

Healthy Built Environment Linkages Toolkit

Making the links between design, planning and health



The Healthy Built Environment (HBE) Linkages Toolkit is maintained by the Population & Public Health team at the BC Centre for Disease Control (BCCDC), under the leadership of the BC Healthy Built Environment Alliance (HBEA) Steering Committee.

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The HBE Linkages Toolkit is sustained through close collaboration with many partner organizations and content experts. We are especially grateful to members of the Working Group for their commitment and generous contributions of time, expertise and support.

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Welcome message from Provincial Health Services Authority (PHSA)

It is my pleasure to present the updated version of the Healthy Built Environment Linkages Toolkit. This update represents a significant collaborative achievement and we are very pleased to work closely with regional health authorities, local governments, Ministry of Health and others to support the advancement of healthier built environments (HBE) in British Columbia.



BC Healthy Built Environment Alliance representatives, Sept 2017

Much has happened since the original release! Since 2014, the Toolkit has been rapidly adopted as an evidence-based conceptual framework for HBE work, and is used across British Columbia and other provinces to highlight health priorities within local planning initiatives, and to validate the impacts that built environments have on our health. It has helped to increase awareness, shape community plans, and support the development of new policies. Brief case studies are featured throughout the document to illustrate a few of these practice examples.

To respond to your feedback, we have looked more closely at research relating built environments to social well-being outcomes, economic cost-savings, and the need for tailored approaches in small and medium-sized community contexts. We've also developed an online tool which brings the evidence diagrams to life, allowing you to interact with research pathways and more easily access source literature.

The rapid uptake of this Toolkit, and other resources that use its framework, reflects a growing desire to translate healthy built environment concepts into practice with the end goal of promoting healthier lifestyles and active living. We are excited to share this update and hope that the Toolkit continues to be a relevant and helpful resource for your work with local governments and other partners.

Trish Hunt, RN, BSN, NP, MSc

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The BC Healthy Built Environment Alliance (HBEA)

HBEA is a collective of diverse stakeholders working together to support the creation of health promoting and more liveable communities in British Columbia. HBEA provides a forum for multi-sectoral leadership, learning and collaborative action. For more information, contact pph@phsa.ca



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Introduction

This Toolkit is intended to support the inclusion of health considerations within community planning and design. It is designed as a quick reference to the body of research evidence which describes how our built environment can influence population health.

The concept of a “healthy built environment” is considered through a holistic perspective including five core features:

1. Neighbourhood Design
2. Transportation Networks
3. Natural Environments
4. Food Systems
5. Housing

A two-page overview of the conceptual framework is provided on page 8-9.

In this Toolkit, you will find a collection of evidence-based messages for each feature above.¹ There are also health evidence diagrams, which are like roadmaps to the reviewed research, to help you identify areas where planning interventions are most strongly correlated with health outcomes, and where there are opportunities for new areas of research. The tools in this Toolkit provide key messages and research correlations in increasing detail.

This Toolkit is written for health professionals to assist them in articulating well informed and credible responses within local government planning processes and decision making. However, it can readily be used by other stakeholders. For example, the key messages and principles described are aligned with standard planning and design imperatives relating to compact and complete communities. Planners may find the health evidence provided is helpful to build the case for applying best practices in planning to communities, developers, and City Councils.

The purpose of this Toolkit is to generate conversation and adaptation by outlining a rationale for “why” the built environment is important for health. For information on “how” to implement the information in this Toolkit in specific planning processes, we encourage you to refer to the practice resources in Appendix C.

What’s new in this version?

This update includes several new components:

- Brief overview of the “tools” and examples of how they are used in communities
- Description of common types of community plans and processes
- Refreshed evidence base for Natural Environments and Food Systems
- Practice considerations for social well-being, economic co-benefits, and small and medium sized community contexts
- Simplified design and symbology in the health evidence diagrams

The HBE Linkages Toolkit is a living document. New research is reviewed, assessed and added in stages every few years. Suggestions for new research can be submitted to pph@phsa.ca.

¹ A range of planning principles that support healthier built environments are considered, including some which may be beyond the control of local governments.



Introduction:

What “Tools” are in this Toolkit?

Fact Sheets

Here you will find key messages and suggestions for how healthy planning and design can support improved population health outcomes that were gathered from research evidence.

Potential uses:

- As a reference to identify how health impacts may be implicated within a planning and development strategy. These could range from site specific bylaws to a city-wide plan or regional level strategy.
- To reference health research within policy and planning discussion, i.e. presentations to City Council, briefing documents
- To help planners highlight how proposed solutions are supported by health evidence
- To support partnerships for activities that fall outside the role of local governments, i.e. funding proposals for new school programs or community food initiatives

Health Evidence Diagrams & Summaries of Research Links

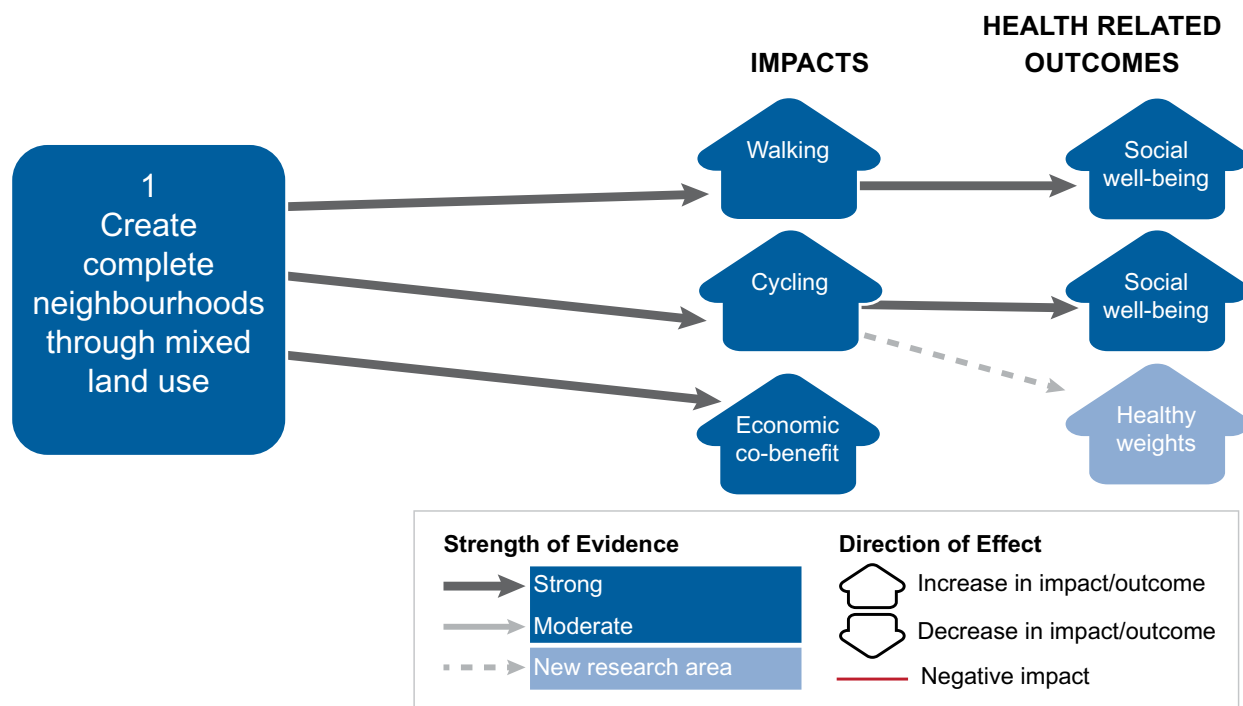
Health evidence diagrams are graphic overviews of the research, which highlight where impacts and outcomes are strong, moderate, or newly emerging. Because research directly connecting planning principles to health outcomes is limited, intermediate impacts must be considered, e.g. planning principles are linked to intermediate impacts through one collection of research, and another collection of research is assessed in order to link intermediate impacts to population health outcomes.

In the excerpt on the next page for one of the diagrams related to Neighbourhood Design, you can determine that creating mixed land use is strongly correlated to an increase in cycling, and cycling is linked to a strong increase in social well-being. A “new research area” link appears between cycling and healthy weights, which indicates that available research does not currently meet our grading criteria but is emerging and worth noting for future evidence review. Economic co-benefits are also indicated to be strongly demonstrated through research to be associated with mixed land use.

An online and interactive health evidence diagrams tool is available to help you interact with research pathways and more easily access source literature. To see the Healthy Built Environment Evidence Diagrams tool, go to www.bccdc.ca and use the search function.



Excerpt from evidence diagrams for “Neighbourhood Design”:



Before the health evidence diagrams for each feature, you will find a “Summary of Research Links”. These are more concise synopses of correlations represented in the diagrams, highlighting the strongest relationships found in literature reviews.

Potential uses:

- To quickly identify specific evidence-based relationships between the built environment and health
- To assess where research evidence is strongest and where there is potential for further research
- To help articulate how a planning solution or impact can have multiple health implications, and how desired health outcomes may be facilitated through multiple planning features
- To access source literature in order to glean additional details and to support further analysis of the key messages, recommendations, and planning principles described in the fact sheets.



Considerations for Practice

To support broader application, three “Considerations for Practice” are included which have significance across the five features.



Social well-being: a growing body of research has shown that our sense of belonging or connectedness has tremendous impacts on physical and mental health. The health outcome of social well-being is highlighted to provide additional rationale for the influence of built environments on health.



Economic co-benefits: Planning interventions which positively impact health often have significant economic co-benefits as well, which can be valuable to reference. Economic co-benefits for individuals, communities and broad institutions (e.g. local governments and health authorities) are offered.



Small & medium sized communities: research on healthy built environments is predominantly focused on urban settings and information on how to apply concepts in non-urban settings is limited. This section reflects research we did find relating to small & medium sized communities, as well as general considerations to support local values and needs.

These topics were prioritized by user feedback and found to be “viable” in terms of available research, but there are many other related considerations that could be explored in future updates to the Toolkit or as companion documents. For example, a companion document was developed by the National Collaborating Centre for Environmental Health which focuses on health equity. See “Supporting Health Equity through the Built Environment Fact Sheet” in Appendix C. Other potential topics for future exploration are healthy interior environments, the connections to climate change, socio-economic dimensions and mental health impacts.



Introduction:

How is the Linkages Toolkit Used?

The HBE Linkages Toolkit is used as a resource for framing and communications, to provide health perspectives and input to inform plans, projects and strategies, and in research and education.

A conceptual framework & communications tool

Here are a few examples of resources and processes based on the Linkages Toolkit framework and developed by a regional health authority:

- Fraser Health Authority: HBE brochure and series of fact sheets. HBE team program plan and staff training.
- Interior Health Authority: HBE training and logic model. The Toolkit framework was used for the development of the City of Kelowna's Healthy City Strategy.
- Northern Health Authority: Land Use Planning Guide and Official Community Plan (OCP) Checklist
- Vancouver Coastal Health Authority: HBE program plan and orientation materials. The Toolkit framework was used in a series of public consultations for the City of North Vancouver's OCP.
- Vancouver Island Health Authority: Land Use Planning Guide, Official Community Plan (OCP) checklist.

"The Toolkit adds credibility to local community initiatives and requests for resources. We can easily reference best practice research in order to prioritize next steps and bring strategy to action" next steps to bring strategy to action".

Danielle Noble-Brandt, Policy and Planning Manager, City of Kelowna

To provide health input on community plans, projects or strategies

All regional health authorities use the Toolkit as a reference resource when providing input into planning processes and strategy documents.



To support research & education

Here are two examples from Simon Fraser University and BC Institute of Technology :

- 'Health and the Built Environment' course (HSCI 403) curriculum, offered yearly since 2015 with about 40 students each year.

"I use the toolkit as the framework for this semester-long course. The students really connect with this - the toolkit structures their thinking about the ways in which urban form impacts health. The evidence diagrams in particular are helpful for students to delve into pathways, and better understand the strength of the evidence".

Dr. Meghan Winters, Associate Professor, Faculty of Health Sciences, Simon Fraser University

- Environmental Health (Public Health Inspection) course curriculum

"I use the Linkages Toolkit all the time to tie in upstream principles and health research particularly when we discuss rural areas where water/sewer standards and access to services are a concern".

Kevin Freer, Environmental Health Officer, Fraser Health Authority and guest lecturer for BCIT

A note about inter-connections

Designing healthier built environments requires consideration of multiple characteristics such as street connectivity, welcoming environments, inclusion of mixed-use development including retail, and unintended factors such as noise. Various components need to be taken into consideration in order to create a fulsome land use plan, and none of these issues can be considered in isolation.²

When using this Toolkit in practice, keep in mind that features and their principles are mutually reinforcing. Positive impacts and desired health outcomes can often be triggered through more than one feature or aspect of the built environment, which is useful when considering planning options for local contexts and priorities. For example, health impacts related to decreased noise exposure can be fostered through transportation and/or housing related interventions. Similarly, the health benefits of improved air quality can be facilitated through planning options in all five features.

To help illustrate this inter-connectivity, we have inserted icons in the Fact Sheets to indicate when research evidence is available to show that an impact or outcome can also be facilitated via another feature.

See Appendix B for a list of impacts and population health outcomes which appear frequently in the research and relate to several or all features. By highlighting these, we aim to show that desired impacts and health outcomes can be promoted through various entry points.

² Laura Chow. Fitting Health into the Transportation World. 2018. Simon Fraser University Continuing Studies.



Introduction:

Collecting the Health Evidence

In 2014, an initial scoping review was conducted which informed the identification of five “physical features” of a healthy built environment and principles for good planning and design. This initial review and articulation of five physical features, now re-named as “features”, led to the development of the Linkages Toolkit.

The content of this Toolkit is drawn from extensive literature reviews from multiple sources and study designs, combined with input from content experts. Findings are examined and graded according to an assessment of combined weight, i.e. “strong”, “moderate” or “new research area”. See Appendix D for details on the grading criteria.

Research on healthy built environments is rapidly evolving and this document does not represent its entirety. In recent literature reviews, and consistent with results for the original Linkages Toolkit, we found that research is predominantly urban-centric. Factors related to equity are most often unaccounted for, such as socio-economics related to populations most likely to access active transportation. Evidence on critical thresholds or targets (minimum levels required to trigger health benefits, e.g. the size of green space necessary to improve measures of mental health) is also lacking.

Even with these limitations, the Toolkit is a good representation of the most important elements and principles of a healthy built environment.

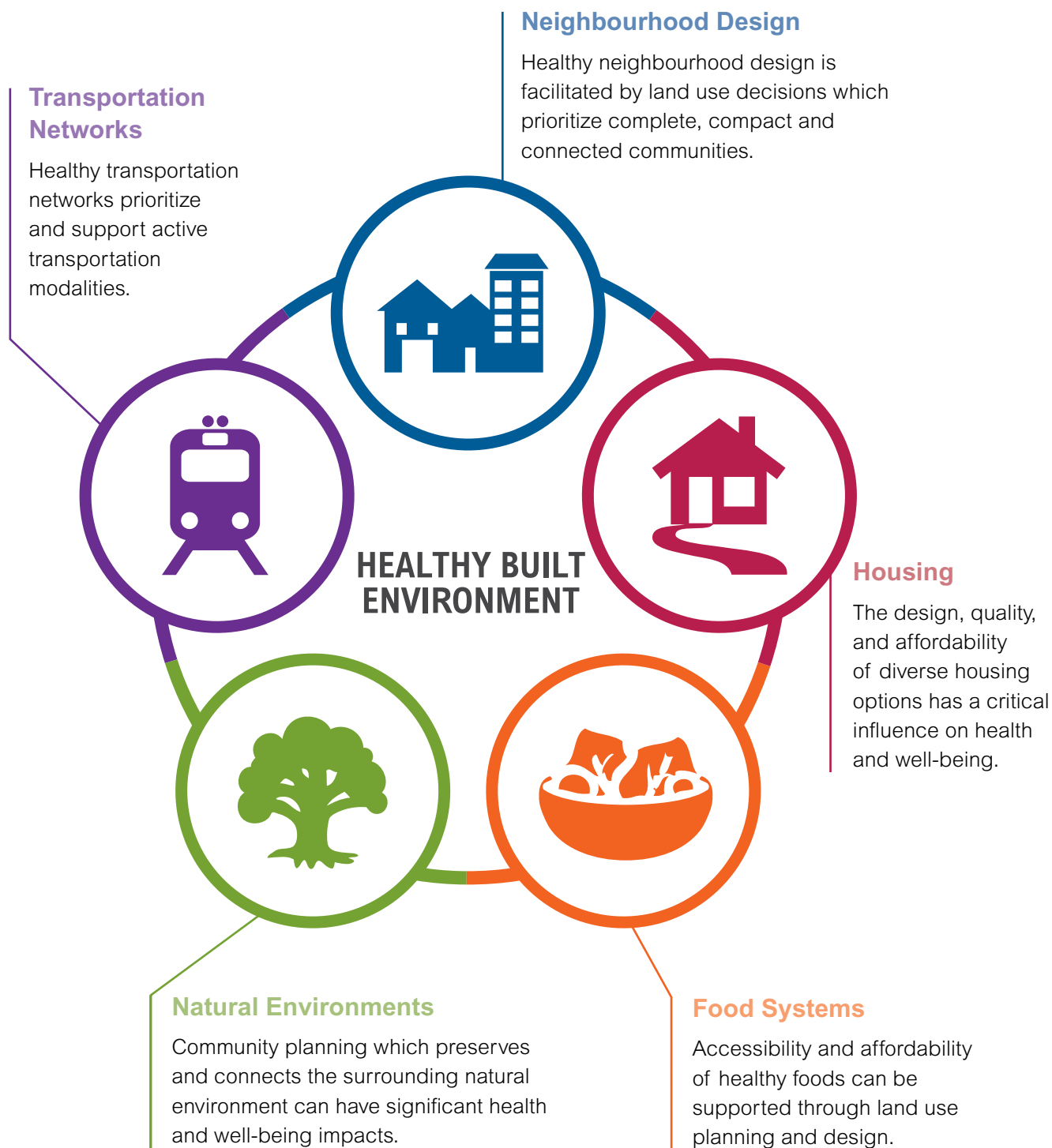
Source Citations

Citations for sources which informed the Fact Sheets and Health Evidence Diagrams are available through the online HBE Evidence Diagrams tool. To see the Healthy Built Environment Evidence Diagrams tool, go to www.bccdc.ca and use the search function. When a source is not provided online, content was either derived from expert opinion or the original citation was not recorded.

References for the Considerations of Practice are cited in Appendix E.



A Framework for Healthy Built Environment



A Framework for Healthy Built Environment

		SOCIAL WELL-BEING	ECONOMIC CO-BENEFITS	SMALL & MEDIUM SIZED COMMUNITIES
Neighbourhood Design		1. Create complete neighbourhoods through mixed land use	2. Build compact neighbourhoods through efficient planning	3. Enhance connectivity with efficient and safe networks
		4. Prioritize new developments within or beside existing communities		
Transportation Networks		1. Use street designs which prioritize active transportation	2. Make active transportation networks safe and accessible for all ages and abilities	3. Design connected routes for active transportation and support multiple modalities
		4. Consider the aesthetics of road, rail and waterway networks		
Natural Environments		1. Preserve and connect environmentally sensitive areas	2. Maximize opportunities for everyone to access natural environments	3. Reduce urban air pollution by expanding natural elements across the landscape
		4. Mitigate urban heat islands by expanding natural elements across the landscape		
Food Systems		1. Increase equitable access to and affordability of healthy food options	2. Protect agricultural land and increase the capacity of local food systems	3. Support community-based food programs
Housing		1. Prioritize affordable housing options through diverse housing forms and tenure types	2. Ensure adequate housing quality for everyone	3. Provide specialized housing options to support the needs of marginalized populations
		4. Site and zone housing developments to minimize exposure to environmental hazards		



Neighbourhood Design Fact Sheet



This is one of five fact sheets included in the Healthy Built Environment Linkages Toolkit. Fact sheets describe planning principles which are associated through research to positive health impacts. The following icons indicate that additional support for a planning solution is available within another fact sheet or practice consideration.



Neighbourhood
Design



Transportation
Networks



Natural
Environments



Food
Systems



Housing



Social
Well-Being



Economic
Co-Benefits



Small and
Medium-sized
Communities

Healthy neighbourhood design is facilitated by land use decisions which prioritize complete, compact and connected communities.

Compact and complete communities are more likely to support walking, cycling and the use of public transit over reliance on cars. Consider how the presence or absence of sidewalks, safe well-lit crosswalks, dedicated or channelized traffic movements, vehicle speeds, land use patterns, building accessibility, and your overall feelings of safety may influence your decisions about how to live and travel in your community. These factors can either promote or discourage our capacity for leisure activities, our nutritious eating habits, and our physical activity levels, all of which have a significant impact on our overall health.

Walkability is a particularly important concept in sustainable urban design, emphasized in research related to helping older adults maintain higher levels of physical activity and overall mobility. Walkable neighbourhoods are characterized by higher residential density, increased mixed land use, and a prominent degree of connectivity for people who walk or cycle. The term “walkability” is intended to include diverse abilities and needs, e.g. children, seniors, and people with cognitive or physical disabilities or activity limitations.

How walkable a neighbourhood is has significant environmental and economic benefits. For example, walkable land-use patterns are associated with economic productivity of a region or neighbourhood.

What is healthy neighbourhood design?

Healthy neighbourhood design is reflected in diverse neighbourhoods where all people can live, work, play, connect and access amenities.



Neighbourhood Design Fact Sheet



The following principles are associated with healthier neighbourhood design, and should be applied with consideration of the unique social, economic and environmental factors of each community.

PLANNING PRINCIPLES for HEALTHY NEIGHBOURHOOD DESIGN

1. Create complete neighbourhoods through mixed land use

Mixed use developments and complete neighbourhoods can have a great impact on health and well-being. Complete neighbourhoods are more convenient, socially engaging, generally consume less energy, and encourage regular physical activity and the use of active transportation.

The City of Regina defines complete communities as “places where residents enjoy their choices of lifestyles, food, housing options, employment, services, retail and amenities, multi-modal transportation, and educational and recreational facilities and programs. Most importantly, complete neighbourhoods provide easy access to the daily life necessities for people of all ages, abilities and backgrounds in an engaging and adaptable urban environment”.³

More research on potential impacts of mixed land use in non-urban areas and on marginalized populations is needed, such as low-income populations and people with mental health issues or disabilities.

What are some evidence-based planning solutions?

- Increase the mix of land uses including residential and commercial, as well as the proximity of amenities to housing options in all neighbourhoods.
- Ensure that residents have access to recreation facilities to meet their physical activity needs, particularly in less dense suburban areas where residents are more likely to rely on recreation for physical activity (versus getting exercise through walking and cycling trips to meet daily needs).

Related info can be found in other sections of this document:



³ <http://designregina.ca/wp-content/uploads/DesignRegina-AppendixA-CompleteNeighbourhoods.pdf>



Neighbourhood Design Fact Sheet



2. Build compact neighbourhoods through efficient planning

Moving towards compact neighbourhoods does not just mean increasing density. It means good planning and design to achieve an urban form which is more compact overall.

Governments of sprawling cities can take many actions to seek a more compact form. For example, the city of Cairo is responding by reducing urban densities in core areas where poverty and other inequities are concentrated. Limiting outward urban expansion can be combined with more efficient use of land resources and more effective protection of natural resources. To this end, city growth can be physically limited through legislated urban growth boundaries, non-urban green belts and the quarantining of development in certain areas.⁴

Distance is a common barrier to participating in active transportation. In compact neighbourhoods with high residential and employment density, healthy daily activities such as walking, cycling and other types of physical activity are naturally promoted through the built environment, e.g., active school transportation for school-aged youth. Residential density is associated with increased use of recreational facilities.

Higher densities tend to result in more people on the streets and increased use of a greater variety of transportation modes, which slows traffic.

Under certain circumstances, compact growth has been associated with unintended consequences such as increased personal exposure to air pollutants and noise. Other commonly expressed concerns relate to the effects of lighting and social isolation.⁵ It is important that density be well-designed, and more research is needed to better understand the nuanced relationship between compact neighbourhoods and water and air quality, reduction of the heat island effect, and other possible impacts.

What are some evidence-based planning solutions?

- Design compact design to increase proximity to work, school, recreation, shopping and other errands.
- Use densification to enhance the viability of fast and frequent transit service, district energy systems and neighbourhood-serving retail destinations.
- Ensure that increases in density correspond with increases in park space and other amenities such as schools, community facilities and secure bike storage.

⁴ http://www.academia.edu/7207756/Managing_Metropolises_by_Negotiating_Mega-Urban_Growth_2013_

⁵ See the Considerations for Practice: Social Well-Being section for information on mitigation strategies related to social isolation.



Neighbourhood Design Fact Sheet



- Mitigate potential air pollution exposure by lowering vehicle speed limits and locating residential intensification at a safe distance from vehicle exhaust and noise, while maintaining short walking distances between homes and shops and transit. (See the definition of “setbacks” in Appendix A.)

Related info can be found in other sections of this document:



3. Enhance connectivity with efficient and safe networks

Creating a compact street grid makes a neighbourhood safer for drivers, pedestrians and cyclists. Enhanced connectivity encourages people to walk or cycle for recreational and transportation purposes and increases total physical activity levels.

What are some evidence-based planning solutions?

- Prioritize compact street grids, street connectivity, and intersection density to provide more direct routes and reduced travel time for people who walk and cycle.
- Prioritize grid-based neighbourhoods, rather than cul-de-sacs, to help increase walking and cycling, and reduce vehicle use.
- Make trails and pathways readily accessible within residential areas, and connect them to common areas of work, play and learning.
- Create quiet residential bikeways and off-street bike paths, and use signage to clearly designate walking and cycling paths, and connections to common destinations.

Related info can be found in other sections of this document:



Neighbourhood Design Fact Sheet



4. Prioritize new developments within or beside existing communities

Sprawl, also known as “urban sprawl”, is a development pattern characterized by the following features:⁶

- low-density development with new growth appearing primarily on previously undeveloped or agricultural land
- outward development at the city edge, in contrast to a process of densification within the city’s existing boundaries
- emphasis on separation of major land uses (residential, commercial, industrial) and on single-use development (in contrast to mixed-use development)
- disconnected residential development where new subdivisions are not contiguous with each other or with the rest of the city

The negative environmental effect of urban sprawl includes conversion of natural spaces to urban environments, water run-off pollution, higher energy consumption and vehicle use. Because basic infrastructure costs remain constant but a smaller population base is served, low density is costlier in terms of development. Service provision such as childcare, food stores, community centres and schools are often impacted as there often isn’t the critical population to make them viable. This is a particular concern when considering the implications related to lack of reliable and frequent public transportation services (Rowan Arundel, 2008).⁷

From a social well-being standpoint, urban sprawl type development has been associated with a variety of problems, such as loss of a sense of place or community, isolating lifestyles, the stress of long commutes, reliance on the automobile, and neighbourhoods segregated by ethnicity and economic class.

Communities can avoid sprawl and reduce driving time by using infill development and brownfield reclamation close to transit infrastructure, employment and other amenities. Infill development is the process of developing vacant or under-used lots within existing urban areas that are already largely developed. Most urban communities have significant vacant land within city limits, which, for various reasons, has been passed over in the normal course of urbanization. Brownfield is defined as an industrial or commercial site that is idle or underused because of real or perceived environmental pollution. Cleanup may be necessary as brownfield development is sometimes associated with exposure to toxins.

⁶ [https://www.ucalgary.ca/oikos/files/oikos/AHS%20-%20Urban%20Sprawl%20InfoSheet%20HPP%20\(Web\).pdf](https://www.ucalgary.ca/oikos/files/oikos/AHS%20-%20Urban%20Sprawl%20InfoSheet%20HPP%20(Web).pdf)

⁷ Vancouver Density: investigating current patterns and potential future densification areas. <http://ibis.geog.ubc.ca/courses/geob479/classof08/vandensity/introduction.html>



Neighbourhood Design Fact Sheet



What are some evidence-based planning solutions?

- Encourage densification and prevent the negative effects of sprawl through developing vacant or underutilized land in a neighbourhood.
- Develop infill and reclaim brownfields close to transit infrastructure, employment and other amenities.

Related info can be found in other sections of this document:



Neighbourhood Design Summary of Research Links



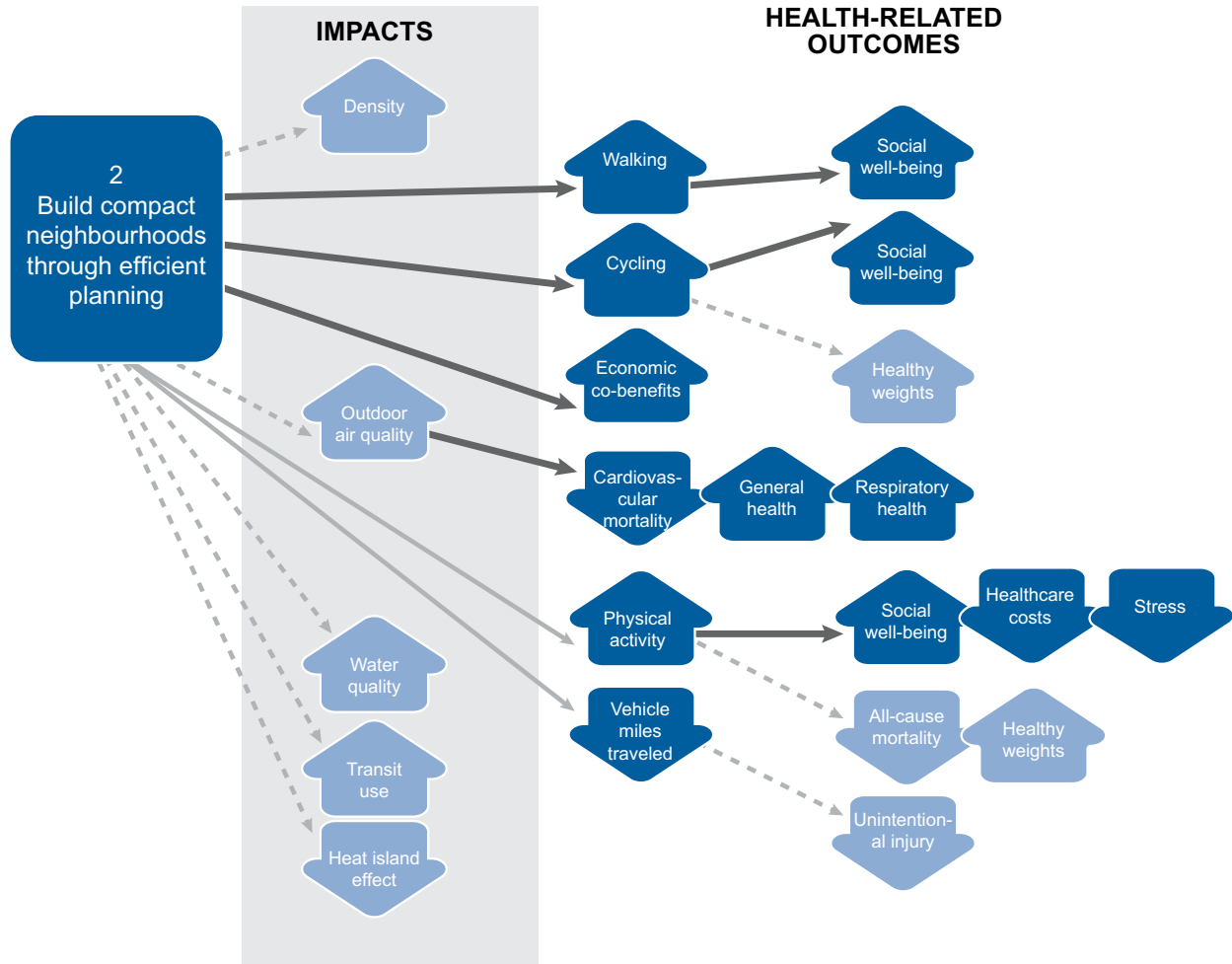
Research has demonstrated that healthy Neighbourhood Design has various positive impacts on the built environment and population health. The summary below shows the strongest research correlations found in evidence reviews related to the four planning principles of Neighbourhood Design:



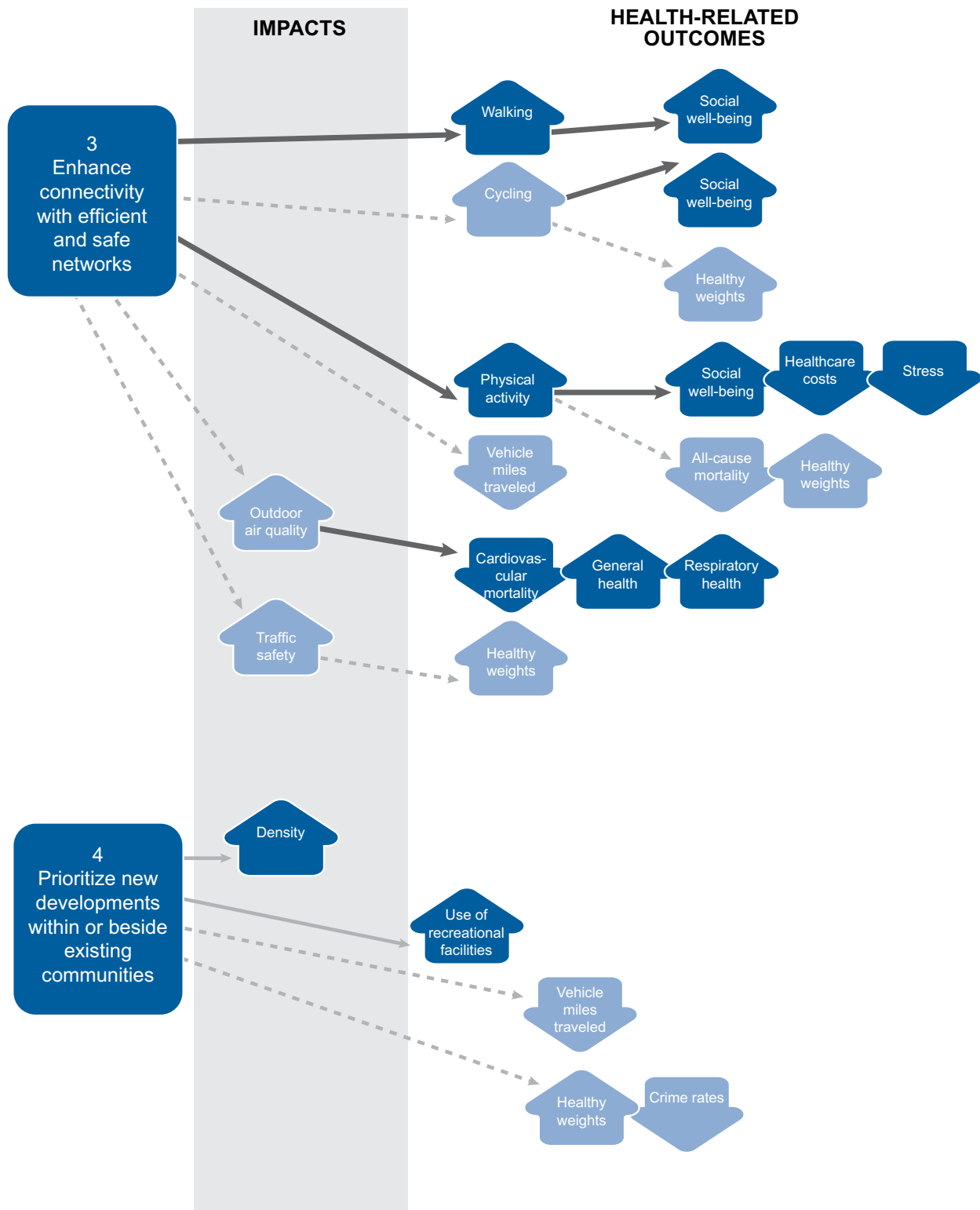
STRENGTH OF EVIDENCE: Strong/Moderate New research area DIRECTION OF EFFECT: ↑ ↑ Increase ↓ ↓ Decrease



Neighbourhood Design Evidence Diagram



Neighbourhood Design Evidence Diagram



Transportation Networks Fact Sheet



This is one of five fact sheets included in the Healthy Built Environment Linkages Toolkit. Fact sheets describe planning principles which are associated through research to positive health impacts. The following icons indicate that additional support for a planning solution is available within another fact sheet or practice consideration.



Neighbourhood
Design



Transportation
Networks



Natural
Environments



Food
Systems



Housing



Social
Well-Being



Economic
Co-Benefits



Small and
Medium-sized
Communities

Healthy transportation networks prioritize and support active transportation modalities.

The convenience of public transit, the safety of cycling paths, and the distance and time it takes to walk to common destinations all play a role in our daily choices about how to get to where we need to go.

When transportation networks are designed to prioritize active transportation,⁸ mobility for all residents is encouraged which leads to improved health outcomes, better physical and mental well-being, and greater opportunities for social connectedness. Since active transportation is more affordable than car ownership, communities also experience improved equity and access to services such as healthcare, education, and employment opportunities.

Moving away from cars and toward active transportation also lends itself to positive benefits for the environment, greenhouse gas reductions and reduced levels of harmful carbon monoxide, hydrocarbons, oxides of nitrogen and particulate matter. For public transit specifically, the relationship between use of public transit and effects of air pollution is an emerging area of study. While the use of transit helps lower overall ambient air pollution levels, it may be associated with higher personal exposure to air pollution.

What is a healthy transportation network?

A healthy transportation network is safe, affordable, accessible to all levels of mobility, and prioritizes active transportation options like walking, cycling and public transit.

⁸ Active transportation includes walking, cycling and the use of public transportation



Transportation Networks Fact Sheet



The following principles are associated with planning and design for healthier transportation networks, and should be applied with consideration of the unique social, economic and environmental factors of each community.

PLANNING PRINCIPLES for HEALTHY TRANSPORTATION NETWORKS

1. Use street designs which prioritize active transportation

Car reliance can be tempered by providing accessible, affordable and safe active transportation options. Encourage the decision to cycle, walk or use transit through planning that is fundamentally oriented around multi-modal transportation.

Providing easy access to trails and paths encourages walking and cycling, especially when pathways are visually pleasing, located within residential areas and connected to common destinations. Street safety and usability is increased through aesthetic features such as well-lit crosswalks and places to sit, and is associated with improved physical activity and social interaction among neighbours.

What are some evidence-based planning solutions?

- Make walking, cycling and public transport more attractive than car driving through market measures like :
 - Increasing the availability and quality of public transit
 - Developing dedicated rail lines, bus lanes, and bus queue jump lanes
 - Prioritizing infrastructure that supports multi-modal trips
 - Considering road pricing, high priced parking, and gas taxes
 - Designing closed off roads
 - Road diets and volume diversion
 - Disruptive (non-grid) street design for cars
 - Non disruptive (continuous and connected) pathways for pedestrians and cyclists
 - The “twenty minute” neighborhood



Transportation Networks Fact Sheet



- Clearly differentiate bike and pedestrian pathways in order to reduce the rate of injury and collision. Bike paths have one-ninth the risk of injury to cyclists compared to major streets with parked cars and no bike infrastructure .
- Use traffic calming methods such as narrower traffic lanes and residential traffic diversion to reduce traffic speeds and volume.
- Decrease traffic collisions and injuries among all road users by using street safety features such as red-light cameras, reduced vehicle speeds, and automated speed enforcement.

Related info can be found in other sections of this document:



2. Make active transportation networks safe and accessible for all ages and abilities

Decreasing our reliance on private vehicles for transportation makes it safer for everyone. People are more likely to choose active transportation when they perceive it as convenient, safe, and accommodating to the needs of all users. For example, traffic calming features such as narrow lanes and street trees are associated with an increase in walking and perceptions of safety.

Equity must also be considered, as low-income residents and ethnic minorities are more likely to rely on public transit as their main form of transportation. People without access to a car and non-drivers are also more likely to walk and cycle. Supporting children, students, older adults, women, and people with disabilities to access public transit enables them to connect with health and social services and recreation, and be more involved in community life.

What are some evidence-based planning solutions?

- Consider the diversity of populations who are most likely to benefit from access to active transportation infrastructures and their specific needs, including language, affordability, connection to health services and schools.
- Use appropriate signage to clearly designate walking and cycling paths, and connections to common destinations.
- Create quiet bikeways and off-street bike paths/trails that are readily accessible to residential areas and connected to common areas of work, play and learning.



Transportation Networks Fact Sheet



- Make active transportation and outdoor physical activity options safer by separating vulnerable road users (e.g. people who walk and cycle) from vehicle traffic through space or time by implementing appropriate measures such as the following:

Spatial/physical separation

- Spatially separate sidewalks and bicycle lanes, e.g. protect sidewalks and cycle paths with some kind of barrier, build underpasses or overpasses for pedestrians and cyclists
- Incorporate pedestrian medians and sidewalk bulges
- Clearly delineate pedestrian and cyclist zones at intersections
- Provide jug-handle left for cyclists
- Divert bicycle lanes around bus stop zones (“floating bus stops”)

Separation through time

- Leading Pedestrian Intervals (LPIs)
- Pedestrian scrambles (exclusive WALK phase for pedestrians in all directions)
- Dedicated signal phases for cyclists
- Prohibition on right-turn-on-red for vehicles
- Elimination of permissive left turn for vehicles, and elimination of concurrent traffic movements

Related info can be found in other sections of this document:



3. Design connected routes for active transportation and support multiple modalities

Active transportation users will often use multiple modalities in one trip (such as walking or cycling to and from transit stops). Supporting these different modalities can increase active transportation. For example, providing sheltered bike racks at bus stations has been shown to increase public transit use.

What are some evidence-based planning solutions?

- Provide bike shelters and racks at bus stations.



Transportation Networks Fact Sheet



- Make public transit service and waiting areas convenient, safe and accessible for all levels of physical mobility.
- Maintain safe cycling and pedestrian access to transit stops.

Related info can be found in other sections of this document:



4. Consider the aesthetics of road, rail and waterway networks

Aesthetics are important factor in how we feel about our neighbourhoods, and how we choose to travel within them. Enhancing the aesthetic experience of cycling and walking encourages active transportation. Evidence suggests that improving neighbourhood aesthetics, especially in parks, can promote physical activity and impact perceptions of safety. Conversely, signs of street decay such as trash and vandalism are associated with decreased physical activity levels and social connections.

Aesthetic features such as well-lit crosswalks and places to sit increases street safety and usability, and are associated with improved physical activity and social interaction among neighbours.

What are some evidence-based planning solutions?

- Create a safe and welcoming sense of place by maximizing the use of aesthetically pleasing features that reflects the unique character of local communities, e.g. public art, murals, communal seating or by highlighting the natural scenery.
- Maintain public road, rail and waterway networks by minimizing signs of decay such as trash and vandalism.
- Improve aesthetics and functionality of active transportation routes, e.g. ensure they are well-lit and include places to sit along the way.

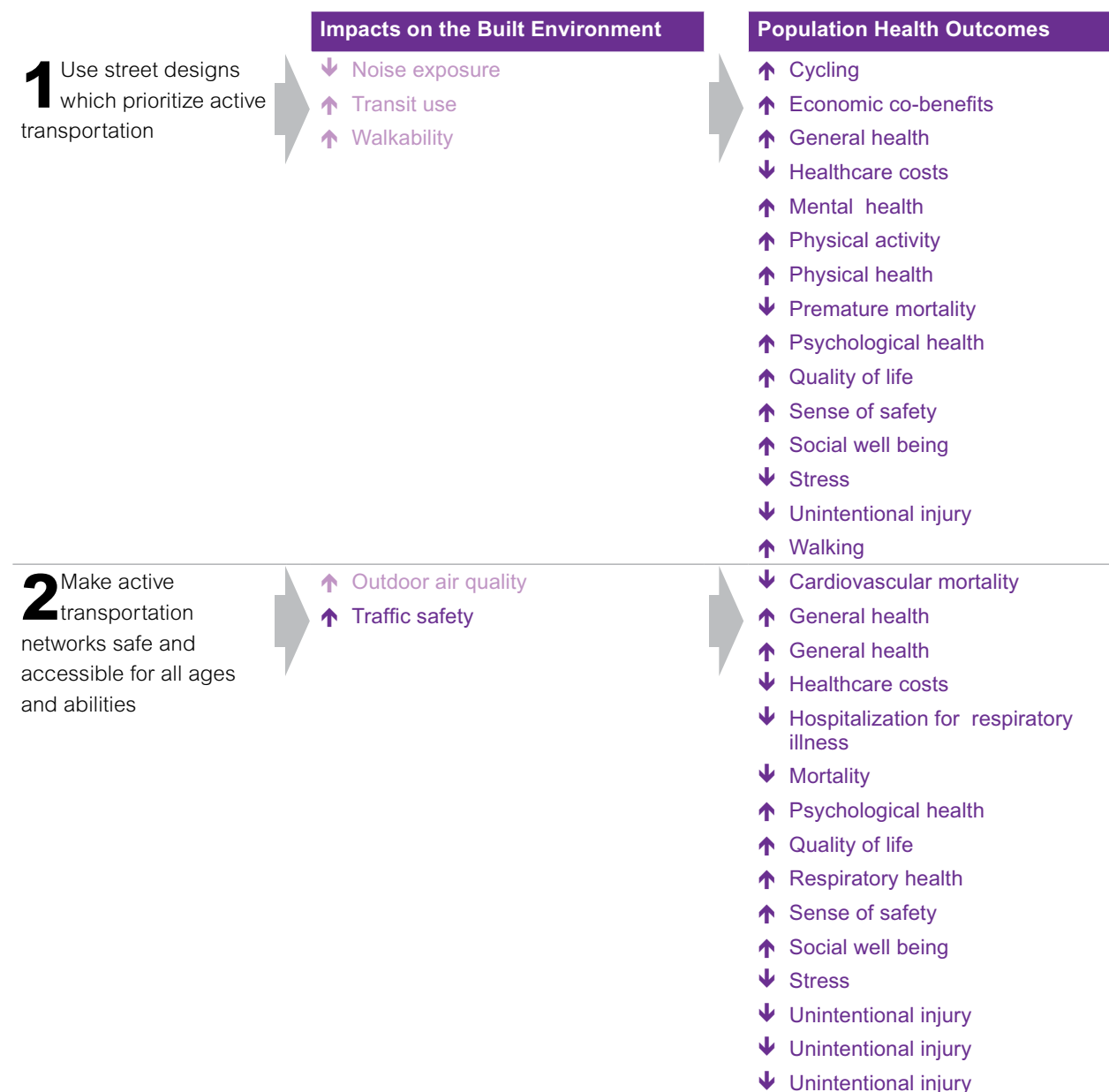
Related info can be found in other sections of this document:



Transportation Networks Summary of Research Links



Research has demonstrated that healthy Transportation Networks have various positive impacts on the built environment and population health. The summary below shows the strongest research correlations found in evidence reviews related to the four planning principles for healthy Transportation Networks:



STRENGTH OF EVIDENCE: Strong/Moderate New research area DIRECTION OF EFFECT: ↑ ↑ Increase ↓ ↓ Decrease



Transportation Networks Summary of Research Links



3 Design connected active transportation routes which support multiple modalities

Impacts on the Built Environment

- ↓ Noise exposure
- ↑ Outdoor air quality
- ↑ Transit use

Population Health Outcomes

- ↓ Cardiovascular mortality
- ↑ General health
- ↓ Healthcare costs
- ↑ Healthy weights
- ↑ Mental health
- ↑ Physical activity
- ↑ Physical health
- ↑ Respiratory health
- ↑ Social well being
- ↓ Stress
- ↑ Walking

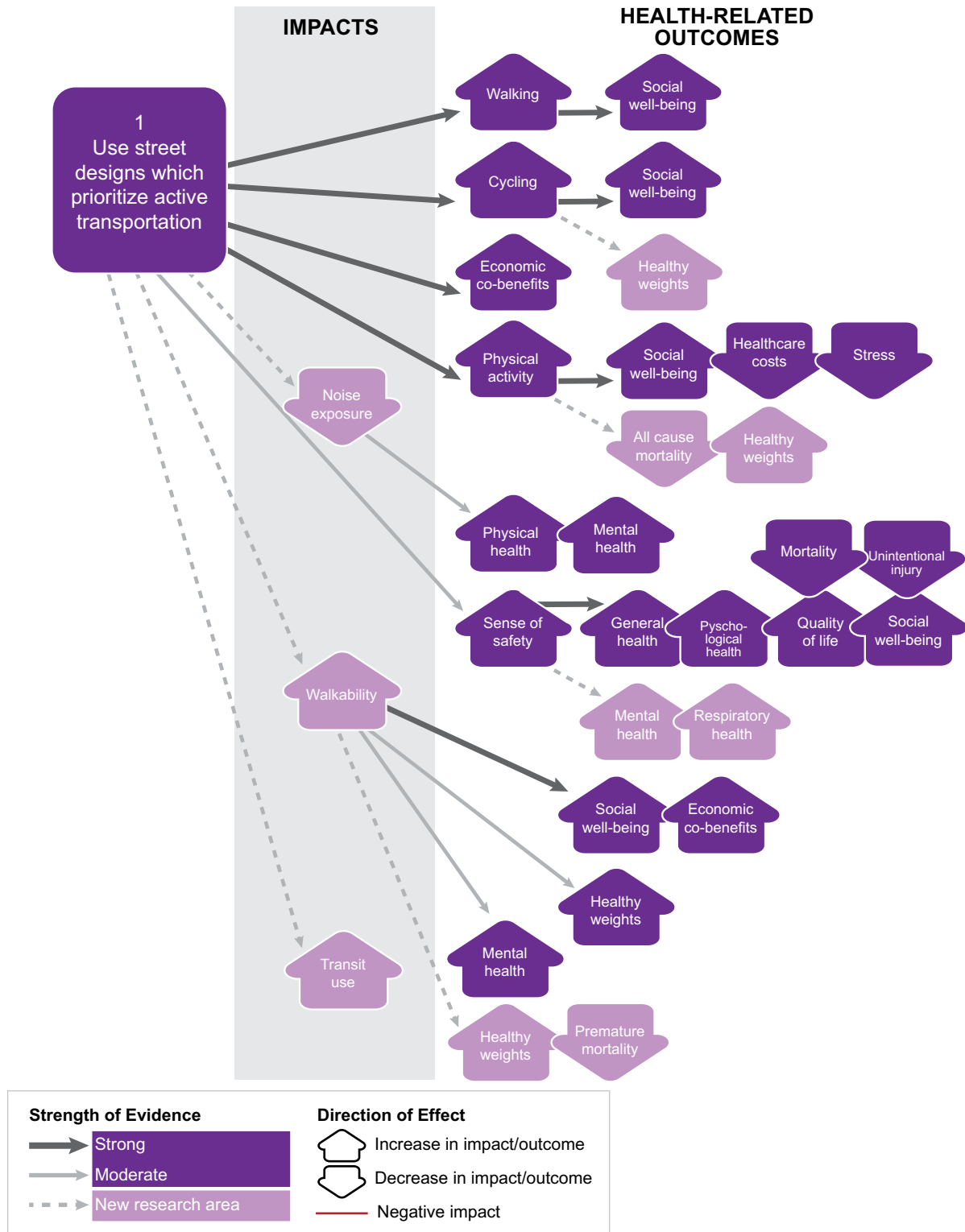
4 Consider the aesthetics of rail and waterway networks

- ↓ Health care costs
- ↑ Physical activity
- ↑ Social well being
- ↓ Stress
- ↑ Walking

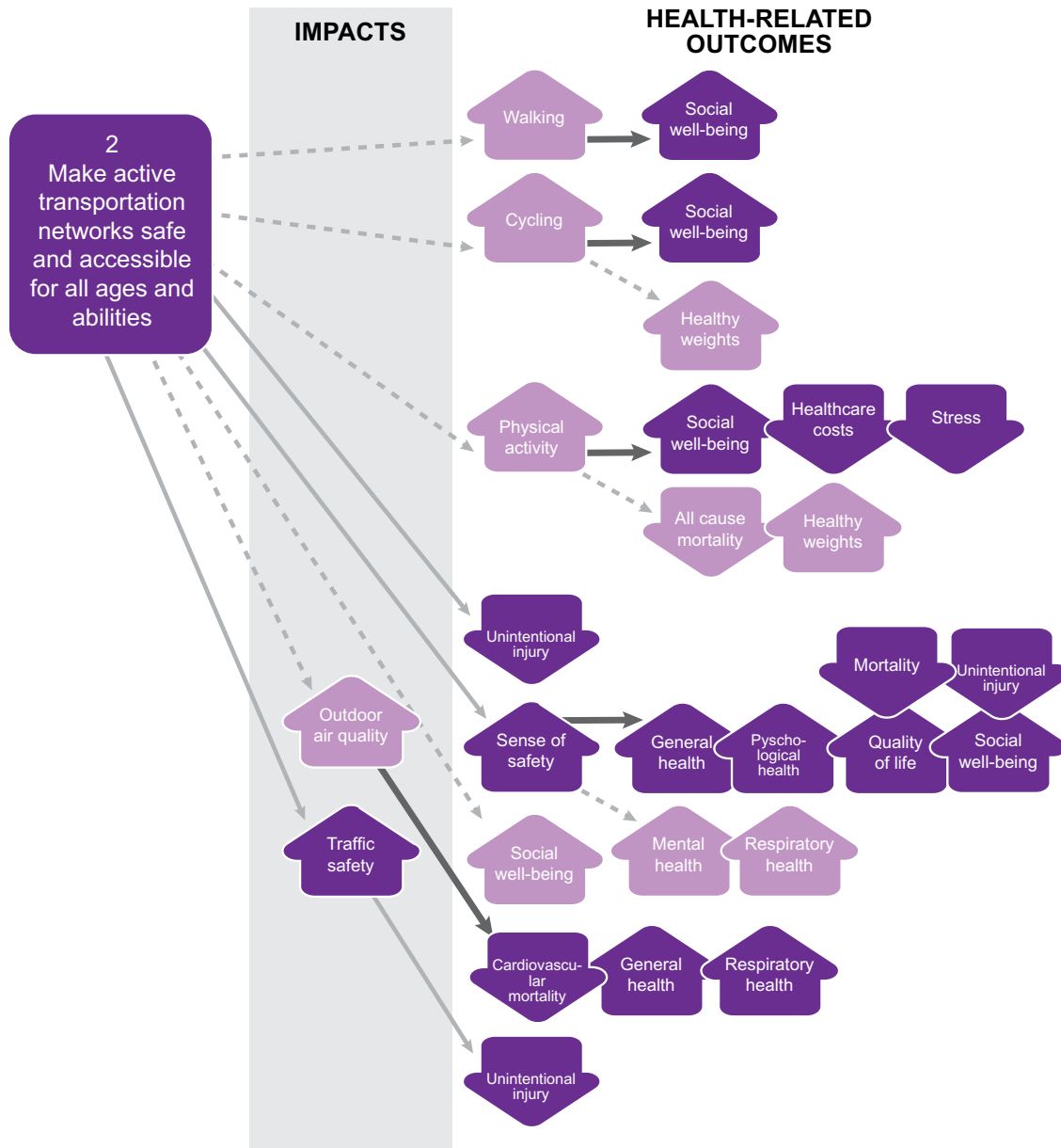
STRENGTH OF EVIDENCE: Strong/Moderate New research area DIRECTION OF EFFECT: ↑ ↑ Increase ↓ ↓ Decrease



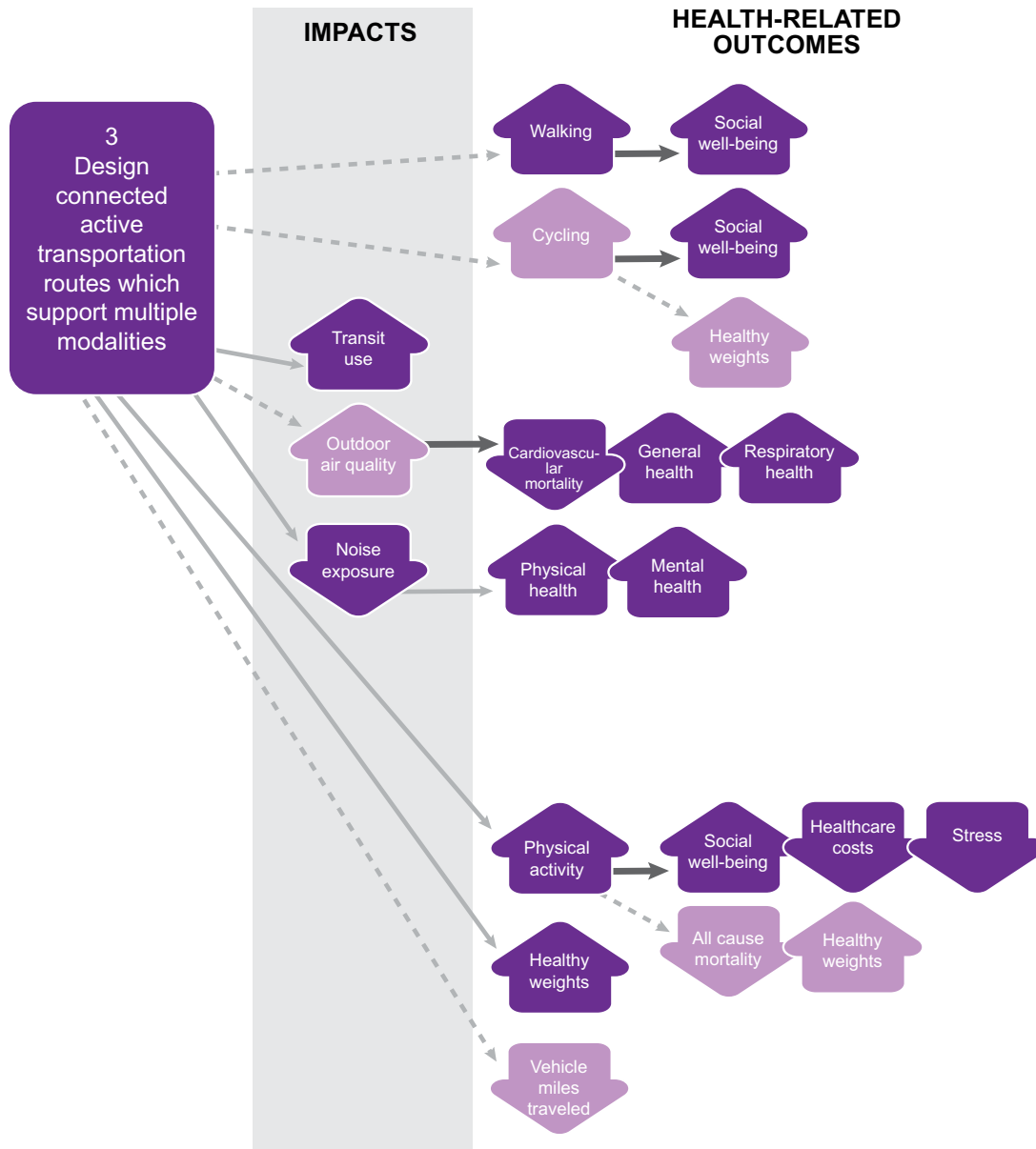
Transportation Networks Evidence Diagram



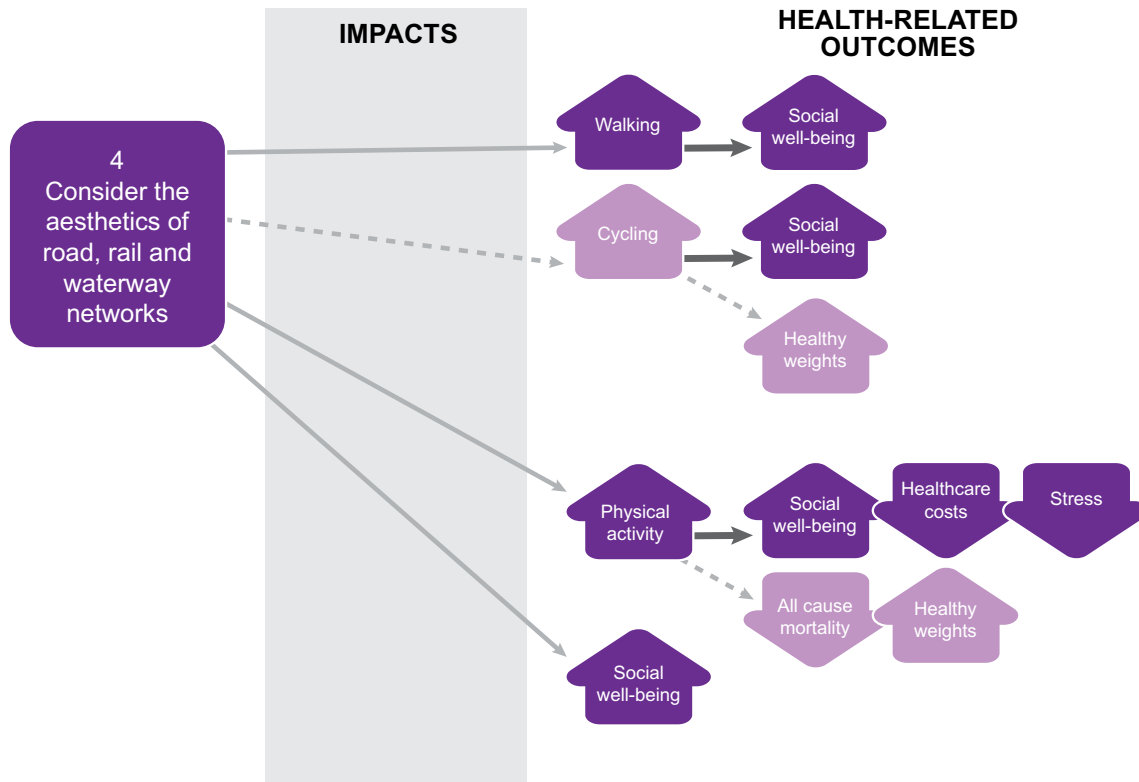
Transportation Networks Evidence Diagram



Transportation Networks Evidence Diagram



Transportation Networks Evidence Diagram



Natural Environments Fact Sheet



This is one of five fact sheets included in the Healthy Built Environment Linkages Toolkit. Fact sheets describe planning principles which are associated through research to positive health impacts. The following icons indicate that additional support for a planning solution is available within another fact sheet or practice consideration.



Neighbourhood
Design



Transportation
Networks



Natural
Environments



Food
Systems



Housing



Social
Well-Being



Economic
Co-Benefits



Small and
Medium-sized
Communities

Community planning which preserves and connects the surrounding natural environment can have significant health and well-being impacts.

Natural environments sustain the essential elements that we need to live. How we integrate our communities and activities with surrounding natural environments is a critical factor in determining our health and well-being.

Land use decisions can mitigate the potential negative health impacts of development by incorporating the benefits of the existing natural environment. Consider, for instance, the capacity of a park to cool and filter the air in a dense neighbourhood, or the ability of a greenway to inspire active transport and access to nature. Such interventions foster more livable surroundings that encourage physical activity, promote better mental health, and bring diverse communities together.

What is a healthy natural environment?

A healthy natural environment is one in which green spaces and natural elements are protected, incorporated into the built surroundings, and accessible to all people including children, low-income residents and people with chronic conditions or disabilities.

The following principles are associated with planning and design for healthier natural environments, and should be applied with consideration of the unique social, economic and environmental factors of each community.



Natural Environments Fact Sheet



PLANNING PRINCIPLES for HEALTHY NATURAL ENVIRONMENTS

1. Preserve and connect environmentally sensitive areas

Natural ecosystem services make all life possible. While the indirect relationship between our ecosystems and human health can be difficult to study through commonly used research methods, its significance should not be overlooked.

There is strong evidence that the experience of being in and viewing nature has significant physical and mental benefits, including increased social well-being and reduced stress. Research also supports a strong relationship between biodiversity and measures of ecosystem functioning, such as water quality, soil health and pollination.

Preserving biodiversity and connecting environmentally sensitive areas also has economic co-benefits. For example, tree canopies are correlated with decreased costs related to air pollution removal and storm management, as well as increased energy savings and property values for home owners.

What are some evidence-based planning solutions?

- Preserve and connect open space and environmentally sensitive areas to protect biodiversity and corresponding measures of ecosystem functioning.
- Incorporate and expand natural elements across the landscape as much as possible.

Related info can be found in other sections of this document:



2. Maximize opportunities for everyone to access and engage with natural environments

Research indicates a strong relationship between exposure to nature and reduced levels of stress, chronic disease, and depression and anxiety, as well as improved concentration and cognitive functioning. Even a brief interaction with nature, such as a ten-minute walk or a view of green space, can have restorative effects. Accessing parks and green space increases social well-being by providing places for residents to make new connections and build relationships with friends and family.



Natural Environments Fact Sheet



Access to natural outdoor spaces makes it more likely that people will be physically active. Children in rural areas are generally more physically active, in part because of their easy access to natural open space. Being in nature, physically active or not, has a powerful effect on physical and mental health.

What are some evidence-based planning solutions?

- Provide easy and safe access to natural trails, parks and other green spaces.
- Ensure that children in urban and suburban areas can easily and safely access green spaces and natural environments.
- Keep parks safe and well-maintained, and include attractive recreational facilities.
- Ensure communal green spaces are designed for the needs of all ages, physical abilities and cultural groups, with features such as adaptive playground equipment, wheelchair-accessible paths, and places for individuals or groups to comfortably sit and talk.

Related info can be found in other sections of this document:



3. Reduce urban air pollution by expanding natural elements across the landscape

Careful community planning and landscape design can limit the production of, and exposure to, air pollution. Current research indicates that vegetation has the potential to clean a significant amount of air pollutants, such as particulate matter and ground level ozone (smog), which can help prevent the onset of cancer, cardiovascular disease and respiratory difficulties.

The degree to which air is cleaned by vegetation depends on the type of plants used, how they are distributed, and the local climate. Planting species appropriate to the site and environmental conditions will maximize the positive effects vegetation can have on air quality.

Urban trees have substantial economic value, from helping to reduce energy use, to removing air pollution and reducing storm water runoff—not to mention the appeal of trees for recreation and tourism. Using natural landscapes like trees to reduce storm water runoff also improves water quality.⁹

⁹ <http://www2.gov.bc.ca/gov/content/environment/climate-change/adaptation/bc-adapts/bc-adapts-rainwater>



Natural Environment Fact Sheet



What are some evidence-based planning solutions?

- Use landscape architecture across the built environment to help clean the air of pollutants; for example, by increasing vegetation in developments, neighbourhoods and transit hubs.
- Plant and place urban trees strategically to reduce energy use, air pollution and storm water runoff, and to add to the aesthetic appeal for recreation and tourism.
- Maximize the benefits of vegetation for air quality by planting species that are appropriate to the site and environment, taking into consideration the overall distribution of greenery and the local climate.

Related info can be found in other sections of this document:



4. Mitigate urban heat islands by expanding natural elements across the landscape

Extreme heat events are strongly linked to illness and death from cardiovascular, respiratory and cerebrovascular causes. Conversely, decreased ambient air temperature is strongly connected to lower levels of heat-related mortality and morbidity.



Natural Environment Fact Sheet



There is increasing urgency to mitigate the negative impacts of extreme heat, as climate change will likely increase the number of hot days in British Columbia. The Pacific Climate Impacts Consortium offers a Plan2Adapt tool that generates maps, plots and data projections of climate conditions for regions throughout the province.¹⁰

Expanding the use of vegetation and natural elements across the built environment mitigates air pollution and the urban heat island effect. In urban centres, the cooling effects of vegetation through parks, urban agriculture and bodies of water, can be significant.

Expanding and protecting green spaces in urban centres can also have important economic co-benefits for local and regional governments and home owners.

What are some evidence-based planning solutions?

- Use the cooling effects of vegetation in parks, urban agriculture and bodies of water to counter extreme heat.
- Increase the number of trees, vegetation and landscape architecture across the built environment including in developments, neighbourhoods and transit hubs.

Related info can be found in other sections of this document:



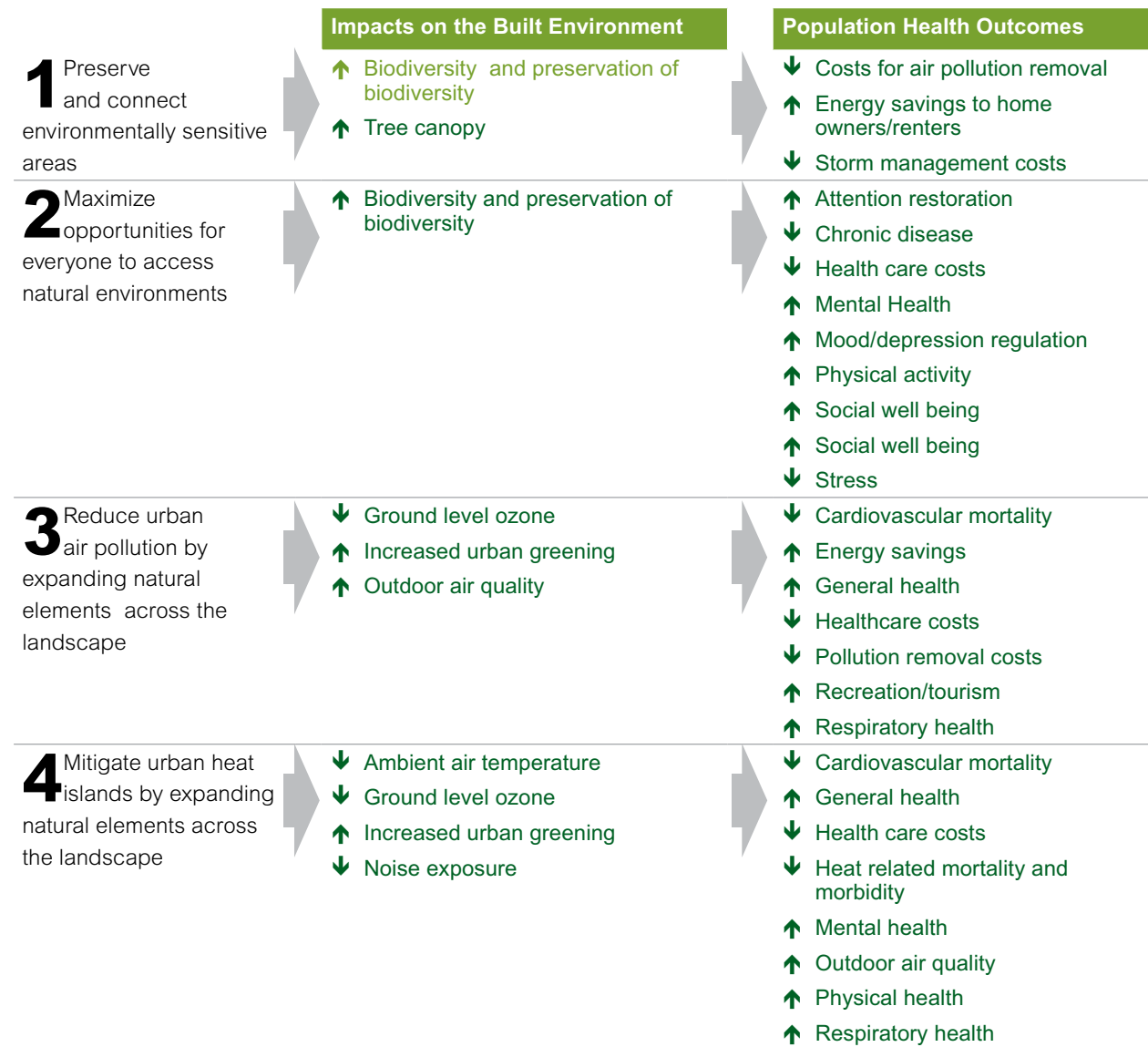
¹⁰ www.pacificclimate.org/analysis-tools/plan2adap



Natural Environment Summary of Research Links



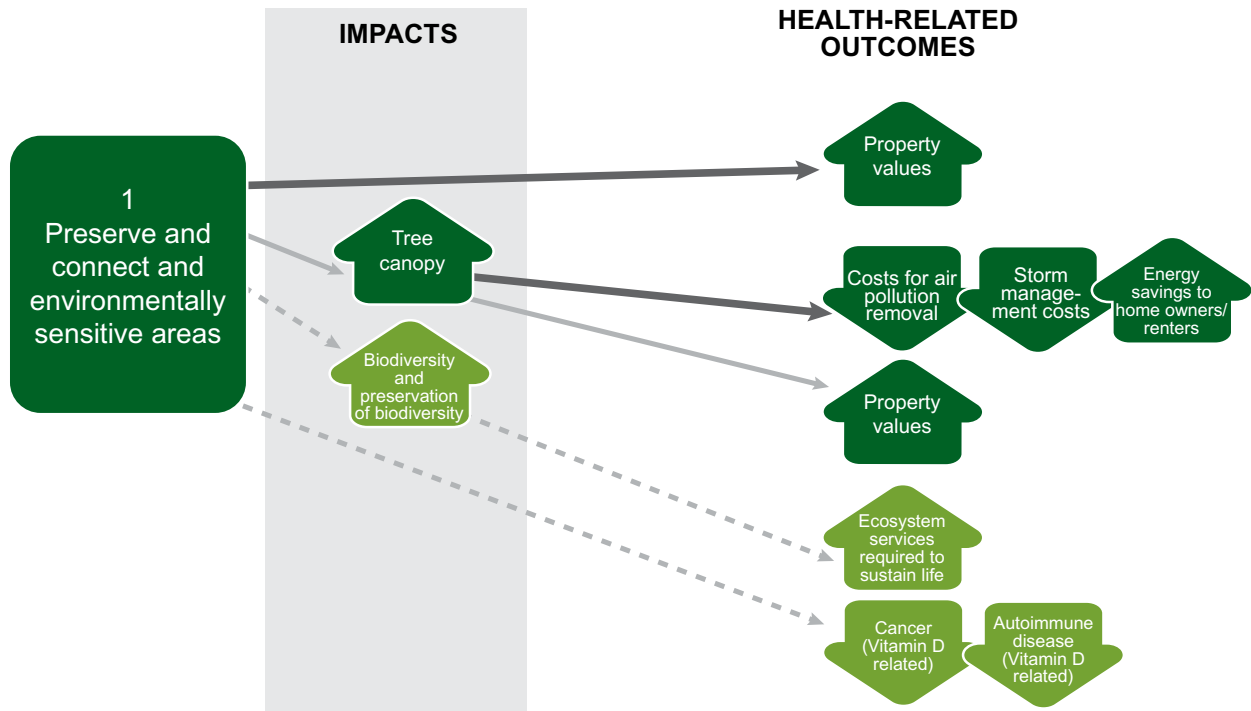
Research has demonstrated that healthy Natural Environment have various positive impacts on the built environment and population health. The summary below shows the strongest research correlations found in evidence reviews related to the four planning principles for healthy Natural Environments:



STRENGTH OF EVIDENCE: Strong/Moderate New research area DIRECTION OF EFFECT: ↑ Increase ↓ Decrease



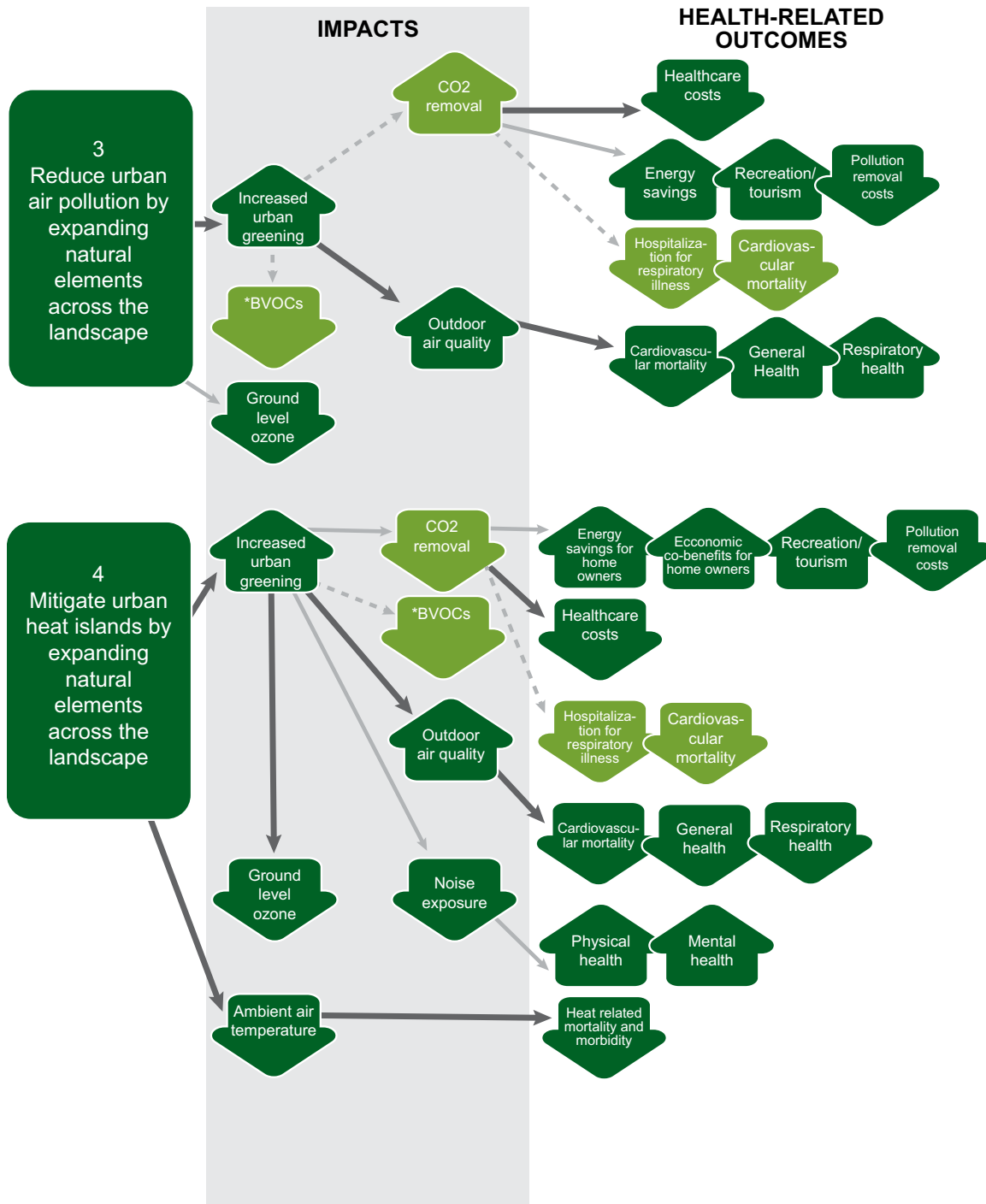
Natural Environments Evidence Diagram



Strength of Evidence	Direction of Effect
Strong	Increase in impact/outcome
Moderate	Decrease in impact/outcome
New research area	Negative impact



Natural Environments Evidence Diagram



* Plants re-emit a substantial fraction of their assimilated carbon into the atmosphere as biogenic volatile organic compounds (BVOCs) that affect the chemical and physical properties of the atmosphere. Penuelas and Llusia (2003).



Food Systems Fact Sheet



This is one of five fact sheets included in the Healthy Built Environment Linkages Toolkit. Fact sheets describe planning principles which are associated through research to positive health impacts. The following icons indicate that additional support for a planning solution is available within another fact sheet or practice consideration.



Neighbourhood
Design



Transportation
Networks



Natural
Environments



Food
Systems



Housing



Social
Well-Being



Economic
Co-Benefits



Small and
Medium-sized
Communities

Accessibility and affordability of healthy foods can be supported through land use planning and design.

Our food choices are shaped by the quality and affordability of our local food system. Not every person or neighbourhood has equal access to healthy food choices due to lack of availability and/or affordability. Agricultural land use decisions and food system infrastructure affect the quality, accessibility and variety of foods available.

This fact sheet contains a range of planning principles which support the move towards healthier food systems, including some which may be beyond the control of local governments. However, local governments can have an impact through official community plans, policy and zoning directives, advocacy to provincial and federal governments, and local grant opportunities.

Healthy eating habits significantly reduce the risk of chronic disease—e.g. high blood pressure, osteoporosis and cancer—which increases quality of life and reduces health care costs. While there are different ideas of what makes a healthy diet, all generally prioritize consumption of whole foods, such as fruits, vegetables and grains. Healthy food systems can also influence positive health outcomes which are unrelated to healthy food choices, e.g. social well-being, feelings of confidence, other healthy living behaviours.

See PHSA's "Agriculture's Connection to Health: Responding to Local Governments" for more information.



Food Systems Fact Sheet



What is a healthy food system?

A healthy food system supports population health by maintaining equitable access to affordable, safe, nutritious, and culturally appropriate foods.

The following principles are associated with planning and design for healthier food systems, and should be applied with consideration of the unique social, economic and environmental factors of each community.

PLANNING PRINCIPLES for HEALTHY FOOD SYSTEMS

1. Increase equitable access to and affordability of healthy food options

Easy access to a variety of fresh produce and whole foods is associated with increased purchase and consumption of healthy foods, which helps to lower obesity rates.

Access depends on availability and affordability of healthy food retail services such as supermarkets. Healthier and more affordable options at food service outlets supports healthier weights and increased consumption of fruits and vegetables. Conversely, an increase in unhealthy food retail services (such as convenience stores that sell mostly processed and packaged foods) is linked to higher levels of unhealthy weights.

Access to traditional food, food lands, and waters is a core part of culture and identity for Indigenous populations, and helps to improve physical activity levels, diet quality and mental health. The availability of culturally appropriate or traditional fresh fruits and vegetables is an important part of healthy eating for immigrant populations.

What are some evidence-based planning solutions?

- Establish population densities that make neighbourhood grocery stores economically viable, enabling residents to live within walking distances of healthy food retail. Work with land economists and market analysts to identify what these local population density thresholds are. For example, a neighbourhood grocery store requires a market population of over 5,000 people.¹¹

¹¹ Walk Score. Walk Score Methodology. July 2011. Retrieved September 2012 from: <https://www.walkscore.com/professional/methodology.php>



Food Systems Fact Sheet



- Provide active transportation options to healthy food retail services, such as making trails and pathways readily accessible within residential areas and connecting them to healthy food retail services.
- Engage in poverty reduction efforts including partnerships with organizations such as the Union of BC Municipalities.

Related info can be found in other sections of this document:



2. Protect agricultural land and increase the capacity of local food systems

Supporting the capacity of local farms and local food system infrastructure from food packing and processing to storage and distribution contributes to a food supply that is resilient to outside stressors. The presence of local farmers' markets encourages people to eat more fruits and vegetables. Local growing and selling of culturally appropriate foods, such as ethno-cultural vegetables, contributes to healthy diets among immigrant populations.

Local governments can contribute to the stability of food systems by enacting bylaws that protect agricultural land reserves. Farmland preservation helps to maintain a level of food production that contributes to food self-sufficiency, and food self-sufficiency supports healthy eating.



Food Systems Fact Sheet



What are some evidence-based planning solutions?

- Increase the mix of land use and connectivity to food retail services that provide culturally appropriate foods, especially produce.
- Enable local farmers' markets to build permanent or temporary market infrastructure through zoning allowances and/or bylaws.
- Provide space and capacity supports for residents to grow food in urban/semi-urban settings.
- Protect existing agricultural land in and near urban/semi-urban settings; for example, by placing zoning restrictions on the size of housing located on agricultural land.
- Enact zoning bylaws which incentivise appropriate use of agricultural land and de-incentivise non-agricultural uses.

Related info can be found in other sections of this document:



Food Systems Fact Sheet



3. Support community-based food programs

While planning principles 1 and 2 address health outcomes related to access and affordability of the local food supply, this planning principle relates to a broader view of population health. Supporting local food programs has been shown to encourage important health outcomes that are meaningful but unrelated to decreasing food insecurity.

Participation in community-based food programs such as community kitchens has a number of health benefits, including increase enjoyment of food; overall confidence; positive interactions with social services; healthy living behaviours; social and coping skills; and budgeting, shopping and cooking skills.

Community and school gardens provide meaningful opportunities for people to connect and build a sense of community, and can also increase consumption of fruits and vegetables. School gardens encourage healthier food preferences among young people and are associated with an increase in food literacy.

What are some evidence-based planning solutions?

- Design civic facilities to support local food programs; for example, by including kitchen space and ovens.
- Provide shared cooking, eating and storage space for community programs in mixed income housing developments.
- Support community and school gardens by incorporating garden space into landscape design and parks planning, including water sources, tool storage sheds and accessible gardens (with raised beds).
- Collaborate with educators to ensure maximum use and benefit of school gardens.
- Offer community grants to support local food programs and services, or allow the addition of food supports as a secondary asset within existing grant opportunities.

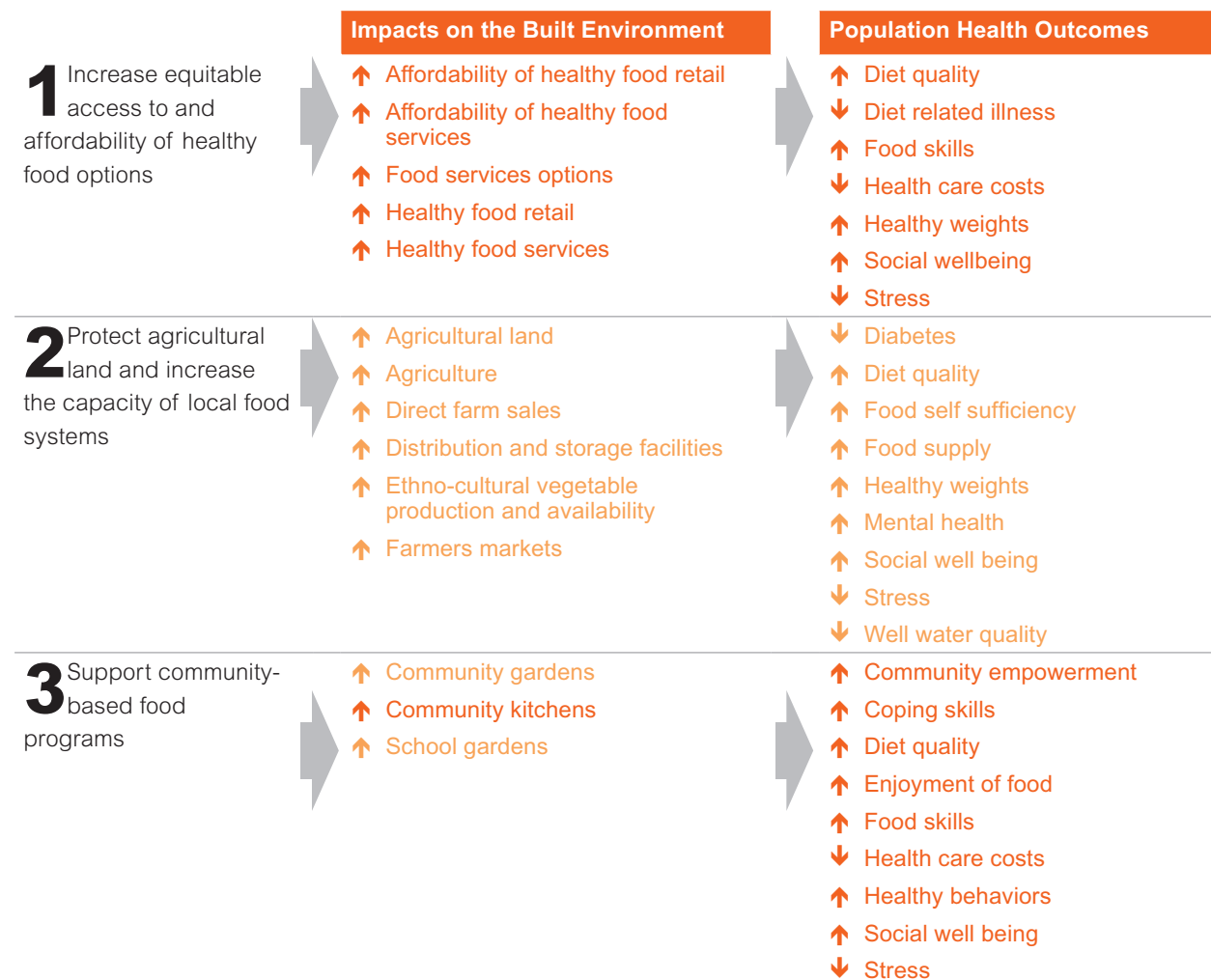
Related info can be found in other sections of this document:



Food Systems Summary of Research Links



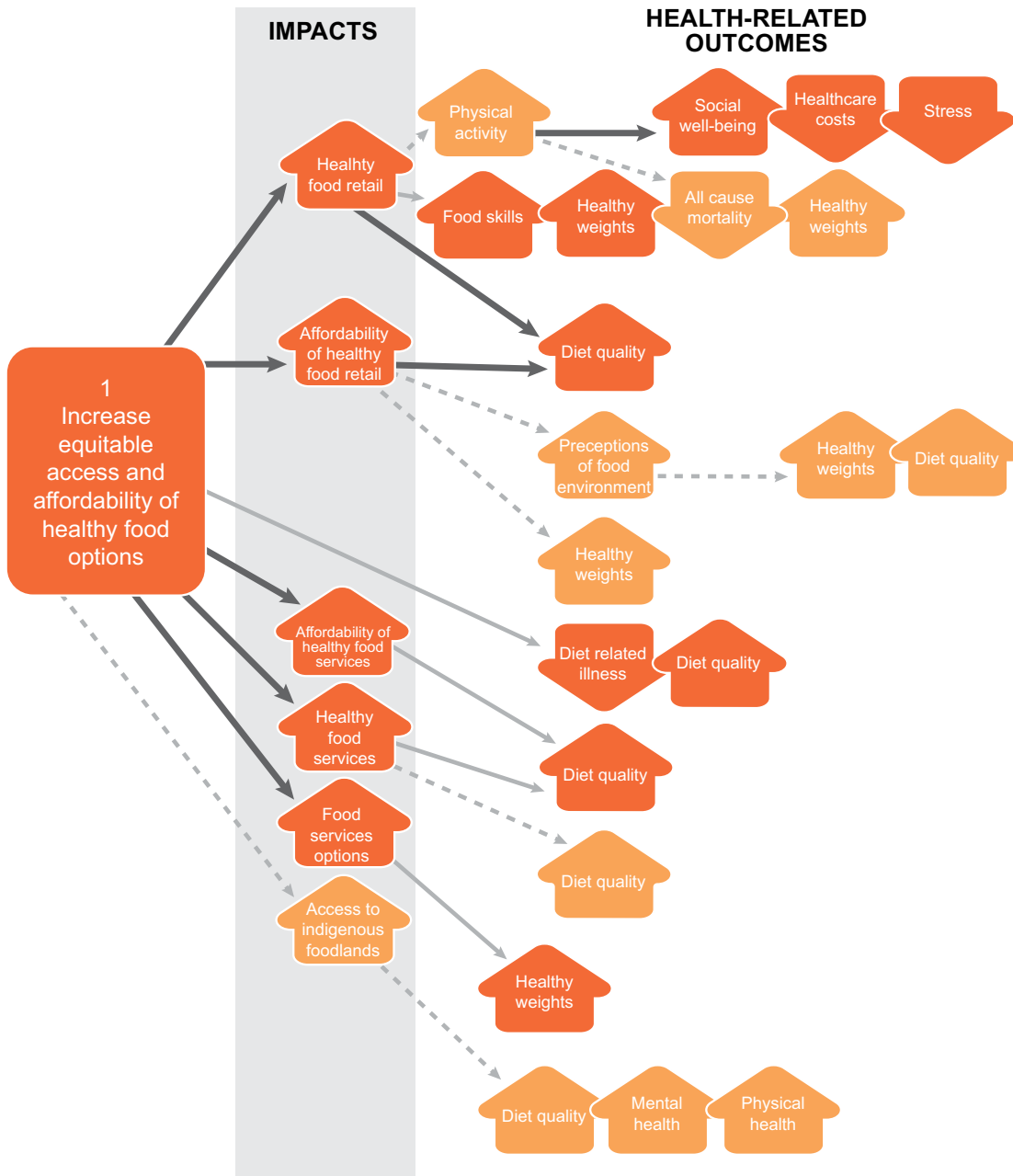
Research has demonstrated that healthy Food Systems have various positive impacts on the built environment and population health. The summary below shows the strongest research correlations found in evidence reviews related to the three planning principles for healthy Food Systems:



STRENGTH OF EVIDENCE: Strong/Moderate New research area DIRECTION OF EFFECT: ↑ ↑ Increase ↓ ↓ Decrease



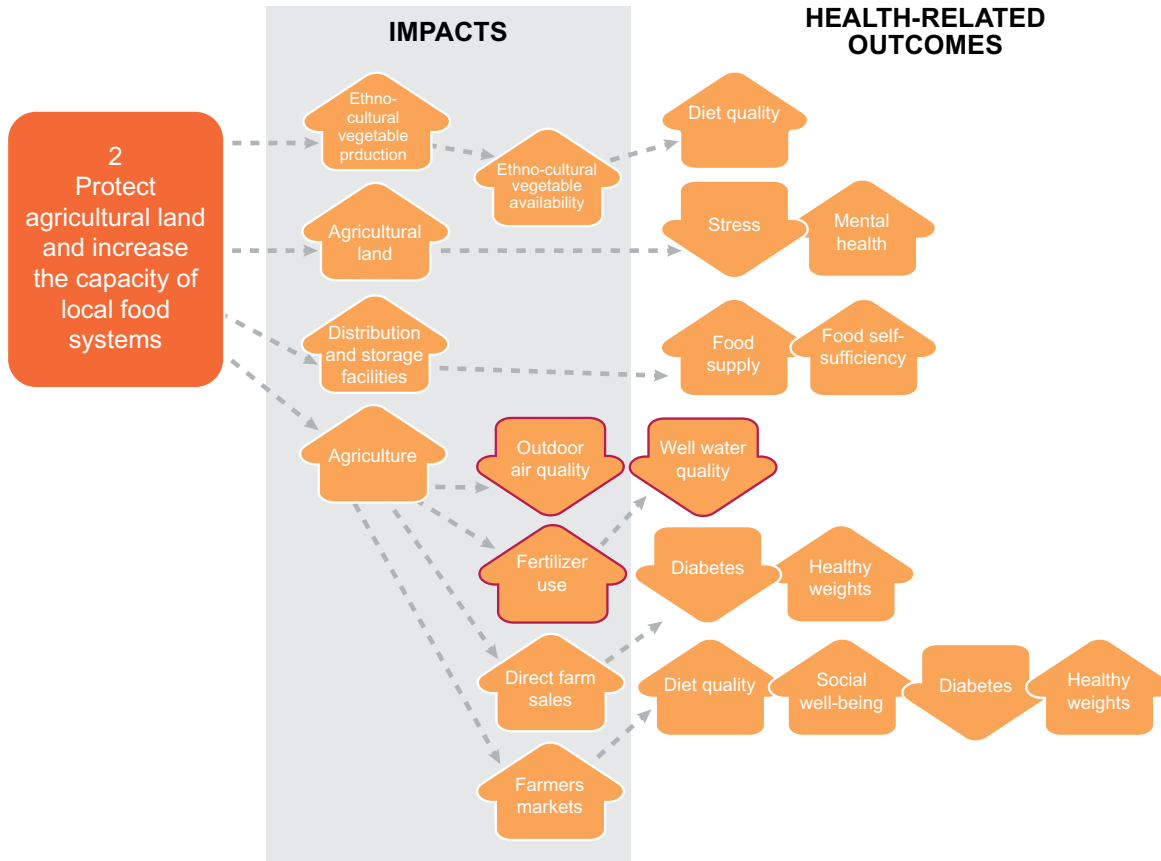
Food Systems Evidence Diagram



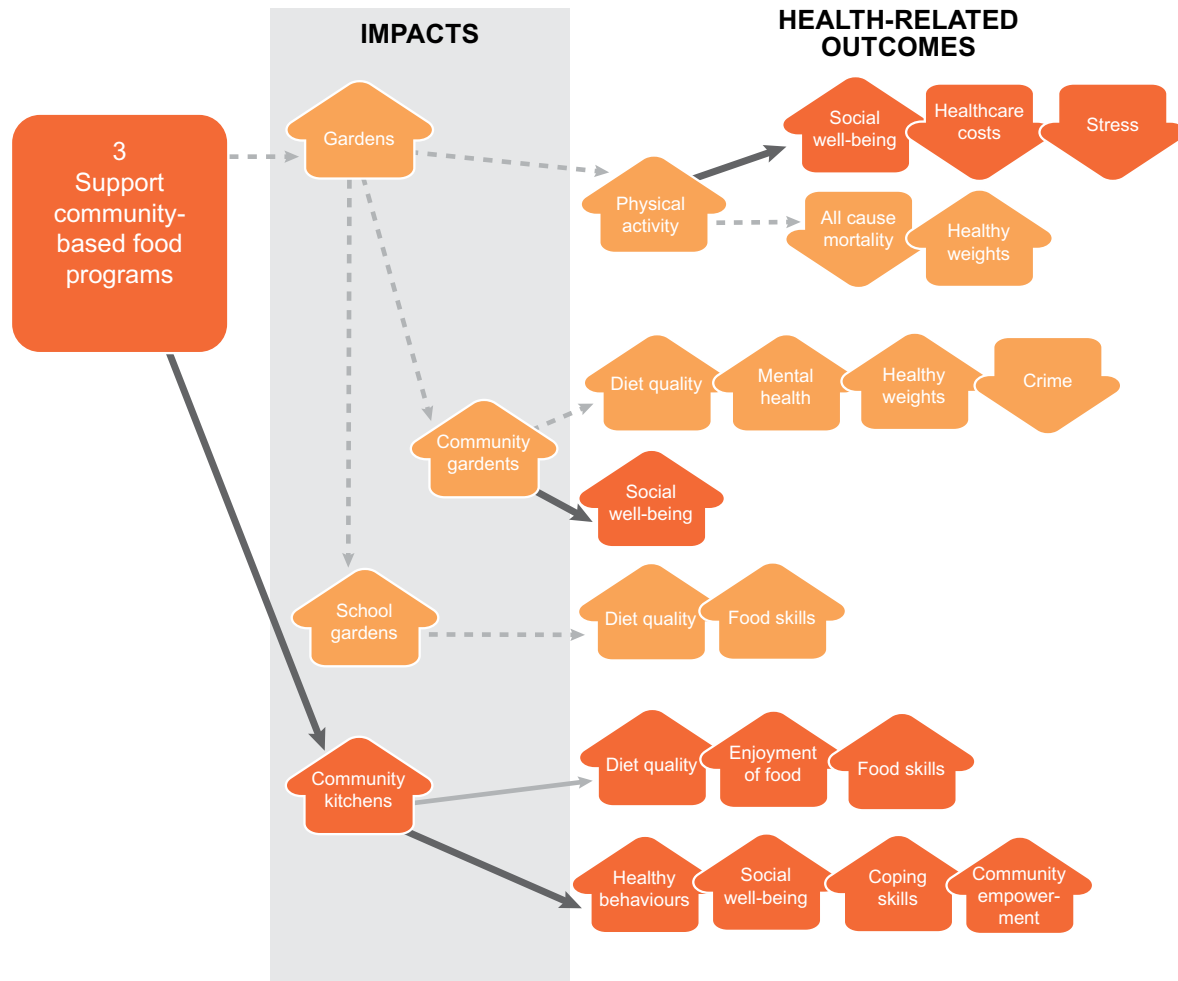
Strength of Evidence		Direction of Effect	
	Strong		Increase in impact/outcome
	Moderate		Decrease in impact/outcome
	New research area		Negative impact



Food Systems Evidence Diagram



Food Systems Evidence Diagram



Housing Fact Sheet



This is one of five fact sheets included in the Healthy Built Environment Linkages Toolkit. Fact sheets describe planning principles which are associated through research to positive health impacts. The following icons indicate that additional support for a planning solution is available within another fact sheet or practice consideration.



Neighbourhood
Design



Transportation
Networks



Natural
Environments



Food
Systems



Housing



Social
Well-Being



Economic
Co-Benefits



Small and
Medium-sized
Communities

Design, quality and affordability of housing options have a critical influence on health and well-being.

We spend most of our time in our homes: we eat, sleep, socialize with friends and family, and often even work from home. While housing is considered a basic human right, not all housing is created to meet the same standards. Differences in housing, such as quality, accessibility, and affordability all have impacts on the health of the people who live there. These impacts can positively or negatively affect our health, over the short- and long-term. Consider, for instance, how living in a stable and affordable home that provides you with a warm, safe and healthy environment can support your health. These factors all describe aspects of healthy housing, which can promote good nutrition, healthy behaviours, and healthy relationships. Healthy housing can foster good mental and physical health, and improved quality of life.

What is healthy housing?

Healthy housing supports healthy living by protecting people from health hazards inside and near the home. It is safe, affordable and accessible to all.

The following principles are associated with planning and design for healthier housing, and should be applied with consideration of the unique social, economic and environmental factors of each community.



Housing Fact Sheet



PLANNING PRINCIPLES for HEALTHY HOUSING

1. Prioritize affordable housing options through diverse housing forms and tenure types

Housing instability disproportionately affects low-income persons and other vulnerable groups, and causes financial and psychological stress. A lack of affordable housing can lead to overcrowding as people “double up” to afford costs. Social well-being research shows that people who live in high-rise apartment buildings are more likely to experience social isolation, especially if they live on a high floor.

Providing mixed income housing developments, and supporting affordable and subsidized housing programs, has health and economic benefits. Lower housing costs are associated with an increase in disposable income, making it easier for individuals and families to afford non-housing related essentials such as medication and nutritious food. Individuals and families are also supported to stay in one place for a longer period, which improves their social well-being and builds connections with the community.

What are some evidence-based planning solutions?

- Prioritize a variety of housing forms and mixed income housing developments to increase access to local, affordable, and diverse housing options, which helps people stay in their communities longer and improves their ability to afford other basic needs such as health care and nutritious food, while decreasing stress.
- Create energy efficiency features to help people live comfortably and more affordably in their homes.
- Design welcoming common areas in high-rise buildings to foster positive social interaction.

Related info can be found in other sections of this document:



2. Ensure adequate housing quality for everyone

Among other things, access to good quality housing is correlated with an increased sense of safety, decreased crime, greater social well-being and improved quality of life. Appropriate heating, insulation and venting systems which support indoor air quality helps people to maintain good general and respiratory health. This is especially important for children with asthma.



Housing Fact Sheet



Poor quality housing is characterized by hazards that increase the risk of unintentional injuries such as burns and physical trauma. Energy inefficient housing in cold climates is also linked to illnesses caused by cold and damp living conditions. Ensuring that people live in good quality housing will largely benefit people of lower socioeconomic status.

What are some evidence-based planning solutions?

- Create energy efficiency features to help people live comfortably and more affordably in their homes.
- Consider offering energy efficiency initiatives, such as grants or rebates for energy efficient appliances.
- Ensure suitable ventilation, particularly for older homes, to promote good indoor air quality by reducing the presence of allergens such as dust and mold, as well as harmful chemicals such as pesticides, volatile organic compounds (including benzene and acetone), and radon.

Related info can be found in other sections of this document:



3. Provide specialized housing options to support the needs of marginalized populations

Unstable or low-quality housing can lead to poorer health outcomes and significantly affects marginalized populations such as people who are homeless, elderly, low-income and/or have disabilities. The accessibility and quality of supportive housing options is also related to improved health and social well-being for people with mental illness.

Prioritizing access to permanent and safe housing for people who are homeless decreases their use of emergency services and helps them stay safe from violence, injury and communicable disease. “Medical priority rehousing” is a promising intervention used internationally to rehouse people into good quality, subsidized housing based on medical need. This strategy helps people with physical and mental illnesses find safe, affordable housing so they are better able to access the healthcare services needed to treat existing illness and diseases, and stay healthy. Unstable or low-quality housing is correlated with higher healthcare costs.

Research suggests that upgrading or retrofitting housing to increase accessibility enables people with physical disabilities to continue living independently in their homes. Most of the research reviewed focused on seniors with disabilities.



Housing Fact Sheet



What are some evidence-based planning solutions?

- Invest in supportive housing for people with mental illness, to help improve their health and increase their social support networks.
- Prioritize access to permanent and safe housing for people who are homeless to reduce their use of emergency services, and provide better access to the healthcare services needed to take care of existing illness and diseases and stay healthy.
- Implement programs that help to upgrade or retrofit housing to allow people with physical disabilities, particularly seniors, to continue living independently in their homes.

Related info can be found in other sections of this document:



4. Site and zone housing developments to minimize exposure to environmental hazards

The location of housing relative to busy roadways and/or radon deposits can impact the level of indoor exposure to air pollution and other environmental hazards. Radon exposure is linked to lung cancer. Community planning must be conducted carefully to limit the production of, and exposure to air pollution, noise pollution and other environmental hazards.

Housing proximity to dense, busy areas or industrial sites is also related to noise levels inside the home. High levels of noise exposure can result in sleep disturbance, fatigue, and other mental and physical health problems.

What are some evidence-based planning solutions?

- Site and zone housing developments to minimize indoor exposure to air pollution (such as dust), noise and environmental hazards (e.g. radon).
- Ensure that housing developments are located a safe distance from busy roadways.
- Use planning and building design to mitigate exposure to environmental hazards.
- Use mitigation measures to vent pollutant concentrations and maintain safe indoor air quality.

Related info can be found in other sections of this document:



Housing

Summary of Research Links



Research has demonstrated that healthy Housing has various positive impacts on the built environment and population health. The summary below shows the strongest research correlations found in evidence reviews related to the four planning principles for healthy Housing:

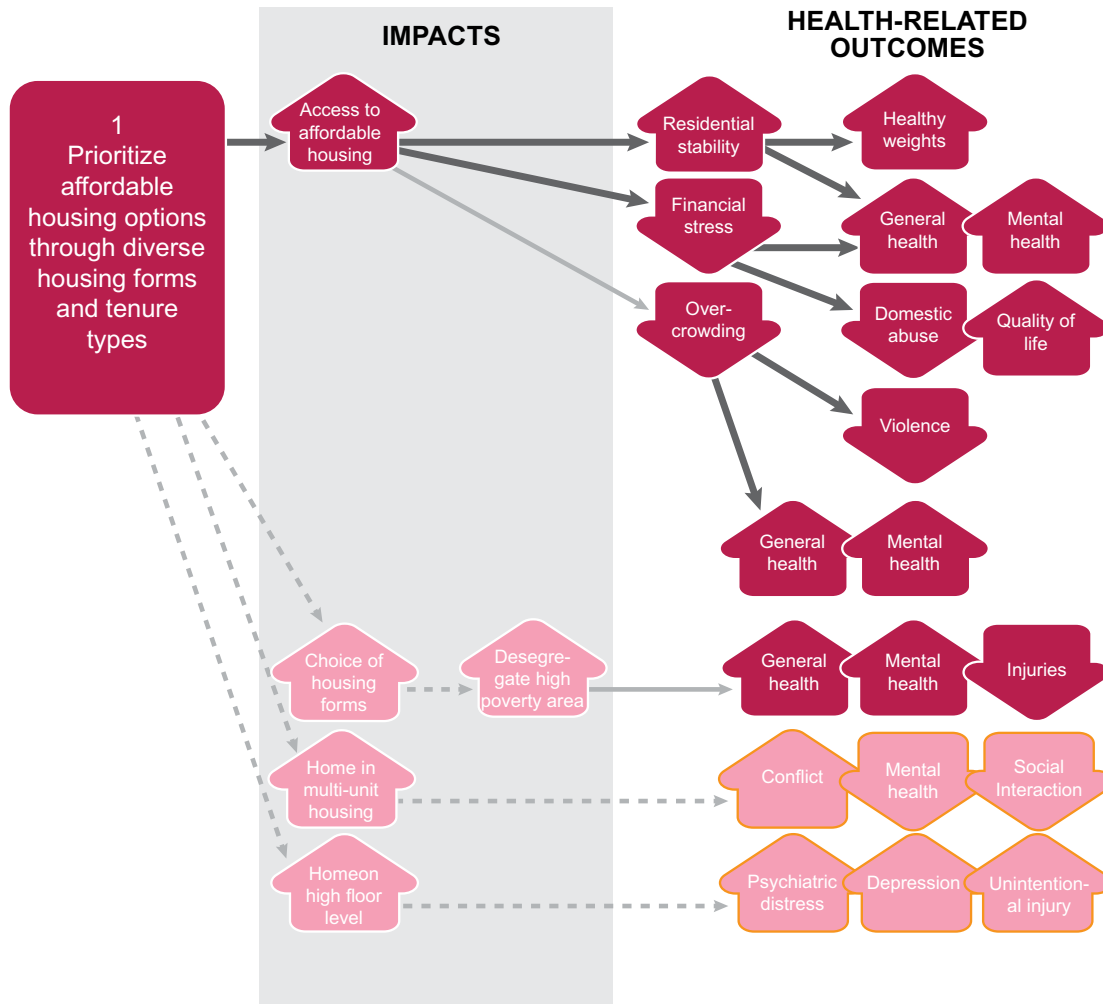
	Impacts on the Built Environment	Population Health Outcomes
1 Prioritize affordable housing options through diverse housing forms and tenure types	<ul style="list-style-type: none"> ↑ Access to affordable housing ↑ Choice of housing forms ↑ Desegregate high poverty areas ↑ Home in multi-unit housing ↑ Home on high floor level 	<ul style="list-style-type: none"> ↓ Domestic abuse ↑ General health ↓ Injuries ↑ Mental health ↑ Mental health ↓ Overcrowding ↑ Quality of life
2 Ensure adequate housing quality for everyone	<ul style="list-style-type: none"> ↑ Access to good quality housing ↓ Crime ↑ Indoor air quality ↓ Physical hazards ↑ Thermal quality & energy efficiency 	<ul style="list-style-type: none"> ↓ Cardiovascular mortality ↑ General health ↓ Mortality ↑ Neuro-development ↑ Psychological health ↑ Quality of life ↑ Respiratory health ↑ Sense of safety ↑ Social well being ↓ Unintentional injury ↓ Winter mortality
3 Provide specialized housing to support the needs marginalized populations	<ul style="list-style-type: none"> ↑ Access to housing for people with mental illness ↑ Access to permanent housing 	<ul style="list-style-type: none"> ↑ General health ↓ Hospitalization ↓ Injuries ↑ Healthcare use ↓ Risk behavior
4 Site and zone housing developments to minimize exposure to environmental hazards	<ul style="list-style-type: none"> ↓ Noise exposure ↓ Radon exposure 	<ul style="list-style-type: none"> ↓ Cancer ↓ Cardiovascular mortality ↑ Economic co-benefits ↑ General health ↑ Mental health ↑ Neuro-development ↑ Physical health ↑ Respiratory health ↑ Social well being

STRENGTH OF EVIDENCE: **Strong/Moderate** New research area DIRECTION OF EFFECT: ↑ ↑ Increase ↓ ↓ Decrease





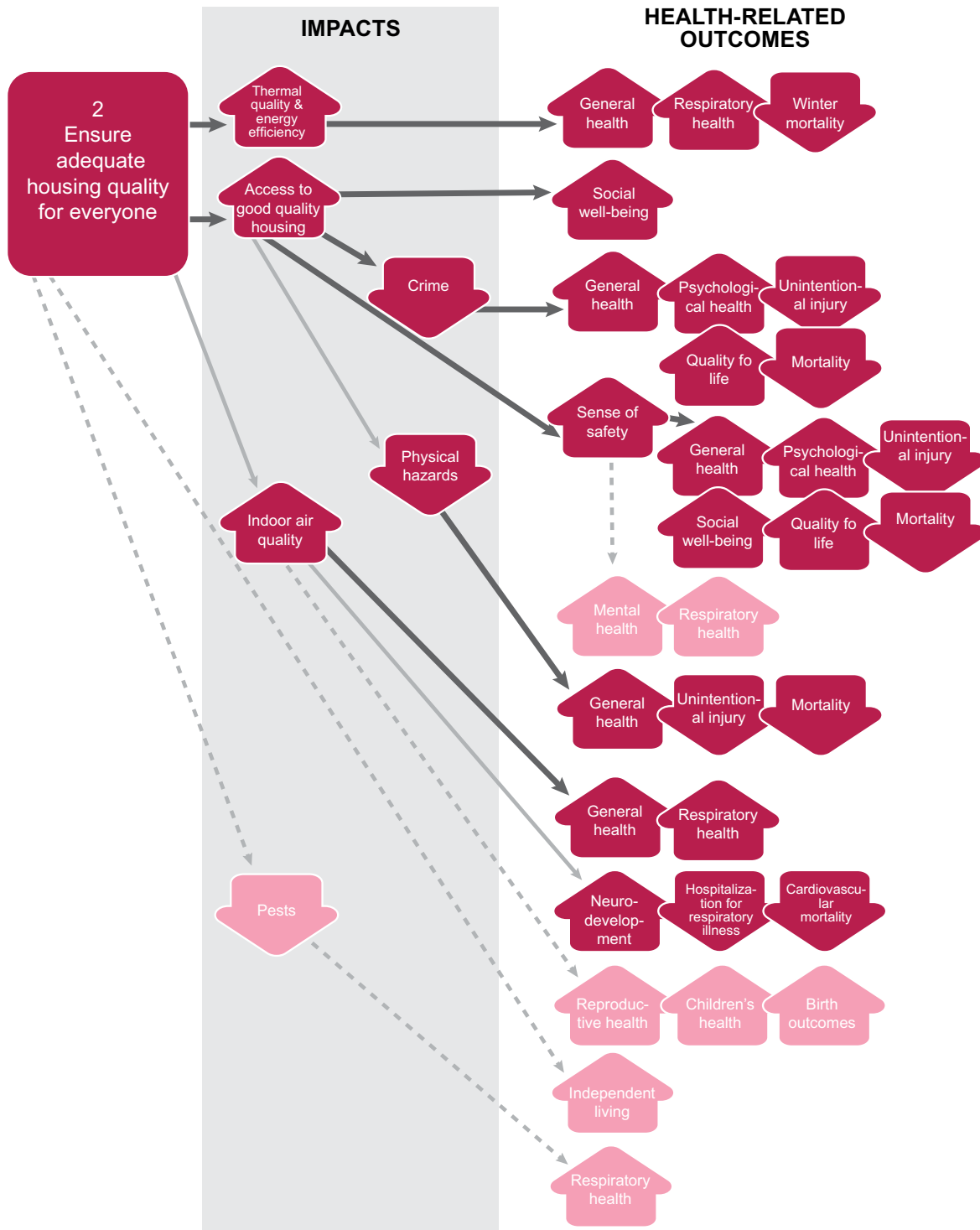
Housing Evidence Diagram



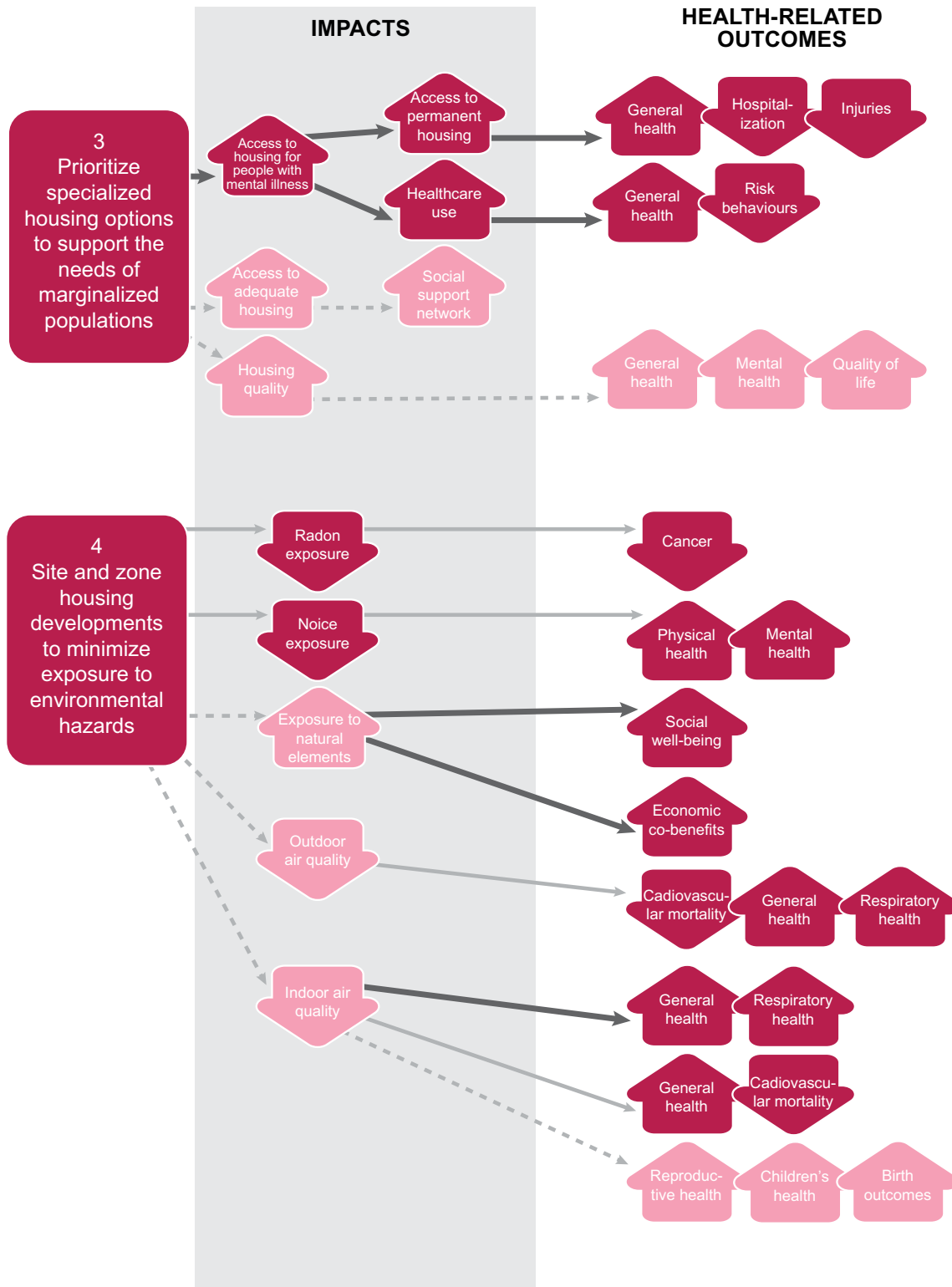
Strength of Evidence		Direction of Effect	
	Strong		Increase in impact/outcome
	Moderate		Decrease in impact/outcome
	New research area		Negative impact



Housing Evidence Diagram



Housing Evidence Diagram



Engaging with Local Governments

The Local Government Act legislates local governments to consult with persons and organizations that may be affected by a plan. However, the Act does not specifically identify health authorities as a key stakeholder.

Health professionals can add value by articulating evidence-based links between standard planning practices and health outcomes, creating added imperative for these to be considered within decision making. It can be extremely valuable to build relationships with your local government's planning department and city councillors. The latter must respond to public perceptions on the implications of local initiatives, and may be newer to HBE concepts. Staying informed and being involved over time builds positive relationships, and increases the likelihood that health input is sought when ideas are being generated instead of when plans are nearly final.

Types of community plans

The most common community plans are described below in order as increasingly detailed plans and bylaws are developed. Less common types include master plans, transportation plans and regional growth strategies. For a more detailed overview of local and regional planning processes and participation opportunities, refer to the "Introduction to Land Use Planning" referenced in Appendix C.

1. Official Community Plan (OCP)

An OCP is the overarching planning and development vision for a community and is the single most important policy framework guiding decision making for local governments of all shapes and sizes. OCPs for small and medium-sized communities are generally more detailed and carry more weight than those for large communities.

The steps involved in developing an OCP are:

- a. Undertaking research and establishing a Steering Committee** | Initial research is conducted on current community status, trends and demographics. Diverse advisory and steering committees are established.
- b. Visioning** | Includes community consultation to generate new ideas and identify challenges and solutions.
- c. Policy development** | Policies related to typical OCP components, e.g. housing, parks and transportation, are debated and drafted to clarify goals and objectives.
- d. Final consultation** | Final consideration of amendments in preparation for formal adoption.
- e. Formal adoption by City Council**



2. Area Structure Plans (ASP)

ASPs are sometimes called “Neighborhood Plans.” They typically follow a similar process as an OCP however the scale is more granular and focuses on the neighborhood rather than the entire city. Health Authority involvement would be similar to OCPs.

3. Rezoning

This is the process through which higher-level policies in an OCP begin to get implemented. A rezoning legally establishes detailed land use, parking ratios, and form/character of buildings.

Rezoning applications are initiated by developers, who are also responsible to implement rezoning decisions approved by local governments. As such, it is vital that developers embrace the spirit of the Toolkit, to optimize the influence that health considerations can have in developments.

Community residents and organizations may respond to an application for development, and health authorities may receive referrals for input on a rezoning application. However, negotiations are often considered finalized prior to an application being submitted to health authorities for comment.

4. Subdivision

Subdivision occurs when a larger piece of land is segmented into smaller pieces. The size of these smaller pieces and their zoning generally determines what is built. For example, larger parcels zoned for retail could become “big box” stores and large parcels zoned for multi-family could become condos or townhouses.

Subdivisions include engineering design for road and sidewalk infrastructure, to be installed by the developer through a Works and Services Agreement. Generally, City Council and the public do not comment on technical activities and health professionals input is limited to related issues such as permitting extensions of water or sewer lines.

5. Development permits / building permits

Permits are issued once buildings are designed and approved. It is unlikely the Health Authority would be involved in this process.



Stages of Planning

Within any type of plan development, there are opportune moments when health expertise is most impactful, and times when meaningful participation is unlikely.

Health considerations must be inserted as early as possible in order to establish health outcomes as a high-level goal in any type of community plan or development. There are three broad opportunities for early input:

1. Visioning—high-level goals are generated and health outcomes can be identified as a targeted priority
2. Public consultation—participating in public engagement opportunities can carry significant weight
3. Draft plan development—health considerations may be incorporated into the more detailed planning and design concept

“When we work on an OCP, we want a high-level commitment to health as part of the vision as well as in the detailed policies and goals as much as possible. Commitment must be very visible in order to build a platform for City Council to be able to speak to the public on the health implications of particular elements.”

Claire Gram,
Population Health Policy and Project Lead
Vancouver Coastal Health

Typical planning stages are outlined below, including suggestions for engagement options.

Planning Stage	Engagement Opportunity
1. Visioning	<p>Establish a health priority early in the process, in both the technical and engagement aspects of the project</p> <ul style="list-style-type: none"> ■ Participate in engagement activities, e.g. surveys, open houses, advisory committees ■ Support planning research by adding a health lens, i.e. present at public events, provide briefing notes ■ Host a health-focused workshop for local government staff, community partners and other stakeholders
2. Draft Plan Development	<p>Identify specific health implications to help shape the draft plan</p> <ul style="list-style-type: none"> ■ Participate in engagement activities, e.g. plan development workshops, public hearings, or meet with councilors and city staff ■ Provide health input for public material ■ Host workshops with councilors, staff and community members on the health impacts of various planning approaches ■ Identify health metrics which could inform the evaluation of early concepts and goals
3. Final Plan Development	<p>At this stage, there is limited opportunity to influence the content of the plan. Possible action could be to meet with planners individually to address outstanding concerns and discuss options for better health outcomes.</p>
4. Implementation	<p>It is unlikely that the plan will be influenced at the stage. Community plans are intended to shape the evolution of a neighborhood, but the specifics of implementation are the responsibility of developers who build its elements</p>



Social Well-Being



Social well-being—the degree to which we feel connected to other people and a sense of belonging to the communities in which we live, work and play—has a significant influence on our physical and mental health. Public spaces that are safe and accessible to everyone, aesthetically pleasing, and culturally appropriate can help prevent the negative health impacts of isolation and loneliness by enabling people to nurture positive local relationships and participate in community life.

On a broad design level, long-term strategies for complete and compact neighbourhoods in which residents can access services and green space via active transportation is vital. But so are “smaller” initiatives, such as planning comfortable common entries for buildings that invite positive interactions, strategically locating park benches, and creating inclusive playgrounds. These are all associated with stronger connections between local residents and the public places they share.

Conversely, there are factors that hinder social well-being within a neighbourhood. As an overriding consideration, people must feel safe and comfortable to participate in community life and access available amenities. For example, we are less likely to walk through a green space that feels unsafe, is littered or looks unkempt. Therefore, designing healthy public spaces with aesthetics as well as safety in mind is neither a luxury nor superficial—it directly supports the health and well-being of residents.

Inviting public participation and creating opportunities for engagement throughout the planning process is another way to enable community cohesion and social well-being. Sharing the decision making that shapes one’s community facilitates social well-being by nurturing a sense of empowerment, connection and community responsibility.

HOW CAN PLANNING AND DESIGN HELP INCREASE SOCIAL WELL-BEING?

The five principles below are associated with planning and design for increased social well-being.

1. Street connectivity and active transportation

Neighbourhoods can be built and designed to invite positive social interactions among residents. Street connectivity for example, is a key urban design feature that influences social well-being, particularly for seniors. Connectivity and easy access to resources and facilities through active transportation encourages social capital and community engagement, as residents are more likely to engage socially, trust their neighbours, and get involved in local decision making. Conversely, urban sprawl not only restricts opportunities for physical activity and access to healthy food, it also undermines social well-being. Reliance on private vehicles limits opportunities for in-person connections which can lead to feelings of isolation.



Positive social relationships among residents cannot be fostered by increased density alone. As described in the third consideration below, our overriding need before entering and engaging in public spaces is to feel safe.

Planning solutions that relate to street connectivity and active transportation

- Create a convenient, safe and affordable public transit service that attracts a broad range of residents, thereby supporting social interactions and building a sense of community. Comfortable and quiet service and waiting areas facilitate conversations: for example, transit stations coupled with community-oriented spaces.
- Make active transportation options as convenient, easy and safe as possible so residents are more likely to walk, bike or use public transit to and from daily activities. Active transportation enhances opportunities for social interaction which increases trust in one's neighbours and involvement in local decision making.

2. Quantity and quality of green spaces

In addition to the human-made infrastructure of our communities, natural green spaces also contribute to a healthy built environment and social well-being. Research shows that contact with nature and access to green spaces in and near urban areas is essential to fostering social interactions and building community cohesion.

Both the quantity and quality of green space are linked to social cohesion at the neighbourhood scale. Conversely, a shortage of green space within urban environments has been linked to feelings of loneliness and lack of social support.

Urban parks must be well-maintained and provide attractive recreational facilities to best support social connectedness among residents. The most beneficial green spaces in urban environments are those that meet the needs of diverse groups in the community, including residents of various ages, physical abilities, and cultural groups.

Community and school gardens can also have positive effects on well-being, social relationships and community cohesion.

Planning solutions that relate to green spaces

- Increase access to green spaces by preserving and connecting environmentally sensitive areas.
- Create meeting spaces in parks, gardens, and other communal areas, including private and semi-private spaces.
- Keep parks safe and well-maintained, and include attractive recreational facilities.
- Include adaptive playground equipment and wheelchair-accessible paths



3. Perceptions of safety

Perceived danger is powerful predictor of neighbourhood level social cohesion as people are much less likely to feel part of, or interact within, a community that they perceive to be unsafe. Even beneficial aspects of neighbourhood aesthetic, including trees and open green spaces, are not viewed positively when residents do not feel safe. Undesirable neighbourhood aesthetics such as graffiti, litter, derelict buildings, and the presence of heavy traffic can create a sense of unease and are associated with poorer social cohesion and community interaction, in part because they interfere with perceptions of safety and a positive sense of place.

Fear of crime and a neighbourhood's reputation for disorder limits use of the public transit system and reduces opportunities for broader community engagement. Unfortunately, neighbourhoods perceived as unsafe are often also in low-income areas.

Clear links between perceptions of safety, social interactions and community cohesion has led some researchers and planners to advocate for "safe growth", which addresses crime prevention through environmental design and broad community participation processes.

In addition to safe designated public spaces, healthy community design should also allow for informal interactions in spaces such shared laneways or corridors, and other quieter and more private areas.

Planning solutions that relate to perceptions of safety

- Make public spaces inviting, with a sense of safety and comfort. Keep grounds and buildings well-maintained.
- Design pleasant and safe shared spaces, coupled with private spaces that allow people to retreat from negative interactions and/or have quiet time when necessary.

4. Place making, public art and heritage conservation

Place-making builds and strengthens community identity. Positive interaction is encouraged when commercial streets are designed as "everyday social spaces" by including elements such as communal seating, street furniture, and natural features.

Public spaces that encourage place making and social interaction have several qualities:¹²

- Location: accessible and near other communal resources (school, market) to support casual encounters
- Seating: benches or communal tables allow for longer interactions
- Adaptable: spaces without specific or prescribed functions enable spontaneous, impromptu activities
- Welcoming: a sense of safety and familiarity
- Pleasant: clean and peaceful, or bustling and lively
- Unique: qualities or aesthetics that make that space distinctive

12 Comstock, N., et al., *Neighborhood attachment and its correlates: Exploring neighborhood conditions, collective efficacy, and gardening*. *Journal of Environmental Psychology*, 2010. 30(4): p. 435-442.



Both quantity and quality of public open spaces are associated with fostering social interactions and sense of community. For example, “privately owned public spaces” which are open squares, gardens, or parks that look publicly owned but are not, can become “dead public spaces” because they stifle spontaneity and inclusion.

Planning solutions that relate to place making and heritage conservation

- Highlight unique characteristics of the community’s natural surroundings or local history to help build a special sense of place and shared culture.
- Design streets as social spaces with seating, gardens, public art or other design elements to help people move beyond just casual, quick encounter.
- Use signage and visual cues to help community members know how to interact in shared spaces, enhance positive interactions, and minimize friction. Knowledge of etiquette in new spaces, such as new cycling pathways or shared trails, reduces friction between users and increases opportunities for positive social interactions.

5. Community engagement

Opportunities to engage in local planning processes also help to facilitate community cohesion and social capital. Participation in shaping one’s immediate built environment, through shared decision-making processes, supports social interaction and well-being by encouraging a sense of empowerment and connection to the community.

Planning solutions that relate to community engagement

- Provide meaningful opportunities for residents to pro-actively engage in the decision-making processes that shape their built environment.
- Ensure engagement processes are inclusive to the diverse needs of all community members, including children and youth, people with diverse abilities, and low-income residents.



Economic Co-benefits of Healthier Built Environments



While the health impact of neighbourhood design is well-established, there is new emphasis on economic co-benefits such as stronger local economies and cost savings for individuals. Most notably, research on cost savings due to active transportation infrastructure and natural environments has grown significantly over the past five years, as interest in revitalized approaches to planning has developed. Increased residential density, mixed land use, greenery, street scale design, accessibility, and street connectivity, have all been associated with economic benefits.

The economic co-benefits in this section were identified through a literature review focused on transportation, natural environments and neighbourhood design.

Some studies identified economic beneficiaries in their design, but it was not always clear in the research who might benefit from the intervention, i.e. individuals and families, governments, health authorities. Most studies focus on urban or suburban settings.

1. Economic co-benefits of complete and compact neighbourhoods

Compact development, or “smart growth”, is associated with a range of economic benefits for individuals, families, and local governments. One Canadian analysis found that a compact development scenario for Halifax, Nova Scotia, would reduce infrastructure and transportation costs by about 10 per cent.

Public infrastructure and service costs

Compact development saves an average of 38 per cent on upfront infrastructure costs, 10 per cent on the ongoing delivery of services, and generates 10 times more tax revenue per acre compared with traditional suburban growth. Recent data from Nova Scotia and Alberta suggests savings of between 10 and 30 per cent.

More compact development also reduces the length of roads and utility lines (such as water pipes and sewers), and distances travelled to provide public services such as garbage collection, policing, emergency response, and school transport. A recent analysis in Calgary, Alberta, suggested that more compact development for that city could save one-third in capital costs and 14 per cent in operating costs for infrastructure and services[4]. Each U.S. \$1 million spent on cycling infrastructure creates 11.4 jobs, substantially more than for road infrastructure.

Household expenses

Compact and inter-connected urban development tends to reduce the costs of many household expenses (particularly transportation costs) for families by increasing retail agglomeration efficiencies and competition, although cost savings vary significantly by city or region. Even in high property value areas, condos are cheaper than single family dwellings, especially in mixed use neighbourhoods

The available data (much of it U.S.-based) indicates that smart growth does increase housing costs, but these are more than offset by cost savings for families in terms of transportation. The financial benefits of compact urban development for B.C. residents in particular is unclear.

Traffic safety

Compact development reduces injuries and mortality from car crashes.

Energy consumption and pollution emissions

Smart growth neighbourhoods reduce per capita energy consumption and pollution emissions by reducing infrastructure requirements, building energy use and vehicle travel, helping residents save on expenses such as heating and cooling costs.

Economic development

Smart growth is associated with reduced land consumption, leaving more land for recreation, tourism, agricultural production, retail and other businesses.

2. Economic co-benefits of active transportation

Improved transportation options for non-drivers

More compact development allows more transportation options for non-drivers, including older adults, children and people with diverse abilities. This has important equity implications as well as social and economic impacts. Because cycling is more affordable than driving, active transportation options increase the ability of low-income residents to access education, employment and other vital services.

Families that live in walkable communities spend less for transportation. Cost savings vary by neighbourhood, city and region.

Health and well-being

Walkable communities that support active transportation are associated with lower levels of chronic disease, better air quality, and significantly reduced health care costs.

An economic analysis of the Toronto-Hamilton regional transportation plan and proposed system improvements estimated that transit use would increase by 7.8 per cent, resulting in the prevention of 338 premature deaths annually and \$2.2 billion in health care cost savings per year.



In 2013, 38 per cent of British Columbians were inactive, which resulted in \$350 million in direct health care costs and \$673 million in costs related to disability and premature mortality. In that same year, the economic burden of excess weight (\$2.6 billion) was higher than physical inactivity (\$1.0 billion), varying across the province's 16 health regions.

Economic development

Convenient and safe active transportation options enhance productivity, business activity, property values and tax revenue. When families drive less for work or school, they stay in their community and spend more in local shops and services. As well, agglomeration efficiencies boost the economic productivity of local businesses by increasing accessibility and, therefore, the efficiencies of economic interactions.

3. Economic co-benefits of green space

Open space preservation

Natural open spaces (including farmland, wetlands, parks, forests, and culturally significant sites) provide a variety of economic, social and environmental services. An analysis of the value of an open space in Puget Sound, B.C., estimated the economic implications based on air and water quality protection, recreation, food production, and disaster mitigation (among other values), to be about US \$3,000 to \$7,000 per acre.

Improved access to natural green space allows all residents to enjoy the important health benefits of time spent in nature, and is associated healthcare cost savings.

Trees

Urban trees help reduce energy use and storm water runoff, remove air pollution, increase property values, and enhance opportunities for recreation and tourism. The overall annual net benefit of urban trees has been measured as between U.S. \$21 and \$159 per tree. Some studies suggest the placement of trees is an important factor, as tree canopies along roadways can partially contain pollutants.



Considerations for Practice

Small and Medium-sized Communities



There are over 110 cities, towns, municipalities and villages in British Columbia. Of those, over 75 per cent are small, rural or remote communities of fewer than 30,000 people. These communities are economically, socially and environmentally diverse and provide essential natural resources such as timber, minerals and fish. Small and medium-sized communities are often intimately set within the natural environment, where issues of sustainability, environmental impact, conservation and engagement with nature are daily concerns. Many people choose to live within small towns because of the lower cost of living, decreased traffic congestion and easier access to the natural environment.

Small and medium-sized communities have different opportunities and challenges than their urban counterparts. Most significantly, because of their smaller tax base and greater reliance on resource-based projects, smaller communities more often face limited and less stable financial resources and human capacity. Small and medium-sized communities are often highly innovative in supporting new pathways for social organization, economic development and local capacity building.

For dispersed areas with fewer resources and lower population densities, urban planning solutions are often inappropriate or not easily applied. For example, walkability and complete streets are harder to implement in dispersed areas with lower population densities.

Nonetheless, as with more urban centres, the planning and design of small and medium-sized communities have a direct and positive influence on how people go about their daily lives, with significant health implications.

As with urban environments, planning decisions for small and medium-sized communities must be informed by the unique cultural, socio-economic and environmental factors that shape it. The ability to adapt general planning principles to an area's level of resources and unique characteristics is particularly important in these communities, to tap into existing strengths and build on the momentum of local activities.



THINGS TO CONSIDER WHEN WORKING WITH SMALL AND MEDIUM-SIZED COMMUNITIES

The five principles below are associated with planning and design for healthier small and medium sized communities.

1. Safety concerns about active transportation

In all contexts, physical activity and active transportation are linked to a spectrum of health benefits including increased social well-being and attention restoration, and decreased stress and personal transportation costs. Safety concerns, such as fast-moving traffic, are a commonly cited barrier to physical activity and active transportation for residents in small and medium-sized communities. These safety concerns can also be a barrier to social well-being.

Although active design principles may need to be adapted for communities with smaller population sizes, they may still be appropriate in more densely developed town centres and neighbourhoods.

Planning interventions for active transportation safety concerns

There are several features that address safety concerns from pedestrians and cyclists about active transportation:

- Construct adequate buffers from traffic when building sidewalks or bike lanes in residential areas.
- Provide wide, safe shoulders along major routes where sidewalks or bike lanes are not feasible.
- Install visible and clear signage that indicates connections to trail systems
- Provide safe crossings at frequent intervals where major thoroughfares pass through town centres.
- Include bicycle parking and safe walkways at inter-city bus stations and other transportation hubs to enable ease of use by those with limited car access.
- Ensure that snow clearing includes shoulders and sidewalks.

Pleasant scenery and aesthetically designed neighbourhoods are associated with increased physical activity in small communities, as well as greater property values and enhanced local economic productivity:

- Use trees and planters to improve aesthetics and create barriers from traffic.
- Install pedestrian lighting for increased safety.



2. Limited public transportation options

Public transportation options in smaller communities are more limited than in urban centres, making it difficult for residents to access resources such as nutritious food sources, health and social services, local parks and recreation facilities. For example, seniors in small and medium- sized communities have difficulties accessing medical care if there is a lack of transportation services connecting them to urban centres, and children and youth are less likely to participate in after school activities. Residents may regularly travel longer distances to their workplaces, which increases stress and limits their ability to participate in recreation and leisure activities.

Some communities have created innovative local initiatives such as ride share programs and neighbourhood shuttles to create more transportation options for seniors, children and youth.

Planning interventions that improve transportation options

- Create safe routes to schools to increase active transportation for children and their parents while simultaneously reducing traffic, such as retrofitting neighbourhoods around schools.
- Design complete streets for all ages, abilities, and modes of travel to help address the safety concerns of residents with restricted mobility such as children and older adults.
- Consider the particular needs of residents with restricted mobility such as children and older adults when designing transportation systems. Ensuring that everyone has equal access to public transportation helps residents feel safe, making them more likely to engage with their communities and be physically active.

3. Access to recreational facilities and green spaces

Recreational areas (including community centres, parks, playgrounds and trails) are important venues for physical activity and social well-being in all communities. In small and medium-sized communities, the natural outdoors offers easily accessible recreation options. The BC Provincial Health Officer's report "Is 'Good', Good Enough" (2016) reflects that children and youth in Northern B.C. have the highest rate of unorganized physical activity with a number of health and social benefits.¹³ Residents in small communities may have limited options for recreation facilities, either because they do not exist or are inaccessible due to limited transportation options or seasonal weather barriers.

Planning interventions that improve access to recreation

- Design recreational facilities for all-weather and all-season use. In outdoor areas, this means considering factors such as adequate shade in the summer and snow-clearing in the winter.
- Provide indoor facilities when short days, inclement weather, or extreme heat limit outdoor activities.
- Locate parks close to where people live and provide transportation options such as public transit or ride sharing to increase usage.

¹³ <http://www.childhealthindicatorsbc.ca/>



4. Access to nutritious food

Residents of small and medium-sized communities may have limited access to healthy, affordable and acceptable foods. Healthy foods tend to be less affordable and of lower quality in remote communities.

Interventions that improve access to nutritious and affordable food

- A strong local food economy is associated with healthier diets. Enhance local food systems and self-sufficiency across the categories of food necessary for a balanced diet (including vegetables, fruit, grains, dairy, eggs and meat.)
- Implement locally driven initiatives to increase access to healthy foods such as:
 - farm-to-school and other farm-to-institution programs,
 - farmers' markets and direct farm sales,
 - community gardens, and
 - community supported agriculture (CSAs).
- Increase access to traditional food sources. For example, affordable hunting and fishing practices help increase physical activity and improve diet quality and mental health among Indigenous populations.

5. Exposure to environmental hazards

Although environmental hazards exist in urban areas as well, residents in small and medium-sized communities may be exposed to higher levels of certain hazards such as wood smoke and radon. Wood burning in small and medium-sized communities account for a substantially larger portion of household energy consumption than that of urban centres in British Columbia, and the smoke from residential burning is a source of particulate matter and other combustion products that adversely impact both indoor and outdoor air quality. Wood burning has also been associated with respiratory illnesses including asthma and chronic obstructive pulmonary disease.

In homes or buildings, radon gas exposure can be a serious health concern. Radon—an odourless, colourless and tasteless radioactive gas found in soils—is a carcinogen, and the leading cause of lung cancer for never-smokers. Radon enters buildings in various ways, including through cracks in the concrete slab foundation or walls. It can only be detected through testing, which can be done simply and inexpensively. If levels are elevated, mitigation options exist that effectively reduce the amount of radon in indoor air. Radon exists naturally in all soils across the country, but can be higher in regions where uranium levels are higher, such as the interior and southeastern parts of British Columbia.

Reducing radon exposure during childhood helps reduce the lifetime risk of developing lung cancer. . Since 2007, four provinces and one territory (Saskatchewan, Quebec, New Brunswick, Nova Scotia and Yukon) have tested all their schools for radon levels. In B.C., only 22 per cent of schools have reported being tested.



More information on radon can be found here: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_brochure_profession/index-eng.php (Health Canada 2009).

Residents in small and medium-sized communities can be affected by noise exposure where residential areas are located close to dense, busy areas such as roadways and industrial areas. Higher levels of noise exposure are associated with sleep disturbance, fatigue, and other mental and physical health problems.

Smaller communities, especially those located along busy highway corridors, often experience elevated dust concentrations in the spring. They are also more likely to have unpaved roadways and parking areas, and/or located in vicinity to unpaved industrial roads, which can exacerbate dust concerns, and limited capacity and finances may hinder the implementation of sweeping programs. Many smaller communities are also reliant on the resource sector, which can mean industrial emissions in close vicinity to residential areas. While the nearness of vast wilderness and forests has many health benefits, smaller communities may also be more affected by wildfires, including the impact of wildfire smoke.

Interventions that decrease exposure to environmental hazards

- Use planning and building design to mitigate exposure to environmental hazards, such as venting radon and maintaining safe indoor concentrations as much as possible through ventilation, air circulation and filtration.
- Site and zone housing developments to minimize indoor exposure to radon gas, noise and dust, through distance from sources and/or barriers.
- Promote alternatives to wood-burning stoves, and upgrade inefficient stoves, to help reduce the production of particulate matter and other combustion products.
- Locate housing developments a safe distance from busy roadways to help decrease exposure to noise, dust and air pollution.



Appendix A: Glossary of Terms

Active transportation: Any form of human-powered transportation, including walking, cycling, using a wheelchair, in-line skating or skateboarding. People often combine the use of active transportation with public transit as a complementary means of getting around (Public Health Association of Canada and Montréal Urban Ecology Centre).

Agricultural capacity: The potential for agriculture based on class ratings for various types of land (e.g. Class 7 is considered non-arable, with no potential for soil bound agriculture) (BC Agricultural Land Reserve).

Biodiversity: The short form for biological diversity, or the variety of plants and animals and other living things in an area or region (California Biodiversity Counsel).

Biological productivity: The rate and amount of production that occurs in an ecosystem over a given time period. Also known as bioproductivity (Michel Serres Institute).

Body mass index (BMI): A simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m²) (World Health Organization).

Brownfields: Usually former industrial lands that are now vacant or underused but have the potential to be redeveloped for new uses. Brownfields may be contaminated due to past or present activities. Examples of brownfields include closed factories, gas stations, and waterfront lands formerly used for commercial port operations (Ontario Ministry of the Environment).

Built environment: Refers to the human-made or modified physical surroundings in which people live, work and play. These places and spaces include our homes, communities, schools, workplaces, parks and recreations areas, business areas and transportation systems, and vary in size from large-scale urban areas to smaller rural developments. This Toolkit focuses on features which relate to the outdoor built environment and their respective health-related outcomes.

Bus queue jump lanes: bus lanes for exclusive use of public transport buses and where a special signal head at intersections gives buses a priority signal to proceed in advance of other motor traffic, ultimately giving a time advantage to public transport users.

Cardiovascular disease: Also referred to as heart disease, or heart and blood vessel disease, it includes numerous health problems, many of which relate to a process called atherosclerosis— a condition that develops when plaque builds up in the walls of the arteries, restricting blood flow (American Heart Association).



Chronic disease: Non-communicable diseases that are long-lasting with a slow progression. The four main types of chronic disease are cardiovascular diseases (e.g. heart attacks and stroke), cancers, chronic respiratory diseases (e.g. chronic obstructed pulmonary disease and asthma) and diabetes (World Health Organization).

Co-benefit: Positive outcomes resulting from an intervention that are unrelated to the original focus or intention of research. Although the focus of the HBE Linkages Toolkit is to illustrate health impacts of planning solutions, we wanted to acknowledge the considerable economic co-benefits which may add weight to the argument for healthier built environments.

Communicable disease: Infectious diseases caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi. Communicable diseases can be spread, directly or indirectly, from one person to another. Zoonotic diseases are infectious diseases of animals that can cause disease when transmitted to humans (World Health Organization).

Community kitchens: Also called collective kitchens, these are community-based cooking programs where small groups of people come together to prepare meals and take food home to their families. In a community kitchen, every member contributes by planning, preparing and cooking food. Community kitchens create opportunities for learning about the importance of healthy eating and developing the skills to prepare healthy and affordable meals (Community Kitchen's Best Practise Toolkit – Canada).

Complete streets: A complete street is designed for all ages, abilities, and modes of travel. Safe and comfortable access for pedestrians, bicycles, transit users and people with disabilities is not an afterthought, but an integral planning feature. (City of Calgary, 2014).

Connectivity: Refers to the directness of links and the density of connections in a transport network. A highly connected network has many short links and intersections, and minimal dead-ends. As connectivity increases, travel distances decrease and route options increase, allowing more direct travel between destinations, and creating a more accessible and resilient transportation system (healthyplaces.org).

Densification: Facilitated sustainable settlement planning through efficient use of spatial resources including bulk service infrastructure, energy sources and a decreasing supply of well-situated land. It is a key strategy to mitigate urban sprawl on the periphery of established development, in order to allow close access to existing economic opportunities and infrastructure (City of Johannesburg, South Africa).

Ecosystem services: The benefits people derive from the plants, animals, fungi and micro-organisms that make up an ecosystem. This includes goods such as food, wood and other raw materials, as well as essential regulating services such as pollination of crops, prevention of soil erosion and water purification, and a vast array of cultural services, like recreation and a sense of place (International Union for Conservation of Nature).

Equity (in health): Exists when all people can reach their full health potential and are not disadvantaged from attaining it because of their race, ethnicity, religion, gender, age, social class, socioeconomic status, sexual orientation or other socially determined circumstance (National Collaborating Centre for Determinants of Health).



Farmlands: Farmland that not only remains protected, but is accessible to farmers and remains actively farmed. Farmland access refers to the ways in which farmers secure the use of land for farming (Farm Folk City Folk, BC)

Food system: The whole array of activities, ranging from input distribution through on-farm production to marketing and processing, involved in producing and distributing food to both urban and rural consumers (Michigan State University – Department of Agricultural Economics).

Food self-sufficiency: A stable food system that is resilient to outside stressors. Generally taken to mean the extent to which a country can satisfy its food needs from its own domestic production (Food and Agricultural Association of the United Nations, 1999). <http://www.fao.org/3/a-i5222e.pdf>. See Figure 1: Basic representation of food self-sufficiency.

Food insecurity: The inadequate or insecure access to food due to financial constraints. More accurately described as “household food insecurity”, it negatively impacts physical, mental, and social health, and costs our healthcare system considerably (University of Toronto – PROOF Food Insecurity Policy Research).

Food security: A long term vision that exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle (United Nations Food and Agriculture Organization, 2001).

Greenway: A corridor of undeveloped land preserved for recreational use or environmental protection (Webster Dictionary).

Infill development: New development that is sited on vacant or undeveloped land within an existing community, and that is enclosed by other types of development. The term “urban infill” implies that existing land is mostly built-out and what is being built is in effect “filling in” the gaps. The term most commonly refers to building single-family homes in existing neighborhoods but may also be used to describe new development in commercial, office or mixed-use areas. (Sustainable Cities Institute).

Jug-handle left: A two stage left-turn that, especially for cyclists, that removes many dangers associated with a traditional left-turn. (e.g., the cyclist goes straight through an intersection, pulls to the right into a marked waiting area then waits for the traffic signal light to change to GREEN and then cycles straight again – ultimately completing a left-hand turn).

Leading pedestrian intervals: An advance WALK signal for pedestrians, that gives them a head start over motor traffic in the range of 3 – 11 seconds or longer, and where traffic lights for motor vehicles are red during this time.

Mixed land use: Enables a variety of land uses including residential, commercial, and industrial to be co-located in an integrated way that supports sustainable forms of transport such as public transit, walking and cycling, and increases neighbourhood amenity. Mixed land use developments can enhance the economic vitality and perceived security of an area by increasing the number of people on the street and in public spaces (Smart Growth).



Morbidity: The incidence of illness in a population (diffen.com). Morbidity is typically used to quantify the burden of disease related to a specific illness, e.g. “cardiovascular morbidity”.

Mortality: The incidence of death in a population (diffen.com). Mortality can refer to the overall death rate in a population (all-cause mortality), or death related to a specific illness (e.g. cardiovascular mortality).

Overcrowding: Housing that does not have enough bedrooms for the size and make-up of resident households, according to the National Occupancy Standard (Canada Mortgage and Housing Corporation).

Pedestrian scrambles: An exclusive WALK signal in all directions, including diagonally, for pedestrians and where traffic lights for motor vehicles are RED in all directions.

Permissive left turn: Left-turns at signalized intersections where oncoming vehicle traffic may be approaching and/or pedestrians have a WALK signal but where motorists may legally turn if they do not see and detect the presence of other vehicles, cyclists or pedestrians. (This is unlike a ‘protected’ or ‘channelized’ traffic movement where only one movement is allowed at one time and the opportunity for driver error is largely removed).

Radon: A colourless, odourless radioactive gas that is formed naturally by the breakdown of uranium in soil, rock and water. As a gas, radon is slowly released from the ground, water, and some building materials that contain very small amounts of uranium, including concrete, bricks, tiles and gyprock. Radon gas breaks down further to form additional radioactive particles called radon daughters, or “progeny”, that can be breathed into the lungs (Health Canada).

Road diet: Reducing the number of lanes (and sometimes the width of those lanes) available to motor traffic and converting that space to pedestrian walkways, cycle tracks and the like.

Road pricing: The practice of charging motorists a fee for using a roadway in line with the basic idea that people should have to pay for the things that they use.

Setbacks: In land use planning, a setback is the distance between a building or other structure and the street or road, a river or stream, a shore or flood plain, or any other place which is deemed to need protection. It also relates to physical or landscape design barriers, e.g. shrubs and boulevards. Setbacks are measured from the property line (private land), and do not include the sidewalk (public land). The most successful (i.e. well used) pedestrian streets are those with wide sidewalks and short or non-existing setbacks.

Social capital: Relates to the idea of social well-being—the degree to which we feel connected to other people and a sense of belonging to the communities in which we live, work and play—and has a significant influence on our physical and mental health.

Sprawl: Also known as urban sprawl, it is a development pattern characterized by the following features: low-density development with new growth appearing primarily on previously undeveloped or agricultural land; outward development at the city edge, in contrast to a process of densification within the city’s existing boundaries; emphasis on separation of major land uses (residential, commercial,



industrial) and on single-use development (in contrast to mixed-use development); and disconnected residential development where new subdivisions are not contiguous with each other or with the rest of the city (Alberta Health Services).

Urban heat island effect: Describes built-up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people or more can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality (US Environmental Protection Agency).

Vulnerable populations: Vulnerable populations are those which have increased susceptibility to adverse health outcomes because of inequitable access to the resources needed to handle risks to health. Examples of vulnerable populations include: Indigenous peoples, people living in poverty, immigrants and temporary workers, refugees, people with disabilities, and people who are gender and sexually diverse (Calgary Health Region).

Walkability: The extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort and offering visually interesting journeys throughout the network (Journal of Aging and Physical Activity).

WALK phase: The WALK sign for pedestrians that tells them it is their turn to cross the street.



Appendix B: Impacts and Outcomes Related to Multiple Features

Positive impacts and desired health outcomes can often be triggered through more than one aspect of the built environment, which is helpful when considering local community contexts and priorities.

The following table lists impacts and outcomes which appear frequently in the research and are tied to several or all features. By highlighting these, we aim to show that desired impacts and population health outcomes can be promoted through various entry points.

Population health outcome	Related to built environment feature(s):	Planning Principles
Economic co-benefits*	Neighborhood Design (via outdoor air quality or physical activity or walkability)	1, 2, 3
	Transportation (via outdoor air quality or physical activity or walkability)	1, 2, 3, 4
	Natural Environments (via outdoor air quality or physical activity)	1, 2, 3, 4
	Food Systems (via outdoor air quality or physical activity)	1, 2, 3
	Housing (via outdoor air quality)	4
Decreased unintentional injury or mortality	Transportation (via sense of safety)	3
	Housing (via sense of safety)	2
General health (mental and physical) or quality of life	Neighborhood Design (via outdoor air quality)	2, 3
	Transportation (via decreased noise exposure or sense of safety)	1, 3
	Natural Environments (via outdoor air quality)	3, 4
	Food Systems (via outdoor air quality)	1
	Housing (via decreased noise exposure, outdoor air quality or sense of safety)	2, 4
Healthy weights	Neighborhood Design (via walkability)	1
	Transportation (via walkability)	1
Respiratory health	Neighborhood Design (via outdoor air quality)	2, 3
	Transportation (via outdoor air quality)	2, 3
	Natural Environments (via outdoor air quality)	3, 4
	Food Systems (via outdoor air quality)	1
	Housing (via outdoor air quality)	4
Social well-being	Neighborhood Design (via walking, cycling or physical activity)	1, 2, 3
	Transportation (via walking, cycling or physical activity or sense of safety)	1, 2, 3, 4
	Natural Environments (via physical activity)	1, 2
	Food Systems (via physical activity)	2, 3
	Housing (via sense of safety)	2

* Refers to cost savings for individuals, local governments or health systems. Includes increased economic productivity when related to walkability.



Appendix C: Additional Resources

1. **Agriculture’s Connection to Health: a summary of evidence relevant to British Columbia.** Consolidated evidence to assist health authorities in supporting local governments in evidence-based planning and decision-making. www.phsa.ca/population-public-health-site/Documents/AgConnectiontoHealth_FullReport_April2016.pdf
2. **Chief Public Health Officer’s report “Designing Healthy Living”, 2017.** This report discusses how improving public health and preventing disease can be influenced through changes to our built environment. www.canada.ca/en/public-health/services/publications/chief-public-health-officer-reports-state-public-health-canada/2017-designing-healthy-living.html
3. **Foundations for a Healthier Built Environment** – An introductory educational resource that links planning and health. www.bccdc.ca/pop-public-health/Documents/foundations-summary.pdf
4. **Health 201 – A Knowledge to Action Framework for Creating Healthier Built Environments** – A step-by-step guide that aims to assist planners, design professionals and local government decision makers to take actions towards creating healthier built environments. www.bccdc.ca/pop-public-health/Documents/health-201-full-guide.pdf
5. **Healthy Built Environments Workshops** – Created by BC Healthy Communities Society, these workshops animate the Toolkit in a shared learning experience. Curricula, agendas and slide decks are open source. <http://planh.ca/healthy-built-environment-workshops>
6. **Healthy Communities Online Course** – This six-module online course is offered through Continuing Education at BCIT (course # ENVH 4901) and is available to individuals outside the Public Health Inspector program. It illustrates the connections between the built environment and the incidence of acute and chronic diseases.
7. **Introduction to Land Use Planning for Health Professionals** – A comprehensive introduction to planning terms and processes, which highlights opportunities for health professional involvement in land-use planning. www.bccdc.ca/pop-public-health/Documents/land-use-introduction.pdf
8. **Supporting Health Equity through the Built Environment: Fact Sheet** – A set of evidence-informed principals to support environmental health officers to incorporate health equity considerations into practice. www.bccdc.ca/resource-gallery/Documents/Educational%20Materials/EH/Equity%20BE%20Fact%20Sheet.pdf



Appendix D: Methodology

The Healthy Built Environment Linkages Toolkit is based on research from various fields and study designs. Literature reviews prioritize peer-reviewed, systemic studies from reputable scientific journals. To assess the collective strength of research correlations, literature findings are graded against criteria in the table below.

- Strong:** Link is supported by consistent findings from good quality research.
- Moderate:** Link is supported by research, but somewhat lacking in quality or consistency.
- New research area:** Link is supported by expert consensus, but more evidence is needed. Studies are few or mostly qualitative, or direction of effect is unclear or inconsistent.

Evidence Strength	Study Design	Quality of Source Based on AMSTAR ratings (high = 8-11; moderate = 4-7)	Minimum # of Sources*	Minimum # of Studies**	Consistency Effect is shown by minimum 60% of studies	Confidence in findings As concluded by study authors
Strong	Reviews	High quality, peer reviewed	2	6	60%	Strong/ Moderate
	Reviews	Moderate quality	5	8	60%	Strong/ Moderate
	Primary studies	High quality	n/a	5	60%	Strong
Moderate	Reviews	High quality	1	4	60%	Strong/ Moderate
	Reviews	Moderate quality	3	5	60%	Strong/ Moderate
	Primary studies	High quality	n/a	2	60%	Strong/ Moderate
	Modelling	High quality	n/a	2	60%	Strong/ Moderate
	Modelling	Moderate quality	2 reviews or 5 primary		60%	Strong/ Moderate
New Research Area	4 experts agree on direction of effect, or 1 primary or 1 modelling study					

NOTE: Minimum criteria across all columns apply. Expert opinion is weighed if results are borderline.

Adapted from the US Community Preventive Services Taskforce framework and the National Institute for Clinical Excellence (NICE) methodology (United Kingdom National Health Service Health Development Agency and Cardiff University). Developed by Dr. Lisa Mu (Medical Health Officer, Fraser Health Authority), Dr. Karen Rideout (Karen Rideout Consulting) and Charito Gailling (BC Centre for Disease Control).



Appendix E: Source Citations for Considerations of Practice

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