Health & Place 33 (2015) 132–141

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

Changes in the perceived neighborhood environment in relation to changes in physical activity: A longitudinal study from childhood into adolescence

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ARTICLE INFO

Article history:
Received 13 November 2014
Received in revised form
23 February 2015
Accepted 4 March 2015
Available online 2 April 2015

Keywords:
Child
Adolescent
Neighborhood
Environment
Changes

ABSTRACT

The aim was to investigate how physical activity and the perceived neighborhood environment in children change when they enter adolescence. Also the relation between changes in the perceived environment and changes in children's physical activity was investigated. In total, 321 children and one of their parents filled out a physical activity questionnaire and the NEWS-Y at two time points (last grade of elementary school and 2 years later). Children also wore an activity monitor. Changes in children's physical activity were dependent on the physical activity domain. Only less than half of children's perceived neighborhood factors changed and about half of the parental perceived neighborhood factors changed. Most of these factors changed towards higher activity friendliness. Changes in the perceived environment were only limitedly related to changes in children's physical activity.

1. Background

Physical activity (PA) is associated with numerous health benefits (Janssen and Leblanc, 2010). Nonetheless overall PA in youth decreases during the transition from childhood into adolescence and fewer children achieve the public health recommendations of 60 minutes moderate- to vigorous-intensity physical activity (MVPA) per day when they enter adolescence (Nader et al., 2008; Riddoch et al., 2004).

While overall PA levels decline from childhood into adolescence (Nader et al., 2008; Riddoch et al., 2004), the changes in PA seem to be dependent on the domain of PA. For example, previous longitudinal studies pointed out that children participate in a smaller proportion of active play (Bringolf-Isler et al., 2009) and less after school MVPA (Jago et al., 2012a) when they grow older. On the other hand, the use of active transportation (Cardon et al., 2012) increases during the transition from childhood into adolescence. Furthermore, some studies found that sport participation increased when children entered adolescence (Bringolf-Isler et al., 2009), whereas other studies found decreases in sport participation (Telama and Yang, 2000; Brettschneider and Naul, 2007; Nuviala Nuviala et al., 2012). Different studies have shown that these changes in PA are more apparent in boys than in girls (Carver et al., 2009; Inchley et al., 2008; Jago et al., 2012b) and this could be due to a floor effect (i.e. lower PA rates at younger ages have less opportunity for decreasing). These findings highlight the importance of identifying determinants of PA changes in different PA domains, in order to develop effective interventions to increase specific PA behaviors, and consequently increase total PA.

During the past decades there has been an increased interest in ecological models of health behaviors in health promotion research. The theoretical perspectives of ecological models emphasize the fact that a person's behavior is not only affected by individual characteristics, but also by the environment in which he or she lives (Sallis et al., 2008). Recently, the relation between the neighborhood environment and children's and adolescents' PA levels has gained increasing attention. In a recent review it was found that the environment related differently to adolescents' and children's PA (Ding et al., 2011): among children, walkability, access/proximity to recreation facilities, land-use mix, and residential density were positively related to their PA levels and traffic speed/volume was negatively related to their PA levels. In adolescents, land-use mix and residential density were positively related to PA. However, the major limitation of most studies included in this review was their cross-sectional design. Therefore,

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http://dx.doi.org/10.1016/j.healthplace.2015.03.004
1353-8292/

there is a need for longitudinal studies in this research domain (Carver et al., 2008; Ding et al., 2011). Longitudinal studies have the potential to investigate if changes in physical environmental factors are related to PA changes over time, within the same subjects.

Perceived and objective measures of neighborhood environmental characteristics are found to have poor agreement (Kirtland et al., 2003; McGinn et al., 2007) and people living in the same objective neighborhood may have different perceptions of the same environmental characteristics. In a German study it was found that a lower exposure to the neighborhood was related to a less favorable perception of the neighborhood towards PA, so it was assumed that when people increased their exposure to the neighborhood, their perception of the neighborhood changed (Wallmann et al., 2012). When children enter adolescence, their independent mobility (i.e. the ability of children to walk or cycle around their neighborhood without adult accompaniment) increases (Prezza et al., 2001) and consequently this may lead to an increased exposure to their neighborhood. As a consequence, it is expected that perceptions of the neighborhood change when children enter adolescence, even when children continue to live in the same neighborhood. It is hypothesized that children's perception of their neighborhood changes from less favorable to more favorable for PA, as they probably become more aware of the advantages and characteristics of their neighborhood. For example, it is expected that their neighborhood is perceived less dangerous from traffic in adolescence compared to childhood, as during adolescence individuals have better motor skills and traffic awareness skills to walk and cycle around in their neighborhood.

Assuming that neighborhood environmental perceptions change over time, it can be assumed that these changes in neighborhood perceptions are related to the changes in the different domains of children's PA that occur when they enter adolescence. To our knowledge, this relationship has not yet been investigated in children. An Australian 10-week follow-up study revealed that men who rated their environment as more aesthetically pleasing at follow-up compared to baseline, were twice as likely to increase their walking frequency (Humpel et al., 2004). An increase in the score of walking convenience at follow-up was related to higher walking levels in men and women (Humpel et al., 2004). Consequently, when children's perception of their neighborhood changes into a more favorable perception of their neighborhood towards PA, it is expected that this may be beneficial for children's PA levels when they enter adolescence.

Furthermore, because parents are often seen as the main decision makers for their children (Panter et al., 2008) and parents play an important role in determining children's PA (Crawford et al., 2010; Edwardson and Gorely, 2010), not only children's own perception of neighborhood environmental characteristics, but also their parents' perception of these characteristics, need attention within this field of research.

To our knowledge, no previous studies have investigated if changes in the perceived neighborhood environment were related to changes in different PA domains when children enter adolescence. Insight into the relation between changes in the perceived neighborhood environment and changes in PA is currently lacking, but is very important in order to develop effective interventions to increase PA in youth. If participants whose neighborhood perceptions become more positive over time also increase their PA, it may be a valuable strategy to focus on these changes in future interventions: in that case, making children and their parents more aware of the benefits of their neighborhood may increase their PA. Therefore, the aim of this study was threefold. First, this study aimed to investigate how different domains of PA change when children make the transition from elementary school (11–12 years) to secondary school (13–14 years). This time period was chosen as this can be seen as a major life event and an experience that greatly influences a child's daily routine. Changes in self-reported active transportation to and from school, walking for transport during leisure time, cycling for transport during leisure time, sport during leisure time and total daily step counts were examined. A second aim was to examine how children's perceptions as well as parental perceptions of neighborhood environmental characteristics change if children continue to live in the same neighborhood as they make the transition into adolescence. Because many children change schools when they enter adolescence and children's high schools are usually located further away from their home compared to their elementary school, it is likely that children's independent mobility increases when they make the transition from elementary school to high school. This increase in independent mobility may induce a change in neighborhood perceptions by children and their parents. It was hypothesized that children's perception of their neighborhood would change into a more favorable neighborhood perception towards PA, due to a higher exposure to their neighborhood (Wallmann et al., 2012). The third and last aim of this study was to investigate if changes in children's and parental perceptions of neighborhood environmental characteristics were related to changes in PA when children enter adolescence. It was hypothesized that a more favorable perception of the neighborhood during adolescence compared to childhood would be related to more favorable PA levels. Furthermore, because the neighborhood environment relates differently to different domains of PA (Carver et al., 2009) it was hypothesized that correlates of changes in PA would be domain-specific. For example, it is likely that the change in the perception of recreation facilities is positively related to the change in sports during leisure time, but is unrelated to change in active transportation to school.

All changes are investigated separately for boys and girls, as in previous studies it has been shown that environmental correlates of boys' and girls' PA might differ (Carver et al., 2009; Hume et al., 2007; Page et al., 2010; Sallis et al., 2000; Timperio et al., 2004; Trapp et al., 2011).

2. Methods

2.1. Participants and procedure

Baseline measurements of this longitudinal study took place during the school year 2009–2010, follow-up measurements took place two years later, during the school year 2011–2012.

At baseline, 148 elementary schools were randomly selected in East- and West-Flanders, and contacted by phone. Forty-four principals agreed to participate in the study (response rate=29.7%). In each participating school, 1 class from the 6th grade (age 11–12 year) was randomly selected and children (n=976) and their parents were invited to participate in the study. In total, the parents of 749 children agreed to let their child participate in the study (response rate =76.7%).

A research assistant visited each class. The children involved in the study and present at the time of the visit (n=736, 98.3%) were asked to complete a questionnaire under the supervision of the research assistant. All participating children were also asked to wear an activity monitor for 7 consecutive days: 297 children (40.4%) received an accelerometer (Actigraph GT1M), due to the limited availability of accelerometers, 439 children (59.6%) received a pedometer (Yamax Digi-walker CW-701). The research assistant explained the use of the activity monitor and the non-wear time activity diary that accompanied the activity monitor in the class. At the end of the visit, every child was given a questionnaire to be completed by one of the parents at home. To be able to recontact the children two years later, the parents were asked to provide three different phone numbers.

Two years after the baseline measurements, the children and parents (n=736) who participated in the first phase of the study