Supplementary Materials

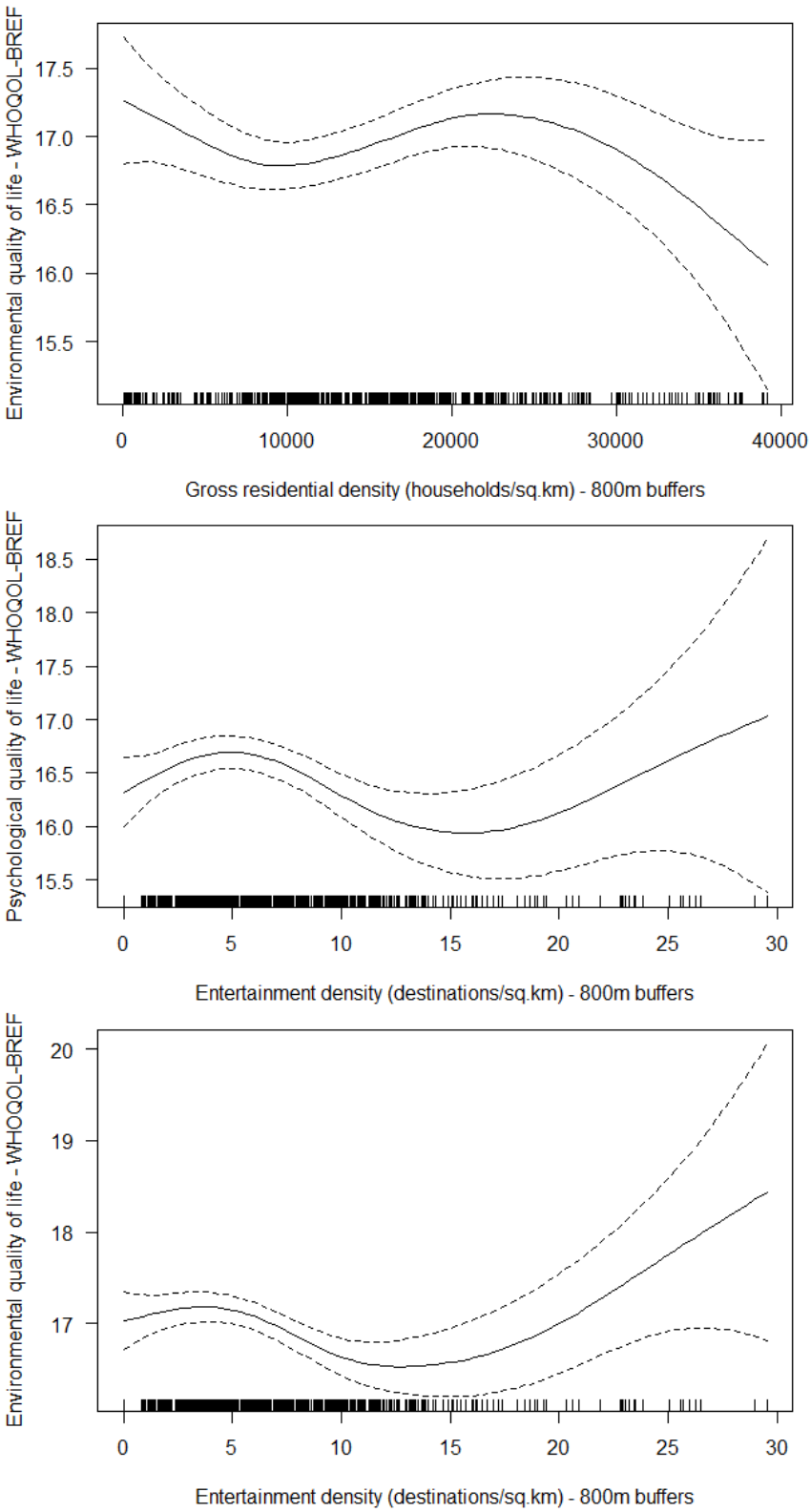

Figure S1. Curvilinear associations of single neighbourhood attributes with quality of life (QoL)—right top: association between gross residential density and environmental QoL; left bottom: association between entertainment density and psychological QoL; right bottom: association between entertainment density and environmental QoL. Notes: the solid lines represent point estimates (and dashed lines represent their 95% confidence intervals) of WHOQOL−BREF scores at various values of neighbourhood attributes.

Table S1. Definitions of environmental variables and expected associations with quality of life (QoL).

Environmental Variable (Data Source; Type of Buffer Used)	Definition	Expected Associations with Quality of Life
Participant street-network residential buffer (extant GIS)	An irregularly shaped polygon around a participant's home address (geocoded) that approximates neighbourhood boundaries. Buffer polygons were created for two distances (400-m and 800-m) by tracing through unique street networks in all directions. We calculated the total land area (km^2) of each participant residential buffer. All GIS variables listed below were computed for each participant's 400 m and 800 m street-network buffers.	Not applicable
Gross residential density (extant GIS; 400 m and 800 m street-network buffers)	Number of residential households divided by the area of the participant street−network residential buffers, expressed as households per km^2.	Positive or rotated J-shaped Providing better access to destinations, more opportunities for physical activity [1] and social interactions [2] that are associated with better perceived QoL [3]. However, very high levels of density may act as stressors [4] which have a negative effect on QoL [5].
Street intersection density (extant GIS; 400 m and 800 m street-network buffers)	Number of three−and−more−way intersections divided by the area of the participant street−network residential buffers, expressed as intersections per km^2.	Positive or rotated J-shaped Providing better access to destinations, more opportunities for physical activity and social interactions that are associated with better perceived QoL. However, moderate-to-high levels of these attributes may be associated with higher traffic-related hazards and noise [6] which have been found to be negatively related to QoL [7].
Connectivity (EA; 400 m crow-fly buffer)	Assessed by 2 items: no cul-de-sacs; bridge/overpass or tunnel. A participant's score on this variable represents the percentage of a street−segment's highest obtainable score (in this case, 2) averaged across audited street segments within a participant crow−fly residential buffer.	
Civic and institutional density (extant GIS; 400 m and 800 m street-network buffers)	Number of civic and institutional locations (e.g., government office, public services, school) divided by the area of the participant street-network residential buffers, expressed as number of destinations per km^2.	Positive Access to civic/institutional destinations provides more opportunities for active transport [6] and social activities that are associated with better QoL [3,8].
Prevalence of non-food retail and services (EA; 400m crow-fly buffer)	Sum of number of non-food retail and services types (post-office, hotel, warehouse, laundry, bank, hardware store, pharmacy, clothing/shoe store, book/stationary store and video/audio store) across all audited street segments within a participant's crow-fly residential buffer.	Positive Access to retail/commercial destinations provides more opportunities for active transport and social activities.
Entertainment density (extant GIS; 400 m and 800m street-network buffers)	Number of entertainment destinations (e.g., theatre, museum, community centre, art gallery) divided by the area of the participant street−network residential buffers, expressed as number of destinations per km^2.	Positive Access to entertainment destinations provides more opportunities for active transport and social and leisure activities that are associated with better perceived QoL [3,8,9].

Recreation density (extant GIS; 400 m and 800 m street-network buffers)	Number of recreational destinations (e.g., sports centre, swimming pool, fitness club) divided by the area of the participant street-network residential buffers, expressed as number of destinations per km^2.	Positive Access to recreational destinations provides more opportunities for active transport, leisure-time physical activity and social activities.
Prevalence of food-related shops (EA; 400 m crow-fly buffer)	Sum of number of food-related shop types (convenience store, supermarket, fresh-food market and bakery/cake shop) across all audited street segments within a participant's crow-fly residential buffer.	Positive Access to food-related destinations provides more opportunities for active transport and social activities.
Prevalence of eating outlets (EA; 400 m crow-fly buffer)	Sum of number of eating outlet types (chained fast−food restaurant, Chinese coffee/noodle shop, Chinese non-fast-food restaurant, Western non-fast-food restaurant and Western coffee shop) across all audited street segments within a participant's crow-fly residential buffer.	
Prevalence of destinations for socialising (EA; 400 m crow-fly buffer)	Sum of number of destinations suitable for socialising (community/elderly centre, museum, HK Jockey Club betting branch, movie or theatre, hairdresser or barber, religious places and library) across all audited street segments within a participant's crow-fly residential buffer.	Positive Access to destinations where older adults can socialise and meet others provides more opportunities for active transport and social activities.
Prevalence of health clinics/services (EA; 400m crow-fly buffer)	Total number of health clinics/services in all audited street segments within a participant's crow-fly residential buffer.	Positive Access to health−related destinations provides more opportunities for active transport and social activities.
Prevalence of public transport stops (EA; 400 m crow-fly buffer)	Total number of public transport stops (bus stop, tram stop, MTR/train stop, ferry) in all audited street segments within a participant's crow-fly residential buffer.	Positive or rotated J-shaped Providing better access to destinations, more opportunities for active transport and social interactions. However, high levels of public transport density may be associated with higher traffic-related noise and pollution and these have negative effects on QoL [9].
Number of parks (EA; 400 m crow-fly buffer)	Number of public parks intersecting a participant's crow-fly residential buffer. A public park was defined as a government designed park of any size that was free of charge, open to the public and maintained by a governmental agency.	Positive Access to parks provides more opportunities for active transport, leisure-time physical activity and social and leisure activities.
Park area (extant GIS; 400 m and 800 m street-network buffers)	Total area (hectare) of public parks intersecting the participant street−network residential buffers.	Positive Access to open space and good quality of parks provide more opportunities for active transport, leisure-time physical activity and social and leisure activities.
Activity types in park (EA; 400 m crow-fly buffer)	Total number of activity types across all public parks intersecting a paritcipant's crow−fly residential buffer.	
Amenities in park (EA; 400m crow-fly buffer)	Maximum number of amenities across all public parks intersecting a participant's crow-fly residential buffer. Amenities are assessed by 7 items: chidren's play equipment, seating facilities, dog litter bags, taps/water sources	

	for dogs, drinking fountains, parking facilities, and public transport. The maximum possible score is 7.	
Trees in park (EA; 400 m crow-fly buffer)	Maximum score of tree scale across all public parks intersecting a participant's crow−fly residential buffer. Tree scale assesses the tree placement at all perimeter sides and within parks, with higher scores indicating wider tree pattern. The maximum possible score is 5.	
Paths in park (EA; 400 m crow-fly buffer)	Maximum score of path scale all across public parks intersecting a participant's crow-fly residential buffer. Path scale assesses the path placement in terms of perimeter sides and diagonal or radial shapes across a park, with higher scores indicating wider path pattern. The maximum possible score is 7.	
Park aesthetics (EA; 400 m crow-fly buffer)	Maximum score of aesthetics across all public parks intersecting a participant's crow−fly residential buffer. Aesthetics is assessed by 3 items: watered grass, no graffiti, and no vandalism. The maximum possible score is 3.	
Park visibility (EA; parks within 400 m crow-fly buffer)	Maximum score of visibility across all public parks intersecting a participant's crow-fly residential buffer. Visibiltiy from both surrounding roads and surrounding buildings/houses are assessed. Three levels are used: clearly seen, partly seen, and cannot be seen. The maximum possible score is 8.	
Pedestrian infrastructure (EA; 400 m crow-fly buffer)	Assessed by 7 items: no steep roads/hilly street, footpaths present, footpaths well-maintained, no wet and slippery streets, bridge/overpass or tunnel, no major barriers to walking, and presence of indoor air-conditioned areas for walking. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 7) averaged across audited street segments within a participant crow-fly residential buffer.	Positive Providing better access to destinations, more opportunities for active transport and social interactions.
Sitting facilities (EA; 400 m crow−fly buffer)	Assessed by a single item: benches/places for sitting. This variable represents the percentage of street-segments within a participant crow-fly residential buffer that have sitting facilities.	Positive Providing a place to rest outdoors and socialise with others.
Crowdedness (EA; 400 m crow-fly buffer)	Assessed by 3 items: street crowded, motor vehicles parked on the footpaths, and hawkers and shops on streets. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 3) averaged across audited street segments within a participant crow-fly residential buffer.	Positive or rotated J−shaped Providing opportunities for active transport and social interactions. However, high levels of crowdedness may be associated with higher levels of noise and stress.
Presence of people (EA; 400 m crow-fly buffer)	Assessed by 4 items: presence of adults or teenagers, elders, children, and people talking and greeting each other. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 4) averaged across audited street segments within a participant crow-fly residential buffer.	Positive Providing opportunities for social interactions.

Traffic safety (EA; 400 m crow-fly buffer)	Assessed by 5 items: dirt/grass strip separating traffic from footpath, no aggressive drivers, street crossing aids, no parked cars blocking view of incoming traffic, and traffic calming devices (stop light, traffic island, crosswalk). A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 5) averaged across audited street segments within a participant crow-fly residential buffer.	Positive Providing a safe environment for walking for transport and recreation.
Greenery/natural sights (EA; 400 m crow-fly buffer)	Assessed by 2 items: trees along street segment, and attractive natural sights. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 2) averaged across audited street segments within a participant crow-fly residential buffer.	Positive Exposure to greenery and aesthetically-pleasing sceneries may improve life satisfaction [10] by promoting engagement of physical and social activities.
Signs of crime/disorder (EA; 400 m crow-fly buffer)	Assessed by 5 items: people fighting, homeless people, prostitutes, needles/syringes, and graffiti. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 5) averaged across audited street segments within a participant crow-fly residential buffer.	Negative Increase feelings of threat and act as deterrents to walking and spending time outdoors.
Stray dogs/animals (EA; 400 m crow-fly buffer)	Assessed by a single item: presence of stray dogs/animals. This variable represents the percentage of street-segments within a participant crow-fly residential buffer where stray dogs/animals were observed.	Negative Increase feelings of threat and act as deterrents to walking and spending time outdoors.
Litter/decay (EA; 400 m crow-fly buffer)	Assessed by 5 items: litter, broken bottles and cans, dog/animal fouling, no attractive buildings, and abandoned/vacant buildings. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 5) averaged across audited street segments within a participant crow−fly residential buffer.	Negative Increase feelings of threat and act as deterrents to walking and spending time outdoors.
Pollution (EA; 400 m crow-fly buffer)	Assessed by 2 items: noise pollution, and unpleasant odour. A participant's score on this variable represents the percentage of a street-segment's highest obtainable score (in this case, 2) averaged across audited street segments within a participant crow-fly residential buffer.	Negative Acts as a deterrent to walking and spending time outdoors and decrease perceived QoL [7].

Notes: GIS = geographic information systems; EA = environmental audits.

References

1. Sallis JF, Cerin E, Conway TL, et al. Physical activity in relation to urban environments in 14 cities worldwide: A cross−sectional study. *Lancet* 2016, 387, 2207−17.
2. Zhu X, Yu CY, Lee C, et al. A retrospective study on changes in residents' physical activities, social interactions, and neighborhood cohesion after moving to a walkable community. *Prev. Med*. 2014, 69 Suppl 1, S93−7.
3. Gouveia ERQ, Gouveia BR, Ihle A, et al. Correlates of health−related quality of life in young−old and old−old community−dwelling older adults. *Qual Life Res*. 2017, 26, 1561−9.
4. Fleming I, Baum A, Weiss L. Social density and perceived control as mediators of crowding stress in high−density residential neighborhoods. *J Pers Soc Psychol*. 1987, 52, 899−906.

5. Almeida DM, Piazza JR, Stawski RS, et al. The speedometer of life: Stress, health and aging. In: Schaie KW, Willis SL, editors. Handbook of the psychology of aging. 7 ed. San Diego, CA: Academic Press; 2011. p. 191−206.
6. Cerin E, Nathan A, van Cauwenberg J, et al. The neighbourhood physical environment and active travel in older adults: a systematic review and meta−analysis. *Int J Behav Nutr Phys Act*. 2017, 14, 15.
7. Oiamo TH, Luginaah IN, Baxter J. Cumulative effects of noise and odour annoyances on environmental and health related quality of life. Soc Sci Med. 2015, 146, 191−203.
8. Van Cauwenberg J, Van Holle V, De Bourdeaudhuij I, et al. Neighborhood walkability and health outcomes among older adults: The mediating role of physical activity. *Health Place*. 2016, 37, 16−25.
9. Kim J, Irwin L, Kim M, et al. The Role of Leisure Engagement for Health Benefits Among Korean Older Women. *Health Care Women Int*. 2015, 36, 1357−74.
10. De Vries S, Van Dillen SM, Groenewegen PP, et al. Streetscape greenery and health: stress, social cohesion and physical activity as mediators. *Soc Sci Med*. 2013, 94, 26−33.

Table S2. Associations of socio−demographic and health−related characteristics with quality of life (QoL) domains.

Characteristics	Physical QoL		Psychological QoL		Social QoL		Environmental QoL	
	***b* (95% *CI*)**	***p***	***b* (95% *CI*)**	***p***	***b* (95% *CI*)**	***p***	***b* (95% *CI*)**	***p***
Age	−0.010 (−0.038, 0.019)	516	−0.004 (−0.030, 0.022)	0.741	0.002 (−0.023, 0.028)	0.853	0.007 (−0.018, 0.031)	0.591
Sex								
Female †	–	–	–	–	–	–	–	–
Male	0.653 (0.293, 1.014) ***	<0.001	0.378 (0.051, 0.704) *	0.023	−0.471 (−0.790, −0.152) **	0.004	0.252 (−0.054, 0.558)	0.106
Education attainment								
No formal education †	–	–	–	–	–	–	–	–
Primary school	0.450 (0.007, 0.893) *	0.046	0.189 (−0.212, 0.589)	0.356	0.127 (−0.265, 0.518)	0.526	0.425 (0.050, 0.802) *	0.026
Secondary school	0.680 (0.202, 1.159) **	0.005	0.433 (0.001, 0.865) *	0.050	0.483 (0.061, 0.906) *	0.025	0.636 (0.230, 1.042) **	0.002
Post-secondary school	0.877 (0.287, 1.466) **	0.004	0.781 (0.250, 1.311) **	0.004	0.860 (0.341, 1.379) **	0.001	0.963 (0.462, 1.464) ***	<0.001
Marital status								
Married or cohabiting †	–	–	–	–	–	–		
Widowed	0.081 (−0.315, 0.477)	0.687	−0.103 (−0.461, 0.255)	0.571	−0.128 (−0.478, 0.221)	0.471	0.160 (−0.176, 0.496)	0.350
Other	0.184 (−0.421, 0.790)	0.551	−0.188 (−0.737, 0.360)	0.500	−0.179 (−0.715, 0.357)	0.512	−0.434 (−0.948, 0.080)	0.098
Housing								
Public and aided †	–	–	–	–	–	–	–	–
Private (purchased)	0.267 (−0.081, 0.614)	0.133	0.242 (−0.057, 0.542)	0.113	−0.025 (−0.320, 0.269)	0.866	0.049 (−0.249, 0.346)	0.748
Renting	0.605 (−0.097, 1.308)	0.091	0.398 (−0.231, 1.027)	0.215	0.043 (−0.573, 0.659)	0.892	0.200 (−0.397, 0.797)	0.511
Living arrangement								
Living with others †	–	–	–	–	–	–	–	–
Living alone	0.150 (−0.267, 0.567)	0.480	−0.069 (−0.448, 0.309)	0.719	−0.176 (−0.545, 0.194)	0.351	−0.189 (−0.542, 0.165)	0.296
Household with car								
No †	–	–	–	–	–	–	–	–
Yes	−0.043 (−0.381, 0.295)	0.802	0.107 (−0.198, 0.412)	0.490	−0.043 (−0.341, 0.255)	0.776	0.298 (0.011, 0.585) *	0.042
Area-level socio-economic status								

Low†	–	–	–	–	–	–	–	–
High	0.019 (−0.355, 0.394)	0.919	−0.082 (−0.368, 0.204)	0.575	−0.082 (−0.367, 0.203)	0.573	0.112 (−0.216, 0.439)	0.504
Recruitment area								
Community centre †	–	–	–	–	–	–	–	–
Elderly health centre	−0.045 (−0.459, 0.369)	0.830	−0.182 (−0.520, 0.157)	0.292	−0.205 (−0.540, 0.130)	0.230	−0.562 (−0.919, −0.205) **	0.002
Number of current diagnosed health problems	−0.329 (−0.409, −0.294) ***	<0.001	−0.177 (−0.249, −0.104) ***	<0.001	−0.072 (−0.143, −0.002) *	0.045	−0.033 (−0.101, 0.035)	0.338

Notes: b = regression coefficient; CI = confidence interval; *p* = *p* value; - = not applicable. † reference group. * p < 0.05; ** p < 0.01; *** p < 0.001.

Table S3. Associations between single GIS neighbourhood environmental attributes based on 400 m street-network buffers and quality of life (QoL) domains.

Environmental Attributes	**(Unit)**	**Physical QoL**		**Psychological QoL**		**Social QoL**		**Environmental QoL**	
		***b* (95% *CI*)**	***p***	***b* (95% *CI*)**	***p***	***b* (95% *CI*)**	***p***	***b* (95% *CI*)**	***p***
Gross residential density	(1000 households/km²)	−0.009 (−0.025, 0.007)	0.262	0.006 (−0.007, 0.018)	0.396	−0.005 (−0.018, 0.008)	0.443	−0.008 (−0.022, 0.006)	0.248
Street intersection density	(100 intersections/km²)	0.089 (−0.197, 0.374)	0.542	−0.208 (-0.451, 0.034)	0.093	−0.132 (−0.370, 0.105)	0.274	−0.277 (−0.517, −0.037) *	0.024
Civic and institutional density	(destinations/km²)	−0.001(−0.004, 0.002)	0.585	−0.000 (−0.003, 0.002)	0.861	−0.001 (−0.004, 0.001)	0.312	−0.001 (−0.004, 0.002)	0.445
Entertainment density	(destinations/km²)	0.001(−0.010, 0.011)	0.907	0.001(−0.007, 0.010)	0.786	−0.006 (−0.014, 0.003)	0.181	-0.007 (−0.016, 0.002)	0.132
Recreation density	(destinations/km²)	−0.001 (−0.007, 0.006)	0.879	0.001 (−0.005, 0.007)	0.762	0.005 (−0.001, 0.010)	0.128	0.003 (−0.002, 0.009)	0.255
Park area	(hectares)	−0.013 (−0.029, 0.003)	0.112	0.004 (−0.010, 0.018)	0.627	−0.008 (−0.022, 0.007)	0.305	−0.001 (−0.015, 0.013)	0.882

Notes: b = regression coefficient; *CI* = confidence interval; *p* = *p* value; - = not applicable; GIS = geographic information systems; All estimates adjusted for age, sex, educational attainment, household with car, marital status, housing type, living arrangement, area-level socio-economic status, type of recruitment centre, and number of current diagnosed health problems. "0.000" occurs due to rounding and does not equal to zero. * $p < 0.05$.