Subgroups of adolescents differing in physical and social environmental preferences towards cycling for transport: A latent class analysis

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ABSTRACT

In order to be able to tailor environmental interventions to adolescents at risk for low levels of physical activity, the aim of the present study is to identify subgroups of adolescents with different physical and social environmental preferences towards cycling for transport and to determine differences in individual characteristics between these subgroups.

In this experimental study, 882 adolescents (12–16 years) completed 15 choice tasks with manipulated photographs. Participants chose between two possible routes to cycle to a friend's house which differed in seven physical micro-environmental factors, cycling distance and co-participation in cycling (i.e. cycling alone or with a friend). Latent class analysis was performed. Data were collected from March till October 2016 across Flanders (Belgium).

Three subgroups could be identified. Subgroup 1 attached most importance to separation of the cycle path and safety-related aspects. Subgroup 2 attached most importance to being able to cycle together with a friend and had the highest percentage of regular cyclists. In subgroup 3, the importance of cycling distance clearly stood out. This subgroup included the lowest percentage of regular cyclists.

Results showed that in order to stimulate the least regular cyclists, and thus also the subgroup most at risk for low levels of active transport, cycling distances should be as short as possible. In general, results showed that providing well-separated cycle paths which enable adolescents to cycle side by side and introducing shortcuts for cyclists may encourage different subgroups of adolescents to cycle for transport without discouraging other subgroups.

1. Background

According to ecological models, physical activity behaviours such as cycling for transport are determined by individual characteristics (e.g. gender, self-efficacy) as well as by the surrounding physical and social environment (Sallis et al., 2006). The physical environment can be divided into macro- and micro-environmental characteristics (Sallis et al., 2011). Macro-environmental characteristics (e.g. residential density, street connectivity) determine the distance one has to cycle to reach daily destinations which has been found to be a consistent correlate of street connectivity) determine the distance one has to cycle to reach daily destinations which has been found to be a consistent correlate of...
environmental factors (e.g., cycling together with a friend) among adolescents (Carver et al., 2005; Emond and Handy, 2012; Hohepa et al., 2007; Verhoeven et al., 2016). Emond and Handy (2012) indicated that in environments which support cycling for transport, social environmental factors may play a main role regarding adolescents’ cycling levels.

Since cross-sectional study designs in order to identify correlates of cycling for transport involve some methodological weaknesses, experimental studies are encouraged. Natural experiments are needed to identify causal associations between environmental characteristics and cycling for transport (Bauman et al., 2002; King et al., 2002), but introducing structural changes to real environments is very expensive and time-consuming. There is also a potential risk for introducing environmental changes that decrease cycling levels. In order to inform local authorities on which environmental changes should get priority, an experimental methodology using manipulated photographs has been developed. This method allowed us to simulate environmental changes under controlled conditions, relatively quickly and with minimal resources. Manipulated photographs were successfully used in a large-scale study that aimed to determine the relative importance of seven physical micro-environmental factors, cycling distance and co-participation in cycling for adolescents’ preferred situation to cycle to a friend’s house (Verhoeven et al., 2017). This study revealed that priority should be given to the provision of cycle paths that are well-separated from motorised traffic when aiming to promote cycling for transport among adolescents. It was confirmed that cycling distance and co-participation in cycling of friends are important factors for adolescents’ cycling for transport.

In order to be able to introduce environmental changes tailored to adolescent subgroups, especially those at risk for low levels of active transport, it is important to identify subgroups with different physical and social environmental preferences towards cycling for transport based on individual characteristics. In addition, identifying subgroups may be important to avoid unintended negative effects in subgroups of the adolescent population as Sallis et al. (2011) suggested that subgroups within a population may respond differently to environmental changes. Therefore, the aim of the present study is to identify subgroups of adolescents with different physical and social environmental preferences towards cycling for transport and to determine differences in individual characteristics between these subgroups.

## 2. Methods

### 2.1. Protocol and participants

Recruitment of adolescents (12–16 years) was done via randomly selected secondary schools across Flanders (n = 103). In each participating school (n = 12), at least one class was randomly selected to participate by the principal or a staff member. This resulted in 1078 adolescents who were invited to complete a structured online questionnaire. Prior to completion of the questionnaire, passive informed consent was obtained from adolescents’ parents. If parents did not agree to let their child participate, they had to sign a form. Furthermore, researchers also obtained active informed consent of adolescents. Eventually, a total of 1013 adolescents participated in the study (response rate = 94.0%) which was conducted at school under supervision of a researcher. School visits were conducted from March till October 2016. The study protocol was approved by the Ethics Committee of the
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