Metadata of the GEOage dataset

Geographic characteristics, outdoor mobility and physical activity of older people – dataset description

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Introduction to GEOage dataset

This dataset is part of the "Geographic characteristics, outdoor mobility and physical activity of older people" (GEOage) project, in which freely available geographic information characterizing the environment is linked to participant data of the "Life-space mobility in old age" (LISPE) cohort comprising 75–90-years-old community-dwelling people living in Jyväskylä and Muurame in Central Finland.

The GEOage dataset contains variables describing the characteristics of the environment (including natural and built environment), in which each participant resides. Home addresses of the 848 study participants were derived from the Population Register and locations were geocoded in the geographic information system (GIS). The home environment was typically studied within a distance of 500 m or 1000 m from each home depending on the variable. Environmental characteristics were derived from freely available GIS datasets. Participant data were collected in spring 2012, and for each spatial dataset, the best temporal fit was chosen to characterize the environment. ArcMap software version 10.2 or 10.3 (ESRI, Redlands, USA) was used to create all environmental variables.

Study area

Jyväskylä city is the seventh largest city in Finland, with about 133,500 inhabitants around the time of participant data collection (Statistics Finland, 2019). Muurame is a separate municipality of a about 9,500 inhabitants, surrounded by Jyväskylä outer areas. The study area is characterized by a main city center (Jyväskylä) and several compact areas for business, services, and residence (subcenters). Surrounding areas are relatively sparsely populated with high presence of natural or agricultural land, lakes and hills.

Available environmental variables are described in this document. A description of the cohort sample and the variables collected from participants can be found in the LISPE study protocol paper: Rantanen et al. BMC Public Health 2012;12:1018. https://doi.org/10.1186/1471-2458-12-1018. *(Open Access paper).*

GEOage project related papers have been published and may provide some additional information on the environmental variables created, e.g.:

1. Portegijs E, Keskinen KE, Tsai L-T, Rantanen T, Rantakokko M. Physical limitations, walkability, perceived environmental facilitators and physical activity of older adults in Finland. International Journal of Environmental Research and Public Health 2017;14:333. https://doi.org/10.3390/ijerph14030333. *(Open Access paper).*

2. Keskinen KE, Rantakokko M, Suominen K, Rantanen T, Portegijs E. Nature as a facilitator for physical activity: Defining relationships between the objective and perceived environment and physical activity among community-dwelling older people. Health and Place 2018;49:111-119. https://doi.org/10.1016/j.healthplace.2017.12.003. *(Open Access paper).*

3. Rantakokko M, Keskinen KE, Kokko K, Portegijs E. Nature diversity and well-being in old age. Aging Clinical and Experimental Research 2018;30;527-532. https://doi.org/10.1007/s40520-017-0797-5. *(Open Access preprint available at https://jyx.jyu.fi/handle/123456789/57751.*

4. Keskinen KE, Rantakokko M, Suomi K, Rantanen T, Portegijs E. Hilliness and the development of walking difficulties among community-dwelling older people. Journal of Aging and Health 2020;32:278-284. https://doi.org/10.1177/0898264318820448. *(Open Access preprint available at https://jyx.jyu.fi/handle/123456789/70095).*

5. Keskinen KE, Rantakokko M, Suomi K, Rantanen T, Portegijs E. Environmental features associated with older adults' physical activity in different types of urban neighborhood. Journal of Aging and Physical Activity 2020;32:278-284. https://doi.org/10.1123/japa.2019-0251. *(Open Access preprint available at https://jyx.jyu.fi/handle/123456789/67648).*

6. Keskinen KE, Gao Y, Rantakokko M, Rantanen T, Portegijs E. Associations of environmental features with outdoor physical activity on weekdays and on weekend days: Cross-sectional study among older people. Frontiers Public Health – Thematic issue: Healthy Aging and the Community Environment 2020. Frontiers of Public Health 2020;8:578275. https://doi.org/10.3389/fpubh.2020.578275. *(Open Access paper).*

Base variables

Participant home addresses

All environmental variables were based on geocoded home addresses of LISPE study participants. Home addresses were derived from the population register and geocoded in GIS. The Digiroad road and street database (Finnish Transport Agency 2013) was used for the geocoding of home addresses.

Dataset references	Finnish Transport Agency. 2013. LISPE participant dataset: Rantanen et al. BMC Publ Health 2012;12:1018

Buffer areas around home location

Distances used to create buffer areas around participant homes were defined using ArcMap software, these were typically 500 m or 1000 m.

Hilliness

Mean road network slope

Mean road network slope depicts the average slope of all roads surrounding the participant's home. It was calculated based on elevation data of 2m x 2m grid cells in the walkable ways network.

GIS variable name	**Slope_u15**	**Slope_1kmu15**
Buffer	500 meters road network buffer	1000 meters road network buffer
Range of values	0.90 … 4.57 %-rise	1.22 … 4.18 %-rise
Scale	Ratio; 0 equals flat and 100 represents 45 degrees	
GIS dataset references	Finnish Transport Agency 2013. National Land Survey of Finland 2014. National Land Survey of Finland 2015.	
Related publications	Keskinen et al. J Aging Health 2020; 32:278-284. Ristikartano et al. 2012.	

Land use

Number of land types

The number of land types was defined as the number of different land use classes present in the buffer area around participant homes. Land use was based on 13 classes: Residential and service; Industry, transport and construction; Sport and leisure facilities; Cultivated fields; Fruit trees and berry plantations; Pastures; Uncultivated agricultural areas; Forests; Shrub and/or herbaceous vegetation; Open spaces with little/no vegetation; Wetlands; Swamps; Water bodies.

GIS variable name	**Land_types**	**Land_1kmtypes**
Buffer	500 meters circular buffer	1000 meters circular buffer
Range of values	3 … 10 land types [n]	5 … 11 land types [n]
Scale	Ratio; count	
GIS dataset references	Finnish Environment Institute 2014. Finnish Transport Agency 2013.	
Related publications	Keskinen et al. Health Place 2018;49:111-119.	

Land-use-mix

Land-use-mix (LUM) was defined as the heterogeneity (Normalized Shannon Diversity Index, SHDI) of land use in the buffer around participant homes. The variable comprised six land-use classes: Residential area; Service, Industry; Transport and construction; Sport and leisure facilities; Agricultural and private garden; Forest and semi-natural areas.

GIS variable name	**LUM_6C**	**LUM_1km6C**
Buffer	500 meters dry circular buffer (water bodies excluded)	1000 meters dry circular buffer (water bodies excluded)
Range of values	0.04 … 0.93 normalized SHDI [-]	0.02 … 0.88 normalized SHDI [-]
Scale	Ratio; 0 = one land use class only; 1 = all land use classes present equally	
GIS dataset references	Finnish Environment Institute 2014. Finnish Transport Agency 2013. National Land Survey of Finland 2015.	
Related publications	Rantakokko et al. Aging Clin Exp Res 2018;30:527-532.	

Diversity of land use

Diversity of land use was defined as the heterogeneity (Normalized Shannon Diversity Index, SHDI) of land use in the buffer around participant homes. Land use was based on 13 classes: Residential and service; Industry, transport and construction; Sport and leisure facilities; Cultivated fields; Fruit trees and berry plantations; Pastures; Uncultivated agricultural areas; Forests; Shrub and/or herbaceous vegetation; Open spaces with little/no vegetation; Wetlands; Swamps; Water bodies.

GIS variable name	**SHDI_Nor**	**SHDI_1kmNor**
Buffer	500 meters circular buffer	1000 meters circular buffer
Range of values	0.16 … 0.77 normalized SHDI [-]	0.16 … 0.73 normalized SHDI [-]
Scale	Ratio; 0 = one land use class only; 1 = all land use classes present equally	
GIS dataset references	Finnish Environment Institute 2014. Finnish Transport Agency 2013.	
Related publications	Keskinen et al. Health Place 2018;49:111-119.	

Nature and green areas

Greenness

Greenness was defined as mean normalized difference vegetation index in the buffer around participant homes. It was calculated from Landsat 5 satellite images (taken in July 2010), which have been processed for surface reflectance as 30 m × 30 m raster data sets.

GIS variable name	**NDVI**	**NDVI_1km**
Buffer	500 meters dry circular buffer (water bodies excluded)	1000 meters dry circular buffer (water bodies excluded)
Range of values	0.06 … 0.64 NDVI [-]	0.16 … 0.62 NDVI [-]
Scale	Ratio; higher values indicating more abundant vegetation	
GIS dataset references	Finnish Transport Agency 2013. National Land Survey of Finland 2015. U.S. Geological Survey 2014.	
Related publications	Keskinen et al. J Aging Phys Act 2020;28:540-548.	

Habitat diversity within large natural and green area

Habitat diversity within large natural and green area was defined as the highest heterogeneity (Normalized Shannon Diversity Index, SHDI) in land use of large (a minimum 10 ha in size) areas of nature and green, which extend inside the buffer area around participant homes. The variable was based on nine land use classes: Cultivated fields; Fruit trees and berry plantations; Pastures; Uncultivated agricultural areas; Forests; Shrub and/or herbaceous vegetation; Open spaces with little/no vegetation; Wetlands; Swamps.

GIS variable name	**SHDI_13C_XLNor_IMP**	**SHDI_13C_1kmXLNor**
Buffer	500 meters circular buffer	1000 meters circular buffer
Range of values	0.00 … 0.71 normalized SHDI [-]	0.13 … 0.71 normalized SHDI [-]
Scale	Ratio; 0 = one land use class only; 1 = all land use classes present equally	
GIS dataset references	Finnish Environment Institute 2014. Finnish Transport Agency 2013.	
Related publications	Keskinen et al. Health Place 2018;49:111-119.	

Neighborhood type

Residential area type

Residential area type was defined at the home location as the residential area type categorized into four classes: High-rise area, low-rise area, sparsely built urban area, and rural area.

GIS variable name	**AREA_4cat**
Buffer	- (at home location)
Range of values	1 - 4
Scale	Nominal
GIS dataset references	Residential areas 2010. Urban form 2010. Finnish Transport Agency 2013.
Related publications	Keskinen et al. Health Place 2018;49:111-119.

Neighbourhood type within urban structure

Neighbourhood type was based on the type of center present within 500 m from a participant's home, and in absence of a center, then based on the mean residential density within the buffer

around participant homes. The variable was categorized as follows: City center, Subcenter, Dense areas outside centers, and Dispersed areas outside centers.

GIS variable name	**UrbanStr**
Buffer	500 meters circular buffer
Range of values	1 - 4
Scale	Nominal
GIS dataset references	Finnish Environment Institute 2015. Official Statistics of Finland 2015. Finnish Transport Agency 2013.
Related publications	Keskinen et al. J Aging Phys Act 2020;28:540-548.

Outdoor mobility supportive infrastructure

Intersection density

Intersection density was defined as the density of intersections along walkable ways in the buffer around participant homes.

GIS variable name	**IntDens_B500**
Buffer	500 meters circular buffer
Range of values	4 … 111 intersections per square km [n / km^2]
Scale	Ratio
GIS dataset references	National Land Survey of Finland 2015. Finnish Transport Agency 2013.
Related publications	Keskinen et al. J Aging Phys Act 2020;28:540-548.

Road network length

Road network length was defined as the total length of walkable way segments in the buffer around participant homes.

GIS variable name	**Network**
Buffer	500 meters road network buffer
Range of values	782 … 10891 meters [m]
Scale	Ratio
GIS dataset references	National Land Survey of Finland 2015. Finnish Transport Agency 2013.
Related publications	Keskinen et al. J Aging Health 2020;32:278-284.

Residential density

Residential density was defined as the mean residential density in the buffer around participant homes.

GIS variable name	**ResDens_B500**
Buffer	500 meters circular buffer
Range of values	1 … 5123 residents per square km [persons / km^2]
Scale	Ratio
GIS dataset references	Official Statistics of Finland 2015. Finnish Transport Agency 2013.
Related publications	Keskinen et al. J Aging Phys Act 2020:28:540-548.

Walkability index

The walkability index represents a summary score of land use mix, street connectivity, and population density in the buffer around participant homes. Index scores are computed based on the sum of Z-scores of the three individual components and computed using SPSS Statistical Software Package 22 (IBM Inc., Armonk, NY, USA).

GIS variable name	**Walkab_1km_LUM4_vaesto**
Buffer	1000 meters road network buffer
Range of values	-5.39 … 4.84 index score
Scale	Ratio
GIS dataset references	Finnish Transport Agency 2013. Finnish Environment Institute 2014. National Land Survey of Finland 2015. Official Statistics of Finland 2015.
Related publications	Portegijs et al. Internat J Environ Res Public Health 2017;14:333.

Services

Number of grocery stores, hypermarkets, and department stores

Number of grocery stores, hypermarkets, and department stores were computed within the buffer around participant homes. Only services available in year 2012 were considered.

GIS variable name	**GroHyper**
Buffer	500 meters circular buffer
Range of values	0 … 9 services [n]
Scale	Ratio; count
GIS dataset references	Finnish Transport Agency 2013. Services: various sources listing service providers (service provider catalogs; Internet pages of municipalities and retail chains, Google search)
Related publications	-

Waterside areas

Distance to a waterside

Distance to a waterside was defined as Euclidean (direct line) distance from home to the closest waterside.

GIS variable name	**LAKE_DIST**
Buffer	- (at home location)
Range of values	9 … 1796 meters [m]
Scale	Ratio
GIS dataset references	National Land Survey of Finland 2015. Finnish Transport Agency 2013.
Related publications	Keskinen et al. Health Place 2018;49:111-119.

GIS dataset references

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Participant data reference

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Other references

Keskinen KE, Gao Y, Rantakokko M, Rantanen T, Portegijs E. Associations of environmental features with outdoor physical activity on weekdays and on weekend days: Cross-sectional study among older people. Frontiers Public Health – Thematic issue: Healthy Aging and the Community Environment 2020. Frontiers of Public Health 2020;8:578275. https://doi.org/10.3389/fpubh.2020.578275.

Keskinen KE, Rantakokko M, Suomi K, Rantanen T, Portegijs E. Environmental features associated with older adults' physical activity in different types of urban neighborhood. Journal of Aging and Physical Activity 2020;32:278-284. https://doi.org/10.1123/japa.2019-0251.

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Portegijs E, Keskinen KE, Tsai L-T, Rantanen T, Rantakokko M. Physical limitations, walkability, perceived environmental facilitators and physical activity of older adults in Finland. International Journal of Environmental Research and Public Health 2017;14:333. https://doi.org/10.3390/ijerph14030333.

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