Journal of Transport & Health 37 (2024) 101822

Contents lists available at ScienceDirect

Journal of Transport & Health

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

Adaptation into Spanish and reliability analysis of the Microscale Audit of Pedestrian Streetscapes mini (Maps-mini-Es)

Maria del Mar Fernandez-Alvarez [a,b,c], Pilar de la Fuente-Laso [d], Alberto Lana [a,b,c], Ruben Martin-Payo [a,b,c,*]

[a] *Facultad de Medicina y Ciencias de la Salud, Universidad de Oviedo, Asturias, Spain*
[b] *Equipo de investigación PRECAM. Instituto de Investigación Sanitaria del Principado de Asturias (ISPA), Asturias, Spain*
[c] *Equipo de Investigación Entorno, Conductas y Salud (ENCOSalud), Universidad de Oviedo, Spain*
[d] *Servicio de Salud de Castilla y León, Castilla y León, Spain*

A R T I C L E I N F O

Keywords:
Walkability
Physical activity
Feasibility
Environment

A B S T R A C T

Introduction: In recent times, we have witnessed an increase in population growth and a tendency to live in urban environments. Walkability is an indicator based on characteristics of the physical environment to determine the association between environmental conditions and health behaviours. It would therefore appear that assessing walkability can contribute to establishing strategies for improving healthy behaviours and population health. In this study, our aim was to adapt and assess the metric properties of the Spanish version of MAPS-Mini for assessing walkability.
Methods: Firstly, the adaptation and translation process was carried out. Subsequently, to assess the reliability of the Spanish version of MAPS-Mini, two raters (E1 and E2) used it independently at street level for 93 segments selected by convenience. Four weeks later, E1 re-evaluated 50 sections randomly selected from the 93 evaluated segments (re-evaluation). Inter-observer reliability and temporal stability were assessed.
Results: No major differences were observed between the original and the Spanish version of MAPS-mini. The average ratings observed by E1 and E2 were 42.2 (SD = 11.5) and 46.5 (SD = 13.1), respectively. The average rating observed in the re-evaluation was 43.4 (SD = 14.2). Cronbach's Alpha showed a rating of 0.972 and the correlation of ratings between E1 and E2, and E1 and the re-evaluation, were higher than 0.9.
Conclusion: The Spanish version of MAPS-mini has adequate metric properties for assessing the walkability of urban environments using measurements at street level.

1. Introduction

In recent times, we have witnessed an increase in population growth and a tendency to live in urban environments. According to the United Nations, 68% of the population will reside in an urban environment by 2050 (United Nations, 2018). This should be considered from a health perspective, given the influence that environments have on population health (Han et al., 2023; Henderson et al., 2016).

* Corresponding author. Facultad de Medicina y Ciencias de la Salud de la Universidad de Oviedo, Campus del Cristo s/n, 33006, Oviedo, Asturias, Spain.

E-mail addresses: fernandezmar@uniovi.es (M.M. Fernandez-Alvarez), pilardlf90@gmail.com (P. de la Fuente-Laso), lanalberto@uniovi.es (A. Lana), martinruben@uniovi.es (R. Martin-Payo).

https://doi.org/10.1016/j.jth.2024.101822
Received 10 October 2023; Received in revised form 14 February 2024; Accepted 10 May 2024
Available online 17 May 2024

For example, neighbourhoods influence health through their potential to promote physical activity, such as walking (Frank et al., 2019). In this sense, it is important to highlight walkability. Although walkability is not a new concept, with the original definition dating from the 1990s, it was later considered by health and sports researchers and professionals due to its potential for evaluating not only walking, but also other types of physical activity, such as cycling, and subsequently to develop strategies for improving population health (Westenhöfer et al., 2023).

In the systematic review carried out by Pontin et al. (2022), with the aim of synthesising the information provided by studies whereby the purpose was to analyse the impact of the environment on the levels of physical activity in adults, walkability stands out as one of the most used indicators.

Walkability is an indicator based on characteristics of the physical environment, which has also been used in urban designs (Frank et al., 2010) to determine the association between environmental conditions and health behaviours (Lo, 2009). Some authors have established a link between this indicator and walking (Kim et al., 2023; Wang et al., 2023), other types of physical activity (Zuniga-Teran et al., 2017) and some highly prevalent Spanish non-communicable diseases, such as cardiovascular diseases and obesity (Creatore et al., 2016; Frank et al., 2022; Makhlouf et al., 2023; Westenhöfer et al., 2023). Zuniga-Teran et al. (2017) conclude that the Walkability Framework, a model to measure the built environment composed of nine neighbourhood design categories, has significant correlations between its categories and physical activity. In short, the Walkability Framework can be used as a model to measure the relationship between the built environment and its ability to promote not only walkability, but also physical activity. Moreover, the aforementioned authors suggest an association between walkability and non-communicable diseases, for example, a decreased prevalence of excess weight, obesity and diabetes (Creatore et al., 2016), as well as a lower probability of developing diabetes and obesity (Frank et al., 2022) and cardiovascular diseases (Makhlouf et al., 2023). It would therefore appear that assessing walkability can contribute to establishing strategies for improving healthy behaviours and population health.

A number of tools are used to assess walkability, for example, the Microscale Audit of Pedestrian Streetscapes (MAPS). This tool has different versions: initially, a long version was developed, showing adequate reliability and other metric properties for assessing the walkability of urban environments (Millstein et al., 2013; Saito et al., 2022), considered, as mentioned above, for evaluating not only walking, but also other types of physical activity, such as cycling (Westenhöfer et al., 2023). Subsequently, shorter versions were developed, such as the Abbreviated Version of the Microscale Audit for Pedestrian Streetscapes (MAPS-Abbreviated) (Cain et al., 2017), which was adapted for international use. The research carried out by Cain et al. (2018) across five countries (Australia, Belgium, Brazil, China and Spain) concludes that MAPS-Global has good or excellent reliability, allowing observers from multiple countries to assess the walkability of both residential and commercial areas. Finally, Sallis et al. (2015a) developed a 15-item version called MAPS-Mini.

1.1. *Aim*

As far as we know, there is no Spanish adaptation of MAPS-Mini. This tool was chosen for this study as the original version remains valid despite its short length, it is more feasible than longer versions and the items included are relatively stable over time and do not tend to change rapidly. Therefore, the aim of this study was to adapt and assess the metric properties of MAPS-Mini in the Spanish version for use in assessing walkability.

2. Material and methods

2.1. *Procedure and design*

The English version of MAPS-Mini (Sallis et al., 2015a) was adapted cross-culturally for the Spanish language. This included cross-cultural adaptation, translation and a measure of statistical reliability. The corresponding STROBE checklist for cross-sectional studies was used in this study (Strobe, 2023).

The analysis was carried out in the city of Lugones, Asturias (Spain). It covers 5.48 km^2, and has approximately 13,000 inhabitants (Siero, 2020). Lugones has six census sections and 109 streets. The units of analysis were all segments of the city selected by convenience. Industrial or rural segments were considered exclusion criteria.

2.2. *Measures and data preparation*

2.2.1. *Description of MAPS-mini*

MAPS-Mini (Sallis et al., 2015a) was designed to measure walkability. It can be completed using two methods: obtaining data at the route level or at the segment level. According to Sallis et al. (2015b), the route level is defined as the process of collecting "*data of the neighbourhood environment between a participant's home and a pre-designated ending destination*". A route could be a participant's regular walking experience, for example, the neighbourhood between the participant's home and job or school. The segment level could be measured as the area of the street between intersections. Therefore, each route could include several segments and be used to evaluate a specific area.

In this study, segment level was taken as the unit of reference. MAPS-Mini consists of 12 items that assess the characteristics of the segments, rated 0–1 (items 1, 4, 6, 7, 9, 10 and 11) or 0–2 (items 2, 3, 5, 8 and 12). It also includes three items for assessing crossover characteristics (located between segments) that are rated 0–1 (items 1 and 3) or 0–2 (item 2). The maximum score ranged from 0 to 20 or 23, according to whether there were one or two crossovers, respectively. Subsequently, the overall score is calculated using the formula (segment score/maximum score for the segment) * 100, where 0 equals worse walkability and 100 better walkability.

2.2.2. Translation, cross-cultural adaptation and reliability analysis

The adaptation and translation process was conducted using the method proposed by Ramada-Rodilla et al. (2013). Firstly, the translation into Spanish was conducted independently by two native Spanish speakers proficient in the English language. Subsequently, both of them and a member of the research team created a consensus version. This version was back-translated into English by an English native proficient in the Spanish language, and the original author checked the content, as well as the conceptual and semantic equivalence (J. Sallis). In addition, an expertise panel composed of two public health experts, i.e. an expert in methodology and an expert in the Spanish language, assessed the semantic and conceptual properties of the Spanish version.

Finally, two independent raters used the Spanish version of MAPS-Mini in ten segments and participated in a cognitive interview to assess their experience and understanding of the tool, as well as its usability, in order to identify potential barriers to use.

According to Zou (2012), a minimum sample size of 41 is required to determine whether inter-observer reliability lies within 0.15 of a sample observation of 0.80, with 87% accuracy. In this research, to improve the accuracy of the reliability assessment of the Spanish version of MAPS-Mini, two raters (E1 and E2) used it independently at street level for 93 segments. Four weeks later, E1 re-evaluated 50 sections randomly selected from the 93 evaluated segments (re-evaluation). Therefore, inter-observer reliability and temporal stability were assessed.

2.2.3. Data preparation

A descriptive study of the variables was carried out using the indices typical of descriptive statistics: means and standard deviation. In addition, a normality analysis of the sample was performed using the Kolmogorov-Smirnov test.

Reliability is the degree to which repeated measurements vary when taken by different observers at the same time or when taken by one observer at different times. A lower variation between measurements indicates higher reliability. It can be assessed using correlation coefficient (Bruton et al, 2000). In this study, the reliability of the scores by both raters in the 93 segments and between the two points in time in the 50 segments was obtained by calculating the Pearson correlations.

Internal consistency describes the extent to which all items in a test measure the same concept. Therefore, it explains the connection between the items and the test (Tavakol and Dennick, 2011). In this study, the internal consistency of the scale was calculated using Cronbach's Alpha.

All analyses were conducted using SPSS for Windows, version 27.0 (SPSS Inc).

3. Results

3.1. Cross-cultural adaptation and translation process

No major differences were observed between the two independent translations of the questionnaire. The final version of MAPS-Mini in Spanish was created upon reaching consensus regarding any discrepancies. The expertise panel that assessed the semantic and conceptual properties of the Spanish version was considered relevant and appropriate. Therefore, both the translation and the conceptual analysis were considered relevant and appropriate for Spanish culture. Finally, the lead author of this article reviewed and approved the blind reverse translation.

The Spanish version of MAPS-Mini has the same number of items, twelve for segments and three for crossovers. Only one change

Table 1
Items and scoring options of the Spanish version of MAPS-Mini.

Item	Scoring
Crossing	
C1. Is the pedestrian crossing signalled?	0 = no; 1 = yes
C2. Does the curb have a ramp?	0 = no; 1 = yes
C3. Is the pedestrian crossing painted?	0 = no; 1 = yes
Segment	
S1. Type	0 = Residential; 1 = Commercial
S2. How many public parks are there?	0 = 0; 1 = 1; 2 = 2 or more
S3. How many public transport stops are there?	0 = 0; 1 = 1; 2 = 2 or more
S4. Are there benches or places to sit down (not including bus stop benches)?	0 = no; 1 = yes
S5. Is there lighting?	0 = none; 1 = some; 2 = abundant
S6. Are the buildings well maintained?	0 = from 0 to 99% well maintained; 1 = 100% well maintained
S7. Is there graffiti or paintings (not including murals)?	0 = yes; 1 = no
S8. Is there a bike lane?	0 = no; 1 = yes, and it is signalled with a painted line; 2 = yes, and it is physically signalled
S9. Is there a pavement?	0 = no; 1 = yes
S10. Are there poorly maintained sections of pavement that represent a major tripping hazard?	0 = some/there is no pavement; 1 = no
S11. Is the pavement separated from other elements?	0 = no/there is no pavement; 1 = yes
S12. What percentage of the pavement, in terms of length, is covered by trees, canopies or other coverage systems?	0 = 0–25%; 1 = 26–75%; 2 = 76–100%

was made to one item in the crossover section. Item C2 has two response options (0 = no; 1 = yes), compared to three options in the original questionnaire (Table 1).

3.2. Reliability analysis

The average ratings observed by E1 and E2 were 42.2 (SD = 11.5) and 46.5 (SD = 13.1), respectively. The average rating observed in the re-evaluation was 43.4 (SD = 14.2).

Cronbach's Alpha showed a rating of 0.972 and the correlation of ratings between E1 and E2, and E1 and the re-evaluation, were higher than 0.939 (Table 2).

Likewise, very significant ($p < .001$) and strong correlations were also observed, except for items S5, S6 and S10, which were average, between the ratings observed in each item among the observers, and between E1 and the re-evaluation (Table 3).

4. Discussion

The results of this study present the adaptation of the MAPS-Mini questionnaire into Spanish and suggest the possibility of its use for assessing the walkability of segments by raters whose language is Spanish. The final version includes a total of three items for assessing the characteristics of the crossings, and twelve for the characteristics of the segments related to walkability.

MAPS-Mini-Es has the same structure and almost the same response options as the original version (Sallis et al., 2015a). It should be noted that only one modification has been included in the response options for item C2, regarding the characteristics of the crossings. In the original version, the rating ranges from 0 to 2: 1 point is attributed to a crossing where only one side of the crossing has a ramp on the curb, while 2 points means there is a ramp on the pavement on both sides. In the Spanish version, the intermediate option was deleted, understanding that the fact that one of the two sides does not have a ramp presents a barrier in and of itself, especially for those with reduced mobility.

On the other hand, very satisfactory results were observed in the metrics used to measure reliability. They showed that the observers were able to reliably use MAPS-Mini-Es, and, therefore, that it is suitable for use by raters that are fluent in Spanish.

The results are consistent with those observed in previous studies, in which the adaptation of the global version of this tool (MAPS-Global) was carried out. In these adaptations, it was also not necessary to make significant changes in terms of content with respect to the original version, and adequate reliability ratings were observed (Sallis et al., 2015a). In contrast to this study, in those mentioned above, the adaptation was carried out at international level, which suggests that MAPS-Mini could have the potential to be included in adaptations into languages other than English and Spanish.

Some Spanish researchers have carried out walkability assessments (Gullón et al., 2017, 2020; Rivera-Navarro et al, 2022). However, they do not appear to enjoy the popularity observed in English-speaking countries such as the US, UK, Canada, Australia and New Zealand, where health impact assessments related to the walkability of urban environments are well established (Westenhöfer et al., 2023). This may be due to the absence of a brief and easy-to-complete tool, such as MAPS-Mini. Therefore, the new version presented here has the potential to promote the development of more walkability assessments in the urban area, which may not only contribute to the implementation of improvements to environmental conditions, but also to improving population health. There is ample evidence to suggest that improving the walkability of neighbourhoods or cities produces positive health impacts (Westenhöfer et al., 2023).

Additionally, it is important to highlight that the Global Action Plan on Physical Activity 2018–2030 (World Health Organization, 2018) points out that the promotion of walkability or the use of bicycles as opposed to other means of transport is essential for improving population health and urges those responsible for environmental policies to include measures aimed at promoting these activities in their agendas. On the other hand, the 2030 Agenda for Sustainable Development specifically mentions the importance of promoting walkability as a means of achieving the Agenda's goals. In order to implement strategies that promote both walkability and cycling in the urban environment, it is essential to previously carry out assessments that allow us to understand the reality in order to establish specific measures. In this sense, MAPS-Mini-Es can be understood as a facilitating tool, with the potential to be used in urban planning. Previous experiences reinforce this idea. For example, the study carried out by Mueller et al. (2020) shows how a so-called *superblock design,* implemented in the city of Barcelona, contributed to improving walkability.

The reliability results demonstrate this aspect in MAPS-Mini-Es, as was observed in the expanded versions of this tool (Cain et al., 2018; Fox et al., 2021; Queralt et al., 2021), although a lower (but not negative) rating was observed in aspects that could be considered more subjective, such as lighting or building maintenance. This was also observed in the study carried out by Queralt et al. (2021), where a lower reliability rating was obtained in subjective aspects, such as those related to aesthetics or social factors. In future applications of this tool, it may be useful to specify what is meant by the existence of "some" or "abundant" lighting and what it means for a building to be perfectly maintained.

Table 2
Analysis of the correlation between the average ratings of MAPS-Mini inter-observers and between E1 and the re-evaluation.

Item	r E1-E2 (n = 93)	r E1- re-evaluation (n = 50)
Global rating	0.945*	0.939*

*$p < 0.001$.

Table 3
Analysis of the correlation between the average ratings of the inter-observer items, and between E1 and the re-evaluation.

Item	r E1-E2 (n = 93)	r E1- re-evaluation (n = 50)
C1	0.909*	0.900*
C2	0.784*	1.000*
C3	0.930*	1.000*
S1	0.789*	1.000*
S2	0.980*	0.937*
S3	1.000*	1.000*
S4	0.912*	1.000*
S5	0.715*	0.602*
S6	0.627*	0.593*
S7	0.930*	0.612*
S8	0.954*	0.978*
S9	0.878*	1.000*
S10	0.603*	0.875*
S11	0.851*	0.840*
S12	1.000*	1.000*

*$p < 0.001$.

4.1. Strengths

It is important to highlight some of the conditions of use of MAPS-Mini-Es. Although the benefits of assessing walkability are clear, it should be noted that the reported values are also useful for the urban environment and allow us to determine whether the implementation of measures that promote physical activity will have an impact on that environment. This means that, despite using the same tool, walkability ratings are not necessarily directly comparable between cities, as suggested by Pontin et al. (2022). On the other hand, it is also important to point out that, on occasions, it may be necessary to broaden the variety of measurements, both of the environment and the impact on physical activity, in order to increase reliability (Pontin et al., 2022).

Previous studies also assessed the measurement using digital resources, such as assessment via Google Maps (Phillips et al., 2017; Queralt et al., 2021; Saito et al., 2022). Although it is a suitable option in terms of efficiency, as it is not necessary to travel to the area in order to measure it, we consider the option at street level to be a more reliable option, as the maps included on the internet may not be up to date and may therefore reduce the reliability of the measurements.

4.2. Limitations

In terms of limitations, it is important to note that the assessment was only carried out in one geographical region. Future studies should include other environments, with better and worse conditions, in order to assess the discriminatory capacity of MAPS-Mini-Es in greater depth. In addition, the measurement was only carried out at street level, unlike other authors who used Google Maps to carry out measurements. In the future, it may be useful to assess the reliability of MAPS-Mini-Es using this type of digital resource.

5. Conclusions

The results of this study allow us to conclude the adequate adaptation and reliability of the MAPS-Mini-Es scale in Spanish to assess the walkability of urban environments using measurements at street level. With regards to previous versions of MAPS, the mini provides greater agility in measurements due to its brief structure, which suggests its potential for use as a resource from a scientific perspective and, from the perspective of transfer to society, for use as a tool to assess and improve walkability in urban environments.

Funding

This research did not receive any specific grants from funding agencies in the public, commercial or not-for-profit sector.

Financial disclosure

The Authors did not receive any specific funding for this work.

CRediT authorship contribution statement

Maria del Mar Fernandez-Alvarez: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Pilar de la Fuente-Laso:** Investigation, Writing – original draft, Writing – review & editing. **Alberto Lana:** Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Ruben Martin-Payo:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing –

review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

References

Bruton, A., Conway, J.H., Holgate, S.T., 2000. Reliability: what is it and how is it measured? Physiotherapy 86 (2), 94–99. https://doi.org/10.1016/S0031-9406(05)61211-4.

Cain, K.L., Gavand, K.A., Conway, T.L., Geremia, C.M., Millstein, R.A., Frank, L.D., Saelens, B.E., Adams, M.A., Glanz, K., King, A.C., Sallis, J.F., 2017. Developing and Validating an Abbreviated version of the Microscale Audit for Pedestrian Streetscapes (MAPS-Abbreviated). J. Transp. Health 5, 84–96. https://doi.org/10.1016/j.jth.2017.05.004.

Cain, K.L., Geremia, C.M., Conway, T.L., Frank, L.D., Chapman, J.E., Fox, E.H., Timperio, A., Veitch, J., Van Dyck, D., Verhoeven, H., Reis, R., Augusto, A., Cerin, E., Mellecker, R.R., Queralt, A., Molina-García, J., Sallis, J.F., 2018. Development and reliability of a streetscape observation instrument for international use: MAPS-global. Int. J. Behav. Nutr. Phys. Act. 15, 19. https://doi.org/10.1186/s12966-018-0650-z.

Creatore, M.I., Glazier, R.H., Moineddin, R., Fazli, G.S., Johns, A., Gozdyra, P., Matheson, F.I., Kaufman-Shriqui, V., Rosella, L.C., Manuel, D.G., Booth, G.L., 2016. Association of neighborhood walkability with change in Overweight, obesity, and diabetes. JAMA 315, 2211–2220. https://doi.org/10.1001/jama.2016.5898.

Fox, E.H., Chapman, J.E., Moland, A.M., Alfonsin, N.E., Frank, L.D., Sallis, J.F., Conway, T.L., Cain, K.L., Geremia, C., Cerin, E., Vanwolleghem, G., Van Dyck, D., Queralt, A., Molina-García, J., Hino, A.A.F., Lopes, A.A.D.S., Salmon, J., Timperio, A., Kershaw, S.E., 2021. International evaluation of the Microscale Audit of Pedestrian Streetscapes (MAPS) Global instrument: comparative assessment between local and remote online observers. Int. J. Behav. Nutr. Phys. Act. 18, 84. https://doi.org/10.1186/s12966-021-01146-3.

Frank, L.D., Sallis, J.F., Saelens, B.E., Leary, L., Cain, K., Conway, T.L., Hess, P.M., 2010. The development of a walkability index: application to the Neighborhood Quality of Life Study. Br. J. Sports Med. 44, 924–933. https://doi.org/10.1136/bjsm.2009.058701.

Frank, L.D., Iroz-Elardo, N., MacLeod, K.E., Hong, A., 2019. Pathways from built environment to health: a conceptual framework linking behavior and exposure-based impacts. J. Transp. Health. 12, 319–335. https://doi.org/10.1016/j.jth.2018.11.008.

Frank, L.D., Adhikari, B., White, K.R., Dummer, T., Sandhu, J., Demlow, E., Hu, Y., Hong, A., Van den Bosch, M., 2022. Chronic disease and where you live: built and natural environment relationships with physical activity, obesity, and diabetes. Environ. Int. 158, 106959 https://doi.org/10.1016/j.envint.2021.106959.

Gullón, P., Bilal, U., Cebrecos, A., Badland, H.M., Galán, I., Franco, M., 2017. Intersection of neighborhood dynamics and socioeconomic status in small-area walkability: the Heart Healthy Hoods project. Int. J. Health Geogr. 16, 21. https://doi.org/10.1186/s12942-017-0095-7.

Gullón, P., Bilal, U., Sánchez, P., Díez, J., Lovasi, G.S., Franco, M., 2020. A comparative case study of walking environment in Madrid and Philadelphia using multiple sampling methods and street virtual audits. Cities Health 4, 336–344. https://doi.org/10.1080/23748834.2020.1715117.

Han, Z., Xia, T., Xi, Y., Li, Y., 2023. Healthy Cities, A comprehensive dataset for environmental determinants of health in England cities. Sci. Data 10, 165. https://doi.org/10.1038/s41597-023-02060-y.

Henderson, H., Child, S., Moore, S., Moore, J.B., Kaczynski, A.T., 2016. The influence of neighborhood aesthetics, Safety, and social Cohesion on perceived stress in Disadvantaged communities. Am. J. Community Psychol. 58, 80–88. https://doi.org/10.1002/ajcp.12081.

Kim, B., Barrington, W.E., Dobra, A., Rosenberg, D., Hurvitz, P., Belza, B., 2023. Mediating role of walking between perceived and objective walkability and cognitive function in older adults. Health Place 79, 102943. https://doi.org/10.1016/j.healthplace.2022.102943.

Lo, R.H., 2009. Walkability: what is it? J. Urban. 2, 145–166. https://doi.org/10.1080/17549170903092867.

Makhlouf, M.H.E., Motairek, I., Chen, Z., Nasir, K., Deo, S.V., Rajagopalan, S., Al-Kindi, S.G., 2023. Neighborhood walkability and cardiovascular Risk in the United States. Curr. Probl. Cardiol. 48, 101533 https://doi.org/10.1016/j.cpcardiol.2022.101533.

Millstein, R.A., Cain, K.L., Sallis, J.F., Conway, T.L., Geremia, C., Frank, L.D., Chapman, J., Van Dyck, D., Dipzinski, L.R., Kerr, J., Glanz, K., Saelens, B.E., 2013. Development, scoring, and reliability of the Microscale Audit of Pedestrian Streetscapes (MAPS). BMC Publ. Health 13, 403. https://doi.org/10.1186/1471-2458-13-403.

Mueller, N., Rojas-Rueda, D., Khreis, H., Cirach, M., Andrés, D., Ballester, J., Bartoll, X., Daher, C., Deluca, A., Echave, C., Milà, C., Márquez, S., Palou, J., Pérez, K., Tonne, C., Stevenson, M., Rueda, S., Nieuwenhuijsen, M., 2020. Changing the urban design of cities for health: the superblock model. Environ. Int. 134, 105132 https://doi.org/10.1016/j.envint.2019.105132.

Phillips, C.B., Engelberg, J.K., Geremia, C.M., Zhu, W., Kurka, J.M., Cain, K.L., Sallis, J.F., Conway, T.L., Adams, M.A., 2017. Online versus in-person comparison of Microscale Audit of Pedestrian Streetscapes (MAPS) assessments: reliability of alternate methods. Int. J. Health Geogr. 16, 27. https://doi.org/10.1186/s12942-017-0101-0.

Pontin, F.L., Jenneson, V.L., Morris, M.A., Clarke, G.P., Lomax, N.M., 2022. Objectively measuring the association between the built environment and physical activity: a systematic review and reporting framework. Int. J. Behav. Nutr. Phys. Act. 19, 119. https://doi.org/10.1186/s12966-022-01352-7.

Queralt, A., Molina-García, J., Terrón-Pérez, M., Cerin, E., Barnett, A., Timperio, A., Veitch, J., Reis, R., Silva, A.A.P., Ghekiere, A., Van Dyck, D., Conway, T.L., Cain, K.L., Geremia, C.M., Sallis, J.F., 2021. Reliability of streetscape audits comparing on-street and online observations: MAPS-Global in 5 countries. Int. J. Health Geogr. 20, 6. https://doi.org/10.1186/s12942-021-00261-5.

Ramada-Rodilla, J.M., Serra-Pujadas, C., Delclós-Clanchet, G.L., 2013. Cross-cultural adaptation and health questionnaires validation: revision and methodological recommendations. Salud Publica Mex. 55, 57–66. https://doi.org/10.1590/s0036-36342013000100009.

Rivera-Navarro, J., Bonilla, L., Gullón, P., González-Salgado, I., Franco, M., 2022. Can we improve our neighbourhoods to be more physically active? Residents' perceptions from a qualitative urban health inequalities study. Health Place 77, 102658. https://doi.org/10.1016/j.healthplace.2021.102658.

Saito, Y., Oguma, Y., Inoue, S., Breugelmans, R., Kikuchi, H., Oka, K., Okada, S., Takeda, N., Cain, K.L., Sallis, J.F., 2022. Inter-rater reliability of streetscape audits using online observations: Microscale Audit of Pedestrian Streetscapes (MAPS) global in Japan. Prev. Med. Rep. 30, 102043 https://doi.org/10.1016/j.pmedr.2022.102043.

Sallis, J.F., Cain, K.L., Conway, T.L., Gavand, K.A., Millstein, R.A., Geremia, C.M., Frank, L.D., Saelens, B.E., Glanz, K., King, A.C., 2015a. Is Your neighborhood designed to Support physical activity? A brief streetscape Audit tool. Prev. Chronic Dis. 12, E141. https://doi.org/10.5888/pcd12.150098.

Sallis, J.F., Frank, L.D., Saelens, B.E., Cain, K.L., Conway, T.L., Chapman, J., Geremia, C.M., King, A.C., 2015b. Microscale Audit of Pedestrian Streetscapes (MAPS), mini version. https://www.drjimsallis.com/_files/ugd/a56315_bcbad144a2cd4da0856c0e6b580d7bde.pdf.

Siero, 2020. Siero in Figures – socioeconomic observatory. Available at: https://www.ayto-siero.es/siero-en-cifras/#60-58-resumen-de-habitantes-por-unidades-de-territorio.

Strobe, 2023. STROBE checklists. Available at: https://www.strobe-statement.org/checklists/. . (Accessed 12 July 2023).

Tavakol, M., Dennick, R., 2011. Making sense of Cronbach's alpha. Int. J. Med. Educ. 27, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd.

United Nations, 2018. World population projected to live in urban areas by 2050. Retrieved from. https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html. (Accessed 12 July 2023).
Wang, M.L., Narcisse, M.R., McElfish, P.A., 2023. Higher walkability associated with increased physical activity and reduced obesity among United States adults. Obesity 31, 553–564. https://doi.org/10.1002/oby.23634.
Westenhöfer, J., Nouri, E., Reschke, M.L., Seebach, F., Buchcik, J., 2023. Walkability and urban built environments-a systematic review of health impact assessments (HIA). BMC Publ. Health 23, 518. https://doi.org/10.1186/s12889-023-15394-4.
World Health Organization, 2018. Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World. Retrieved from. https://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf. (Accessed 12 July 2023).
Zou, G.Y., 2012. Sample size formulas for estimating intraclass correlation coefficients with precision and assurance. Stat. Med. 31, 3972–3981. https://doi.org/10.1002/sim.5466.
Zuniga-Teran, A.A., Orr, B.J., Gimblett, R.H., Chalfoun, N.V., Marsh, S.E., Guertin, D.P., Going, S.B., 2017. Designing healthy communities: Testing the walkability model. Front. Archit. Res. 6, 63–73. https://doi.org/10.1016/j.foar.2016.11.005.