DURHAM REGION
HEALTH DEPARTMENT

2025

CLIMATE CHANGE and HEALTH in DURHAM REGION

Assessing the impact of solar ultraviolet radiation

durham.ca/ClimateAndHealth

The Region of Durham exists on lands that the Michi Saagiig Anishinaabeg inhabited for thousands of years prior to European colonization. These lands are the traditional and treaty territories of the Nations covered under the Williams Treaties, including the Mississaugas of Scugog Island First Nation, Alderville First Nation, Hiawatha First Nation, Curve Lake First Nation, and the Chippewa Nations of Georgina Island, Beausoleil and Rama.

We honour, recognize, and respect Indigenous Peoples as rights holders and stewards of the lands and waters on which we have the privilege to live. In our efforts towards reconciliation, we continue to build and strengthen relationships with First Nations, as well as the large Métis community and growing Inuit community here in Durham. We commit to learning from Indigenous values and knowledge, building opportunities for collaboration, and recognizing that we are all connected.

CLIMATE CHANGE AND HEALTH IN DURHAM REGION:

Assessing the impact of solar UVR

REPORT | January 2025

durham.ca/ClimateAndHealth

AUTHORS

Alexandra Swirski, MSc.

Tara Zupancic, MPH

EDITING

Erin Elliot

ACKNOWLEDGEMENTS

We would like to thank the Mississaugas of Scugog Island First Nation (MSIFN) for their support and guidance. MSIFN identified important gaps in our climate change and health vulnerability assessments, including a holistic approach to Indigenous health, and made recommendations for strengthening the reports.

We would also like to express our gratitude to the dedicated team members and advisors listed below who worked to gather, analyze, present, support, review and revise the information included in this background primer report. Their support and commitment to excellence have been instrumental and this report would not have been possible without their collective efforts. We appreciate their contributions and extend our genuine thanks to each of them.

Durham Region Health Department
Report Development and Support Team

Jacquie Beckett, Graphics Designer

Brianne Kinahan, Master of Public Health practicum student

Allison Jealouse, Public Health Nurse

Shannon Logan, Policy Advisor, Sustainability, Office of the CAO, Region of Durham

Jasantha Naidoo, Epidemiologist

Tara Wheeler, Public Health Nurse

Durham Region Health Department
Leadership and Advisory Team

Glendene Collins, Manager, Community and Resource Development

Lisa Fortuna, former Director, Health Protection, DRHD

Mary-Anne Pietrusiak, former Manager, Health Analytics and Research Team

Sendi Struna, Manager, Health Protection Division

Table of Contents

Figures and Tables

List of Figures

List of Tables

About this Report

This report on exposure to solar ultraviolet radiation (UVR) is the second in a series of Durham Region Health Department climate change and health vulnerability assessments.

Climate change is projected to increase the number, intensity, and duration of climate hazards such as solar UVR and flooding. Significant action is required to both mitigate and adapt to climate change to protect the livability of our planet and the places we call home.

In Canada, federal and provincial vulnerability assessments have been completed to determine the impact of climate change on health. Less is known about local health risks and vulnerabilities faced by Ontario municipalities. To fill this knowledge gap, Durham Region Health Department (DRHD) initiated a series of climate change and health vulnerability assessments (CCHVA) to determine current and future impacts of climate hazards on the health and well-being of Durham Region residents. Each vulnerability assessment focuses on a specific climate hazard and has been written as a stand-alone report. **This vulnerability assessment explores current and projected health impacts of solar UVR in Durham Region.**

DRHD's solar UVR and health vulnerability assessment will help our region to:

- Better understand local health risks of solar UVR, and those who may be most affected.
- Foster public engagement and local knowledge on how to prepare for and respond to climate change and associated health risks of solar UVR.
- Develop local strategies for protecting residents from solar UVR. Examples include surveillance and communications campaigns on risks and protective practices.
- Champion health equity by prioritizing measures to reduce impacts to equity-deserving people and groups.
- Promote community partnership development, including meaningful engagement with priority populations to understand barriers to climate adaptation measures as well as potential harms or unintended consequences of adaptation plans.
- Establish indicators to monitor adaptive capacity to solar UVR exposure.
- Identify intersectional adaptation interventions that offer numerous health co-benefits.
- Promote a health lens in broader regional UVR planning and program development.
- Find opportunities for working across municipal sectors to deliver health benefits to Durham Region residents.

Detailed information about the CCHVA process, Durham Region's diverse environment and communities, and a high-level summary of the causes and impacts of our changing climate can be found in the previously published report: Climate Change and Health in Durham Region: understanding the local health impacts of climate change, available at: **durham.ca/ClimateAndHealth**.

Executive Summary

This vulnerability assessment explores current and future local health impacts of solar UVR exposure and its relationship to climate change. Findings will be used to support evidence-informed adaptation plans, policies and programs to protect the health of Durham Region residents.

Solar UVR exposure and health

- Although harmful UVR exposure is preventable, most Durham Region residents report they do not take protective measures.
- Frequent and prolonged UVR exposure can cause sunburn, severe eye damage, skin cancers, and suppression of the immune system.
- A single severe sunburn in childhood can double a person's risk of developing melanoma.
- Health impacts of solar UVR are influenced by an individual's exposure, sensitivity, and adaptive capacity (ability to protect themselves).
- Although UVR can harm everyone, some people are at greater risk of harm than others due to multiple and compounded health risks and socioeconomic barriers.
- Incidence of melanoma (the deadliest form of skin cancer) appears to be highest among males and people 75 and older.
- Incidence of skin cancer is expected to increase in Durham Region due to increased UVR exposure associated with warmer temperatures from climate change.
- Approximately 80 per cent of a person's lifetime exposure to solar UVR is received before the age of 18 when skin is most sensitive to sunburns.
- Action is needed to prevent local health impacts including sunburn, melanoma, and other skin cancers.

Climate change and solar UVR exposure in Durham Region

Climate change is expected to increase solar UVR in Durham Region. Exposure risks can be greatly reduced through individual and neighbourhood-level protections.

- Solar UVR levels are highest in Durham Region from April to September between the hours of 11 am and 3 pm.
- An increase in local harmful UVR exposure is expected in the future due to warmer temperatures and overall low uptake of sun safe behaviours among Durham Region residents.
- The highest proportion of solar UVR-related emergency department (ED) visit rates in Durham Region occur in the summer months of June and July.
- Spring weather presents unique UVR exposure risks and extra precaution is needed.
- Some residents experience greater risk of solar UVR exposure than others due to unequal access to protections including outdoor shade where they live, work, and play.

Solar UVR sensitivity in Durham Region

A commitment to health equity means prioritizing the needs and barriers of those who are at greater risk of poor health outcomes from solar UVR exposure.

- Although everyone can be harmed by solar UVR, some people are more sensitive than others and are at higher risk of negative health outcomes. These include infants and children, individuals with skin that sunburns easily, those with a history of sunburn or family history of skin cancer, people using certain medications, and people who work outdoors.
- Durham Region has a large proportion of residents who may be sensitive to solar UVR.
- Due to high UVR sensitivity and exposure among children, child-centered UVR protections are essential for reducing lifelong risks of skin cancer and other negative health outcomes from UVR in Durham Region.
- Disparities in tree canopy cover indicate unequal access to shade for many children in the region's urban municipalities, particularly among children living with low income.
- Although the incidence rate has decreased in recent years, almost one quarter of Durham Region adults report annual sunburns: a major risk factor for skin cancer including melanoma.
- Similar to provincial trends, sunburns in Durham Region appear to be most common among males, younger adults and people with high incomes. Sunburns are also more common among residents of Durham Region's northern, more rural municipalities of Brock, Uxbridge and Scugog.
- Alerting residents about medication-induced UVR sensitivity is important for preventing sunburns and negative health outcomes from UVR exposure.
- With expected increases in solar UVR, protections are essential for Durham Region residents who must work outdoors.

Adaptive capacity to solar UVR in Durham Region

It is essential that all Durham Region residents have the ability to avoid harmful solar UVR exposure through personal and community level protections.

- Provincial policies aimed at reducing harmful solar UVR exposure are limited and there is no specific legislation to limit UVR exposure in child and youth settings.
- Increasing all residents' capacity to protect themselves and others requires both health promotion strategies and built environment interventions.

Building local adaptive capacity requires, but is not limited to:

- Improved understanding of factors and settings that lead to harmful UV exposure among youth.
- Prioritization of UVR protection in outdoor settings frequented by children and youth.
- Targeted health communications on risks and protections from harmful solar UVR.
- Early spring communications on the risks of solar UVR and protective measures.
- Assessment of shade distribution and access, especially in high-exposure areas such as outdoor playing fields and play areas, active transportation routes and transit waiting areas.
- Establishment of local tree canopy cover baselines and targets with a focus on equitable access.

Current local strengths to protect residents from solar UVR exposure include:

- DRHD's health promotion on sun safety at work, school and child care facilities including a sun safety policy package for child care facilities.
- Strategic green infrastructure and tree planting programs.
- Municipal shade programs, with some of the province's most progressive shade policies (i.e., the Town of Ajax).

Next steps and priorities

This assessment helps residents and decision-makers to better understand current and future health risks of solar UVR to Durham Region communities and it supports adaptation planning to protect all community members, especially those worst affected and least protected. Next steps include exploring three main adaptation action areas to prevent harmful solar UVR exposure in Durham Region:

1. **Local knowledge and data** such as monitoring and reporting UVR levels, exposure, and associated local health impacts on people and health systems.
2. **Health promotion and education** to support the ability of Durham Region residents to assess their risk and the risk of those they care for and how to take action.
3. **Policies, programs, and services** to help residents avoid or protect against harmful UVR exposure. Plans may include shade policies, tree planting programs, and standards for childcare settings, and outdoor recreation events.

A list of potential activities is provided in **Table 6.1**, **"Examples of adaptation initiatives to prevent harmful solar UVR exposure"**. These are illustrative examples only and have yet to be assessed for feasibility or priority.

1. Why prioritize harmful solar ultraviolet radiation?

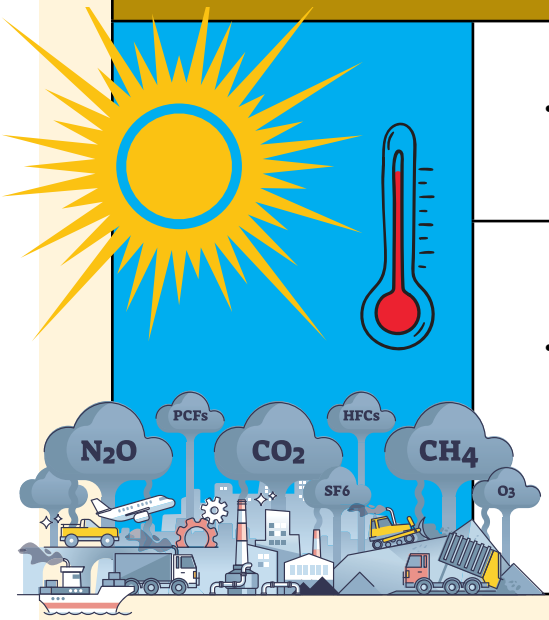
Although harmful UVR exposure is preventable, most Durham Region residents report they do not take protective measures.

Ultraviolet radiation is a form of non-ionizing radiation that can come from artificial and natural sources. Unlike heat and visible light, solar UVA and UVB rays cannot be seen or felt. Solar UVA rays penetrate deep into the skin and are associated with long-term skin damage that is undetectable during exposure. [1, 2] Although brief exposures to solar UVB can support health, extended exposure can be harmful by damaging skin cells and genetic material. UVB rays only penetrate the outer layer of the skin and are the main cause of sunburns and associated skin cancers. [1, 2] In Ontario, exposure to UVR is attributed to an estimated 2,540 cancer cases each year, making it the leading cause of environmentally acquired cancer in the province. [3]

Climate change is expected to increase harmful solar UVR exposure in Durham Region.

Estimates for local solar UVR exposures under future climate change scenarios are complex and difficult to project. **Table 1.1** summarizes the key factors expected to increase harmful UVR exposure in Durham Region.

Table 1.1 I Key factors expected to increase solar UVR exposure in Durham Region

Key factors expected to increase solar UVR exposure in Durham Region	
	• **Decreased protective cloud cover** from increased concentrations of greenhouse gases (GHGs). [7] • **Warmer days** which are expected to increase outdoor time and harmful solar UVR exposure. For example, it is estimated that a two-degree Celsius increase in air temperature is associated with a 10 per cent annual increase in skin cancer. [7, 12, 78, 79]

Action is needed to prevent local health impacts including sunburn, melanoma, and other skin cancers.

Most harmful UVR exposure is preventable using simple, low-cost measures such as protective clothing and limiting outdoor time when the UV Solar Index is high (**Figure 1.1**). Some residents face barriers to protecting themselves while others may be unaware of the risks or necessary protections. Understanding individual and local factors of vulnerability and sun protective behaviours can help protect the health of Durham Region residents now and in the future. [4, 5]

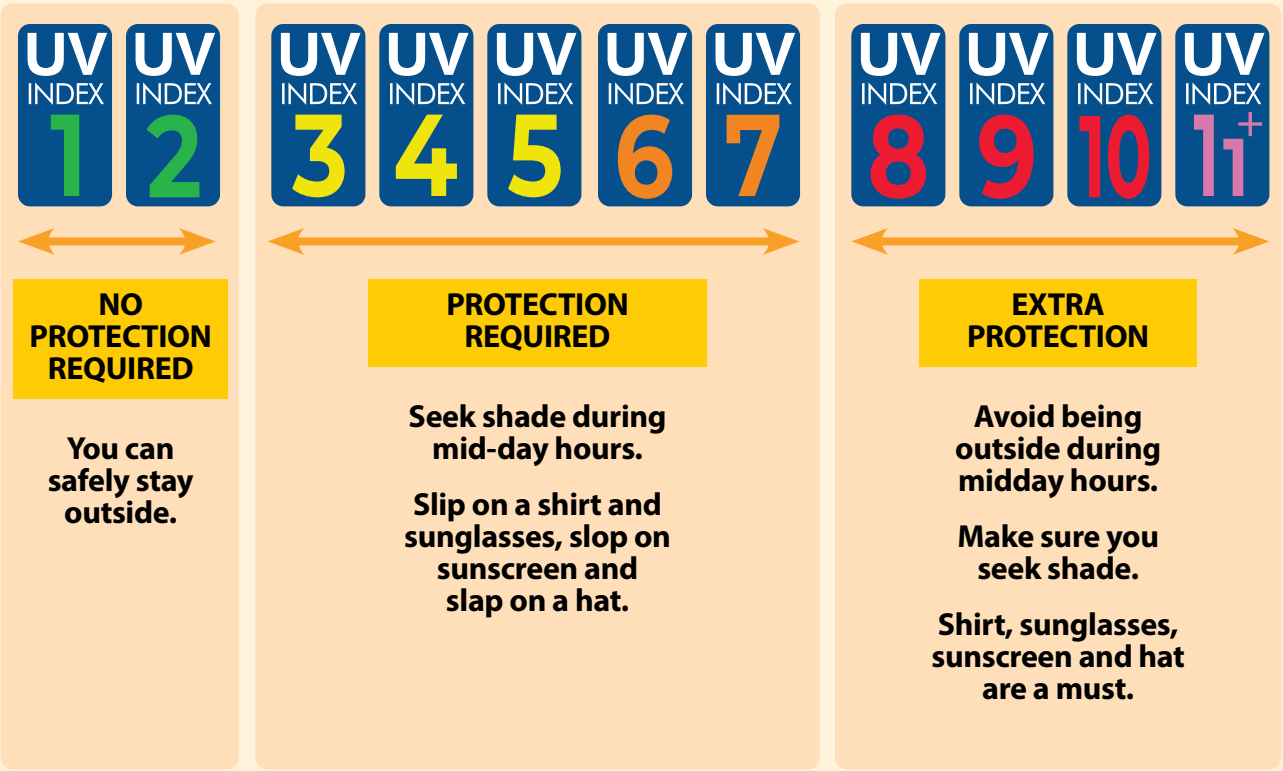


Figure 1.1 | The Global Solar UV Index (UVI)

The higher the index value, the greater the potential for skin and eye damage to occur. The UVI is used to guide decisions to adopt protective measures.

Source: Adapted from World Health Organization [63]

2. What is the purpose of this assessment?

Findings will be used to support evidence-informed adaptation plans, policies, and programs to protect Durham residents from harmful solar UVR.

The purpose and objectives of this vulnerability assessment are outlined in **Figure 2.1**. The assessment will also support community and municipal partners' climate change and health planning and adaptation processes to reduce harmful UVR exposure.

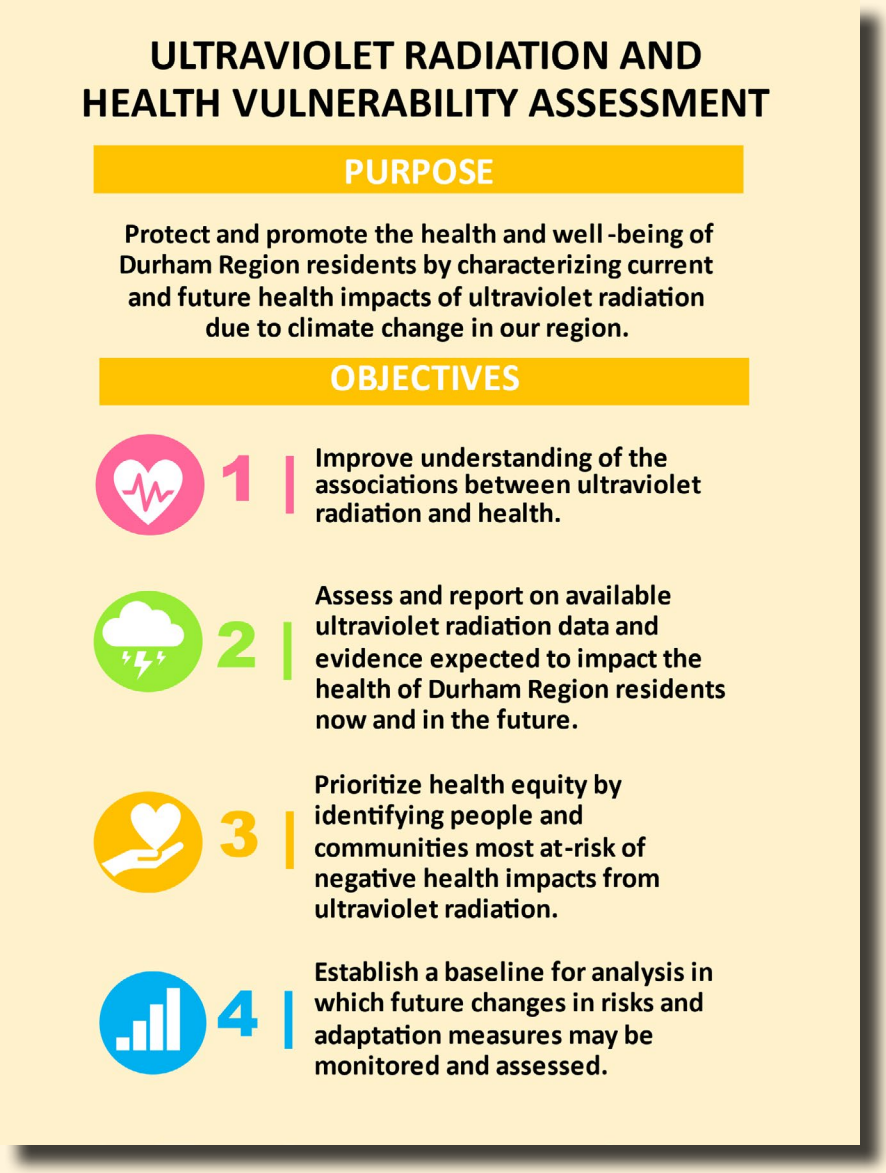


Figure 2.1 | Purpose and objectives of DRHD's solar UVR and health vulnerability assessment

3. What determines solar UVR vulnerability?

Health impacts of solar UVR are influenced by exposure, sensitivity, and adaptive capacity.

Figure 3.1[1] illustrates three main factors of solar UVR vulnerability: (1) **exposure** (for example, a person who works outdoors will have frequent sun exposure); (2) **sensitivity** to solar UVR is influenced by factors such as age, genetics, and health status (for example, individuals with skin that tends to burn are more susceptible to skin damage caused by UVR); and (3) **adaptive capacity** to take protective measures to avoid solar UVR, (for example, a person with limited financial resources may face barriers to accessing protective shelter and clothing).

Solar UVR vulnerability can be influenced by many upstream factors such as housing and working conditions, as well as a person's ability to earn sufficient income, access healthcare, find safe and stable housing, and live in a healthy, supportive community. Although factors of vulnerability are important for assessing health risk, the term vulnerable as a label for people can be stigmatizing and harmful and should be avoided.

1 For a more detailed overview of this framework, please refer to the DRHD primer report: Climate Change and Health in Durham Region, available at durham.ca/ClimateAndHealth

> ***"The concept of vulnerability can be highly stigmatizing, so it is important to recognize that climate vulnerability is not a label for communities or populations."***
>
> *- Chief Public Health Officer of Canada Report on the State of Public Health in Canada 2022 [70]*

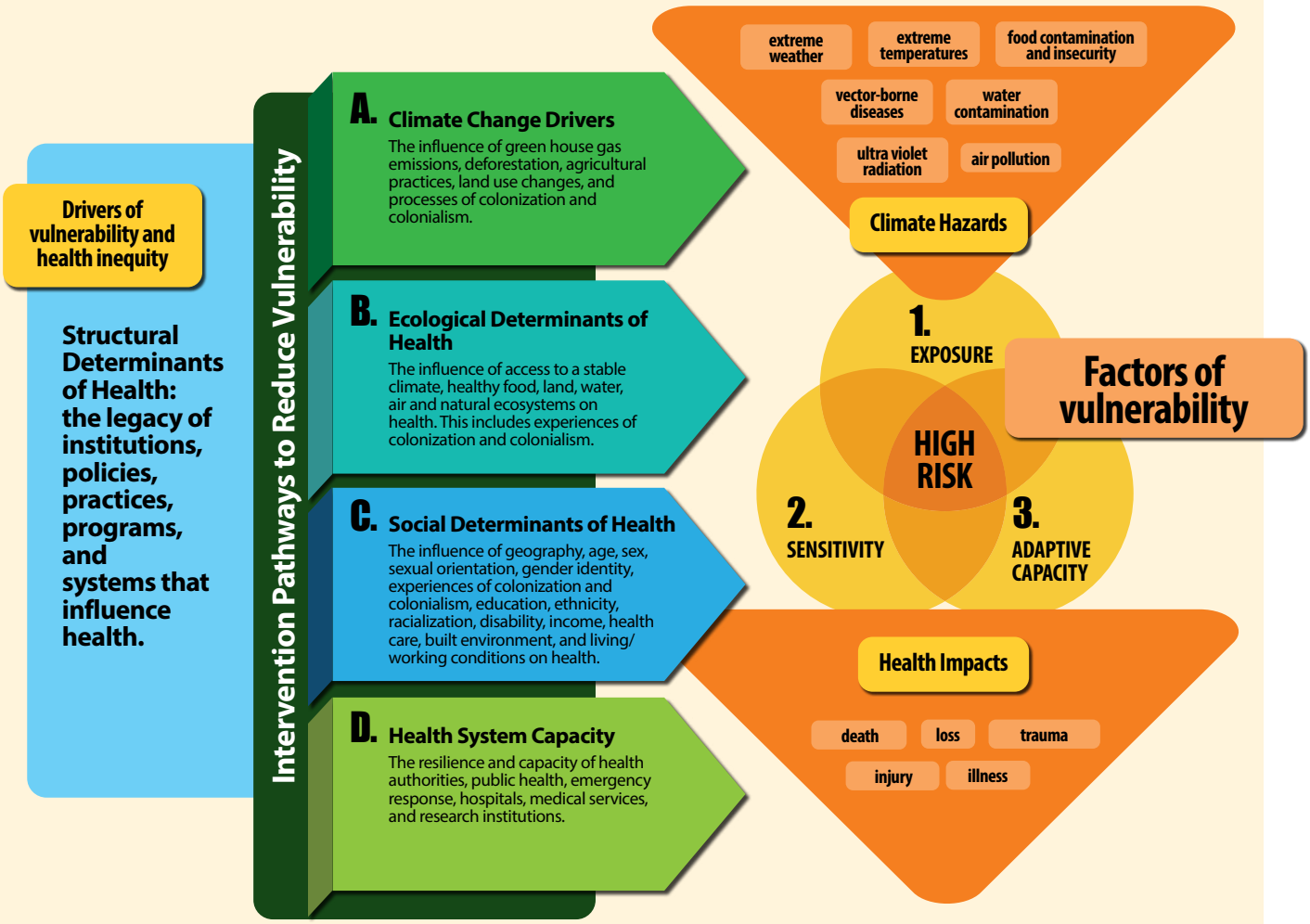


Figure 3.1 | Climate Change and Health Vulnerability Adaptation Framework

(Developed under guidance of Schnitter et al. 2022). [69]

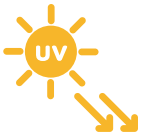
4. How does solar UVR impact health in Durham Region?

Frequent and prolonged UVR exposure can cause sunburn, severe eye damage, skin cancers and suppression of the immune system. [2, 3]

Regular but very brief sun exposure can help individuals produce vitamin D, which supports the immune system as well as cardiovascular and bone health, and may protect against some autoimmune diseases[2]. [6, 7] Although five minutes of sun exposure two to three times a week is considered sufficient for maintaining vitamin D levels, safe levels of UVR exposure have not been established and the harmful effects of UVR exposure usually far outweigh its benefits. [8, 9] For these reasons UVR exposure as a method for obtaining vitamin D is not recommended. [9] Extended exposure to solar UVR can cause immediate and painful sunburns and over time is a strong causal risk factor for severe eye damage and skin cancers[3].

2 It is estimated that almost one third of Canadians have sub-optimal levels of vitamin D. [6]

3 The incidence of UVR-related eye damage in Durham Region is not well understood.



UV radiation

- Skin cancer
- Cataracts
- Sunburn
- Eye disease
- Skin cancer
- Immuno-suppression

- **Sunburn:** UVR exposure is the main cause of sunburns. [2] Childhood sunburns may increase risk of melanoma skin cancer later in life. [36]
- **Eye disease:** Exposure to UVA radiation can cause premature aging of the eye which can lead to the development of cataracts (poor vision and clouding of the eye lens). [74, 73] Repeated exposure can also lead to damage or cancers in and around eyes. [7]
- **Skin cancer:** UVR is the leading cause of skin cancer. Exposure to UVR from the sun has been associated with increased risk of developing malignant melanoma which has the highest mortality rate of all skin cancer types. [72, 73] Exposure to UVR is estimated to be attributed to an average of 2,540 cancer cases each year in Ontario, making it the leading cause of environmentally acquired cancer in the province. [3]
- **Immunosuppression:** DNA damage from overexposure to UVB can trigger immune system suppression. [75, 81]

Figure 4.1 | Direct negative health outcomes associated with solar UVR exposure

Incidence of melanoma in Durham Region appears to be highest among males and people 75 and older.

Melanoma represents an estimated three per cent of all skin cancer cases in Canada, but is considered the deadliest due to its potential to spread throughout the body. [10] The leading causes of melanoma are UVR exposure and sunburns, accounting for 80 per cent of cases in Ontario. [3] In 2018, there were 174 new melanoma cases in Durham Region, representing an age-standardized incidence rate of 25 new cases diagnosed per 100,000 (**see Table D.1 in Appendix D**). **Figure 4.2** shows no significant change in incidence rate of malignant melanoma skin cancer between 2010 and 2018. From 2007 to 2016, Durham Region melanoma incidence rates were significantly higher among males (11.3 per 100,000) compared to females (4.6 per 100,000) with mortality increasing significantly with age. The highest incidence rates are seen in those aged 75 and older, with approximately 109 cases per 100,000 (2007 to 2016). [11]

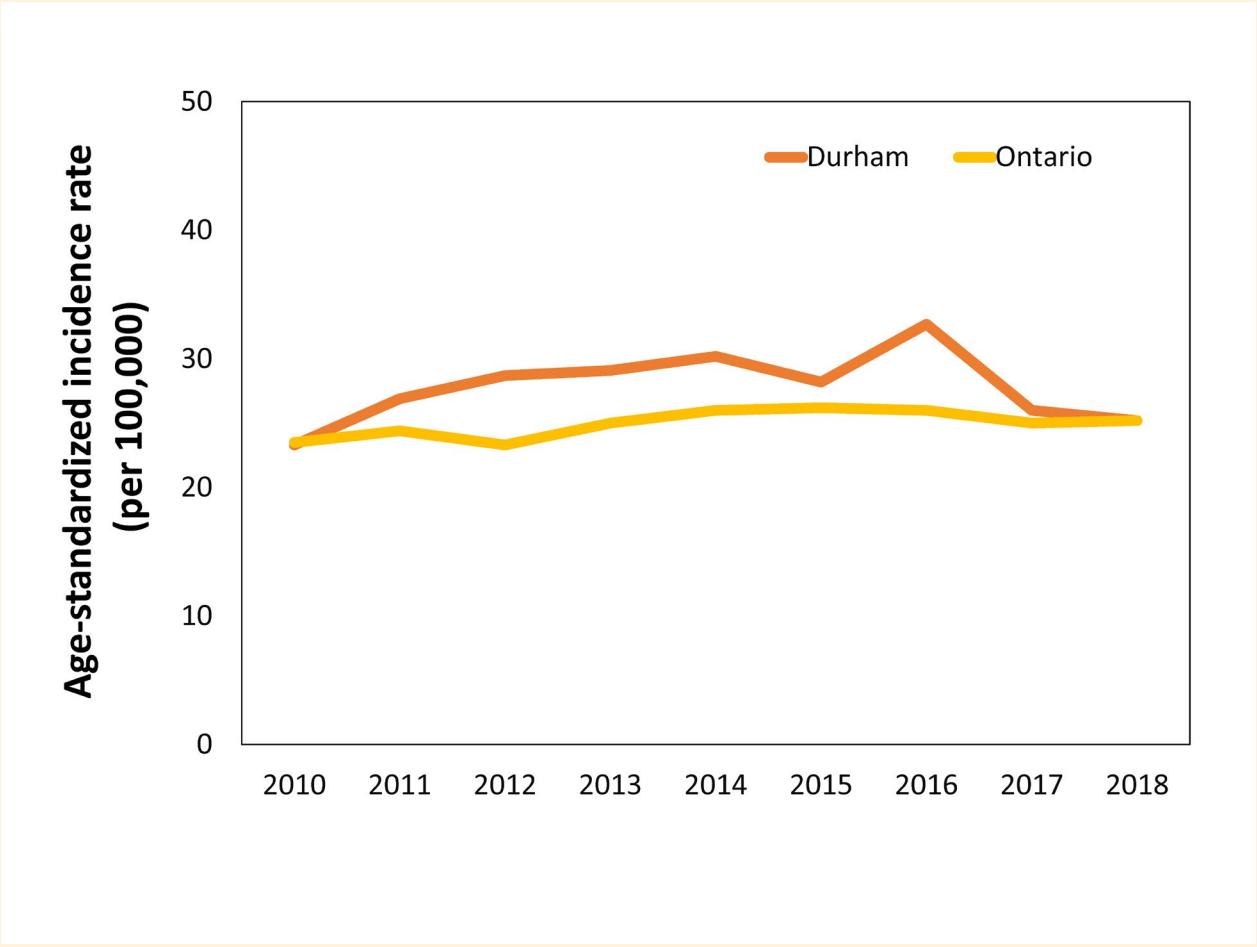


Figure 4.2 I Age-standardized incidence rate of malignant melanoma in Durham Region and Ontario, 2010 to 2018*

*Data source: Ontario Cancer Incidence, 1981-2018 Database: Ontario Cancer Registry SEER*Stat Package – Release 12 – OCR (Mar. 2021). Statistics Canada Table 17-10-0005-01 Population estimates on July 1st by age and sex. Ottawa (CA): Government of Canada; 2020 Sep 29.*

**The difference between Durham Region and Ontario is not statistically significant.*

Incidence of skin cancer is expected to increase in Durham Region due to increased UVR exposure associated with warmer temperatures from climate change.

Warmer temperatures due to climate change are associated with an increase in solar UVR exposure and increased skin cancer incidence, including non-melanoma skin cancer. [12] Basal cell carcinomas (BCCs) and squamous cell carcinomas (SCCs) are the most common non-melanoma skin cancers. [13, 5, 14] Although usually non-life-threatening, the incidence of these cancers is increasing and are approximately 12 times more common than melanoma, placing a large burden on health care systems. [5, 15, 3] In Durham Region, the projected increase in temperature due to climate change may result in approximately 13 and 25 per cent increases in the rates of BCCs and SCCs, in the 2050s and 2080s, respectively (**Table 4.1**).

Table 4.1 | Projected percentage (%) increase in basal and squamous cell carcinomas for Durham Region for the 2050s and 2080s compared to baseline (1971 to 2000)

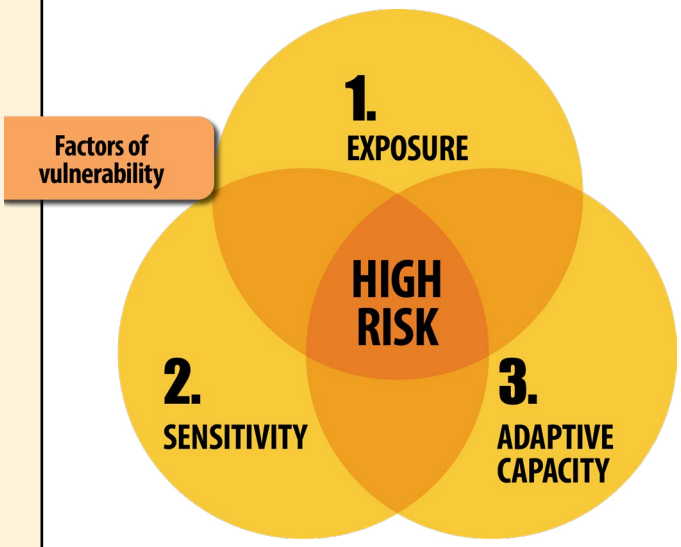
	2050s	2080s
Percentage increase in basal cell carcinomas	7.8	13.0
Percentage increase in squamous cell carcinomas	14.7	24.7

Data source: Gough et al. 2016 [65] The precise relationship between UVR levels of exposure and cancer risk uncertain and more research is required.

Although UVR can harm everyone, some people are at greater risk of harm due to multiple and compounded health risks and socioeconomic barriers.

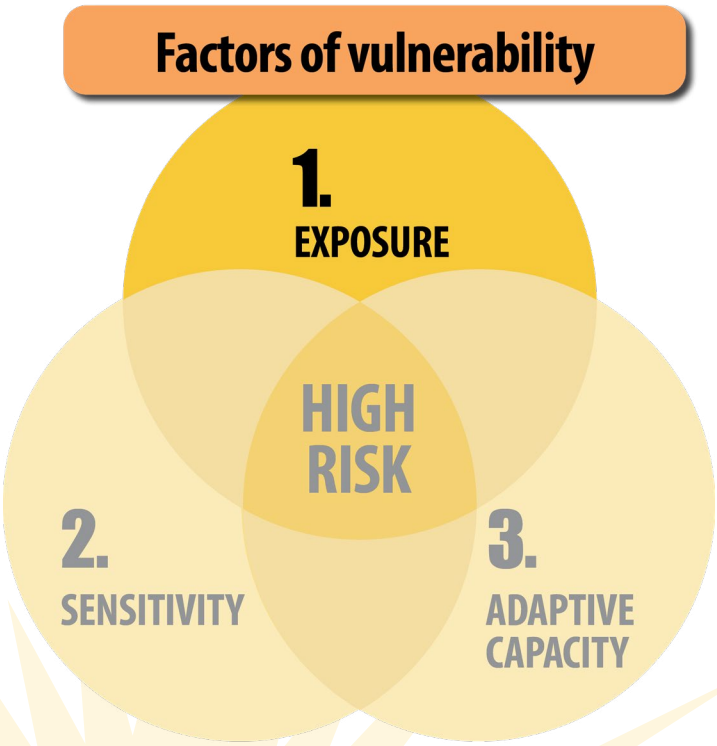
Our understanding of UVR vulnerability is incomplete and evolving. UVR vulnerability is related to exposure, sensitivity, and adaptive capacity. Some people experience greater exposure to UVR because they work or spend more time outdoors than others. Some people may be more sensitive to the effects of UVR due to their age, skin characteristics, history of sunburn, family history of skin cancer, and current medications. Others may face risk due to social and economic barriers that limit their access to protective shelter or clothing. **Table 4.2** outlines factors of UVR vulnerability and at-risk priority populations. These groups are not distinct and risk categories often overlap. Those who experience all three factors of UVR vulnerability are at greatest risk of negative health outcomes. These priority populations experience greater exposure and sensitivity to heat, as well as barriers that limit their capacity to protect themselves.

Table 4.2 | Factors of UVR vulnerability and priority populations [16, 17]

Factors of UVR vulnerability	Priority populations*
 **Exposure:** The degree to which an individual or community is exposed to harmful UVR. It is influenced by underlying social and economic conditions that result in some individuals or communities experiencing more exposure to UVR than others. **Sensitivity:** The degree to which an individual or community is affected by harmful UVR. This can be influenced by age, genetics, health status or community health disparities. **Adaptive capacity:** The ability of an individual or community to respond to and protect against the health impacts of UVR. Capacity may include access to informational, social, financial, and institutional supports	• Infants and young **children** • Individuals with skin that **easily sunburns** • People who use **certain medications** or products that cause sun sensitivity • People with a **history of sunburn and/or family history of skin cancer** • People who **work** or spend time **outdoors** • People who **lack access to protection** (i.e., protective shelter or clothing) ** Those who experience all three factors of UVR vulnerability are at greatest risk of negative health outcomes from UVR exposure*

5. Understanding solar UVR vulnerability in Durham Region

Climate change is expected to increase solar UVR in Durham Region. Exposure risks can be greatly reduced through individual and neighbourhood-level protections.



5.1 UVR exposure in Durham Region

Solar UVR levels are highest in Durham Region from April to September between 11am and 3pm. [7]

Peak solar UVR levels in Durham Region correspond to summer months, when people are more inclined to spend long periods of time outdoors. **Figure 5.1.1** shows the months of the year that present the highest UVR levels Ontario.

Climate change is projected to increase overall solar UVR in Durham Region.

Changes in local solar UVR under future climate change scenarios are difficult to predict and depend on many factors such as pollution levels, stratospheric ozone thickness, surface reflectivity and cloud cover. [7, 18] In general, increased concentrations of GHGs are expected to reduce overall cloud cover in Durham Region resulting in increased solar UVR in the environment. [7, 18]

Approximately 60 per cent of the day's total carcinogenic radiation is received before 2pm. [19, 20]

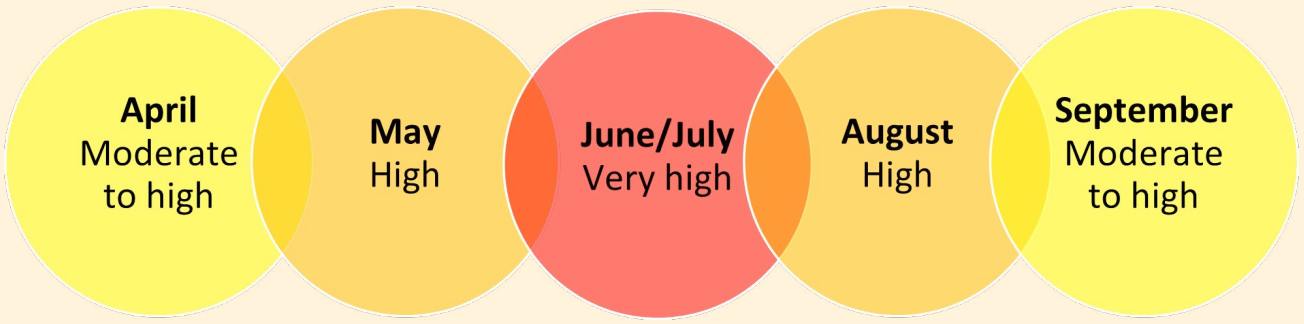


Figure 5.1.1 | Months of the year with the highest UVR levels in Ontario [33, 18]

The highest proportion of solar UVR-related ED visit rates in Durham Region occur in the summer months of June and July.

Figure 5.1.2 shows ED visits for acute skin conditions related to UVR exposure, with the highest proportion of ED visit rates seen in June and July, representing more than half of all ED visits during the year (52 per cent). This corresponds with the months of the year when UVR levels in Ontario are at their highest.

Spring weather presents unique UVR exposure risks and extra precaution is needed.

Although spring solar UVR levels are generally lower than summer levels, many people go outside for extended periods to compensate for winter months spent indoors. [19] Spring sun exposure presents unique risks because although the sun feels less intense, there is less protective atmospheric ozone and an increase in reflective surfaces such as snow and large puddles which can nearly double UVR exposure. [19, 13] This may explain why in Durham Region a greater proportion of UVR-related ED visits are seen in Durham Region in April (eight per cent) and May (17 per cent) compared to the later summer months of August (12 per cent) and September (three per cent) (**Figure 5.1.2, see also Table D.2 in Appendix D**).

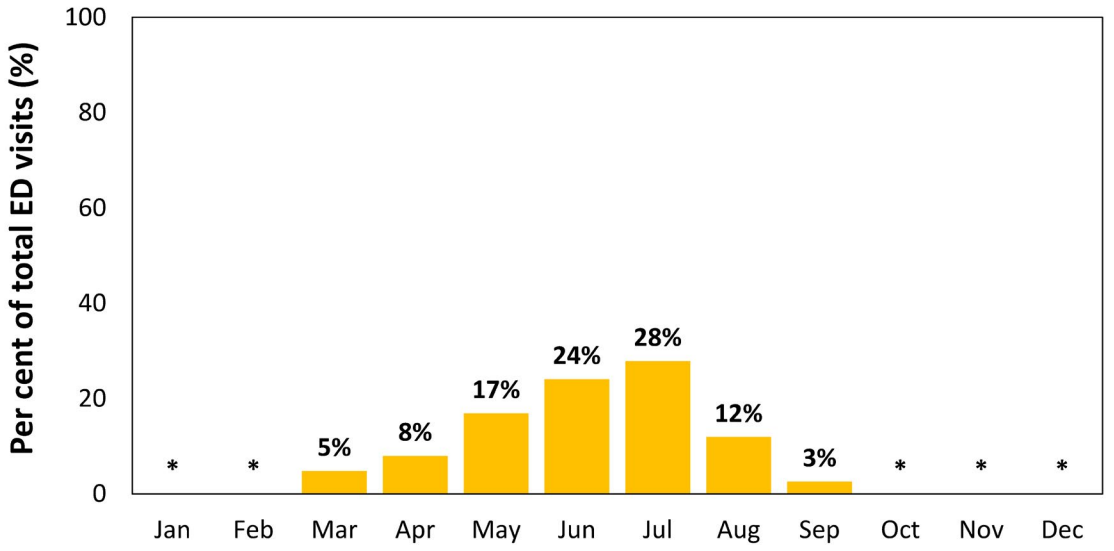


Figure 5.1.2 | Percentage of total ED visits from 2012 to 2022 among Durham Region residents for acute skin conditions related to UVR exposures by month.

Data source: ED Visits, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.

An increase in local harmful UVR exposure is expected in the future due to warmer temperatures and overall low uptake of sun-safe behaviours among Durham residents.

Warmer and longer summer seasons due to climate change are associated with increased outdoor time and unprotected sun-exposure. [20, 21] Individuals tend to expose more skin to the sun during warmer summer months, resulting in increased UVR exposure. [20, 21] The DRHD collects information about sun safety practices among Durham Region adults (age 18 and older) through the Rapid Risk Factor Surveillance System (RRFSS) telephone survey[4]. **Figure 5.1.3** displays the results of the 2018 RRFSS survey showing that although some residents protect themselves from the sun, most do not. Sunscreen use was the least reported sun-protective behaviour (**Table D.3**). This combination of warmer temperature and low uptake of protective behavior is expected to increase future local UVR exposure.

4 RRFSS is an online and telephone survey that collects health-related behaviour data among Ontario adults 18-years and older. These data provide important information that helps support public health units in planning and evaluating local programs and services, and informing education, awareness and advocacy efforts related to health behaviours.

Durham Region adults: sun-protective behaviours

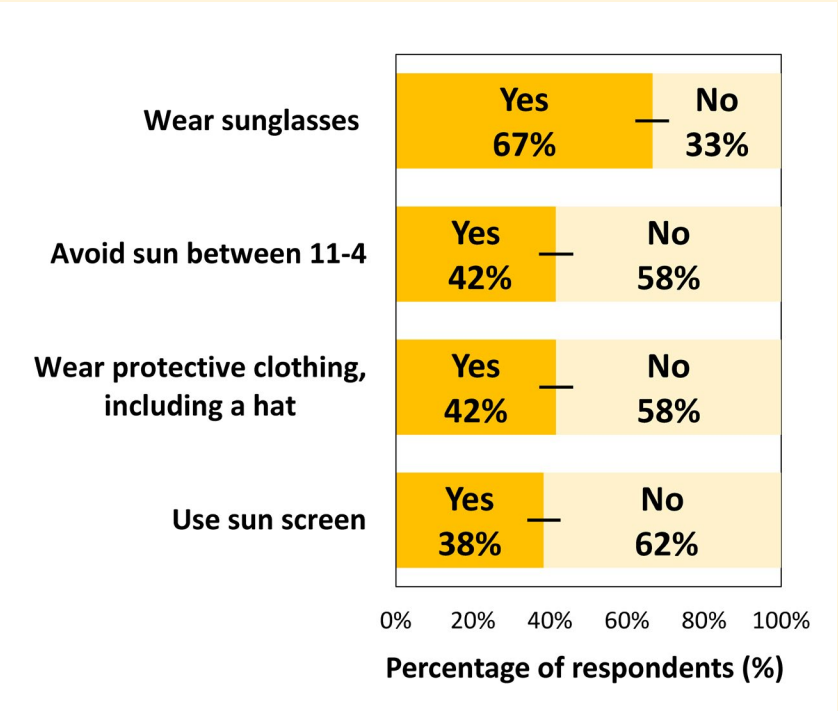


Figure 5.1.3 I
Percentage of Durham Region adults (18+) who reported practicing sun-protective behaviours

"Yes" refers to practicing the behaviour 'all of the time' or most of the time. This question was asked from May to August 2018 as part of the RRFSS survey.

— = 95% Confidence Interval

Data Source: RRFSS 2018 (May-August), DRHD, collected by ISR at York University.

Some residents experience greater risk of solar UVR exposure than others due to unequal access to outdoor shade where they live, work, and play.

Local shade is important because many residents cannot avoid being outdoors between 11am and 3pm, when the UV index is the highest. There is evidence that shade provides more reliable UVR protection than sunscreen and the provision of shade increases shade-seeking behaviours and reduces UVR exposure. [4, 3, 15, 22] The provision of built and natural shade, particularly in high-use areas such as transit stops, active transportation routes, school and outdoor play areas can help reduce UVR exposure. However, neighbourhood disparities in local tree canopy cover indicate some residents may have a decreased capacity to avoid UVR, compared to others. Further analysis is needed to better understand shade distribution and its impact to health equity. **Figure 5.1.4** provides two examples from the City of Oshawa and the Town of Ajax. While some parts of Oshawa and Ajax have up to 71 per cent tree canopy cover, some neighbourhoods have less than 12 per cent. [23]

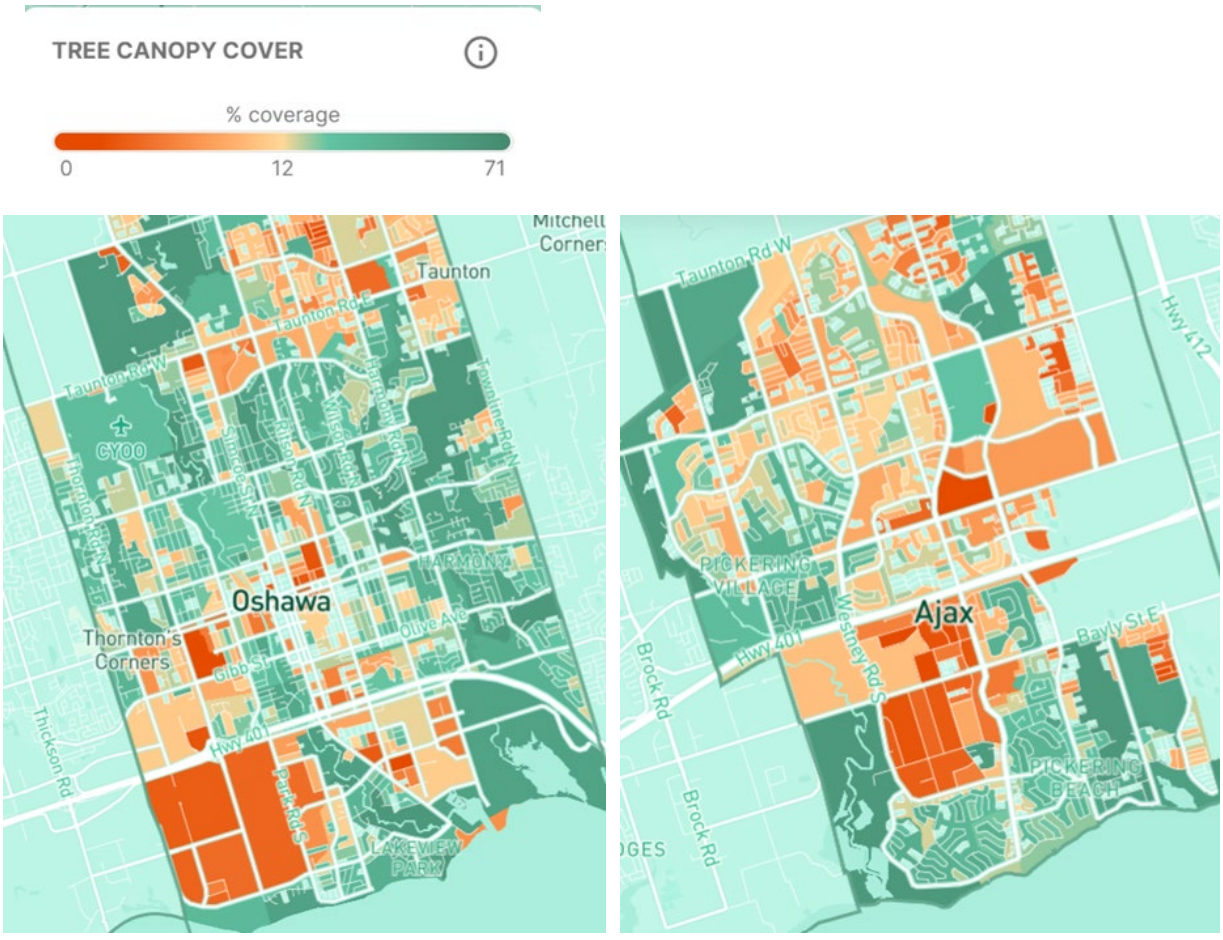
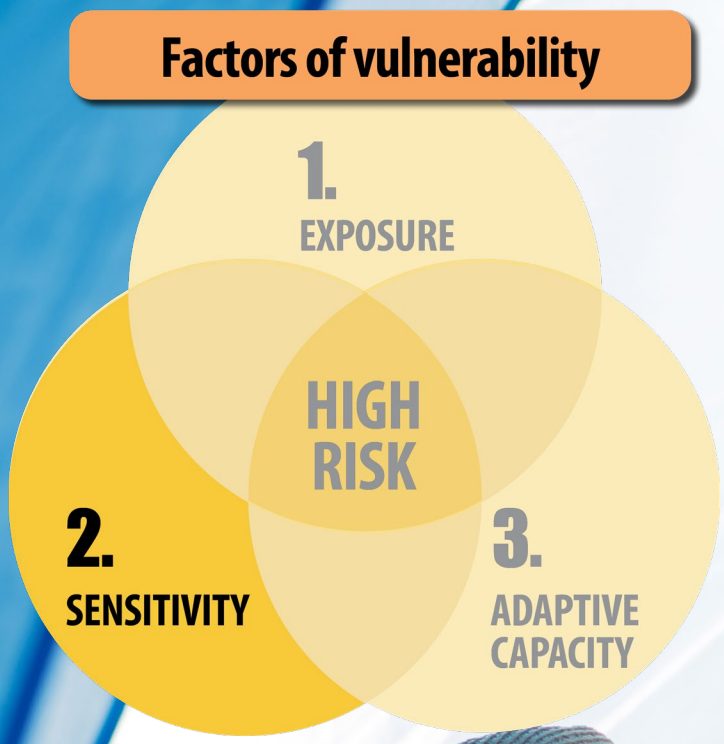


Figure 5.1.4 I Percentage tree canopy cover in the City of Oshawa and Town of Ajax for 2015

Data source: HealthyPlan.City, Dalla Lana School of Public Health [23]



5.2 UVR sensitivity in Durham Region

A commitment to health equity means prioritizing the needs and barriers of those who are at greater risk of poor health outcomes from solar UVR exposure.

Although everyone can be harmed by solar UVR, some people are more sensitive than others and are at higher risk of negative health outcomes. These include infants and children, individuals with skin that sunburns easily, those with a history of sunburn or family history of skin cancer, people using certain medications, and people who work outdoors. [24, 25, 26, 27, 28, 29, 30, 31, 32, 2]

5.2.1 UVR sensitive populations in Durham Region

5.2.1.1 Infants and children [18, 24, 25, 28]

Table 5.1 | Factors of UVR vulnerability and potential health outcomes among infants and young children

Factors of UVR vulnerability	Examples of health outcomes
Sensitivity • The skin of infants and young children is thin, sensitive and burns more easily than adults; even short exposure to peak UVR can cause serious burns. It is recommended that babies under 12-months old are not exposed to direct sun when the UV Index is three or above. [18] **Interactions with other vulnerability factors:** **Exposure** • More than 50 per cent of children spend at least two hours per day in the sun and usually during peak hours of solar UVR. [33] • Approximately 80 per cent of a person's lifetime exposure to solar UVR is received before the age of 18. [33] • More than 50 per cent of children report their worst sunburn while watching or participating in outdoor recreational activities. [33] • Greater potential exposure for those who live or play in settings lacking shade or tree-canopy (e.g., along active transportation routes, at transit stops and at playing fields). [7] **Adaptive capacity** • Inability to recognize or protect against solar UVR exposure. [34] • Dependence on caregivers' knowledge and ability to assess and respond to risk. [34] • Older children (six to 12) are less likely than younger children to use sun-protections. [33] • Children living with low income may lack access to sun-protection (e.g., shade, shelter, sunscreen, protective clothing, and eyewear). [35]	• Childhood exposure to UVR is more likely to contribute to skin cancer later in life. [18] • Sunburns in children may increase the risk of melanoma later in life. [36] • A single severe sunburn in childhood can double a person's risk of developing melanoma. [37]

Child-centered UVR protections are essential for reducing lifelong risks of skin cancer and other negative health outcomes from UVR in Durham Region.

Between 2012 and 2021, most ED visits for UVR exposure were among younger age groups, 24 and younger (**Figure 5.2.1.1**). The highest rate observed was in the 18 to 24 age group (16.0 ED visits per 100,000). The rate declined with increasing age, with the lowest rate observed in the 65-plus, or oldest age group (2.5 ED visits per 100,00) (see **Table D.4**). These trends are similar to findings of the 2022 RRFSS survey, which showed the highest proportion of reported sunburns among adults 18-24 (**Figure 5.2.1.5**).

Given the higher relative proportion of sunburn among children and young adults and given that childhood exposure to UVR is more likely to contribute to skin cancer over one's lifetime, a focus on sun protection and education in childhood is essential to protecting the lifelong health of residents. [33, 18]

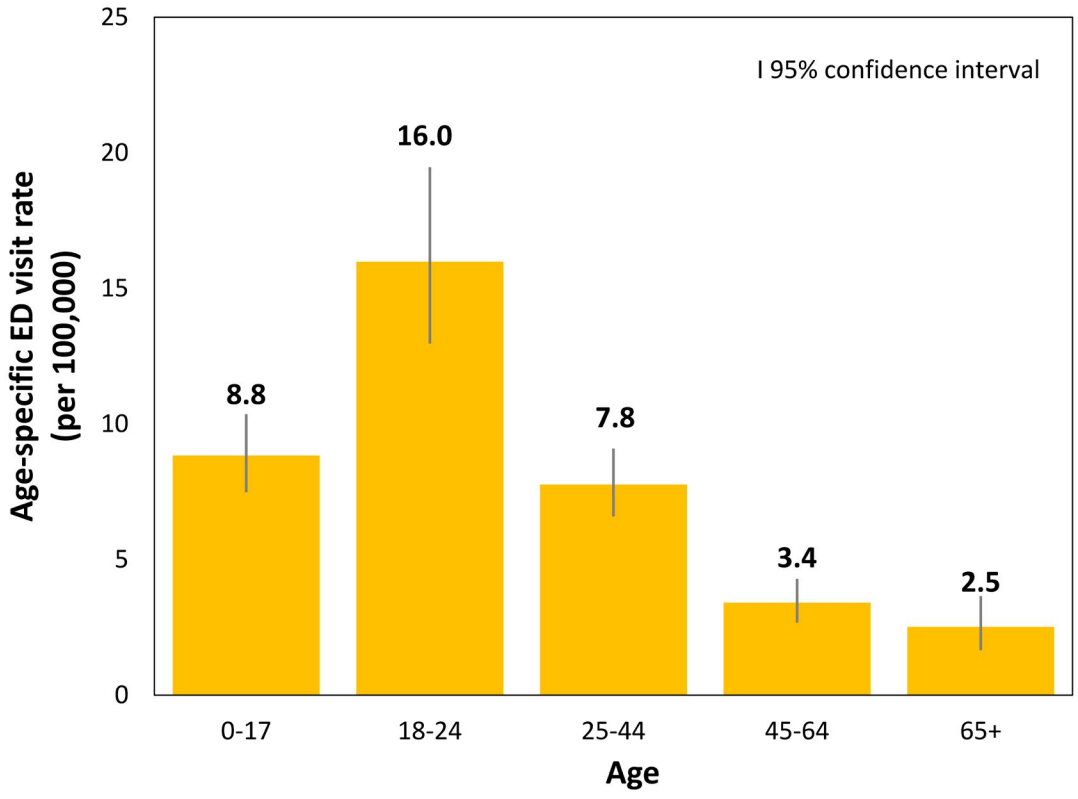


Figure 5.2.1.1 I Age-specific ED visit rates for Durham Region residents experiencing acute skin conditions related to UVR exposure, 2012 to 2022

Data source: ED Visits and population estimates, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.

Disparities in tree canopy cover indicate unequal access to shade for many children in Durham Region's urban municipalities, particularly among children living with low income. [23]

In general, shade provides more reliable protection from ultraviolet radiation exposure than sunscreen. [22] **Figure 5.2.1.2** shows that some children living in Durham Region reside in areas where additional tree canopy cover could improve shade access. There is also evidence that in the municipalities of Oshawa, Whitby, Pickering, and Ajax, children living with low-income have overall less access to tree canopy cover than other children, indicating inequitable access to tree shade among this highly UVR sensitive age group (see **Table D.5**). [23]

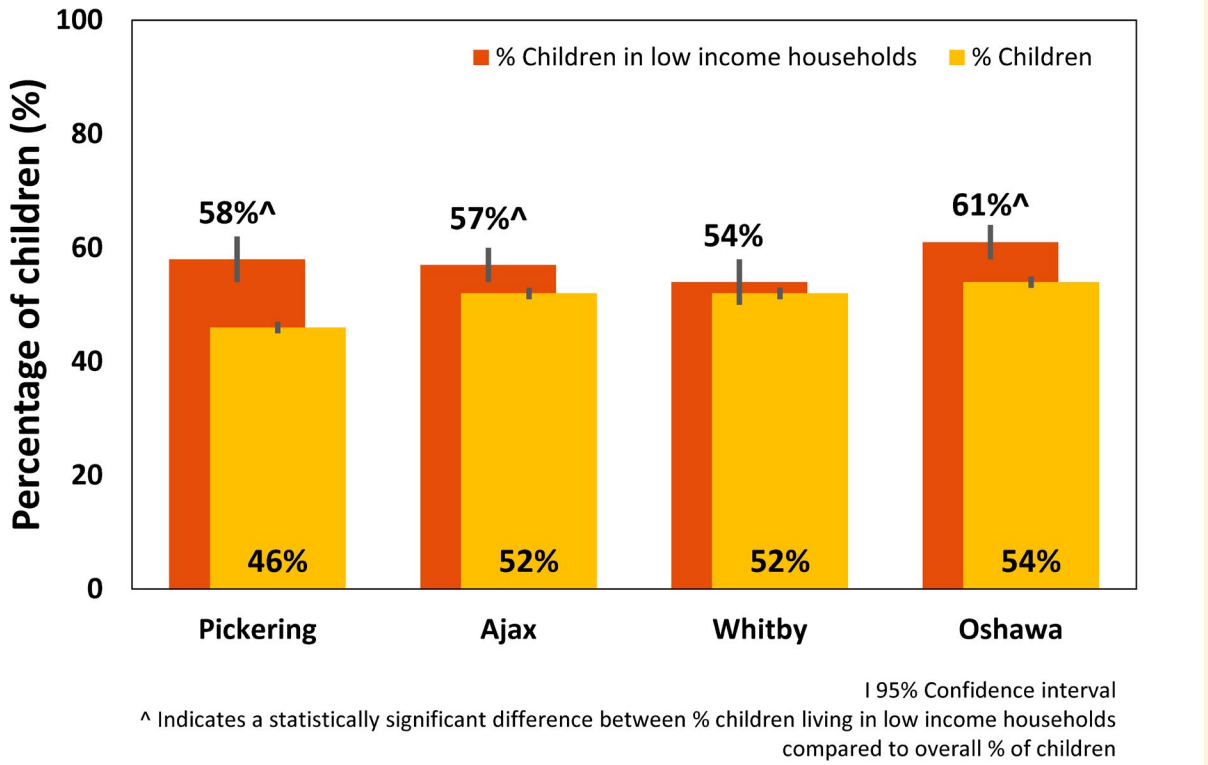


Figure 5.2.1.2 I Percentage of children and low-income children living in areas with below median tree canopy cover

Data source: Dalla Lana School of Public Health HealthyPlan.City. [23]

5.2.1.2 People with skin that sunburns easily

Table 5.2 | Factors of UVR vulnerability and potential health outcomes among people with skin that sunburns easily

Factors of UVR vulnerability	Examples of health outcomes
Sensitivity • People with less skin pigmentation and melanin to protect their skin from UVR damage are particularly vulnerable to sunburns, eye damage and skin cancers associated with UVR exposure. [33, 15, 2] **Interactions with other vulnerability factors:** **Exposure** • Increased risk for people who spend time outdoors for work or recreation (e.g., farming, life-guarding, athletics, fishing). • Greater potential exposure for those who live, work, or play in settings lacking shade or tree-canopy (e.g., along active transportation routes, at transit stops and on playing fields). [7] **Adaptive capacity** • People experiencing low or no income may lack access to sun-protection (e.g., shade, shelter, sunscreen, protective clothing, and eyewear). [35] • Increased risk for those lacking general knowledge about the risks of solar UVR exposure and appropriate protections. [7]	• Individuals with light hair, light eye colour, light skin, and freckles are at a higher risk of developing non-melanoma skin cancers such as basal cell carcinomas (BCCs) and squamous cell carcinoma (SCCs). [2, 13, 15, 28]

Durham Region has a large proportion of residents who may be sensitive to solar UVR.

It is difficult to estimate the proportion of residents who may sunburn easily, but it is estimated that a majority of Durham Region's population may be sensitive to sunburns and associated negative health outcomes related to UVR exposure. [38] It is important to note that although the incidence of skin cancer is lower among people with more melanin-rich skin, skin cancer does occur and is often detected at later, more dangerous stages. [39] Therefore, it is important to ensure health communication on UVR is not based on sunburn sensitivity alone.

5.2.1.3 People with a history of sunburn and/or family history of skin cancer

Table 5.3 | Factors of UVR vulnerability and potential health outcomes among people with a history of sunburn and family history of skin cancer

Factors of UVR vulnerability	Examples of health outcomes
Sensitivity • A history of sunburns is associated with an increased risk of developing skin cancer later in life. [28] • Genetics and family history of skin cancer are good indicators for an individual's susceptibility to developing skin cancer. [40] **Interactions with other vulnerability factors:** **Exposure** • A history of sunburn may indicate personal behaviours toward exposure risks. [24] For example, greater potential exposure among those who perceive tanned skin as beauty enhancing. [41, 42] • Increased risk for people who spend time outdoors for work or recreation (e.g., farming, lifeguarding, athletics, fishing). • Greater potential exposure for those who live, work, or play in settings lacking shade or tree-canopy (e.g., along active transportation routes, at transit stops and on playing fields). [7] **Adaptive capacity** • People experiencing low or no income may lack access to sun-protection (e.g., shade, shelter, sunscreen, protective clothing, and eyewear). [35] • Increased risk for those lacking general knowledge about the risks of solar UVR exposure and appropriate protections. [7]	• A person's risk of developing melanoma increases if they have experienced five or more sunburns within their lifetime. [28]

Although the incidence rate has decreased, almost one-quarter of Durham Region adults report annual sunburns: a major risk factor for skin cancer, including melanoma.

From 2012 to 2022, the percentage of Durham residents who self-reported having an annual sunburn has significantly decreased, from 38 per cent in 2012 to 24 per cent in 2022 (**Figure 5.2.1.3, see also Table D.6**)[5].

Self-reported sunburn rates among Durham Region adults are similar to observed trends in ED visits. **Figure 5.2.1.4** shows that the age-standardized ED visit rate for acute effects of UVR exposure, including sunburn, has decreased from a rate of 8.2 ED visits per 100,000 in 2012 to 4.4 ED visits per 100,000 in 2022 (**see also Table D.7**). The vast majority of these visits were for sunburns (88 per cent) compared to other acute skin conditions (12 per cent).

5 The DRHD collects information about sun safety practices among Durham Region adults (18 years and older) through the RRFSS telephone survey. During the survey, respondents are asked if they have experienced a sunburn on any part of their body in the past 12 months.

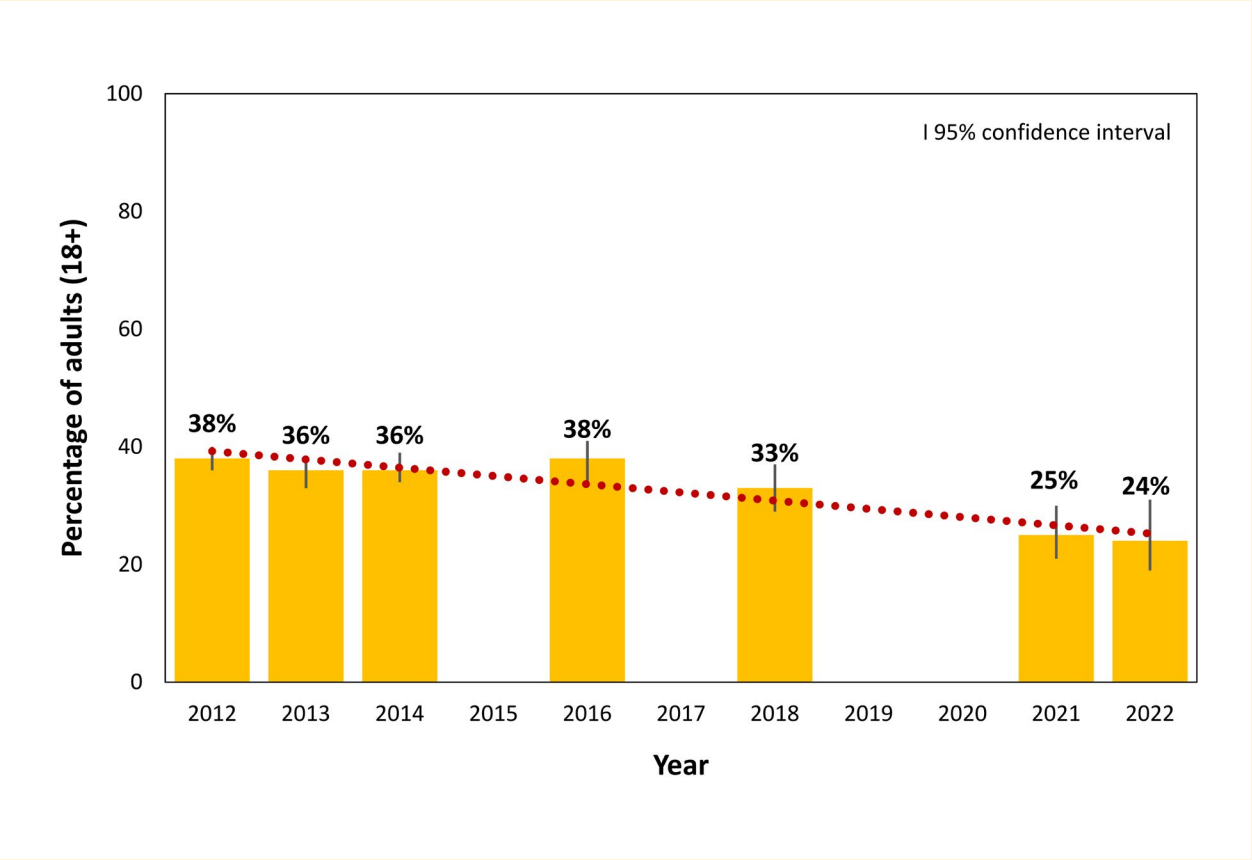


Figure 5.2.1.3 I Percentage of Durham Region adults (18+) who reported having a sunburn on any part of their body in the past 12 months, 2012 to 2022

Data source: RRFSS, Durham Region Health Department and Institute for Social Research, York University, 2012-2022.

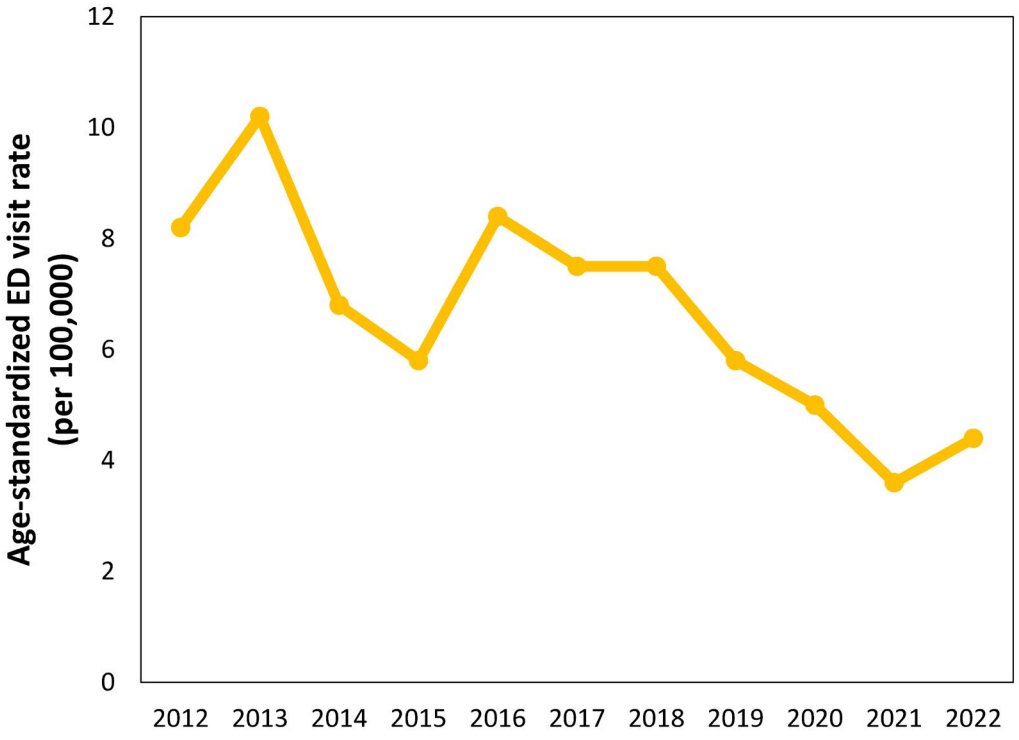


Figure 5.2.1.4 I Age-standardized ED visit rates for Durham Region residents experiencing acute skin conditions related to UVR exposure, 2012 to 2022

Data source: ED Visits and population estimates, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.— = 95% Confidence Interval

Data Source: RRFSS 2018 (May-August), DRHD, collected by ISR at York University.

Similar to provincial trends, sunburns in Durham Region appear to be most common among males, younger adults, and people with high incomes. Sunburns are also more common among residents of Durham Region's northern, more rural municipalities of Brock, Uxbridge, and Scugog.

The proportion of reported sunburns differed by gender, municipality, age group and income level (**Figure 5.2.1.5, see also Table D.9**). Although small sample sizes limit the interpretation of these data, the trends align with Canadian Community Health Survey (CCHS) data, which find that sunburns are more common among males than females, younger age groups, higher income households, outdoor workers, and people living in rural areas compared to urban. [43, 2, 44, 22]

- **Gender:** Males reported having a sunburn (31 per cent) more frequently than females (19 per cent), although this difference was not statistically significant. It was more common for women (76 per cent) than men (64 per cent) to report using sun protection.
- **Age group:** Reports of sunburn was highest in the youngest age group (18 to 24) and lowest in the oldest age group (65-plus). The same trend was found in local ED visit rates for acute skin conditions involving UVR exposure (**Figure 5.2.1.1**).
- **Income level estimate:** A slight positive trend was observed between income and reported sunburns with greatest proportion reported in the high-income group.
- **Municipality:** The proportion of adults who reported experiencing a sunburn varied across Durham Region's municipalities. The southwest urban municipalities, notably Pickering, Ajax, and Whitby had the lowest proportions of self-reported sunburns, whereas the northern more rural municipalities of Brock, Uxbridge, and Scugog had the highest. This trend is similar to the municipal differences observed in (2012 to 2022) ED visit rates for acute skin conditions related to UVR exposure (see **Table D.8**).

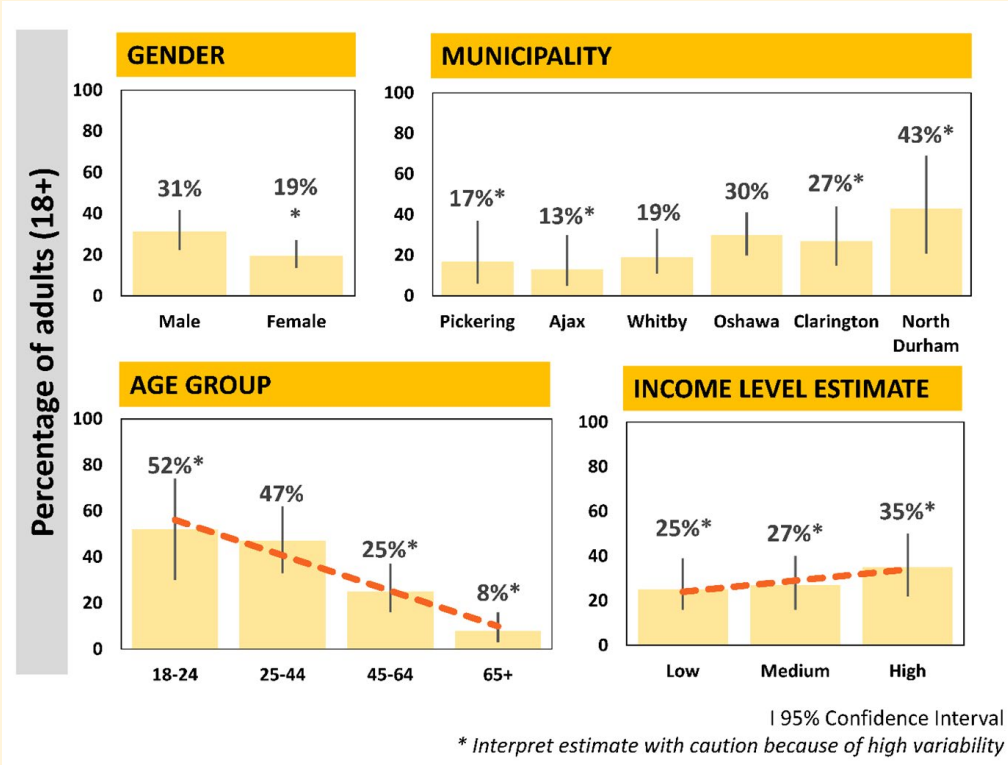


Figure 5.2.1.5 I Demographic differences in the percentage of Durham Region adults (18+) who reported having a sunburn on any part of their body in the past 12 months, 2022

Data Source: RRFSS, Durham Region Health Department and Institute for Social Research, York University, January-May 2022.

5.2.1.4 People using certain medications

Table 5.4 | Factors of UVR vulnerability and potential health outcomes among people using certain medications

Factors of UVR vulnerability	Examples of health outcomes
Sensitivity • Risk of sunburn may be greater among those who use certain creams or medications such as antidepressants, antibiotics, diabetes medications, oral contraceptives, immunosuppressants, and some cosmetics. [7] **Interactions with other vulnerability factors:** **Exposure** • Increased risk for people who spend time outdoors for work or recreation (e.g., farming, lifeguarding, athletics, and fishing). • Greater potential exposure for those who live, work, or play in settings lacking shade or tree-canopy (e.g., along active transportation routes, at transit stops, and on playing fields). [7] **Adaptive capacity** • People experiencing low or no income may lack access to sun-protection (e.g., shade, shelter, sunscreen, protective clothing, and eyewear). [35] • Increased risk for those lacking general knowledge about the risks of solar UVR exposure and appropriate protections [7]	• Some medications and creams can cause chemically induced changes in the skin that increase sunburn-like symptoms and skin rash when exposed to UVR. • Patients taking anti-hypertension medications for high blood pressure (e.g., diuretics or calcium channel blockers) are advised to limit sun exposure due to some evidence of increased risk of non-melanoma skin cancer. [45]

Alerting residents about medication-induced UVR sensitivity is important for preventing sunburns and negative health outcomes from UVR exposure.

It is not possible to estimate the proportion of residents who may be taking medications associated with increased UVR sensitivity. However, given the wide range of medication categories associated with an increased risk of sunburn, it is reasonable to assume that many residents would be affected. Highlighting medication and drug interactions are essential to comprehensive health communications and education on UVR exposure and prevention.

5.2.1.5 People who work outdoors

Table 5.5 | Factors of UVR vulnerability and potential health outcomes among people who work outdoors

Factors of UVR vulnerability	Examples of health outcomes
Sensitivity • Outdoor workers are more sensitive to the negative health impacts of solar UVR because they experience many cumulative years of exposure to peak carcinogenic solar UVR. [18] **Interactions with other vulnerability factors:** **Exposure** • Approximately 60 per cent of the sun's total carcinogenic radiation is emitted during the workday between 10am and 2pm. [18] • All outdoor workers are at risk of solar UVR exposure; one of the most common occupational carcinogen exposures in Ontario. [46] **Adaptive capacity** • Outdoor workers have little control over workplace health and safety regulations, standards or working hours. [9] • International agricultural workers may experience greater risks due to language and literacy barriers and limited knowledge of worker rights, protections, and health service programs. [9] • There may be an increased risk for those lacking general knowledge about the risks of solar UVR exposure and appropriate protections. [7]	• Outdoor workers, both full-time and part-time, have a higher-than-average risk of BCC and SCC, as well as long-term damage to eyes and skin. [18, 33] • In Ontario, it is estimated that 1,400 non-melanoma skin cancer cases per year are attributed to occupational UVR exposure. [46]

With expected increases in solar UVR, protections are essential for Durham Region residents who must work outdoors.

Based on data from the 2021 Census, almost 10 per cent of Durham Region residents work outdoors (**Table 5.2.1.1**). The proportion of outdoor workers is underestimated and does not include seasonal recreational workers such as lifeguards, camp counsellors and landscapers.

Table 5.6 | Percentage of Durham Region residents who are outdoor workers (2016)

Industry classification	Per cent (%)
Natural resources, agriculture and related production occupations	1.6
Construction	8.1
Total	9.7

Data source: Statistics Canada. 2021. Durham Region Census Profile. 2021 Census. [38]

5.3 Adaptive capacity to UVR exposures in Durham Region

All Durham Region residents should have equal ability to avoid harmful solar UVR.

Most harmful solar UVR exposure can be prevented through personal protective measures and shade access, particularly in places where people are outside during peak UVR hours. Unfortunately, not everyone has equal ability to protect themselves as UVR exposure is influenced by factors such as caregiver knowledge, shade access, occupation, and local UVR policies and programs. [47]

Provincial policies to reduce solar UVR exposure are limited.

The *Occupational Health and Safety Act* of Ontario requires employers to take reasonable measures to protect workers from workplace hazards, including UVR. The Ministry of Labour, Immigration, Training and Skills Development and Sun Safety at Work Canada supports employers with guidelines and resources for limiting workplace UVR exposure. [22]

Ontario's Provincial Policy Statements, which provide direction on key land-use planning, do not provide direction on solar UVR protection or shade provision. However, municipalities in Ontario may include shade policies or guidelines in their planning policy documents. [22]

There are no specific policies to limit UVR exposure in child and youth settings. [48]

Although recommendations exist to protect school-aged children from harmful UVR, there is no specific provincial legislation to limit UVR exposure in childcare, school, or recreational facilities. [46, 20] The Ontario Public Health Standards, School Health Guideline (2018), requires Boards of Health to offer support to school boards and schools in implementing health-related curricula and health needs, including UVR exposure. [48, 49] In addition, the Ontario Health and Physical Education Curriculum includes education on UVR protection for grade two students. [50, 22] There are also many guiding frameworks to reduce UVR exposure among children. For example, the Canadian Cancer Society's SunSense program supports elementary schools in protecting students and staff from harmful ultraviolet radiation exposure. [22]

Increasing all residents' capacity to protect themselves and others requires both health promotion strategies and built environment interventions.

Tailored supports are needed to ensure equitable access to sun protection. This may include early-childhood programs, targeted, equity-focused health promotion campaigns on UVR risk, and equitable access to neighbourhood-level shade provision, particularly in high-exposure areas such as transit stops, outdoor recreational play settings, and active transportation routes. [22]

5.3.1 Local Needs: Improving adaptive capacity to UVR exposure

The following section identifies some local needs identified by this vulnerability assessment to improve the capacity of Durham Region residents to protect themselves from solar UVR. Comprehensive community engagement is required to understand the full range of needs and opportunities, particularly among priority populations.

Improve understanding of UVR exposure among youth.

In Durham Region, sunburns are more common among children and young adults than other age groups. UVR exposure at this life stage is more likely to contribute to skin cancer later in life. [18] A better understanding of exposure settings and youth barriers and facilitators to sun protection are needed to design more relevant health communications, programs, and place-based shade provision to address this group's specific needs and risks.

> ***"Sunburns in childhood lead to a higher risk of skin cancer in later life."***
>
> *- -World Health Organization [85]*

Prioritize UVR protection in outdoor settings frequented by children and youth.

Compared to adults, children and youth are at a greater risk of harmful UVR exposure, with most lifetime exposure occurring before age 18. [48] Protecting children and young people from sunburn and harmful solar UVR is essential to preventing skin cancer and other negative health outcomes later in life. Similar to national trends, children and youth in Durham Region generally report more sunburns than adults 25 and older. Harmful UVR exposure is most commonly associated with outdoor recreation and play, and yet a recent evaluation of shade coverage on public playgrounds reported that the majority of playgrounds assessed in Canada had no shade coverage. [22] Assessing and addressing local UVR protection in outdoor settings frequented by children and youth can help protect their lifelong health.

Develop targeted health communications on risks and protections from solar UVR.

Although the overall incidence of annual sunburns appears to be declining, there is local and provincial evidence that sunburns are more common among males, young adults and people living in rural areas. [43, 2, 44, 22] Tailored communications to increase sun protective behaviours among at-risk groups can help reduce harmful health outcomes attributed to UVR exposure and reduce the burden of related health care expenses and resources. [51, 4]

Ensure early spring communication on the risks of solar UVR and protective measures.

Health protection messaging in early spring is needed to respond to the unique risks of spring UVR exposure and the proportion of UVR related ED visits in Durham Region in the spring. Enhanced messaging in early spring to promote sun-protective behaviours may be especially important in the future, as both climate change and the depletion of the protective stratospheric ozone layer increases.

> ***"A single severe sunburn in childhood can double a person's risk of developing melanoma."***
>
> *- Canadian Skin Cancer Foundation [37]*

Assess shade distribution and access, especially in high-exposure areas.

There is evidence that shade provision has a positive effect on shade-seeking behaviours. [4, 3, 15] Shade provision in unavoidable, high-exposure areas such as transit waiting areas and active transportation routes is important. [22] Assessing shade distribution and access is essential for establishing baselines, identifying inequities, and evaluating shade interventions over time. Local and provincial data is limited but emerging evidence suggests inadequate shade and tree canopy is more common in lower-income neighbourhoods. [22] In Durham Region, there is evidence of inequitable access to tree canopy cover, but further analysis is needed. [23]

Establish local tree canopy cover baselines and targets with a focus on equitable access.

The establishment of tree canopy baselines and targets that prioritize underserved residents would increase UVR adaptive capacity in Durham Region. The Durham Regional Official Plan calls for collaboration with area municipalities, conservation authorities, Indigenous communities, and the broader community to increase regional tree canopy cover (also called "urban forest") including identifying a regional baseline and target(s). [52] There are several approaches to setting targets and prioritizing locations for tree planting. For example, the City of Toronto set a target of 40 per cent tree canopy by 2050. [53] Nature Canada advocates for equity-based targets such as the 3-30-300 goal to provide all residents with at least three visible trees at home, 30 per cent neighbourhood tree canopy cover and at least one hectare of accessible greenspace within 300 metres of home. [54] A multi-indicator approach called the Nature-Based Climate Solutions Siting Tool (NBCS), is used by the Toronto and Region Conservation Authority to prioritize green infrastructure planning. [55] Community-informed targets and prioritization criteria would help support equitable shade access and local UVR protection.

5.3.2. Local Strengths and Opportunities for Increasing Adaptive Capacity

The following measures and programs are currently active in Durham Region and can help reduce UVR exposure. With climate change expected to increase local solar UVR, there is a need to explore options for expanding or improving measures to reduce exposure. Many of the listed measures offer co-benefits by improving resilience to other climate hazards such as heat and flooding.

Health promotion on sun safety

DRHD provides information on the harmful effects of UVR and protective measures for residents (durham.ca/sunsafety). Information includes recommendations and resources to support sun safety at work, school, and child care facilities including a sun safety policy package for child care facilities. [56]

Strategic green infrastructure and tree planting programs

Durham Region continues to coordinate a collaborative effort with local area municipalities to provide funding and support for the LEAF Backyard Tree planting program, which provides subsidized tree planting to residents in Pickering, Ajax, Whitby, Oshawa, Clarington, Brock, and Scugog. From 2020 to 2022, approximately 770 trees had been planted. [83]

Municipal shade programs

Some of the province's most progressive shade policies can be found in Durham Region. A 2022 review by Ontario Health identified the Town of Ajax as having one of the strongest municipal shade policies in the province. Ajax's policies encompass both municipal and private lands with a goal to "create protection against ultraviolet radiation at the right time of day and at the right time of year". [22, 57] Other area municipalities are updating shade provision plans. For example, Whitby's Climate Emergency Response Plan, includes tree planting in high-use and active transportation areas, plans for a temporary shade strategy including special events, plans for a minimum shade standard for public spaces and a new label in the Town's Asset Management Plan which identifies "Shade Facilities" in its inventory of amenities. [58] The City of Pickering supports the planting of shade trees on school properties through the Environmental Schools Grant and has developed an Integrated Sustainable Design Standard which includes shade and tree protection requirements. [59, 60]

6. Next steps and priorities

This vulnerability assessment characterized solar UVR exposure, priority populations, and adaptive capacity in Durham Region. Due to climate change, residents are expected to experience increasing exposure to UVR. Health promotion interventions are needed to increase all residents' ability to protect themselves and others. Due to unequal burdens of UVR, tailored strategies are also needed to meet the unique needs of priority populations.

Durham Region can improve adaptive capacity to UVR through three main activities: data and knowledge gathering, health promotion strategies, and local services and policies.

1. **Local knowledge and data** such as monitoring and reporting UVR levels, exposure, and associated local health impacts on people and health systems.
2. **Health promotion and education** to support the ability of Durham Region residents to assess their risk and the risk of those they care for and know how to take action. [61, 17]
3. **Policies, programs, and services** to help residents avoid or protect against UVR exposure. [17, 62] Plans may include shade policies, tree planting programs and standards for child care settings, and outdoor recreation events. [62]

Table 6.1 provides examples of adaptation initiatives for each category. These are illustrative examples only and have yet to be assessed for feasibility or priority.

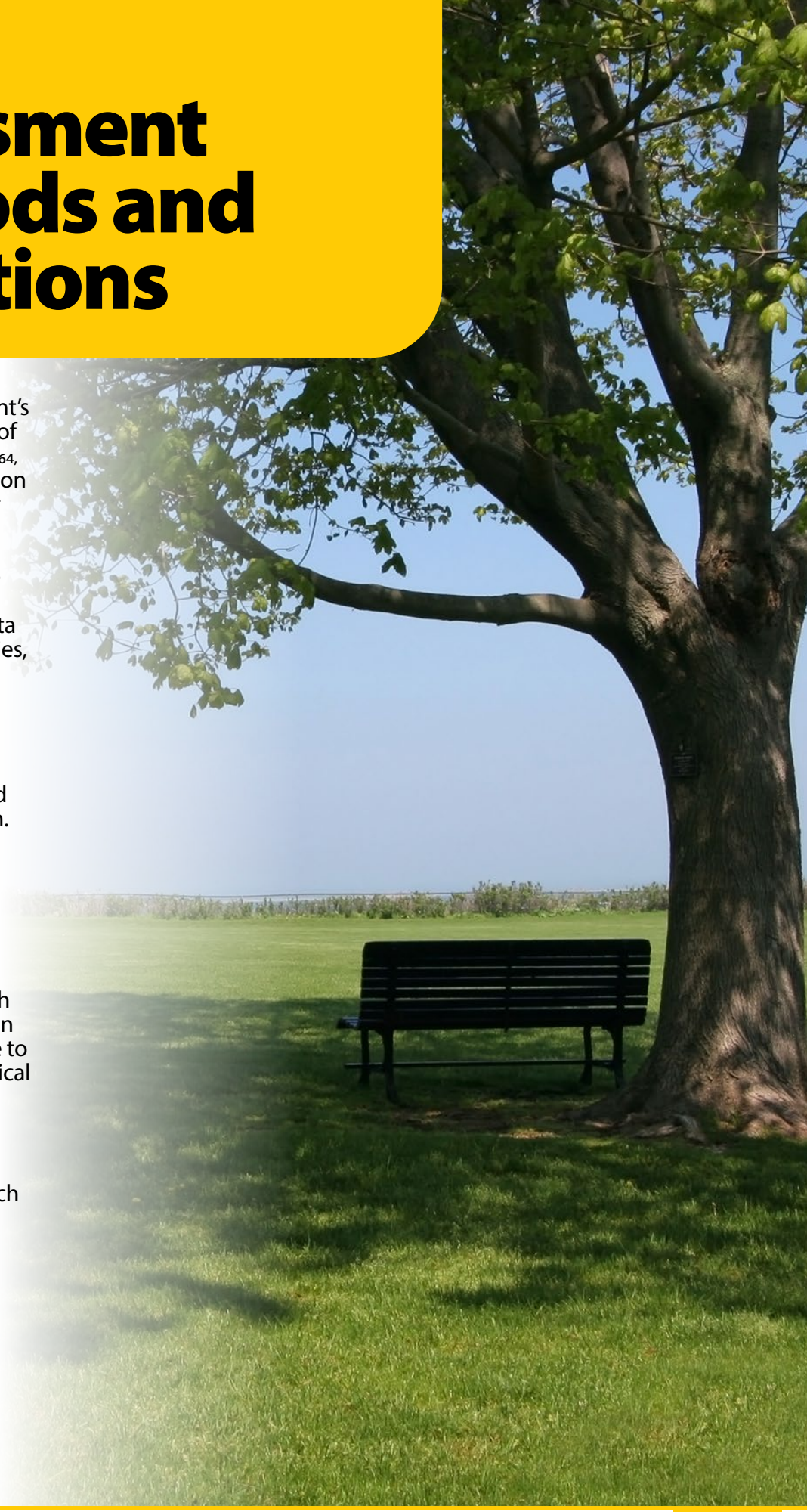
Table 6.1 I Examples of adaptation initiatives to prevent harmful solar UVR exposure

Local knowledge and data	• Health Neighborhood shade audit • Community-informed shade audit of high-use outdoor areas including transit stops, active transportation routes, child play areas, pools and water play areas, public squares, and sports fields • Monitor emerging evidence of health impacts of UVR • Surveillance and reporting of Durham Region sunburn and skin cancer rates • RRFSS question on sunburns among household including children • Survey on sun protection barriers and facilitators among high-risk groups such as young adults

Health promotion and education	• Early spring community education campaign on the dangers of sunburns and UVR through the lifespan and in high-risk settings (e.g., children's outdoor recreation facilities)
	• Social media campaign on understanding the solar UV index and actions to take:
	  ○ may include promotion of the World Health Organization's free Sun Smart UV application for smart phones [63]
	• Health promotion campaign for sun protection such as the use of shade, protective clothing, eye protection, and sunscreen:
	  ○ may include infographic on risks and protective actions and maintaining adequate vitamin D levels
	• Sun-safety at work communication campaign
	• Sun-safety and shade workshops for targeted audiences including childcare facility operators, planners, landscape architects, parks operators, events planners, etc.
	• Development of sun safety and drug interactions brochure

Programs, policies or services	• Sunscreen distribution
	• Limiting outdoor time during peak UV hours for child care and other day-programs
	• Grants for needs-based neighbourhood shade provision
	• Inclusion of shade policy in planning which may include: [33]
	  ○ tree planting in underserved neighbourhoods
	  ○ tree planting along trails, sidewalks, and outdoor recreation facilities
	  ○ tree canopy cover targets
	  ○ mandatory shade structure provision in high-risk areas including child play areas and parks, pools and water play areas, sports fields, active transportation routes, transit stops and other outdoor waiting areas, public squares, and paved activity areas
	  ○ portable shade requirement for planned local events
	  ○ shade requirements incorporated into urban and open space permitting process

7. Assessment methods and limitations



Durham Region Health Department's CCHVA approach is adapted from of the MOH's Guidelines for Ontario [64, 65, 66] and Health Canada's adaptation workbook. [67] Assessment of solar UVR risk is examined through the three factors of vulnerability: exposure, sensitivity, and adaptive capacity. This draws on empirical studies, social theory, and local data on health, socioeconomic disparities, the built environment, and climate trends. [68] For a complete description of the assessment process, scope, and limitations, please see Appendix 3.1 of the primer report: Climate Change and Health in Durham Region (durham.ca/ClimateAndHealth).

Additional limitations of this assessment include:

Lack of municipal data on UVR exposure. Assessing the potential impact of exposure to UVR for each municipality across Durham Region would be beneficial. However, due to several data limitations and analytical concerns such as unavailability of data at the municipal level, small sample sizes and case numbers, it was not possible to present UVR exposure data in this report for each municipality separately.

References

[1] Environment and Climate Change Canada (ECCC), "UV and the ozone layer," Government of Canada, 2018.

[2] N. B. Henrikson, C. C. Morrison, P. R. Blasi, M. Nguyen, K. C. Shibuya, and C. D. Patnode, "Behavioral counseling for skin cancer prevention: Evidence report and systematic review for the US Preventive Services Task Force," JAMA, vol. 319, no. 11, pp. 1143-1157, 2018.

[3] Cancer Care Ontario and Ontario Agency for Health Protection and Promotion (Public Health Ontario), "Environmental burden of cancer in Ontario," Queen's Printer for Ontario, Toronto, 2016.

[4] K. Thoonen, L. van Osch, H. de Vries, S. Jongen, and F. Schneider, "Are environmental interventions targeting skin cancer prevention among children and adolescents effective? A systematic review," Int J Environ Res Public Health, vol. 17, no. 2, p. 529, 2020.

[5] G. Sánchez, J. Nova, A. Rodriguez-Hernandez, R. D. Medina, C. Solorzano-Restrepo, J. Gonzalez, M. Olmos, K. Godfrey, and I. Arevalo-Rodriguez, "Sun protection for preventing basal cell and squamous cell skin cancers," Cochrane Database Syst Rev, vol. 7, no. 7, 2016.

[6] R. H. Friis, "Essentials of Environmental Health, 3rd ed." Massachusetts: Jones and Bartlett Learning, 2019.

[7] P. Berry and R. Schnitter, Eds. "Health of Canadians in a changing climate: Advancing our knowledge for action," Government of Canada, Ottawa, 2022.

[8] World Health Organization, "Radiation: The known health effects of ultraviolet radiation," WHO. int. [Online]. Available: https://www.who.int/news-room/questions-and-answers/item/radiation-the-known-health-effects-of-ultraviolet-radiation

[9] L. D. Marrett, M. B. H. Chu, J. Atkinson, R. Nuttall, G. Bromfield, L. Hershfield, C. F. Rosen, and National Consensus Process on the Recommended Core Content for Sun Safety Messages in Canada, "An update to the recommended core content for sun safety messages for public education in Canada: A consensus report," Can J Public Health, vol. 107, pp. e473-e479, 2016.

[10] Canadian Cancer Society, "What is non-melanoma skin cancer?" Cancer.ca. Accessed: 2025. [Online]. Available: https://cancer.ca/en/cancer-information/cancer-types/skin-non-melanoma/what-is-non-melanoma-skin-cancer

[11] Statistics Canada and Ontario Ministry Finance, July 2020. "2011 Canadian Population Census, CCO SEER*Stat Package Release 10-OCR . Melanoma of the skin (ICD-9 Code: 172)," 2015.

[12] J. C. van der Leun, R. D. Piacentini, and F. R. Gruijl, "Climate change and human skin cancer," Photochem Photobiol Sci, vol. 7, no. 6, p. 730-733, 2008.

[13] M. Saraiya et al., "Interventions to prevent skin cancer by reducing exposure to ultraviolet radiation: A systematic review," Am J Prev Med, vol. 27, no. 5, pp. 422-466, 2004.

[14] C. E. Lan, "Effects and interactions of increased environmental temperature and UV radiation and photoageing and photocarcinogenesis of the skin," Exp Dermatol, vol. 28, no. S1, pp. 23-27, 2019.

[15] C. Horsham, J. Auster, M. C. Sendall, M. Stoneham, P. Youl, P. Crane, T. Tenkate, M. Janda and M. Kimlin, "Interventions to decrease skin cancer risk in outdoor workers: Update to a 2007 systematic review," BMC Res Notes, vol. 7, no. 1, 2014.

[16] A. Swirski and T. Zupancic, "Climate change and health in Durham Region: Understanding the local health impacts of climate change," Durham Region Health Department, Whitby, 2023.

[17] Health Canada, "Communicating the health risks of extreme heat events: Toolkit for public health and emergency management officials," Her Majesty the Queen in Right of Canada, represented by the Minister of Health, Ottawa, 2011.

[18] World Health Organization and World Meteorological Organization, "Solar Radiation," ClimaHealth.info. Accessed: Jan. 24, 2025. [Online]. Available: https://climahealth.info/hazard/solar-radiation/

[19] A. E. Czerwińska and J. W. Krzyścin "Climatological aspects of the increase of the skin cancer (melanoma) incidence rate in Europe," Int J Climatol, vol. 40, no. 6, pp. 3196-3207, 2019.

[20] C. E. Lefevre, W. Bruine de Bruin, A. L. Taylor, S. Dessai, S. Kovats, and B. Fischhoff, "Heat protection behaviors and positive affect about heat during the 2013 heat wave in the United Kingdom," Soc Sci Med, vol. 128, pp. 282-289, 2015.

[21] A. Swaminathan, R. Lucas, D. Harlkey and A. McMichael, "Will global climate change alter fundamental human immune reactivity: Implications for child health?," Children, vol. 1, no. 3, pp. 403-423, 2014.

[22] Ontario Health, "Prevention System Quality Index 2023," King's Printer for Ontario, 2023.

[23] D. Doiron et al., "HealthyPlan.City: A web tool to support urban environmental equity and public health in Canadian communities," J Urban Health, vol. 101, no. 3, pp.497-507, 2025.

[24] Cancer Care Ontario, "Cancer risk factors in Ontario: Evidence summary," Queen's Printer for Ontario, Toronto, 2013.

[25] H. Olsen, E. Kennedy, and J. Vanos, "Shade provision in public playgrounds for thermal safety and sun protection: A case study across 100 play spaces in the United States," Landsc Urban Plan, vol. 189, pp. 200-211, 2019.

[26] C. Horsham, J. Auster, M. C. Sendall, M. Stoneham, P. Youl, P. Crane, T. Tenkate, M. Janda, and M. Kimlin, "Interventions to decrease skin cancer risk in outdoor workers: update to a 2007 systematic review," BMC Res Notes, vol. 7, no. 10, 2014.

[27] World Health Organization, "Radiation, non-ionizing," WHO.int. [Online]. Available: https://www.who.int/health-topics/radiation#tab=tab_3

[28] V. K. Nahar, "Skin cancer prevention among school children: a brief review," Cent Eur J Public Health, vol. 21, no. 4, pp. 227-232, 2013.

[29] National Cancer Institute, "Genetic testing for inherited cancer risk," Cancer.gov. [Online]. Available: https://www.cancer.gov/about-cancer/causes-prevention/genetics/genetic-testing-fact-sheet

[30] H. R. Moldovan, M. Wittlich, S. M. John, R. Brans, G. S. Tiplica, C. Salavastru, S. T. Voidazan, R. C. Duca, E. Fugulyan, G. Horvath, A. Alexa, and A. I. Butacu, "Exposure to solar UV radiation in outdoor construction workers using personal dosimetry," Environ Res, vol. 181, 2020.

[31] E. Rydz, A. Harper, B. Leong, V. H. Arrandale, S. Kalia, L. Forsman-Phillips, D. L. Holness, T. Tenkate, and C. E. Peters, "Solar ultraviolet radiation exposure among outdoor workers in Alberta, Canada," Environ Res, vol. 189, 2020.

[32] D. Reinau, M. Weiss, C. R. Meier, T. L. Diepgen, and C. Surber,"Outdoor workers' sun-related knowledge, attitudes and protective behaviours: A systematic review of cross-sectional and interventional studies," Br J Dermatol, vol. 168, no. 5, pp. 928-940, 2013.

[33] Toronto Cancer Prevention Coalition, "Shade Guidelines," Toronto Public Health, Toronto, 2010.

[34] Health Canada, "Extreme heat event guidelines: Technical guide for health care workers," Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, 2011.

[35] K. R. Smith, A. Woodward, D. Campbell-Lendrum, D. D. Chadee, Y. Honda. Q. Liu, J.M. Olwoch, B. Revich, and R. Sauerborn, "Human health: Impacts, adaptation, and co-benefits," in "Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of working group II to the fifth assessment report of the Intergovernmental Panel on Climate Change," C. B. Field, et al., Eds., Cambridge, UK and New York, NY, USA: Cambridge University Press, 2014, pp. 709-754.

[36] J. Benedetti, "Sunburn," Merck Manuals. [Online]. Available: https://www.merckmanuals.com/en-ca/professional/dermatologic-disorders/reactions-to-sunlight/sunburn

[37] Canadian Skin Cancer Foundation, "Prevention: Skin cancer prevention," Canadian Skin Cancer Foundation. [Online]. Available: https://www.canadianskincancerfoundation.com/prevention/

[38] Statistics Canada, "Durham Region Health Unit Census Profile," 2021.

[39] P. T. Bradford, "Skin cancer in skin of color," Dermatol Nurs, vol. 21, no. 4, pp. 170-177, 2009.

[40] National Cancer Institute, "Genetic testing for inherited cancer risk," Cancer.gov. [Online]. Available: https://www.cancer.gov/about-cancer/causes-prevention/genetics/genetic-testing-fact-sheet

[41] K. White, L. Starfelt, R. Young, A. Hawkes, S. Leske, and K. Hamilton, "Predicting Australian adults' sun-safe behaviour: Examining the role of personal and social norms," Br J Health Psychol, vol. 20, no. 2, pp. 396-412, 2015.

[42] J. Taylor, M. Murray, and A. Lamont, "Talking about sunbed tanning: Social representations and identity-work," Soc Sci Med, vol. 184, pp. 161-168, 2017.

[43] R. Lucas, A. McMichael, B. Armstrong, and W. Smith, "Estimating the global disease burden due to ultraviolet radiation exposure," Int J Epidemiol, vol. 37, no. 3, pp. 654-667, 2008.

[44] L. Pinault and V. Fioletov, "Sun exposure, sun protection and sunburn among Canadian adults," Statistics Canada. [Online]. Available: https://www150.statcan.gc.ca/n1/pub/82-003-x/2017005/article/14792-eng.htm

[45] R. Ghiasvand, B. L, B. Andreassen, J. Stenehjem, T. Heir, O. Karlstad, A. Juzeniene, and I. Larsen, "Use of antihypertensive drugs and risk of cutaneous melanoma: A nationwide nested case-control study," Int J Epidemiol, vol. 52, no. 3, pp. 887-898, 2023.

[46] Cancer Care Ontario and Occupational Cancer Research Centre, "Burden of occupational cancer in Ontario: Major workplace carcinogens and prevention of exposure," Queen's Printer for Ontario, Toronto, 2017.

[47] M. P. Purdue, "Predictors of sun protection in Canadian adults," Can J Public Health, vol. 83, no. 6, pp. 470-474, 2022.

[48] "Ontario public health standards: Requirements for programs, services, and accountability," Ontario Ministry of Health, Toronto, ON, 2021.

[49] Population and Public Health Division and Ministry of Health and Long-Term Care, "School health guideline 2018," Queen's Printer of Ontario, Toronto, ON, 2018.

[50] Ministry of Education, "The Ontario curriculum grades 9 to 12: Health and physical education," Queen's Printer for Ontario, 2015. [Online]. Available: https://www.edu.gov.on.ca/eng/curriculum/secondary/health9to12.pdf

[51] G. Sánchez et al., "Sun protection for preventing basal cell and squamous cell skin cancers," Cochrane Database Syst Rev, vol. 7, no. 7, 2016.

[52] Regional Municipality of Durham, "Envision Durham: Adopted official plan," Regional Municipality of Durham, Whitby, ON, 2023.

[53] General Manager, Parks, Forestry and Recreation, "Report for action: Actions to reaffirm Toronto's tree canopy target," City of Toronto, ON, 2021.

[54] E. Whittingham, V. Vabi, S. Lallo, and S. Hak, "Canada's urban forests: Bringing the canopy to all," Nature Canada, 2022.

[55] Toronto and Region Conservation Authority for Canadian Wildlife Service, "Nature-based climate solutions siting tool," Mar. 31, 2022. [Online]. Available: https://trcaca.s3.ca-central-1.amazonaws.com/app/uploads/2023/04/06105846/TRCA-Nature-Based-Solutions-Siting-Tool_Final-Report_2023_for-Web-AODA.pdf. Accessed: Feb. 1, 2025.

[56] Durham Region Health Department, "Sun safety and tanning," Durham.ca. Accessed: Jan. 29, 2025 [Online]. Available: https://www.durham.ca/en/health-and-wellness/sun-safety-and-tanning.aspx

[57] Planning and Development Services, "Town of Ajax shade policies, 2022 update," Town of Ajax, ON, 2022.

[58] Connect Whitby, "Whitby climate emergency response plan," Connectwhitby.ca. Accessed: Feb. 1, 2025. [Online]. Available: https://connectwhitby.ca/climatechange#:~:text=Climate%20Emergency%20Response%20Plan%20%2D%20Phase%201%3A%20Resilience,-Phase%201%20involved&text=The%20purpose%20of%20the%20Plan,of%20GHG%20emissions%20mitigation%20measuresEmergency%20Response%20Plan%20%2D%20Phase%201%3A%20Resilience,-Phase%201%20involved&text=The%20purpose%20of%20the%20Plan,of%20GHG%20emissions%20mitigation%20measures. [Accessed 01 February 2025].

[59] City of Pickering, "Environmental schools grant," Pickering.ca. [Online]. Available: https://www.pickering.ca/en/living/environmental-schools-grant.aspx

[60] City of Pickering, "Building green: Integrated sustainable design standards user guide," City of Pickering, ON, 2022.

[61] Health Canada, "Heat alert and response systems to protect health: Best practices guidebook," Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, and Health Canada, Ottawa, 2012.

[62] Health Canada, "Extreme heat event guidelines: Technical guide for health care workers," Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, and Health Canada, Ottawa, 2011.

[63] World Health Organization, "SunSmart Global UV app helps protect you from the dangers of the sun and promotes public health," WHO.int. Accessed: Jan. 24, 2025. [Online]. Available: https://www.who.int/news/item/21-06-2022-sunsmart-global-uv-app-helps-protect-you-from-the-dangers-of-the-sun-and-promotes-public-health

[64] J. Paterson, A. Yusa, V. Anderson, and P. Berry, "Ontario climate change and health vulnerability and adaptation assessment guidelines: Workbook," Queen's Printer for Ontario, Ontario, 2016.

[65] W. Gough, V. Anderson, and K. Herod, "Ontario climate change and health modelling study," Queen's Printer for Ontario, Toronto, 2016.

[66] K. Ebi, V. Anderson, P. Berry, J. Paterson, and A. Yusa, "Ontario climate change and health vulnerability and adaptation assessment guidelines: Technical document," Queen's Printer for Ontario, Toronto, 2016.

[67] P. Enright, P. Berry, J. Paterson, K. Hayes, R. Schnitter, and M. Verret, "Climate change and health vulnerability and adaptation assessment: Workbook for the Canadian health sector," Health Canada, Ottawa, ON, 2022.

[68] C. Wenwen, D. Li, Z. Liu, and R. Brown, "Approaches for identifying heat-vulnerable populations and locations: A systematic review," Sci Total Environ, vol. 799, p. 149417, 2021.

[69] R. Schnitter, E. Moores, P. Berry, M. Verret, C. Buse, C. Macdonald, M. Perri, and D. Jubas-Malz, "Climate change and health equity," in "Health of Canadians in a changing climate: Advancing our knowledge for action," P. Berry and R. Schnitter, Eds., Ottawa, ON, Government of Canada, 2022.

[70] Public Health Agency of Canada, "Chief Public Health Officer of Canada's report on the state of public health in Canada 2022: Mobilizing public health action on climate change in Canada," Public Health Agency of Canada, Ottawa, ON, 2022.

[71] D. Brenner, H. Weir, A. Demers, L. Ellison, C. Louzado, A. Shaw, D. Turne, R. Woods, and A. Smith, "Projected estimates of cancer in Canada in 2020," CMAJ, vol. 192, no. 9, pp. E199-E205, 2020.

[72] M. Watson, D. M. Holman, and M. Maguire-Eisen, "Ultraviolet radiation exposure and its impact on skin cancer risk," Semin Oncol Nurs, vol. 32, no. 3, pp. 241-254, 2016.

[73] P. Gosselin, C. Campagna, D. Demers-Bouffard, S. Qutob, and M. Flannigan, "Natural Hazards," in "Health of Canadians in a changing climate: Advancing our knowledge for action," P. Berry and R. Schnitter, Eds., Ottawa, ON, Government of Canada, 2022.

[74] I. V. Ivanov, T. Mappes, P. Schaupp, C. Lappe, and S. Wahl, "Ultraviolet radiation oxidative stress affects eye health," J. Biophotonics, vol. 11, no. 7, p. e201700377, 2018.

[75] D. L. Damian, Y. J. Matthews, T. A. Phan, and G. M. Halliday, "An action spectrum for ultraviolet radiation-induced immunosuppression in humans," Br J Dermatol, vol. 64, no. 3, pp. 657-659, 2011.

[76] World Meteorological Association, "Hazard information profiles: Supplement to UNDRR-ISC hazard definition & classification review," Accessed: November 24, 2025. [Online]. Available: https://council.science/wp-content/uploads/2020/06/Hazard-Information-Profiles-Supplement-to-UNDRR-ISC-Hazard-Definition-Classification-Review-Technical-Report-2021.pdf

[77] Statistics Canada, "Durham Regional Health Unit Census Profile 2016," Catalogue no. 98-316-X2016001, 2016.

[78] B. H. Kaffenberger, D. Shetlar, S. A. Norton, and M. Rosenbach, "The effect of climate change on skin disease in North America," J Am Acad Dermatol, vol. 76, no. 1, pp. 140-147, 2017.

[79] D. M. Freedman, C. M. Kitahara, M. S. Linet, B. H. Alexander, G. Neta, M. P. Little, and E. K. Cahoon, "Ambient temperature and risk of first primary basal cell carcinoma: A nationwide United States cohort study," J Photochem Photobiol B, vol. 148, pp. 284-289, 2015.

[80] A. K. Bharath and R. J. Turner, "Impact of climate change on skin cancer," J R Soc Med, vol. 102, no. 6, pp. 215-218, 2009.

[81] T. Schwarz, "Mechanisms of UV-induced immunosuppression," Keio J Med, vol. 54, no. 4, pp. 165-171, 2005.

[82] Institute of Social Research (ISR), "Rapid Risk Factor Surveillance Survey (RRFSS). Durham Region Health Department," York University, Toronto, 2022.

[83] Health Canada, "Important new safety information regarding the use of hydrochlorothiazide and the risk of non-melanoma skin cancer," Government of Canada, 2019.

[84] Ministry of Education, "The Ontario curriculum: Grades 1-8," Queen's Printer for Ontario, Toronto, 2019.

[85] World Health Organization, "Ultraviolet radiation," WHO.int. Accessed: Feb. 9, 2025. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/ultraviolet-radiation#People%20at%20Particular%20Risk

Appendix A: Acronyms, Terms and Definitions

BCC	Basal cell carcinoma
CCHS	Canadian Community Health Survey
CCHVA	Climate change and health vulnerability assessment
DRHD	Durham Region Health Department
ED	Emergency Department
MOH	Ministry of Health
NBCS	Nature-Based Climate Solutions Siting Tool
RRFSS	Rapid Risk Factor Surveillance System
SCC	Squamous cell carcinoma
UVA	Ultraviolet A
UVB	Ultraviolet B
UVI	Ultraviolet Index
UVR	Ultraviolet Radiation

Terms & Definitions

A more complete list of terms and definitions related to climate change and health can be found in our primer report: Climate Change and Health in Durham Region: Understanding the local health impacts of climate change, available at: durham.ca/ClimateAndHealth.

ACTIVE TRANSPORTATION

Any form of person powered transportation such as walking, cycling, or using a wheelchair.

AGE-STANDARDIZED INCIDENCE RATE

A statistical measure used to compare the incidence of a disease or condition across different populations, while adjusting for differences in age distributions among those populations.

AUTOIMMUNE DISEASE

Health conditions in which a person's immune system mistakenly attacks its own tissues causing illness.

CANADIAN COMMUNITY HEALTH SURVEY

A national survey conducted by Statistics Canada which collects information about health status, healthcare use and health determinants from a representative sample of Canadians 12 and older.

CATARACTS

An eye condition that leads to clouding of the eye lens, blurred vision, light sensitivity, and difficulty seeing at night. Cataracts can often be treated with surgery.

CARCINOGENIC

Substances that have the potential to cause cancer such as solar UVR.

BASAL CELL CARCINOMA

The most common type of skin cancer. It typically develops on areas of the skin that are regularly exposed to sunlight such as the face, head and neck. Although this type of skin cancer rarely spreads it can cause disfigurement if not treated early.

CLIMATE VULNERABILITY

The predisposition for health to be adversely affected by climate change. Climate vulnerability is determined by differential exposure, sensitivity, and capacity to adapt to climate hazards. In public health, the concept of vulnerability can be highly stigmatizing, so it is important to emphasize that vulnerability is not a label for communities or populations. [1, 2, 3]

EQUITY-DESERVING GROUPS

Populations or communities that experience significant collective barriers to participating in society, often due to historical and structural disadvantages, inequities, and underrepresentation.

EXPOSURE

The degree to which an individual or community encounters climate hazards. It is influenced by underlying social and economic conditions that result in some individuals or communities experiencing more exposure to climate hazards than others.

HEALTH EQUITY

Health equity means that everyone has a fair opportunity to enjoy their full health potential and are not disadvantaged by unfair social, economic, and environmental conditions. Many factors outside the health care system influence health. Health equity is achieved when health inequalities between groups that are due to unfair social and structural factors are eliminated. [4, 5]

HEALTH INEQUITY

Differences in health outcomes that are unfair, unjust, and avoidable. Health differences result from social, economic, demographic, geographic, or environmental disadvantages.

HEALTH NEIGHBOURHOODS

Durham Region has 50 Health Neighbourhoods and presents health and demographic information at the neighbourhood level to better understand the demographics and health of Durham Region communities.

IMMUNOSUPPRESSION

Weakening of the human immune system that fights infections and disease.

MELANIN

A pigment produced by special cells called melanocytes, found in the skin, hair and eyes of humans and other animals. Its main function is to protect against damage caused by exposure to UVR.

MELANOMA

This type of skin cancer is often caused by cumulative solar UVR exposure, affecting the cells that produce melanin, the pigment responsible for skin colour. Melanoma is the most serious type of skin cancer as it can spread to other parts of the body and be fatal.

RAPID RISK FACTOR SURVEILLANCE SYSTEM

RRFSS is an online and telephone survey that collects health-related behaviour data among Ontario adults 18 and older. These data provide important information that helps support public health units in planning and evaluating local programs and services, and informing education, awareness and advocacy efforts related to health behaviours.

SENSITIVITY

How much individuals or a population are affected by the health impacts of climate change. It is influenced by biologic and social factors within the population such as age, sex, chronic illness, or socioeconomic status.

SOLAR RADIATION

Energy radiated from the sun in the form of electromagnetic waves, including visible and ultraviolet light and infrared radiation. Usually referred to as sunlight.

SQUAMOUS CELL CARCINOMA

This type of skin cancer is often caused by cumulative solar UVR exposure and affects squamous cells which are the flat cells found in the outer layer of the skin.

STRATOSPHERIC OZONE

The ozone layer located in Earth's atmosphere that can absorb the majority of the sun's harmful UVR.

TREE CANOPY COVER

In this report, local tree canopy measures reflect the percentage of tree canopy cover derived from LandSat 8 satellite data in Google Earth Engine as used by the Dalla Lana School of Public Health's healthyplan.city database tool. [6]

ULTRAVIOLET A

One of the three types (A, B & C) of ultraviolet radiation emitted by the sun. UVA rays can penetrate deep into the skin contributing to skin damage and skin cancer.

ULTRAVIOLET B

One of the three types (A, B & C) of ultraviolet radiation emitted by the sun. UVB rays have shorter wavelengths than UVA rays and primarily affect the outer layers of the skin. UVB radiation plays a key role in the production of vitamin D but is a major cause of sunburn skin damage and skin cancer.

UVR SOLAR INDEX

The UVI Solar Index is a measure of the strength of ultraviolet radiation from the sun at a particular time of day. It typically ranges from zero to 11 or higher with higher values indicating greater potential for skin and eye damage. [7]

Appendix B: Avoiding harmful solar UVR exposure

Most harm from solar UVR can be prevented! [1]:

Limit direct exposure when UVR levels are 3 or higher (**Figure B.2**): The UV Index is used to guide decisions to adopt protective measures. The higher the index value, the greater the potential for skin and eye damage to occur.

Cover skin: Wear protective clothing like a hat, UV 400 sunglasses, a long-sleeved shirt, and pants or use protective equipment like umbrellas. [2, 3]

Use sunscreen: Apply broad-spectrum sunscreen to all parts of the skin that can't be covered with clothing. Sunscreen will not block all UVR so it should only be used with other sun protection measures. Regular use of sunscreen has been proven to decrease the risk of skin cancer. [3] It can also prevent the development of moles and nevi, which can be indicators for future cases of skin cancer. [4, 5]

Seek shade: Shade from natural or built structures can reduce direct exposure to solar UVR. Even in the shade, UVR can still reach you, so it is important to continue to use all forms of sun protection.

Figure B.1 | Health Canada sun safety infographic [6]

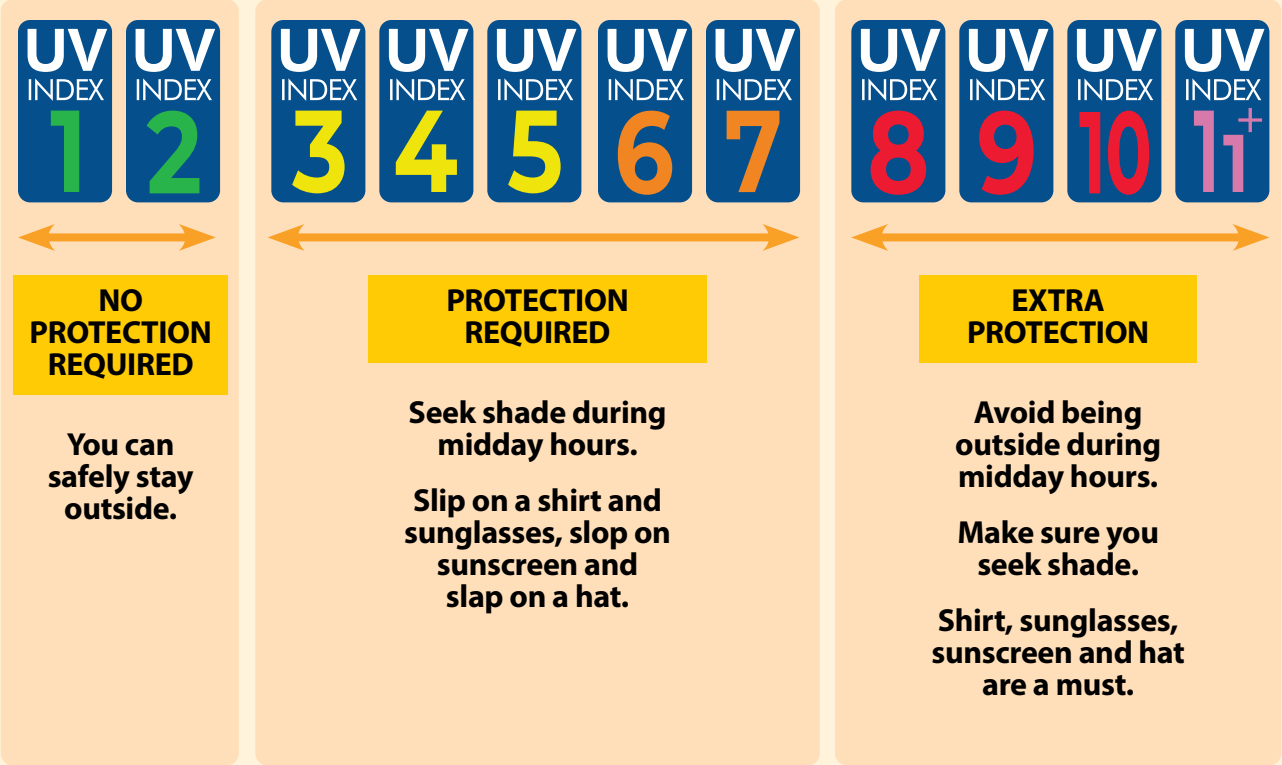


Figure B.2 | The Global Solar UV Index (UVI).

Source: Adapted from World Health Organization [1]

References

[1] World Health Organization, "SunSmart Global UV app helps protect you from the dangers of the sun and promotes public health," WHO.int. Accessed: Jan. 24, 2025. [Online]. Available: https://www.who.int/news/item/21-06-2022-sunsmart-global-uv-app-helps-protect-you-from-the-dangers-of-the-sun-and-promotes-public-health

[2] K. Thoonen, L. van Osch, H. de Vries, S. Jongen, and F. Schneider, "Are environmental interventions targeting skin cancer prevention among children and adolescents effective? A systematic review," Int J Environ Res Public Health, vol. 17, no. 2, p. 529, 2020.

[3] G. Sánchez, J. Nova, A. Rodriguez-Hernandez, R. D. Medina, C. Solorzano-Restrepo, J. Gonzalez, M. Olmos, K. Godfrey, and I. Arevalo-Rodriguez, "Sun protection for preventing basal cell and squamous cell skin cancers," Cochrane Database Syst Rev, vol. 7, no. 7, 2016.

[4] M. Saraiya et al., "Interventions to prevent skin cancer by reducing exposure to ultraviolet radiation: A systematic review," Am J Prev Med, vol. 27, no. 5, pp. 422-466, 2004.

[5] Environment and Climate Change Canada (ECCC), "UV and the ozone layer," Canada.ca. Accessed: Feb. 29, 2025. [Online]. Available: https://www.canada.ca/en/environment-climate-change/services/weather-health/uv-index-sun-safety/ozone-layer.html

[6] Health Canada, "Sun Safety," Canada.ca. Accessed: Jan. 29, 2025. [Online]. Available: https://www.canada.ca/en/health-canada/services/sun-safety.html

Appendix C: Health co-benefits of shade

Shade provision offers several health co-benefits in addition to UVR protection.

A health co-benefit refers to an additional positive outcome that occurs because of actions or policies designed to address a different issue. There are several health and sustainability co-benefits to shade provision including increased physical activity, reduced greenhouse gas and air pollution, reduced urban heat island effect, and reduced energy costs (**Figure C.1**). For example, by lowering ambient air temperature, shade trees and structures can help to slow the process of smog formation and improve local air quality. [1, 2]

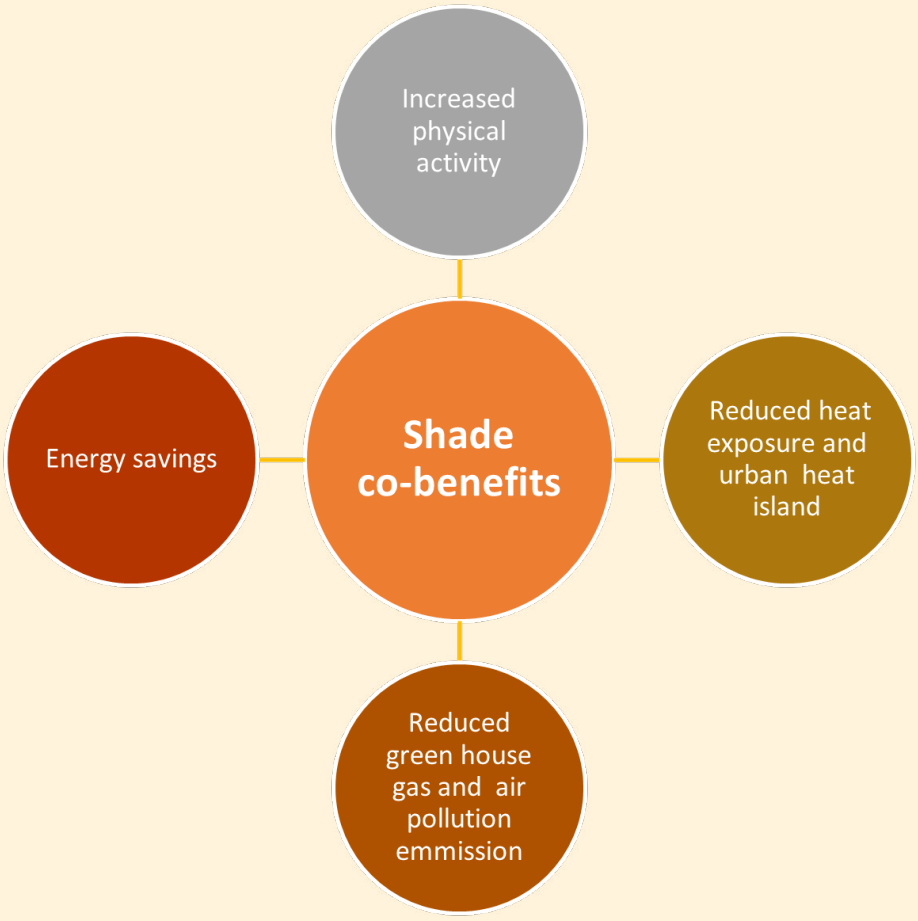


Figure C.1 I Co-benefits of shade provision in addition to reduced UVR exposure

References

[1] Toronto Cancer Prevention Coalition, "Shade Guidelines," Toronto Public Health, Toronto, 2010.

[2] Ontario Health, "Prevention System Quality Index 2023," King's Printer for Ontario, 2023.

Appendix D: Data tables for report figures

Table D.1 for figure 4.2 | Age-standardized incidence rate of malignant melanoma in Durham Region and Ontario, 2010 to 2018

Year	Durham Region incidence rate (per 100,000)	Ontario incidence rate (per 100,000)
2010	23.3	23.5
2011	26.9	24.4
2012	28.7	23.3
2013	29.1	25.0
2014	30.2	26.0
2015	28.2	26.2
2016	32.7	26.0
2017	26.0	25.0
2018	25.2	25.2

*Data source[1]: Ontario Cancer Incidence, 1981-2018 Database: Ontario Cancer Registry SEER*Stat Package – Release 12 – OCR (Mar. 2021). Statistics Canada Table 17-10-0005-01 Population estimates on July 1st by age and sex. Ottawa (CA): Government of Canada; 2020 Sep 29.*

1 More information on melanoma incidence can be accessed online through the Durham Region Cancer Data Tracker, at durham.ca/healthstats

Table D.2 for figure 5.2 | Percentage of total ED visits from 2012 to 2022 among Durham Region residents for acute skin conditions related to UVR exposures by month

Month	Percentage of total ED visits (%)
January	*
February	*
March	5
April	8
May	17
June	24
July	28
August	12
September	3
October	*
November	*
December	*

**** Less than two per cent of total ED visits.***

Data source: ED visits, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.

Table D.3 for figure 5.3 | Percentage of Durham Region adults (18+) who reported practicing sun-protective behaviours

Behaviour	Percentage of respondents (%)	95% CI
Wear sunglasses with UV protection		
Always/often	67	62 – 71
Sometimes	13	10 – 16
Never	21	17 – 25
Avoid sun between 11am to 4pm		
Always/often	42	37 – 46
Sometimes	27	24 – 31
Never	31	27 - 36
Wear protective clothing, including a hat		
Always/often	42	37 - 46
Sometimes	22	18 - 26
Never	37	32 - 41
Use sunscreen		
Always/often	38	34 - 43
Sometimes	18	15 - 22
Never	44	39 - 48

Data Source: RRFSS 2018 (May-August), DRHD, collected by ISR at York University.

Table D.4 for figure 5.2.1.1 | Age-specific ED visit rates for Durham Region residents experiencing acute skin conditions related to UVR exposure, 2012 to 2022

Age category	ED visit rate (per 100,000)	95% CI
0 to 17	8.8	7.5 - 10.4
18 to 24	16.0	13.0 - 19.5
25 to 44	7.8	6.6 - 9.1
45 to 64	3.4	2.7 - 4.3
65 and older	2.5	1.7 - 3.7

Data source: ED visits and population estimates, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.

Table D.5 for figure 5.2.1.2 | Percentage of children and low-income children living in areas with below median tree canopy cover

Municipality	Percentage of children in low income households[2] (95% confidence interval)	Percentage of children[3] (95% confidence interval)
Pickering	58 (54 – 62)	46 (45 – 47)
Ajax	57 (54 – 60)	52 (51 – 53)
Whitby	54 (50 – 58)	52 (51 – 53)
Oshawa	61 (58 – 64)	54 (53 – 55)

Confidence intervals were calculated by using approximated denominators. Note, for these measures, low-income children included those 18 and under, and children included 15 and under. As these are slightly different age groups, the comparison should be interpreted with caution.

Data source: Dalla Lana School of Public Health HealthyPlan.City

2 Refers to children ages 18 years and under.

3 Refers to children ages 15 years and under.

Table D.6 for figure 5.2.1.3| Percentage of Durham Region adults (18+) who reported having a sunburn on any part of their body in the past 12 months, 2012 to 2022

Year	Percentage of adults (%)	95% confidence interval
2012	38	36 – 40
2013	36	33 – 38
2014	36	34 – 39
2015	Not asked this year	
2016	38	34 – 41
2017	Not asked this year	
2018	33	29 – 37
2019	Not asked this year	
2020	Not asked this year	
2021	25	21 – 30
2022	24	19 – 31

Data source: RRFSS, Durham Region Health Department and Institute for Social Research, York University, 2012-2022.

Table D.7 for figure 5.2.1.4 | Age-standardized ED visit rates for Durham Region residents experiencing acute skin conditions related to UVR exposure, 2012 to 2022

Year	ED visit rate(per 100,000)	95% confidence interval
2012	8.2	6.0 – 10.4
2013	10.2	7.8 – 12.6
2014	6.8	4.8 – 8.8
2015	5.8	4.0 – 7.7
2016	8.4	6.2 – 10.6
2017	7.5	5.4 – 9.5
2018	7.5	5.5 – 9.6
2019	5.8	4.0 – 7.5
2020	5	3.4 – 6.7
2021	3.6	2.3 – 5.0
2022	4.4	2.9 – 5.9

Data source: ED visits and population estimates, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.

Table D.8 | Age-standardized ED visit rates for Durham Region residents experiencing acute skin conditions related to UVR exposure (2012 to 2022), by municipality

Municipality	ED visit rate (per 100,000)	95% confidence interval
Pickering	3.5	2.4 - 4.6
Ajax	4.9	3.7 - 6.1
Whitby	4.7	3.6 - 5.8
Oshawa	8.3	7.0 - 9.6
Clarington	9.6	7.8 - 11.4
North Durham	11.1	8.4 - 13.9

Data source: ED visits and population estimates, 2012-2022, Ministry of Health and Ministry of Long-Term Care, intelliHEALTH ONTARIO.

Table D.9 for figure 5.2.1.5 | Demographic differences in the percentage of Durham Region adults (18+) who reported having a sunburn on any part of their body in the past 12 months, 2022

Demographic sub-population	Percentage of adults (%)	95% confidence interval
Gender		
Male	31	22—42
Female	19*	14 – 27
Age category		
18-24	52*	30—74
25-44	47	33—62
45-64	25*	16—37
65+	8*	3—16
Municipality		
Pickering	17*	6 – 37
Ajax	13*	5 – 30
Whitby	19	11—33
Oshawa	30	20 –41
Clarington	27	15 – 44
North Durham	43	21 – 69
Income level estimate		
Low	25*	16 – 39
Medium	27*	16 – 40
High	35*	22 – 50

* Interpret estimate with caution because of high variability.

Data Source: RRFSS, DRHD and Institute for Social Research, York University, January-May 2022.

DURHAM REGION
HEALTH DEPARTMENT

Durham Health Connection Line
1-800-841-2729 or 905-668-2020
durham.ca/health
If you require this information in an accessible format, contact 1-800-841-2729.

January 2025