

Coastal proximity and visits are associated with better health but may not buffer health inequalities

Geiger, Sandra J.; White, Mathew P.; Davison, Sophie M. C.; Zhang, Lei; McMeel, Oonagh; Kellett, Paula; Fleming, Lora E.

DOI:

[10.1038/s43247-023-00818-1](https://doi.org/10.1038/s43247-023-00818-1)

License:

Creative Commons: Attribution (CC BY)

Document Version

Publisher's PDF, also known as Version of record

Citation for published version (Harvard):

Geiger, SJ, White, MP, Davison, SMC, Zhang, L, McMeel, O, Kellett, P & Fleming, LE 2023, 'Coastal proximity and visits are associated with better health but may not buffer health inequalities', *Communications Earth and Environment*, vol. 4, no. 1, 166. <https://doi.org/10.1038/s43247-023-00818-1>

[Link to publication on Research at Birmingham portal](#)

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

Supplementary Information:

Coastal proximity and visits are associated with better health but may not buffer health inequalities

Sandra J. Geiger, Mathew P. White, Sophie M. C. Davison, Lei Zhang,
Oonagh McMeel, Paula Kellett, & Lora E. Fleming

Table of Contents

Supplementary Notes 1: Search Terms for all Databases	2
Supplementary Notes 2: Descriptive Statistics	3
Supplementary Notes 3: Model Comparison Based on the Leave-one out Cross-Validation Information Criterion (LOOIC)	6
Supplementary Notes 4: Results of the Sensitivity Analyses	7
Supplementary Notes 5: Overview of Measures in the SOPHIE and SOPHIA Surveys	8
Supplementary Notes 6: Flow Diagrams of Data Exclusions for Each Hypothesis.....	10
Supplementary Notes 7: Deviations from Preregistration.....	11
Supplementary Notes 8: Standard Cut-off Criteria for the Bayes Factor Including Their Interpretation	12
Supplementary Notes 9: The Buffering Effect of Home Coastal Proximity and Visits on the Relationship Between Household Income and Self-Reported General Health	13
References	15

**Supplementary Notes 1:
Search Terms for all Databases**

Table 1.1**Search Terms Adapted for Scopus (Elsevier) Using Boolean Operators**

Search	Search Term
Relationship of nature contact and health	TITLE-ABS-KEY ((coast* OR "marine environment*") AND (visit* OR proximity OR distance) AND health*) AND (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "French") OR LIMIT-TO (LANGUAGE, "Dutch") OR LIMIT-TO (LANGUAGE, "German"))
Buffering effect of nature contact between income and health	TITLE-ABS-KEY ((natur* OR green?space* OR coast* OR "marine environment*") AND (income OR "socio?economic" AND status OR ses OR equigenesis OR equigenetic)) AND (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "French") OR LIMIT-TO (LANGUAGE, "German") OR LIMIT-TO (LANGUAGE, "Dutch"))

Table 1.2**Search Terms Adapted for CINAHL and PsycINFO (EBSCO) Using Boolean Operators**

Search	Search Term
Relationship of nature contact and health	((“coast*” OR “marine environment*”) AND (“visit*” OR “proximity” OR “distance”) AND (“health*”) AND LA (“English” OR “German” OR “French” OR “Dutch”))
Buffering effect of nature contact between income and health	((“natur*” OR “greenspace*” OR “green space*” OR “green-space*” OR “coast*” OR “marine environment*”) AND (“income” OR “socio-economic status” OR “socioeconomic status” OR “ses” OR “equigenesis” OR “equicenetic”) AND LA (“English” OR “German” OR “French” OR “Dutch”))

Table 1.3**Search Terms Adapted for Google Scholar**

Search	Search Term
Relationship of nature contact and health	(coast "marine environment") (visit proximity distance) (health)
Buffering effect of nature contact between income and health	(natur greenspace coast "marine environment") (income "socio-economic status" ses equigenesis equicenetic)

**Supplementary Notes 2:
Descriptive Statistics**

**Table 2.1
Unweighted Sample Size, Age, Sex, Household Income, Home Coastal Proximity, Coastal Visits, and Health per Country**

Country	N	Age (in years) M (SD)	Sex (% female)	Household income (in quintiles)	Home proximity (% per category)	Coastal visits (% per category)	Health (% per category)
Australia	1,012	48.66 (16.81)	51.4%	Q1: 7.4% Q2: 18.1% Q3: 16.1% Q4: 24.0% Q5: 21.9% Missing: 12.5%	> 1 km: 12.4% 1-2 km: 5.7% 2-5 km: 9.0% 5-10 km: 14.6% 10-20 km: 16.4% 20-50 km: 18.6% 50-100 km: 9.0% > 100 km: 10.0% Missing: 4.4%	1x/week: 18.3% 2-3x/week: 14.9% 1x/month: 12.5% 2-3x/month: 18.7% 1-2x/year: 29.5% Never: 5.0% Missing: 1.0%	Very good: 18.5% Good: 46.0% Fair: 26.4% Bad: 5.8% Very bad: 2.4% Missing: 0.9%
Belgium	1,001	46.53 (16.27)	50.8%	Q1: 15.5% Q2: 18.0% Q3: 20.3% Q4: 16.3% Q5: 10.8% Missing: 19.2%	> 1 km: 2.2% 1-2 km: 0.8% 2-5 km: 1.1% 5-10 km: 1.5% 10-20 km: 2.3% 20-50 km: 7.2% 50-100 km: 24.9% > 100 km: 57.3% Missing: 2.7%	1x/week: 3.3% 2-3x/week: 4.4% 1x/month: 5.6% 2-3x/month: 13.9% 1-2x/year: 56.5% Never: 14.9% Missing: 1.4%	Very good: 10.7% Good: 47.3% Fair: 29.8% Bad: 9.2% Very bad: 2.0% Missing: 1.1%
Bulgaria	1,004	44.83 (14.31)	50.9%	Q1: 4.8% Q2: 3.2% Q3: 5.7% Q4: 14.6% Q5: 64.0% Missing: 7.7%	> 1 km: 5.9% 1-2 km: 3.8% 2-5 km: 3.4% 5-10 km: 1.7% 10-20 km: 0.8% 20-50 km: 2.2% 50-100 km: 7.9% > 100 km: 73.4% Missing: 1.0%	1x/week: 11.9% 2-3x/week: 5.5% 1x/month: 4.6% 2-3x/month: 13.1% 1-2x/year: 59.3% Never: 3.5% Missing: 2.2%	Very good: 22.9% Good: 46.9% Fair: 26.0% Bad: 2.7% Very bad: 0.4% Missing: 1.1%
Czechia	1,006	46.64 (15.89)	51.3%	Q1: 8.0% Q2: 7.3% Q3: 10.5% Q4: 10.6% Q5: 46.4% Missing: 17.2%	> 1 km: 0.3% 1-2 km: 0.3% 2-5 km: 0.1% 5-10 km: 0.4% 10-20 km: 0.5% 20-50 km: 0.1% 50-100 km: 0.5% > 100 km: 89.9% Missing: 8.0%	1x/week: 0.7% 2-3x/week: 0.8% 1x/month: 0.9% 2-3x/month: 1.9% 1-2x/year: 61.1% Never: 29.1% Missing: 5.5%	Very good: 16.0% Good: 43.4% Fair: 30.4% Bad: 7.6% Very bad: 1.6% Missing: 1.0%
France	1,024	47.92 (16.27)	51.9%	Q1: 22.9% Q2: 20.3% Q3: 19.7% Q4: 18.3% Q5: 9.0% Missing: 9.8%	> 1 km: 4.6% 1-2 km: 1.7% 2-5 km: 3.3% 5-10 km: 3.3% 10-20 km: 4.2% 20-50 km: 9.4% 50-100 km: 11.6% > 100 km: 58.4% Missing: 3.5%	1x/week: 10.2% 2-3x/week: 5.9% 1x/month: 7.4% 2-3x/month: 16.2% 1-2x/year: 45.8% Never: 13.3% Missing: 1.3%	Very good: 9.7% Good: 40.7% Fair: 35.9% Bad: 9.9% Very bad: 2.3% Missing: 1.5%
Germany	1,017	48.48 (15.77)	51.3%	Q1: 18.8% Q2: 13.6% Q3: 17.4% Q4: 18.5% Q5: 15.9% Missing: 15.8%	> 1 km: 1.4% 1-2 km: 1.0% 2-5 km: 0.9% 5-10 km: 1.0% 10-20 km: 1.3% 20-50 km: 2.9% 50-100 km: 7.1% > 100 km: 80.8% Missing: 3.7%	1x/week: 2.5% 2-3x/week: 2.6% 1x/month: 3.2% 2-3x/month: 8.1% 1-2x/year: 53.1% Never: 28.6% Missing: 2.0%	Very good: 9.4% Good: 38.5% Fair: 38.2% Bad: 10.3% Very bad: 1.7% Missing: 1.8%
Greece	1,013	42.10 (13.33)	49.2%	Q1: 24.8% Q2: 24.5% Q3: 19.0% Q4: 15.3% Q5: 6.0% Missing: 10.5%	> 1 km: 19.2% 1-2 km: 11.3% 2-5 km: 14.9% 5-10 km: 15.7% 10-20 km: 13.9% 20-50 km: 13.1% 50-100 km: 6.7% > 100 km: 3.8% Missing: 1.5%	1x/week: 43.3% 2-3x/week: 23.8% 1x/month: 11.1% 2-3x/month: 12.9% 1-2x/year: 8.0% Never: 0.5% Missing: 0.4%	Very good: 36.7% Good: 48.9% Fair: 12.0% Bad: 1.2% Very bad: 1.0% Missing: 0.2%
Ireland	1,000	44.69 (15.62)	50.4%	Q1: 11.3% Q2: 22.3% Q3: 17.8% Q4: 19.5%	> 1 km: 14.8% 1-2 km: 8.1% 2-5 km: 10.7% 5-10 km: 13.0%	1x/week: 21.3% 2-3x/week: 16.3% 1x/month: 15.5%	Very good: 24.8% Good: 45.6% Fair: 23.0% Bad: 4.2%

				Q5: 15.8% Missing: 13.3%	10-20 km: 14.6% 20-50 km: 17.1% 50-100 km: 13.9% > 100 km: 3.4% Missing: 4.4%	2-3x/month: 19.4% 1-2x/year: 25.7% Never: 1.5% Missing: 0.3%	Very bad: 1.5% Missing: 0.9%
Italy	1,020	47.97 (15.57)	52.5%	Q1: 18.7% Q2: 14.5% Q3: 23.4% Q4: 17.7% Q5: 10.2% Missing: 15.4%	> 1 km: 11.5% 1-2 km: 3.5% 2-5 km: 7.0% 5-10 km: 8.2% 10-20 km: 9.5% 20-50 km: 15.9% 50-100 km: 13.6% > 100 km: 27.8% Missing: 2.9%	1x/week: 22.3% 2-3x/week: 12.9% 1x/month: 10.6% 2-3x/month: 16.9% 1-2x/year: 31.3% Never: 3.6% Missing: 2.5%	Very good: 10.2% Good: 49.5% Fair: 35.2% Bad: 3.2% Very bad: 0.8% Missing: 1.1%
Netherlands	1,001	47.76 (17.15)	52.0%	Q1: 13.1% Q2: 12.4% Q3: 18.8% Q4: 19.7% Q5: 18.4% Missing: 17.7%	> 1 km: 3.1% 1-2 km: 2.4% 2-5 km: 5.2% 5-10 km: 6.6% 10-20 km: 9.4% 20-50 km: 22.2% 50-100 km: 19.5% > 100 km: 27.5% Missing: 4.2%	1x/week: 5.8% 2-3x/week: 8.1% 1x/month: 12.7% 2-3x/month: 18.8% 1-2x/year: 39.6% Never: 13.0% Missing: 2.1%	Very good: 8.4% Good: 51.4% Fair: 31.1% Bad: 6.8% Very bad: 0.6% Missing: 1.7%
Norway	1,019	45.99 (16.17)	51.7%	Q1: 19.8% Q2: 18.4% Q3: 17.3% Q4: 12.9% Q5: 12.9% Missing: 18.8%	> 1 km: 32.7% 1-2 km: 11.0% 2-5 km: 16.3% 5-10 km: 12.3% 10-20 km: 7.5% 20-50 km: 6.7% 50-100 km: 4.0% > 100 km: 6.4% Missing: 3.2%	1x/week: 29.5% 2-3x/week: 16.0% 1x/month: 14.6% 2-3x/month: 16.6% 1-2x/year: 15.7% Never: 3.0% Missing: 4.5%	Very good: 18.7% Good: 45.3% Fair: 25.4% Bad: 7.8% Very bad: 1.0% Missing: 1.8%
Poland	1,003	44.16 (15.24)	51.9%	Q1: 9.4% Q2: 11.3% Q3: 15.8% Q4: 23.2% Q5: 33.3% Missing: 7.1%	> 1 km: 1.0% 1-2 km: 1.6% 2-5 km: 2.9% 5-10 km: 3.0% 10-20 km: 2.5% 20-50 km: 3.0% 50-100 km: 8.0% > 100 km: 75.5% Missing: 2.6%	1x/week: 6.1% 2-3x/week: 6.2% 1x/month: 6.0% 2-3x/month: 11.2% 1-2x/year: 59.3% Never: 8.9% Missing: 2.4%	Very good: 15.0% Good: 50.3% Fair: 27.0% Bad: 6.6% Very bad: 0.6% Missing: 0.5%
Portugal	1,000	43.58 (14.56)	49.7%	Q1: 10.9% Q2: 12.6% Q3: 19.0% Q4: 23.5% Q5: 23.0% Missing: 11.0%	> 1 km: 10.5% 1-2 km: 5.4% 2-5 km: 12.3% 5-10 km: 17.6% 10-20 km: 19.2% 20-50 km: 19.6% 50-100 km: 8.3% > 100 km: 6.0% Missing: 1.1%	1x/week: 32.0% 2-3x/week: 21.4% 1x/month: 17.2% 2-3x/month: 15.4% 1-2x/year: 10.8% Never: 1.0% Missing: 2.2%	Very good: 9.9% Good: 55.3% Fair: 30.6% Bad: 2.8% Very bad: 0.9% Missing: 0.5%
Spain	1,025	45.76 (15.12)	50.7%	Q1: 14.2% Q2: 16.4% Q3: 20.6% Q4: 16.7% Q5: 19.9% Missing: 12.2%	> 1 km: 14.5% 1-2 km: 7.5% 2-5 km: 9.3% 5-10 km: 6.5% 10-20 km: 5.9% 20-50 km: 8.5% 50-100 km: 8.1% > 100 km: 38.4% Missing: 1.3%	1x/week: 21.5% 2-3x/week: 14.4% 1x/month: 9.7% 2-3x/month: 15.1% 1-2x/year: 31.7% Never: 3.0% Missing: 4.6%	Very good: 12.6% Good: 44.0% Fair: 34.0% Bad: 7.2% Very bad: 1.6% Missing: 0.7%
United Kingdom	1,034	47.86 (16.86)	53.8%	Q1: 13.1% Q2: 10.3% Q3: 19.1% Q4: 18.3% Q5: 21.9% Missing: 17.5%	> 1 km: 10.4% 1-2 km: 2.9% 2-5 km: 5.8% 5-10 km: 5.0% 10-20 km: 9.1% 20-50 km: 16.1% 50-100 km: 23.2% > 100 km: 22.6% Missing: 4.8%	1x/week: 13.2% 2-3x/week: 6.8% 1x/month: 7.6% 2-3x/month: 21.1% 1-2x/year: 42.6% Never: 7.5% Missing: 1.3%	Very good: 21.1% Good: 46.1% Fair: 22.1% Bad: 6.7% Very bad: 2.2% Missing: 1.8%
Total	15,179	46.20 (15.81)	51.3%	Q1: 14.2% Q2: 14.9% Q3: 17.4% Q4: 17.9% Q5: 21.9%, Missing: 13.7%	> 1 km: 9.7% 1-2 km: 4.5% 2-5 km: 6.8% 5-10 km: 7.4% 10-20 km: 7.8% 20-50 km: 10.8% 50-100 km: 11.1%	1x/week: 16.1% 2-3x/week: 10.7% 1x/month: 9.3% 2-3x/month: 14.6% 1-2x/year: 38.0% Never: 9.1%	Very good: 16.3% Good: 46.6% Fair: 28.5% Bad: 6.1% Very bad: 1.4% Missing: 1.1%

					> 100 km: 38.7% Missing: 3.3%	Missing: 2.2%	
--	--	--	--	--	----------------------------------	---------------	--

Note. Q1: lowest income quintile, Q5: highest income quintile. In the survey, respondents were presented with ten income ranges that matched the income deciles in their specific country at the time of sampling. These deciles were collapsed into five ‘quintiles’ (e.g., deciles 1 and 2 were collapsed into quintile 1) and reflect levels of relative income within each country rather than five equally sized groups within our sample. These quintiles do not have equal proportions of respondents because (a) samples were not stratified on household income and (b) substantial numbers of respondents (13.7%) preferred not to answer this question.

Table 2.2
Weighted Descriptive Statistics for Self-Reported General Health Depending on Home Coastal Proximity (n = 13,620; excluding Czechia)

	Home Coastal Proximity							
	< 1 km	1-2 km	2-5 km	5-10 km	10-20 km	20-50 km	50-100 km	> 100 km
Very good health	22.3%	19.0%	18.4%	20.9%	15.8%	15.9%	16.2%	13.2%
Good health	46.2%	48.7%	46.6%	48.2%	50.9%	48.8%	49.5%	45.9%
Fair health	24.7%	25.1%	28.1%	25.2%	27.4%	29.0%	26.3%	32.5%
Bad health	5.4%	4.6%	5.6%	4.6%	4.7%	5.2%	6.4%	7.2%
Very bad health	1.4%	2.5%	1.3%	1.1%	1.3%	1.1%	1.7%	1.3%
Total n ^a	1,477	680	1,034	1,085	1,131	1,617	1,666	4,931

Note. ^aRounded to integers.

Table 2.3
Weighted Descriptive Statistics for Self-Reported General Health Depending on Coastal Visits (n = 14,702)

	Coastal Visits					
	1 Once a week or more often	2 Once every 2 or 3 weeks	3 Once a month	4 Once every 2 or 3 months	5 Once or twice a year	6 Never
Very good health	23.8%	20.0%	16.8%	16.9%	14.1%	8.0%
Good health	47.6%	48.8%	52.8%	49.2%	47.2%	36.0%
Fair health	22.7%	26.7%	24.2%	27.9%	30.9%	39.9%
Bad health	4.2%	3.5%	5.0%	5.0%	6.6%	13.3%
Very bad health	1.6%	0.9%	1.2%	1.0%	1.3%	2.9%
Total n ^a	2,458	1,594	1,402	2,175	5,710	1,363

Note. ^aRounded to integers.

Table 2.4
Unweighted Descriptive Statistics for Household Income Depending on Home Coastal Proximity (n = 11,916)

	Home Coastal Proximity							
	< 1 km	1-2 km	2-5 km	5-10 km	10-20 km	20-50 km	50-100 km	> 100 km
1 st income quintile (lowest)	248	94	177	150	157	219	242	683
2 nd income quintile	249	121	174	168	198	269	260	659
3 rd income quintile	253	129	188	229	213	325	272	857
4 th income quintile	260	116	181	211	242	317	344	903
5 th income quintile (highest)	250	134	176	201	221	264	324	1,238

Table 2.5
Unweighted Descriptive Statistics for Household Income Depending on Coastal Visits (n = 12,790)

	Coastal Visits					
	1 Once a week or more often	2 Once every 2 or 3 weeks	3 Once a month	4 Once every 2 or 3 months	5 Once or twice a year	6 Never
1 st income quintile (lowest)	373	204	191	297	695	320
2 nd income quintile	403	250	229	307	767	235
3 rd income quintile	424	318	260	399	975	211
4 th income quintile	459	350	271	400	1,038	162
5 th income quintile (highest)	500	305	276	513	1,440	218

**Supplementary Notes 3:
Model Comparison Based on the Leave-one out Cross-Validation Information Criterion (LOOIC)**

Predictor	Model	Model Description	LOOIC	SE	ΔLOOIC	ΔSE
Proximity (Hypothesis 1)	Model 1	Categorical predictor, random intercept	32,399.13	192.84	0.60	8.17
	Model 2	Categorical predictor, random intercept and slope	32,405.74	192.16	7.21	11.19
	Model 3	Monotonic predictor, random intercept	32,400.41	193.80	1.88	4.24
	Model 4	Monotonic predictor, random intercept and slope	32,398.53	193.76	0	0
Visits (Hypothesis 2)	Model 1	Categorical predictor, random intercept	34,962.24	200.64	21.05	10.20
	Model 2	Categorical predictor, random intercept and slope	34,945.75	201.12	4.56	8.56
	Model 3	Monotonic predictor, random intercept	34,960.21	200.50	19.03	10.17
	Model 4	Monotonic predictor, random intercept and slope	34,941.19	201.39	0	0
Proximity and Income (Hypothesis 3)	Model 1	Categorical income, random intercept, random slope proximity	28,364.91	183.45	30.43	13.20
	Model 2	Categorical income, random intercept, random slope proximity and categorical income	28,362.10	184.24	27.62	6.99
	Model 3	Categorical income, random intercept, random slope proximity and categorical income, random interaction	38,366.98	184.08	32.50	7.89
	Model 4	Monotonic income, random intercept, random slope proximity	28,361.40	183.13	26.92	12.96
	Model 5	Monotonic income, random intercept, random slope proximity and monotonic income	28,334.48	184.68	0	0
	Model 6	Monotonic income, random intercept, random slope proximity and monotonic income, random interaction	28,336.12	184.65	1.64	1.08
Visits and Income (Hypothesis 4)	Model 1	Categorical income, random intercept, random slope visits	30,445.73	190.63	27.42	12.44
	Model 2	Categorical income, random intercept, random slope visits and categorical income	30,442.66	190.93	24.35	7.39
	Model 3	Categorical income, random intercept, random slope visits and categorical income, random interaction	30,445.61	190.72	27.30	8.91
	Model 4	Monotonic income, random intercept, random slope visits	30,442.00	190.20	23.69	12.18
	Model 5	Monotonic income, random intercept, random slope visits and monotonic income	30,418.31	191.54	0	0
	Model 6	Monotonic income, random intercept, random slope visits and monotonic income, random interaction	30,419.35	191.20	1.04	2.17

Note. LOOIC = leave-one-out cross-validation information criterion (lower means better). SE = standard error. Bold indicates the model with the best predictive abilities, with the delta values referenced to this best model.

**Supplementary Notes 4:
Results of the Sensitivity Analyses**

Hypothesis	Confirmatory results	Results of sensitivity analysis with Normal(0, 5)	Results sensitive/ insensitive to prior choice?	Results of sensitivity analysis that excluded speeders ^a	Results sensitive/ insensitive to exclusion of speeders?	Results of sensitivity analysis that include Czech data	Results sensitive/ insensitive to inclusion of Czech data?	Results of sensitivity analysis with additional covariates ^b	Results sensitive/ insensitive to inclusion of additional covariates?
Hypothesis 1: proximity and health (Model 4)	BF ₊ = 82.33, b = 0.02, SE = 0.01, 90% CrI [0.01, 0.03]	BF ₊ = 92.02, b = 0.02, SE = 0.01, 90% CrI [0.00, 0.03]	Insensitive	BF ₊ = 81.19, b = 0.02, SE = 0.01, 90% CrI [0.00, 0.03], n = 13,329	Insensitive	BF ₊ = 126.66, b = 0.02, SE = 0.01, 90% CrI [0.01, 0.03]	Insensitive (but changed the value and classification of the Bayes Factor)	BF ₊ = 199.00, b = 0.02, SE = 0.00, 90% CrI [0.01, 0.03], n = 11,632	Insensitive (but changed the value and classification of the Bayes Factor)
Hypothesis 2: visits and health (Model 4)	BF ₊ → ∞, b = 0.11, SE = 0.02, 90% CrI [0.08, 0.13]	BF ₊ → ∞, b = 0.11, SE = 0.02, 90% CrI [0.08, 0.13]	Insensitive	BF ₊ → ∞, b = 0.11, SE = 0.02, 90% CrI [0.08, 0.13], n = 14,392	Insensitive			BF ₊ → ∞, b = 0.11, SE = 0.02, 90% CrI [0.08, 0.14], n = 12,485	Insensitive
Hypothesis 3: interaction of proximity and income on health (Model 5)	BF ₊ = 39.68, b = 0.01, SE = 0.00, 90% CrI [0.00, 0.01]	BF ₊ = 41.40, b = 0.01, SE = 0.00, 90% CrI [0.00, 0.01]	Insensitive	BF ₊ = 71.29, b = 0.01, SE = 0.00, 90% CrI [0.00, 0.02], n = 11,653	Insensitive	BF ₊ = 54.05, b = 0.01, SE = 0.00, 90% CrI [0.00, 0.01]	Insensitive	BF ₊ = 11.21, b = 0.00, SE = 0.00, 90% CrI [0.00, 0.01]	Insensitive (but changed the value and classification of the Bayes Factor)
Hypothesis 4: interaction of visits and income on health (Model 5)	BF ₊ = 1.08, b = 0.00, SE = 0.00, 90% CrI [-0.01, 0.01], BF ₀₁ = 2,348.96	BF ₊ = 1.09, b = 0.00, SE = 0.00, 90% CrI [-0.01, 0.01], BF ₀₁ = 1,163.51	Insensitive Two-sided testing: insensitive	BF ₊ = 1.06, b = 0.00, SE = 0.00, 90% CrI [-0.01, 0.01], BF ₀₁ = 2,268.72, n = 12,514	Insensitive Two-sided testing: insensitive			BF ₊ = 2.11, b = 0.00, SE = 0.01, 90% CrI [-0.01, 0.01], BF ₀₁ = 1,815.68	Insensitive Two-sided testing: insensitive

Note. ^aSpeeders are defined as respondents who completed the survey faster than 5 min. Individuals with a missing completion time (i.e., all Australian respondents) were not excluded.

^bAdditional covariates were education, work status, and political orientation.

**Supplementary Notes 5:
Overview of Measures in the SOPHIE and SOPHIA Surveys**

**Table 5.1
Overview of the Items in Both Surveys**

SOPHIE survey (Europe)	SOPHIA survey (Australia)
	Region
	Marine connectedness
Home coastal proximity	Home coastal proximity
Professions associated with marine environment	Professions associated with marine environment
Frequency visiting the coast in the past 12 months	Frequency visiting the coast in the past 12 months
Sea/ coast recreational activities	Sea/ coast recreational activities
	Frequency of eating seafood in the past 12 months
Risks/ benefits of marine activities to the economy	Risks/ benefits of marine activities to the economy
Risks/ benefits of marine activities to the environment	Risks/ benefits of marine activities to the environment
Risks/ benefits of marine activities to public health and well-being	Risks/ benefits of marine activities to public health and well-being
Policy intervention to protect public health	Policy intervention to protect public health
Importance of goals (economic growth for marine businesses, protecting marine environment, protecting and promoting public health and well-being through protecting the marine environment) for policymakers	Importance of goals (economic growth for marine businesses, protecting marine environment, protecting and promoting public health and well-being through protecting the marine environment) for policymakers
Importance of goals (economic growth for marine businesses, protecting marine environment, protecting and promoting public health and well-being through protecting the marine environment) for individual	Importance of goals (economic growth for marine businesses, protecting marine environment, protecting and promoting public health and well-being through protecting the marine environment) for individual
Concerns about threats to public health and well-being	Concerns about threats to public health and well-being
	Ease/difficulty to reduce risk by members of public
Support for research funding to understand health and well-being implications	Support for research funding to understand health and well-being implications
Key priorities for public health and marine protection	
General health	General health
	Evaluative well-being/life satisfaction
Big-5 personality	Big-5 personality
Highest education level	Highest education level
Current employment status	Current employment status
	Number of adults in household
	Number of children in household
Political orientation	Political affiliation
Annual household income	Annual household income

**Table 5.2
Overview of Income Categories per Country**

Country	Income Categories									
	1	2	3	4	5	6	7	8	9	10
Australia	Up to \$9,999 year (Up to \$189 per week)	\$10,000 to \$19,999 per year (\$190 - \$379 per week)	\$20,000 to \$29,999 per year (\$380 - \$579 per week)	\$30,000 to \$39,999 per year (\$580 - \$769 per week)	\$40,000 to \$49,999 per year (\$770 - \$959 per week)	\$50,000 to \$59,999 per year (\$960 - \$1,149 per week)	\$60,000 to \$79,999 per year (\$1,150 - \$1,529 per week)	\$80,000 to \$99,999 per year (\$1,530 - \$1,919 per week)	\$100,000 to \$124,999 per year (\$1,920 - \$2,399 per week)	\$125,000 or more per year (Over \$2,400 per week)
Belgium	Up to €13,390	€13,390 to €16,850	€16,850 to €20,650	€20,650 to €25,210	€25,210 to €30,260	€30,260 to €36,700	€36,700 to €44,870	€44,870 to €54,330	€54,330 to €67,000	More than €67,000
Bulgaria	Up to 400 лв	401 лв to 450 лв	451 лв to 500 лв	501 лв to 550 лв	551 лв to 650 лв	651 лв to 700 лв	701 лв to 830 лв	831 лв to 1,000 лв	1001 лв to 1,200 лв	1,201 лв to 1,700 and more
Czechia	Up to 11,899 Kč	11,900 to 15,299 Kč	15,300 to 19,899 Kč	19,900 to 23,499 Kč	23,500 to 27,299 Kč	27,300 to 31,999 Kč	32,000 to 37,899 Kč	37,900 to 44,599 Kč	44,600 to 55,999 Kč	More than 56,000 Kč
France	Up to €13,550	€13,551 to €17,400	€17,401 to €21,100	€21,101 to €25,350	€25,351 to €30,050	€30,051 to €35,400	€35,401 to €41,900	€41,901 to €50,400	€50,401 to €65,200	More than €65,200
Germany	Up to €12,710	€12,711 to 17,290	€17,291 to €21,460	€21,461 to €25,660	€25,661 to €30,280	€30,281 to €35,500	€35,501 to €41,650	€41,651 to €49,780	€49,781 to €63,050	More than €63,050

Greece	Up to €575	€576 to €775	€776 to €980	€981 to €1,190	€1,191 to €1,425	€1,426 to €1,700	€1,701 to €2,040	€2,041 to €2,500	2,501 to 3,230 €	More than € 3,231
Ireland	Up to €12,740	€12,741 to €18,720	€18,721 to €24,960	€24,961 to €30,680	€30,681 to €36,400	€36,401 to €42,640	€42,641 to €49,660	€49,661 to €61,360	€61,361 to €84,240	More than €84,240
Italy	Up to €9,000	€9,001 to €13,500	€13,501 to €17,000	€17,001 to €20,500	€20,501 to €24,000	€24,001 to €29,000	€29,001 to €34,500	€34,501 to €42,500	€42,501 to €54,500	More than €54,500
Netherlands	Less than €13,200	€13,200 to €17,300	€17,300 to €20,800	€20,800 to €24,500	€24,500 to €28,700	€28,700 to €33,900	€33,900 to €40,100	€40,100 to €47,800	€47,800 to €60,100	More than €60,100
Norway	Up to 251,000 kr	251,001 kr to 356,000 kr	356,001 kr to 448,000 kr	448,001 kr to 537,000 kr	537,001 kr to 634,000 kr	634,001 kr to 729,000 kr	729,001 kr to 830,000 kr	830,001 kr to 955,000 kr	955,001kr to 1,162,000 kr	More than 1,162,000 kr
Poland	Up to 16,800zł	16,801zł to 22,800zł	22,801zł to 28,800zł	28,801zł to 34,800zł	34,801zł to 40,800zł	40,801zł to 48,000zł	48,001zł to 56,400zł	56,401zł to 67,200zł	67,201zł to 85,200zł	More than 85,200zł
Portugal	Up to €4,960	€4,961 to €7,200	€7,201 to €9,200	€9,201 to €11,400	€11,401 to €13,900	€13,901 to €16,500	€16,501 to €19,700	€19,701 to €24,450	€24,451 to €37,000	More than €37,000
Spain	Up to €9,350	€9,351 to €12,000	€12,001 to €15,000	€15,001 to €18,000	€18,001 to €21,600	€21,601 to €26,400	€26,401 to €30,000	€30,001 to €34,200	€34,201 to €44,400	More than €44,400
United Kingdom	Up to £11,440	£11,441 to £15,340	£15,341 to £19,032	£19,033 to £22,984	£22,985 to £27,404	£27,405 to £32,760	£32,761 to £39,052	£39,053 to £47,684	£47,685 to £63,128	More than £63,128

Note. There was a typo in the original German survey for income category 4. It stated €24,461 to €25,660, while it should have been €21,461 to €25,660. Individuals that earned between 21,461 and 24,460 may have indicated a different income or “don’t know” or skipped this item.

**Supplementary Notes 6:
Flow Diagrams of Data Exclusions for Each Hypothesis**

Figure 6.1
Flow Diagram of Data Exclusions for Hypothesis 1 (Home Coastal Proximity) and 3 (Interaction of Home Coastal Proximity and Household Income)

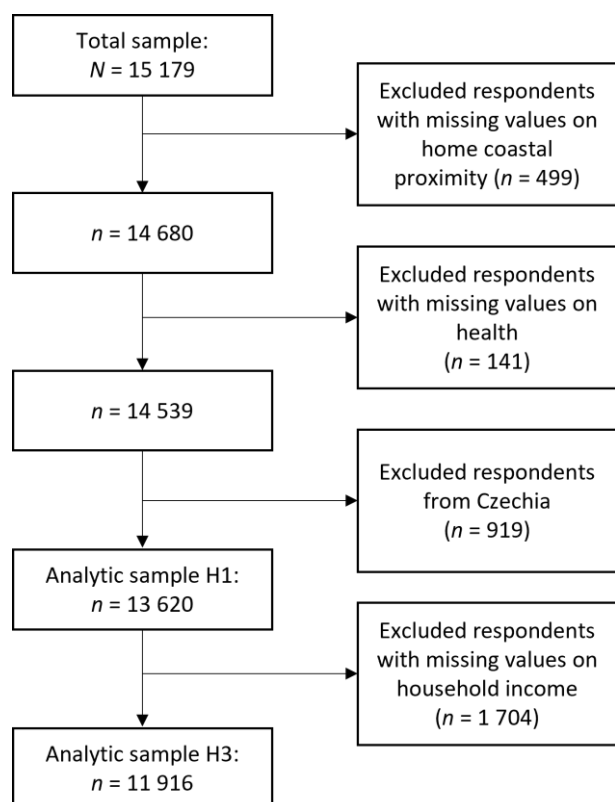
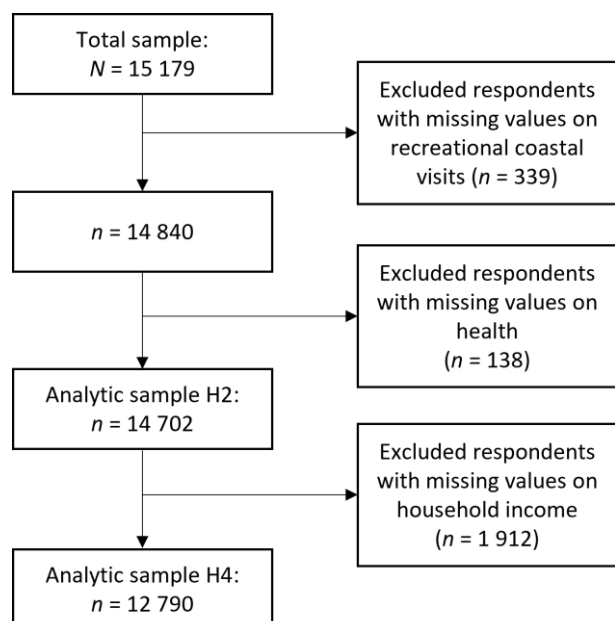


Figure 6.2
Flow Diagram of Data Exclusions for Hypothesis 2 (Coastal Visits) and 4 (Interaction of Coastal Visits and Household Income)



**Supplementary Notes 7:
Deviations from Preregistration**

Section	Preregistered	Deviation	Reason
Reporting	We preregistered that we would report all results in two studies in a single manuscript.	We split the results into marine protection (Paper 1) and health/well-being (Paper 2).	There were more key messages than expected, so we decided to have one clear message per paper.
Analysis	We preregistered that all models would be fit with both proximity and visits as predictors: Model 1: no random slope Model 2: random slope proximity Model 3: random slope visits Model 4: random slope both	We fit all models with proximity or visits as a predictor: Model 1: proximity, no random slope Model 2: proximity, random slope proximity Model 3: visits, no random slope Model 4: visits, random slope visits	Multicollinearity between home home coastal proximity and visits.
Analysis	We preregistered that we would fit a model with and without a random effect for the interaction and compare the fit based on the LOOIC.	We fit three models per interaction: Model 1: random slope proximity, fixed slope income, and fixed interaction Model 2: random slope proximity, random slope income, and fixed interaction Model 3: random slope proximity, random slope income, and random interaction Model 4: random slope visits, fixed slope income, and fixed interaction Model 5: random slope visits, random slope income, and fixed interaction Model 6: random slope visits, random slope income, and random interaction	We additionally wanted to test whether the slope of income varies across countries.
Analysis	We preregistered that we would fit the models for Hypothesis 1 and 3 (with home coastal proximity as a predictor) in all 15 countries.	We fit the models in 14 countries, excluding Czechia.	Czechia is a landlocked country and had little variation in home coastal proximity. When excluding Czechia, the results did not substantially differ from those that included Czechia.
Sensitivity Analysis	We preregistered that we would conduct sensitivity analyses with a narrower prior, $\alpha, \beta \sim \text{Normal}(0, 5)$, to check the robustness of the findings when choosing a different prior distribution.	We additionally set a narrower prior on for the between-country variation $\sigma_{\text{country}} \sim \text{HalfCauchy}(0, 5)$.	We did this to additionally test the effect of a narrower prior on the between-country variation.

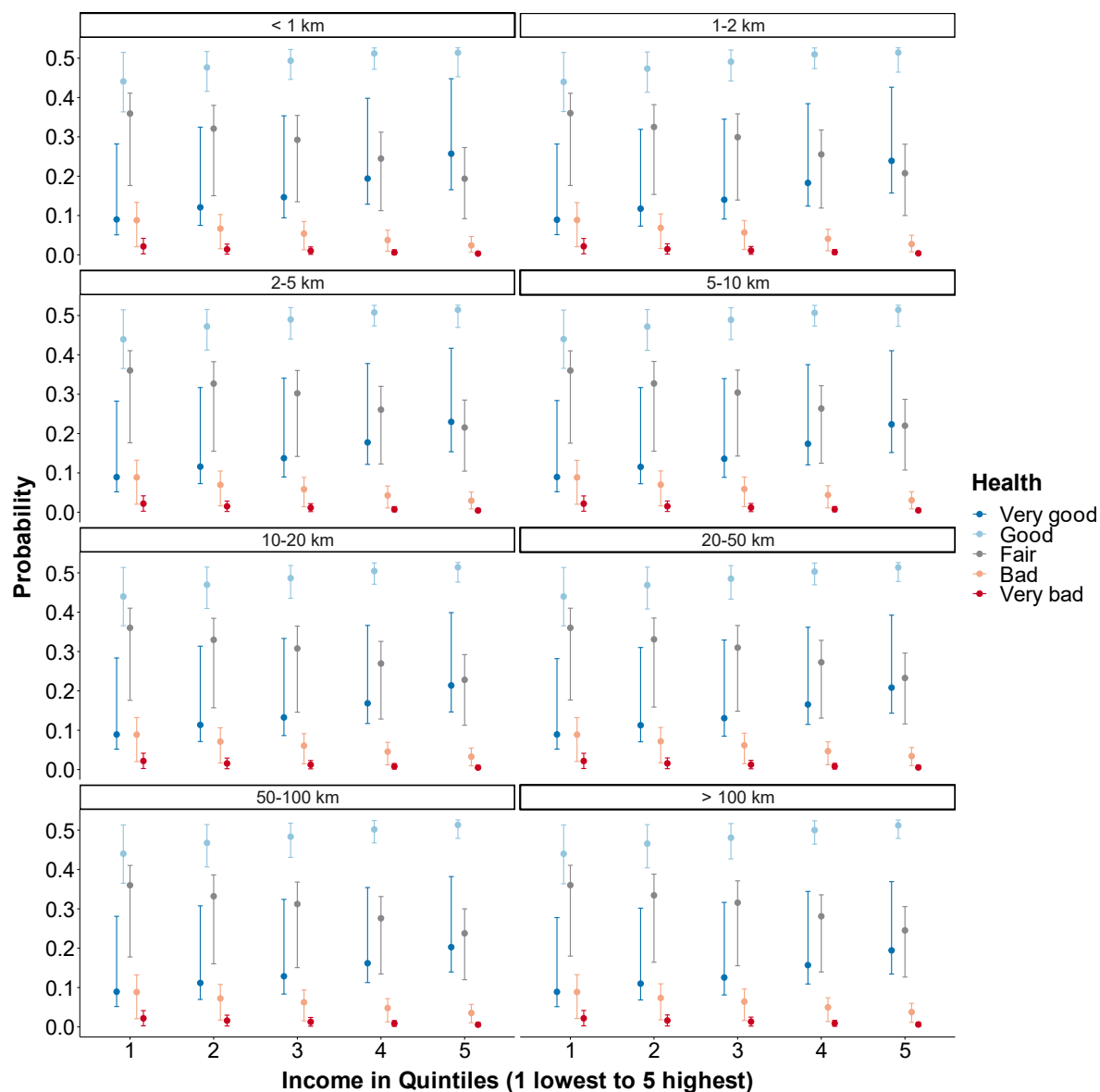
**Supplementary Notes 8:
Standard Cut-off Criteria for the Bayes Factor Including Their Interpretation**

BF₁₀ Evidence for H₁	Interpretation	BF₀₁ Evidence for H₀	Interpretation
≥ 100	The effect is <i>extremely</i> supported by the evidence.	≥ 100	The null effect is <i>extremely</i> supported by the evidence.
30 ≤ BF ₁₀ < 100	The effect is <i>very strongly</i> supported by the evidence.	30 ≤ BF ₀₁ < 100	The null effect is <i>very strongly</i> supported by the evidence.
10 ≤ BF ₁₀ < 30	The effect is <i>strongly</i> supported by the evidence.	10 ≤ BF ₀₁ < 30	The null effect is <i>strongly</i> supported by the evidence.
3 ≤ BF ₁₀ < 10	The effect is <i>moderately</i> supported by the evidence.	3 ≤ BF ₀₁ < 10	The null effect is <i>moderately</i> supported by the evidence.
1 < BF ₁₀ < 3	The evidence is <i>insufficient</i> to make a decisive decision, although the effect likely exists.	1 < BF ₀₁ < 3	The evidence is <i>insufficient</i> to make a decisive decision, although the null effect likely exists.
1	No evidence	1	No evidence

Note. Adapted from Lieberoth et al.¹, and interpretation based on Jeffreys.²

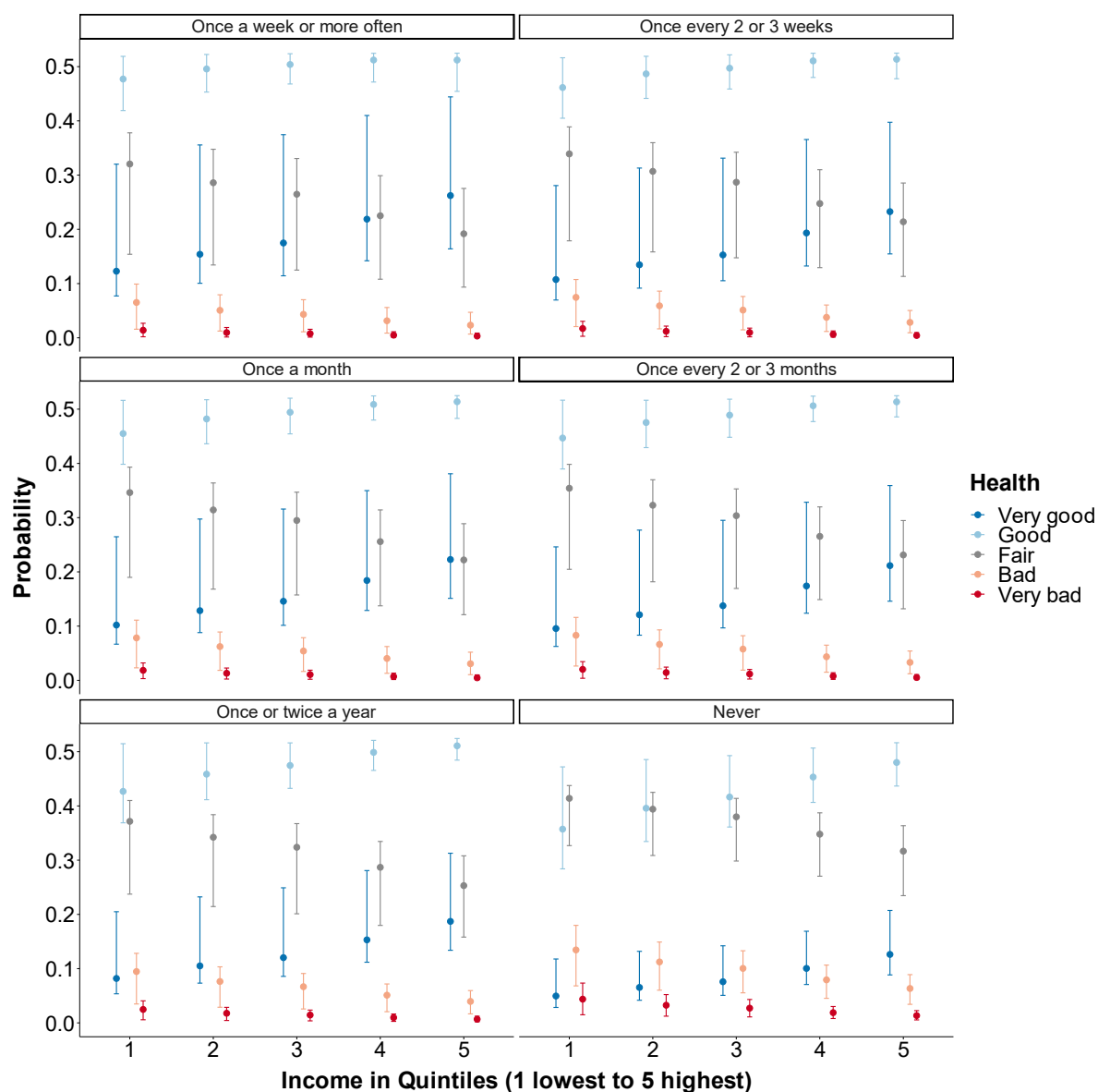
**Supplementary Notes 9:
The Buffering Effect of Home Coastal Proximity and Visits on the Relationship Between Household
Income and Self-Reported General Health**

Figure 9.1
Marginal Effects of Household Income and Home Coastal Proximity on Self-Reported General Health
(Treated as Ordinal)



Note. Points represent the posterior mean of the probability of self-reported health from 1 'very good' to 5 'very bad' (indicated by the five colors and treated as ordinal) depending on both household income in quintiles (x-axis) and home coastal proximity (categories). Error bars indicate the 95% credible interval, including the random effects variation across countries.

Figure 9.2
Marginal Effects of Household Income and Visits on Self-Reported General Health (Treated as Ordinal)



Note. Points represent the posterior mean of the probability of self-reported health from 1 'very good' to 5 'very bad' (indicated by the five colors and treated as ordinal) depending on both household income in quintiles (x-axis) and home coastal proximity (categories). Error bars indicate the 95% credible interval, including the random effects variation across countries.

Supplementary References

1. Lieberoth A, Lin S-Y, Stöckli S, Han H, Kowal M, Gelpi R, et al. Stress and worry in the 2020 coronavirus pandemic: Relationships to trust and compliance with preventive measures across 48 countries in the COVIDiSTRESS global survey [Internet]. [cited 2022 Mar 29]. Available from: <https://doi.org/10.1098/rsos.200589>
2. Jeffreys H. Theory of probability. 3rd ed. Vol. 432. Oxford University Press; 1961.