Appendix 4

PDS 4-2024

Health Impacts Assessment

Logic Model

Environmental, economic and social factors that can be impacted by tree canopy and the associated health outcomes are outlined below in Figure 1. A brief summary of recent literature on tree canopy as it relates to the identified health impacts is included below.

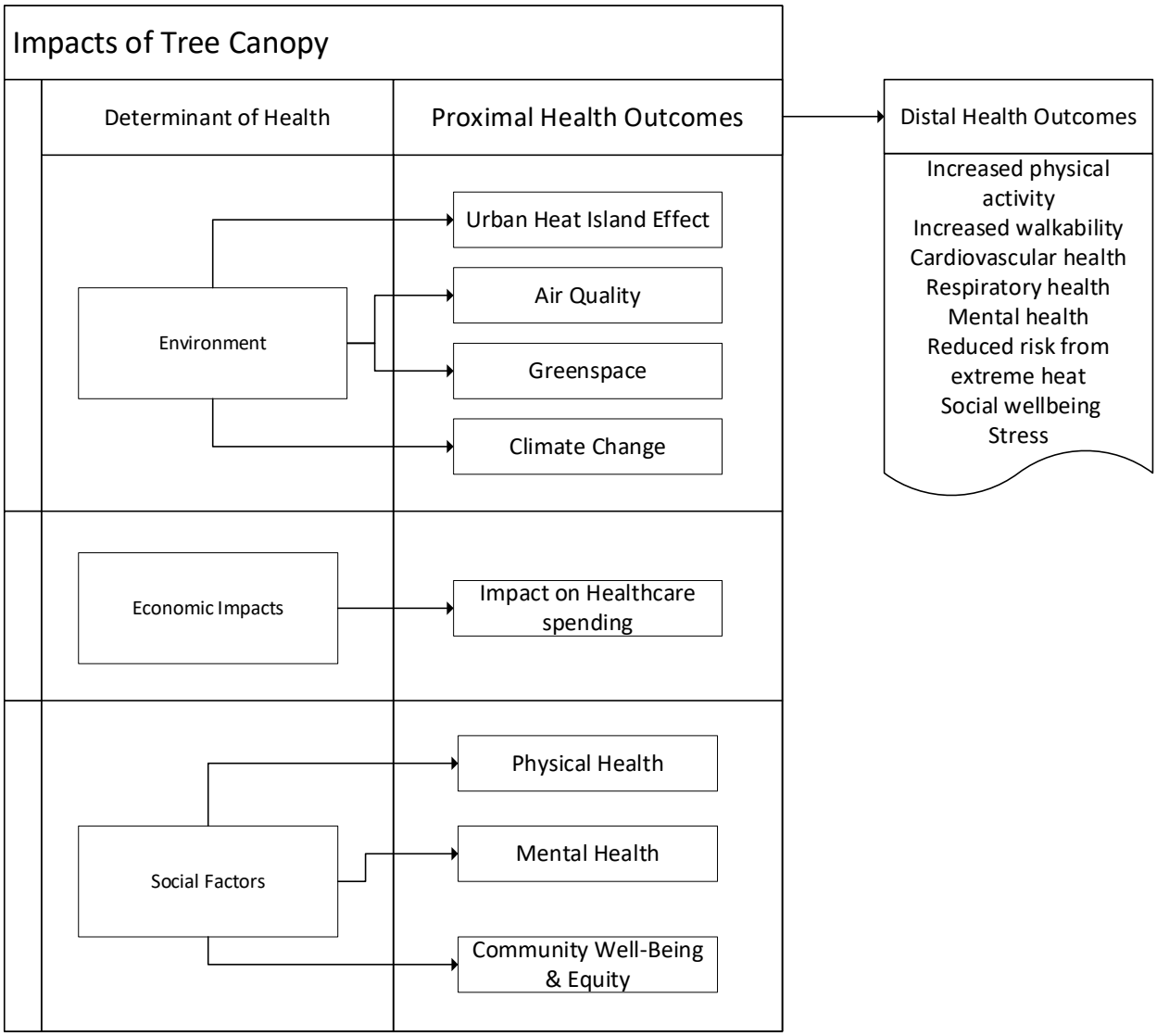

Figure 1: Logic Model

Assessment of Literature

Urban Heat Island Effect and Climate Change

The Urban Heat Island Effect is when areas in urban centres experience higher temperatures for longer periods of time, due to the lack of trees and vegetation to cool the areas, additionally these areas are often built with heat-absorbing materials.[i] This

results in cities becoming hotter than rural areas and can magnify the impacts of warmer temperatures, especially during extreme heat events.[ii] Temperature increases caused by the urban heat island effect can be counteracted by having a developed tree canopy present.[iii] Increased canopy cover can reduce overall temperatures in the summer as well as reduce humidex values during a heat wave.[iv]

Serious health hazards can result from an inability to cool down or as a result of continued exposure of extreme temperatures. Swelling, heat rash, fainting and heat stroke can be caused by a heat wave, additionally, pre-existing conditions such as heart disease, kidney disease, asthma, COPD and other lung conditions can be exacerbated by extreme temperatures.[v] Higher mortality rates and increased use of healthcare services can be seen even during short-term rises in outdoor temperatures.[vi] Through a heat wave in Quebec in 2018, 86 heat-related deaths occurred.[vii] Studies have estimated that an increase in temperature of 2 – 3 degrees Celsius can translate into an increase in mortalities due to heat of 4 – 7 percent.[viii] During periods of extreme heat, increased tree canopy cover can reduce heat stress within neighbourhoods at the street level, this can result in fewer heat-related emergency room visits and heat-related mortalities.[ix,x]

Certain populations are more vulnerable to the impacts of heat waves and may be more likely to experience heat-related illness. Populations including young children, older populations, individuals with pre-exiting health conditions, socially isolated populations, individuals with mobility issues, individuals working outdoors or homeless populations are disproportionately affected by heat-related illnesses.[xi] As well, lower income populations may live in areas that lack green space, air conditioning and are without access to a pool, further impacting the health effects of extreme heat.[xii] Individuals facing mobility challenges or who are socially isolated may have a harder time accessing help or moving somewhere cooler. A higher risk may also be experienced by individuals who may have limited access or understanding of information provided by public health such as a heat warning if it is only provided in English and no additional languages.[xiii]

Urban heat islands can be reduced by expanding vegetation cover, increasing surface reflectivity of buildings and paving materials and retrofitting buildings to be more energy efficient[xiv] Building temperature can be reduced by having large shade trees planted beside them, reducing the need for air conditioning as well as blocking cold winds and lowering the cost of heating.[xv] A recent study on suburban neighbourhoods in Peel Region found that during a heat wave urban trees could make it feel up to eleven degrees Celsius cooler.[xvi] Increasing vegetative or grassy surfaces and reducing the amount of pavement or other impervious surfaces can also support decreases in temperatures.[xvii]

A study in Toronto found that neighbourhood canopy cover had a negative correlation with the number of heat-related ambulance calls.[xviii] Five times as many heat-related calls were seen from neighbourhoods with less than five percent canopy cover

compared to neighbourhoods with greater than five percent canopy cover.[xix] Fifteen times as many heat-related calls were seen compared to neighbourhoods with over seventy percent tree canopy cover.[xx] Increased canopy cover could therefore result in reduced heat-related ambulance calls.

Canada will continue to see an increase in the number of heat waves that are experienced as temperatures continue to rise due to climate change. Canada will see substantial increases in daily extreme temperatures and an increase in 'hot days' where the maximum temperature is over thirty degrees Celsius.[xxi] By 2051-2080, Canadian urban centres are estimated to experience longer extreme heat events with four times as many days over thirty degrees Celsius.[xxii] Climate predictions have flagged Niagara Falls – St. Catharines as one of the top ten metropolitan areas that will be at the highest risk for average length of heat waves, highest maximum temperatures and number of very hot days.[xxiii] Communities need to build climate change resilience into their environments and tree canopy can mitigate the urban heat island effect, providing cooling and protecting people from the heat.[xxiv]

Impact on Healthcare Spending

The relationship of tree canopy and extreme heat events has also been shown to impact the usage of health care services or systems. Studies controlling for economic status and demographics have seen lower rates of utilizing mental health services and treatments in communities with higher levels of tree cover and green space.[xxv] Extreme heat events also cause health system strain through increased number of ambulance calls, increased number of visits to emergency departments and increased usage of telephone helplines.[xxvi]

Tree canopy can also support long term health impacts of populations through the positive effect it has on air quality, with urban tree cover acting as a buffer to airborne pollution.[xxvii] Increased canopy cover can filter pollutants and improve air quality, positively impacting respiratory health.[xxviii] This impact is significant as it is estimated that in Canada each year there are approximately 21,000 premature deaths related to air pollution.[xxix]

A study done on the tree canopy in Brampton, Ontario quantified the health benefits of canopy cover by determining their healthcare savings associated with reduced heat, lower levels of air pollutants, increased physical activity and improved mental health, which are all impacted by tree canopy levels.[xxx] It was estimated that a scenario with a 50 % increase in tree canopy cover (current baseline canopy cover at 18.4% increasing to 27.6% cover) could equal $2,437,363 in healthcare savings and with an 80% increase in canopy cover, savings of $3,175,826.[xxxi]

Physical Health, Mental Health & Greenspace

Urban forests have demonstrated positive effects on individual's health by improving mental health and encouraging the use of greenspace, increasing physical activity and

reducing stress which are associated with preventing chronic diseases.[xxxii] Studies have demonstrated that a 30% canopy cover can provide health benefits including improved mental health, decreased incidence of heart disease, diabetes and hypertension and reduced feelings of loneliness.[xxxiii] Mood and stress have been found to be positively impacted by exposure to natural areas including community gardens, forests or parks.[xxxiv] Green space can impact individual's social well-being by providing space for individuals to join together and socialize as well as providing opportunities for building community networks through social activities. Higher levels of reported health and well-being, mental well-being and self-reported happiness is positively associated with spending time in a green space.[xxxv]

Additionally, the impact tree canopy has on extreme heat events can also impact health through the mitigation of negative health effects experienced during extreme heat exposure. Increased mood and behavioural distress and exacerbated mental illnesses have been documented from experiencing extreme heat.[xxxvi] Heat related mental health impacts are more likely to affect seniors, individuals with existing mental health conditions or individuals with chronic diseases.[xxxvii]

Community Well-Being and Equity

Health impacts associated with tree canopy may hit certain populations disproportionately. Individuals living on lower incomes are often impacted more significantly during extreme heat events, this can be due to many reasons such as living somewhere without air conditioning, not having access to green space in their neighbourhood or not being able to access a pool.[xxxviii] The urban heat island effect will also disproportionately magnify health impacts of heat for populations living in urban areas. Social isolation and low-income were identified risk factors for individuals who died during the heat wave in Montreal in 2018.[xxxix] Public green spaces and tree canopy cover are less accessible to low-income and racialized communities in Toronto, meaning they experience less mitigation of the urban heat island effect.[xl] These inequities in the availability of tree canopy and greenspace resulting because there is increased access found in affluent areas exacerbates the negative health outcomes experienced by marginalized communities without the protective factors tree canopy provides against heat and air pollution.[xli] The ability to adapt and be resilient to the effects of climate change on health is also connected to how accessible and available emergency management and public health services are to various communities.[xlii]

With this knowledge of how different communities could be impacted by tree canopy cover, equity can be used as a factor to identify neighbourhoods that may be especially vulnerable to extreme heat. By assessing factors such as income, age, existing canopy and access to supportive community resources such as a pool, identified communities can then be prioritized for future urban tree plantings, and/or protecting of existing canopy.[xliii]

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