

**Applying Realist Review to Assess the Potential of Interventions in the Urban Built
Environment for Public Health in Peel Region**

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1. Background and Context

This paper is prepared for the Region of Peel Public Health Department to assist with the application of evidence to improving public health through interventions in the built environment. It complements a paper prepared by Lawrence Frank & Company.

The need for this paper arises from the challenge of applying observational evidence in the fields of population and public health to decision-making. Specifically, the main issue is that while there is evidence that the urban built form is associated with relevant public health outcomes and risk factors, such as obesity and healthy body weights, air pollution, pedestrian safety and mental health, there is very little evidence from interventions and not even much evidence from longitudinal studies. This, of course, leaves open the possibility that the association seen in previous studies is not causal.

Even in the presence of experimental or quasi-experimental studies, however, it would be very difficult to draw inferences about the appropriate actions to be undertaken in Peel to improve public health from modification of the urban built form. The primary challenge is the complexity of any intervention. But before discussing the challenges of complex interventions and population health phenomena, it is worthwhile to discuss the typical pattern knowledge synthesis in the health sciences, and introduce an innovative approach to knowledge translation that is used in this paper.

In the health sciences, a great deal of scholarly activity has been dedicated to the field of knowledge synthesis and translation, which mainly involves finding ways to summarize and communicate research evidence to practitioners and to find ways to get them to conduct their practices in a manner that conform to the best evidence. This view has become orthodoxy in the clinical health sciences, where the where interventions tend to be less complex than in the population health sciences. Knowledge translation in the clinical health sciences first involves summarizing the evidence in a balanced manner with attention to high quality studies.

The Cochrane Collaboration is an institution that has been established which has been instrumental in elevating the quality and rigour of systematic reviews of research in the clinical health sciences. As a rule, Cochrane reviews *only review evidence from randomized clinical trials* published in peer-reviewed scientific journals. These reviews are themselves peer-reviewed by specialists in systematic reviews and the evidence is summarized in ways that allow for clear conclusions to be drawn for clinical practice. In subsequent stages of the knowledge synthesis and translation process, the information gleaned from the review is communicated to practitioners (often in the form of clinical practice guidelines) and then there is a body of research on how best to get clinical practitioners (mostly physicians) to adhere to those clinical practice guidelines.

In contrast, evaluations of interventions in population health cannot as easily conduct randomized control trials of interventions. Similarly, reviews of the evidence in the population and public health sciences are unable to follow the same set of procedures as in the clinical health sciences and so these must be modified to accommodate the nature of the phenomena under study. Most importantly, evaluation evidence in population health interventions must accommodate a much more complex set of causal phenomena, making evaluations of such interventions more complex.

In the case of the clinical health sciences, the main social phenomenon of interest is the way that physicians use tests, drugs and other procedures to treat disease. The equivalent process in the population and public health sciences, however, involves a wide range of potential stakeholders and fields of study, taking actions that are much more difficult to standardize (since societal phenomena, like the urban built form are more complex and context-specific) and which are directed to *preventing disease* among large populations that have both *individual- and population-based risks*.

Moreover, reviews of the evidence in population and public health are unable to have as narrow inclusion criteria as Cochrane reviews do because there is relatively little evidence from experiments or quasi-experiments. Even if there were more quasi-experimental

studies of the urban built form and population and public health, it would still be difficult to make valid comparisons between them, because such interventions are difficult to standardize and are invariably adapted to suit the local context as is desirable. This kind of approach is very different from the approach in the clinical health sciences where the intervention can (and should) be highly standardized. Administration of a drug, for example, can easily be standardized via testing & screening of patients for eligibility and suitability, dosage, follow-up, and reporting of adverse events. It is difficult to imagine an equivalent level of standardization in an intervention in the built environment.

Although it is clear that an assessment of the evidence on the relationship between urban built form and public health would be aided by evidence from randomized experiments and/or quasi-experiments, even if they were available, it would still be necessary to ‘unpack’ the elements of the intervention in each instance, as well as assessing whether there were population sub-groups for whom the intervention worked and others for whom it did not work. In the existing observational evidence, it is possible to obtain some information about sub-groups for whom interventions in the built environment may be more or less effective. This approach to evidence appraisal, known as realist review or synthesis, is an increasingly popular approach as the shortcomings of the approaches from the clinical health sciences become apparent (Pawson, 2002).

In the following section, an overview of the method of realist synthesis is presented. Realist synthesis is a valuable method for summarizing the results of studies in the population and public health sciences because, like the Cochrane review, it is structured, but does not suffer some of the shortcomings of Cochrane reviews (when applied to complex interventions). These include an overly narrow definition of what is considered as valid evidence, an inability to account for *why and how* interventions produce the results they do, an inability to accommodate non-standardized interventions, and an insensitivity to context (both site and personal).

The discussion of the realist review methodology is followed by a short discussion of contextual factors in the Region of Peel that require consideration in any decisions

concerning interventions in the built environment for public health. In the final section, the evidence on the impacts of urban built form on obesity and healthy body weights is reviewed using realist synthesis and the potential for achieving public health gains from interventions in the urban built environment is assessed.

2. Realist Review: An Introduction to the Method

According to Pawson et al., (2005), realist review “is a relatively new strategy for synthesizing research which has an explanatory rather than a judgemental focus. It seeks to unpack the mechanism of *how* complex programmes work (or *why* they fail) in particular contexts or settings” (p. 21). The approach has its roots in realist philosophy, specifically critical realism and transcendental realism (Bhaskar, 1998; Sayer, 1997), and as such, realist review “seeks to unpack the mechanism of *how* complex programmes work (or *why* they fail) in particular contexts and settings”.

This contrasts the usual approach to systematic review, which is much less concerned with *how* something works than *whether* it works. These kinds of concerns are actually fairly superfluous in the case of reviews of interventions like prescription medicines because the mechanism of operation of the intervention (*how* it works) is largely invariant from person to person or context to context (so long as people actually take their pills). In many ways concerns about how something works or why it doesn't work are superfluous for interventions like prescription medicines because the mechanism of action is a *closed system* – in other words, it is not significantly influenced by the patients' belief in its effectiveness, or any other 'external' factor. Indeed, demonstration that the presumed mechanism is the correct one comes simply from repeated success of the intervention in clinical trials, where mechanisms are not visible or even articulated.¹ Reviews of such evidence (e.g., Cochrane reviews, meta-analysis) simply need to correctly classify similar types of programs and summarize the evidence of their effectiveness (or dangers) to allow for a recommended 'best practice'.

¹ It is clearly a partial fiction, however, that the system is completely closed in such interventions, for if it was completely closed, there would be no placebo effect in medicine, nor would there be evidence that patients who believe their physician did a better job of listening to them show better outcomes from the same treatment (Moerman, 2002). Moreover, it certainly seems legitimate to question why 'compliance' is usually considered to be an extraneous factor in the evaluation of most prescription medicines, when it is one of the most common causes of ineffectiveness in medicine.

The nature of social interventions, however, is significantly different and arguably requires a much different approach. The realist approach utilizes a “generative” approach to causation, which means that realists believe that “it is not ‘programmes’ that work: rather it is the underlying reasons or resources that they offer subjects that generate change” (Pawson, 2002, p342). Moreover, “this *process* of how subjects interpret the intervention stratagem is known as the programme ‘mechanism’ and it is the pivot around which realist evaluation revolves” (Pawson, 2002, p342).

According to the generative model of causality (upon which realist enquiry is based), “to infer a causal outcome (O) between two events (X and Y), one needs to understand the underlying mechanism (M) that connects them and the context (C) in which the relationship occurs” (Pawson et al., 2005, p22). So, for example, in order to evaluate whether a health behaviour modification program reduces smoking (O), a realist would examine its underlying mechanisms (M) (e.g., have knowledge, motivation and skills changed?) and its relevant contexts (C) (e.g., are there local a plethora of cigarette vendors in the local area?). Realist evaluation is mainly concerned with hypothesizing and testing such CMO configurations. In a realist review, “the basic evaluation question – what works? – changes to ‘what is it about this programme that works for whom and in what circumstances?’” (Pawson et al., 2005, p22). “Programmes work in limited circumstances,” in other words, “and for the realist, the discovery of these scope conditions is the main task of review and synthesis” (Pawson, 2002, p346). In the case of built environment interventions to improve obesity and physical activity, it would be necessary to ask therefore, ‘What are the mechanisms by which built environment interventions are expected to affect obesity and healthy body weights, and what are the contextual conditions that vary what we would expect to affect the operation of these mechanisms?’. Moreover, it is necessary to ask ‘for whom do interventions in the built environment work and for whom do they not work?’.

The Nature of Complex Interventions

An intervention in the built environment to improve obesity and physical activity levels is arguably a complex social intervention. According to principles of realist review, complex interventions have several defining characteristics.

Complex interventions are theories

The first defining feature of complex social interventions is that they are theories. By this Pawson means that such interventions “are always based on a hypothesis that postulates: if we deliver a program in this way or we manage services like so, then this will bring about some improved outcome” (Pawson et al., 2005, p22). These theories are effectively conjectures that are grounded on assumptions about what gives rise to undesired outcomes, and how changes may be made to produce more desirable outcomes. In the case of the built environment, as will be described in detail, one of the key theories is that the built environment near an individual’s house acts as a relative constraint or enabling factor on physical activity patterns, or as a “health opportunity structure” (Macintyre et al., 2002).

Complex interventions are active

The second defining feature of complex interventions is that they are active: “that is, they achieve their effects via the active input of individuals,” including clinicians, educators, managers, planners, firms, etc. The dynamic nature of the intervention itself is important for the realist review, unlike the traditional methods of evaluation and evidence review in the health sciences. In randomized trials, for example,

“human volition is seen as a contaminant. The experimental propositions under test relate to whether the treatment (and the treatment alone) is effective. As well as random allocation of participants, safeguards such as the use of placebos and double blinding are utilized to protect this causal inference. The idea is to remove any shred of human intentionality from the investigation. Active programmes, by contrast, only work through the stakeholders’ reasoning and knowledge of that reasoning is integral to understanding its outcomes” (Pawson et al., 2005, p22).

Intervention theories begin in the minds of their designers and go through many stages

The third characteristic is, as Pawson puts it, “intervention theories have a long journey”. They begin in the minds of policy designers and may pass into the hands of managers and practitioners, and ultimately subjects. Depending on the intervention, however, the input of frontline workers may be critical to implementation, or consultations with the general public. The relative success or failure of an intervention, therefore

“depends on the cumulative success of the entire sequence of these mechanisms as the programme unfolds. Broadly speaking, then, we should expect reviews to explore the integrity of the implementation chain, examining which intermediate outputs need to be in place for successful final outcome to occur, and noting and examining the flows, blockages and points of contention” (Pawson et al., 2005, p22).

In the case of an intervention in the built environment aimed at increasing participation in physical activity, urban planning firms, property developers, marketing specialists, politicians, public health practitioners, municipal planners, and citizens are stakeholders and part of the implementation chain.

Implementation chains of complex interventions are non-linear

“The fourth feature of complex service interventions is that their implementation chains are non-linear and can even go into reverse” (Pawson et al., 2005, p23). For example in interventions like hospital scorecards, a struggle may emerge between professional associations and management about the validity or fairness of the indicators on the scorecard, altering the plan for the intervention. The actual intervention, therefore, takes shape according to the relative power of the respective parties. In the case of a built environment intervention, the introduction of design features that attempt to encourage people to replace car trips with active transport trips (e.g., pedestrian paths in the place of roads) may not create a net increase in physical activity. This may occur because rather than replacing the car trips with walking trips, for instance, people just make fewer trips.

Complex interventions are embedded in multiple social systems

The implication of the fifth attribute of complex interventions is that they are “fragile creatures” (Pawson et al., 2005) and “rarely, if ever, is a programme equally effective in all circumstances because of the influence of context” (Pawson et al., 2005). Consequently, realist inquiry must “take heed of the different layers of social reality that make up and surround interventions. The realist reviewer should expect the same intervention to meet with both success and failure (and all points in between), when applied in different contexts”. As will be shown, given the state of evidence for built environment interventions and obesity and physical activity, the importance of context will be critical to the initial design of such interventions, given that there is little evidence from interventions. Nevertheless, there is a tautology that if the built environment does not permit it, then people will not engage in physical activity in that environment. A sensible first step in policy, therefore, is to make the environment walkable, and then identify the remaining factors that prevent inactive residents from engaging in physical activity, so that these can be addressed.

Complex interventions are open systems that feed back upon themselves

This final feature of complex interventions is important as it highlights the fact that the targets of interventions and the contexts in which they reside are not inert, they have voice and agency and can react back upon the interventions that change the original conditions for which the intervention was designed. As Pawson et al. (2005) put it, “As interventions are implemented, they change the conditions that made them work in the first place. Learning occurs that alters subsequent receptivity to interventions.” (p. 23). The implication of this is that those responsible for designing and implementing interventions must ensure that they have receptor capacity for feedback about the intervention and that elements of the intervention itself are dynamic and can be altered as a result of changing circumstances.

Limitations of Realist Reviews

Because realist reviews embrace complexity and seek to map out the operation of multiple theories in multiple contexts, they can easily grow quite large. A realist review, therefore, can only cover a limited amount of “territory”, necessitating that the outcomes that can be considered must be prioritized. In this report, one key outcome has been selected as the primary outcome of interest for interventions in the built environment, although it is acknowledged that there are a number of possible outcomes of interest and value, many of which lie outside the public health sector.

In addition to the limitations on scope that are possible, there are limitations to the nature and quality of information that can be retrieved. Most evaluation studies of complex social interventions are not done from a realist perspective and therefore important details for a realist review about the nature of the intervention and its context may be omitted. Other factors are considered ‘contaminants’ to the intervention in conventional evaluation and may therefore be omitted, whereas this is valuable information about implementation for the realist review (Pawson et al., 2005). In the case of this review on the built environment and physical activity, however, the chief limitation is a significant dearth of evidence from intervention or even longitudinal studies where participants move from less walkable environments to more walkable environments. Consequently, this review has little more than observational studies to draw upon, limiting the ability to make strong recommendations. The observational studies do provide important guidance for research that needs to be conducted in advance of implementing interventions in the built environment, however. To that end, the conclusions of this report include recommendations on a research agenda.

A third limitation on realist reviews is a limit on what can be delivered in the way of recommendations:

“Social interventions are so complex that there is little hope of reproducing them lock, stock and barrel and, even if one could, they are so context

sensitive that the ‘same’ assemblage may then go on to misfire. However, what one can do by way of planning in open systems is to gather vast experience of the options and possibilities and to figure out what kinds of things work for what kinds of subjects in what kinds of situations.” (Pawson et al., 2005, p21).

This kind of limited recommendation capacity may seem unsatisfying compared to the kind of apparent certainty in the outcomes of traditional systematic reviews of ‘best practice’ in the health sciences and other fields. Nevertheless, it is still preferable to decision-makers than adopting such a best practice, and implementing it to the highest standards of fidelity, without considering the context, and then having it fail for supposedly ‘inexplicable’ reasons. The latter scenario is both costly and in the longer term represents a significant setback in a policy area that may have promise but then becomes politically unsustainable because of initial ‘failure’ of a ‘best practice’.

3. Interventions in the Built Environment and Obesity – The Evidence

A number of supportive reviews of the relationship between the built environment and physical activity have been published in the last several years (Bray et al., 2005; Tucs and Dempster, 2007; Williams and Wright, 2007). By and large these are published by advocacy organizations that are concerned with environmental, land use, public health and sport and recreation organizations. The term ‘supportive review’ in this context refers to reviews that are intended to document all of the possible relationships between the built environment and public health, in order to gauge the potential for policy development and intervention. Such reviews generally do not emphasize the relative quality of individual studies, explicitly giving greater weight to higher quality studies, and they generally do not engage in an explicit analysis of the overall balance of evidence that is supportive, unsupportive and neutral with respect to the question of interest. Moreover, most of the supportive reviews in the literature are relatively vague about how the evidence informs the design of specific intervention strategies. Supportive reviews are important for stimulating new research, innovative policy directions and identifying knowledge gaps. For public health, urban planning, and land use decision-making, however, more critical reviews of the evidence are required.

An example of a supportive review is by Williams and Wright (2007), who write in their paper commissioned by the Simcoe Muskoka District Health, that

“The available empirical evidence shows an association between the built environment and physical activity but few studies have been conducted that demonstrate a causal relationship. One of the challenges is that most of the research has used cross-sectional studies correlating health indicators with land use design or transportation practices. Nevertheless, public health and local decision makers do not need to wait for better research designs to provide evidence of causation. Enough research has been conducted to indicate that changes in the built environment are necessary and that action is necessary now” (Williams and Wright, 2007).

This assessment of the evidence is an accurate one, and consistent with other reviews, although the recommendations of most other authors is more conservative. Indeed, Raine et al. (2008) recently published a review for the Canadian Population Health Initiative of the Canadian Institute for Health Information which comes to a similar conclusion about the state of the evidence, but does not suggest that the evidence (or lack thereof) points to the need for action.

Although a precautionary principle may indicate that there is a case for interventions in the built environment are warranted, we have even substantially less evidence (practically none, in fact) about *what kinds* of interventions might be effective, and essentially no evidence on *how interventions need to be modified to fit particular contexts* to be successful. This paper attempts to provide some preliminary guidance on the intervention options available based on their presumed mechanisms of action, and the kinds of contextual factors in designing and implementing such interventions. There are good indications that the built environment is *a factor* in physical activity and healthy body weights, but that other factors contribute to these outcomes must be taken into consideration about public policy decisions and program design in this area.

Major Emphases of the Built Environment and Physical Activity Literature

In their systematic review of the literature, Raine et al. (2008) found 89 studies with 228 findings that investigated the association between what they characterized as the ‘physical setting’ (which included built environment characteristics) and prevalence of obesity. Interestingly, nearly half of the studies they reviewed showed no significant association between the physical setting, as they called it, and obesity or healthy body weights. Of the studies that did show such an association (53%), were split almost evenly between a positive association (27%) and a negative association (25%).

Land use and street network characteristics

A little more than half of the physical setting findings (57%) in Raine et al.'s review (2008) were related to built environment characteristics such as intersection density, residential density and land-use mix, and most of these findings come from three studies (Hazuda et al., 1991; Giles-Corti and Donovan 2002a; Frank, et al. 2004). Raine, et al. found that some of the contradictory findings with respect to the built environment and obesity could be explained by mediating influences of ethnicity and gender. Frank et al. (2004), for example, found a significant association between built environment characteristics (land use mix, residential density, and intersection density) and obesity among Caucasians, but not among African-Americans.

Walkability and Availability of Facilities

Raine et al. (2008) uncovered 11 findings from 5 studies investigating the association between walkability / access to facilities and body weight. They characterized the evidence in this area as 'somewhat equivocal'. One important finding in this area, however, is the importance of *perceptions* of the local environment for attitudes and intentions towards physical activity – residents reported that lack of safe places for children to play was a barrier to physical activity, however, in other studies no association has been shown between child overweight and neighbourhood crime (or proximity to playgrounds for that matter). In addition to measuring overall characteristics of the land use pattern, for physical activity it is important to assess how a project or a plan provides access to parks, trails, recreational facilities and transit.

Urban Sprawl

At an aggregate level, there is evidence that indicators of urban sprawl at the area-level are associated with obesity / healthy body weights (Lopez et al., 2004). After controlling for

(area-level) indicators of gender, race/ethnicity, income and education, Lopez et al. (2004) found a positive and significant association between urban sprawl and obesity rates. Similar findings have been reported by Ewing et al. (2003) and Frank et al. (2004).

Demographics

Demographic factors – income, gender, age, and auto ownership, among others – are also strongly related to physical activity and body weights. It will be important to factor in demographics to the degree possible when evaluating physical activity impacts of development, particularly in the Peel Region, which has a high amount of new immigrants. However, caution is due when performing such work, as it is nearly impossible to predict how demographics could change given different development patterns.

Key Land Use Factors

Based on available evidence, the key factors in the built environment factors that are strongly and consistently associated with physical activity, walking or obesity outcomes include:

- residential density: the number of residential units per acre of land in residential use. The greater the residential density, the greater the walkability and the greater the physical activity in general;
- street network connectivity: the number of intersections per acre. This is preferable to measures such as block size or block length. Greater street network connectivity is associated with higher levels of physical activity;
- land use mix: is defined as the variety of land uses in a given area. It is an important measure of walkability and predictor of physical activity;
- characteristics of retail land uses: measures used here can include a simple count of the number of parcels zoned for retail in a defined geographic area as well as retail

site design. Higher retail density and smaller parking lots at retail site translates into higher walkability and physical activity levels in general;

- proximity to parks, recreational facilities & pathways: parks, recreational facilities and pathways within walking distance have been consistently correlated with physical activity, particularly in children and their proximity to residences is easily measured using Geographic Information Systems.
- proximity to transit: transit within walking distance of a person's residence not only impacts transit use, but walking and physical activity as well. It is an important factor in routine physical activity;
- presence of sidewalks: sidewalks have been directly linked to walking and physical activity in previous research. There is probably no better illustration of the tautological nature of the relationship between the built environment and physical activity: if there are no sidewalks, then it is highly unlikely that people will walk a great deal. On the other hand, if there are sidewalks, it does not necessarily follow that people will walk, as discussed earlier.

In general, the research shows an association between the built environment, sedentary vs. physically active transportation and physical activity more generally (Lopez, 2004). In addition to the association between urban form and active transport, urban form has been correlated with total amount of physical activity (King et al., 2003; Saelens et al., 2003b). Proximity to transit and parks and other destinations have also been found to be important factors in predicting physical activity. Despite these associations, there is little research that demonstrates a causal connection between urban form and physical activity (Transportation Review Board-Institute of Medicine). There is evidence that both preferences and the built environment impact the use of active transportation and physical activity (Frank et al., 2007).

4. Interventions in the Built Environment and Public Health: A Realist Synthesis

In this section, the tenets of the realist synthesis are used to examine the evidence on the effect of urban built form and healthy body weights. The review presupposes that the most important public health issue is physical activity. The review, therefore, considers the effects of the built environment on physical activity as a major contributor to public health. Specifically, the review question is:

Does moving to, and living in a more ‘walkable’ local built environment translate into greater physical activity and reduced obesity rates for residents?

To answer the question it is necessary to a) summarize the evidence on the relationship between the built environment and physical activity (see previous section), and b) construct a ‘theory map’ of the theories that are presupposed by any belief that there is a causal relationship between interventions in the built environment and physical activity. This latter step is the hallmark of the realist review.

In this section, the ‘theory map’ for the theories that underlie the belief that interventions in the built environment will improve physical activity is described. The theory map is limited to physical activity as an outcome because it is an order of magnitude more complicated to draw a theory map for the relationship between a built environment intervention and obesity. This, in part, is due to the fact that even at its simplest level obesity is the outcome of an energy imbalance (calories consumed / calories expended), and therefore a theory map of the built environment and nutrition would be required as well, and connections between these two maps would have to be elaborated. The causal relationship between the built environment and physical activity, in other words, is more direct and more practicable than the map between the built environment and obesity. To draw a theory map to include the other side of the energy balance equation would require one to consider other causal factors in the relationship nutritional patterns and obesity, including factors such as thyroid dysfunction, adrenal fatigue and cortisol dysregulation, factors affecting appetite, food additives, food toxins, etc.

The theory map for interventions in the built environment and physical activity appears in Figure 1. Arrows pointing to the right are theories that are consistent with the overall theory that interventions in the built environment can result in changes in physical activity patterns, while arrows pointing to the left are theories that contradict, or represent forces working against the overall theory concerning the potential of built environment interventions to increase physical activity.

Theory 1: Health Opportunity Structures affect behaviour

The basic theory underlying the potential for interventions is the notion that health behaviours are constrained and enabled by ‘health opportunity structures’. If there are no sidewalks, bike paths, transit stops, stores and offices in someone’s immediate residential environment, then they won’t walk, bike, or use active transportation to get to transit, to shop or to go to work. Calls to action identified in some current literature reviews are based on the unstated assumption that if the opportunity structures are altered, the behaviour will change. There is no *direct* evidence that this is the case, although there is some evidence that is suggestive that it may be an effective strategy, at least for some segments of the population, in some contexts, some of the time.

The ‘health opportunity structures’ theory was developed in the context of the West of Scotland Twenty-07 study in Glasgow. Since 1987, this study has used a variety of methods of systematic social observation to investigate systematic differences in health opportunity structures in two pairs of socially contrasting neighbourhoods in Glasgow, Scotland. The study seeks to understand, in a thick, detailed way, how local residential environments constrain some health behaviours and enable others. Some of the opportunity structures that have been investigated include the accessibility of healthy foods, the safety of streets for walking and exercise, the availability of parks and recreation centres, and the reputation of the community (Macintyre et al., 1993; Macintyre, Maciver, & Cummins, 2002). A similar stream of work has been undertaken by a group in Western Australia, who

have investigated how socio-economic differences in the propensity to exercise are mediated by characteristics of the local environment (availability of bike paths, sidewalks, safety, etc.) (Giles-Corti et al., 2003).

One of the attractive features of this theory has been its contrast from traditional voluntaristic models of behaviour, which assumed that undesirable health behaviour was the product of lack of knowledge and/or incorrect attitudes, which has often been demonstrated to be false. Moreover, traditional voluntaristic models can have counter-productive 'blame the victim' overtones, undermining their desired effects.

It's unlikely that supporters of built environment interventions to promote physical activity are so naïve as to think that this is the *only* factor that influences physical activity. Recent research suggests that factors such as gender, race/ethnicity, and socio-economic status are mediating factors in the relationship between the built environment and obesity (Giles-Corti and Donovan, 2003; Frank et al., 2007). These factors and others are considered in subsequent theories in the theory map.

Theory 2: If You Build It, They Will Come

The success any intervention based on the theory that new-build, walkable urban built environments will promote physical activity depends on people actually choosing to buy and renting homes in such developments and enjoy living in them. One of the arguments against compact, high-density, transit-oriented, 'walkable' urban design and land use that is commonly heard is that developers are just responding to market demand when they build developments consisting of single-family dwellings with low dwelling density, low mixed land use, and low street network connectivity.

While there is certainly still demand housing in the latter type of development, there also seems to be ample evidence that there is significant demand for housing in compact, high-density, transit-oriented, 'walkable' urban areas. In a recent paper, for example, Frank et al.

(2007), a survey of Atlanta households asked respondents to rate their desired neighbourhood type on a scale from 1 to 10 on seven different aspects of neighbourhood design. Analysis of this data compared people's desired neighbourhood type to the actual neighbourhood that they lived in, and it showed that there was a significant mismatch – fully 33% of the sample were living in significantly less walkable neighbourhoods than they wanted to be. This suggests that there would be a sizeable demand for housing in compact, high-density, transit-oriented, 'walkable' neighbourhoods.

In addition to this evidence, there is some indirect evidence of the desirability of housing in compact, high-density, transit-oriented, 'walkable' neighbourhoods, that comes from observing patterns of gentrification in Toronto in the past 30-40 years (Hulchanski, 2008). Housing in the compact, high-density, transit-oriented, 'walkable' is the most sought-after in the city as evidenced by the fact that the socio-economic status of such neighbourhoods has been rising rapidly along with house prices. This suggests, albeit indirectly, that there is a strong demand for such housing. Indeed, the demand may be so strong that unless such housing is supplied adequately, living in a walkable neighbourhood will be an exclusive privilege of the affluent.

This also raises a very important issue about selection factors and the importance of the association between physical activity and obesity. If compact, high-density, transit-oriented and walkable communities achieve the status of exclusivity then this could significantly undermine the potential of such interventions. There are two issues here. First, is the simple suspicion among many researchers in this field (which cannot be ruled out because of the observational, cross-sectional nature of the evidence base) that there are significant selection factors involved in the relationship between the built environment and obesity. People who enjoy physical activity for recreation, according to this logic, choose to live in compact, high-density, transit-oriented, 'walkable' neighbourhoods.

But another element of housing choice concerns household income and housing affordability. If compact, high-density, transit-oriented and walkable neighbourhoods become exclusive enclaves, for whatever reason, then this will significantly undermine the

potential public health impact of built environment interventions. The literature clearly shows that socio-economic status is the clearest and strongest predictor of obesity and in fact mediates the relationship between the built environment and obesity. In other words, housing affordability is the greatest problem in the groups at highest risk for obesity (Raine et al., 2008; Booth et al., 2005), so any initiative on the built environment and obesity must pay close attention to housing affordability issues.

Theory 3A & 3B: New residents of walkable communities will walk for leisure

This particular theory is broken into 2 parts to distinguish the change that would be expected when the same *individuals* move from an ‘unwalkable’ to a ‘walkable’ environment from the fact that the theories presented here would also suggest that physical activity would be greater in new *neighbourhoods* planned to be compact, high-density, transit-oriented, and walkable than in other neighbourhoods. These theories are also focused on physical activity for recreation, which is important to distinguish from physical activity for transportation. The determinants of recreational physical activity and active transportation are undoubtedly different, and decision-making must be attentive to the public health potential of both.

In short, the advent of interventions in the built environment intended to promote physical activity for recreation, which might include construction of sidewalks, bike paths, etc., presupposes that people will use such amenities if they are nearby. There is likely a significant proportion of the population for whom walking and biking are not desirable activities, or not something they are accustomed to scheduling into their time use patterns, so supports may be required. This is discussed in greater detail under Theory 8, but such supports may include social marketing or recreational programs.

Theory 4A and 4B: New residents of walkable communities will use active transportation

One hypothesis that is often advanced to explain differences in obesity rates between North Americans and people in European countries, for example, is that because of the nature of the urban form, automobiles are used less and in fact are less convenient, so that active transportation becomes a more common source of *routine* physical activity in such places. This is a highly plausible explanation and is a strategy that has great potential for designing interventions. In other words, if our cities and towns are designed so that transportation to school, work, for shopping and service utilization and trips from home for other purposes can be made as easily or nearly as easily using active methods of transportation (biking, walking or one of the two combined with public transit), then this should help to achieve goals related to the promotion of physical activity and the reduction of obesity.

One of the key findings of a little-known study (Wells and Bainbridge, 2004) emphasizes the importance of significant destinations in the relationship between built form and physical activity. In this quasi-experimental study, a group of participants in Habitat for Humanity in the southern United States were slated to re-locate to new, detached homes in one of two different suburban communities. One of the communities employed a traditional suburban design, with no sidewalks, lot widths of 60' to 100', street setbacks of 40' to 50', no front porches and no local park. Another group of participants was slated to move to a 'neo-traditional' designed community, with much narrower lots, much smaller street setbacks, sidewalks, a local park and front porches. The authors hypothesized that the participants who moved to the neo-traditional community would show greater increases in physical activity than the participants who moved to the traditional suburban community. Study participants were all African-American single mothers with incomes between \$12,000 and \$17,000 per year. Physical activity patterns were measured at baseline and at follow-up using accelerometers. On average, physical activity levels declined slightly in both groups, and there was no significant difference in changes in activity levels from baseline to follow-up between the two groups. The main explanation that was offered for this somewhat surprising finding was that both communities were new-build developments

at the periphery of a city and without significantly important destinations for routine physical activity, the relatively modest differences in urban design had no effect on the outcome. This finding is of particular importance for Peel Region, where new developments are likely to be located on the urban periphery in places where there are fewer significant destinations and less transit service than in more established areas.

Another important aspect of Theories 3 and 4, raised in part by the Wells and Bainbridge study is to mention is their relationship to one another (as indicated by diagonal arrows from 3B to 4A and 3A to 4B). These are meant to indicate that there is a potential for significant interaction between recreational and routine physical activity. A new resident of a compact, high-density, transit-oriented, 'walkable' neighbourhood may begin participating in active transportation and then, as a result, develop an interest in recreational physical activity. Similarly, a person attracted to a new neighbourhood with bike paths and hiking trails but which also has opportunities for active transportation may experience a synergistic effect between the two.

Theory 5: Determinants of physical activity are complex

As mentioned previously, it is naïve to think that removal of barriers to physical activity *alone* will be effective in promoting physical activity and reducing obesity. The factors that determine physical activity levels are complex, and include things such as time pressures (due to work, family and other commitments), perceptions of crime and safety, perceptions of distance and travel time by walking or biking, and highly complex compound trips (dropping more than one child at different schools on the way to work, for example).

Theory 6: (S)he who comes will have baggage

Under Theory 5 some of the more easily understood complexities are discussed, although they can be understood, that doesn't necessarily make them simple targets for intervention.

The more complex and less easily understood issues, however, are the effects of factors such as socio-economic status, education, and ethnicity and culture. As alluded to above, without careful consideration of the constraints imposed by low income, as just one example, interventions in the built environment may be less effective than they could be.

Of particular concern in the Canadian metropolitan context is the influence of ethnicity and culture. There are a number of studies from the U.S. that show that there is no association between the built environment and obesity among African Americans. There is probably no ethnic group in Canada comparable to African Americans, so there is no direct lesson that can be learned, but it does raise questions about whether the relationship between the built environment and obesity / physical activity is mediated by factor such as culture and ethnicity. Very little is known about culture- and ethnicity-specific physical activity patterns or about preferences for housing and neighbourhood type among new immigrants. Factors like housing and neighbourhood preferences may be significantly shaped by cultural norms around family relationships (e.g., 3-generation households) and constrained by income. It is essential that efforts be made to fill these knowledge gaps if interventions in the built environment are to be successful in promoting physical activity (and in the housing sales and retail leasing marketplaces).

Theory 7: (S)he who buys will have constraints and expectations...

...that are different from, and unanticipated by planners and program designers. This is a significant challenge related to the attribute of interventions described above, namely that implementation chains are complex and non-linear.

In other words, people will come to the new neighbourhood with unanticipated and not easily elicited motivations, attitudes, lifestyle patterns, cognitions, tastes, etc. that significantly affect their physical activity patterns and will significantly affect how their new built environment influences their physical activity patterns. Even the most painstaking advance research strategy will be unable to avoid such unanticipated problems,

but the intervention managers will have to adjust the main intervention to account for new information while the intervention is being implemented or in its early stages. Take perceptions of distance and time of travel, for example. Many people, especially those who are less active to begin with, significantly over-estimate distances and travel times for walking trips they are contemplating (Giles-Corti and Donovan, 2002b). Although this may be something that could be addressed by a social marketing program, to urge people to walk anyway because ‘it’s not as far as you think’, that introduces a supplementary intervention into the main one. Nevertheless, it is possible that for some sub-groups in some contexts, this will arise as a significant issue and such supports (and also including recreation programs, like walking groups, etc.) will be required.

5. Conclusions and Needs for Further Research

There are a number of literature reviews that have been published in the last few years that suggest there is strong potential for interventions in the built environment as a means to increase physical activity. Indeed, at one level, this is a tautology; if the built environment inhibits physical activity in urban neighbourhoods, then the removal of barriers would clearly represent potential for interventions in the built environment.

Built environment interventions, however, are highly unlikely to be a panacea for remedying low levels of physical activity, since the determinants of physical activity are much more complex and the relative effectiveness of built environment will likely vary from person to person and place to place. This is one of the important insights of the realist perspective, namely, that mechanism + context = outcome. The outcome of an intervention, in other words, is the sum of the mechanism of action of that intervention (in this case, removing barriers to and creating opportunities for, physical activity) and the context (in this case, the people and firms that comprise the potential market for housing and commercial land / space in new developments to promote physical activity, as well as the geographic context – proximity to rapid transit, major destinations, employers, and the walkability of neighbouring regions. All of this means that a significant amount of further research is required to understand the activity patterns of various population sub-groups who differ by age, gender, ethnicity, socio-economic status, (dis)ability, labour force participation, civic engagement, etc. and some careful thought will have to be devoted to how to provide It is necessary to compile as much information as possible to provide at least a preliminary answer to the question ‘what works, for whom and under what conditions?’.

One of the concepts with the greatest potential for realizing gains in physical activity is the notion of increasing *routine* physical activity. This means constructing urban areas in a way that makes active transportation to transit stops, workplaces, services, commercial areas, recreational opportunities and other common land uses a means of transport that is highly

desirable, if not unavoidable. There is a large literature on transit-oriented design which, for example, gives excellent illustrations of the kinds of urban forms possible.

Even under the best of circumstances, however, modifications to the built environment will probably not achieve their goals without additional support for residents. While on the one hand, some people who enjoy active transportation and walking will seek to live in urban environments that enable walking, there is a large segment of the population who whom simply moving to a walkable area will not have an appreciable impact on their physical activity levels. Among this group, some will increase their physical activity more readily than others, although it is impossible to know how these people will be distributed along the spectrum from changeable with relative ease to changeable with difficulty (or even unchangeable). In order to maximize the potential of interventions of the built environment, it would be necessary to determine what factors influence people's physical activity levels when they live in highly walkable areas and design programming to support the adoption of new behaviours that can appeal to individuals across a wide spectrum of readiness for change.

One of the key issues that the design of an intervention in the built environment to increase physical activity (and attendant programming) will have to consider are the differences between routine and recreational physical activity. For some people, recreational physical activity opportunities will be the most important attraction, while for others it will be the opportunities for routine physical activity, or active transport.

This paper has avoided any analysis of the relationship between the built environment and its potential for reducing obesity and / or diabetes. The reason for this, on the one hand, is that if there is any potential for interventions in the built environment and the reduction of obesity and diabetes, the causal pathway necessarily runs (at least partly) through physical activity; in other words, there is no causal pathway directly from the built environment to obesity or diabetes. In addition, the factors that contribute to obesity and diabetes are complex and multi-factorial and go far beyond just physical activity.

Although there is good evidence from observational studies linking the built environment to health, and especially physical activity, there is little or no evidence from intervention studies. This does not necessarily imply that action is unwarranted. There are a wide range of extremely credible reasons for building cities with more compact, walkable urban form, including reducing air pollution, land conservation, and possibly benefits to social interaction. These are all extremely important policy goals and there is no doubt that the environmental objectives can be achieved. In order to set reasonable expectations for the effects of built environment interventions on health, however, it is necessary to focus on an outcome that has a direct link to the built environment (physical activity). Moreover, as this paper has emphasized, it is necessary to design and evaluate interventions recognizing that they are complex interventions being imposed on a complex social reality. The outcome of such interventions, therefore, will be a result of the operation of the mechanisms of the intervention (creating opportunity structures for physical activity) and the context into which it is being inserted (which includes personal factors in the target population and social contextual factors like the surrounding urban areas, commuting patterns, time pressures, etc.). Despite this complexity, the effort is a very worthwhile one.

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Figure 1: Theory Map for Built Environment & Physical Activity

