Walking Behavior in Temuco, Chile

Subjects: Urban Studies

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Chile is known as a semi-developed country or a country in transition towards being a developed country. Temuco, the capital of the Araucania region, is one of the medium-sized southern cities with a population of almost 300 thousand people according to the 2017 Census. The rate of walking decreased (5%), while the rate of using private cars increased (7%) in daily transport trips from 2003 to 2013 in this city. However, walking has still remained the most common transport mode up until today among lower-middle income groups in Chile. This is confirmed by the analysis of walking trips in Temuco, which shows that 24% of the total trips in Temuco are dedicated to walking trips

Keywords: walking behavior ; socio-demographic factors ; built environment ; destination type

1. Introduction

The use of private cars for daily transport leads to more air pollution, which is one of the main problems in the cities of southern Chile. Non-motorized modes of transportation such as walking and cycling, on the other hand, are the most sustainable forms of transportation due to their accessibility, lesser emissions, and cheaper prices [1]. In addition, the increase in active travel contributes to maintaining the minimum rate of physical activity and therefore has a positive impact on inhabitants' public health [2][3]. The need for an increase in active modes of travel for daily transport was also emphasized during the recent COVID-19 pandemic, when the use of public transport presented risks for the inhabitants' health [4]. As of late April 2020, more than 150 communities have expanded their emergency cycling and walking infrastructures to strengthen their resiliency in the face of the COVID-19 pandemic [5].

Chile is known as a semi-developed country or a country in transition towards being a developed country [6]. Temuco, the capital of the Araucania region, is one of the medium-sized southern cities with a population of almost 300 thousand people according to the 2017 Census. The rate of walking decreased (5%), while the rate of using private cars increased (7%) in daily transport trips from 2003 to 2013 in this city [7]. However, walking has still remained the most common transport mode up until today among lower-middle income groups in Chile [8]. This is confirmed by the analysis of walking trips in Temuco, which shows that 24% of the total trips in Temuco are dedicated to walking trips [7]. Thus, the rate of walking for daily transport in this city has decreased in recent decades in spite of its potential for being the main travel mode of inhabitants in this medium-sized city. In this regard, the main objective of this research is to clarify the main socio-demographic, social, and built environment factors contributing to improve walking behavior in Temuco (**Figure 1**). It should be noted that most of the factors in regards to walking have been found in developed countries, and there is still a lack of such studies in the countries in transition towards developed status such as Chile.

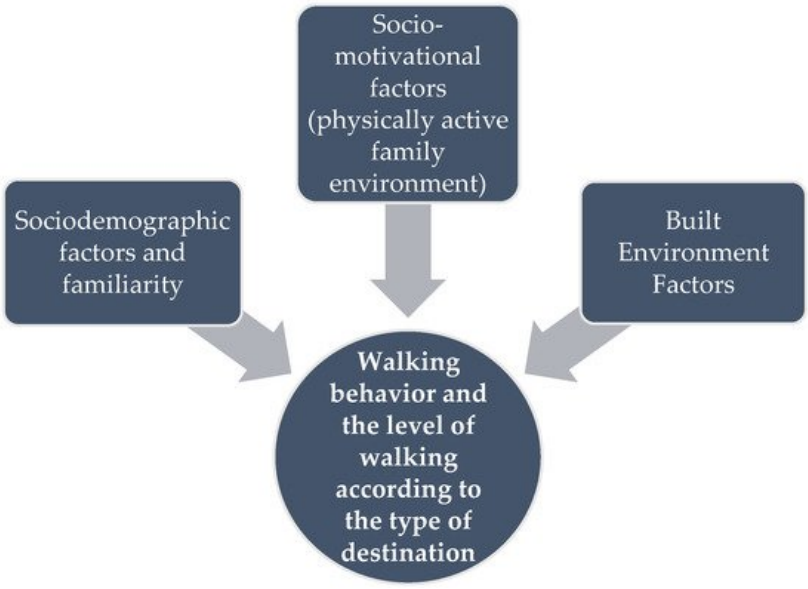

Figure 1. The Research Framework.

Walking behavior is governed by a complex interaction between individual and environmental (physical and social) characteristics, according to ecological models [9][10]. Previous research has shown that a variety of personal and sociodemographic, social, and built environment elements play a role in improving walking habits [11][12][13][14][15]. In addition, some prior research on walking behavior looked at the relationship between walking behavior and its contributing elements based on the specific aims of walking trips, such as walking to work, walking to school, and other sorts of walking trips [16][17][18][19][20][21][22]. These studies revealed that the influence of many elements on walking behavior changes depending on the goal of the walks.

2. Walking Behavior

In terms of socio-demographic parameters, age [23][24][25], gender [23][25], holding a driver's license [26], and educational level [23][24][27] are all consistently connected to walking. For instance, the walking rate usually decreases for older people [23]. Other research [27][28][29] discovered links between walking and having a job, income, marital status, the number of automobiles, the number of adults, and the Body Mass Index (BMI). The influence of attitudes toward walking as well as lifestyle on walking behavior has also been demonstrated by previous studies [30][31][32][33][34]. Previous research on walking behavior has also shown a link between familiarity with the walking environment and walking behavior [11][35]. Furthermore, the social environment refers to the impact that friends and family might have on a person's walking habits [36]. Most of the social aspects associated to walking were first discovered in the literature on physical exercise and subsequently applied to walking [23]. A positive social environment has regularly been shown to improve physical activity and walking in previous studies [37][38]. The existence of a role model has been found to be a motivating factor for walking and physical activity among the social factors related with walking [23][39]. When it comes to walking, role models are persons who walk and urge others to do so as well. Physical exercise and walking are directly related with the support of family and friends, such as a partner or friends who are physically active [39][40]. A physically active family setting has a significant influence in encouraging people to engage in more physical exercise and walking, according to the role model indicators [41]. Some research, however, found that this component had no effect on walking or overall physical activity [23].

In terms of the built environment, most of the research found that measures of land use, such as population/residential density, housing density, and mixed land use, have a beneficial impact on walking behavior [14][32][42][43][44][45]. Likewise, access to a variety of destinations such as shops, services, and work is one of the most important built environment attributes which contributes to walking behavior [15][32][34][35][45][46][47]. The pedestrian environment, which includes variables such as ease of street crossing, sidewalk presence, sidewalk breadth, sidewalk continuity, well-connected street network, street density, and terrain, has a favorable impact on walking behavior [32][35][42][43][48]. Walking facilities, such as sidewalk condition and benches, were also mentioned as factors that influence walking habits [15][35][49]. Walking for transportation has also been linked to traffic safety and personal security [35][42][47][49][50][51]. Furthermore, characteristics such as visual interest, visibility of landmarks along pathways, vistas of public gardens, visible activity, street trees, and cleanliness all influenced walking behavior [3][35][42][52].

3. The Influence of Socio-Demographic and Social Factors on Walking Behavior

According to descriptive analysis, most of the respondents who had an income came from low-income families (63.8 percent). As a result, many of the people who walk in Temuco come from low-income households. This is consistent with the findings of Herrmann-Lunecke et al. [8], who discovered that walking is the most popular mode of transportation in Chile, particularly among low-income groups. Furthermore, people with low monthly income walk significantly more for shopping than people with average/high monthly income. This result is in line with previous studies which found that greater monthly income contributes to sedentary behavior, as well as less walking and vice versa [53][54]. One interpretation in this regard is that those with lower incomes may walk longer distances to the shops that have the goods they need at cheaper prices. Because one product could have different prices in different shops at varying distances from home in Chile. On the other hand, those who have a higher monthly income may use the nearest shop to their home regardless of the price difference in different shops; in this way, their daily walking for shopping is reduced. However, an analysis of the distribution of land uses and shops in different neighborhoods is also required to prove this theory, and future studies could investigate this relationship in more depth.

Furthermore, overall walking improves among persons who have a job and a monthly income. These findings should be seen in the perspective of low-to-middle-income families, which account for most persons who walk in this city. Those who work and earn a monthly income are responsible for their families and must be more active to meet the demands of other

family members; as a result, they walk more than their other family members. Moreover, among the people who work, those who work at home walk significantly more than others for shopping. A low percentage of respondents (5.2%) work at home and according to researchers' experience in this city most of these jobs are service work such as groceries and special workshops. One interpretation could therefore be that these people need to buy various necessities in regards to their home-based businesses, and as a result, their walking rate increases.

It was found that most of the people who walk in this city do not have a private car and/or a driver's license. Thus, private cars generally have no role in the lives of people who walk in this city. Furthermore, for people who do not have a driver's license, the overall walking and walking to educational places improves. Previous research backs up this conclusion, showing that the number of automobiles in a household and holding a driver's license reduces active travel and walking [36][55]. Furthermore, these findings reveal an incompatibility between walking and private car use for daily transportation of persons who walk in this city, particularly those who walk to educational destinations. In terms of walking to educational destinations among younger people and millennials in this city, the majority of those who walk to educational destinations are younger people and millennials born after 1980/1990. Previous studies have shown that unlike developed countries, where millennials rely more on active travel in their daily trips, young people and millennials in developing countries have a greater tendency to use private cars for their daily trips to reach the universities [56]. There could be a similarity between this context and developing countries rather than developed ones in terms of the tendency of millennial for less motivation to walk in their daily trips.

Moreover, older people are considerably more likely to walk in this city. When it comes to different types of walking journeys based on the destination, older people walk more to work and to school. According to researchers' findings, the bulk of persons who walk to reach educational locations are adolescents and young people (10 to 29 years old; 89 percent), also known as millennials, who were born between 1980 and 1990. Further analysis also showed a significant correlation of age with walking behavior, which is due to the significant differences between age groups under 60 years old in relation to walking behavior. Moreover, the three elderly age groups between 60 and 100 years old did not show a significant correlation with walking behavior. This contrasts with prior research, which revealed that physical activity and walking behavior decreases with age [23][57][58]. One interpretation in regards to walking to educational destinations is that the adolescents—in contrast to young adults—are not able to ward off the potential health risks during walking. As a result, they may be more reliant on other modes of transportation, such as school service, rather than walking independently from their home. In addition, men walk significantly more when compared to women. Similarly, men walk much more than women to get to work and educational institutions. Gender has an impact on walking behavior, according to previous studies [24][59]. One interpretation is that this reduction in walking rate is due to the influence of environmental factors such as perceived insecurity and the potential threats women may encounter when walking, since previous studies have shown the impact of perceived insecurity on reducing women's walking in Chile [51]. In this regard, women are generally more vulnerable than men regarding potential threats that may occur during their walking [60][61]. Future research could investigate the other obstacles that women face when walking in this city.

Furthermore, persons who have televisions in their houses walk substantially less to and from work than those who do not. This is an intriguing finding that demonstrates how technology devices have a negative impact on physical activity and walking. Previous research has showed that watching more television leads to greater sedentary behavior and less physical activity, such as walking [62][63]. However, walking to workplaces is considered to be a mandatory activity which does not have the flexibility to be adopted at any time and place. This suggests that there could be additional reasons outside the positive influence of television on sedentary behavior, which future research should look at. Similarly, more access to the Internet contributes to less walking for shopping and vice versa. Information and communication technologies (ICT) have had a major impact on travel behavior patterns within the last decades [64]. Along with this global trend, the rate of online shopping through different related mobile apps has increased in Chile within the last decades [65], and this could be the reason for finding a reduction in walking for shopping where there is greater Internet access. This result is also in line with the findings of the previous studies, which showed the impacts of technology on enhancing sedentary behavior which may finally contribute to decreasing the level of physical activity and walking [66][67]. Future studies may investigate the role of access to Internet and the ways in which it contributes to the level of physical activity and walking in this city.

Furthermore, people with a higher educational level walk more toward educational destinations. This is in line with the results of previous studies, which found that people with a higher educational level walk more than others [23][24][27]. However, the reason for this finding and the difference in walking frequency between adolescent and university students could be more closely related to other aspects such as less independence of adolescents compared to university students rather than related to their educational level.

4. The Influence of Built Environment Factors on Walking Behavior

Regarding the built environment factors, the number of parks and plazas showed a significant positive correlation with total walking and two types of walking including walking for shopping and walking to workplaces. People in those areas which presented the highest numbers of parks and plazas, walk significantly more to all types of destination, including workplaces and shops. This finding is supported by previous studies, which showed the importance of aesthetic factors such as the presence of recreational green spaces to encourage walking [35][42]. However, these studies showed the contribution of recreational green spaces to walking for recreation rather than transport walking [68]. Thus, a direct association between the number of parks and plazas and walking to workplaces is not well supported by previous studies. One interpretation in this regard is that many workplaces are located around the park and plazas in this city and therefore increasing the number of parks and plazas contributes to a greater number of workplaces; therefore, walking to workplaces is increased. In addition, this city does not have a high number of recreational spaces such as parks and plazas in the different city sectors, especially in peripheral areas, and several of the current recreational spaces are not in good physical condition [7]. This finding is therefore applicable for the city's urban and transport policy makers; they should raise the quality and quantity of recreational and green spaces such as parks and plazas in different sectors in order to improve walking in this city.

Mixed land use is the other built environment factor which contributes to enhancing overall walking and walking for shopping as well as walking to workplaces. This finding is supported by previous studies which found a positive correlation between mixed land use and walking behavior [32][42]. It is also to be noted that the mixed land use is higher in the city center and its surrounding areas, where the land uses other than residential land use, including commercial, service, health, and educational land uses, increase significantly. Indeed, enhancing mixed land uses in the city center and its surrounding areas has been part of the compact city approach, which is observed in these areas within the last decades in Temuco. One of the most well-known methods to sustainable urban development is the compact city [69], which leads to an increase in sustainable transportation modes such as walking and cycling [70]. This finding supports the positive impact of the compact city approach, initiated and strengthened in Temuco in recent decades on enhancing the walking level and sustainable urban transportation in this city. Therefore, it is to be strengthened by urban/transport policy makers of this city at future.

Furthermore, the Link Node Ratio, as one of the indicators of connectivity, was shown to have significant negative correlations with overall walking level. This shows that a better-connected street network contributes to a decrease in the level of walking. In other words, people walk more when there is a more disconnected urban street pattern. In contrast to prior research, which concluded that a better-connected street network improves walking behavior, this is not the case [71][72]. One interpretation in regards to these findings is that such results could be considered in the light of the crime level and sense of insecurity as a factor, for which correlation to walking to workplaces has also been found. The number of gated communities within residential neighborhoods has increased within the last decade in different cities of this country in order to enhance actual security as well as the sense of security among the residents. Gated communities are usually residential areas restricted by fences and walls. In fact, the actual crime rate as well as fear of crime create situations where the inhabitants prefer to walk more in disconnected street patterns than connected ones. This situation regarding the design and layout of streets in relation to walking behavior could also describe one of the major differences between this context and the developed countries in terms of the association between the factors of built environment and walking behavior.

Moreover, a higher housing density is associated with the increase in overall walking level as well as two types of walking, including walking to workplaces and walking for shopping. The positive effect of residential/population density on increased walking has been indicated by previous studies [15][73][74]. In fact, the increase in residential/population density —together with mixed land uses—contributes to reducing travel time and distance between origins and destinations and promoting walking as a means of transportation [75]. This result shows that the increase in the level of walking can constitute a supporting argument for the urban densification policy in Temuco. More precisely, this result supports the positive impact of the compact city approach in improving walking and sustainable transportation that has been initiated and reinforced especially in city center and its surrounding areas in recent decades.

Lower accident rates, as an indicator of traffic safety, contributes to enhancing walking to workplaces. This finding is supported by the previous studies which found that more traffic safety contributes to enhance walking [35][76]. In addition, a higher crime rate is the other built environment factor which contributes to a decrease in walking to workplaces. Chile is considered to be a country with a moderate to low crime rate, when compared to the average amount of crime around the world [77]. However, the different types of crime in the Araucania region are mostly concentrated in Temuco [78]. In addition, previous studies have shown the effect of perceived insecurity in reducing the level of walking in residential areas of

Santiago, Chile [51]. The study used the real crime rate rather than perceived insecurity. The relationship between the fear of crime and the rate of crime is not well supported [79]. Indeed, the perception of insecurity does not necessarily correspond with actual insecurity [80]. However, this finding shows that there may be a strong relationship between the actual crime rate and perceived insecurity in this context, which contributes to a decrease in the level of walking. This could be further investigated by future studies in this area. The policy makers of this city could apply this finding by aiming to reduce the crime rate and its contributing social and environmental factors in order to encourage walking in this city.

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