Association Between the Availability of Registered Respiratory Therapists and Healthcare Utilization of People with Chronic Obstructive Pulmonary Disease

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Association Between the Availability of Registered Respiratory Therapists and Healthcare Utilization of People with Chronic Obstructive Pulmonary Disease

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Ontario's health care system is committed to "working through integration, coordination, connection, and clinical excellence, to reduce strain on the system which will enable investment in more resources for the care Ontarians need, and, most importantly, to improve health outcomes and overall wellness for all." (Ontario Health, 2020) Aligning right care at the right time in the right place to meet the needs of every Ontarian is a challenge.

Respiratory therapists (RTs) are licensed health care providers in Ontario who have specialized skills, knowledge and ability related to cardiorespiratory health, and chronic and infectious cardiorespiratory diseases affecting health outcomes for neonates, children, and adults across Ontario. They work as integral members of interdisciplinary teams across all practice settings. (Rickards, 2018) (College of Respiratory Therapists of Ontario, 2022) (Please refer to Additional References).

In 2018, the Respiratory Therapy Society of Ontario (RTSO) submitted an Applied Health Research Question (AHRQ) application to ICES (formerly known as the Institute for Clinical Evaluative Sciences) to help identify gaps in care provided by RTs across multiple practice settings across the province to improve health outcomes. By focusing on people with chronic obstructive pulmonary disease (COPD), clinical services provided by RTs could be assessed in relation to the health equity and health care utilization characteristics for over 900,000 Ontarians over 35 years old with COPD in various regions across the province. It is hoped that this report will serve as a starting point to match patient needs with resources on a local basis to achieve the best health for all Ontarians.

Background

COPD is a common disease, demanding a significant amount of healthcare resources. A report by Dr. Andrea Gershon quantifies the health care utilization impact of COPD with the view of optimizing services to improve health outcomes. (Gershon, 2017) In that context, it accounts for a significant burden to Ontario's health system. In a 2019 Public Health Ontario report, lower chronic lower respiratory disease, including COPD and asthma, was one of four chronic diseases significantly impacting the health on Ontarians. (CCO and Ontario Agency for Health Protection and Promotion (Public Health Ontario, 2019.)

RTs' roles across multiple practice settings have become more integral to interdisciplinary patient care to prevent and manage cardiorespiratory disorders, improving health outcomes. (Please refer to Additional Resources) Historically, most RTs work in hospitals. (Gamble B. et al., 2011) With the health care system focusing on disease prevention and early intervention in community settings, new roles have evolved for RTs in primary care, home care, community medical clinics and continuing care.

In this study, we seek to describe the characteristics of people living with COPD by 5 Ontario Health Interim and Transitional Regions as well as the 14 Local Health Integration Networks (LHINs) across Ontario, and how they relate to the availability of registered respiratory therapists.

Key aims of the initiative are to:

- Assist with the identification of respiratory patient needs across the province at Regional and LHIN levels to be able to project staffing and alignment of RTs, and to
- Provide an exercise in sub-region disease-related population methodology which may serve as a template for respiratory and other conditions.

Study design and data sources

Data for the Descriptive Study of RTs

The CRTO provided a dataset of anonymized RT employers, and practice data for all RTs licensed to practice in Ontario as of October 2019. The distribution of the RT and the COPD patient characteristics was aligned with the 5 Ontario Health Interim and Transitional Regions as well as the 14 Local Health Integration Networks (LHINs), based on the city where the employer was identified. The Interim and Transitional Regions were broad regional groupings of LHINs being adopted by the Ministry of Health, December 2019. The authors acknowledge that as of April 1, 2021, Local Health Integration Networks (LHINs) are now Home and Community Care Support Services (HCCSS). However, for the purpose of this study, we refer to LHINs, using the boundaries established for the study's timeframe.

RT Inclusion Criteria

We described the number of RT roles stratified by both the employer category and position type of each role. An RT may cover more than one role type in a position type. For example, an RT in a staff therapist position, working full time in a small hospital may also work in additional roles performing diagnostic testing, and clinical education for RT students.

We identified all RT clinical roles that were anticipated to serve the COPD patient population in Ontario. Within each position, an RT could cover multiple clinical roles. In the CRTO data, RRT's reported up to six different work positions. A detailed description of RT roles across the continuum of care can be accessed in the RTSO's integrated role profile at https://www.rtso.ca/registered-respiratory-therapist-role-profile-across-multiple-practice-setting-in-ontario/ .

Only positions at employers located in Ontario were included, based on the city where the employer was identified. Included positions had to be in one of the following employer categories:

- Community respiratory clinic
- Continuing care (i.e., long-term care, rehabilitation, and other continuing care facilities)
- Hospital
- Home care and
- Primary care.

Roles also had to be in one of the following position type categories for inclusion:

- Home care
- Patient education
- Rehabilitation
- Pulmonary diagnostics or
- Staff therapist.

For each role, we also report the role 'status', which describes whether it was full-time, part-time, or casual. We used this information to estimate the full-time equivalents (FTEs) associated with each role using the following scheme based on personal communication with the RTSO Executive and Research Interest Group: full-time = 1.0 FTE, part-time = 0.45 FTE, and casual = 0.25 FTE.

Values <6 are not reported to preserve anonymity.

RT Exclusion Criteria

The study excluded RTs with inactive CRTO status and RT roles in the following employer name categories:

- Academic institutions
- Children's hospitals
- Other clinics
- Consulting company

- Government
- Medical devices supplier/company
- Patient transport
- Working outside Ontario
- Professional association
- Regulatory body
- Non-profit organization or
- Research.

We also excluded RT roles where the practice area was:

- Administration/management
- Anaesthesia
- CPAP care coordinator
- Consultant
- Education (didactic, post-secondary)
- Health informatics
- Hyperbarics
- Infection control
- Other
- Patient transport (i.e., air/land)
- Polysomnography
- Public health
- Quality management
- Research
- Sales
- Simulation
- Telemedicine or
- The ventilator equipment pool.

Supply of RT FTEs serving the COPD patient population

The supply of RT FTEs providing care to the COPD patient population was determined by calculating the crude rates of RT FTEs available per 1,000 COPD patient population. We reported overall supply of RT FTEs, as well as stratified by both employer category and position type. We further stratified the RT FTE supply by Ontario Health Interim and Transitional Regions and LHINs.

Data for the cohort study of individuals with COPD

A cohort of individuals aged 35 years and older in Ontario who had been diagnosed with COPD on or before March 31, 2019, and who were alive and eligible for Ontario Health Insurance Program (OHIP) coverage as of the index date (April 1, 2019), were identified. We applied an administrative data definition of COPD which has been validated in Ontario and has a sensitivity of 85.0% and specificity of 78.4%. (Gershon et al., 2017) Individuals were considered to have COPD if they had at least one physician visit with a diagnosis of COPD (OHIP diagnosis codes: 491, 492, or 496) or at least one hospitalization with a diagnosis of COPD (International Classification of Diseases, 10th revision [ICD-10] codes J41.x-J44.x, or ICD-9 codes 491.x, 492.x, or 496.x) ever.

Residents of Ontario are insured under a single-payer system, OHIP which provides coverage for most hospital and physician services and procedures. The administrative databases used in the cohort study included the Registered Persons Database (registry of all Ontarians eligible for health care insurance), Local Health Integration Network database (geographic information), Postal Code Conversion File (geographic information), OHIP claims (physician billings), Discharge Abstract Database (hospital admission), National Ambulatory Care Reporting System (ambulatory care including emergency department [ED] visits), Same Day Surgery (same day surgery), Ontario Drug Benefits claims (universal drug

insurance for those on social assistance or older than 65 years), National Rehabilitation Reporting System (rehabilitation), Home Care Database (home care), Ontario Mental Health Reporting System (mental health hospital admissions), and the Ontario Cancer Registry (cancer diagnoses). These datasets were linked using unique encoded identifiers and analyzed at ICES. The use of the data in this project is authorized under section 45 of Ontario's Personal Health Information Protection Act (PHIPA) and does not require review by a Research Ethics Board.

Inclusion Criteria for COPD Patients

The study incorporates administrative health data obtained from ICES to outline sociodemographic descriptive characteristics of adults aged 35 years and older with COPD in Ontario as of April 1, 2019. These characteristics include:

- Age
- Income quintile
- Rurality
- LHIN location
- Ontario Marginalization (ON-MARG) index scores (i.e., instability quintile, deprivation quintile, dependency quintile, and ethnic concentration quintile)
- Comorbidity burden characteristics such as years since COPD diagnosis
- Long-term care use in the past year
- Home care use in past year and
- Several comorbidities from ICES derived cohorts, and from the ICES COPD research group lead by Dr. Andrea Gershon.

This population of COPD patients was used as the denominator to calculate crude rates of RT FTEs available per 1,000 COPD patient population.

We further describe health outcomes among the COPD patient population over 1 year (April 1, 2019, to March 31, 2020), stratified by LHIN and Ontario Health Interim and Transitional Region. The following outcomes were included:

- All-cause hospitalizations,
- COPD-specific hospitalizations,
- COPD-related hospitalizations,
- Cardiovascular-related hospitalizations,
- All-cause emergency department (ED) visits,
- COPD-specific ED visits, COPD-related ED visits,
- Cardiovascular-related ED visits,
- Primary care visits,
- Specialist visits to any specialist serving the COPD patient population (geriatricians, internal medicine specialists, and respirologists), and
- All-cause mortality

Results

2,206 of 3,024 RTs in the CRTO database were identified as having clinically relevant roles caring for COPD patients over 35 years old. 818 RTs were excluded. 1,880 RTs work in hospitals, 254 RTs in respiratory homecare, 65 in primary care, and 60 in community clinics – respiratory, and 42 in continuing care settings.

2,795 clinical roles related to caring for COPD patients were sorted from the 4,260 total roles identified in the CRTO database. 1,465 administrative/other roles were excluded. (Refer to the inclusion and exclusion criteria). Of the total RT roles, 46% were full-time, 27% part time and 27% casual. Table 1 provides a breakdown by employer category. Additional breakdown by Interim and Transitional Region and LHINs are available in Appendix 1.

Table 2 provides the data by position type in the various practice settings across the province, staff therapist being the predominant position covered by RTs.

Table 1: The number of RTs and RT roles by Employer Name Category among all clinical RTs serving the COPD population in Ontario (Refer to Appendix 1 for Interim and Transitional Regional and LHIN tables)

Employer Name Category	Statistic	Total	% Of Total RT Roles
ALL	Total #RTs covering clinical roles for COPD patients	2206	
	#RT FT Roles	1282	46%
	#RT PT Roles	759	27%
	#RT Casual Roles	754	27%
	Total RT roles	2795	
	Crude Rate of RT roles per 1,000 COPD patient population	3.01 (2.90, 3.12)	
	Total FTE across all RT roles	1812.05	
	Crude Rate of RT FTEs per 1,000 COPD patient population	1.95 (1.86, 2.04)	
Community Clinic - Respiratory	Total #RTs covering clinical roles for COPD patients	60	
	#RT FT Roles	16	26%
	#RT PT Roles	22	36%
	#RT Casual Roles	23	38%
	Total RT roles	61	
	Crude Rate of RT roles per 1,000 COPD patient population	0.07 (0.05, 0.08)	
	Total FTE across all RT roles	31.65	
	Crude Rate of RT FTEs per 1,000 COPD patient population	0.03 (0.02, 0.05)	
Continuing care (includes Long-term care, rehabilitation, and continuing care)	Total #RTs covering clinical roles for COPD patients	42	
	#RT FT Roles	17	40%
	#RT PT Roles	15	35%
	#RT Casual Roles	11	26%
	Total RT roles	43	
	Crude Rate of RT roles per 1,000 COPD patient population	0.05 (0.03, 0.06)	
	Total FTE across all RT roles	26.5	
	Crude Rate of RT FTEs per 1,000 COPD patient population	0.03 (0.02, 0.04)	
Hospital	Total #RTs covering clinical roles for COPD patients	1880	
	#RT FT Roles	1006	43%
	#RT PT Roles	658	28%
	#RT Casual Roles	696	29%
	Total RT roles	2360	
	Crude Rate of RT roles per 1,000 COPD patient population	2.54 (2.44, 2.65)	
	Total FTE across all RT roles	1476.1	
	Crude Rate of RT FTEs per 1,000 COPD patient population	1.59 (1.51, 1.67)	
Respiratory Home Care	Total #RTs covering clinical roles for COPD patients	254	
	#RT FT Roles	214	82%
	#RT PT Roles	26	10%
	#RT Casual Roles	22	8%
	Total RT roles	262	

Employer Name Category	Statistic	Total	% Of Total RT Roles
	Crude Rate of RT roles per 1,000 COPD patient population	0.28 (0.25, 0.32)	
	Total FTE across all RT roles	231.2	
	Crude Rate of RT FTEs per 1,000 COPD patient population	0.25 (0.22, 0.28)	
Primary Care	Total #RTs covering clinical roles for COPD patients	65	
	#RT FT Roles	29	42%
	#RT PT Roles	38	55%
	#RT Casual Roles	<6	na
	Total RT roles	69	
	Crude Rate of RT roles per 1,000 COPD patient population	0.07 (0.06, 0.09)	
	Total FTE across all RT roles	46.6	
	Crude Rate of RT FTEs per 1,000 COPD patient population	0.05 (0.04, 0.07)	

Table 2: The number of RTs and RT roles by Employer Name Category and Position Type Category among all clinical RTs serving the COPD population in Ontario

Employer Name Category		Home care	Patient education	Rehabilitation	Pulmonary diagnostics	Staff therapist
Community Clinic - Respiratory	Total # RTs covering clinical roles for COPD pts.	0	1	0	41	18
	# RT FT Roles	0	<6	0	9	6
	# RT PT Roles	0	0	0	12	10
	# RT Casual Roles	0	0	0	21	<6
	All	0	<6	0	42	18
Continuing care (includes Long-term care, rehabilitation, and continuing care facilities)	Total # RTs covering clinical roles for COPD pts.	<6	0	0	0	37
	# RT FT Roles	<6	0	0	0	14
	# RT PT Roles	0	0	0	0	15
	# RT Casual Roles	0	0	0	0	9
	All	<6	0	0	0	38
Hospital	Total # RTs covering clinical roles for COPD pts.	11	15	<6	72	1796
	# RT FT Roles	<6	<6	0	22	977
	# RT PT Roles	6	7	<6	26	617
	# RT Casual Roles	<6	<6	<6	41	649
	All	11	15	<6	89	2243
Respiratory Home Care	Total # RTs covering clinical roles for COPD pts.	208	0	0	0	46
	# RT FT Roles	178	0	0	0	36
	# RT PT Roles	19	0	0	0	7
	# RT Casual Roles	17	0	0	0	<6
	All	214	0	0	0	48
Primary Care	Total # RTs covering clinical roles for COPD pts.	0	17	<6	<6	27
	# RT FT Roles	0	8	1	0	9
	# RT PT Roles	0	7	0	<6	17
	# RT Casual Roles	0	<6	0	0	<6
	All	0	17	<6	<6	28

928,252 COPD patients ≥35yo were included in the study. The number of patients with COPD varied across the province as reflected in the LHIN counts in Table 3. Males and females were relatively equally represented across the province. Patients aged 65-99 represented the largest group of patients at 55.7%. The West Interim and Transitional Region had the largest portion of COPD patients at 32.4%. The lowest was Toronto at 7.1%. The highest portion of COPD patients in LHINs were LHIN 4 Hamilton Niagara Haldimand Brant at 12.4% and LHIN 9 Central East at 12.1%. The lowest was LHIN 14 North West at 2.1%.

Table 4 summarizes the health care outcomes for the COPD patients in this study. Appendix 2 provides data by Interim and Transitional Region and by LHIN. Though the median for all cause hospitalizations in 1 (1-2), it is worth noting that the highest number of hospitalizations was 34. Similar relationships with other outcomes should be noted.

The total population of Ontario in 2019 was 14.7M with approximately 56% or 8.2M over 35YO. 928,252 people over 35YO with COPD represents approximately 11% of that population.

Table 3: Descriptive characteristics of adults aged 35 years and older with COPD in Ontario as of April 1, 2019

VARIABLE	VALUE	Females	Males	TOTAL
		N=466,580	N=461,672	N=928,252
Age at index date	Mean ± SD	67.51 ± 12.92	66.33 ± 12.47	66.92 ± 12.71
	Median (IQR)	67 (58-77)	66 (57-75)	66 (58-76)
Age group	35-49	38,383 (8.2%)	42,743 (9.3%)	81,126 (8.7%)
	50-64	162,202 (34.8%)	168,013 (36.4%)	330,215 (35.6%)
	65-99	265,995 (57.0%)	250,916 (54.3%)	516,911 (55.7%)
Interim and Transitional Regions	Central	110,087 (23.6%)	118,110 (25.6%)	228,197 (24.6%)
	East	128,516 (27.5%)	122,228 (26.5%)	250,744 (27.0%)
	North	42,058 (9.0%)	40,026 (8.7%)	82,084 (8.8%)
	Toronto	31,474 (6.7%)	34,829 (7.5%)	66,303 (7.1%)
	West	154,445 (33.1%)	146,479 (31.7%)	300,924 (32.4%)
LHIN	Erie St. Clair (1)	35,015 (7.5%)	32,925 (7.1%)	67,940 (7.3%)
	South West (2)	38,742 (8.3%)	37,527 (8.1%)	76,269 (8.2%)
	Waterloo Wellington (3)	20,929 (4.5%)	20,718 (4.5%)	41,647 (4.5%)
	Hamilton Niagara Haldimand Brant (4)	59,759 (12.8%)	55,309 (12.0%)	115,068 (12.4%)
	Central West (5)	18,094 (3.9%)	20,274 (4.4%)	38,368 (4.1%)
	Mississauga Halton (6)	25,482 (5.5%)	27,195 (5.9%)	52,677 (5.7%)
	Toronto Central (7)	31,474 (6.7%)	34,829 (7.5%)	66,303 (7.1%)
	Central (8)	44,095 (9.5%)	50,137 (10.9%)	94,232 (10.2%)
	Central East (9)	55,762 (12.0%)	56,453 (12.2%)	112,215 (12.1%)
	South East (10)	25,758 (5.5%)	23,144 (5.0%)	48,902 (5.3%)
	Champlain (11)	46,996 (10.1%)	42,631 (9.2%)	89,627 (9.7%)
	North Simcoe Muskoka (12)	22,416 (4.8%)	20,504 (4.4%)	42,920 (4.6%)
	North East (13)	32,244 (6.9%)	30,632 (6.6%)	62,876 (6.8%)
	North West (14)	9,814 (2.1%)	9,394 (2.0%)	19,208 (2.1%)

Table 4: Outcome rates among adults aged 35 years and older with COPD in Ontario April 1, 2019, to March 31, 2020 (Refer to Appendix 2 for LHIN and Interim and Transitional Regions' results)

Outcome	Value		
	COPD Patient Population Denominator		928,252
All-cause hospitalizations	Individuals with any hospitalization		132,819
	Crude Rate of Individuals with any hospitalization per 1000 COPD patient population (95%CI)		143.09 (142.32, 143.86)
	Total hospitalizations		209,787
	Hospitalizations per person	Median_IQR	1 (1-2)
		Min	1
		Max	34
COPD-specific hospitalizations	Individuals with any COPD-specific hospitalization		28,169
	Crude Rate of Individuals with any COPD-specific hospitalization per 1000 COPD patient population (95%CI)		30.35 (29.99, 30.70)
	Total COPD-specific hospitalizations		40,428
	COPD-specific Hospitalizations per person	Median_IQR	1 (1-2)
		Min	1
		Max	26
COPD-related hospitalizations	Individuals with any COPD-related hospitalization		12,070
	Crude Rate of Individuals with any COPD-related hospitalization per 1000 COPD patient population (95%CI)		13.00 (12.77, 13.24)
	Total COPD-related hospitalizations		13,429
	COPD-related Hospitalizations per person	Median_IQR	1 (1-1)
		Min	1
		Max	11
Cardiovascular-related hospitalizations	Individuals with any Cardiovascular-related hospitalization		37,733
	Crude Rate of Individuals with any Cardiovascular-related hospitalization per 1000 COPD patient population (95%CI)		40.65 (40.24, 41.06)
	Total Cardiovascular-related hospitalizations		51,617
	Cardiovascular-related Hospitalizations per person	Median_IQR	1 (1-2)
		Min	1
		Max	21
All-cause ED visits	Individuals with any ED visit		290,022
	Crude Rate of Individuals with any ED visit per 1000 COPD patient population (95%CI)		312.44 (311.30, 313.58)
	Total ED visits		585,067
	ED visits per person	Median_IQR	1 (1-2)
		Min	1
		Max	278
COPD-specific ED visits	Individuals with any COPD-specific ED visit		21,269
	Crude Rate of Individuals with any COPD-specific ED visit per 1000 COPD patient population (95%CI)		22.91 (22.61, 23.22)
	Total COPD-specific ED visits		30,357
	COPD-specific ED visits per person	Median_IQR	1 (1-1)
		Min	1
		Max	66
COPD-related ED visits	Individuals with any COPD-related ED visit		16,323
	Crude Rate of Individuals with any COPD-related ED visit per 1000 COPD patient population (95%CI)		17.58 (17.32, 17.86)
	Total COPD-related ED visits	Total	18,156
	COPD-related ED visits per person	Median_IQR	1 (1-1)

Outcome	Value		
		Min	1
		Max	7
Cardiovascular-related ED visits	Individuals with any Cardiovascular-related ED visit		10,164
	Crude Rate of Individuals with any Cardiovascular-related ED visit per 1000 COPD patient population (95%CI)		10.95 (10.74, 11.16)
	Total Cardiovascular-related ED visits	Total	12,044
	Cardiovascular-related ED visits per person	Median_IQR	1 (1-1)
		Min	1
		Max	41
Primary care visits	Individuals with any Primary care visit		797,627
	Crude Rate of Individuals with any Primary Care visit per 1000 COPD patient population (95%CI)		859.28 (857.39, 861.17)
	Total Primary Care visits	Total	5,051,308
	Primary care visits per person	Median_IQR	5 (2-8)
		Min	1
		Max	360
Specialist visits to any specialist serving the COPD patient population (geriatricians, internal medicine specialists, and respirologists)	Individuals with any COPD Specialist visit		239,905
	Crude Rate of Individuals with any COPD Specialist visit per 1000 COPD patient population (95%CI)		258.45 (257.41, 259.48)
	Total COPD Specialist visits	Total	576,530
	COPD Specialist visits per person	Median_IQR	2 (1-3)
		Min	1
		Max	126
All-cause mortality	Total deaths		36,885
	Crude Rate of deaths per 1000 COPD patient population (95%CI)		39.74 (39.33, 40.14)
	Age at death	min	36
		max	101
		Median_IQR	81 (72-89)
	Age group at death	35-49	325
		50-64	4,204
		65+	32,356

Discussion

Care provided by RTs have demonstrated improvements in health outcomes for people with cardiorespiratory and related disorders across multiple practice settings. (Please see Additional References) Though positions and roles are increasing in health care settings other than hospitals, Table 2 demonstrates that across the province, there are a number of opportunities to integrate RT practice into community, continuing and primary care settings. RT services in hospital settings may also be reviewed relative to gaps in service locally, and to maximize health outcomes for all patients with cardiorespiratory disorders.

Health Quality Ontario has also published a report with recommendations to address gaps in patient and public knowledge about COPD provides insight about treatment strategies to be considered to improve patient outcomes and efficiency for the health care system. (Health Quality Ontario, 2012)

Results reported in this study demonstrate variations in the COPD patient population and their health outcomes across Ontario. Along with access to care, there are other factors that impact the local COPD population, e.g., air quality, smoking

rates, occupational exposures, prevalence of other cardiorespiratory conditions, etc. These factors were beyond the scope of this study but need to be considered locally to align care with need.

The variation in the availability of RTs, as well as the roles in which they function, needs to be taken into consideration. The Ontario health care system is evolving with an increased focus on community and continuing care, health promotion and disease prevention. (Ministry of Health, 2019) (Ontario Health, 2020) (Ontario Community Support Association, 2018) The *Registered Respiratory Therapist (RRT) Integrated Role Profile in Ontario* provides a comprehensive descriptions of RT roles in all practice settings. (Respiratory Therapy Society of Ontario, 2020) The document is intended "to provide a broad, inclusive role description for RRTs working in a variety of practice settings across the continuum of care, demonstrating that with our specialized expertise, RRTs can have a positive impact on patient, caregiver, and provider outcomes. The goal is to maximize quality, safety, health, and health care utilization outcomes across those settings, and through transitions in care within a patient centric model of care" to help address the gaps in RT services locally.

Noting the low and variable crude rate of FTEs per 1,000 COPD patients across the province provides a perspective relative to setting. The LHIN breakdown, including FT, PT and Casual, should help inform local healthcare planning. For example, research shows that COPD programs in primary care have a significant impact on reducing healthcare utilization in high-risk COPD patients. (Ferrone, 2019)

Staffing patterns

Staffing patterns, especially in the context of a variable workload, are always a challenge. (West, 2016) (Premier Healthcare Alliance, 2003)

As new RT roles evolve, particularly in community settings and those related to non-acute respiratory care, providing home and continuing care, and patient education, part-time and/or casual employment may be appropriate in terms of efficiency, relative to the setting. The low percentage of full-time positions in most practice settings should be taken into consideration in relation to the safe and effective provision of quality health care services

Acute care settings, in particular, are faced with the dilemma of "hallway medicine" across the province, adding to health care provider stress and the ability to deliver safe, timely and high-quality health care services due to surges. (Premier's Council, 2019)

Another element contributing to the dilemma is the "increasing population of Ontario, projected to increase by 35.8 per cent, or almost 5.3 million, over the next 26 years, from an estimated 14.7 million on July 1, 2020, to over 20.0 million by July 1, 2046. In addition, the number of seniors aged 65 and over is projected to almost double from 2.6 million, or 17.6 per cent of population, in 2020 to 4.5 million, or 22.2 per cent, by 2046. The growth in the share and number of seniors accelerates over the 2020–2031 period as the last cohorts of baby boomers turn age 65. (Ministry of Finance, 2019)

A key concern related to RTs and staffing is the fact that there are less than 3,000 RTs working clinically across all practice settings in Ontario in 2019. Consider that, in that same year, there were almost 1 million Ontarians with COPD (Gershon, 2017), over 2 million with asthma (To, 2022), and many other neonates, children and adults with other cardiorespiratory chronic and infectious conditions that did or could benefit from RT care. Table 1 reports a crude rate of RT FTEs per 1,000 COPD patient population as 1.95 (1.86, 2.04).

In addition, the COVID-19 (SARS-CoV-2) pandemic has highlighted concerns related to staffing for all health care professionals (HCPs). In Ontario, a recent publication by the Ontario COVID-19 Science Advisory Table and Mental Health Working Group, refers to the exacerbation of HCP's burnout due to the COVID-19 pandemic. (Maunder et al., 2021) It identifies concern about the threat of burnout to maintaining a functioning healthcare workforce. Reference is made to HCPs working in intensive care settings, COVID-19 units or hospitals, and emergency department though the report acknowledges burnout effecting HCPs in hospitals generally, primary care and community settings, public health, long-term care, and first responders in emergency medical services.

Conclusions

RTs are integral to Ontario's health care system. We anticipate this study will provide a "picture" of COPD patient access to RT services across the province that can guide staffing projections to meet present and future patient needs, improving outcomes for patients with cardiorespiratory conditions, and health care system performance.

Key issues - population to be served, prevalence of disease, practice settings, RT role expectations, surge capacity and outcome projections - will vary by locality across the province and need to be taken into consideration when projecting staffing patterns.

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Appendix 1

The number of RTs and RT roles by Employer Name Category among all clinical RTs serving the COPD population in Ontario

Employer Name Category	Statistic	East	% of Total RT Roles	West	% of Total RT Roles	North	% of Total RT Roles	Central	% of Total RT Roles	Toronto	% of Total RT Roles
ALL	Total #RTs covering clinical roles for COPD patients	526		704		145		563		420	
	#RT FT Roles	262	41%	396	47%	89	57%	316	45%	219	47%
	#RT PT Roles	203	32%	232	28%	50	32%	188	27%	86	18%
	#RT Casual Roles	170	27%	212	25%	18	11%	192	28%	162	35%
	Total RT roles	635		840		157		696		467	
	Crude Rate of RT roles per 1,000 COPD patient population	2.53 (2.34, 2.74)		2.79 (2.61, 2.99)		1.91 (1.63, 2.24)		3.05 (2.83, 3.29)		7.04 (6.42, 7.71)	
	Total FTE across all RT roles	395.85		553.4		116		448.6		298.2	
	Crude Rate of RT FTE's per 1,000 COPD patient population	1.58 (1.43, 1.74)		1.84 (1.69, 2.00)		1.41 (1.17, 1.69)		1.97 (1.79, 2.16)		4.50 (4.00, 5.04)	
Community Clinic - Respiratory	Total #RTs covering clinical roles for COPD patients	19		20		<6		14		<6	
	#RT FT Roles	<6	N/A	<6	N/A	<6	N/A	<6	N/A	<6	N/A
	#RT PT Roles	12	N/A	<6	N/A	<6	N/A	<6	N/A	<6	N/A
	#RT Casual Roles	7	N/A	10	50%	.	N/A	<6	N/A	.	N/A
	Total RT roles	N/A		20		<6		14		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		0.07 (0.04, 0.10)		N/A		0.06 (0.03, 0.10)		N/A	
	Total FTE across all RT roles	8.15		9.75		<6		7.85		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.03 (0.01, 0.06)		0.03 (0.02, 0.06)		N/A		0.03 (0.01, 0.07)		N/A	
Continuing care (includes LTC, rehabilitation and continuing care)	Total #RTs covering clinical roles for COPD patients	7		<6		<6		0		27	
	#RT FT Roles	<6	N/A	<6	N/A	<6	N/A	.	N/A	12	N/A
	#RT PT Roles	<6	N/A	<6	N/A	.	N/A	.	N/A	10	N/A
	#RT Casual Roles	<6	N/A	<6	N/A	<6	N/A	.	N/A	<6	N/A
	Total RT roles	7		<6		<6		.		N/A	
	Crude Rate of RT roles per 1,000 COPD patient population	0.03 (0.01, 0.06)		N/A		N/A		. (., .)		N/A	
	Total FTE across all RT roles	3.1		<6		<6		.		18	

Employer Name Category	Statistic	East	% of Total RT Roles	West	% of Total RT Roles	North	% of Total RT Roles	Central	% of Total RT Roles	Toronto	% of Total RT Roles
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.01 (0.00, 0.04)		N/A		N/A		. (., .)		0.27 (0.16, 0.43)	
Hospital	Total #RTs covering clinical roles for COPD patients	456		580		104		486		387	
	#RT FT Roles	211	40%	300	43%	54	50%	241	40%	200	47%
	#RT PT Roles	167	31%	197	29%	41	38%	179	30%	74	17%
	#RT Casual Roles	155	29%	193	28%	12	11%	181	30%	155	36%
	Total RT roles	533		690		107		601		429	
	Srude Rate of RT roles per 1,000 COPD patient population	2.13 (1.95, 2.31)		2.29 (2.13, 2.47)		1.30 (1.07, 1.58)		2.63 (2.43, 2.85)		6.47 (5.87, 7.11)	
	Total FTE across all RT roles	324.9		436.9		75.45		366.8		272.05	
	Crude Rate of RT FTE's per 1,000 COPD patient population	1.30 (1.16, 1.44)		1.45 (1.32, 1.59)		0.92 (0.72, 1.15)		1.61 (1.45, 1.78)		4.10 (3.63, 4.62)	
Respiratory Home Care	Total #RTs covering clinical roles for COPD patients	56		91		32		71		<6	
	#RT FT Roles	43	N/A	78	84%	22	69%	66	89%	<6	N/A
	#RT PT Roles	10	N/A	7	8%	<6	N/A	<6	N/A	.	N/A
	#RT Casual Roles	<6	N/A	8	9%	<6	N/A	<6	N/A	.	N/A
	Total RT roles	N/A		93		32		74		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		0.31 (0.25, 0.38)		0.39 (0.27, 0.55)		0.32 (0.25, 0.41)		N/A	
	Total FTE across all RT roles	48.75		83.15		25.7		68.6		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.19 (0.14, 0.26)		0.28 (0.22, 0.34)		0.31 (0.20, 0.46)		0.30 (0.23, 0.38)		N/A	
Primary Care	Total #RTs covering clinical roles for COPD patients	16		30		9		7		<6	
	#RT FT Roles	<6	N/A	12	36%	<6	N/A	<6	N/A	<6	N/A
	#RT PT Roles	11	N/A	21	64%	<6	N/A	<6	N/A	<6	N/A
	#RT Casual Roles	.	N/A	.	N/A	<6	N/A	.	N/A	<6	N/A
	Total RT roles	N/A		33		9		7		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	0.07 (0.04, 0.11)		0.11 (0.08, 0.15)	na	0.11 (0.05, 0.21)		0.03 (0.01, 0.06)		N/A	
	Total FTE across all RT roles	10.95		21.45		7.15		5.35		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.04 (0.02, 0.08)		0.07 (0.04, 0.11)		0.09 (0.04, 0.18)		0.02 (0.01, 0.05)		N/A	

The number of RTs and RT roles by Employer Name Category among all clinical RTs serving the COPD population in Ontario (cont'd)

Employer Name Category	Statistic	LHIN 1	% of Total RT Roles	LHIN 2	% of Total RT Roles	LHIN 3	% of Total RT Roles	LHIN 4	% of Total RT Roles	LHIN 5	% of Total RT Roles
ALL	Total #RTs covering clinical roles for COPD patients	134		253		123		228		83	
	#RT FT Roles	71	48%	142	49%	56	40%	127	48%	46	42%
	#RT PT Roles	56	38%	85	29%	42	30%	49	19%	20	18%
	#RT Casual Roles	22	15%	62	21%	42	30%	86	33%	43	39%
	Total RT roles	149		289		140		262		109	
	Crude Rate of RT roles per 1,000 COPD patient population	2.19 (1.86, 2.57)		3.79 (3.36, 4.25)		3.36 (2.83, 3.97)		2.28 (2.01, 2.57)		2.84 (2.33, 3.43)	
	Total FTE across all RT roles	101.7		195.75		85.4		170.6		65.75	
	Crude Rate of RT FTE's per 1,000 COPD patient population	1.50 (1.22, 1.82)		2.57 (2.22, 2.95)		2.05 (1.64, 2.53)		1.48 (1.27, 1.72)		1.71 (1.32, 2.18)	
Community Clinic - Respiratory	Total #RTs covering clinical roles for COPD patients	<6	N/A	0	N/A	8	N/A	7	N/A	<6	N/A
	#RT FT Roles	<6	N/A	.	N/A	<6	N/A	<6	N/A	.	N/A
	#RT PT Roles	<6	N/A	.	N/A	.	N/A	<6	N/A	<6	N/A
	#RT Casual Roles	.		.		7		<6		<6	
	Total RT roles	<6		.		N/A		N/A		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		. (., .)		N/A		0.06 (0.02, 0.13)		N/A	
	Total FTE across all RT roles	<6		.		<6		3.65		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	N/A		. (., .)		N/A		0.03 (0.01, 0.08)		N/A	
Continuing care (includes LTC, rehabilitation and continuing care)	Total #RTs covering clinical roles for COPD patients	0		<6		0		<6		0	
	#RT FT Roles	.	N/A	.	N/A	.	N/A	<6	N/A	.	N/A
	#RT PT Roles	.	N/A	<6	N/A	.	N/A	.	N/A	.	N/A
	#RT Casual Roles	.	N/A	<6	N/A	.	N/A	.	N/A	.	N/A
	Total RT roles	.		<6		.		<6		.	
	Crude Rate of RT roles per 1,000 COPD patient population	. (., .)		N/A		. (., .)		N/A		. (., .)	
	Total FTE across all RT roles	.		<6		.		N/A		.	
	Crude Rate of RT FTE's per 1,000 COPD patient population	. (., .)		N/A		. (., .)		N/A		. (., .)	
Hospital	Total #RTs covering clinical roles for COPD patients	104		210		101		192		75	
	#RT FT Roles	52	45%	116	48%	37	33%	95	43%	40	40%
	#RT PT Roles	43	37%	69	29%	42	38%	43	20%	18	18%
	#RT Casual Roles	21	18%	57	24%	33	29%	82	37%	42	42%
	Total RT roles	116		242		112		220		100	
	Crude Rate of RT roles per 1,000 COPD patient population	1.71 (1.41, 2.05)		3.17 (2.79, 3.60)		2.69 (2.21, 3.24)		1.91 (1.67, 2.18)		2.61 (2.12, 3.17)	

Employer Name Category	Statistic	LHIN 1	% of Total RT Roles	LHIN 2	% of Total RT Roles	LHIN 3	% of Total RT Roles	LHIN 4	% of Total RT Roles	LHIN 5	% of Total RT Roles
	Total FTE across all RT roles	76.6		161.3		64.15		134.9		58.6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	1.13 (0.89, 1.41)		2.11 (1.80, 2.47)		1.54 (1.19, 1.97)		1.17 (0.98, 1.39)		1.53 (1.16, 1.97)	
Respiratory Home Care	Total #RTs covering clinical roles for COPD patients	14		27		19		31		<6	
	#RT FT Roles	11	79%	20	74%	18	N/A	29	N/A	<6	N/A
	#RT PT Roles	<6	N/A	<6	N/A	.	N/A	<6	N/A	.	N/A
	#RT Casual Roles	<6	N/A	<6	N/A	<6	N/A	<6	N/A	.	N/A
	Total RT roles	14		27		N/A		N/A		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	0.21 (0.11, 0.35)		0.35 (0.23, 0.52)		N/A		N/A		N/A	
	Total FTE across all RT roles	12.15		22.35		18.5		30.15		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.18 (0.09, 0.31)		0.29 (0.18, 0.44)		0.44 (0.27, 0.70)		0.26 (0.18, 0.37)		N/A	
Primary Care	Total #RTs covering clinical roles for COPD patients	14		16		0		<6		<6	
	#RT FT Roles	<6	N/A	<6	N/A	.	N/A	.	N/A	<6	N/A
	#RT PT Roles	8	N/A	11	N/A	.	N/A	<6	N/A	.	N/A
	#RT Casual Roles	.	N/A	.	N/A	.	N/A	.	N/A	.	N/A
	Total RT roles	N/A		N/A		.		<6		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		N/A		. (., .)		N/A		N/A	
	Total FTE across all RT roles	9.6		10.95		.		<6		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.14 (0.07, 0.26)		0.14 (0.07, 0.26)		. (., .)		N/A		N/A	

The number of RTs and RT roles by Employer Name Category among all clinical RTs serving the COPD population in Ontario (cont'd)

Employer Name Category	Statistic	LHIN 6	% of Total RT Roles	LHIN 7	% of Total RT Roles	LHIN 8	% of Total RT Roles	LHIN 9	% of Total RT Roles	LHIN 10	% of Total RT Roles
ALL	Total #RTs covering clinical roles for COPD patients	174		420		263		190		90	
	#RT FT Roles	93	46%	219	47%	130	46%	95	41%	47	45%
	#RT PT Roles	56	28%	86	18%	83	29%	80	35%	44	42%
	#RT Casual Roles	54	27%	162	35%	69	24%	54	24%	14	13%
	Total RT roles	203		467		282		229		105	
	Crude Rate of RT roles per 1,000 COPD patient population	3.85 (3.34, 4.42)		7.04 (6.42, 7.71)		2.99 (2.65, 3.36)		2.04 (1.78, 2.32)		2.15 (1.76, 2.60)	
	Total FTE across all RT roles	131.7		298.2		184.6		144.5		70.3	
	Crude Rate of RT FTE's per 1,000 COPD patient population	2.50 (2.09, 2.97)		4.50 (4.00, 5.04)		1.96 (1.69, 2.26)		1.29 (1.09, 1.52)		1.44 (1.12, 1.82)	
Community Clinic - Respiratory	Total #RTs covering clinical roles for COPD patients	<6	N/A	<6	N/A	7	N/A	<6	N/A	<6	N/A
	#RT FT Roles	<6	N/A	<6	N/A	<6	N/A	<6	N/A	.	N/A
	#RT PT Roles	<6	N/A	<6	N/A	.	N/A	<6	N/A	<6	N/A
	#RT Casual Roles	<6		.		<6		.		.	
	Total RT roles	<6		<6		7		<6		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		N/A		0.07 (0.03, 0.15)		N/A		N/A	
	Total FTE across all RT roles	<6		<6		<6		<6		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	N/A		N/A		N/A		N/A		N/A	
Continuing care (includes LTC, rehabilitation and continuing care)	Total #RTs covering clinical roles for COPD patients	0		27		0		0		0	
	#RT FT Roles	.	N/A	12	N/A	.	N/A	.	N/A	.	N/A
	#RT PT Roles	.	N/A	10	N/A	.	N/A	.	N/A	.	N/A
	#RT Casual Roles	.	N/A	<6	N/A	.	N/A	.	N/A	.	N/A
	Total RT roles	.		N/A		.		.		.	
	Crude Rate of RT roles per 1,000 COPD patient population	. (., .)		N/A		. (., .)		. (., .)		. (., .)	
	Total FTE across all RT roles	.		18		.		.		.	
	Crude Rate of RT FTE's per 1,000 COPD patient population	. (., .)		0.27 (0.16, 0.43)		. (., .)		. (., .)		. (., .)	

Employer Name Category	Statistic	LHIN 6	% of Total RT Roles	LHIN 7	% of Total RT Roles	LHIN 8	% of Total RT Roles	LHIN 9	% of Total RT Roles	LHIN 10	% of Total RT Roles
Hospital	Total #RTs covering clinical roles for COPD patients	150		387		228		163		80	
	#RT FT Roles	70	40%	200	47%	103	42%	78	40%	40	46%
	#RT PT Roles	55	31%	74	17%	79	32%	67	34%	35	40%
	#RT Casual Roles	52	29%	155	36%	62	25%	52	26%	12	14%
	Total RT roles	177		429		244		197		87	
	Crude Rate of RT roles per 1,000 COPD patient population	3.36 (2.88, 3.89)		6.47 (5.87, 7.11)		2.59 (2.27, 2.94)		1.76 (1.52, 2.02)		1.78 (1.42, 2.19)	
	Total FTE across all RT roles	107.8		272.05		154.05		121.15		58.75	
	Crude Rate of RT FTE's per 1,000 COPD patient population	2.05 (1.68, 2.47)		4.10 (3.63, 4.62)		1.63 (1.39, 1.91)		1.08 (0.90, 1.29)		1.20 (0.91, 1.55)	
Respiratory Home Care	Total #RTs covering clinical roles for COPD patients	21		<6		28		24		8	
	#RT FT Roles	20	N/A	<6	N/A	23	82%	16	N/A	<6	N/A
	#RT PT Roles	.	N/A	.	N/A	<6	N/A	<6	N/A	<6	N/A
	#RT Casual Roles	<6	N/A	.	N/A	<6	N/A	<6	N/A	<6	N/A
	Total RT roles	N/A		<6		28		N/A		8	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		N/A		0.30 (0.20, 0.43)		N/A		0.16 (0.07, 0.32)	
	Total FTE across all RT roles	20.25		<6		24.65		19.2		5.95	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.38 (0.24, 0.59)		N/A		0.26 (0.17, 0.39)		0.17 (0.10, 0.27)		0.12 (0.04, 0.27)	
Primary Care	Total #RTs covering clinical roles for COPD patients	<6		<6		<6		<6		<6	
	#RT FT Roles	<6	N/A	<6	N/A	<6	N/A	.	N/A	<6	N/A
	#RT PT Roles	.	N/A	<6	N/A	<6	N/A	<6	N/A	<6	N/A
	#RT Casual Roles	.	N/A	<6	N/A	.	N/A	.	N/A	.	N/A
	Total RT roles	<6		<6		<6		<6		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		N/A		N/A		N/A		N/A	
	Total FTE across all RT roles	<6		<6		<6		<6		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	N/A		N/A		N/A		N/A		N/A	

The number of RTs and RT roles by Employer Name Category among all clinical RTs serving the COPD population in Ontario (cont'd)

Employer Name Category	Statistic	LHIN 11	% of Total RT Roles	LHIN 12	% of Total RT Roles	LHIN 13	% of Total RT Roles	LHIN 14	% of Total RT Roles
ALL	Total #RTs covering clinical roles for COPD patients	256		78		111		34	
	#RT FT Roles	120	40%	47	46%	71	59%	18	50%
	#RT PT Roles	79	26%	29	28%	41	34%	9	25%
	#RT Casual Roles	102	34%	26	25%	9	7%	9	25%
	Total RT roles	301		102		121		36	
	Crude Rate of RT roles per 1,000 COPD patient population	3.36 (2.99, 3.76)		2.38 (1.94, 2.88)		1.92 (1.60, 2.30)		1.87 (1.31, 2.59)	
	Total FTE across all RT roles	181.05		66.55		91.7		24.3	
	Crude Rate of RT FTE's per 1,000 COPD patient population	2.02 (1.74, 2.34)		1.55 (1.20, 1.97)		1.46 (1.18, 1.79)		1.27 (0.81, 1.88)	
Community Clinic - Respiratory	Total #RTs covering clinical roles for COPD patients	9	N/A	0	N/A	<6	N/A	<6	N/A
	#RT FT Roles	.	N/A	.	N/A	<6	N/A	.	N/A
	#RT PT Roles	<6	N/A	.	N/A	.	N/A	<6	N/A
	#RT Casual Roles	7		.		.		.	
	Total RT roles	N/A		.		<6		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	N/A		. (., .)		N/A		N/A	
	Total FTE across all RT roles	<6		.		<6		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	N/A		. (., .)		N/A		N/A	
Continuing care (includes LTC, rehabilitation and continuing care)	Total #RTs covering clinical roles for COPD patients	7		0		<6		0	
	#RT FT Roles	<6	N/A	.	N/A	<6	N/A	.	N/A
	#RT PT Roles	<6	N/A	.	N/A	.	N/A	.	N/A
	#RT Casual Roles	<6	N/A	.	N/A	<6	N/A	.	N/A
	Total RT roles	7		.		<6		.	
	Crude Rate of RT roles per 1,000 COPD patient population	0.08 (0.03, 0.16)		. (., .)		N/A		. (., .)	
	Total FTE across all RT roles	3.1		.		<6		.	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.03 (0.01, 0.10)		. (., .)		N/A		. (., .)	
Hospital	Total #RTs covering clinical roles for COPD patients	219		62		72		32	
	#RT FT Roles	93	37%	28	35%	37	N/A	17	50%
	#RT PT Roles	65	26%	27	34%	33	N/A	8	24%

Employer Name Category	Statistic	LHIN 11	% of Total RT Roles	LHIN 12	% of Total RT Roles	LHIN 13	% of Total RT Roles	LHIN 14	% of Total RT Roles
	#RT Casual Roles	91	37%	25	31%	<6	N/A	9	26%
	Total RT roles	249		80		N/A		34	
	Crude Rate of RT roles per 1,000 COPD patient population	2.78 (2.44, 3.15)		1.86 (1.48, 2.32)		N/A		1.77 (1.23, 2.47)	
	Total FTE across all RT roles	145		46.4		52.6		22.85	
	Crude Rate of RT FTE's per 1,000 COPD patient population	1.62 (1.37, 1.90)		1.08 (0.79, 1.44)		0.84 (0.63, 1.10)		1.19 (0.75, 1.79)	
Respiratory Home Care	Total #RTs covering clinical roles for COPD patients	25		19		32		0	
	#RT FT Roles	22	85%	19	N/A	22	69%	.	N/A
	#RT PT Roles	<6	N/A	<6	N/A	<6	N/A	.	N/A
	#RT Casual Roles	<6	N/A	<6	N/A	<6	N/A	.	N/A
	Total RT roles	26		N/A		32		.	
	Crude Rate of RT roles per 1,000 COPD patient population	0.29 (0.19, 0.43)		N/A		0.51 (0.35, 0.72)		. (., .)	
	Total FTE across all RT roles	23.6		19.7		25.7		.	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.26 (0.17, 0.39)		0.46 (0.28, 0.71)		0.41 (0.27, 0.60)		. (., .)	
Primary Care	Total #RTs covering clinical roles for COPD patients	9		<6		8		<6	
	#RT FT Roles	<6	N/A	.	N/A	<6	N/A	<6	N/A
	#RT PT Roles	<6	N/A	<6	N/A	<6	N/A	.	N/A
	#RT Casual Roles	.	N/A	.	N/A	<6	N/A	.	N/A
	Total RT roles	9		<6		8		<6	
	Crude Rate of RT roles per 1,000 COPD patient population	0.10 (0.05, 0.19)		N/A		0.13 (0.05, 0.25)		N/A	
	Total FTE across all RT roles	6.25		<6		6.15		<6	
	Crude Rate of RT FTE's per 1,000 COPD patient population	0.07 (0.03, 0.15)		N/A		0.10 (0.04, 0.21)		N/A	

Appendix 2

Outcome rates among adults aged 35 years and older with COPD in Ontario April 1, 2019, to March 31, 2020 by LHIN

Outcome	Variable		East	West	North	Central	Toronto
	COPD Population Denom		250744	300924	82084	228197	66303
All-cause hospitalizations	Individuals with any hospitalization		34982	43813	13492	31115	9417
	Crude Rate of Individuals with any hospitalization per 1000 COPD patient population (95%CI)		139.51 (138.05, 140.98)	145.59 (144.23, 146.96)	164.37 (161.61, 167.17)	136.35 (134.84, 137.88)	142.03 (139.18, 144.93)
	Total hospitalizations		55136	68502	21848	48670	15631
	Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	23	28	17	22	34
COPD-specific hospitalizations	Individuals with any COPD specific hospitalization		7573	9621	2922	5881	2172
	Crude Rate of Individuals with any COPD-specific hospitalization per 1000 COPD patient population (95%CI)		30.20 (29.53, 30.89)	31.97 (31.34, 32.62)	35.60 (34.32, 36.91)	25.77 (25.12, 26.44)	32.76 (31.40, 34.17)
	Total COPD-specific hospitalizations		10887	13733	3974	8335	3499
	COPD-specific Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-1)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	20	16	16	14	26
COPD-related hospitalizations	Individuals with any COPD-related hospitalization		3174	3802	977	3212	905
	Crude Rate of Individuals with any COPD-related hospitalization per 1000 COPD patient population (95%CI)		12.66 (12.22, 13.11)	12.63 (12.24, 13.04)	11.90 (11.17, 12.67)	14.08 (13.59, 14.57)	13.65 (12.77, 14.57)
	Total COPD-related hospitalizations		3548	4182	1084	3597	1018
	COPD-related Hospitalizations per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	11	4	4	8	4
Cardiovascular-related hospitalizations	Individuals with any Cardiovascular-related hospitalization		9821	12587	3867	8889	2569
	Crude Rate of Individuals with any Cardiovascular-related hospitalization per 1000 COPD patient population (95%CI)		39.17 (38.40, 39.95)	41.83 (41.10, 42.57)	47.11 (45.64, 48.62)	38.95 (38.15, 39.77)	38.75 (37.26, 40.27)

Outcome	Variable		East	West	North	Central	Toronto
	Total Cardiovascular-related hospitalizations		13463	16943	5378	12271	3562
	Cardiovascular-related Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-1)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	12	10	9	11	21
All-cause ED visits	Individuals with any ED visit		80270	95347	32550	64208	17647
	Crude Rate of Individuals with any ED visit per 1000 COPD patient population (95%CI)		320.13 (317.92, 322.35)	316.85 (314.84, 318.87)	396.55 (392.25, 400.88)	281.37 (279.20, 283.56)	266.16 (262.24, 270.11)
	Total ED visits		161717	189697	79100	117580	36973
	ED visits per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-3)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	278	253	237	132	176
COPD-specific ED visits	Individuals with any COPD-specific ED visit		6587	7370	3147	3267	898
	Crude Rate of Individuals with any COPD-specific ED visit per 1000 COPD patient population (95%CI)		26.27 (25.64, 26.91)	24.49 (23.94, 25.06)	38.34 (37.01, 39.70)	14.32 (13.83, 14.82)	13.54 (12.67, 14.46)
	Total COPD-specific ED visits		9168	10608	4785	4430	1366
	COPD-specific ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-2)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	22	66	65	26	42
COPD-related ED visits	Individuals with any COPD-related ED visit		4388	5858	2144	3195	738
	Crude Rate of Individuals with any COPD-related ED visit per 1000 COPD patient population (95%CI)		17.50 (16.99, 18.03)	19.47 (18.97, 19.97)	26.12 (25.03, 27.25)	14.00 (13.52, 14.50)	11.13 (10.34, 11.96)
	Total COPD-related ED visits		4891	6461	2491	3501	812
	COPD-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	7	7	6	5	4
Cardiovascular-related ED visits	Individuals with any Cardiovascular-related ED visit		3239	3179	1123	1955	668
	Crude Rate of Individuals with any Cardiovascular-related ED visit per 1000 COPD patient population (95%CI)		12.92 (12.48, 13.37)	10.56 (10.20, 10.94)	13.68 (12.89, 14.51)	8.57 (8.19, 8.96)	10.07 (9.33, 10.87)
	Total Cardiovascular-related ED visits		3900	3727	1413	2220	784
	Cardiovascular-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	18	41	11	8	7

Outcome	Variable		East	West	North	Central	Toronto
Primary care visits	Individuals with any Primary care visit		213373	259572	66065	201980	56637
	Crude Rate of Individuals with any Primary Care visit per 1000 COPD patient population (95%CI)		850.96 (847.35, 854.58)	862.58 (859.27, 865.91)	804.85 (798.72, 811.01)	885.11 (881.26, 888.98)	854.21 (847.19, 861.28)
	Total Primary Care visits		1275460	1577331	344823	1431689	422005
	Primary care visits per person	Median_IQR	4 (2-7)	4 (2-8)	4 (2-7)	5 (3-9)	5 (3-9)
		Min	1	1	1	1	1
		Max	164	360	197	308	206
Specialist visits to any specialist serving the COPD patient population (geriatricians, internal medicine specialists, and respirologists)	Individuals with any COPD Specialist visit		58901	83518	14227	64113	19146
	Crude Rate of Individuals with any COPD Specialist visit per 1000 COPD patient population (95%CI)		234.90 (233.01, 236.81)	277.54 (275.66, 279.43)	173.32 (170.49, 176.19)	280.95 (278.78, 283.14)	288.77 (284.69, 292.88)
	Total COPD Specialist visits	Total	136075	199517	27636	161020	52282
	COPD Specialist visits per person	Median_IQR	2 (1-3)	2 (1-3)	1 (1-2)	2 (1-3)	2 (1-3)
		Min	1	1	1	1	1
		Max	89	95	28	114	126
All-cause mortality	Total deaths		10131	12634	3519	8060	2541
	Crude Rate of deaths per 1000 COPD patient population (95%CI)		40.40 (39.62, 41.20)	41.98 (41.26, 42.72)	42.87 (41.47, 44.31)	35.32 (34.55, 36.10)	38.32 (36.85, 39.84)
	Age at death	min	36	37	38	36	40
		max	101	101	101	101	101
		Median_IQR	81 (72-88)	80 (71-88)	79 (69-86)	83 (74-89)	82 (71-90)
	Age group at death	35-49	95	103	39	71	17
		50-64	1148	1484	495	737	340
		65+	8888	11047	2985	7252	2184

Outcome rates among adults aged 35 years and older with COPD in Ontario April 1, 2019, to March 31, 2020 by LHIN (cont'd)

Outcome	Variable		LHIN 1	LHIN 2	LHIN 3	LHIN 4	LHIN 5
	COPD Population Denom		67,940	76269	41647	115068	38368
All-cause hospitalizations	Individuals with any hospitalization		9,327	11554	5967	16965	5171
	Crude Rate of Individuals with any hospitalization per 1000 COPD patient population (95%CI)		137.28 (134.51, 140.10)	151.49 (148.74, 154.28)	143.28 (139.66, 146.96)	147.43 (145.22, 149.67)	134.77 (131.13, 138.50)
	Total hospitalizations		14209	18524	9147	26622	8052
	Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	16	16	19	28	15
COPD-specific hospitalizations	Individuals with any COPD specific hospitalization		2,195	2642	1390	3394	831
	Crude Rate of Individuals with any COPD-specific hospitalization per 1000 COPD patient population (95%CI)		32.31 (30.97, 33.69)	34.64 (33.33, 35.99)	33.38 (31.64, 35.18)	29.50 (28.51, 30.50)	21.66 (20.21, 23.18)
	Total COPD-specific hospitalizations		3,198	3782	1869	4884	1159
	COPD-specific Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-1)	1 (1-2)	1 (1-1)
		Min	1	1	1	1	1
		Max	16	15	9	14	10
COPD-related hospitalizations	Individuals with any COPD-related hospitalization		733	1082	432	1555	603
	Crude Rate of Individuals with any COPD-related hospitalization per 1000 COPD patient population (95%CI)		10.79 (10.02, 11.60)	14.19 (13.35, 15.06)	10.37 (9.42, 11.40)	13.51 (12.85, 14.20)	15.72 (14.49, 17.02)
	Total COPD-related hospitalizations		818	1200	468	1696	660
	COPD-related Hospitalizations per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	4	3	3	3	3
Cardiovascular-related hospitalizations	Individuals with any Cardiovascular-related hospitalization		2801	3060	1607	5119	1574

Outcome	Variable		LHIN 1	LHIN 2	LHIN 3	LHIN 4	LHIN 5
	Crude Rate of Individuals with any Cardiovascular-related hospitalization per 1000 COPD patient population (95%CI)		41.23 (39.71, 42.78)	40.12 (38.71, 41.57)	38.59 (36.72, 40.52)	44.49 (43.28, 45.72)	41.02 (39.02, 43.10)
	Total Cardiovascular-related hospitalizations		3797	4133	2082	6931	2150
	Cardiovascular-related Hospitalizations per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	8	10	7	10	10
All-cause ED visits	Individuals with any ED visit		19288	28446	12228	35385	11505
	Crude Rate of Individuals with any ED visit per 1000 COPD patient population (95%CI)		283.90 (279.91, 287.93)	372.97 (368.65, 377.33)	293.61 (288.43, 298.86)	307.51 (304.32, 310.73)	299.86 (294.40, 305.39)
	Total ED visits		37296	60260	23431	68710	21922
	ED visits per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	83	51	125	253	95
COPD-specific ED visits	Individuals with any COPD-specific ED visit		1524	2584	950	2312	578
	Crude Rate of Individuals with any COPD-specific ED visit per 1000 COPD patient population (95%CI)		22.43 (21.32, 23.59)	33.88 (32.59, 35.21)	22.81 (21.38, 24.31)	20.09 (19.28, 20.93)	15.06 (13.86, 16.34)
	Total COPD-specific ED visits		2124	3848	1289	3347	802
	COPD-specific ED visits per person	Median_IQR	1 (1-1)	1 (1-2)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	34	27	16	66	26
COPD-related ED visits	Individuals with any COPD-related ED visit		1101	1984	659	2114	645
	Crude Rate of Individuals with any COPD-related ED visit per 1000 COPD patient population (95%CI)		16.21 (15.26, 17.19)	26.01 (24.88, 27.18)	15.82 (14.64, 17.08)	18.37 (17.60, 19.17)	16.81 (15.54, 18.16)
	Total COPD-related ED visits		1198	2208	730	2325	713
	COPD-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	4	6	4	7	4
Cardiovascular-related ED visits	Individuals with any Cardiovascular-related ED visit		797	969	383	1030	319

Outcome	Variable		LHIN 1	LHIN 2	LHIN 3	LHIN 4	LHIN 5
	Crude Rate of Individuals with any Cardiovascular-related ED visit per 1000 COPD patient population (95%CI)		11.73 (10.93, 12.57)	12.71 (11.92, 13.53)	9.20 (8.30, 10.17)	8.95 (8.41, 9.52)	8.31 (7.43, 9.28)
	Total Cardiovascular-related ED visits		915	1136	499	1177	366
	Cardiovascular-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	4	5	41	6	8
Primary care visits	Individuals with any Primary care visit		58801	64764	35288	100719	34482
	Crude Rate of Individuals with any Primary Care visit per 1000 COPD patient population (95%CI)		865.48 (858.50, 872.51)	849.15 (842.62, 855.72)	847.31 (838.49, 856.20)	875.30 (869.90, 880.72)	898.72 (889.26, 908.25)
	Total Primary Care visits		384228	358736	180040	654327	277410
	Primary care visits per person	Median_IQR	5 (3-8)	4 (2-7)	4 (2-6)	5 (2-8)	6 (3-10)
		Min	1	1	1	1	1
		Max	235	188	100	360	162
Specialist visits to any specialist serving the COPD patient population (geriatricians, internal medicine specialists, and respirologists)	Individuals with any COPD Specialist visit		20699	17201	10156	35462	11049
	Crude Rate of Individuals with any COPD Specialist visit per 1000 COPD patient population (95%CI)		304.67 (300.53, 308.85)	225.53 (222.17, 228.93)	243.86 (239.14, 248.65)	308.18 (304.98, 311.41)	287.97 (282.63, 293.39)
	Total COPD Specialist visits	Total	50373	36056	22961	90127	28246
	COPD Specialist visits per person	Median_IQR	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)
		Min	1	1	1	1	1
		Max	26	95	29	53	45
All-cause mortality	Total deaths		2708	3317	1761	4848	1290
	Crude Rate of deaths per 1000 COPD patient population (95%CI)		39.86 (38.37, 41.39)	43.49 (42.02, 45.00)	42.28 (40.33, 44.31)	42.13 (40.95, 43.33)	33.62 (31.81, 35.51)
	Age at death	min	38	39	37	38	36
		max	101	101	101	101	100
		Median_IQR	80 (71-88)	80 (71-88)	81 (72-89)	81 (71-88)	82 (73-88)
	Age group at death	35-49	17	31	11	44	15
		50-64	340	369	189	586	143
		65+	2351	2917	1561	4218	1132

Outcome rates among adults aged 35 years and older with COPD in Ontario April 1, 2019, to March 31, 2020 by LHIN

Outcome	Variable		LHIN 6	LHIN 7	LHIN 8	LHIN 9	LHIN 10
	COPD Population Denom		52677	66303	94232	112215	48902
All-cause hospitalizations	Individuals with any hospitalization		7254	9417	12087	15190	7293
	Crude Rate of Individuals with any hospitalization per 1000 COPD patient population (95%CI)		137.71 (134.56, 140.91)	142.03 (139.18, 144.93)	128.27 (125.99, 130.58)	135.37 (133.22, 137.54)	149.14 (145.73, 152.60)
	Total hospitalizations		11157	15631	18895	23396	11532
	Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	22	34	15	23	13
COPD-specific hospitalizations	Individuals with any COPD specific hospitalization		1393	2172	2128	3042	1822
	Crude Rate of Individuals with any COPD-specific hospitalization per 1000 COPD patient population (95%CI)		26.44 (25.07, 27.87)	32.76 (31.40, 34.17)	22.58 (21.63, 23.56)	27.11 (26.15, 28.09)	37.26 (35.57, 39.01)
	Total COPD-specific hospitalizations		1929	3499	3048	4312	2618
	COPD-specific Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-1)	1 (1-2)
		Min	1	1	1	1	1
		Max	12	26	14	20	11
COPD-related hospitalizations	Individuals with any COPD-related hospitalization		744	905	1334	1373	575
	Crude Rate of Individuals with any COPD-related hospitalization per 1000 COPD patient population (95%CI)		14.12 (13.13, 15.18)	13.65 (12.77, 14.57)	14.16 (13.41, 14.94)	12.24 (11.60, 12.90)	11.76 (10.82, 12.76)
	Total COPD-related hospitalizations		836	1018	1517	1521	633
	COPD-related Hospitalizations per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	8	4	4	11	6
Cardiovascular-related hospitalizations	Individuals with any Cardiovascular-related hospitalization		2000	2569	3495	4095	2032

Outcome	Variable		LHIN 6	LHIN 7	LHIN 8	LHIN 9	LHIN 10
	Crude Rate of Individuals with any Cardiovascular-related hospitalization per 1000 COPD patient population (95%CI)		37.97 (36.32, 39.67)	38.75 (37.26, 40.27)	37.09 (35.87, 38.34)	36.49 (35.38, 37.63)	41.55 (39.77, 43.40)
	Total Cardiovascular-related hospitalizations		2720	3562	4854	5622	2678
	Cardiovascular-related Hospitalizations per person	Median_IQR	1 (1-1)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-1)
		Min	1	1	1	1	1
		Max	8	21	11	8	12
All-cause ED visits	Individuals with any ED visit		13645	17647	24372	33520	17910
	Crude Rate of Individuals with any ED visit per 1000 COPD patient population (95%CI)		259.03 (254.70, 263.41)	266.16 (262.24, 270.11)	258.64 (255.40, 261.91)	298.71 (295.52, 301.93)	366.24 (360.90, 371.65)
	Total ED visits		23976	36973	42546	64925	37705
	ED visits per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1	1
		Max	132	176	78	278	63
COPD-specific ED visits	Individuals with any COPD-specific ED visit		536	898	943	2287	1831
	Crude Rate of Individuals with any COPD-specific ED visit per 1000 COPD patient population (95%CI)		10.18 (9.33, 11.07)	13.54 (12.67, 14.46)	10.01 (9.38, 10.67)	20.38 (19.55, 21.23)	37.44 (35.75, 39.20)
	Total COPD-specific ED visits		703	1366	1239	3140	2629
	COPD-specific ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	23	42	21	18	14
COPD-related ED visits	Individuals with any COPD-related ED visit		601	738	1063	1696	1033
	Crude Rate of Individuals with any COPD-related ED visit per 1000 COPD patient population (95%CI)		11.41 (10.52, 12.36)	11.13 (10.34, 11.96)	11.28 (10.61, 11.98)	15.11 (14.40, 15.85)	21.12 (19.86, 22.45)
	Total COPD-related ED visits		638	812	1160	1870	1160
	COPD-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	2	4	4	7	5
Cardiovascular-related ED visits	Individuals with any Cardiovascular-related ED visit		382	668	769	1165	682

Outcome	Variable		LHIN 6	LHIN 7	LHIN 8	LHIN 9	LHIN 10
	Crude Rate of Individuals with any Cardiovascular-related ED visit per 1000 COPD patient population (95%CI)		7.25 (6.54, 8.02)	10.07 (9.33, 10.87)	8.16 (7.59, 8.76)	10.38 (9.79, 11.00)	13.95 (12.92, 15.03)
	Total Cardiovascular-related ED visits		417	784	873	1353	822
	Cardiovascular-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1	1
		Max	5	7	4	18	7
Primary care visits	Individuals with any Primary care visit		47051	56637	84197	98165	40353
	Crude Rate of Individuals with any Primary Care visit per 1000 COPD patient population (95%CI)		893.20 (885.15, 901.31)	854.21 (847.19, 861.28)	893.51 (887.48, 899.56)	874.79 (869.33, 880.28)	825.18 (817.15, 833.27)
	Total Primary Care visits		346461	422005	621357	644424	210784
	Primary care visits per person	Median_IQR	5 (3-9)	5 (3-9)	5 (3-9)	5 (3-8)	4 (2-7)
		Min	1	1	1	1	1
		Max	121	206	308	164	98
Specialist visits to any specialist serving the COPD patient population (geriatricians, internal medicine specialists, and respirologists)	Individuals with any COPD Specialist visit		16666	19146	27925	30052	8824
	Crude Rate of Individuals with any COPD Specialist visit per 1000 COPD patient population (95%CI)		316.38 (311.60, 321.22)	288.77 (284.69, 292.88)	296.34 (292.88, 299.84)	267.81 (264.79, 270.85)	180.44 (176.70, 184.25)
	Total COPD Specialist visits	Total	42203	52282	73241	72309	18650
	COPD Specialist visits per person	Median_IQR	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-2)
		Min	1	1	1	1	1
		Max	62	126	114	89	28
All-cause mortality	Total deaths		1872	2541	3098	4387	2167
	Crude Rate of deaths per 1000 COPD patient population (95%CI)		35.54 (33.95, 37.18)	38.32 (36.85, 39.84)	32.88 (31.73, 34.05)	39.09 (37.95, 40.27)	44.31 (42.47, 46.22)
	Age at death	min	37	40	37	36	36
		max	101	101	101	101	101
		Median_IQR	83 (75-90)	82 (71-90)	84 (75-90)	82 (72-89)	79 (70-87)
	Age group at death	35-49	15	17	20	44	19
		50-64	148	340	262	489	267
		65+	1709	2184	2816	3854	1881

Outcome rates among adults aged 35 years and older with COPD in Ontario April 1, 2019, to March 31, 2020 by LHIN (cont'd)

Outcome	Variable		LHIN 11	LHIN 12	LHIN 13	LHIN 14
	COPD Population Denom		89627	42920	62876	19208
All-cause hospitalizations	Individuals with any hospitalization		12499	6603	10090	3402
	Crude Rate of Individuals with any hospitalization per 1000 COPD patient population (95%CI)		139.46 (137.02, 141.92)	153.84 (150.16, 157.60)	160.47 (157.36, 163.64)	177.11 (171.21, 183.17)
	Total hospitalizations		20208	10566	16099	5749
	Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1
		Max	13	15	17	12
COPD-specific hospitalizations	Individuals with any COPD specific hospitalization		2709	1529	2258	664
	Crude Rate of Individuals with any COPD-specific hospitalization per 1000 COPD patient population (95%CI)		30.23 (29.10, 31.39)	35.62 (33.86, 37.46)	35.91 (34.45, 37.42)	34.57 (31.99, 37.30)
	Total COPD-specific hospitalizations		3957	2199	3070	904
	COPD-specific Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-1)	1 (1-1)
		Min	1	1	1	1
		Max	10	8	16	8
COPD-related hospitalizations	Individuals with any COPD-related hospitalization		1226	531	660	317
	Crude Rate of Individuals with any COPD-related hospitalization per 1000 COPD patient population (95%CI)		13.68 (12.92, 14.47)	12.37 (11.34, 13.47)	10.50 (9.71, 11.33)	16.50 (14.74, 18.42)
	Total COPD-related hospitalizations		1394	584	717	367
	COPD-related Hospitalizations per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1
		Max	5	3	4	3
Cardiovascular-related hospitalizations	Individuals with any Cardiovascular-related hospitalization		3694	1820	2918	949

Outcome	Variable		LHIN 11	LHIN 12	LHIN 13	LHIN 14
	Crude Rate of Individuals with any Cardiovascular-related hospitalization per 1000 COPD patient population (95%CI)		41.22 (39.90, 42.57)	42.40 (40.48, 44.40)	46.41 (44.74, 48.12)	49.41 (46.31, 52.65)
	Total Cardiovascular-related hospitalizations		5163	2547	4043	1335
	Cardiovascular-related Hospitalizations per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1
		Max	11	9	9	7
All-cause ED visits	Individuals with any ED visit		28840	14686	24949	7601
	Crude Rate of Individuals with any ED visit per 1000 COPD patient population (95%CI)		321.78 (318.07, 325.51)	342.17 (336.66, 347.75)	396.80 (391.89, 401.75)	395.72 (386.87, 404.72)
	Total ED visits		59087	29136	58916	20184
	ED visits per person	Median_IQR	1 (1-2)	1 (1-2)	1 (1-3)	2 (1-3)
		Min	1	1	1	1
		Max	84	78	202	237
COPD-specific ED visits	Individuals with any COPD-specific ED visit		2469	1210	2450	697
	Crude Rate of Individuals with any COPD-specific ED visit per 1000 COPD patient population (95%CI)		27.55 (26.47, 28.66)	28.19 (26.63, 29.83)	38.97 (37.44, 40.54)	36.29 (33.64, 39.08)
	Total COPD-specific ED visits		3399	1686	3811	974
	COPD-specific ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-2)	1 (1-1)
		Min	1	1	1	1
		Max	22	12	65	15
COPD-related ED visits	Individuals with any COPD-related ED visit		1659	886	1587	557
	Crude Rate of Individuals with any COPD-related ED visit per 1000 COPD patient population (95%CI)		18.51 (17.63, 19.42)	20.64 (19.31, 22.05)	25.24 (24.01, 26.51)	29.00 (26.64, 31.51)
	Total COPD-related ED visits		1861	990	1841	650
	COPD-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1
		Max	6	5	6	6
Cardiovascular-related ED visits	Individuals with any Cardiovascular-related ED visit		1392	485	817	306

Outcome	Variable		LHIN 11	LHIN 12	LHIN 13	LHIN 14
	Crude Rate of Individuals with any Cardiovascular-related ED visit per 1000 COPD patient population (95%CI)		15.53 (14.73, 16.37)	11.30 (10.32, 12.35)	12.99 (12.12, 13.92)	15.93 (14.20, 17.82)
	Total Cardiovascular-related ED visits		1725	564	1009	404
	Cardiovascular-related ED visits per person	Median_IQR	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
		Min	1	1	1	1
		Max	8	5	5	11
Primary care visits	Individuals with any Primary care visit		74855	36250	51176	14889
	Crude Rate of Individuals with any Primary Care visit per 1000 COPD patient population (95%CI)		835.18 (829.21, 841.19)	844.59 (835.92, 853.33)	813.92 (806.88, 821.00)	775.15 (762.74, 787.70)
	Total Primary Care visits		420252	186461	265810	79013
	Primary care visits per person	Median_IQR	4 (2-7)	4 (2-6)	4 (2-6)	4 (2-7)
		Min	1	1	1	1
		Max	155	257	197	183
Specialist visits to any specialist serving the COPD patient population (geriatricians, internal medicine specialists, and respirologists)	Individuals with any COPD Specialist visit		20025	8473	10924	3303
	Crude Rate of Individuals with any COPD Specialist visit per 1000 COPD patient population (95%CI)		223.43 (220.34, 226.54)	197.41 (193.23, 201.66)	173.74 (170.50, 177.03)	171.96 (166.14, 177.93)
	Total COPD Specialist visits	Total	45116	17330	21268	6368
	COPD Specialist visits per person	Median_IQR	2 (1-3)	2 (1-2)	1 (1-2)	1 (1-2)
		Min	1	1	1	1
		Max	48	76	28	18
All-cause mortality	Total deaths		3577	1800	2635	884
	Crude Rate of deaths per 1000 COPD patient population (95%CI)		39.91 (38.61, 41.24)	41.94 (40.02, 43.92)	41.91 (40.32, 43.54)	46.02 (43.04, 49.16)
	Age at death	min	36	38	38	39
		max	101	101	101	100
		Median_IQR	81 (72-89)	81 (72-88)	79 (70-86)	79 (69-87)
	Age group at death	35-49	32	21	22	17
		50-64	392	184	377	118
		65+	3153	1595	2236	749