

## Examination Report on the Doctoral Dissertation

University: Waseda University  
School: Graduate School of Sport Sciences  
Applicant Name: KOOHSARI, Mohammad Javad  
Degree: Doctor of Sport Sciences  
Dissertation Title:

(English) Activity-Friendly Built Environment and Cardiovascular Disease

(Japanese) アクティビティに配慮した建築環境と心血管疾患

Examination Committee:

Chief Examiner: OKA, Koichiro Waseda University (早稲田大学) Professor (教授) Ph.D.  
(Waseda University)

Sub Examiner: MIYACHI, Motohiko Waseda University (早稲田大学) Professor (教授) Ph.D.  
(University of Tsukuba)

Sub Examiner: MAEDA, Seiji Waseda University (早稲田大学) Professor (教授) Ph.D.  
(University of Tsukuba)

Sub Examiner: ISHII, Kaori Waseda University (早稲田大学) Professor (教授) Ph.D. (Tokyo  
Medical University)

Sub Examiner: SHIBATA, Ai University of Tsukuba (筑波大学) Associate Professor (准教  
授) Ph.D. (Waseda University)

### Report:

Cardiovascular disease is the number one cause of death in the world, responsible for about 17.9 million deaths per year. Scientific and public interest in the role of the neighbourhood built environment in preventing cardiovascular disease is growing. While motivating individual lifestyle changes remains essential in preventing these diseases, built environment interventions that can impact a high percentage of the population are needed. Nevertheless, the science of modifying the built environment to enhance cardiovascular health outcomes is still in its infancy, with several challenges. This PhD thesis identified the key conceptual, methodological, and policy-relevant issues on the activity-friendly built environment and cardiovascular disease. It discussed how two built environment tools, Walk Score<sup>®</sup> and space syntax, can address some of this topic's methodological and policy-relevant issues.

This PhD thesis comprises ten peer-reviewed articles published in scientific journals and is presented through the following six chapters:

**Chapter one** briefly describes the common terminology in cardiovascular disease and introduces the research problem, aims, the significance of this research, and an overview of the chapters in this PhD thesis.

**Chapter two** provides a critical literature review of the previous studies on the activity-friendly built environment and cardiovascular disease. This chapter identifies the critical research gaps and the next steps in research on this topic. Notably, this chapter classifies these research gaps into three categories of conceptual, methodological, and policy-relevant gaps. It elaborates on the importance of addressing these gaps to advance the science on this topic. This chapter was published in *Nature Reviews Cardiology* (paper number 5) and *Environmental Research Letters* (paper number 3).

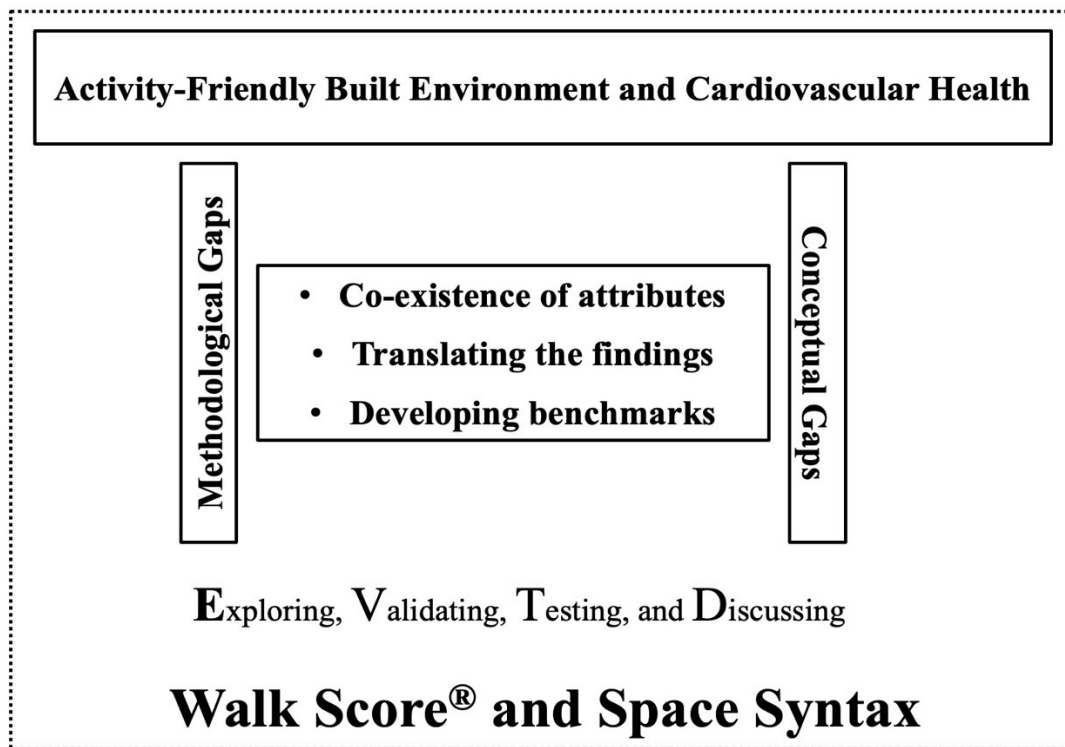
**Chapter three** describes the validity of using Walk Score® as a practical, easy-to-use tool for measuring walkability in the context of Japan for the first time. The first study examined the concurrent validity of the Walk Score® compared with objectively measured walkable built environment variables. The findings provide evidence of the validity of using Walk Score® in the context of Japan. The second study in this chapter explored whether there are also associations between Walk Score® and people's perceived walkable built environment attributes or not. This study found that Walk Score was also correlated with perceived measures of walkable environments in Japan. This chapter was published as two papers in *Preventive Medicine Reports* (papers number 9 and 4).

**Chapter four** describes the concept and theory of space syntax and explains how space syntax could be relevant to research on (re)designing activity-friendly built environment. Notably, it discussed the space syntax theory of natural movement in detail and identified the pathways through which this theory can be linked to physical inactivity, a modifiable risk factor of cardiovascular disease. This chapter was published in *Health & Place* (paper number 7).

**Chapter five** provides empirical evidence on the role of Walk Score® and space syntax in promoting cardiovascular health. This chapter comprises four studies. The first study explored the associations between Walk Score® and active and sedentary behaviours in Japan. Significant associations were found between Walk Score® and walking and driving behaviours. The second study applied space syntax theory to examine how street layouts were associated with active and sedentary behaviours. This study provided evidence on how space syntax measures can be applied in relation to physical inactivity. The third study examined the association between space syntax walkability, a newly-developed index, with sedentary behaviours, as the first study to our knowledge. This study found that space syntax walkability was significantly negatively associated with sedentary behaviours. The fourth study explored how activity-friendly built environment attributes are associated with objectively-assessed cardiovascular risk factors. As the first study on this topic, this study provided preliminary evidence on the relevance of space syntax measures in relation to objectively-assessed cardiovascular biomarkers. This chapter was published in four peer-review papers at *Cities* (paper number 8), *Health & Place* (paper number 10), *Environmental Research Communications* (paper number 6), and *Preventive Medicine* (paper number 1).

**Chapter six** summarises the main findings of this PhD research and discusses the main findings. It also provides the next issues that need to be considered to advance research in this field. This chapter was published in *Sport Sciences Research* (paper number 2).

In conclusion, this PhD research has made significant contributions to health and sport sciences through addressing several gaps in the current literature on built environment and cardiovascular disease. This PhD research specifically and arguably advanced the field by exploring, validating, testing, and discussing two built environment tools, Walk Score® and space syntax to address three methodological and policy-relevant gaps in this area of research. One of the notable strengths of this PhD research lies in its inclusion of case studies conducted not only in highly populated areas of Japan but also in sprawled low-density areas in Canada. This multi-site approach enhances the variability in built environment attributes.



The contribution of this PhD research to health & sport sciences

**Published peer-reviewed journal article:**

1. **Koohsari, M. J.**, Oka, K., Nakaya, T., Vena, J., Williamson, T., Quan, H., & McCormack, G. R. (2023). Urban design and cardio-metabolic risk factors. *Preventive Medicine*, 173: 107552.
2. **Koohsari, M. J.**, & Oka, K. (2023). Walk Score® and space syntax in research on activity-friendly built environment and cardiovascular diseases. *Sport Sciences Research*, 20: 27-38.
3. **Koohsari, M. J.**, Nakaya, T., McCormack, G. R., & Oka, K. (2021). Socioeconomic disparity in cardiovascular health: The role of where we live. *Environmental Research Letters*, 16: 041001.
4. **Koohsari, M. J.**, McCormack, G. R., Shibata, A., Ishii, K., Yasunaga, A., Nakaya, T., & Oka, K. (2021). The relationship between Walk Score® and perceived walkability in ultrahigh density areas. *Preventive Medicine Reports*, 23: 101393.

5. **Koohsari, M. J.**, McCormack, G. R., Nakaya, T., & Oka, K. (2020). Neighbourhood built environment and cardiovascular disease: Knowledge and future directions. *Nature Reviews Cardiology*, 17(5): 261-263.
6. **Koohsari, M. J.**, Oka, K., Nakaya, T., Shibata, A., Ishii, K., Yasunaga, A., & McCormack, G. R. (2020). Environmental attributes and sedentary behaviours among Canadian adults. *Environmental Research Communications*, 2(5): 051002.
7. **Koohsari, M. J.**, Oka, K., Owen, N., & Sugiyama, T. (2019). Natural movement: A space syntax theory linking urban form and function with walking for transport. *Health & Place*, 58: 102072.
8. **Koohsari, M. J.**, Sugiyama, T., Shibata, A., Ishii, K., Hanibuchi, T., Liao, Y., Owen, N., & Oka, K. (2018). Walk Score<sup>®</sup> and Japanese adults' physically-active and sedentary behaviors. *Cities*, 74: 151-155.
9. **Koohsari, M. J.**, Sugiyama, T., Hanibuchi, T., Shibata, A., Ishii, K., Liao, Y., & Oka, K. (2018). Validity of Walk Score<sup>®</sup> as a measure of neighborhood walkability in Japan. *Preventive Medicine Reports*, 9: 114-117.
10. **Koohsari, M. J.**, Sugiyama, T., Shibata, A., Ishii, K., Liao, Y., Hanibuchi, T., Owen, N., & Oka, K. (2017). Associations of street layout with walking and sedentary behaviors in an urban and a rural area of Japan. *Health & Place*, 45: 64-69.