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Canadian green spaces during COVID-19: Public health benefits and planning for resilience

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Key Messages

- Canadian green spaces saw marked changes in visitation during the first months of the COVID-19 pandemic. These included city parks and provincial and national parks, as well as informal green spaces.
- Park use appeared to have partially compensated for both lost physical activity and negative mental health impacts due to the pandemic, although rigorous, large-scale studies are lacking.
- Park use did not increase uniformly across communities. Regional differences in park access and public health communications may have affected park use, even in places without local restrictions. In addition, marginalized or racialized communities may have experienced barriers to park access, whether due to lack of local parks or concerns regarding safety or discriminatory enforcement of public health orders.
- Parks, and green spaces more broadly, should be viewed as public health assets, increasing resilience during the current pandemic and during future climate-related disruptions. Accordingly, environmental public health should take opportunities to participate in park planning and design to ensure best health outcomes.

Introduction

The rapid spread of COVID-19 in March 2020 led to the imposition of lockdowns and the closure of public spaces worldwide. Media coverage subsequently reported a surge in the use of locally accessible natural environments, including parks, trails, beaches, and other outdoor green spaces. However, concern was also voiced as to whether these spaces could be used safely and without other ill effects such as crowding and environmental damage. In response, the NCCEH published a document entitled *COVID-19 and outdoor safety: Considerations for use of outdoor recreational spaces*.[1] The aim of this document was to recognize the very important role that outdoor spaces were likely to play during the pandemic, as they would allow safe socialization and healthy physical activity and could alleviate some of the mental health impacts of the pandemic.

Since then, data from across the globe have revealed a similar surge in the use of parks and green spaces and their positive and negative consequences. Geng et al.[2] used Google Mobility data to look at park visitation in 48 countries, and found that increasing park use was related to local restrictions or "hard" lockdowns, although others have also identified a strong seasonal component.[3] Similarly, Ugolini et al.[4] collected online survey data in five countries and found that respondents had

increasingly sought out green space early in the pandemic, particularly urban parks and especially if the park was close and could be reached on foot.[4] However, in nations such as Spain and Italy, hard lockdowns resulted in decreased park use.[4]

This document will explore Canadians' use of parks and green spaces during the COVID-19 pandemic. Throughout the document, we will briefly highlight several innovative uses of parks and natural spaces (**Boxes 1-3**). The document will also discuss the successes and challenges related to park use during the pandemic, their implications for park planning and design, and the potential contributions of environmental health practitioners and researchers to creating resilient parks and populations.

Literature search methodology

We searched the scholarly and grey literature for information on park use, health effects, and the COVID-19 pandemic using the EBSCOhost databases (includes Medline, CIHAHL, Academic Search Complete, and ERIC), Google Scholar, and Google. Relevant English-language results were collected from January 2020 to February 2022; additional references were added via forward and backward chaining of those search results as well as supplementary searches. For scholarly literature, both peer-reviewed and pre-print sources were considered. For grey literature, we included reports and white papers from known public health or academic institutions. We also included several reports from Park People,[5-7] a non-governmental organization that collected survey data from park users and park managers over the pandemic period. Complete search terms and the full list of results are available upon request.

Studies were selected for review if they dealt with use of city parks, green spaces or simply greenness, blue space (area dominated by water), gardens, wilderness, outdoor recreational areas, or national or provincial parks. One systematic review looked extensively at the interactions between green infrastructure, general health, and COVID-19 outcomes in 22 studies from around the world,[8] excluding Canada. Accordingly, this review was scoped to focus specifically on park use and health effects observed in Canada. The studies were assessed by a single reviewer and the results were synthesized narratively. The synthesis was subjected to internal and external review.

Results

How did use of parks and green spaces change during the early pandemic in Canada?

In March 2020, numerous urban, provincial, and national parks were temporarily closed, but the effects of those closures are challenging to interpret due to the heterogeneity of approaches and rapid policy adjustments. Using data from the Canadian Municipal Barometer survey, Armstrong and Lucas[9] analyzed the responses from 552 councillors in 306 Canadian cities and found that roughly 65% of municipalities had fully closed their parks at some point before mid-April. However, a slightly later survey of 51 city park departments found that only 22% of responding cities closed their parks completely in the first few months of the pandemic, whereas the remaining 78% closed shared facilities and equipment (e.g., playgrounds and washrooms), but kept trails and green spaces open.[5] De Lannoy et al.[10] provide a useful overview of Canadian park restrictions in the spring of 2020.

Despite uncertainty regarding where and when parks were closed, park use appears to have increased overall through the early pandemic. Geng et al.[2] used Google Community Mobility data to examine park visits in Canada during the first few months of the pandemic (February 16 to May 26 2020) compared to visits in January 2020. Initially, despite the seasonal change, Canadians did not increase park visits until late April. In May, park use increased rapidly, which was likely due to both the warming weather, the downward trend in cases, and the implementation of policies to encourage safe use in some Canadian cities (e.g., physical distancing aids, park ambassadors, or one-way circulation on paths and trails).[10]

These results are consistent with a national survey published in July 2020.[5] Data collected from over 1600 individuals and 51 municipalities showed that the use of public green spaces, such as public parks, beaches, plazas, dog parks, and public gardens, increased over the first three months of the pandemic.[5] Almost three-quarters of individual users indicated that their appreciation of parks and green spaces had increased during this time, and 55% of city park departments reported increased attendance at their sites. The most common health protection measures used to keep parks open included posting signage, social media engagement, increasing by-law enforcement, using park staff as ambassadors, and converting spaces for public use to allow distancing.[5] In June 2021, additional data collected from over 3500 individuals and 32 municipalities showed a sustained increase in park use into 2021, including during the winter months when park use typically declines (**Box 1**).[7] In total, over two-thirds of individual respondents and 94% of municipal park departments reported increased park use.[7] Of those who spent more time in parks, the vast majority indicated that they expected to continue or further increase their park use, suggesting that increased park use may become a long-term trend.

Box 1: Canadian cities turned the winter season into opportunities for safe socialization and economic recovery.

In the fall of 2020, the NCCEH received numerous inquiries about how to continue "COVID-safe" outdoor activities such as patio dining and recreation, despite the challenges of Canadian winter. This led to our NCCEH document entitled *Cities for all seasons – Considerations for using outdoor urban spaces during the winter*. Canadian cities embraced the challenge of winter recreation by creating events, activities, art installations, and various other programs to engage residents outdoors:

- The City of Edmonton has a broach-reaching and long-standing WinterCity Strategy that encourages residents to "reclaim the joy of winter" through creating positive winter experiences.
- The City of Montreal installed 26 "winter stations" featuring lights, furniture, and art. These were set up in parks as well as in other public spaces, like commercial districts, to encourage residents to explore outside and patronize local businesses.
- Toronto's Welcome T.O. Winter parks plan installed 16 km of trails or "snow loops" to encourage residents to try sports like snowshoeing and cross-country skiing. Some of these trails were created on city-owned golf courses to take advantage of underused space.
- Finally, the City of Calgary implemented a community fire pit program to promote outdoor socialization. Fire pits are booked online, can be used after dark, and permit responsible alcohol consumption.

Despite these national analyses, observations at the regional or local scale told a different story. In the Waterloo region of southwestern Ontario, a majority of survey respondents reported using parks and green spaces "much less" or "somewhat less" frequently in May 2020 compared to May 2019.[11] This is despite the fact that Waterloo green spaces remained publicly accessible, although shared infrastructure and facilities were closed. This study demonstrates that although park use may have increased overall, nationwide, this likely varied a great deal at the local level, which may have been due to differences in public health messaging or perhaps "bleed over" from other nearby jurisdictions. For example, the behavior of Waterloo residents may have been influenced by media coverage from Toronto, where strict orders around physical distancing in parks resulted in tickets being issued to some park users.[12] Similarly, in the state of New Jersey, closing specific parks appeared to decrease overall visitation, even in parks not included in the closures.[13]

A survey led by Brock University in Ontario found that individuals decreased park use by more than 50% from March 17 through May 15, 2020.[14] The key reasons for decreasing park activities or changing to other activities, such as gardening, running, walking, and birdwatching, were the need to observe physical distancing and avoid those potentially infected, the ability to do an activity alone, and the need to observe park closures. It should be noted that survey respondents were primarily

from Ontario (70%), where restrictions were tightest, and were also self-identified "outdoor enthusiasts" who likely used parks more intensively (average 11 hours per week) prior to the pandemic.

In addition to regional differences, park use also differed by population. Borkenhagen et al.[11] found that men in the Waterloo region appeared to be more likely than women to visit parks during May 2020, which was attributed to gender differences in risk perception and greater uncertainty about the virus at the time. Similarly, older people were less likely to visit, perhaps due to the increased COVID-19 risk to this population. Members of larger households also tended to visit parks less, perhaps due to less need for outside socializing. Finally, people from households earning > $100,000 annually were more likely to visit than those earning < $100,000, which the authors speculated might be due to greater access to green space in more affluent neighbourhoods. Although not examined by the authors, it is also possible that lower income households were more likely to be engaged in essential work, which would mean limited time for recreation.

Finally, the types of green spaces accessed also changed due to the pandemic. In the spring of 2020, public park users reported a decrease in their average travel time to recreational spaces,[14] with 10% more people reporting that they travelled 30 minutes or less to reach their destination compared to just before the start of the pandemic. This is consistent with national survey data published in July 2020, which found that respondents were more likely to visit parks and green spaces closer to home.[5] National and provincial parks and historic sites were initially closed in the spring of 2020, but later opened for summer holidays, at which point the media reported a 200% increase in campsite reservations in Ontario,[15] and similarly large increases in Alberta.[16] Overall, Parks Canada noted increased park visits within 100 km of urban centres in the summer of 2020.[17] These findings may reflect the public's desire to travel tempered by public health recommendations or orders to limit non-essential travel outside of home communities.

As shown above, most of the research on park use focusses on the early pandemic period, from March to May 2020. Additional research will be needed to understand whether park use remains higher over the longer term, both through the continuing pandemic and into the post-pandemic future.

What role did parks play in Canadians' health during the early pandemic?

The effects of green spaces on human health have been well studied, with benefits ranging from stress reduction, better mental health, improved cardiovascular health, decreased prevalence of diabetes, to enhanced overall wellbeing.[18] In pandemic times, green spaces may be important in either mitigating the negative effects of COVID-19 directly (reducing case counts, speeding recovery)

or mitigating indirect effects, such as stress, social isolation, and lack of physical activity. In a global review of the relationship between green infrastructure and COVID-19 outcomes, Heckert and Bristowe[8] found weak and conflicting information regarding the effects of park use on COVID-19 transmission, deaths, and other direct effects indicators. However, 14 of the 15 studies examining indirect effects revealed that pandemic-related physical and mental health impacts were indeed less severe among those who reported increased green space access or exposure. This section will examine the literature looking at the direct and indirect impacts of the pandemic on the health of Canadian park users.

Parks did not appear to exacerbate COVID-19 transmission, but context matters

Early on in the pandemic, some jurisdictions closed public parks out of concern that crowding or socializing would drive further COVID-19 transmission. However, although transmission can certainly occur outdoors under worst-case conditions,[19,20] outbreak data indicate that the risk of this occurring is orders of magnitude lower than in indoor settings.[21]

No data on park use and COVID-19 transmission were found for Canada, but data collected elsewhere indicate that transmission is unlikely if physical distancing can be maintained. In the UK, Johnson et al.[22] used Google Community Mobility data from 299 districts to examine the relationship between park use and local COVID-19 case rates from March to December 2020. Although overall mobility to all destinations, combining parks, groceries and pharmacies, workplaces, transport hubs, retail and recreational amenities, was suppressed over the study period, mobility data related to parks alone remained elevated over the summer and up until the winter respiratory season began in October. Reducing overall mobility was associated with the greatest decrease in case rates. However, compared to other mobility types (going to work, grocery/pharmacies, retail/recreation, or using transport), increased park use was not associated with increased case rates. Rather, lower COVID-19 case rates were observed in areas with increased park use, suggesting that if people are out of the home, spending time in a park may be less risky than in other places. However, a review of six studies in developed and developing countries found mixed results when examining the interaction between park use and COVID-19 outcomes[8]; two of these studies indicated that park use had increased transmission rates in situations where crowded park use might have been expected.

Parks may have ameliorated the loss of healthy physical activity

Pandemic restrictions like lockdowns and closures aim to reduce transmission by decreasing human interactions; an unintended consequence of this is decreased overall mobility and more individuals unable to achieve recommended daily physical activity levels. Because the use of parks and green spaces appeared to have increased during the early pandemic, a number of researchers have examined whether access to parks and green space helped to lessen the negative impacts of mobility restrictions.

Unsurprisingly, the studies reviewed below revealed a dramatic decrease in physical activity during the spring of 2020, which is consistent with research showing decreased activity and increased sedentary behaviour worldwide.[23] However, the role of parks in mitigating this lost activity is unclear. In an April 2020 survey of 1098 adults (primarily BC residents), 36% indicated that they were more active, whereas 34% became less active.[24] Although 88% indicated that having a natural environment to exercise in was somewhat or very important, only 13% of all respondents indicated that "rec sites, trails and parks" were their most common location, compared to 46% identifying their neighbourhood or outdoors generally. In a national survey published in July 2020, respondents indicated that they were more likely to access parks and informal green spaces if they were closer to home.[5] These findings likely reflect public health recommendations to remain within local communities, but also highlight the potential importance of non-park green spaces such as school playgrounds, tree-lined streets, or private yards and gardens.

The ParticipACTION survey carried out in April 2020 found that the majority of children and youth spent less time playing outside in the first weeks of the pandemic compared to the period before restrictions came into effect,[25] likely due to the loss of school and sports activities nationwide. However, the greatest decrease was observed in Ontario, where restrictions on public green space were most aggressive,[9] whereas BC and the Atlantic provinces saw the smallest decreases in physical activity.[10] In a more detailed analysis of the same data set, Mitra et al.[26] found that living in a single detached dwelling and living far from major roadways made younger children more likely to have increased outdoor activity during the early pandemic. For older children, living in a high-density neighbourhood made increased outdoor activity less likely, except when that dwelling was within 1 km of a park. Similarly, Riazi et al.[27] found that BC and Ontario parents cited park closures as one of several factors making it difficult to ensure that their children received enough physical activity. These findings can be better understood in light of studies carried out by McCormack et al.,[28] who found that children were not only spending less time exercising and less time playing in parks and public spaces, but that children of parents expressing the greatest COVID-19 anxiety were most affected. In other words, parental stress may have been a factor in their children's decreased physical activity.

Among adults, parks and non-park public spaces like trails and sidewalks were identified as important for physical activity. In a small qualitative study of adults in Calgary, respondents emphasized safety, looking for wider paths, larger open spaces, and visiting green spaces at off-peak hours to reduce their chance of COVID-19 transmission.[29] In contrast, Rhodes et al.[30] surveyed 1230 Canadian adults regarding a wide array of social, psychological, and built environment factors that may have affected an individual's ability to maintain moderate-to-vigorous activity levels through to May 2020. They found that maintaining physical activity was most strongly dependent on demographics such as age, income, and education, personal psychology, and to a lesser extent on factors like dog ownership,

availability of home equipment, and home workouts. Proximity to parks and trails was *not* a significant predictor in this analysis.

These data show that although park use may have increased overall, the amount of physical activity achieved by Canadians decreased overall during the first months of the pandemic. For those with access to park space, shifting activities outdoors helped to somewhat ameliorate the loss of physical activity due to pandemic disruptions. However, other personal psychological and identity factors may have been equally or more important than access to green space.

Parks were resources for addressing mental health and social isolation

Canadians' mental health was severely impacted during the early pandemic. Research conducted on behalf of Mental Health Research Canada, found that the number of people nationwide reporting high levels of anxiety in April 2020 had quadrupled, and the number of those reporting high levels of depression more than doubled.[31] Personal job loss, the economic downturn generally, and fear of family members contracting COVID-19 were the three factors with the largest negative impacts on mental health.

Prior to the pandemic, a growing body of research had examined the relationship between green space and health in Canada. Most recently, Crouse et al.[32] used the nationwide Canadian Community Health Survey to examine the relationship between mental health indicators and vegetative cover in the neighbourhood. Although the results varied according to demographics (age, sex) and neighbourhood (urban core vs. suburb), there was an overall tendency toward decreased odds of poor self-rated mental health with increasing greenness within 500 m. In older adults (45-85 years old), green cover within 500 m showed stronger relationships with a number of mental health indicators, particularly among lower-income respondents.[33] This positive association between green space and mental health appears to have held true during the pandemic. Several non-academic surveys conducted during the pandemic have reported that Canadians who used urban and rural (provincial and national) parks were doing so because it supported their mental health and social connectivity.[5,34]

Although some work is available internationally,[8] it is still early to expect large-scale studies regarding green space and specific mental health outcomes in Canada. Some early work suggests that physical activity outdoors or in parks may have supported mental health. For example, in April 2020, people who reported better mental health were more likely to have exercised that those with poorer mental health, and this protective effect appeared to be stronger for outdoor rather than indoor exercise.[35] Similarly, those who performed a greater portion of their physical activity outdoors had lower levels of anxiety.[24]

One aspect of the park use that warrants greater attention is the effect of green space on social cohesion or connectivity.[36] Greater than 40% of respondents surveyed nationally in Dozois et al.[31]

cited social isolation as having the greatest impact on their mental health, and the ability to interact with members of one's own household had a strong positive effect. Throughout the pandemic, the media provided examples in which social engagement in parks became a pandemic-coping mechanism. For example, a regular exercise group in High Park in Toronto drew park visitors which led to lasting friendships amongst all the members, resulting in a strong social support system during the pandemic.[37] Dog parks are another source of social cohesion, where the presence of animals bridges the gap between strangers and creates a supportive community.[38] Although many Canadian cities initially closed dog parks,[6] the lack of space to exercise animals and the associated outcry meant that these parks were some of the first to reopen. Further research is needed to better understand the interaction between green space and social cohesion during large societal disruptions such as the pandemic.

Closures may have increased physical risks to park users

Outdoor recreation is not without risk, particularly if park users are trying new activities or if facilities or staff are unavailable in urgent situations. In the media, there were numerous reports of injuries and emergencies related to increased park use, new park users, and lack of staff or safety measures.[39]

No data were available regarding park-related injuries in Canada. However, the closures of facilities meant that life-saving equipment may not have been available when needed. Leung et al.[40] analyzed registries of automated external defibrillators (AEDs) in four provinces and two municipalities and examined whether that equipment was likely to be accessible to the public under existing closure orders. They found that 89% of AEDs located in parks were completely or partially inaccessible to the public. This is of great concern given that their simultaneous analysis of Google Community Mobility analysis indicated that parks showed the lowest decrease in foot traffic over the study period (Feb 15 to May 1, 2020).[40] Further research is needed to understand whether crowding or park management during the pandemic contributed to an increase injuries or adverse events, such as being unable to access an AED in an emergency.

What were the barriers to accessing green space benefits?

Although parks and green spaces may have become more popular during the pandemic, not everyone was able to access or enjoy these areas equally. In addition, changes in use may have created other unintended consequences that may impact public health. This section will explore some of the barriers to the use of parks and natural spaces during the early pandemic in Canada.

Not all enjoyed equal access to and safety within green space

Regardless of park closures, not all Canadians enjoyed equal access to green space. Parks and green spaces are often distributed unevenly or absent entirely in communities with lower incomes and greater diversity. In Canada, a recent analysis found that white, high-income census respondents tend

to have higher exposure to green or vegetative cover within 500 m of their homes, whereas tenants, low-income households, recent immigrants, and certain visible minorities were less likely to have green space around their homes.[41] During the pandemic, these issues were highlighted in media coverage noting that in Toronto's North St. James Town, a high-density immigrant neighbourhood, a large proportion (40%) of its residents live at poverty level and lack access to nearby green space.[42] Parks that do exist in low income neighbourhoods may be of lower quality due to historic inequities in park investment, or residents may be deterred from using them due to safety perceptions.[43]

In addition to inequitable access to green space, the pandemic also brought to light pre-existing social injustices that may have deterred public outings by marginalized communities. A 2020 Statistics Canada report summarized some of the ways in which visible minorities, immigrants, women, sexual minorities, people with disabilities and gender diverse participants had experienced disproportionate economic and health impacts, as well as overt discrimination during the pandemic.[44] In particular, Asian communities have experienced a sustained increase in hate crimes, as indicated by coverage in the media[45] and surveys conducted by Angus Reid Institute.[46,47]

These negative experiences appear to have impacted who accessed park space and what benefits they derived from it. In the *2021 Canadian City Parks Report*, Canadians who identified as Black, Indigenous or a person of colour (BIPOC) reported that they visited parks less than white Canadians during the early pandemic.[7] Overall, 22% of BIPOC respondents indicated that harassment or discrimination prevented them from accessing or enjoying park space, compared to only 8% of white respondents. Approximately 24% of BIPOC respondents indicated that fear of ticketing kept them out of parks, a fear that was potentially amplified by media coverage of visible minorities suffering discriminatory application of COVID-19 fines in Toronto.[12] Indeed, the Canadian Civil Liberties Association received numerous complaints of racialized individuals who reported discriminatory ticketing or application of public health orders.[48] Perhaps as a result of these stressors, a much smaller proportion of Black (69%) or Indigenous (72%) respondents indicated that park use had a positive impact on their mental health during the pandemic compared to white respondents (88%).[7]

Although COVID-19 has highlighted inequities in access to green space and the ability to use it safely, addressing these inequities may also help to alleviate the disproportionate health burdens imposed by COVID-19 on vulnerable communities.[49] Guidance to achieving these goals in Canadian parks is provided in the *2021 Canadian City Parks Report: Centring Equity and Resilience*.[7]

The pandemic increased pressure on and conflict around homelessness

Existing issues with homelessness were further amplified by the economic downturn, resulting in more people unhoused for the first time.[50] At the same time, park facilities such as washrooms were closed, and only a quarter of 51 cities surveyed reported having installed temporary washrooms or handwashing stations as of July 2021.[5] This intensified use of public spaces without basic services was

a key driver for NCCEH's 2020 document on *Environmental public health guidance for encampments during the COVID-19 pandemic*.[51]

As of June 2021, 90% of municipalities identified homelessness as an even greater issue during the first year of the pandemic.[7] However, Canadian jurisdictions continued to address homeless encampments in city parks in ways that are harmful and ineffective and a failure to uphold the basic human rights of the unhoused.[52] Ticketing, by-law enforcement, and clearing of encampments appear to have been a common initial response during the pandemic.[53-55] In fact, a 2020 survey of parks departments found that only 16% of cities had halted encampment clearances.[56] Because public parks and green spaces serve as refuges in times of disruption, both during the current pandemic and potentially also during future climate-driven emergencies, finding better means to address encampments and supporting the needs of unsheltered park users is urgently important.

Universal accessibility was overlooked in many parks

Promoting universal accessibility is a key principle in park planning. More than 80% of the cities surveyed in the 2021 Canadian City Parks Report acknowledged the need for improved accessibility; however, less than half of those respondents had developed plans or guidelines around accessibility.[7] For example, just as washroom closures created difficulties for people experiencing homelessness, the lack of washrooms during the pandemic has hindered people with certain illnesses and disabilities from accessing public parks at all.[57] We have furthered explored this and other issues around accessibility during the pandemic in our NCCEH blogs, *Accessibility for persons with disabilities during the COVID-19 pandemic*[58] and *Creating healthy community places and spaces with individuals with diverse abilities.*[59]

Budgetary pressures may have jeopardized access to high-quality spaces

In addition to access to green space, or exposure to "greenness," the quality of that space also matters. During the pandemic, increased park visitation also led to a number of negative consequences, including crowding, damage to ecologically sensitive areas, dangerous fires, littering, and even public defecation due to lack of washroom facilities.[57,60] In addition, as a result of increased maintenance and the costs of new programs, 60% of cities surveyed in the *2021 Canadian City Parks Report* indicated that the pandemic had an overall negative effect on their budgets. However, survey data also indicated that the pandemic had elevated the importance of parks amongst city leaders and park planners, and 85% of members of the public surveyed supported greater investment in parks.[7] Thus, although park operations may have been challenged during the pandemic, the popularity of parks and the various benefits discussed in this paper may help to reinvigorate conversations around park investment.

What can environmental health offer to post-pandemic park planning?

Traditionally, environmental health practitioners may have engaged in park management over issues related to recreational water safety, waste management and sanitation, or food safety at permanent or temporary venues. However, given the growing recognition that urban green spaces represent critical public health infrastructure, and given the expanding role of environmental health practice into the realm of the built environment, there may be further opportunities for collaboration in park planning, design, and management.

Reducing the risk of harmful exposures

Environmental public health (EPH) professionals have an invaluable role in the design and management of parks, by assisting with the identification and investigation of health hazards. The following are some examples in which EPH expertise would be particularly useful:

- Allergen exposure. Research has suggested that exposure to green space may be associated with asthma symptoms in some locations, which was attributed to specific pollen sources.[61] The selection of plant species, or decisions around plant management, can be informed by EPH knowledge.
- Vector-borne disease. In parks that are "re-wilding", or reverting to a more natural state, environmental health insight into landscape design and management may be helpful to reduce potential exposures to ticks and tick-borne disease,[62] among other potential vectors.
- Safety of cultivated and foraged food. Green spaces are also food sources. EPH oversight is warranted for activities such as foraging, as the presence of organisms like the death cap mushroom (*Amanita phalloides*), thought to have been introduced on the roots of imported trees,[63] has led to poisonings and death.[64] Even the striking surge in pandemic gardening (Box 2), whether as solitary recreation[14] or because of food security concerns,[65] may be of concern due to the risk of exposure to contaminated urban soils and water used in community gardens.[66]
- Extreme heat and cold. As park use increases over time, including into seasonal extremes (Box 1), EPH professionals can help to keep the public safe by planning for both extreme heat and extreme cold events. This is particularly relevant for vulnerable unhoused populations.

Box 2: Meeting increased demand for gardening and food production.

One recurrent theme in the pandemic literature is the intensified interest in community gardens and food production, as well as private, at-home gardening. Cities across Canada attempted to meet that demand, highlighting the role of gardens in relieving stress, creating social connectivity, and bolstering food security during an emergency:

- In 2020, the City of Edmonton created 350 allotments in pop-up community gardens on underused city properties. Due to high demand, the program was renewed in 2021 and 2022 and prioritized according to social vulnerability.
- The City of Victoria re-allocated staff and nursery space at Beacon Hill Park to grow food plants for distribution to the wider community. In 2020, *Get Growing, Victoria!* provided 81,500 food plants to over 10,000 households through community partners. In 2021, 86,500 food plants were provided to 12,000 households; 100,000 seedlings will be distributed in 2022. Socially vulnerable community members are again prioritized.
- The City of Brampton's Backyard Garden Program provided gardening materials and supports to home growers who then consumed the produce or donated it back to the community. In 2021, 6,946 lbs of produce were donated to residents in need, and growers benefitted from having a healthy, outdoor, at-home activity.

Advocating for inclusive parks

Reaping the public health benefits of green spaces requires eliminating the barriers that prevent some communities from accessing or enjoying parks safely, including racialized groups, those with disabilities, unsheltered park users, and others. The 2020 and 2021 *Canadian City Parks Reports*[6,7] contain many suggestions for creating more inclusive parks. One of the most important of these recommendations is ensuring that the diversity of park users is reflected in the boards and committees making decisions on park design and management.

However, environmental public health practitioners and researchers may have additional tools and expertise to resolve inequities in park-related benefits. For example, EPH professionals have a great deal of insight into the communities they serve, and can assist in identifying neighbourhoods lacking parks and green space, especially in neighbourhoods which are high in poverty, ethnically diverse, and have insufficient access to amenities such as parks or gardens. In some cases, public health professionals may have access to community-specific data on health inequities that could inform and be integrated into planning processes.

Understanding the connections between the built environment and health is an evolving field of practice and it can be challenging to evaluate the success of interventions. EPH professionals have

unique tools to draw on, including the *Healthy Built Environment Linkages Toolkit*[67] which lays out planning principles and evidence-based interventions for natural environments, and others. EPH professionals involved in park planning and evaluation may also draw on *Health Equity Impact Assessment Tool*[68] to identify and address inequities. Finally, as public health agencies seek to engage more meaningfully in reconciliation with Indigenous communities, seeking Indigenous and other racialized perspectives on land management, park design, and park programming may help to promote healing in these public spaces.[69]

Designing for disruption

The disruptions created by the pandemic may in some ways be similar to expected climate-related disruptions. As during the pandemic, green spaces may become an important site of mental and physical refuge during climate-related events. Given that green spaces are increasingly viewed as public health[70] *and* climate resilience infrastructure,[71] EPH professionals will have a natural role in designing these spaces for maximum benefit and should consider these joint perspectives of pandemic and climate resilience. The following are some of the ways in which EPH professionals can help parks design for disruption:

- Create more green space outside of formal parks. Because people tend to benefit the most from the green space closest to them,[4] establishing smaller parklets and informal green spaces in places that residents frequent during their daily routines (e.g., streets, yards, parks, laneways and schools) may be a way to amplify benefits. Increasing green cover and green corridors for active transportation is also thought to be important for mitigating the effects of extreme heat events, provided that these spaces are safe and inclusive, and have adequate facilities to support users when needed. It is also important that these new spaces are equitably distributed. For example, park planners in Vancouver made use of a mapping tool that integrated data on park space per person, leafy canopy, and demand for low-barrier recreation to identify areas of the city that needed additional green space the most.[72]
- Reconsider what is an "essential activity." During the early pandemic, some cities closed community gardens whereas others deemed them to be essential. What can be done to ensure that features like community gardens, which contribute to local food security, healthy physical activity, mental health and social cohesion, are permanent rather than improvised features and can continue to operate despite disruptions? Are there other activities carried out in parks that should be deemed essential in future disruptions?
- Ensure that park spaces are multi-purpose. During the pandemic, many cities found rapid ways to create more space. This included repurposing other spaces (e.g., opening up baseball fields, creating slow streets), having more flexible opening hours, or revisiting previously restrictive policies like bans on public alcohol consumption (Box 3). The ability to flexibly repurpose space is important given that park spaces are also likely to be damaged in climate-

related disasters, as evidenced by the destruction at Cultus Lake Provincial Park after the BC Flood.[73] Flexibility in park design and creativity in expanding green space may help preserve public health benefits through climate-related disruptions.

- Ensure that basic services can continue. Early in the pandemic, many cities were quick to close facilities and washrooms, whether due to staffing shortages, to limit transmission, or to discourage campers. However, these closures had several undesirable consequences, such as blocking access to AEDs, excluding visitors who require washroom access, and the accumulation of human waste and litter.[74] Given that sanitary facilities are of first-order importance in any emergency, finding ways for basic park services to continue is critical.
- Plan for encampments. Encampments are related to growing housing deficits and lack of social supports; climate-related disasters will certainly exacerbate these needs, and unsheltered people will continue to seek refuge in parks. In addition to providing adequate facilities should the need arise, there is also an opportunity to turn temporary, pandemic-related housing solutions into permanent housing,[55] which will reduce the number of people at risk of homelessness in future disasters. Educating the public through park ambassadors may be one way to reduce the stigma and conflict around sheltering in public parks.[6,56] However, changing problematic approaches to encampments will require leadership from the environmental public health community, with the use of a health equity lens.

Box 3: Reviewing policies on public alcohol consumption in parks.

For people without their own yards or private outdoor space, parks became one of the few places to socialize safely. To encourage outdoor gatherings, some cities reversed long-standing policies on alcohol consumption in parks. This harm reduction approach allowed park users to carry out their typical social activities without resorting to a more risky indoor private space.

Pilot projects were carried out in Vancouver, Calgary, Edmonton, Quebec, and other jurisdictions, usually with restrictions such as designated consumption zones or requiring food consumption as well. Further reports on these pilots are forthcoming.

However, this policy shift is not universally supported, as allowing public, unsupervised consumption of alcohol has other public health and public safety ramifications that may extend beyond the COVID-19 pandemic. Some of these harms include the well-known health risks of alcohol use in adults and minors who emulate them, as well as equity concerns as those who are uncomfortable with alcohol use may avoid places where it is consumed. Data from the Calgary's pilot project revealed that 42% of respondents would leave the area if they saw people using tables dedicated for alcohol consumption.

- Ensure that climate adaptation does not create public health hazards. Green spaces are increasingly viewed as a tool to reduce climate impacts. For example, green infrastructure is being used to mitigate flooding from severe storms[75] or to provide shade from urban heat islands or extreme heat events.[76] EPH input is useful in these innovative projects to ensure that such initiatives are not maladaptive. Maladaptation is a key focus in the most recent report from the Intergovernmental Panel on Climate Change, which emphasizes the growing problems with actions taken to lessen the impacts of climate change that inadvertently create new hazards or lessen benefits already enjoyed.[77] An example of maladaptation in park planning might be creating or renovating park space in a low-income neighborhood, without addressing the potential for gentrification and displacement of those meant to benefit. EPH professionals can also assist with the selection of indicators and collection of health evidence regarding the effectiveness of adaptation measures.
- Be alert for funding opportunities. Given the current interest in parks as public health infrastructure, interdisciplinary planning teams involving EPH professionals may find opportunities to achieve health goals through cross-sector funding for park-based projects. This is especially salient given the recent allocation of substantial federal funding to improve urban park spaces in Canada. The National Urban Parks program[78] and the Healthy Communities Initiative[79] will provide $160 million in federal funding to create green infrastructure for climate resilience and biodiversity, while producing environments for improving health and wellness. This work will be carried out in collaboration with provincial/territorial, municipal and Indigenous governments. EPH participation in these project will help to ensure that the synergy between creating healthy resilient human communities and healthy resilient natural systems is maximized.

Gaps and further research

Although the broader public health benefits of green space were recognized long before the COVID-19 pandemic, the pandemic has underscored several ways in which parks have supported public health goals in a period of great disruption. The literature reviewed here primarily covered the early months of the pandemic. Further information collected during and after the pandemic is needed to illuminate some of the following questions:

- What features of green spaces were more (or less) important in terms of pandemic benefits gained, and for whom?
- What can we do to ensure that beneficial park interactions initiated during the pandemic carry on through time?

- How do the benefits observed in relation to urban parks compare to non-urban parks, informal green spaces, and private green spaces?
- What measures can we take to increase the resilience of green spaces in the face of changing climate conditions (e.g., droughts and wildfires) such that they can continue to provide public health benefits when needed most?

Summary

The COVID-19 pandemic brought a new focus on and appreciation for outdoor public spaces. Although parks have traditionally served as multipurpose spaces, the pandemic required an even further expansion of these uses and highlighted their role as critical public health infrastructure. However, although the research shows that some populations increased park use and experienced benefits, other populations did not enjoy the same degree of access or safety in public green spaces. These findings highlight the need for public health to not only consider urban green spaces as tools for resilience and health promotion, but to redouble our efforts to create inclusive spaces that mitigate rather than exacerbate health inequities.

The literature reviewed here supports a role for natural environments in creating resilient communities. EPH professionals can make valuable contributions to park planning and design, both in terms of minimizing the risk of harmful exposures and promoting health equity. Furthermore, joint efforts between park planners and public health are needed to move forward with the implementation of green infrastructure solutions to address the overlapping opportunities and challenges of creating pandemic and climate resilience.

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