emergency care, various clinical areas, oncology, rehabilitation, public health, telehealth, and other direct service sectors.

As for RPNs, their practice areas include medicine/surgery, paediatrics, geriatric/long-term care, crisis/emergency services, occupational health, oncology, rehabilitation, palliative care, children and adolescent services, developmental habilitation /disabilities, addiction services, acute services, forensic services, and other direct service fields.

The aim of this analysis is to determine the ratio of nurses engaged in direct care per 100,000 population, both on a provincial and health region basis, and to investigate the prevailing trend.

In conducting this analysis, we utilized the refined data from both Table 3 (Regulated nursing workforce employed in direct care) and Table 4 (Population estimates). Initially, we integrated these tables by province, year, and region. This integration enabled us to compute the ratio of the direct care workforce per 100,000 population for each health region within the provinces. Subsequently, we employed PowerBI to visualize and present the outcomes.

FINDINGS:

KEY QUESTION 3.1:

Which province exhibits the highest ratio of nurses employed in direct care per 100,000 population? Additionally, what are the corresponding figures for the major provinces?

SQL QUERY:

```
SELECT t3.Year, t3.Province,
ROUND(SUM(t3.nurse_practitioners) / (SUM(t4.Population)/100000),1) AS Ratio_nurse,
ROUND(SUM(t3.registered_nurses) / (SUM(t4.Population)/100000),1) AS Ratio_registered,
ROUND(SUM(t3.registered_psychiatric_nurses) / (SUM(t4.Population)/100000),1) AS
Ratio_psychiatric,
ROUND(SUM(t3.licensed_practical_nurses )/ (SUM(t4.Population)/100000),1) AS Ratio_licensed
FROM table3 t3
JOIN table4 t4 ON t3.Province = t4.Province AND t3.Year = t4.Year AND t3.Region = t4.region
GROUP BY t3.Year,t3.Province;
```

VISUALISATION:

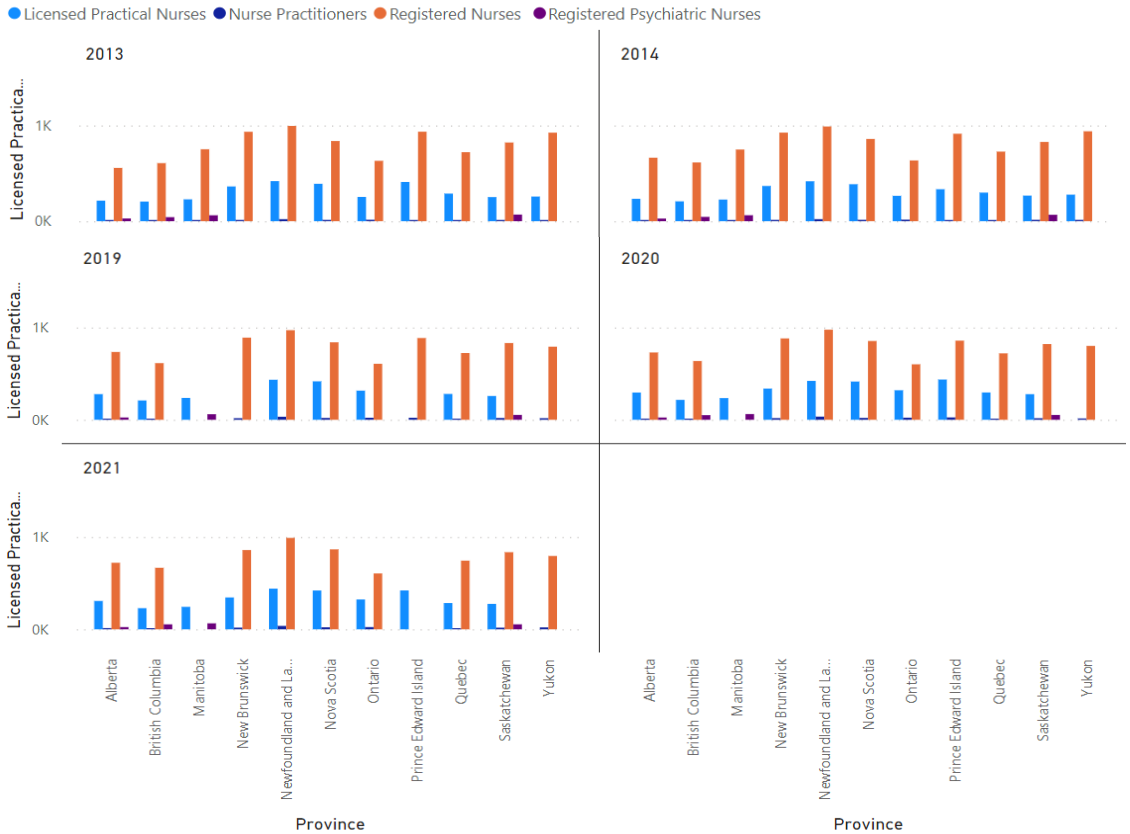


Fig :3.1 Direct care workforce – years and provinces

Registered nurses consistently maintain the highest numerical representation across all provinces annually, followed by licensed practical nurses and psychiatric nurses/practitioners. Newfoundland and Labrador particularly stand out with the highest ratio of registered nurses per 100,000 population, reaching nearly 1000 from 2013 to 2021. Noteworthy is the observation that Alberta, British Columbia, and Ontario consistently maintain a range of 500-700 registered nurses per 100,000 population over the years.

KEY QUESTION 3.2:

In the context of Alberta, which health regions exhibit the highest ratio of nurses in direct care per 100,000 population? Additionally, what noteworthy patterns have been identified?

SQL QUERY:

```
SELECT t3.Year, t3.Province,t3.Region,
ROUND(t3.nurse_practitioners / (t4.Population/100000),1) AS Ratio_nurse,
ROUND(t3.registered_nurses / (t4.Population/100000),1) AS Ratio_registered,
ROUND(t3.registered_psychiatric_nurses / (t4.Population/100000),1) AS Ratio_psychiatric,
ROUND(t3.licensed_practical_nurses / (t4.Population/100000),1) AS Ratio_licensed
FROM table3 t3
JOIN table4 t4 ON t3.Province = t4.Province AND t3.Year = t4.Year AND t3.Region = t4.region;
```

VISUALISATION:

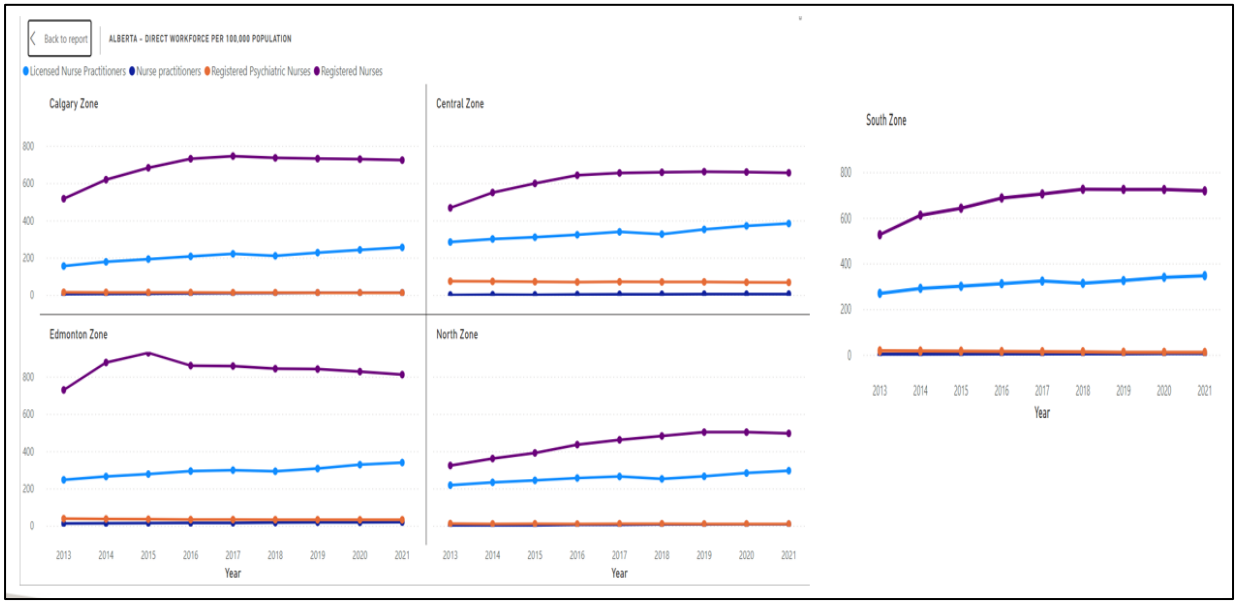


Fig: 3.2 Alberta Health Regions - Direct Workforce per 100,000 population

In our analysis, we observe a distinct prominence of nurses in the Edmonton zone, indicating a concentration of healthcare professionals in this region, with higher numbers compared to other zones. Conversely, the remaining zones demonstrate relatively similar but somewhat lower figures for their respective nursing categories.

Shifting focus to psychiatric nurses, the Central Zone emerges as notable. The data underscores that the Central Zone exhibits a higher concentration of psychiatric nurses per 100,000 population compared to the other zones in Alberta.

4. **Return-to-practice regulated nurses - during COVID, KARUNAKAR**

Starting in 2020, certain professional regulatory bodies issued invitations for inactive health professionals to rejoin the workforce in response to the heightened patient care demands attributed to COVID-19 (CIHI, 2023).

Examining the count of nurses returning to practice during the COVID-19 period will provide insights into the extent of the challenges faced during this pandemic.

For this examination, we utilized Table 1 and Table 5 to determine the percentage of regulated nurses who returned to practice during the COVID-19 period, considering the supply available. We conducted a join of Table 1 and Table 5, aligning the data based on jurisdiction and the specific profession type. This amalgamation facilitated the computation of the percentage of regulated nurses who resumed practice during the COVID period.

To enhance comprehension of the trends, we employed PowerBI to generate visual representations.

FINDINGS:

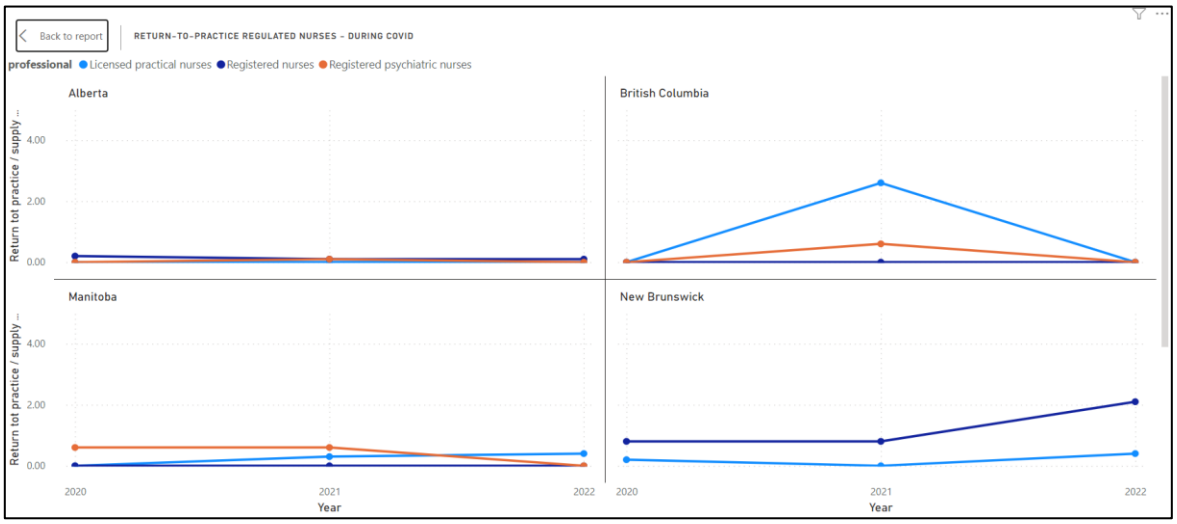
KEY QUESTION 4.1:
Among the available supply, which provinces have demonstrated an uptick in the number of individuals returning to practice in 2021?

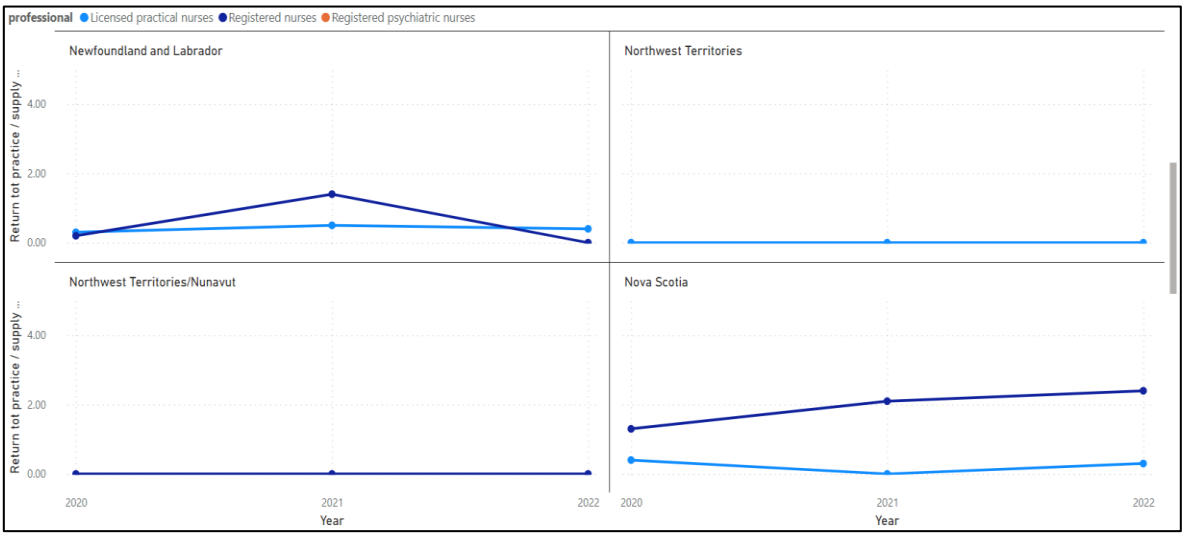
Our focus on the year 2021 stems from the fact that efforts to address the COVID situation began to take effect during this period.

SQL QUERY:

```
SELECT covid.Year, covid.Jurisdiction, covid.professional,
covid.count,supply.supply_count,
ROUND((covid.count/supply.supply_count)*100,1) AS percentage
FROM table5 covid
JOIN table1 supply
ON covid.Year = supply.year AND covid.Jurisdiction = supply.Jurisdiction AND covid.professional =
supply.professional;
```

VISUALISATIONS:





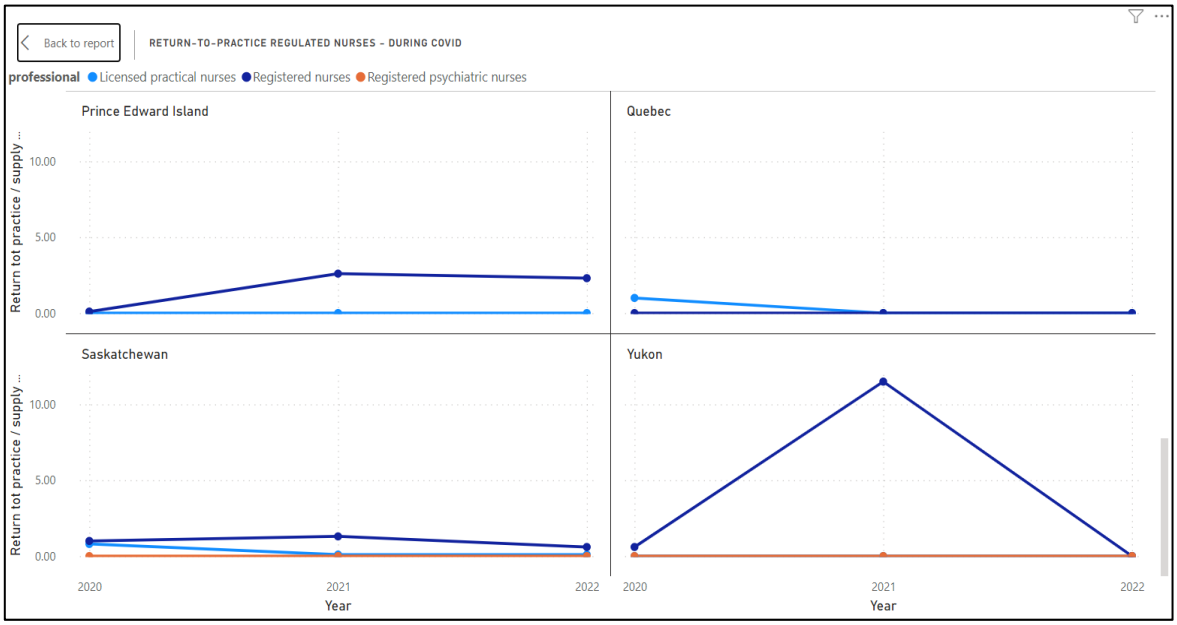


Fig 4.1 Return-to-practice nurses percentage during COVID – province and year

Remarkably, in 2021, significant increases in the percentage of returning nurses were observed in various regions, such as BC, Newfoundland, Nova Scotia, Prince Edward Island, and Yukon, as compared to preceding years. Notably, the trend of returning-to-practice was not notably pronounced among psychiatric nurses.

5. Nursing Workforce Distribution and supply of the Nursing Workforce

We analysed the distribution of the regulated nursing workforce employed in direct care based on place of work, type of professional, and jurisdiction of registration from 2013 to 2022. The analysis gave us insight into where the different nursing workforce were concentrated as well as the shortfalls between supply and retained nursing workforce.

FINDINGS:

KEY QUESTION 5.1:
Which provinces have had the highest Nursing Workforce since 2013 to 2022?

Spanning our analysis over the nine years' period gave us the opportunity to understand the general trend in the distribution of the regulated nursing workforce employed in direct care based on place of work, type of professional, and jurisdiction of registration before COVID and post COVID. However, the visualisation was shown for 2018 to 2022 due to conflicting colours.

SQL QUERY:

```
select
   T3.Year,
   T3.Region AS “Province”,
   T1.Jurisdiction AS 'Jurisdiction of Registration',
   T3.nurse_practitioners,
   T3.registered_nurses,
   T3.registered_psychiatric_nurses,
   T3.licensed_practical_nurses,
   nurse_practitioners + registered_nurses + registered_psychiatric_nurses +
licensed_practical_nurses AS Total_nurses
FROM
   project.table1 T1
 Right JOIN
   project.table3 T3 ON T3.Year = T1.Year
WHERE
   T3.Year = T1.Year and T3. Jurisdiction = T1.Jurisdiction
ORDER BY Total nurses DESC
```

VISUALISATIONS:

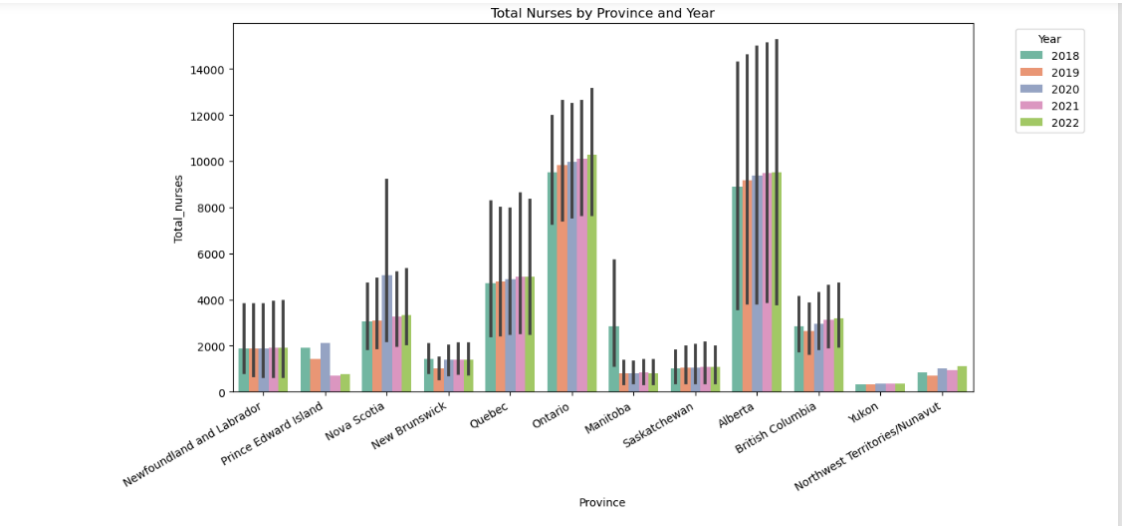


FIG 5.1 Nursing Workforce from 2013 to 2022 by Province

From the visualization, Alberta, Ontario and Quebec have the highest distribution of total regulated Nursing workforce whiles Yukon and Northwest Territories have the least.
There is an upward trend in the distribution of nurses in most provinces especially in Alberta, Ontario and Quebec whiles Manitoba showed a sharp dip from 2019 to 2022. This shows that most nurses did not return as a result of COVID.

KEY QUESTION 5.2:
How does the supply of regulated Nurses compared to the number of nurses retained from 2013 to 2022?
The revealed the shortfalls between total supply and the number of retained nursing workforce.

SQL QUERY:

```
select
        Year,Jurisdiction,supply_number_of_nurses, supply_inflow, supply_outflow, supply_renewal,
   supply_inflow-supply_outflow+supply_renewal AS Net_supply
FROM project.table1;
```

VISUALISATION

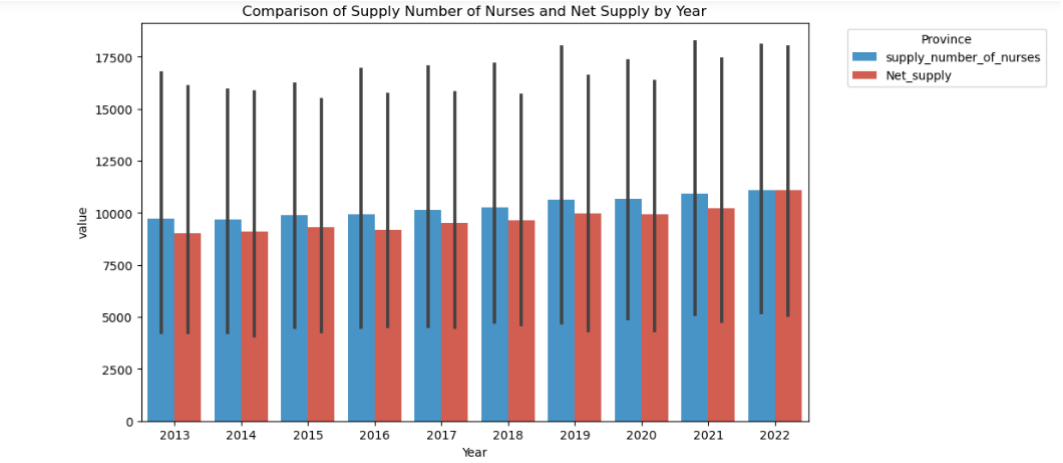


FIG 5.2 Comparison of Supply Number of Nurses and Net Supply by Year

From the Visual above, there is a consistent gap between supply of nurses and those retained from 2013 to 2021. This could be attributed to socio-economic factors such as brain-drain, further studies, early retirement and the like.

CONCLUSION

In summary, our analysis reveals diverse nurse-to-supply ratios across regions, indicating workforce adequacy or potential shortages. Examining experience distribution provides insights into workforce dynamics by detailing nurse composition across different experience levels.

Temporal variations in nurse-to-supply ratios highlight fluctuations, while changes in work type distribution underscore evolving contributions of part-time and full-time nurses. Comprehensive insights into regulated nurses based on gender, professional type, age, and rural/urban areas depict the workforce's diverse composition.

Identifying provinces with the highest nurse-to-population ratios offers valuable benchmarks, especially in Alberta, where health regions with notable patterns can be pinpointed. Lastly, our examination of returning-to-practice trends in 2021 provides key insights into workforce dynamics and areas of growth.

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