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# Addictive Behaviors

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## Editorial

### Green space and substance use and addiction: A new frontier



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A large body of research has linked exposure to green space with better health outcomes including reduced mortality (Kondo, Fluehr, McKeon, & Branas, 2018), lower cardiovascular risks (Yeager et al., 2018), and increased physical activity (Akpınar, 2016). Recently, an emerging area of research investigates the association between exposure to green space and mental health. This research has explored several aspects of mental health and well-being but has not yet thoroughly investigated the issue of substance use and addiction. In this editorial, we will discuss what is missing in the current body of evidence, as well as methodological challenges and considerations for future research.

#### 1. The missing link

There have been two fundamental strategies in studies investigating the association between exposure to green space and mental health: (i) to evaluate mental health with respect to specific behavioral and emotional outcomes; and (ii) to evaluate mental health more broadly in terms of general well-being. Both streams of research have identified positive associations between exposure to green space and mental health, but have favored a limited range of mental health outcomes (Astell-Burt & Feng, 2019; Gascon et al., 2015; Houlden, Weich, de Albuquerque, Jarvis, & Rees, 2018; Tillmann, Tobin, Avison, & Gilliland, 2018; Vanaken & Danckaerts, 2018). Outcomes related to substance use and addiction is one such area that is lacking research.

From a public health perspective, substance use is of critical importance. It plays a significant role on the global burden of disease and contributes to a host of social and economic maladies (Whiteford, Ferrari, Degenhardt, Feigin, & Vos, 2015). In Canada, drug, alcohol, and tobacco use represent three of the top-ten risk factors that contribute to disability-adjusted life years (IHME, 2019). A further concern is the high rate of substance abuse. The lifetime-prevalence of substance use disorder is an estimated 22% in Canada (Pearson, Teresa, & Jennifer, 2013). The collective toll of substance use and abuse has been far reaching and costs Canadians \$34 billion dollars per year (Stockwell & Young, 2018).

#### 2. The green space connection

Although no studies have explicitly examined the relationship between exposure to green space and substance use and addiction, related evidence suggests that further investigation is warranted. For example, research from environmental psychology has documented improvements in substance-abuse behavior and ideation with nature-assisted therapies (Annerstedt, Währborg, & Sveriges lantbruksuniversitet, 2011; Richards & Kafami, 1999). These therapies range from engagement with elements of natural environments, like plants and horticultural therapy, to engagement with nature more broadly, like wilderness and outdoor adventure therapy. Within epidemiology, research has investigated how alterations to the built environment can affect public health and safety. One study investigated the effect of green stormwater infrastructure, a form of urban greening, on health and safety in the surrounding areas. The authors found that these initiatives improved public safety through the reduction of certain crimes, most notably narcotics possession (Kondo, Low, Henning, & Branas, 2015). The mechanisms through which these reductions occurred, however, were not studied. Research from environmental criminology has also explored the association between green space and substance use through the general framework of green space and crime. This literature highlights how variation in crime is related more to the physical and social organization of the space than it is to a particular type (e.g. residential park, public garden, sporting fields/facilities) of space (Groff & McCord, 2012). One important organizational element is the presence or absence of amenities, such as playgrounds, seating areas, sporting facilities, and enclosed spaces. Amenities offer variable amounts of surveillance, and conversely opportunity, thus making them integral to the understanding of green space crime (Groff & McCord, 2012). On account of this, some researchers have opted to classify green spaces based on their arrangement of amenities as opposed to their colloquial label (e.g. “neighborhood park”). One group of researchers analyzed green spaces based on a 4-level typology, ranging from ‘amenity poor’ to ‘amenity rich’, and found a strong association between total crime, including drug crime, and the presence of amenities (Kimpton, Corcoran, & Wickes, 2017). This approach highlights the importance of a well operationalized ‘type’, as even green spaces of a similar class can

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present much heterogeneity (Kimpton et al., 2017). Another study found that youth who lived in areas with greater proximity to neighborhood parks had a higher likelihood of engaging in substance use behaviors (Kotlaja, Wright, & Fagan, 2018). Unfortunately, this study did not take into consideration variations in park size, amenities, conditions, or greenness.

### 3. Future research

Although all areas of green space research share a similar set of challenges, there are two priority considerations for future research. The first issue pertains to measurement of exposure. Green space is routinely captured through a vegetation index that attaches a 'greenness score' to a predefined geographical area (Beyer et al., 2014; Dzhambov, Hartig, Markevych, Tilov, & Dimitrova, 2018; Kondo et al., 2018). The problem with this methodology is that it tells us very little about other meaningful characteristics of those spaces, such as the presence of amenities or incivilities. Nor does it tell us about the individual experiences within that exposure. If a person lives in an area where green space is plentiful, their exposure status is reflected by this alone and not their actual engagement within the space. This of course has important implications when trying to understand the underlying causal mechanisms involved. Future research should place a greater emphasis on parsing out these differential effects.

The second challenge, which is more pronounced for green space research involving mental health outcomes, is reverse causality, especially in the context of cross-sectional studies. Intuitively, the direction of effect should start with exposure to green space and move towards substance use outcomes. The opposite relationship, however, also remains plausible. Vanaken and Danckaerts (2018) hypothesize that a gene-environment interaction might be relevant whereby individuals with mental health issues purposely seek out and reside in areas away from green spaces. They describe one hypothetical scenario where parents with attention deficit tendencies choose to reside in stimulation-rich environments, particularly those associated with low proximity to green space (e.g. the inner-city). Consequently, the association between green space and the mental health of their children would be characterized more by genetics than by environmental risk factors. A similar situation could be used to describe the relationship between green space and substance abuse and addiction. Those suffering from addiction might choose to live in areas with easy and reliable access to their drug of choice. If those areas are characterized by low proximity to green space (like the inner-city), then any association between the two would be attributed to addiction. Future research would benefit from a greater assortment of study designs that include a longitudinal perspective where possible.

### 4. Looking ahead

The foregoing discussion points to the necessity of understanding the effects of varying levels of exposure to different types of green space on substance use behavior. Substance use and addiction represent an important element of mental health that has received little attention in the green space literature thus far. Future research allows for a more complete understanding of these effects and has the opportunity to guide policy in meaningful ways. A priority for future research is to better understand the direction of effect. The current evidence, albeit peripheral, has provided conflicting results as to whether green space exposure is protective or detrimental to substance use and addiction. Ultimately, the goal of future research will be to subject any observed associations to causal analysis. Although the underlying mechanisms will depend on the direction of effect, the epidemiologic and environmental criminology literature has eluded to several causal pathways for future consideration. These include temporal (social routines), environmental (physical structures and layout; landscape), and psychological (stress reduction) pathways (Hartig, Mitchell, de Vries, &

Frumkin, 2014; Kimpton et al., 2017; Kondo et al., 2015). In addition to the pathways between green space and health, future research should explore interactions between environmental and social triggers of addiction and green space.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2019.106155>.

### References

- Akpınar, A. (2016). How is quality of urban green spaces associated with physical activity and health? *Urban Forestry & Urban Greening*, 16, 76–83. <https://doi.org/10.1016/j.ufug.2016.01.011>.
- Annerstedt, M., Währborg, P., & Sveriges lantbruksuniversitet (2011). Nature-assisted therapy: Systematic review of controlled and observational studies. *Scandinavian Journal of Public Health*, 39, 371–388. <https://doi.org/10.1177/1403494810396400>.
- Astell-Burt, T., & Feng, X. (2019). Association of urban green space with mental health and general health among adults in Australia. *JAMA Network Open*, 2(7), e198209. <https://doi.org/10.1001/jamanetworkopen.2019.8209>.
- Beyer, K. M. M., Kaltenbach, A., Szabo, A., Bogar, S., Javier Nieto, F., & Malecki, K. M. (2014). Exposure to neighborhood green space and mental health: Evidence from the survey of the health of Wisconsin. *International Journal of Environmental Research and Public Health*, 11(3), 3453–3472. <https://doi.org/10.3390/ijerph110303453>.
- Dzhambov, A., Hartig, T., Markevych, I., Tilov, B., & Dimitrova, D. (2018). Urban residential greenspace and mental health in youth: Different approaches to testing multiple pathways yield different conclusions. *Environmental Research*, 160, 47–59. <https://doi.org/10.1016/j.envres.2017.09.015>.
- Gascon, M., Mas, M. T., Martínez, D., Davdand, P., Forn, J., Plasència, A., & Nieuwenhuijsen, M. J. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: A systematic review. *International Journal of Environmental Research and Public Health*, 12(4), 4354–4379. <https://doi.org/10.3390/ijerph120404354>.
- Groff, M., & McCord, E. (2012). The role of neighborhood parks as crime generators. *Security Journal*, 25, 1–24. <https://doi.org/10.1057/sj.2011.1>.
- Hartig, T., Mitchell, R., de Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health*, 35, 207.
- Houlden, V., Weich, S., de Albuquerque, J. P., Jarvis, S., & Rees, K. (2018). The relationship between greenspace and the mental wellbeing of adults: A systematic review. *Plos One*, 13(9), <https://doi.org/10.1371/journal.pone.0203000>.
- Institute for Health Metrics and Evaluation. (2019). Country Profiles: Canada.
- Kimpton, A., Corcoran, J., & Wickes, R. (2017). Greenspace and crime: An analysis of greenspace types, neighboring composition, and the temporal dimensions of crime. *Journal of Research in Crime and Delinquency*, 54(3), 303–337. <https://doi.org/10.1177/0022427816666309>.
- Kondo, M. C., Fluehr, J. M., McKeon, T., & Branas, C. C. (2018). Urban green space and its impact on human health. *International Journal of Environmental Research and Public Health*, 15(3), 445. <https://doi.org/10.3390/ijerph15030445>.
- Kondo, M. C., Low, S. C., Henning, J., & Branas, C. C. (2015). The impact of green stormwater infrastructure installation on surrounding health and safety. e114–e12. *American Journal of Public Health*, 105(3), <https://doi.org/10.2105/AJPH.2014.302314>.
- Kotlaja, M. M., Wright, E. M., & Fagan, A. A. (2018). Neighborhood parks and playgrounds: Risky or protective contexts for youth substance use? *Journal of Drug Issues*, 48(4), 657–675. <https://doi.org/10.1177/0022042618788834>.
- Pearson, C., Teresa, J., & Jennifer, A. (2013). Mental and substance use disorders in Canada, Health at a Glance. September. Statistics Canada Catalogue no. 82-624-X.
- Richards, H. J., & Kafami, D. M. (1999). Impact of horticultural therapy on vulnerability and resistance to substance abuse among incarcerated offenders. *Journal of Offender Rehabilitation*, 29(3–4), 183–193. [https://doi.org/10.1300/J076v29n03\\_11](https://doi.org/10.1300/J076v29n03_11).
- Stockwell, T., & Young, M. (2018). *Substance use in Canada costs 38.4 billion a year*. Canadian Institute for Substance Use Research, University of Victoria.
- Tillmann, S., Tobin, D., Avison, W., & Gilliland, J. (2018). Mental health benefits of interactions with nature in children and teenagers: A systematic review. *Journal of Epidemiology and Community Health*, 72(10), 958–966. <https://doi.org/10.1136/jech-2018-210436>.
- Vanaken, G., & Danckaerts, M. (2018). Impact of green space exposure on children's and adolescents' mental health: A systematic review. *International Journal of Environmental Research and Public Health*, 15(12), 2668. <https://doi.org/10.3390/ijerph15122668>.
- Whiteford, H. A., Ferrari, A. J., Degenhardt, L., Feigin, V., & Vos, T. (2015). The global burden of mental, neurological and substance use disorders: An analysis from the global burden of disease study 2010. *Plos One*, 10(2), <https://doi.org/10.1371/journal.pone.0116820>.
- Yeager, R., Riggs, D. W., Riggs, D. W., DeJarnett, N., DeJarnett, N., ... Bhatnagar, A. (2018). Association between residential greenness and cardiovascular disease risk. *Journal of the American Heart Association*, 7(24), <https://doi.org/10.1161/JAHA.118.009117>.

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