



## Research Paper

# Environmental influences on older adults' transportation cycling experiences: A study using bike-along interviews



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## ABSTRACT

Cycling for transport offers an opportunity to promote active and sustainable mobility among the growing population of older adults. However, only a few studies examined how environmental factors may promote cycling for transport among older adults. Purposeful convenience sampling was used to recruit 40 older adults in Flanders, Belgium. Researchers and participants made a cycle trip, during which bike-along interviews were used to obtain in-depth and context-sensitive information about the environmental factors influencing their perceptions and experiences, which were analysed using inductive content analysis.

A model including seven environmental themes emerged; traffic safety, cycling infrastructure, road design & maintenance, connectivity, aesthetics, hilliness and weather. Traffic safety appeared to be the most important concern. Participants felt safer where cycling tracks were well-separated from motorized traffic and where clearly demarcated crossings were present. They expressed preferences for cycling tracks being wide, obstacle-free, even and well-separated from the sidewalk; and, for a well-connected street network that provided alternative routes to reach destinations.

Our findings suggest that traffic safety may have a major influence on older adults' transportation cycling experiences and that the provision of a well-separated cycling space may be crucial in that context. Further research studies with larger, more-representative, samples and using quantitative methods are needed to examine the mechanisms proposed in our inductively-derived model.

## 1. Introduction

Given its potential to reduce carbon emissions and traffic congestion, the promotion of cycling for transport is included in several national and international policy documents (Austroads, 2010; Biton, Daddio, & Andrew, 2014; European Parliament, 2010; Thiry, 2011). Furthermore, from a health perspective, cycling for transport offers an opportunity to integrate physical activity into the daily lives of the growing, but insufficiently physically active, population of older adults ( $\geq 65$  years) in many countries (Centers for Disease Control and Prevention, 2013; Chodzko-Zajko et al., 2009; Eurobarometer, 2010; Sallis, Frank, Saelens, & Kraft, 2004). While walking requires a lower level of physical fitness, which makes it a feasible form of transport for

most older adults, cycling enables greater distances to be covered and may increase older adults' action radius (Mandl et al., 2012). Older adults may cycle for transportation (to reach a destination such as a shop, service, friend's house) as well as for recreational purposes (cycling for pleasure, health or sports without the purpose of reaching a specific destination). In the current study we focused on cycling for transport (Sallis et al., 2006). Despite the benefits of cycling for transport, its share of trips among older adults is low and ranges from 0.5% in the USA to 23% in the Netherlands (Buehler and Pucher, 2012; Pucher, Buehler, & Seinen, 2011). Among Flemish (Belgian) older adults, cycling accounts for 17.5% of the kilometres travelled per day (Janssens, Declercq, & Wets, 2013) and 23.7% reported cycling for transport almost daily (Van Cauwenberg, Clarys et al., 2012). While

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these proportions are relatively high in comparison to other countries, 47.5% of all trips shorter than 3 km travelled by Flemish older adults are done by private motorized transport (Janssens et al., 2013). This highlights the scope for promotion of cycling for transport among Flemish older adults (which is the target population of the current study).

To promote cycling for transport among older adults, supportive physical environments should be provided (Sallis et al., 2006). The physical environment may be characterised as the objective and perceived attributes of the context in which people spend their time (e.g. home, neighborhood), including elements of urban design (e.g. presence of cycling paths), traffic density and speed, distance to and design of venues for physical activity (e.g. parks), crime, safety and weather conditions (Davison and Lawson, 2006). Understanding the physical environmental factors influencing older adults' cycling for transport requires a behaviour- and purpose-specific approach; environmental factors important for transportation walking or recreational cycling may differ from those that are important for transportation cycling (Sallis et al., 2006). For example, distance to shops and services may be important to stimulate transportation cycling, while this may be irrelevant for recreational cycling. Likewise, the presence of aesthetically pleasing scenery may be an important facilitator of recreational cycling but may be of less relevance to transportation cycling. A literature review focusing on the environmental determinants of frequency and volume of transportation cycling among European adults reported consistent positive relationships for neighborhood walkability (an index composed of residential density, street connectivity and land use mix diversity), access to destinations and urbanization (Van Holle et al., 2012). Additionally, traffic-related safety was found to be consistently unrelated to adults' frequency and volume of transportation cycling. This may be explained by adults generally preferring to cycle in safer streets, but some cycling destinations may be located in areas that have both higher levels of bicycling and are more risky because of higher motor-traffic levels. Therefore, some may find it necessary to cycle in such environments to reach their desired destinations. Inconsistent results were reported for presence and quality of cycling facilities, crime-related safety, aesthetics and hilliness.

Other international reviews concluded that cyclists have a strong preference for physically separated bike paths or lanes over cycling in roadways with motorized traffic, especially when traffic is busy and fast (Buehler and Dill, 2016; Fraser and Lock, 2011; Handy, Van Wee, & Kroesen, 2014). Furthermore, intersections were found to have adverse relationships with objective or perceived safety and route choice, but these may, for example, be overcome by the provision of traffic signalling. It was also concluded that there is need for more research to identify particular elements of cycling infrastructure (e.g. pavement characteristics, signalling near intersections) that may influence cycling experiences (Buehler and Dill, 2016). Given age-related decreases in functional capacity, older adults may be particularly sensitive to such specific characteristics of cycling infrastructure.

Age-related functional and sensory impairments may compromise older adults' cycling abilities (Spiriduso, Francis, & MacRae, 2005). Therefore, older adults' cycling for transport may be more susceptible to certain environmental barriers (e.g. uneven cycling tracks, complex traffic situations, hilly terrain) compared to younger populations (Wahl and Lang, 2003). Consequently, relationships between environmental factors and frequency and volume of cycling for transport can be anticipated to be stronger among older adults compared to younger populations. Furthermore, environmental factors that are irrelevant for those who are younger may be important for older adults' cycling for transport. For example, among Belgian young adults a study using focus group interviews reported travel time to be a major determinant of mode choice while safety issues were only of minor concern (Simons et al., 2014). On the other hand, safety plays a major role in older adults' mobility decisions according to a recent systematic review (Yen, Flood, Thompson, Anderson, & Wong, 2014). Therefore, it is crucial not

to rely solely on research conducted in younger populations and to generalize these findings to older adults. However, a recent systematic review and meta-analysis retrieved only two studies that have previously examined the environmental factors related to frequency or volume of cycling for transport specifically among older adults (Cerin, Nathan, Van Cauwenberg, Barnett, & Barnett, 2017). Both studies were conducted in Flanders (Belgium) (Van Cauwenberg, Clarys et al., 2012; Van Holle et al., 2014). The first study showed good perceived access to daily destinations (shops, services and public transport) to be related to higher odds of daily cycling for transport. Perceived safety from crime and presence of street lighting was related to higher odds of daily cycling for transport among women, but not among men. However, unexpectedly, the perceived presence of litter and noise and lower levels of perceived traffic safety were unrelated to higher odds of daily cycling for transport (Van Cauwenberg, Clarys et al., 2012a). These unexpected findings may be explained by cycling destinations (i.e. shops and services) being located in areas that have higher levels of human activity and motorized traffic levels, which may coincide with higher levels of litter and noise and lower levels of traffic safety. Some older adults may find it necessary to cycle in such environments to reach their desired destinations. The second study showed objectively-measured neighborhood walkability to be unrelated to volume of cycling for transport (Van Holle et al., 2014).

Two US studies have examined the physical environmental correlates of active transport (including walking and cycling) among older adults (Cain et al., 2014; King et al., 2011). They observed higher levels of objectively-measured neighborhood walkability, residential density, presence of shops, restaurants, services, aesthetics, curb quality and intersection control and lower levels of impediments to be related to higher levels of physically-active transport. Other studies among older adults have examined environmental influences on total cycling (including cycling for transport and for recreation). In a sample of Chinese rural older adults, Zhang, Yang, Li, Liu, and Li (2014) found higher population density, land use mix and bike lane density to be related to higher frequency and duration of total cycling. In a mixed methods study among Canadian older adults, Winters, Sims-Gould, Franke, and McKay, (2015) concluded that total cycling was facilitated by supportive cycling infrastructure and hindered by low levels of safety, including the presence of motor vehicle traffic, other cyclists' behaviours and theft. Among Australian older adults who were attending a cycling skills course, the primary barrier for total cycling was fear of cars and riding on streets amongst motorized traffic (Zander, Passmore, Mason, & Rissel, 2013).

To summarize, only a limited number of studies have examined the relationships between physical environmental factors and older adults' cycling. Most have combined either transportation walking and cycling or transportation and recreational cycling into one outcome measure. Only two studies, both conducted in Flanders (Belgium), have examined specifically the physical environmental correlates of transportation cycling among older adults. Therefore, it can be concluded that there is limited information for policy makers and planners about how to (re) design streets and neighbourhoods such that cycling for transport among older adults is stimulated most effectively. Further research examining the physical environmental factors that influence older adults' cycling for transport is needed. Given the limited evidence base, qualitative research could be useful to explore not only which, but also how and why, physical environmental factors relate to older adults' cycling for transport (Sallis et al., 2006). The use of systematic observations and interactional methods in qualitative research can help to understand the meaning of older adults' cycling experiences (Thomas, 2005). Qualitative studies may yield more in-depth information about known physical environmental factors; and, may also reveal physical environmental factors important for older adults' cycling for transport that have not been considered in previous studies. This can help to refine and extend questionnaires for future quantitative studies.

Typically, qualitative studies use indoor sit-down (individual or

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