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Effects of a new walking and cycling route on leisure-time physical activity of Brazilian adults: A longitudinal quasi-experiment

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ABSTRACT

The primary aim of this study was to evaluate the effects of a new walking and cycling route on leisure-time physical activity (PA) (walking and moderate-to-vigorous PA) of adults. Furthermore, we also investigated the use, intention to use and barriers to use the new route for leisure-time PA. A longitudinal quasi-experiment was carried out. Three exposure groups were defined, based on the distance from home to the new route: 0–500 m, 501–1000 m and 1001–1500 m. Telephone-based interviews were carried out in 2009 and 2012. Those living around the new walking and cycling route increased their leisure-time walking by 15 min/week on average. Those residing up to 500 m from the route increased leisure-time walking by 30 min/week and walking plus moderate-to-vigorous PA by 50 min/week. The proportion of people who started walking or practicing moderate-to-vigorous PA during leisure time and who reported intention to use the new route was higher among those living closer to it. Perceived distance was the most prevalent barrier to use the new route.

1. Introduction

Changes in the built environment have the potential to increase opportunities and remove barriers to upturn population physical activity (PA) levels, and may have an important role in achieving sustainable behavior change and public health impact (Hoehner et al., 2005; Beale et al., 2012; Cerin et al., 2014; Franco et al., 2015). However, understanding the effects of those changes on PA levels is still challenging.

Most evidence on the relationship between built environment and PA comes from observational studies (McCormack and Shiell, 2011; Mayne et al., 2015; Van Holle et al., 2012), which allow the assessment of correlations between environmental features and outcomes, but have limitations to investigate the long-term consequences of changes in built infrastructure on people's behavior. Natural experiments and longitudinal quasi-experiments can help to overcome some of those limitations, improving causal inference (Craig et al., 2012).

Natural experiments can be defined as “natural circumstances in which subsets of the population have different levels of exposure to a supposed causal factor in a situation resembling an actual experiment. […] The presence of persons in a particular group is typically non-random; yet for a natural experiment, it suffices that their presence is independent of (unrelated to) potential confounders” (Porta, 2008). However, in a real policy setting it is difficult to guarantee the latter condition, because the intervention, such as a new or refurbished facility, can be delivered where people advocate strongly for it or where there is a clear unmeet demand. These are still very interesting opportunities to

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obtain evidence, although it is more adequate to denominate these studies as longitudinal quasi-experiments instead of natural experiments.

Mayne et al. (2015) pointed out that most studies considered as natural experiments and longitudinal quasi-experiments on PA actually used less robust designs, such as case-only or repeated cross-sectional with comparison group studies. This can undermine the confidence of the results. For example, results from repeated cross-sectional studies may be positively biased by residential self-selection, and effect size estimates from case-only studies can be uncertain because they lack a counterfactual reference (Mayne et al., 2015). found just three studies that used a within-person longitudinal design with comparison group, which allows better causal inference, among the 17 studies on PA included in their review. Two of those studies were carried out in adults. One found positive (West and Shores, 2011) and the other null (MacDonald et al., 2010) influence of the built environment on PA.

Some natural experiments and longitudinal quasi-experiments suggested a positive influence of constructing or changing built environment features – such as walking and cycling routes, places for physically active recreation and increasing streets connectivity – on leisure-time and transport-related PA (Giles-Corti et al., 2013; Gustat et al., 2012; Parker et al., 2013; Goodman et al., 2014). Besides, people living nearer walking and cycling routes may experience higher increases in PA level in the long-term (Goodman et al., 2014; Goodman et al., 2013). However, results are not consistent and some studies did not find evidence of significant increase in population PA practice (West and Shores, 2011; Goodman et al., 2013; Evenson et al., 2005) or a stronger effect of living closer to the new infrastructure, at least in the short-term (around one year time) (West and Shores 2011; Goodman et al., 2014; West and Shores 2015). These inconsistencies reflect the large heterogeneity among studies. For example, Mayne et al. (2015) identified that most studies with positive effects had follow-up periods larger than six months. Null or mixed results were found in studies with small samples. In general, assessment was made via a combination of self-report and systematic observation methods. Most studies reported the amount of people engaging in PA in a new or refurbished facility, but only about half reported PA levels, and these studies had the most heterogeneous result. The type of intervention also varies, ranging from improving a greenspace area to building a new cycling lane.

Finally, barriers and reasons that prevent people from using the new PA infrastructures are still a poorly explored topic on previous studies. Cross-sectional epidemiological studies conducted in Brazil suggest that intrapersonal barriers, such as lack of time, feeling too tired and disliking exercising (Reichert et al., 2007; Silva et al., 2016), as well as aspects of the perceived environment, like distance to PA facilities and safety (Florindo et al., 2009; Florindo et al., 2011), may be important elements during the individual decision-making process towards using new PA infrastructures and, ultimately, to the reach and success of the intervention.

Therefore, our primary aim was to evaluate the effects of a new walking and cycling route in Florianópolis, Brazil, on leisure-time PA (walking and moderate-to-vigorous PA) of adults residing nearby the route, using within-person longitudinal design with comparison group. Secondly, we investigated the use and intention of using the route for leisure-time PA, as well as the main reasons for not using it.

2. Method

2.1. Overview

In July 2010, a new walking and cycling route (2.3 km long) was inaugurated in the continental coast of Florianópolis, SC, Brazil, in order to improve the infrastructure for transportation and leisure-time PA in that region. To test the impact of this new route on PA, a longitudinal quasi-experiment was carried out. Three exposure groups were defined, based on the distance from people's residence to the new route, and a sample of adults living in those regions were evaluated 12–16 months before and 20–29 months after the new route was available to the public.

2.2. Intervention and context

The project was entirely planned and executed by the public sector of Florianópolis, primarily to reduce and organize the traffic on a specific region of the continental coast, which is a predominantly middle-income and mixed-use (commercial and residential) area with heavy traffic. The project included a new avenue, parking lots, and an on-road walking and cycling route, all along the seashore. Fig. S1 (supplementary material) shows the area where the new facilities were built, called Beira-Mara Continental (2.3 km long). A new project exists to add 8.3 km to the Beira-Mar Continental and to connect it with the main road of the city (BR 101), but this is still being planned.

Despite the main goal being to facilitate commuting, the walking and cycling route is mostly used for leisure-related activities at the moment. One reason is the current lack of connection of the route with other walking trails and cycling lanes of the city, hindering its use for commuting. Secondly, the community of that region was in need of an adequate, safe and free place to practice leisure-time PA. Until then, the options were mostly the neighborhoods' streets and sidewalks (that were dangerous because of the heavy traffic), few plazas and schools, and paid clubs and gyms. The new walking and cycling route brought a pleasant and safe place to practice leisure-time PA, alongside the shore.

2.3. Sampling and data collection processes

Six neighborhoods (Jardim Atlântico, Estreito, Capoeiras, Canto, Coloninha and Balneário) were within 1500 m from the new route, the area defined for this study, encompassing around 55.7 thousand residents in 2009. Brazilian Institute of Geography and Statistics (2010) The required sample size was calculated using the following parameters: 75% of adults not practicing at least 150 min/week of leisure-time PA, confidence interval of 95% and 3.3 percentage points of sampling error. The required sample size (656) was increased by 10% to account for losses and refusals, and then by 15% to allow controlling for confounding factors in multivariable analysis. Therefore, the required sample size was 820.

Systematic sampling was used to select households, based on the list of landlines of all streets within the study area at baseline ($n=7630$). Telephones from companies, those that were out of service or with no response after 10 calls made in different days and hours were non-eligible. The first adult (aged ≥ 18 years) of each selected household who answered the telephone call was invited to participate in the study. Participants were excluded if they met any of the following criteria: non-permanent resident in the house, planning to move from the neighborhood in a one-year period, current pregnancy, and being unable to practice PA due to health issues.

Telephone-based interviews were carried out by one trained interviewer between March and July in 2009 (baseline), and between March and December in 2012 (follow-up). Each participant