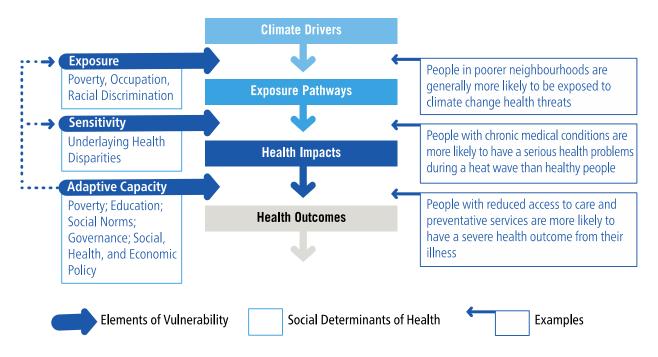# CHAPTER 4
Vulnerable Populations

4.0 Populations Vulnerable to Climate Change in York Region

It is unlikely that the impacts of climate change will be experienced equally amongst York Region residents, with certain subpopulations being more vulnerable. In the context of climate change, vulnerable populations are those at greater risk for health impacts due to increased sensitivity, capacity to respond and/or increased exposure. Considering the range of climate change impacts, incorporating a social determinants of health (SDOH) lens will help frame the potential impacts on vulnerable populations. Figure 4.2 illustrates the relationship of SDOH and climate vulnerability based on exposure, sensitivity and adaptive capacity.

Figure 4.2. The relationship between social determinants of health and climate change health impacts.

Source: Gamble JL, Balbus J et al. Ch. 9: Populations of concern. In. The impacts of climate change on human health in the United States: a scientific assessment [Internet]. Washington: U.S. Global Change Research Program; 2016. Fig 9.2, Intersection of social determinants of health and vulnerability; p.251. Available from: https://s3.amazonaws.com/climatehealth2016/low/ClimateHealth2016_09_Populations_small.pdf. Reproduced with permission from the copyright holder.

These SDOH factors can act individually and collectively and can contribute to climate change vulnerability from both exposure and adaptive capacity. Some examples include:[22]

- Populations that may have a greater risk of exposure to extreme weather events, such as outdoor workers, emergency responders and individuals who are active outdoors

- Individuals who spend more time in higher risk areas, such as individuals living in urban heat islands or flood plains or who regularly access trails with disease vectors present

- Infrastructure conditions that impact supply or availability of resources and services, such as limited availability and costs of food resources for low-income individuals during extreme weather events

- Individuals with low socioeconomic status (SES) who may experience challenges coping with stressors, or may have barriers to access services

Populations can also be more vulnerable due to factors such as age, life stage and general health status. Certain age groups, such as children and seniors and individuals with pre-existing conditions can be more susceptible to climate change impacts, including individuals with respiratory conditions who are more susceptible to aeroallergens. This refers to the **biological sensitivity** of populations that can contribute to the overall health status of populations.[22]

To better understand the potential impacts of climate change in York Region, the following sections provide an overview of vulnerable populations relating to SDOH and sensitivity.

Perceived health status of York Region residents

Good health and physical activity levels can also increase a population's resiliency to health impacts from climate change. The **Canadian Community Health Survey** (CCHS) collects information on self-reported health indicators for York Region.[23] Table 4.1 presents results from the 2015 to 2016 CCHS for different demographics based on age and gender. Overall, the majority of the population 12 years of age and older perceived their health to be very good or excellent.

Individuals with pre-existing diseases are also vulnerable to environmental stressors from climate change. Examples include heat stress impacting those with cardiovascular diseases. When considering York Region's aging population, it is likely that existing chronic diseases and mobility limitations will become larger issues in the future. Senior populations reported having relatively poorer health indicators such as perceived health, being overweight, arthritis and higher blood pressure. There are also some gender differences, with a higher percentage of males being smokers (Table 4.1).

Table 4.1. Self-reported health indicators, by age and gender, in York Region, 2015 to 2016.

Indicator	Percentage (%) of the total population (12 years of age and older)	Percentage (%) of youth (12 to 17 year-olds) population	Percentage (%) of senior 65 years of age and older) population	Percentage (%) of female population	Percentage (%) of male population
Perceived very good or excellent health	62.0	79.7	44.3	64.3	59.5
Perceived health fair or poor	9.7	≠	24.1	9.6	9.8
Perceived mental health, very good or excellent	71.1	83.8	61.4	69.5	72.9
Perceived life stress, most days quite a bit or extremely stressful	23.5	8.2*	14.8*	26.9	20.0
Life satisfaction, satisfied or very satisfied	94.7	100	90.7	96.0	93.3
BMI: Overweight (18 years of age and older)	32.6	N/A	44.8	26.8	38.4
BMI: Obese (18 years of age and older)	21.4	N/A	20.5	17.8	24.8
BMI: Overweight or obese (12 to 17 years of age)	N/A	18.3*	N/A	≠	≠
Arthritis (15 years of age and older)	16.6	≠	39.8	17.2	15.9
Diabetes	7.0	≠	20.4	5.0*	9.2
Asthma	6.2*	5.9*	4.4*	6.0*	6.5*
High blood pressure	16.1	≠	49.6	16.1	16.0
Mood disorder	5.7%	≠	8.2*	6.5*	4.9*
Fruit and vegetable consumption, 5x or more per day	29.7	19.0	31.2	35.8	23.1
Current smoker (daily or occasional)	12.6	≠	5.7*	9.5	15.7
Sense of belonging to local community, somewhat strong or very strong	68.8	84.4	69.9	70.8	66.8
Has a regular healthcare provider	92.7	92.6	96.7	96.0	89.2

Data Source: 2015 to 2016 Canadian Community Health Survey, Table 13-10-0113-01, Statistics Canada, 2017. Percentage of the population is based on 2016 population data.
* Interpret with caution
≠ Estimate too unreliable to report

Source: Self-reported health indicators by age and gender in York Region 2015-2016. Canadian Community Health Survey, 2017, Statistics Canada, Ontario Share File, Ontario Ministry of Health and Long-Term Care.

Socioeconomic status

Climate change can exacerbate health inequities by impacting those with low socioeconomic status (SES). SES is influenced by many factors, including the level of education, income, social status and connectedness with communities, and gender. Low SES individuals are more vulnerable as they have fewer resources and social supports to respond to current and future climate events.

Individuals considered low SES are more likely to have poorer health and are disproportionately affected by chronic medical conditions, such as mental health illnesses, asthma, diabetes and cardiovascular diseases.[24] These health status inequities can worsen as a result of climate change impacts.[22,25]

Many of these factors are considered in the Ontario Marginalization Index,[26] which looks at the geographic distribution of multiple variables related to SES, such as income, social isolation, dependency and ethnic identity. There are areas in York Region that consistently reported poorly on the Ontario Marginalization Index variables and also had poorer health outcomes. Examples include:[24]

- Higher rates of premature mortality in areas with the most material deprivation[i]
- Higher hospital admission rates overall in areas with the most material deprivation and residential instability[j]
- Higher hospital admission rates for injuries and cardiovascular disease in areas that had higher material deprivation and residential instability

Low-income

Low-income[k] populations are more vulnerable to environmental exposures and have a reduced capacity to adapt due to limited social support and financial resources. Income is a key determinant of health that can affect a person's vulnerability to multiple climate change health impacts, including food security, air quality, extreme heat and extreme weather events.[4,5] In addition, low-income populations tend to reside in areas with older infrastructure or poorer housing conditions. In 2016, 11,090 (3%) of York Region dwellings were in need of major plumbing, electrical wiring or structural repairs.[13] Around 14% of children and 11.5% of seniors resided in low-income households in York Region in 2016 (Figure 4.3).
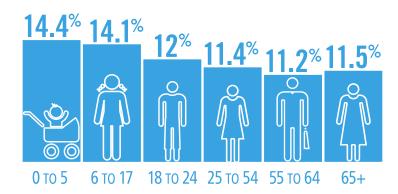
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[i] Material deprivation is based on multiple census variables that are reflective of refers to the inability or challenges in affording modern day goods and conveniences.
[j] Residential instability refers to the instability experienced in families and in housing.
[k] A person is considered low-income if the income of the census family they live in (or, in the case of a person not living in a census family, their individual income) fell below the Low Income Measure After, Tax (LIM-AT) for their census family size.

Figure 4.3. The proportion of the population in low-income households in York Region in 2016.

Proportion of Population in Low Income Households

14.4% 14.1% 12% 11.4% 11.2% 11.5%

0 TO 5   6 TO 17   18 TO 24   25 TO 54   55 TO 64   65+

Statistics Canada has revised the methodology used to calculate annual after-tax Low Income Measure (LIM-AT) for the 2016 Census. Please refer to the back page for more details.*

The income data reported represents people aged 15 and over.

Source: The Regional Municipality of York. 2016 Census release reports [Internet]. Newmarket: Regional Municipality of York; 2018. Proportion of population in low income households; p. D3. Available from https://www.yorklink.ca/wp-content/uploads/2018/03/2016-census-release-york-region.pdf

While York Region had the second highest median household income in the Greater Toronto and Hamilton Area in the 2016 Census,[27] the number of low-income residents grew faster than the overall population between 2000 and 2012.[28] The majority of low-income populations reside in the most populated municipalities of Markham, Richmond Hill and Vaughan, with low-income rates as high as 25.1% to 35.5% in nine census tracts in 2012.[28] Neighbourhoods with the lowest income also reported having poor health, more residents who smoke and higher all-cause hospitalization rates.[24]
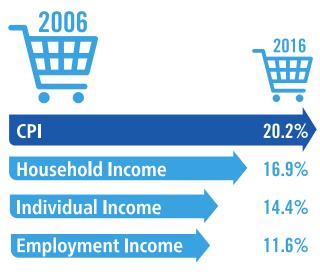
In 2016, there were 164,840 low-income residents in York Region, representing 15% of the population.[29] While the proportion of low-income seniors living in York Region is relatively low, the proportion has increased from 7% in 2000 to 11.5% in 2016.[27,30]

The cost of living has substantially increased in York Region relative to income levels. From 2006 to 2016, the Consumer Price Index (CPI) increased at a higher rate than income in York Region (Figure 4.4). In 2016, 28% of homeowners and 52% of renters were spending 30% or more of their income on shelter costs.[27] The CPI may also be an important consideration for individuals who are not considered low-income as they may have fewer resources to adapt to climate change impacts.

Figure 4.4. Growth in Consumer Price Index compared to income from 2006 to 2016 in York Region.

Income and cost of living since 2006

Since 2006, the Consumer Price Index (CPI) has grown faster than York Region's median household, individual and employment income.

2006

2016

CPI	20.2%
Household Income	16.9%
Individual Income	14.4%
Employment Income	11.6%

The Ontario inflation rate was used in the Consumer Price Index (CPI) calculation.

Source: The Regional Municipality of York. 2016 Census release reports [Internet]. Newmarket: Regional Municipality of York; 2018. Income and cost of living since 2006; p. D3. Available from https://www.yorklink.ca/wp-content/uploads/2018/03/2016-census-release-york-region.pdf

Homelessness

Individuals who are homeless are vulnerable to climate change due to:[31]

- Increased exposure to extreme temperatures and disease vectors

- High rates of poorly controlled chronic illness, respiratory illnesses and mental illnesses
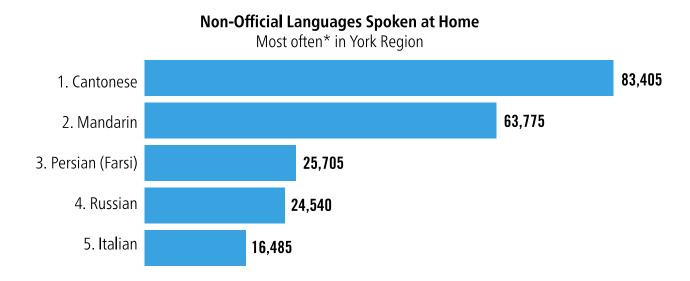
- Limited resources to adapt to climate change impacts

Individuals experiencing homelessness in York Region tend to be adults between the ages of 25 and 65.[32] A recent 2018 **I Count** homelessness survey conducted in April 2018 found 389 individuals experiencing homelessness in York Region.[32] The majority of those living unsheltered were male (82%) and were homeless for six months or more in the past year (79%). Around 1 in 3 individuals were 24 years of age or younger. Gender differences were less pronounced for those living in emergency housing or provisional accommodation.[32]

Of those surveyed, individuals reported having a mental health issue (48%), an existing medical condition (37%), an addiction (34%) or a physical disability (31%).[32]

New permanent residents

The inability to speak one of the official languages adds vulnerability as it presents a barrier to accessing services and connecting with the community. The most common non-official languages spoken in York Region homes are Cantonese, Mandarin, Persian (Farsi), Russian and Italian (Figure 4.5). From 2010 to 2014, 40% of new permanent residents who intended to settle in York Region arrived with no ability to speak English or French. This is a higher proportion than the average for Canada (29%), Ontario (28%) and the GTA (30%).[33] Approximately 72% of the seniors who arrived in York Region between 2010 and 2014 had no ability to speak English or French (Figure 4.6).[33]
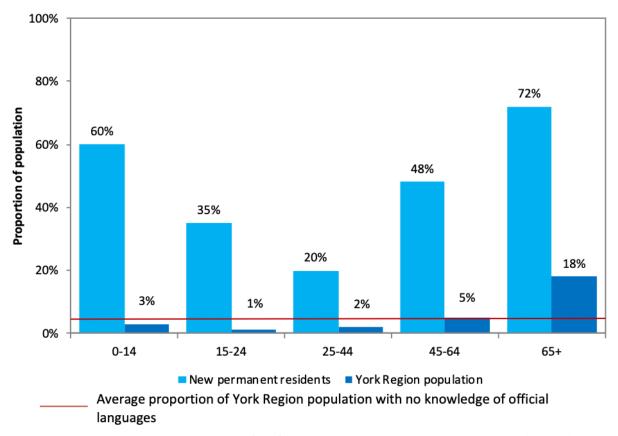
Figure 4.5. Most common non-official languages spoken at home by York Region residents in 2016.

Non-Official Languages Spoken at Home
Most often* in York Region

Language	Count
1. Cantonese	83,405
2. Mandarin	63,775
3. Persian (Farsi)	25,705
4. Russian	24,540
5. Italian	16,485

*Numbers based on the total number of respondents who provided a single response at the time of data collection

Source: The Regional Municipality of York. 2016 Census release reports [Internet]. Newmarket: Regional Municipality of York; 2018. Non-official languages spoken at home; p.C3. Available from: https://www.yorklink.ca/wp-content/uploads/2018/03/2016-census-release-york-region.pdf

Figure 4.6 Proportion of new permanent residents and York Region residents with no knowledge of official languages, by age groups.

Data sources: Citizenship and Immigration Canada (RDM). New permanent resident population 2010-2014 [data file]. Ottawa: Government of Canada; 2015.
2011 Census, York Region Population. Toronto: Statistics Canada.

York Region's new permanent residents are diverse and experience multiple factors increasing their vulnerability. The majority of new permanent residents are settling in Markham, Richmond Hill and Vaughan**.**[33] Each year, approximately 10,000 of the 220,000 new permanent residents admitted to Canada intend to settle in York Region.[33] The top five countries of origin for residents were China, Iran, the Philippines, India and Pakistan.[27] Between 2010 and 2014, 60% of new permanent residents were between 25 and 64 years old, 29% were children/youth and 11% were seniors (Figure 4.7).[33] New immigrants also experience twice the unemployment rate and earn half the income compared to the general York Region population.[34]

Immigration also contributes to the growth of York Region's senior population. Seniors are the fastest growing age group of new permanent residents in York Region. The proportion increased from 6% in 2010 to 11% in 2014 and is higher than the rest of the GTA (6% in 2014).[34]
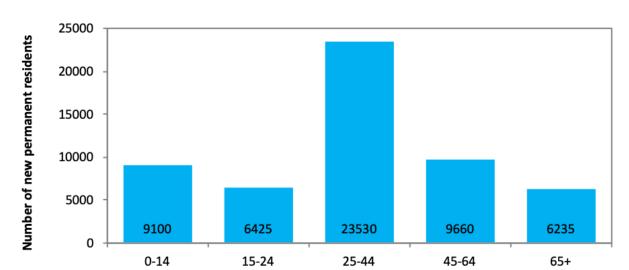
Figure 4.7. Number of new permanent residents, to York Region, by age group between 2010 to 2014.

Data source: Immigration, Refugee, and Citizenship Canada RDM. Number of new York Region permanent residents [data file]. Toronto: Statistics Canada; 2015.

Outdoor workers and recreational activity

Outdoor workers and those active outdoors may have a higher exposure to climate-related hazards such as extreme heat, solar ultraviolet radiation (UVR), air pollution, extreme weather events and vector-borne diseases. In 2016, there were 43,055 people working in construction, 54,185 in manufacturing, 33,525 in the accommodation and food service industry and 2,270 in agriculture or primary industries across York Region (Table 4.2).[13] These occupations may place individuals at a greater risk of exposure to climate-related hazards if appropriate measures are not taken, such as staying hydrated and taking breaks in cool spaces during hot days.

In addition, local residents and visitors may also be spending significant time outdoors for recreational activities, which can also increase the risk of exposure to extreme weather events, extreme temperatures and vector-borne diseases. While an estimated 1,623 individuals visit York Regional Forests daily, there is limited data to illustrate other outdoor activities, such as beach use, municipal parks and trails.[35]

Table 4.2: Number of workers in industries with increased exposure to climate-related hazards for York Region from 2016 Census.

Industry	Total	Males	Females
Construction	43,055	36,235	6,825
Manufacturing	54,185	35,295	18,895
Accommodation and food service industry	33,525	16,090	17,440
Agriculture, forestry, fishing and hunting	2,270	1,380	890

Socially isolated individuals

Social supports and strong social networks have an influence on mental and physical health, and increase the ability of residents to respond to climate change impacts. Those with the fewest social connections tend to experience more mental health problems, illnesses and higher mortality rates.[36]

Based on Statistics Canada's General Social Survey program, the proportion of Canadians having three or more close friends increased slightly from 70% to 75% between 2003 and 2013.[37] However, the percentage of people who saw their friends a few times a week decreased from 56% to 44% over the same period.[37] In the same survey, 6% of Canadians (15% of those 75 years of age or older) reported having no close friends.[37] In 2013, Canadians were also less likely to visit or communicate with family than they were in 2003 (26% versus 38% respectively).[37] Overall, the survey results suggest Canadians are becoming more socially isolated.[37]

In York Region, there has been a 24% increase in the number of one person households from 2011 to 2016, 41% of those being seniors (Figure 4.8). Additionally, there were 43,915 lone parent families, a 13% increase from 2011.[27]

Figure 4.8. The number of one person households in York Region.

York Region One Person Households
Increased by 24 per cent since 2011

42,410
2011

56,460
↑24%
2016

41%
of all people living alone in York Region are Seniors (65+)

Source: The Regional Municipality of York. 2016 Census release reports [Internet]. Newmarket: Regional Municipality of York; 2018. York Region one person households; p. c3. Available from https://www.yorklink.ca/wp-content/uploads/2018/03/2016-census-release-york-region.pdf

Children

Children are considered a vulnerable population for a number of reasons, including:[4]

- Being unable to fully care for themselves and reliant on caregivers

- Having developing systems with less mature immune systems that make them sensitive to diseases and environmental contaminants

- Having thermoregulatory abilities not fully developed

Children under 15 years of age represented 18% of York Region's population in 2016, totalling 195,575 individuals. The number of pre-school aged children (0 to 4 years of age) in York Region declined by 2.5%, or almost 1,500 children, since the 2011 Census.[27] However, five of the nine local municipalities experienced an increase in the number of preschool aged children, with the Township of King and the Town of Whitchurch-Stouffville recording the largest growth rates.[13]

Children from low-income households are particularly vulnerable due to a lack of resources to prevent and treat illnesses. In 2016 around 14% of children under 17 years of age were in low-income households in York Region.[27] Underweight/undernourished children are also more susceptible to infectious diseases that can lead to chronic diseases in later stages of life.[38]

Seniors

Senior citizens may be affected by limitations - functional, physiological, or psychological – that can impact their ability to adapt to climate change, including: [4]

- Reduced thermoregulatory capacity and heat tolerance

- Increased likelihood to suffer from additional chronic diseases, physical disabilities and infections

- Increased social isolation due to the low quantity and/or quality of contact with others, adversely impacting mental and physical well-being

However, it should be noted that seniors in York Region are some of the most affluent in Canada.[30] They also often have more resources at their disposal than other age groups. This may reduce their vulnerability compared to typical senior profiles traditionally discussed in literature. While York Region seniors are, on average, among the most affluent in Canada, the proportion of low-income seniors is increasing.

York Region's senior population is growing faster than any other age group. In 2016, there were 161,870 individuals 65 years of age and older in York Region, representing approximately 15% of the population (Figure 4.9).[27] From 2011 to 2016, the largest increases in senior population occurred in Whitchurch-Stouffville, Richmond Hill, Markham and Vaughan.[27] By 2031, it is estimated that 1 in 5 people in York Region will be 65 years of age or older.[39]
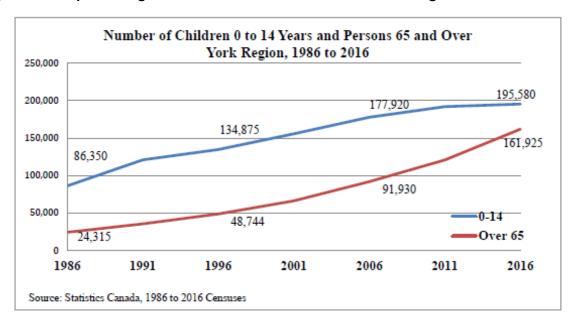
Figure 4.9. Population growth of children and seniors in York Region from 1986 to 2016.

Number of Children 0 to 14 Years and Persons 65 and Over
York Region, 1986 to 2016

Source: Statistics Canada, 1986 to 2016 Censuses

Source: The Regional Municipality of York. 2016 Census release report - age and sex and type of dwelling [Internet]. Newmarket: Regional Municipality of York; 2017. Number of children 0 to 14 years and persons aged 65 and over; p. 2. Available from: https://www.york.ca/wps/wcm/connect/yorkpublic/1bb54839-83b9-44c8-9da6-6cba457fe7ea/2016_Census_Release_Report_YR_Population_Age_and_Sex.pdf?MOD=AJPERES

Senior citizens, particularly those 75 years of age and older, have greater health care needs. Seniors are at an increased risk of falls leading to fatal and non-fatal injuries, and need more supports, care and medication.[39] As such, they use health and social services disproportionately more than the rest of the population and are vulnerable to the disruption of these services.[40]

Recognizing the importance of mental health

Mental health is more than the absence of mental illness. Having good mental health can help individuals to cope during stressful life events and can mitigate the development of poor mental health or mental illnesses.[41] The Public Health Agency of Canada defines mental health as "the capacity of each and all of us to feel, think and act in ways that enhance our ability to enjoy life and deal with the challenges we face."[42] Mental illness refers to conditions that severely and negatively impact how we function in our lives.[43] Mental health and mental illness can be influenced by a mix of social, economic, psychological, biological and genetic factors.[41] The built environment is an important determinant of mental health and includes geography, climate, housing, water, air quality and transportation systems.[44]

Climate change is likely to have significant negative effects on mental health and well-being, especially for vulnerable populations and those with pre-existing mental illnesses. Climate change will affect the mental health of individuals and communities through three main pathways:

1. Increasing the frequency of natural disasters and extreme weather events
2. Increasing the risk of injury and the prevalence of physical injury and illness
3. Changing the environment people rely on for their income and well-being[45]

There is strong evidence that natural disasters lead to stress and poor mental health, such as post-traumatic stress disorder (PTSD), depression and anxiety.[45,46] In a review of 36 studies, increased psychological symptoms, such as anxiety, depression and phobias, were observed in 7% to 40% of individuals who experienced a natural disaster.[47] Depression, anxiety, PTSD, suicidal ideation and suicide rates also increase after a natural disaster. After the 2013 Alberta flood, there was a 64% increase in the number of mental issues reported, as well as a two-fold increase in sleep aid prescriptions and a three-fold increase in sexual assault cases.[48]

Individuals at greater risk for distress and mental health outcomes due to weather-related disasters include seniors, children, women (in particular pregnant and post-partum women), individuals experiencing homelessness, first responders and the economically disadvantaged.[45] Those with pre-existing mental illnesses are vulnerable to extreme heat as it may affect their ability to recognize and take heat-protective behaviours, such as ensuring adequate hydration, wearing appropriate clothing or seeking out cool places. Thermoregulation may also be affected by the use of medication, and individuals may be socially isolated and have deficits in self-care.[49]

Mental health is already an important issue in York Region. The York Region Community and Health Services (CHS) Department is seeing more residents with complex needs across all program areas, including mental health and addictions.

In 2017, the rate of selected mental illness-related emergency visits of York Region residents increased to a 10-year high of 1,860 emergency visits per 100,000 population.[50] In particular, those between the ages of 15 and 24 had the highest rates of mental illness-related emergency visits.[50] Additionally, mental health issues have been increasingly observed across York Region services, with a 40% increase in mental health-related calls to the York Region Police and York Region Paramedic Services between 2012 and 2016.[51] Consequently, the future impacts of climate change in York Region can potentially increase mental health related issues and add further strain to York Region services.

York Region Mental Health Matters: The York Region Mental Health Matters Initiative was launched to support the mental health needs of residents by improving the way that services are provided. It focuses on early intervention, prevention and effective responses to crises. The initiative aims to address mental health issues holistically by collaborating with York Regional Police to help build capacity in building resilience and preventing mental health issues within our communities, providing ongoing support to those living with a mental illness and providing effective crisis intervention. Increasing the effectiveness of mental health service delivery will also build resiliency to climate change.

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