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Walking speed of older people and pedestrian crossing time

Etienne Duim*, Maria Lucia Lebrão, José Leopoldo Ferreira Antunes

School of Public Health, University of São Paulo, São Paulo, Brazil

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ABSTRACT

Background: Traffic lights that regulate the pedestrian crossings in Sao Paulo, Brazil are programmed to consider a standard walking speed of 1.2 m/s (m/s). However, the frequently slower walking speed of the elderly may make it difficult for them to cross the streets safely and contribute to their social seclusion.
Objectives: To assess the walking speed of older people living in the community and to compare the results with the international standards for pedestrian crossing.
Design: A cross-sectional, population-based study.
Setting and Participants: A probabilistic sample of 1191 individuals aged 60 years or more, living in the city of Sao Paulo, Brazil, in 2010.
Measurements: Walking speed was directly measured using a physical test, and was dichotomously classified using two cut-off points: 1.1 and 0.9 m/s. Interviews informed covariates on socio-demographic characteristics and health status.
Results: Vast majority (97.8%) of older adults in Sao Paulo walks at a slower pace than is currently demanded by the lights at the pedestrian crossings (1.2 m/s). This proportion remained practically unchanged (95.7%) when a standard pedestrian walking speed of 1.1 m/s is considered. Reducing the reference speed to 0.9 m/s would narrowed this proportion to 69.7%. Women, light-skinned blacks, poorly educated individuals and those with poorer health were more likely to walk at a slower pace than is required by traffic lights at the pedestrian crossings in the city.
Conclusions: Overwhelming majority of older adults living in Sao Paulo cannot cross streets at their own walking speed. Therefore, there is an urgent need for modifying the traffic environment to prevent accidents involving vulnerable pedestrians and promote urban mobility.

1. Introduction

The reduced walking speed of older people may put them at risk while crossing the streets. Crossing time allowed by the pedestrian lights may not meet the needs of these individuals, and may increase the risk of injury by accidents and foster social isolation. Although several studies have attempted to address this problem, how socio-demographic characteristics and physical factors contribute to this issue is not well understood (Asher et al., 2012; Romero-Ortuno et al., 2010; Hoxie and Rubenstein, 1994; ITF, 2012).

Mobility is an important skill for autonomous individuals (Satariano et al., 2014). For the elderly population, walking is important related for health and social interaction, and a reduced walking speed is considered a strong predictor of adverse outcomes such as mortality and functional decline (Abellan van Kan et al., 2009). The reduced walking speed of older people has

* Correspondence to: School of Public Health, University of São Paulo, Av Dr Arnaldo, 715, 01246-904 São Paulo, SP, Brazil.
E-mail addresses: etienneduim@usp.br (E. Duim), mllebr@usp.br (M.L. Lebrão), leopoldo@usp.br (J.L.F. Antunes).

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been reported to be associated with slow decision-making, as well as visual and hearing impairments (Asher et al., 2012; Holland and Hill, 2010). Furthermore, mobility is also important for safely crossing the streets (Pooley et al., 2014).

The Sao Paulo Company of Traffic Engineer (CET-SP) regulates the crossing time for pedestrians according to the crosswalk distance. The crossing time is calculated considering a walking speed of 1.2 m/s (m/s) (Ejzenberg, 2011), an international standard adopted in several countries and cities, as England and Ireland (Asher et al., 2012; Romero-Ortuno et al., 2010), South Africa (Amosun et al., 2007) and the USA. The flashing red lights, which assumes a higher walking speed (1.4 m/s) and time to traverse half the distance of the crosswalk, allows additional crossing time. However, these standards do not address the needs of the elderly population, putting them at risk and stress (Asher et al., 2012; Romero-Ortuno et al., 2010). Taking this into consideration, the CET-SP suggested that a reduced reference walking speed of 1.1 m/s be considered in Sao Paulo, as already had been adopted in New York City (Cucci Neto et al., 2010), which allows a longer crossing time and improves safety in crosswalks. Two Spanish cities (Valencia and Barcelona) reduced the reference walking speed to 0.9 m/s, considering the importance of a longer time in crosswalks in an ageing society (Romero Ortuño, 2016). Our study focused both these parameters (1.1 and 0.9 m/s) as reference speed in crosswalks of the biggest city in Brazil, and assessed the ability of the older population in complying with these standards.

The elderly population need longer pedestrian crossing times because of a reduction in walking speed associated with aging (Bohannon, 2008). Yet, few studies have assessed the pedestrian traffic issues involving the elder population in Brazil (Freire Júnior et al., 2013; Fiorelli et al., 2015). A previous study assessed gait speed in a representative sample of older adults in Brazil (Busch et al., 2015). However, no study assessed walking speed of the elderly in relation to the time given by pedestrian lights. Thus, the objective of this study was to assess the walking speed of older people in São Paulo, in terms of their ability to comply with the two international standards that regulate pedestrian crossing lights.

2. Methods

2.1. Database

The Health, Well-being and Ageing Study (Lebrão and Laurenti, 2005) (SABE is the acronym in Portuguese) is a longitudinal study involving a home-based probabilistic sample of older adults in the city of Sao Paulo, Brazil. The initial sample was obtained in the year 2000 using a multi-stage design, which aimed to statistically analyze the urban population of 60 years of age or more. The primary and secondary sampling units were the city's census tracts and the households, respectively. All individuals over 60 years of age living in these households were eligible for the study, and the total number of participants was 2143.

This study examined the cross-sectional data gathered during the third wave of this cohort in 2010. Among those who participated in 2000, 748 survivors who were located in 2010 agreed to continue their participation. Of the 298 new participants aged 60–64 years and enrolled in 2006, 241 who were located in 2010 agreed to continue participating. Additionally, 355 new participants aged 60–64 years were included in 2010, thus the total number of participants was 1344 individuals. Sample weights applied in 2000 were reassessed in 2010 to allow statistical inferences for older adults in the city.

Information was collected using a structured questionnaire and by physical tests performed at home and monitored by a visiting health professional. The database included socio-demographic characteristics and health conditions. Further details of the procedures used for sampling and data collection have been reported previously (Albala et al., 2005). The SABE Study adhered to the international standards of ethics in research involving human subjects, and was approved by the National Committee for Ethics in Research.

2.2. Main outcome and covariates

Walking speed, defined as the speed at which individuals walk at sidewalks, was the main outcome of this study. Participants were asked to walk three meters at their normal pace (Guralnik et al., 1994). The test was not carried out if they felt it was unsafe to do so or if they needed aid to walk. The test was done twice and the results were averaged. The outcome was dichotomously categorized according to the cut-off proposed by the CET-SP as the new standard to regulate the pedestrian lights (1.1 m/s). We also used an alternative categorization (0.9 m/s), according to the standard pedestrian crossing time adopted in Barcelona and Valencia, Spain (Romero Ortuño, 2016). These cut-off points were used to assess the differences in factors associated with reduced walking speed among the elderly population.

Among the socio-demographic characteristics, gender (male/female), age (60–69, 70–79 and 80 or more years old), race/ethnicity and educational level (illiterates, one to three years of formal education, four to seven and eight or more) were assessed. The criteria established by the official agency for demographic analysis in Brazil (the Brazilian Institute for Geography and Statistics) was used for the classification of race/ethnicity and referred to the answer of participants to the direct question about their race/ethnicity (Travassos and Williams, 2004). "White" referred to population of European descent; "black" referred to those of African descent. Because of miscegenation is a prominent characteristic of the Brazilian population, the category "light-skinned" was prevalent among blacks.

Health perception was classified as very good or good, regular, and poor or very poor. Six non-communicable diseases (diabetes, arterial hypertension, pulmonary obstructive chronic disease, stroke, depression and arthrosis) were assessed according to the answer to a direct question ("have a doctor already said that you suffer from any of the following diseases?"). Participants were categorized as having no non-communicable conditions (NCC), one NCC and two or more. Functional limitation was assessed by examining the impairment in one or more Activities of Daily Life (ADL) (feeding, bathing, dressing and using the bathroom) and one