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Supplementary appendix

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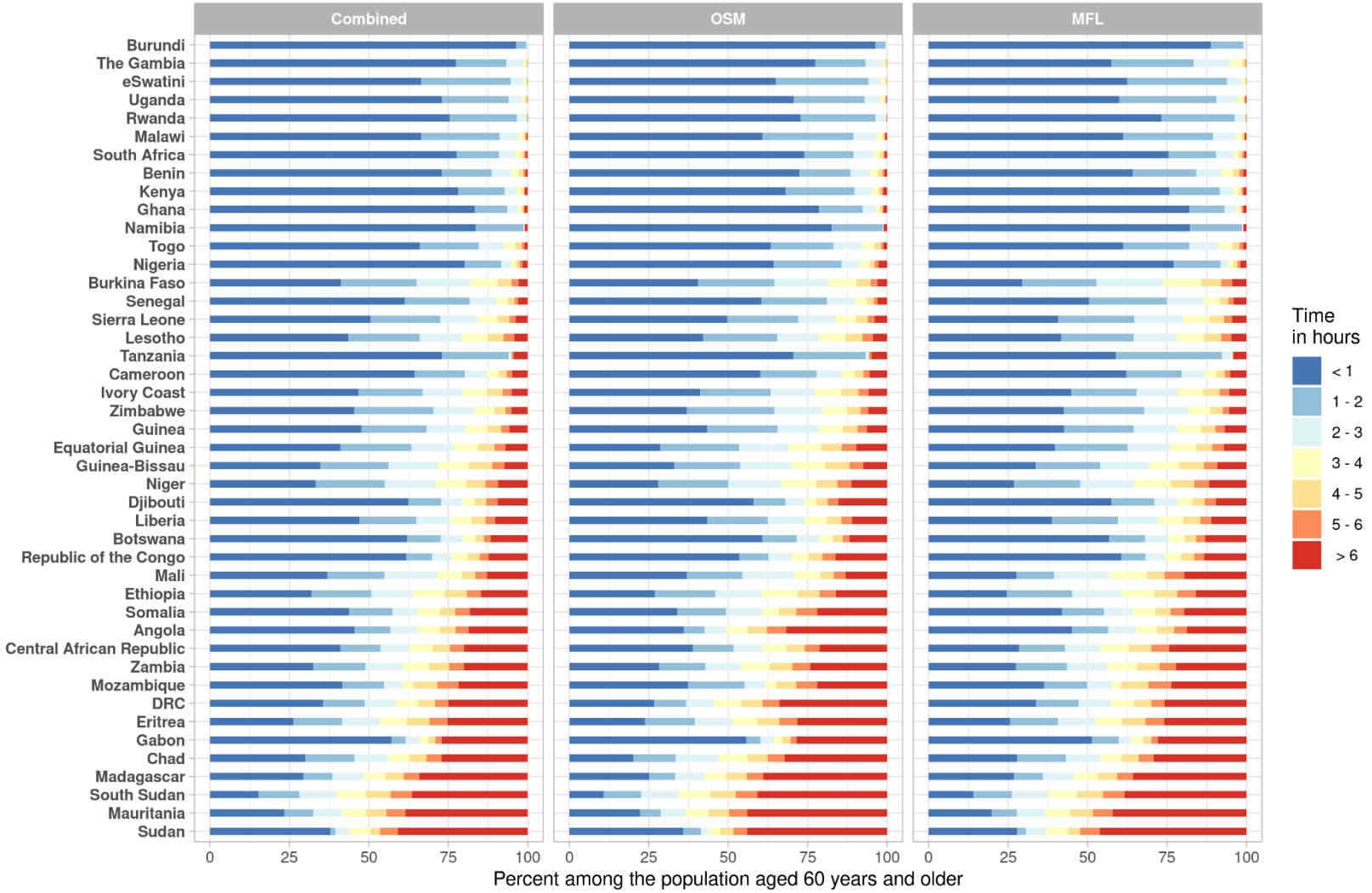
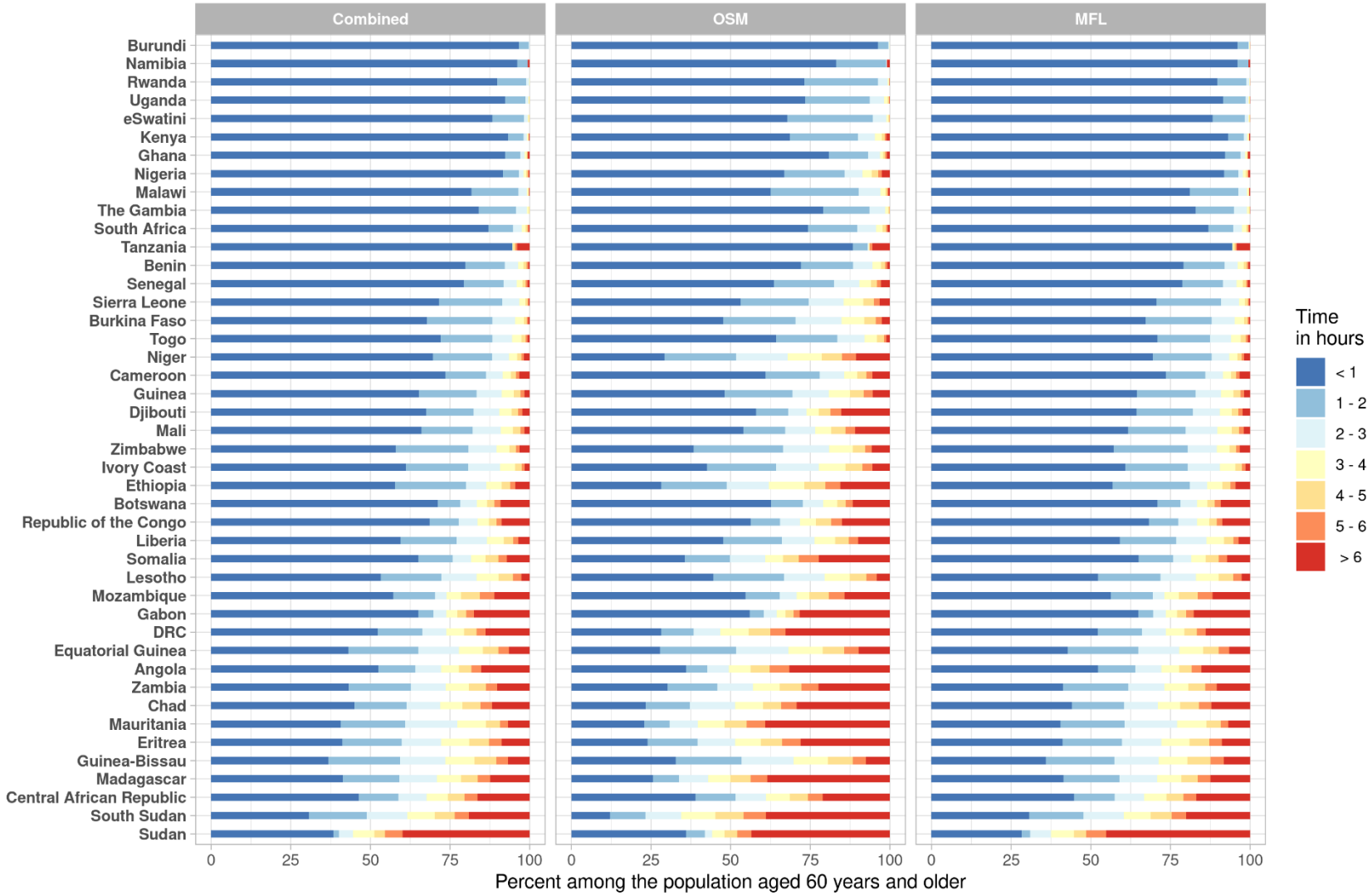


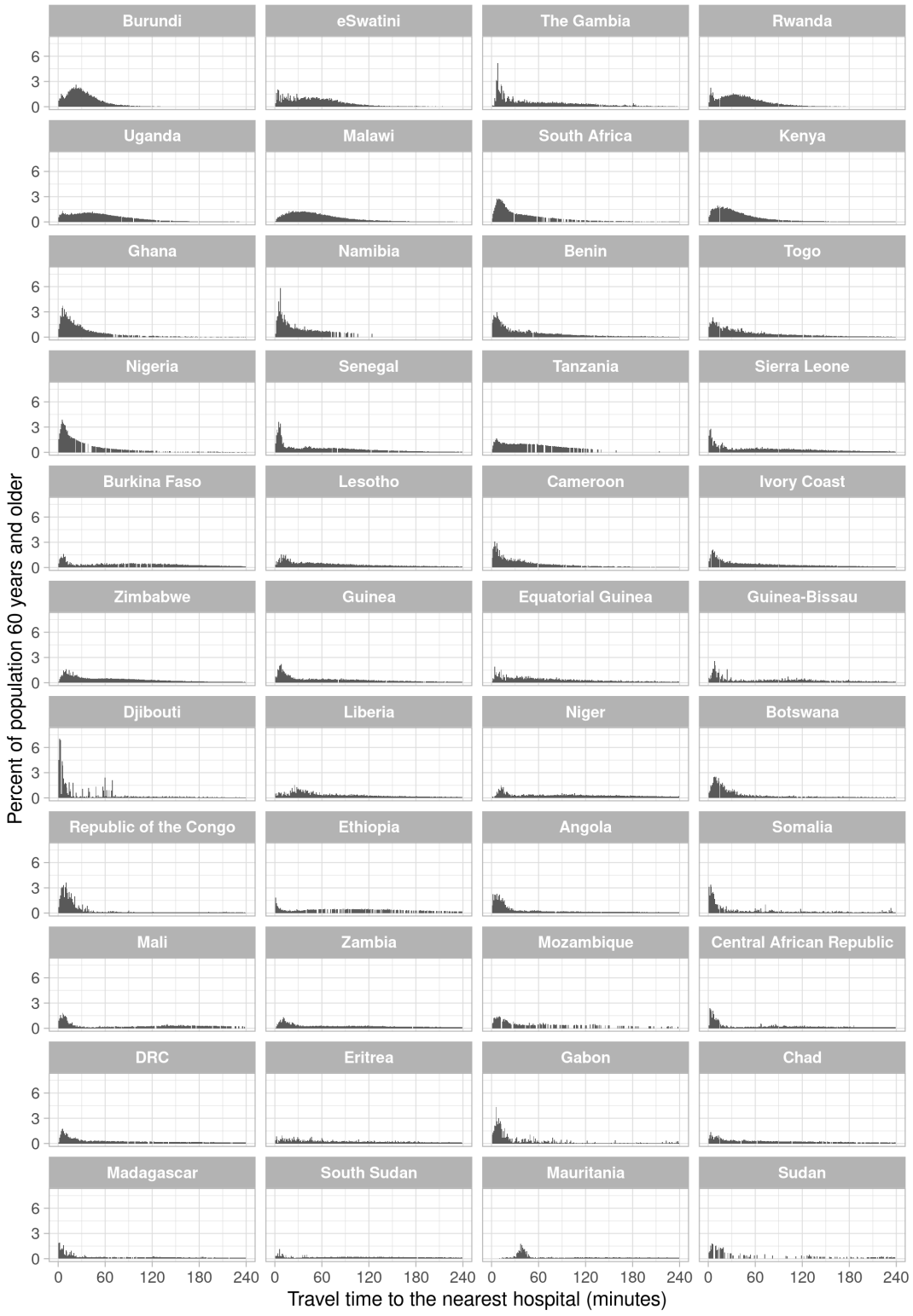
Abbreviations: DRC=Democratic Republic of the Congo
"Combined" refers to the travel time to the nearest hospital regardless of whether the hospital was recorded in the MFL or OSM data.

Figure S2. Distribution of travel time to the nearest healthcare facility of any type, by country



Abbreviations: DRC=Democratic Republic of the Congo
"Combined" refers to the travel time to the nearest healthcare facility regardless of whether the facility was recorded in the MFL or OSM data.

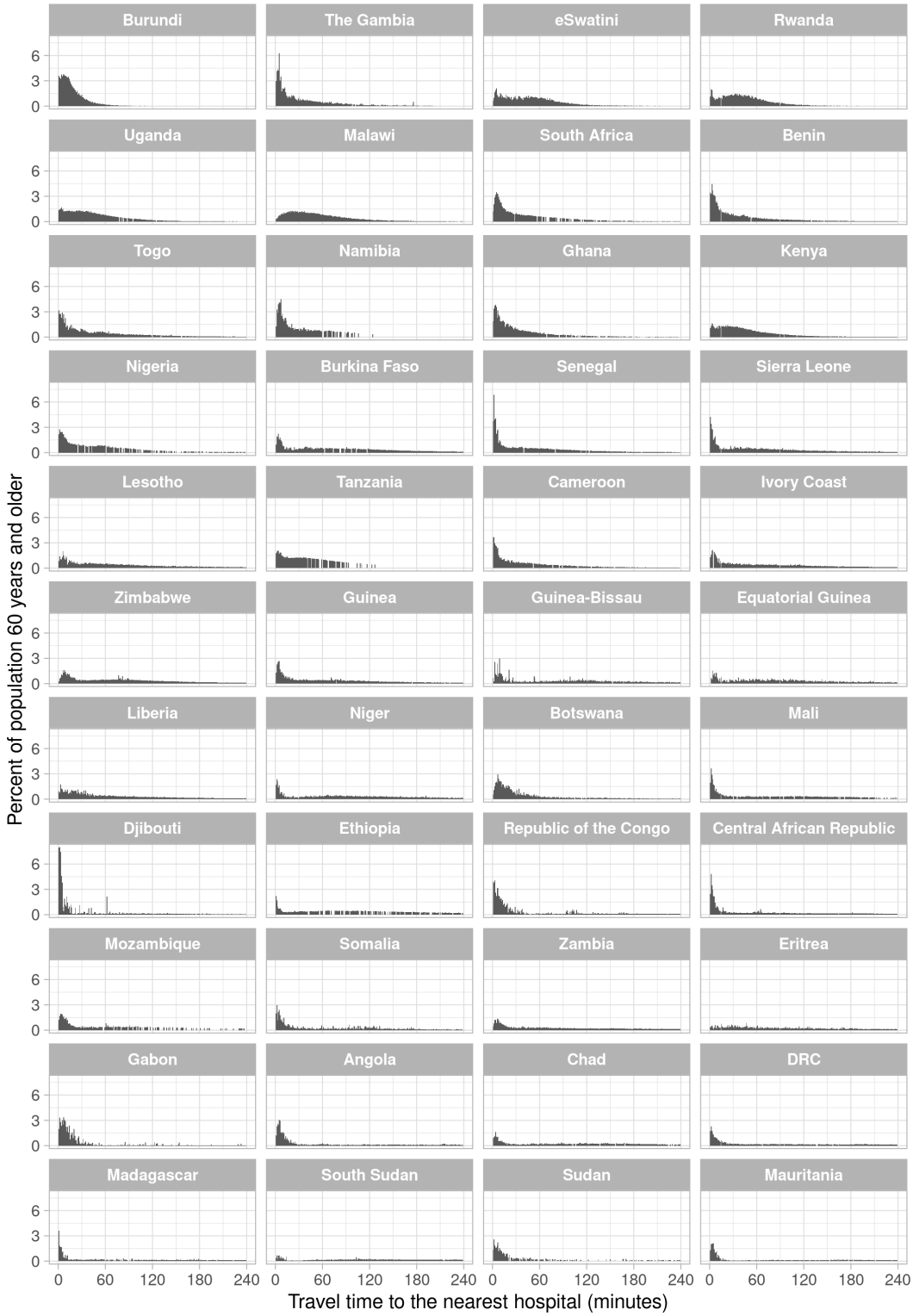
Figure S3. Histogram of travel time to the nearest hospital in the MFL dataset for adults aged 60 years and older, by country[1]



Abbreviations: DRC=Democratic Republic of the Congo

[1] Countries were ordered in ascending order by the proportion of adults aged 60 years and older in their population who reside in a 1km x 1km area that has an estimated travel time >2 hours to the nearest hospital.

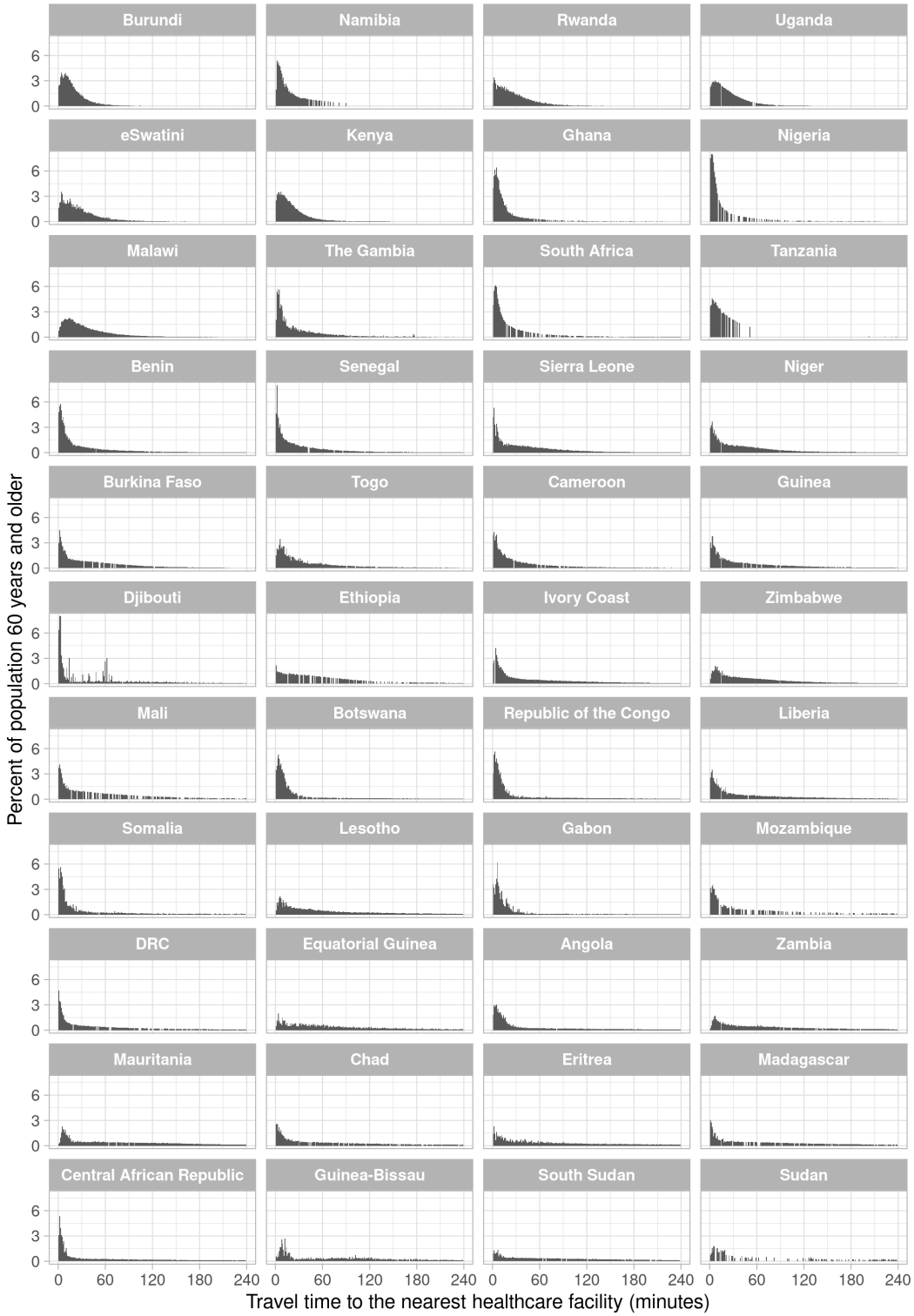
Figure S4. Histogram of travel time to the nearest hospital in the OSM dataset for adults aged 60 years and older, by country[1]



Abbreviations: DRC=Democratic Republic of the Congo

[1] Countries were ordered in ascending order by the proportion of adults aged 60 years and older in their population who reside in a 1km x 1km area that has an estimated travel time >2 hours to the nearest hospital.

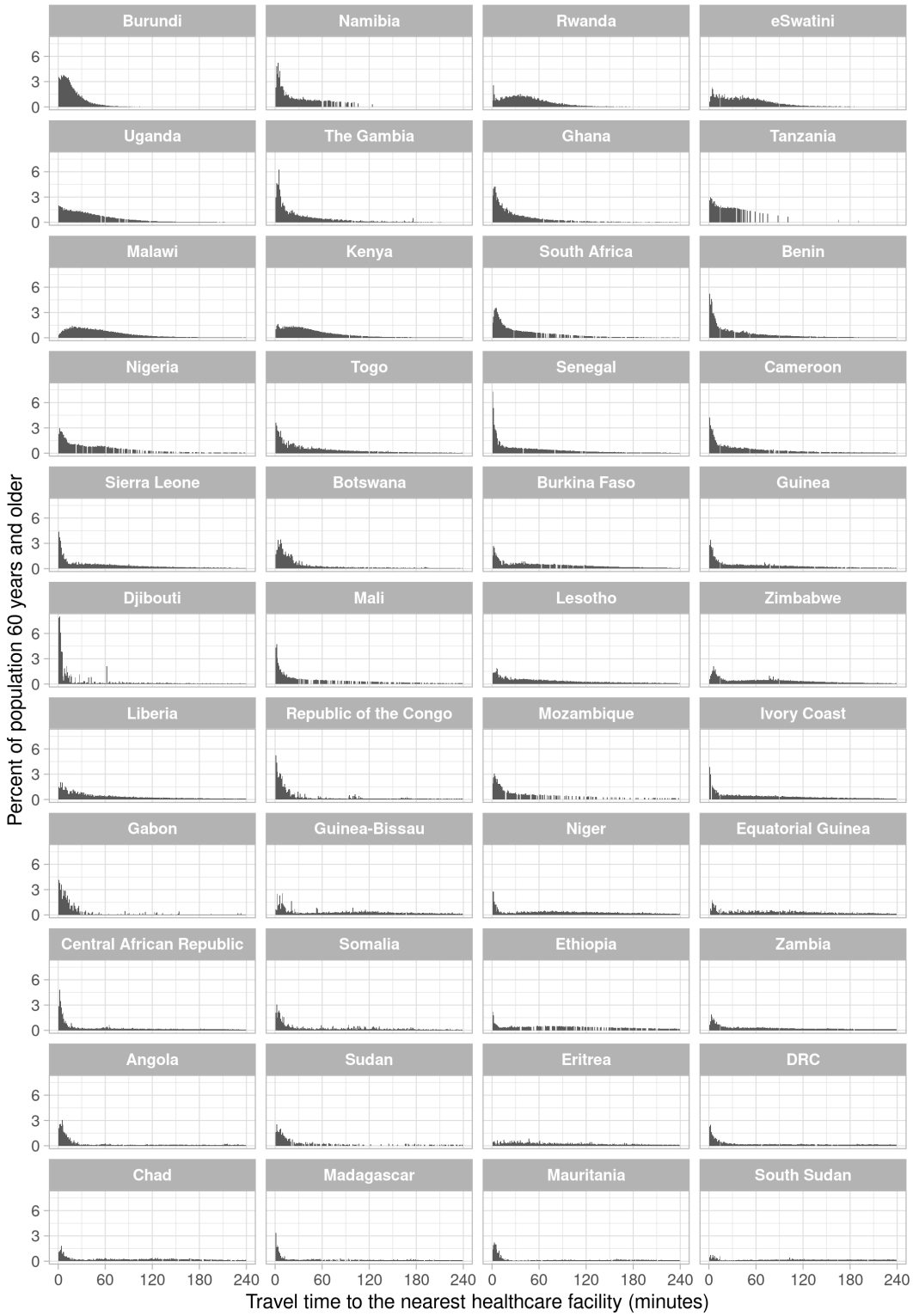
Figure S5. Histogram of travel time to the nearest healthcare facility (of any type) in the MFL dataset for adults aged 60 years and older, by country[1]



Abbreviations: DRC=Democratic Republic of the Congo

[1] Countries were ordered in ascending order by the proportion of adults aged 60 years and older in their population who reside in a 1km x 1km area that has an estimated travel time >2 hours to the nearest healthcare facility.

Figure S6. Histogram of travel time to the nearest healthcare facility (of any type) in the OSM dataset for adults aged 60 years and older, by country[1]



Abbreviations: DRC=Democratic Republic of the Congo

[1] Countries were ordered in ascending order by the proportion of adults aged 60 years and older in their population who reside in a 1km x 1km area that has an estimated travel time >2 hours to the nearest healthcare facility.

Figure S7. Angola map of travel time to the nearest hospital for adults aged ≥ 60 years

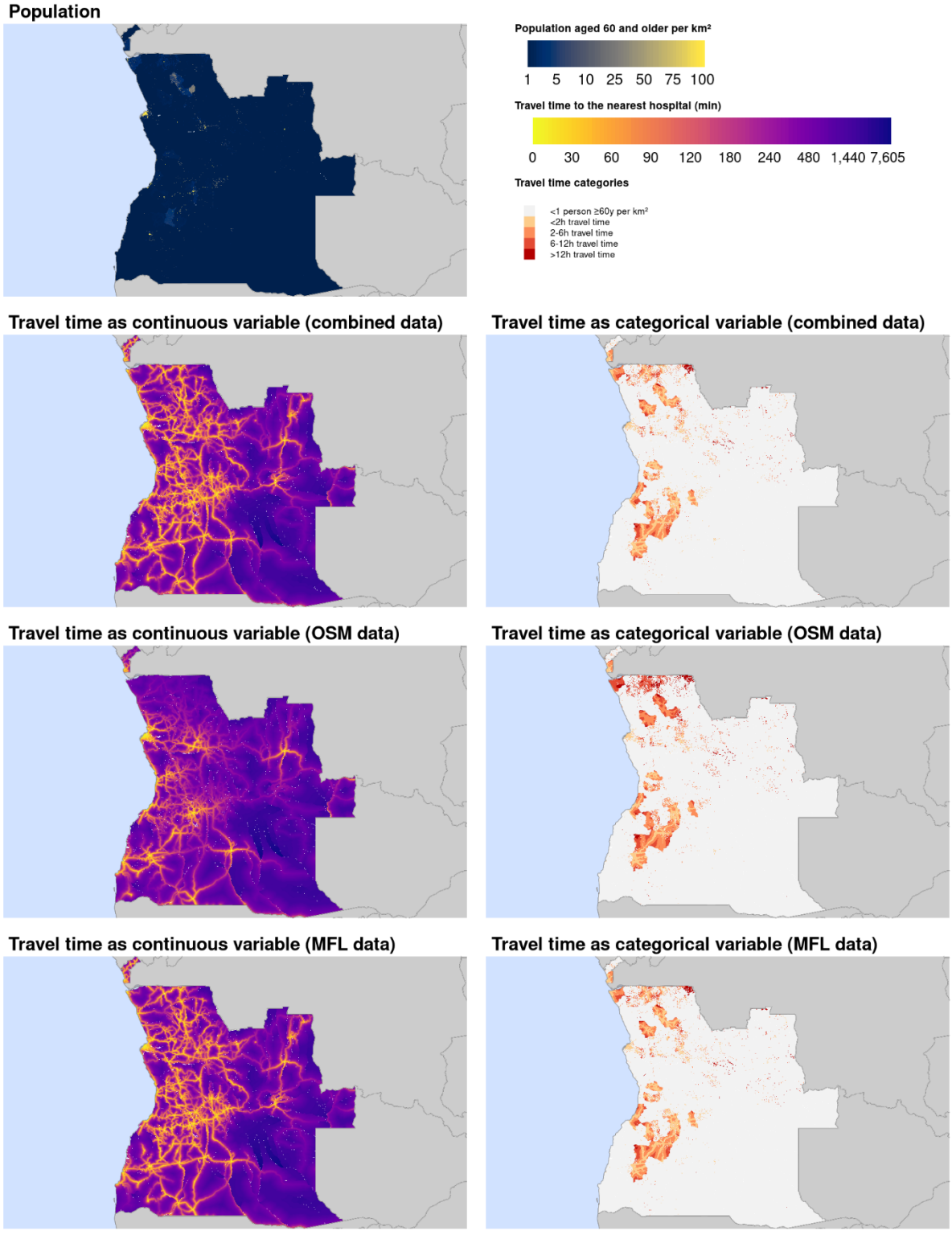


Figure S8. Benin map of travel time to the nearest hospital for adults aged ≥ 60 years

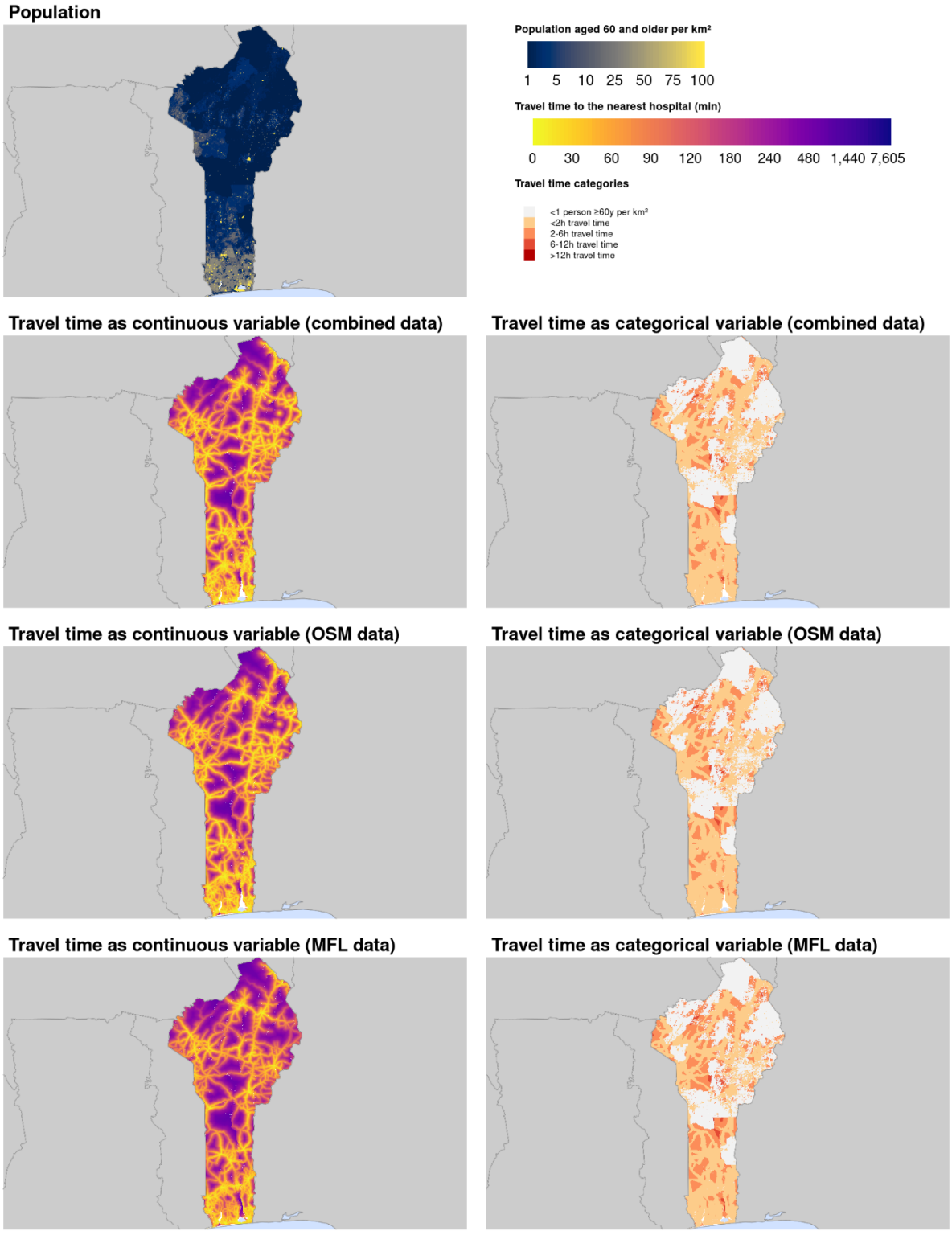


Figure S9. Botswana map of travel time to the nearest hospital for adults aged ≥ 60 years

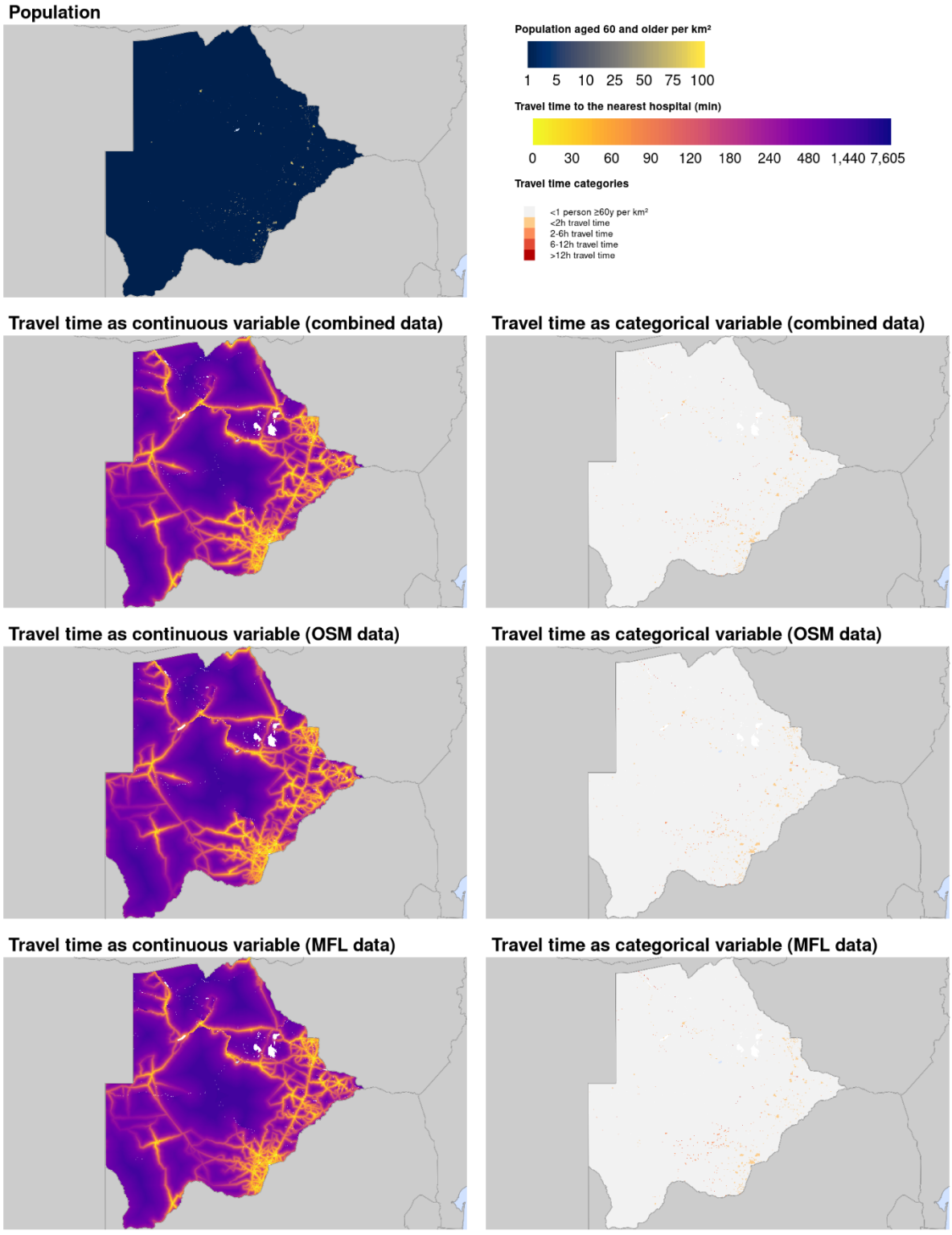


Figure S10. Burkina Faso map of travel time to the nearest hospital for adults aged ≥ 60 years

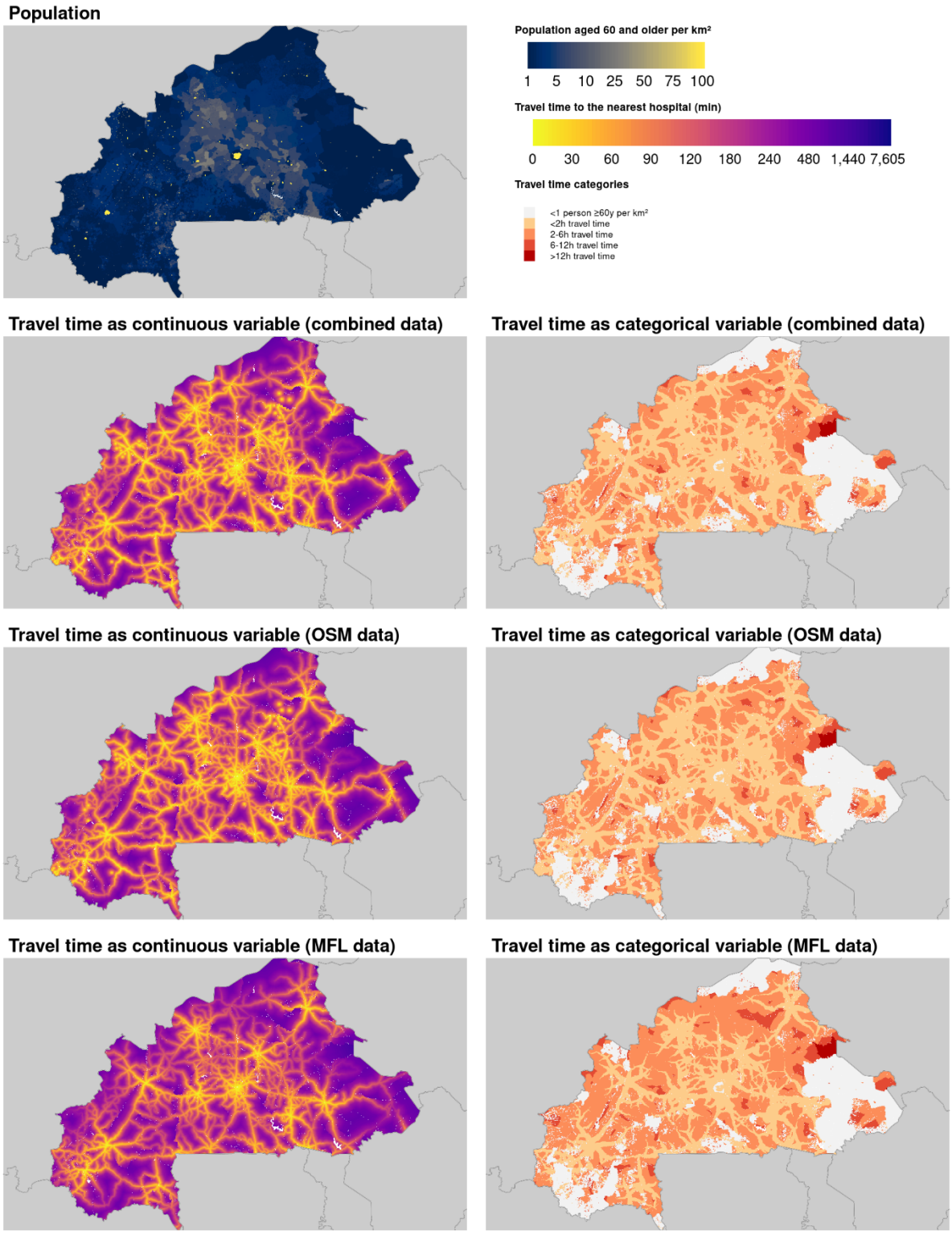


Figure S11. Burundi map of travel time to the nearest hospital for adults aged ≥ 60 years

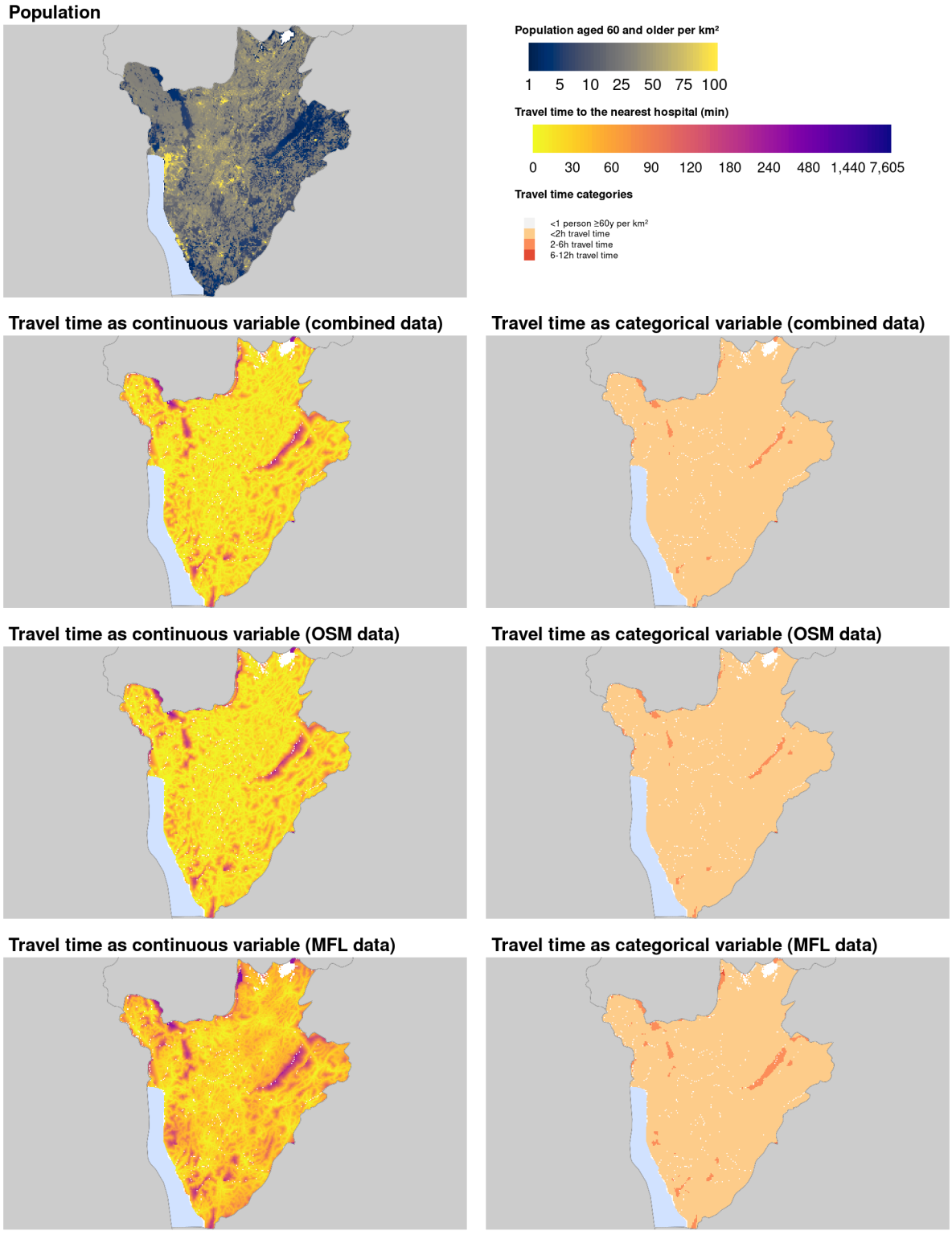


Figure S12. Cameroon map of travel time to the nearest hospital for adults aged ≥ 60 years

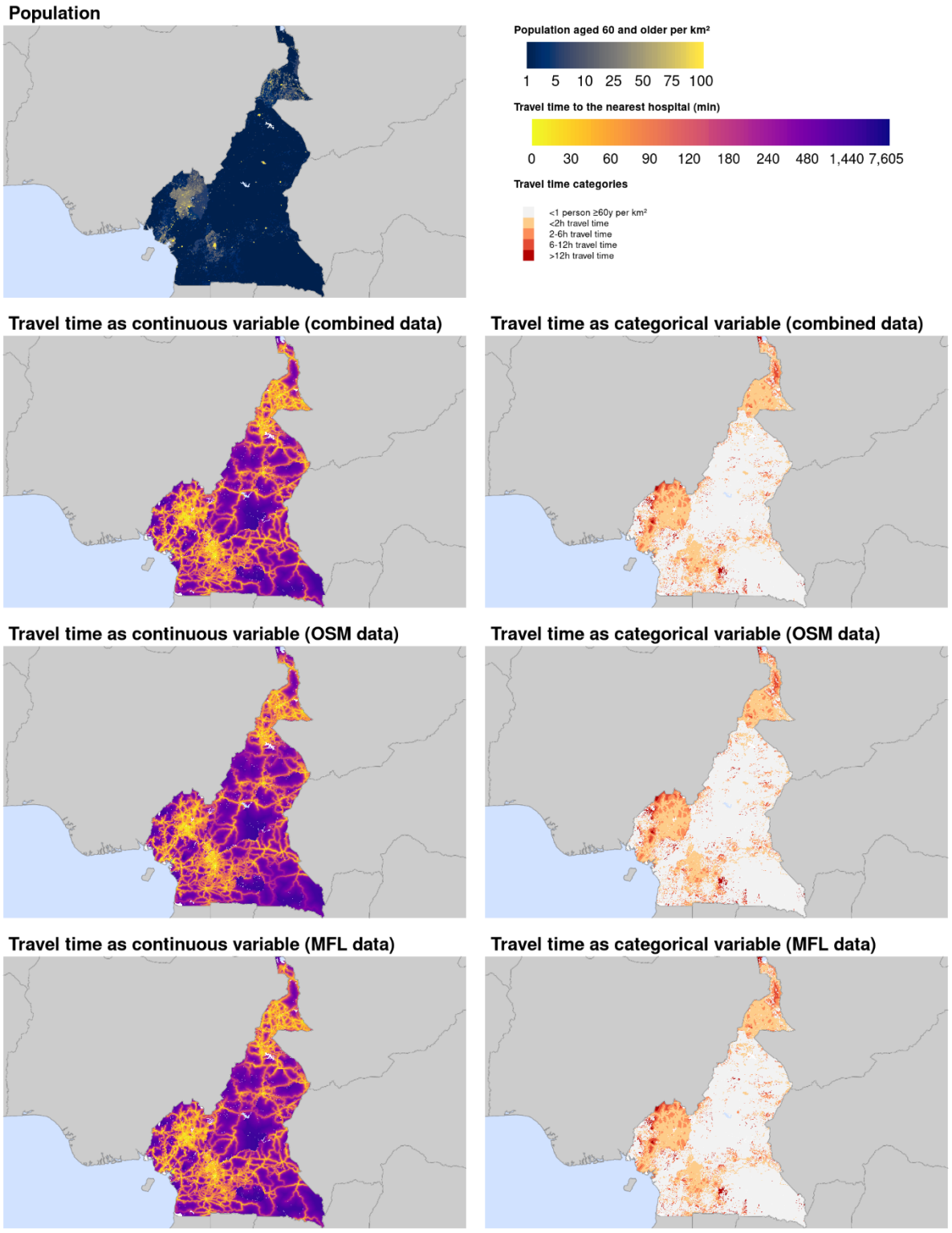


Figure S13. Central African Republic map of travel time to the nearest hospital for adults aged ≥ 60 years

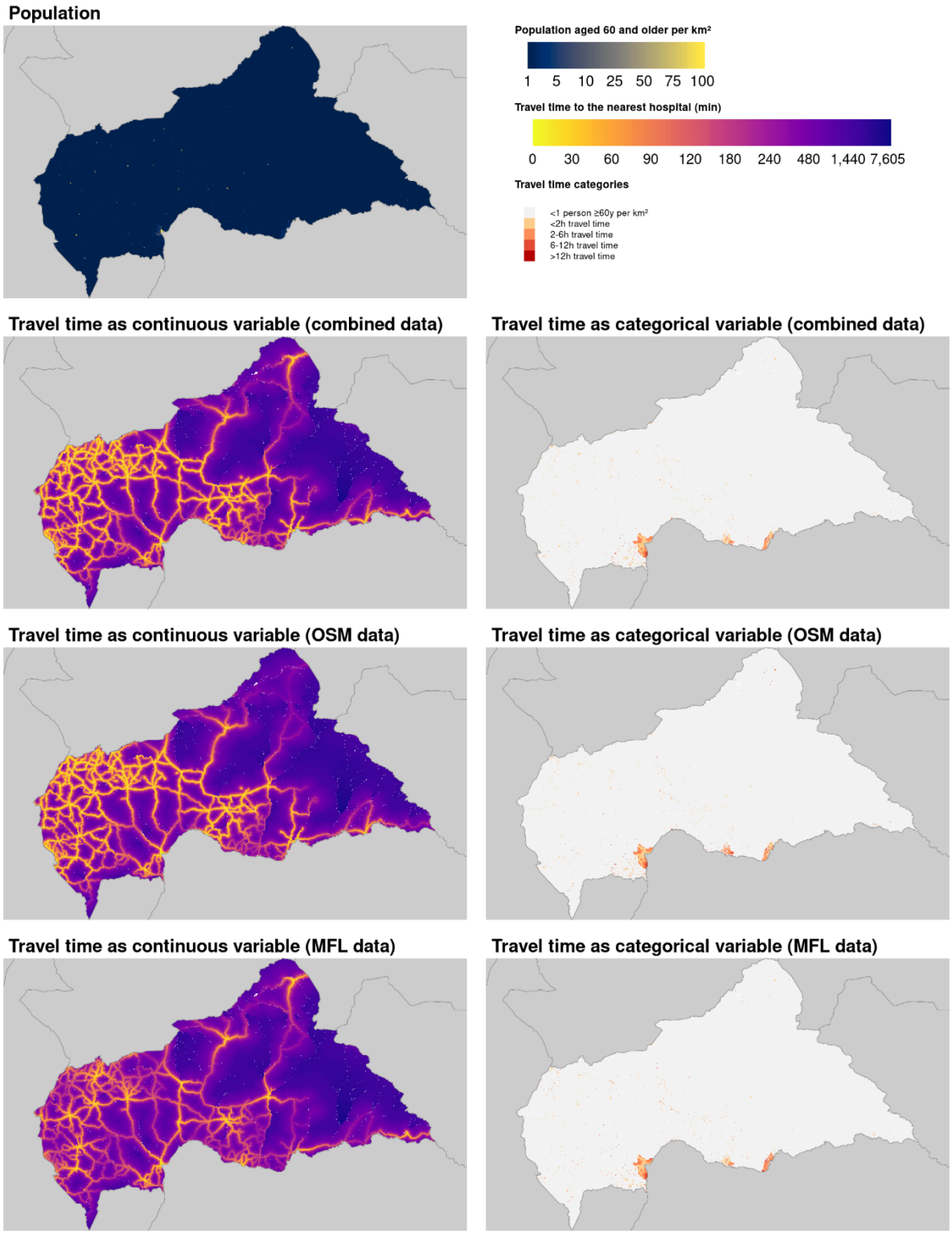


Figure S14. Chad map of travel time to the nearest hospital for adults aged ≥ 60 years

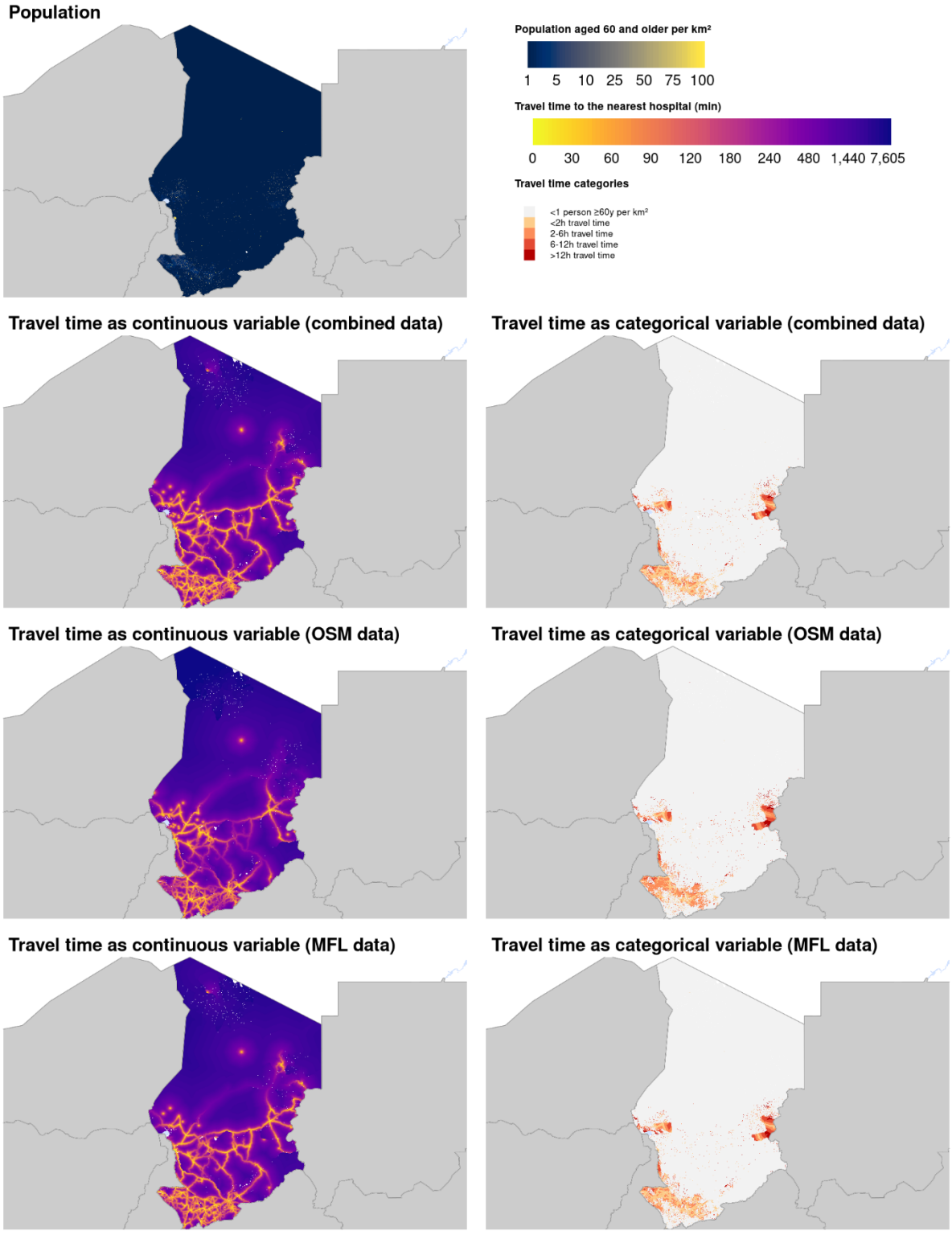


Figure S15. Djibouti map of travel time to the nearest hospital for adults aged ≥ 60 years

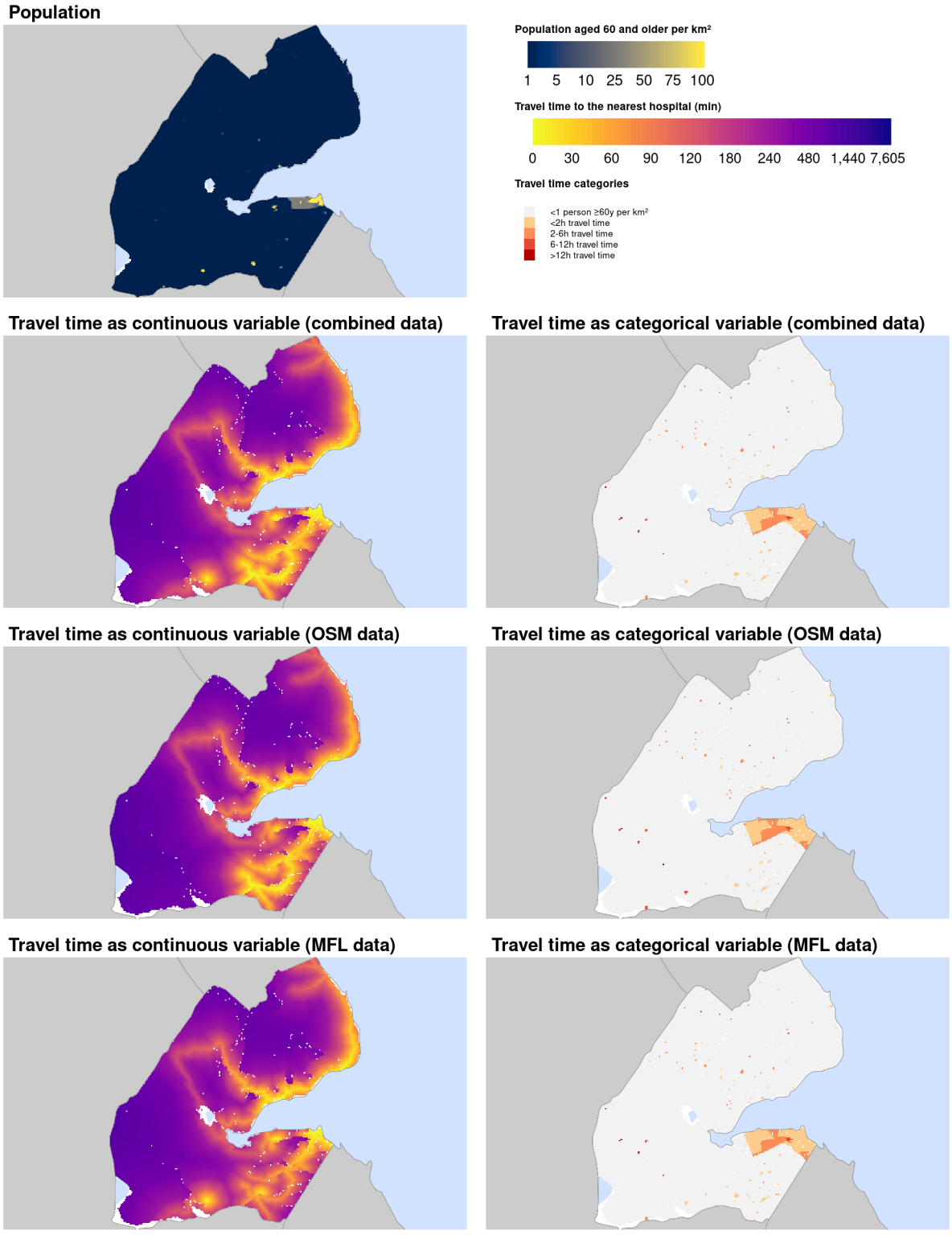


Figure S16. DRC map of travel time to the nearest hospital for adults aged ≥ 60 years

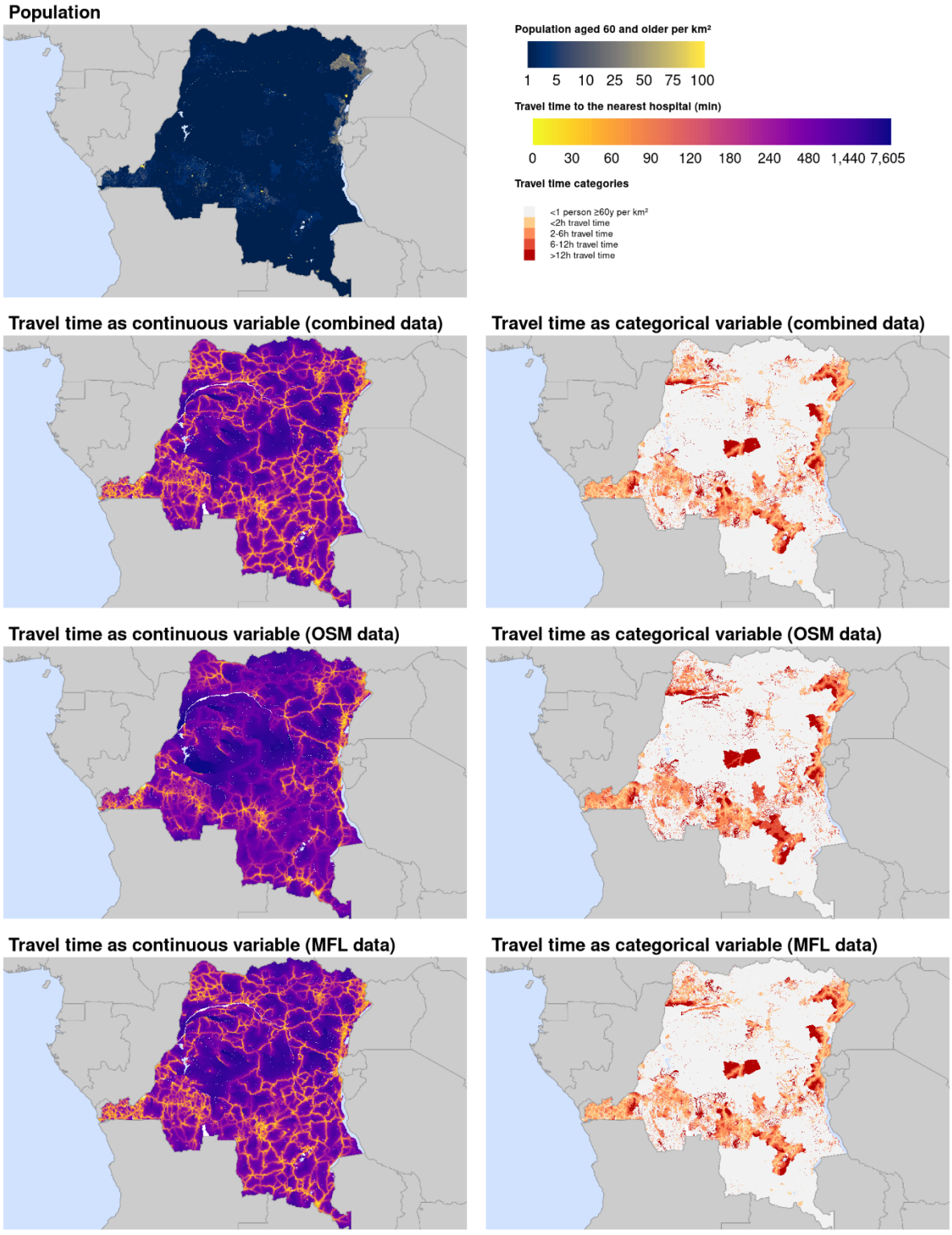


Figure S17. Equatorial Guinea map of travel time to the nearest hospital for adults aged ≥ 60 years

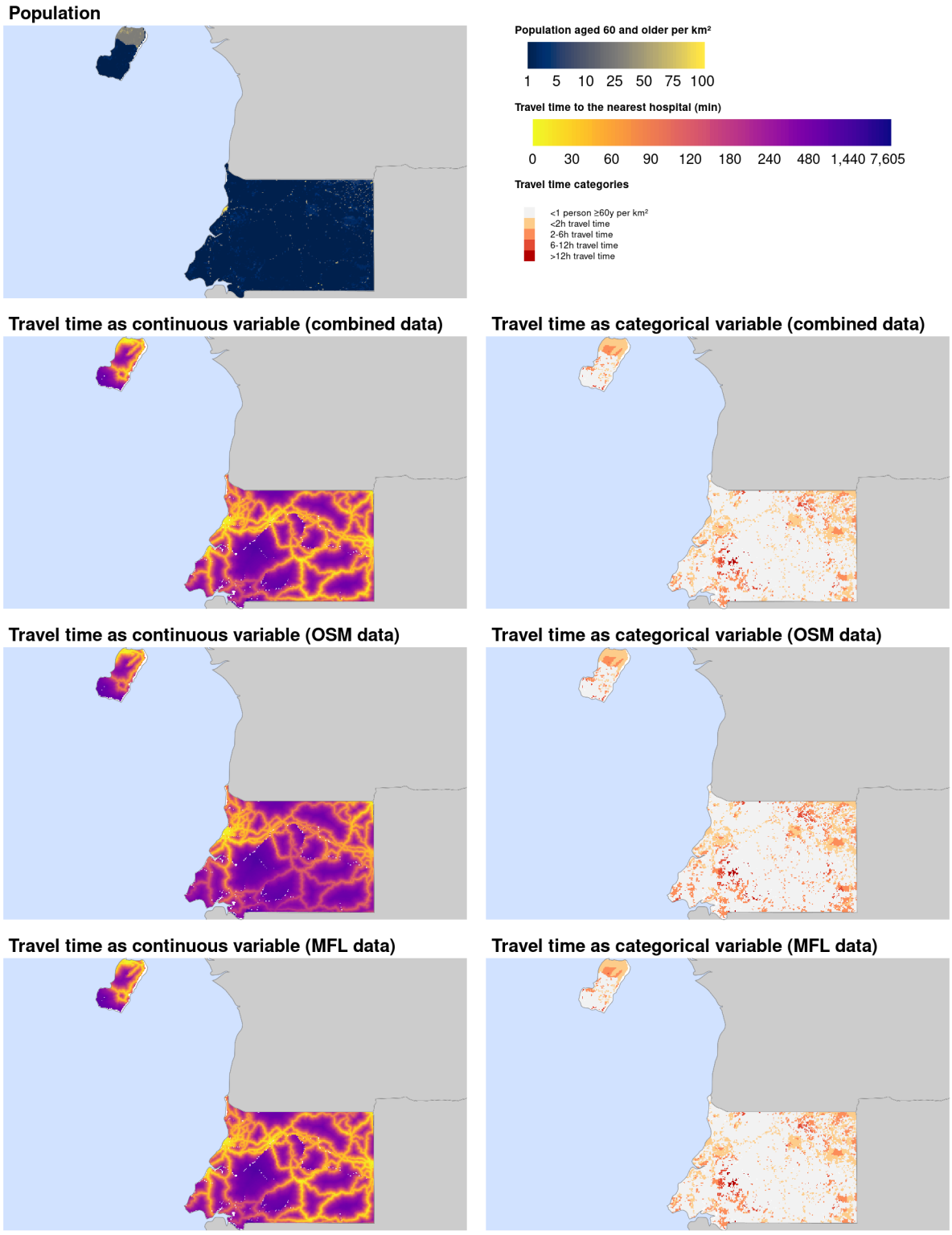


Figure S18. Eritrea map of travel time to the nearest hospital for adults aged ≥ 60 years

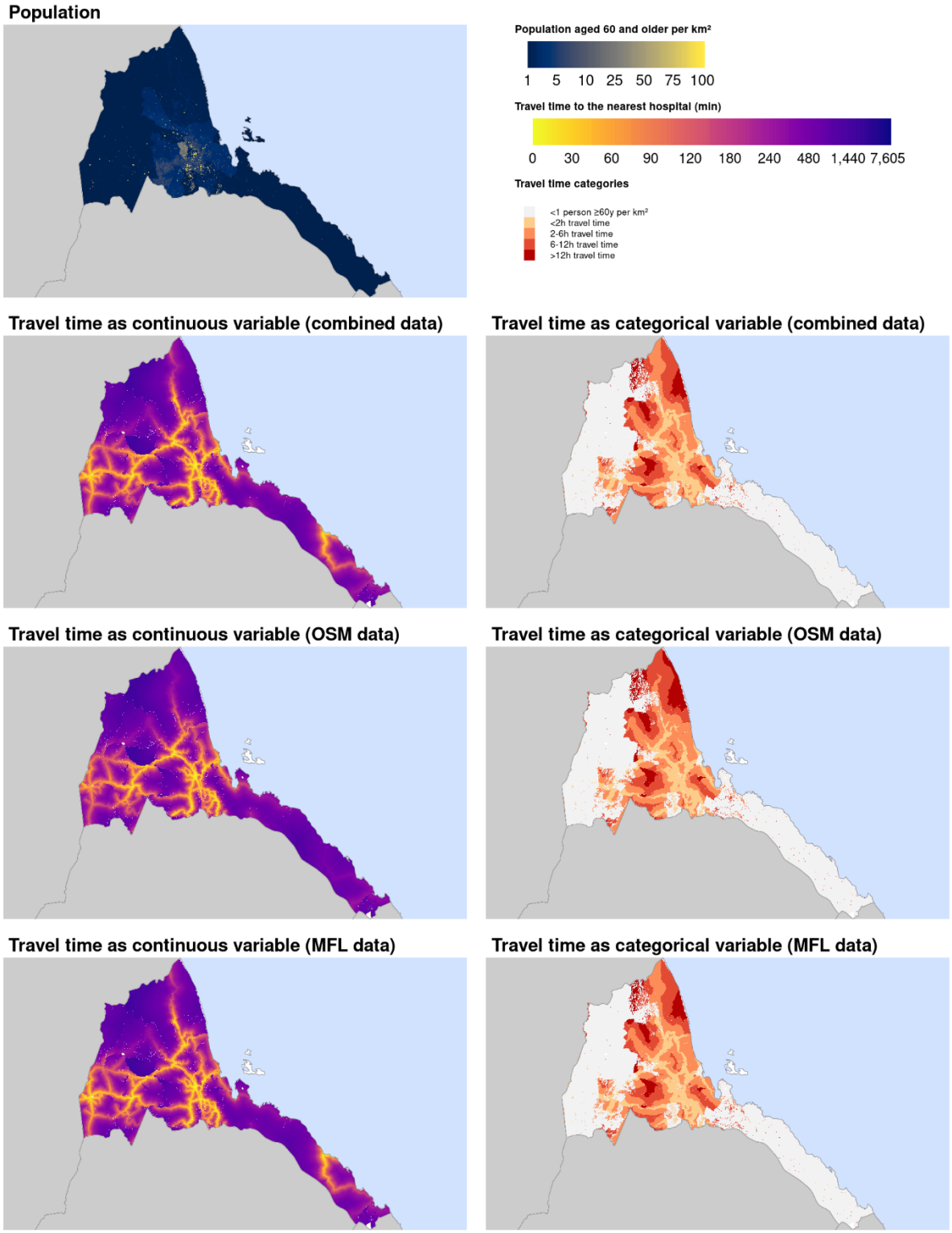


Figure S19. eSwatini map of travel time to the nearest hospital for adults aged ≥ 60 years

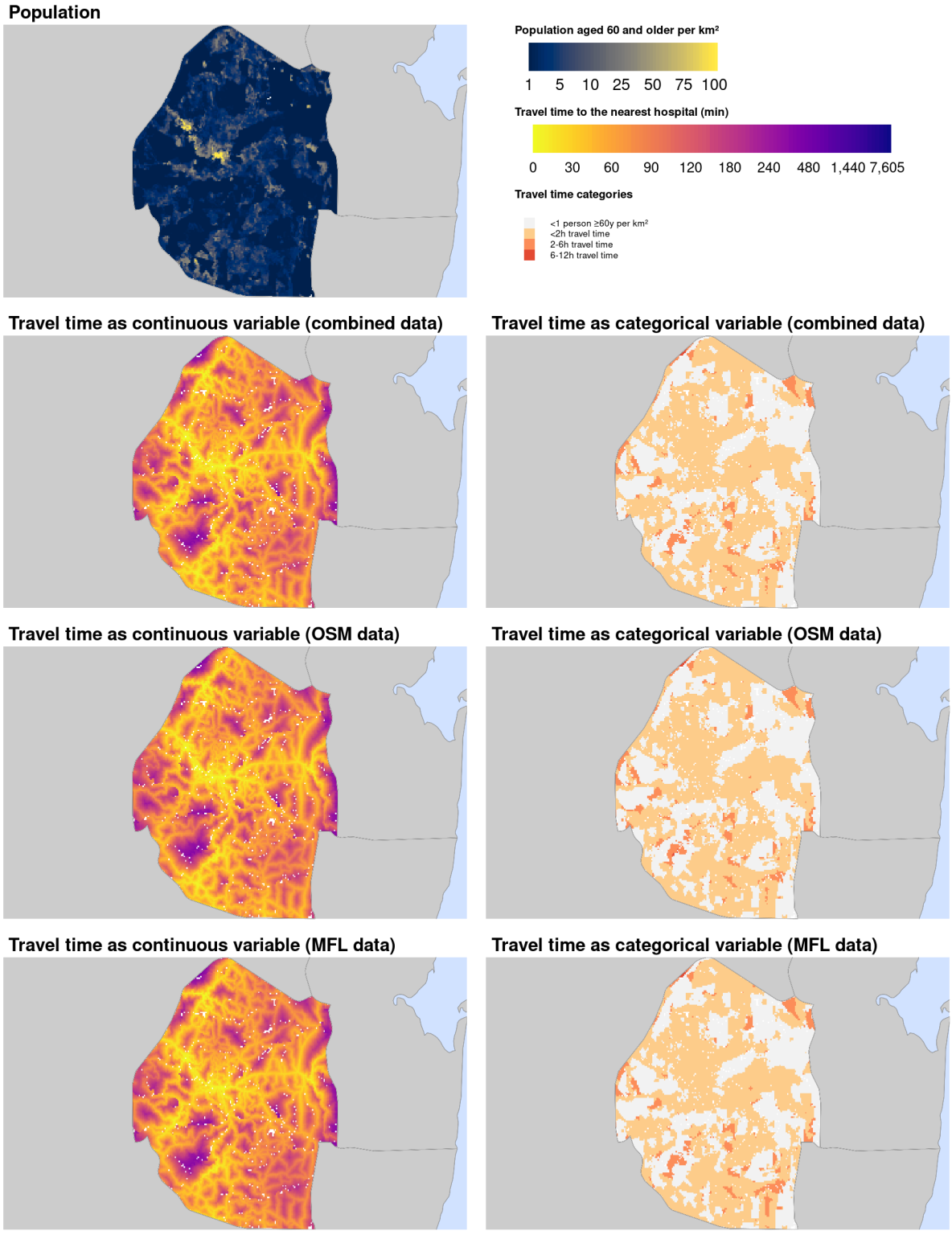


Figure S20. Ethiopia map of travel time to the nearest hospital for adults aged ≥ 60 years

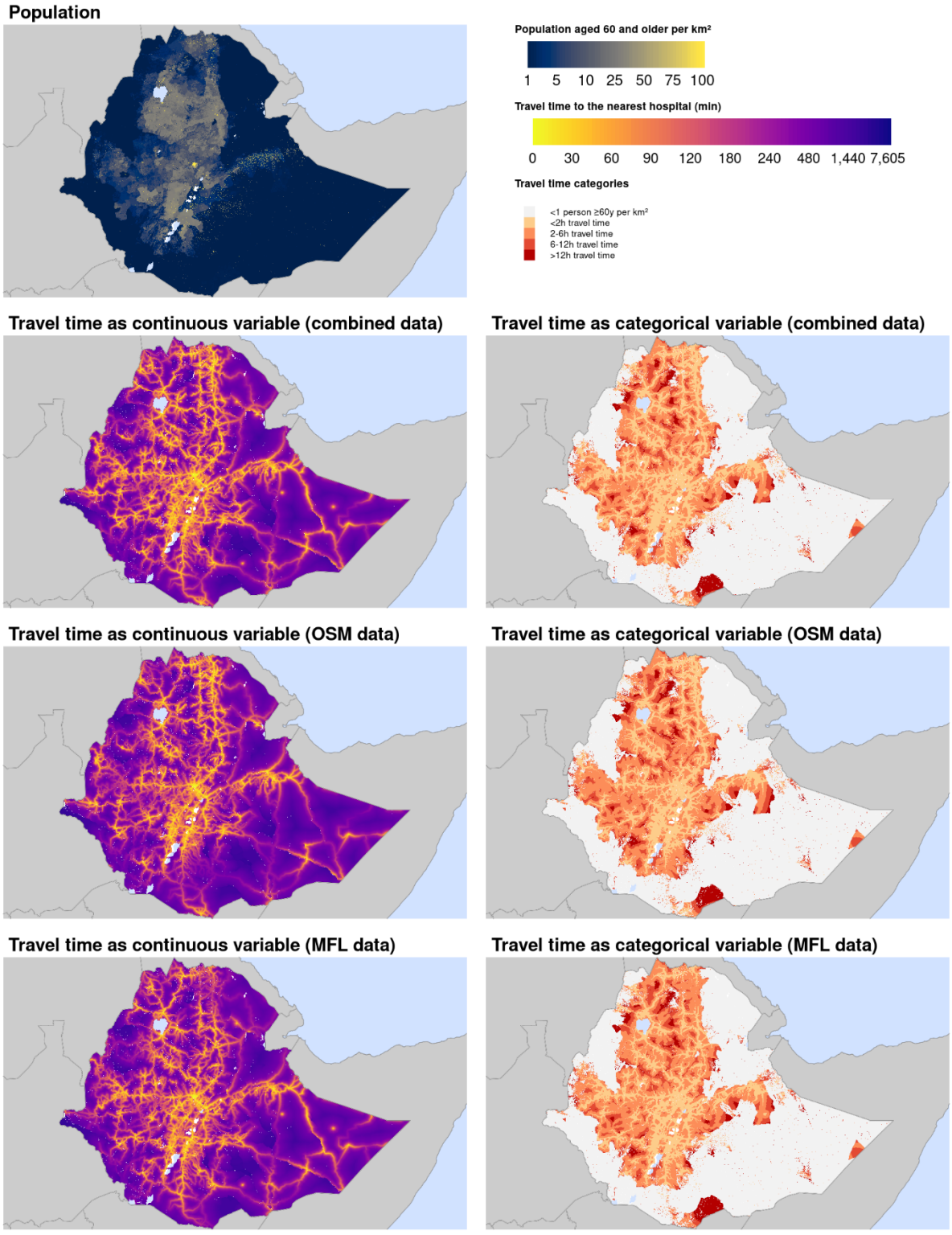


Figure S21. Gabon map of travel time to the nearest hospital for adults aged ≥ 60 years

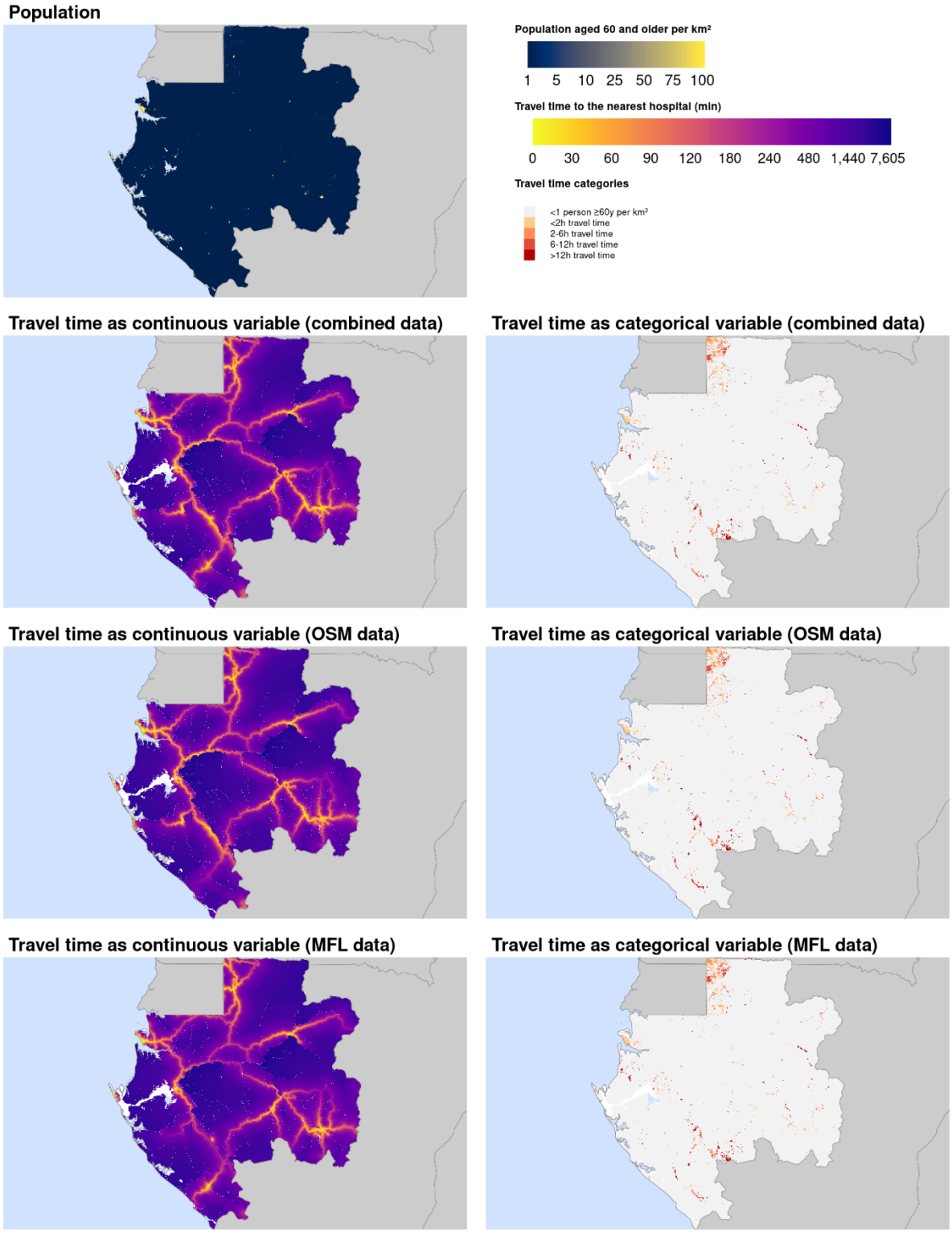


Figure S22. Ghana map of travel time to the nearest hospital for adults aged ≥ 60 years

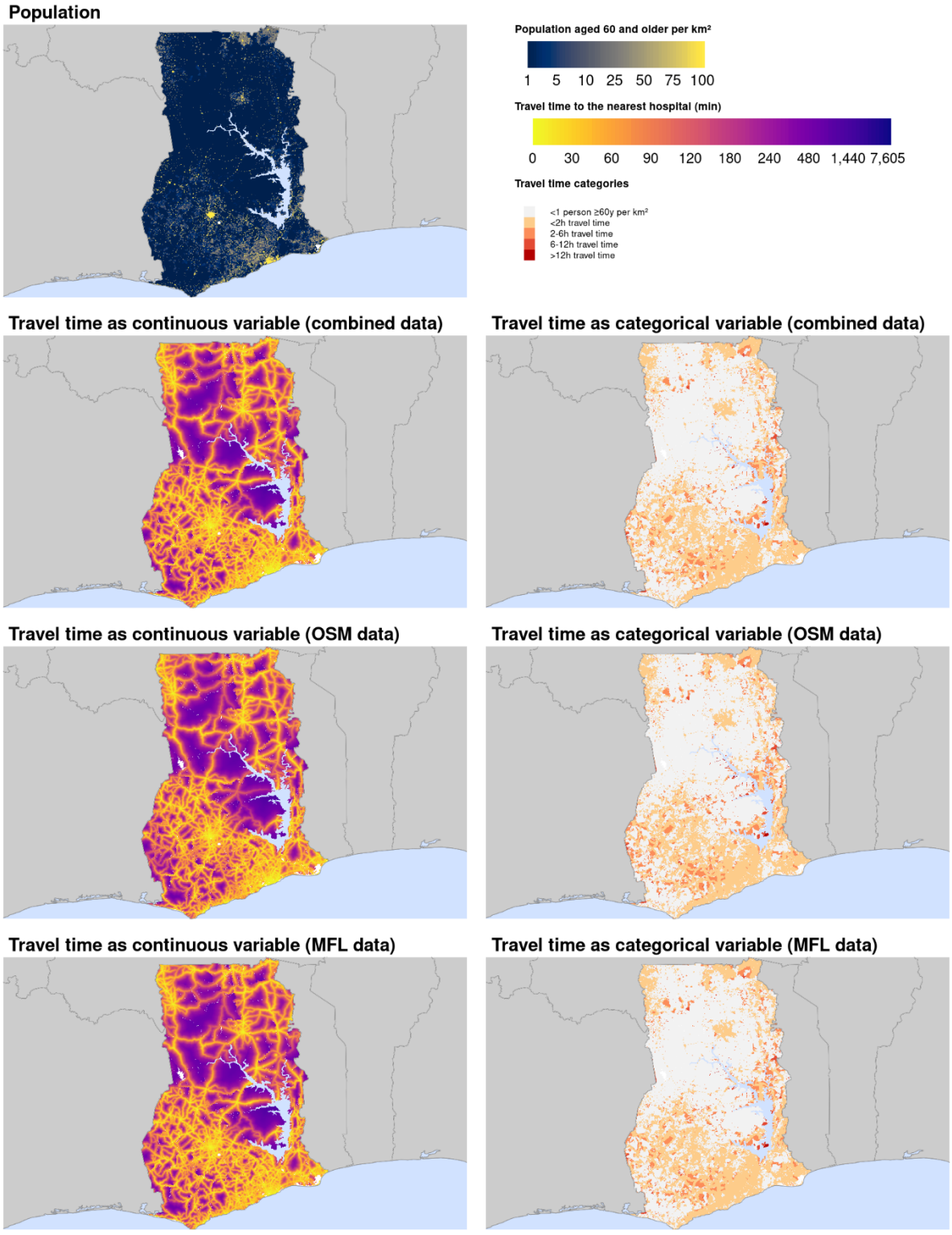


Figure S23. Guinea map of travel time to the nearest hospital for adults aged ≥ 60 years

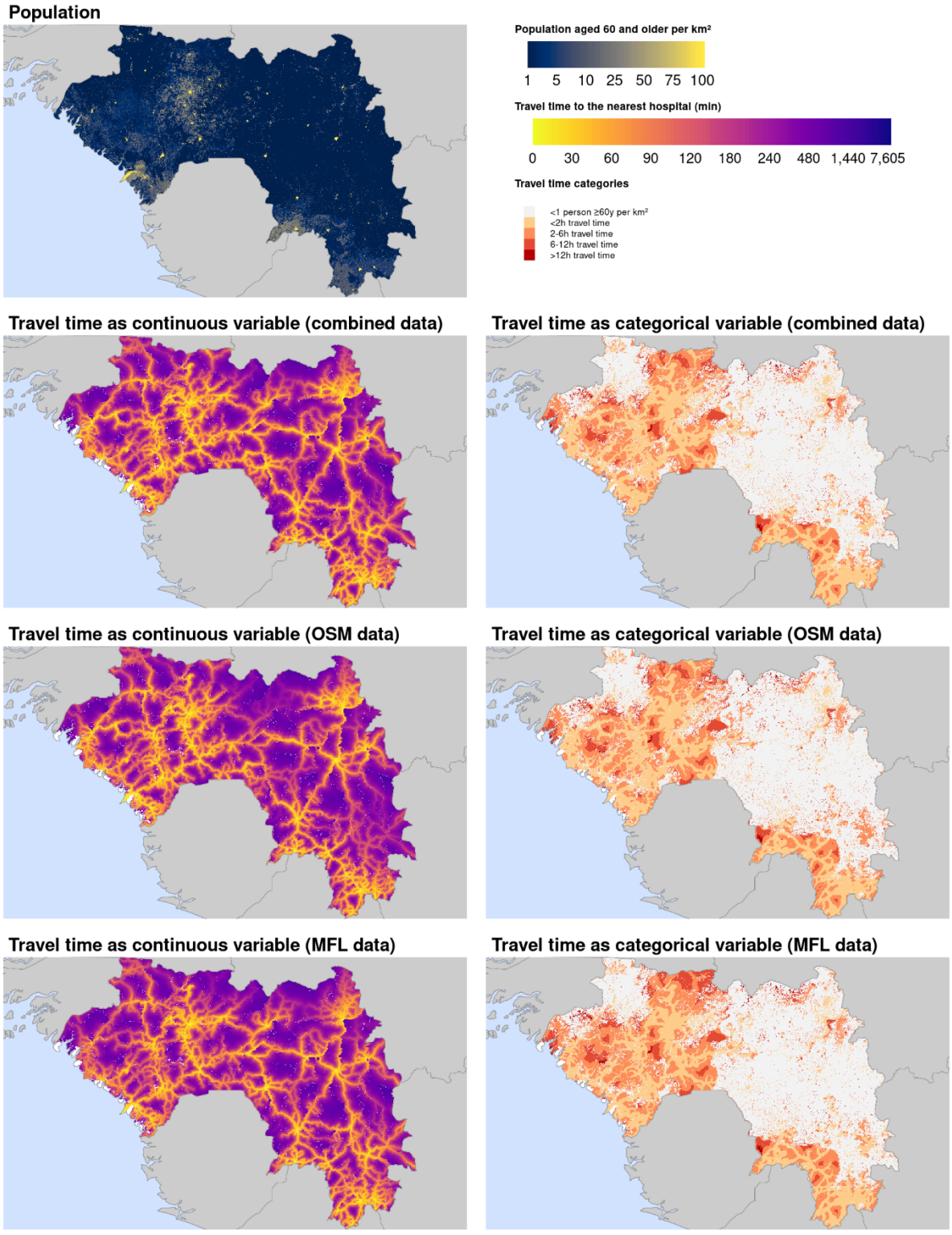


Figure S24. Guinea-Bissau map of travel time to the nearest hospital for adults aged ≥ 60 years

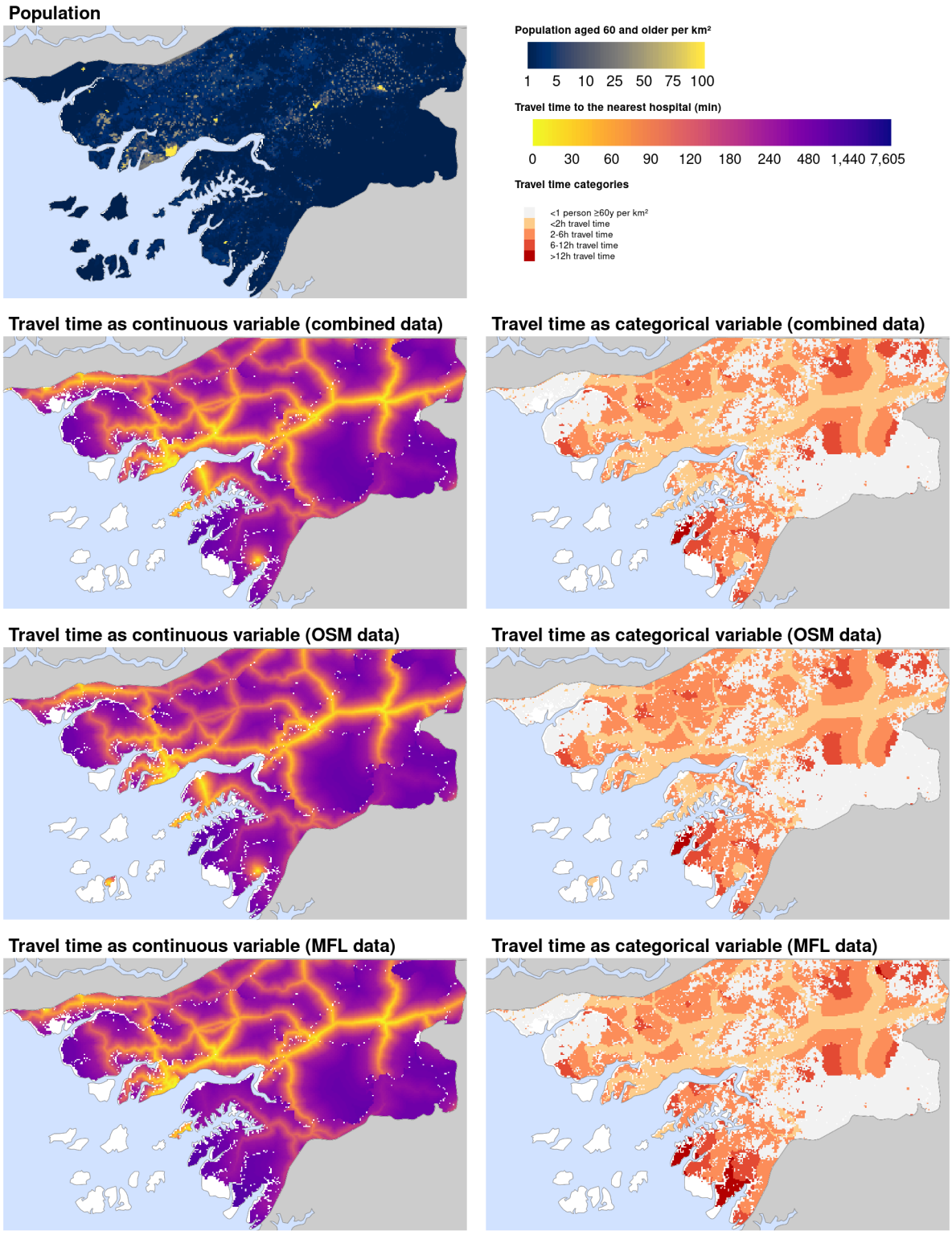


Figure S25. Ivory Coast map of travel time to the nearest hospital for adults aged ≥ 60 years

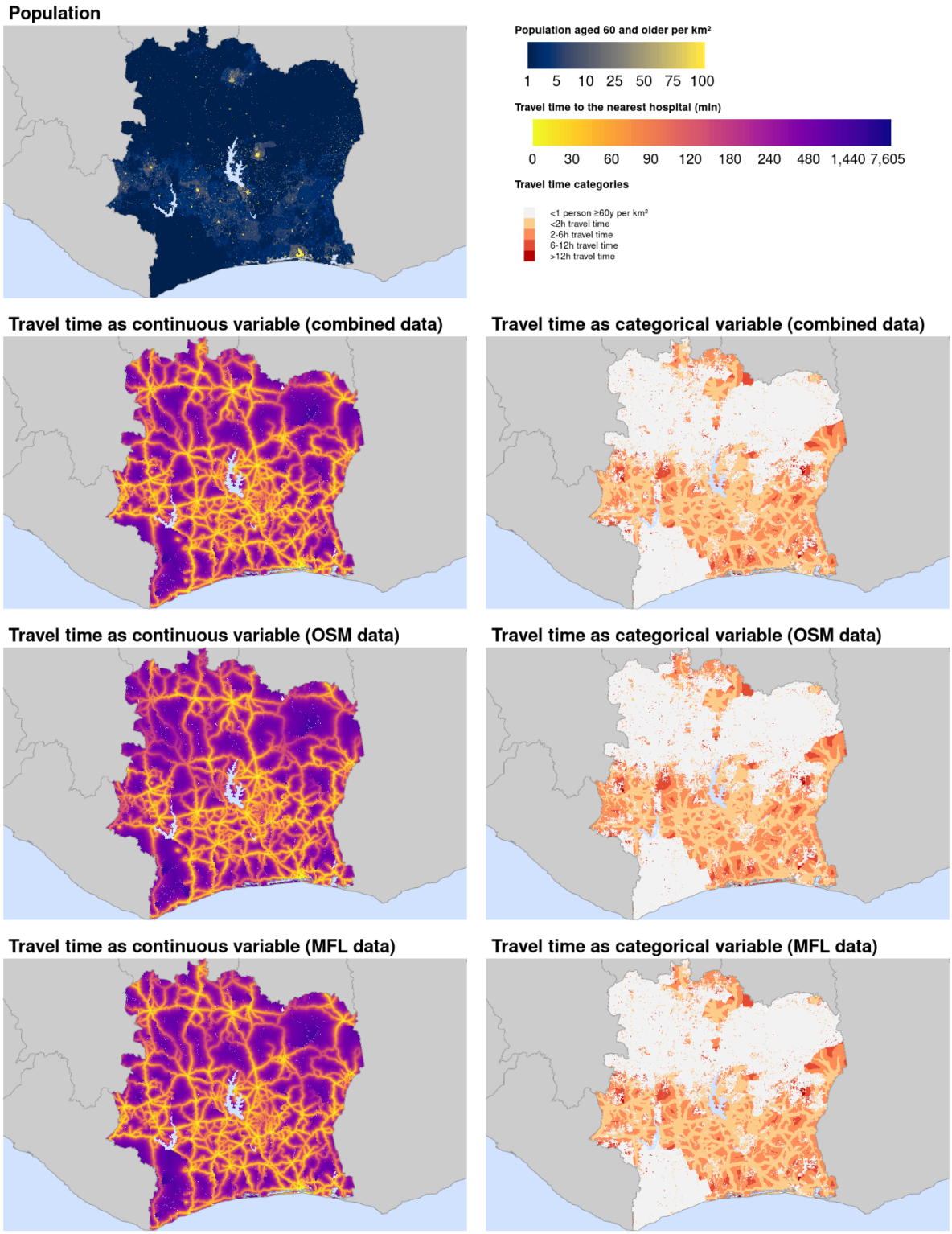


Figure S26. Kenya map of travel time to the nearest hospital for adults aged ≥ 60 years

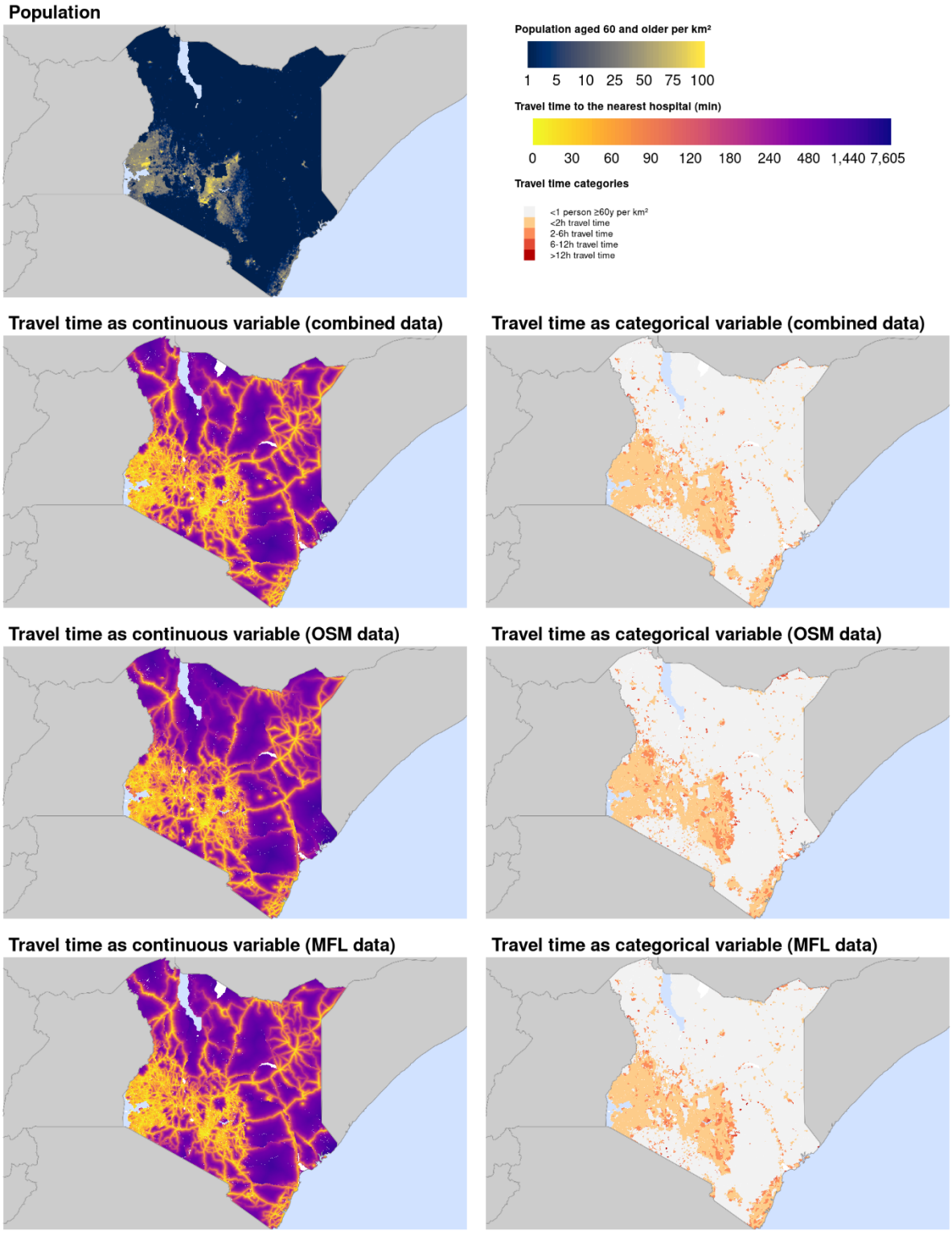


Figure S27. Lesotho map of travel time to the nearest hospital for adults aged ≥ 60 years

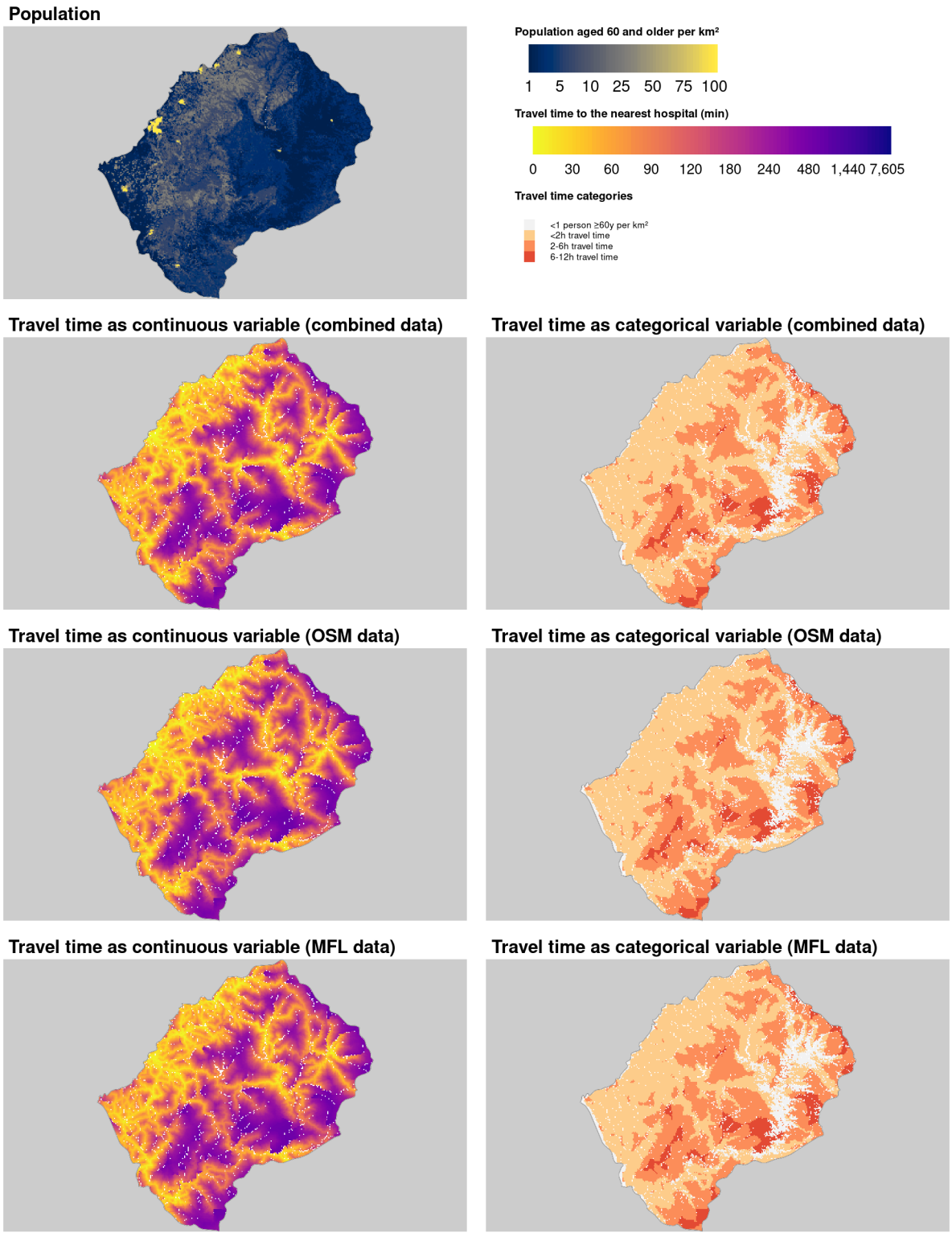


Figure S28. Liberia map of travel time to the nearest hospital for adults aged ≥ 60 years

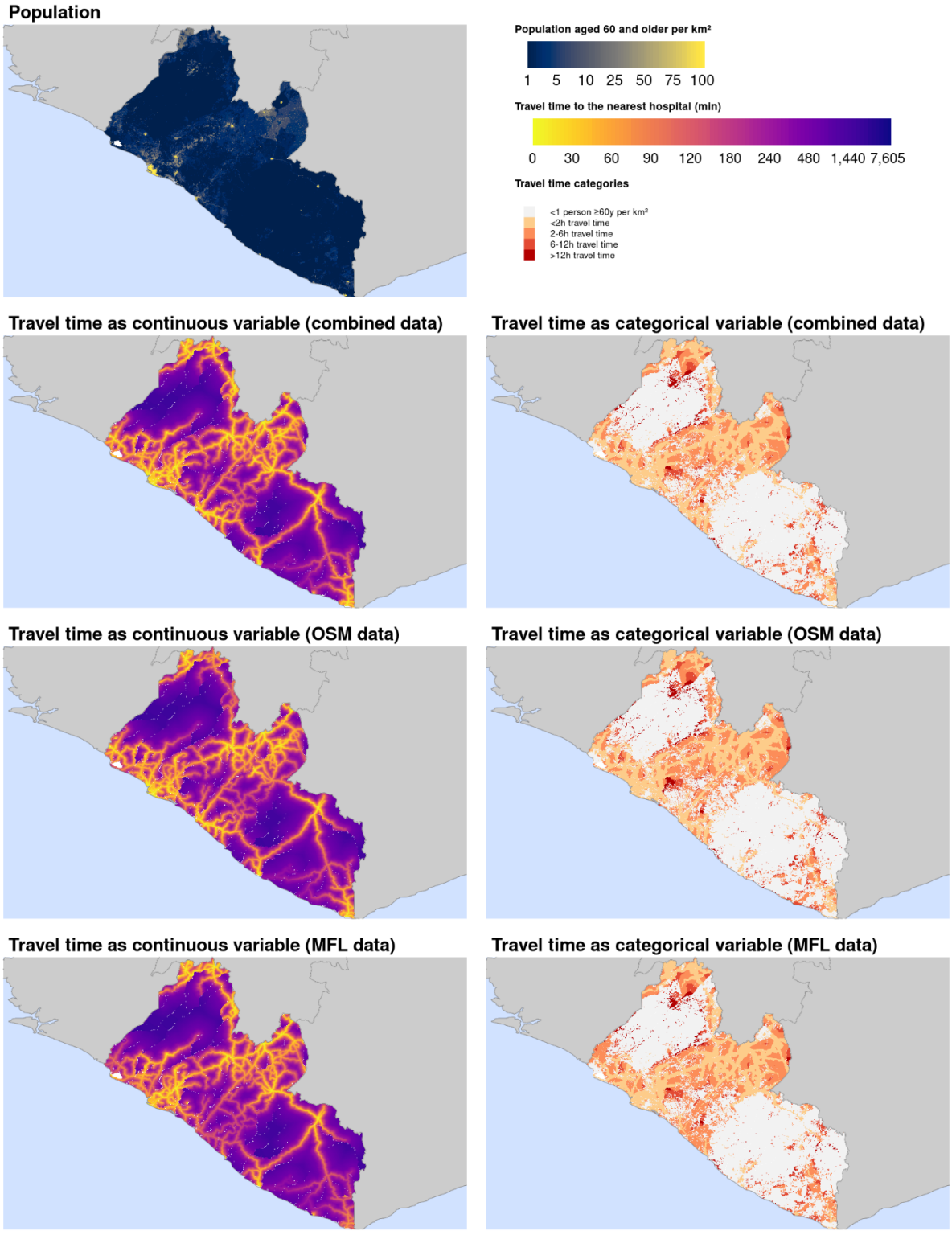


Figure S29. Madagascar map of travel time to the nearest hospital for adults aged ≥ 60 years

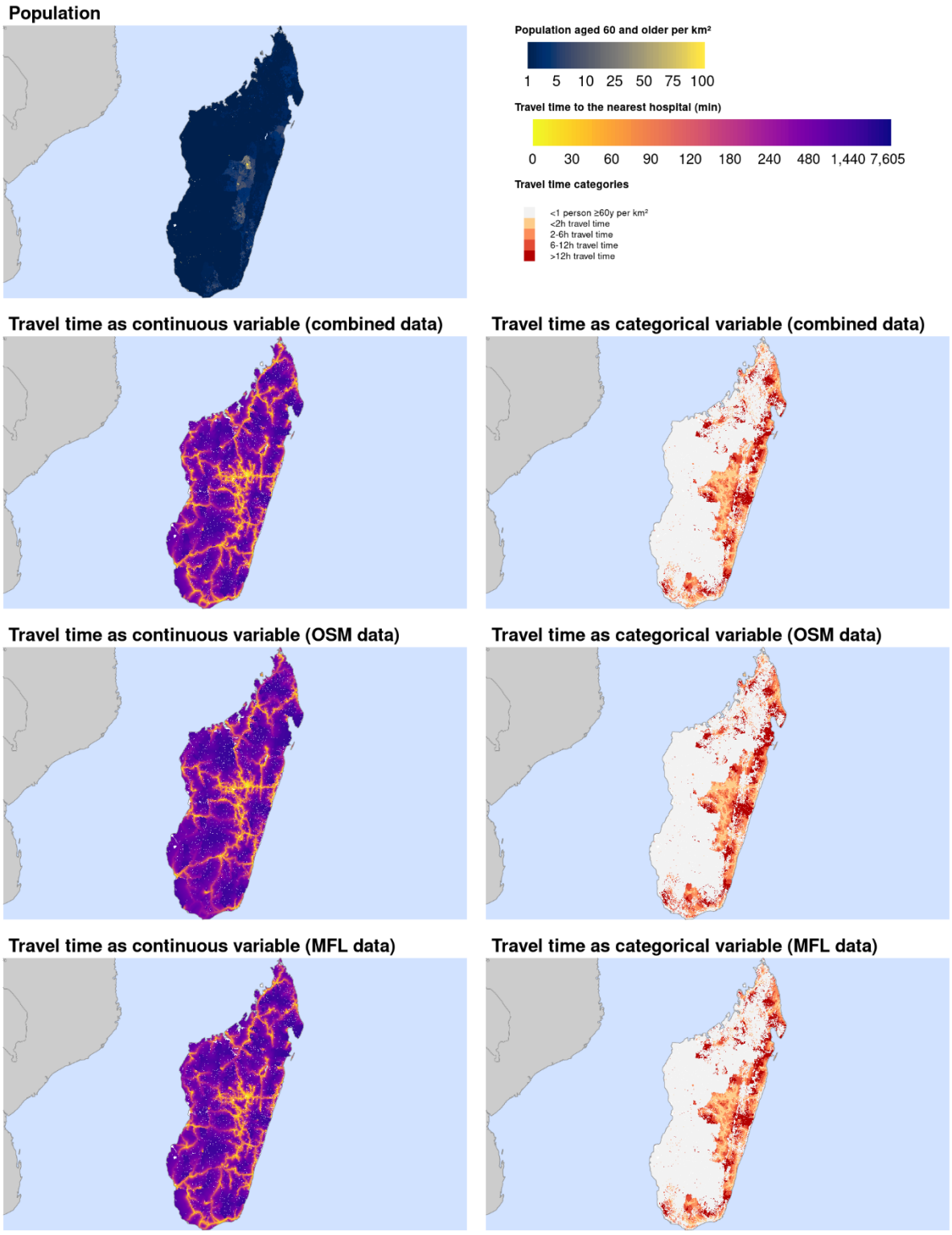


Figure S30. Malawi map of travel time to the nearest hospital for adults aged ≥ 60 years

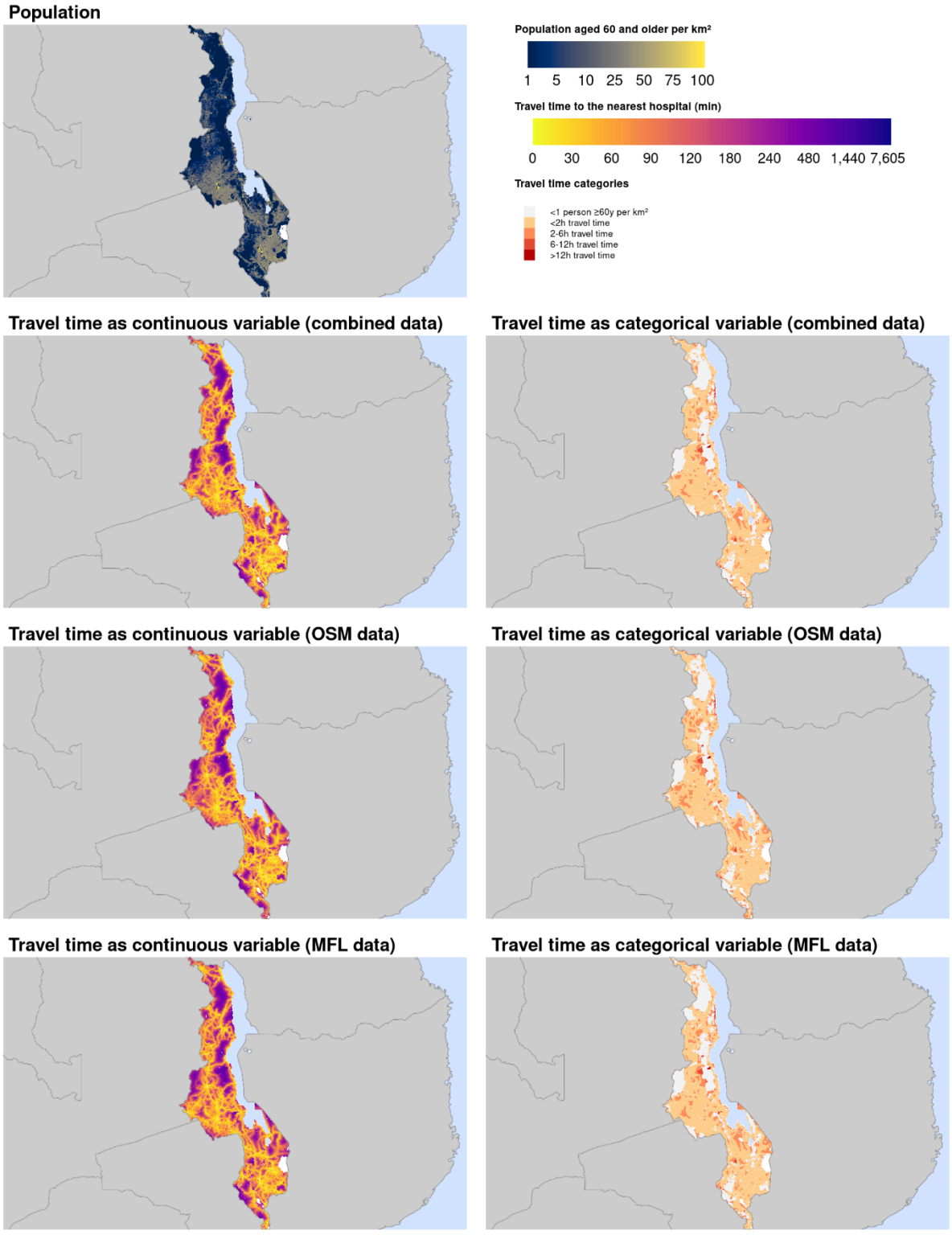


Figure S31. Mali map of travel time to the nearest hospital for adults aged ≥ 60 years

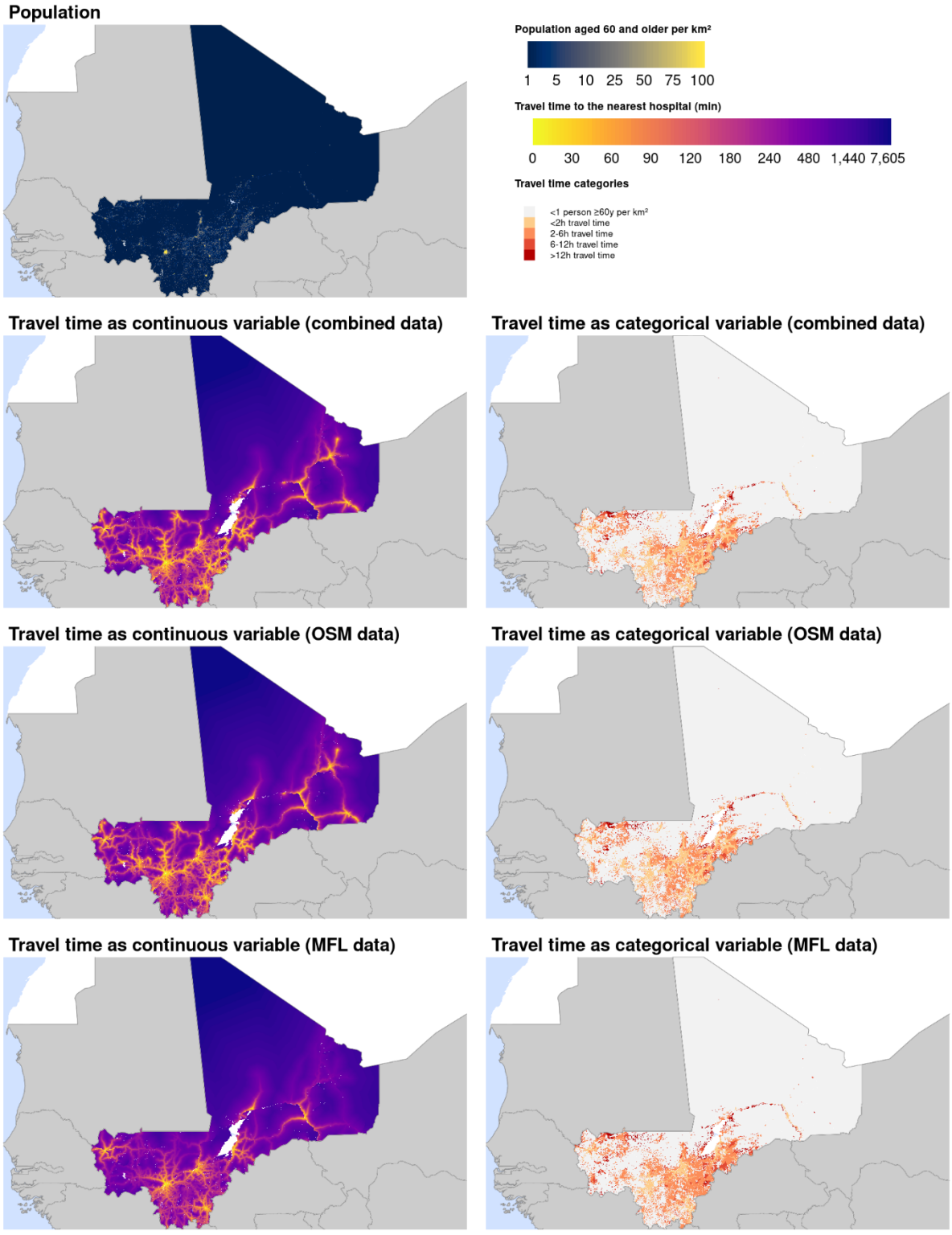


Figure S32. Mauritania map of travel time to the nearest hospital for adults aged ≥ 60 years

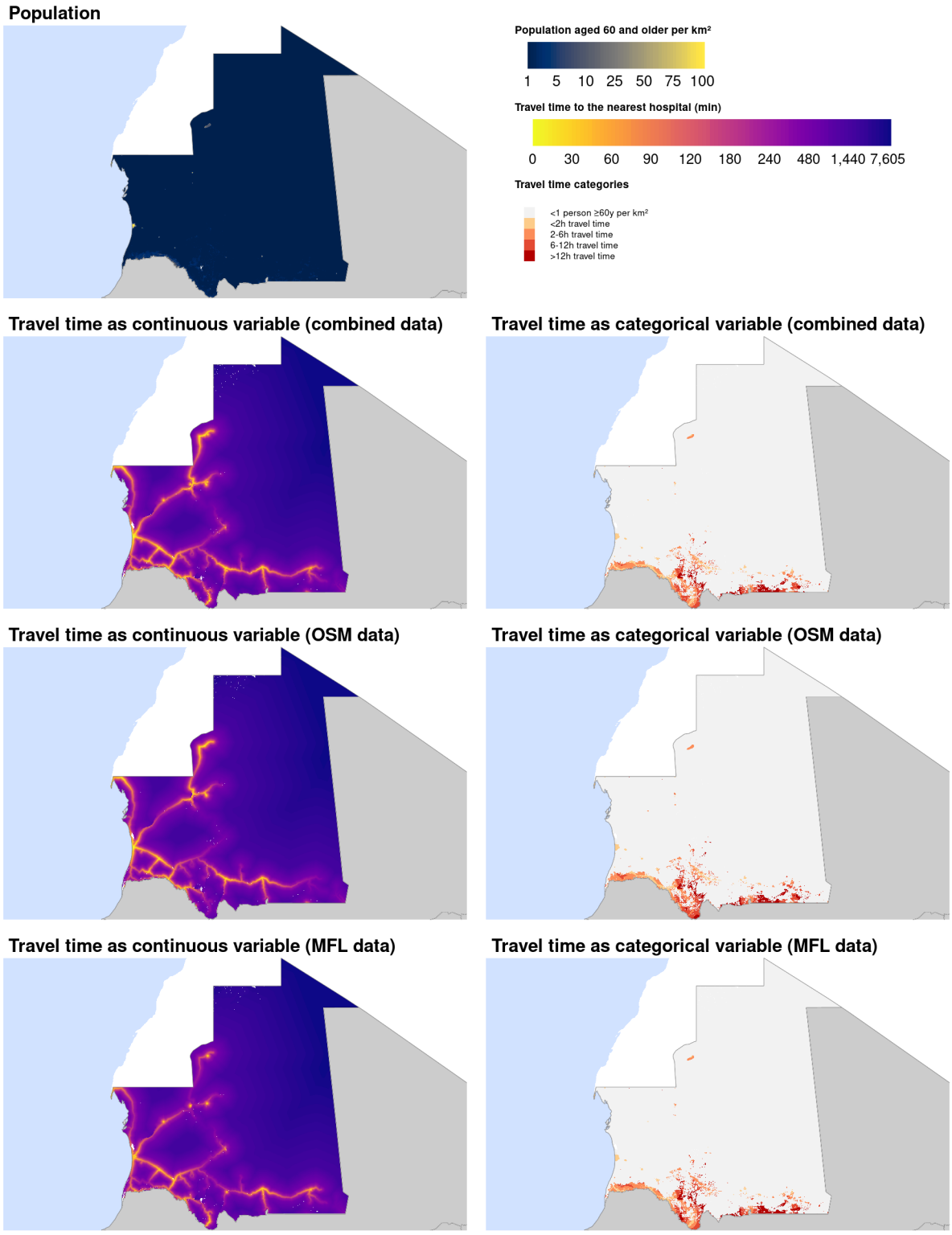


Figure S33. Mozambique map of travel time to the nearest hospital for adults aged ≥ 60 years

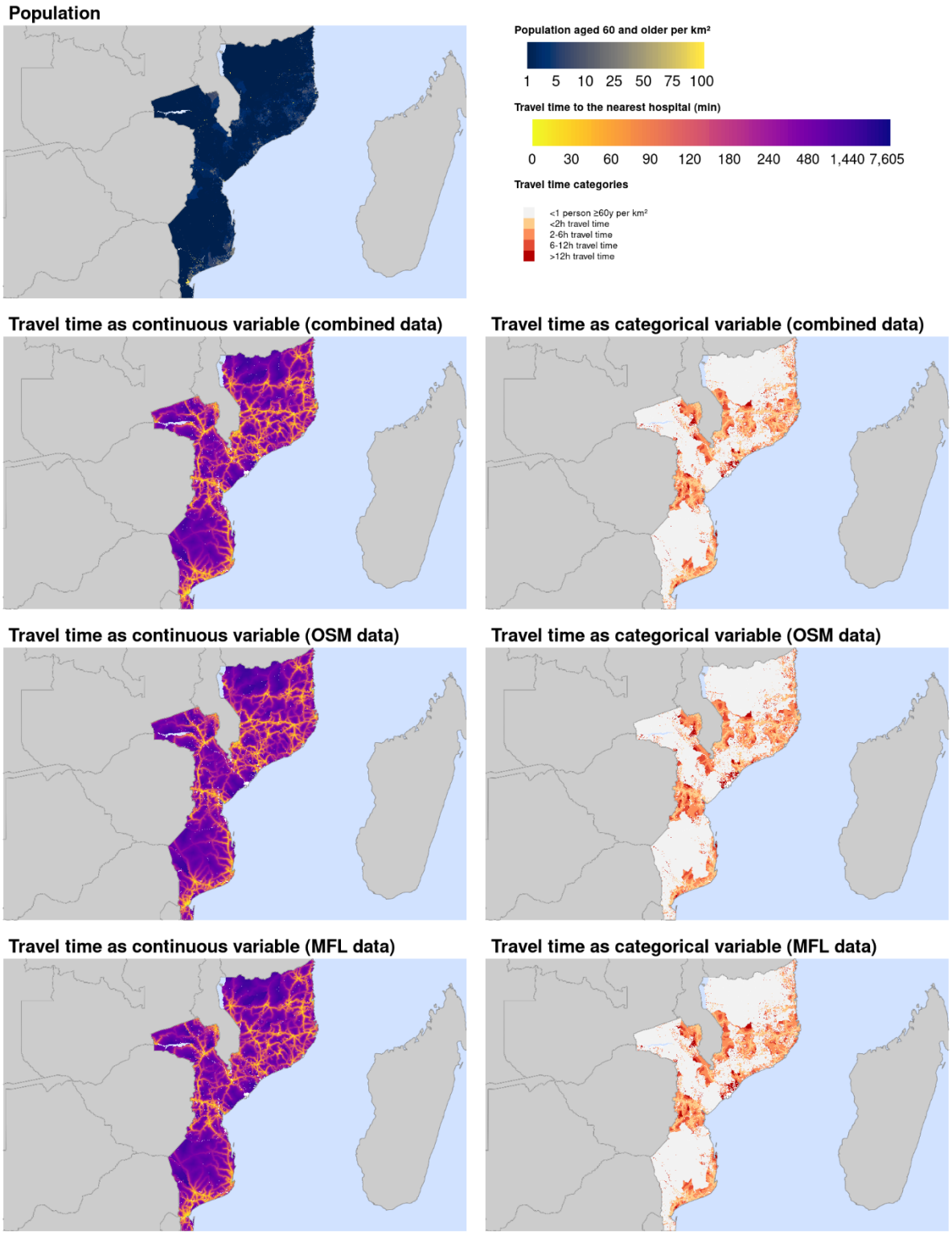


Figure S34. Namibia map of travel time to the nearest hospital for adults aged ≥ 60 years

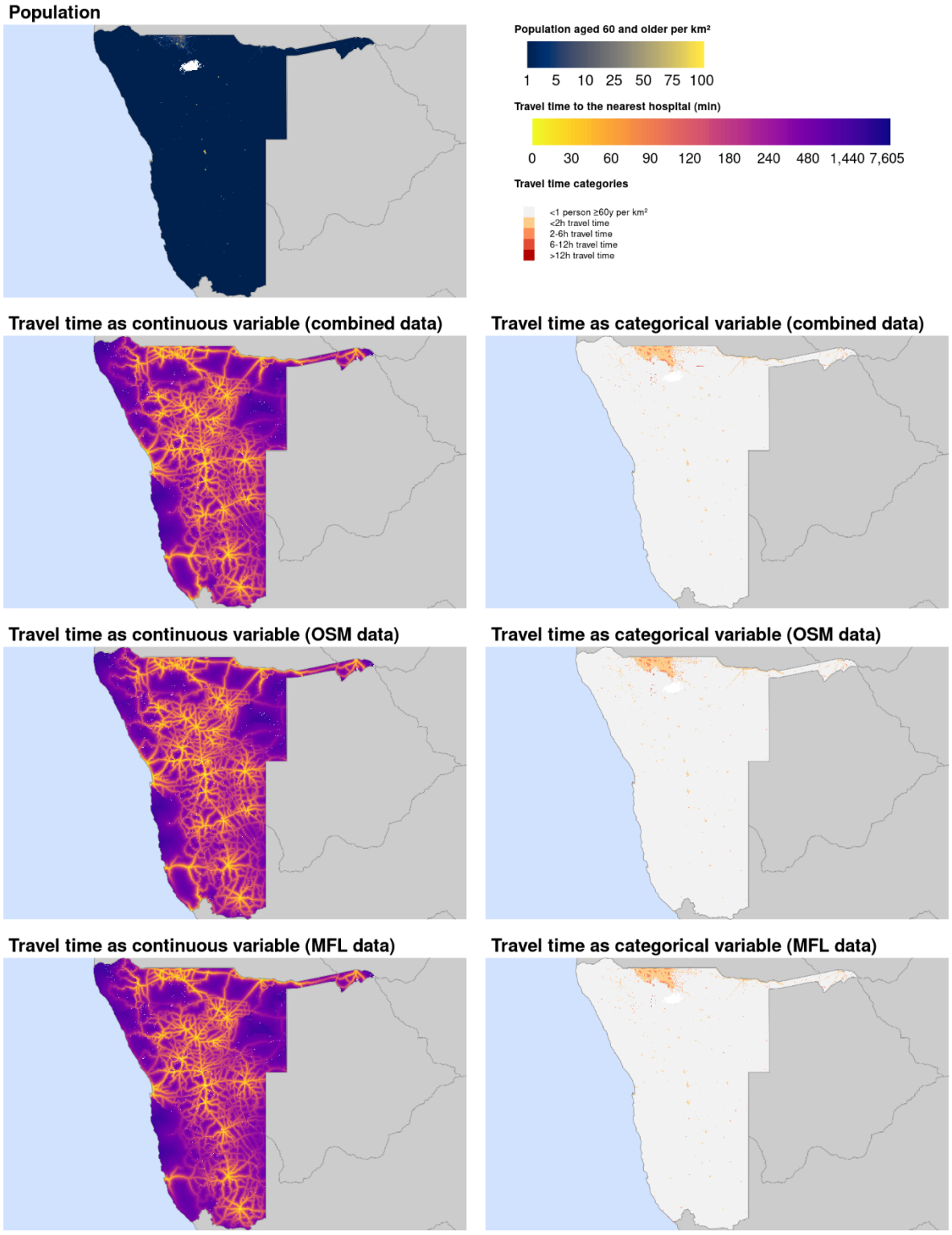


Figure S35. Niger map of travel time to the nearest hospital for adults aged ≥ 60 years

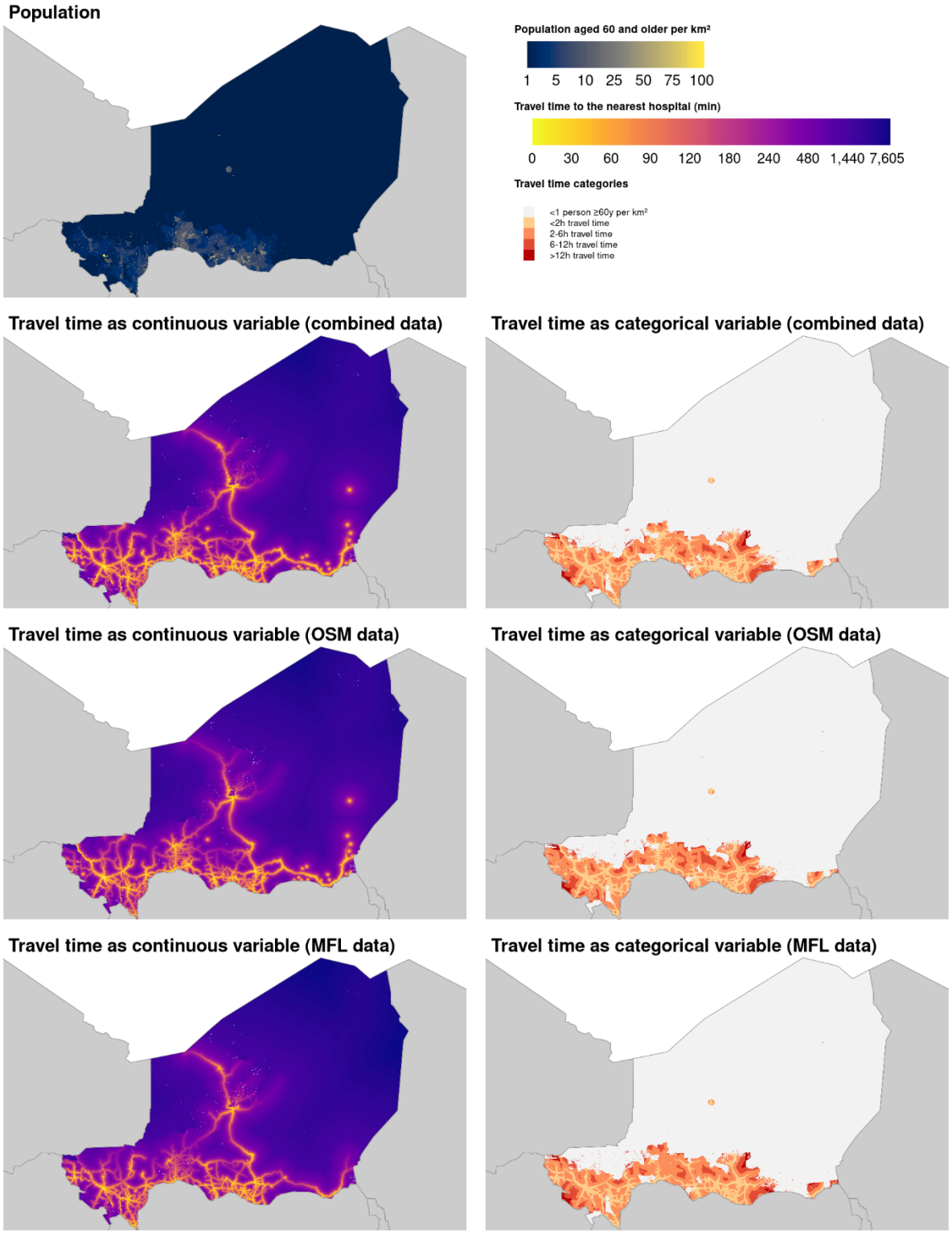


Figure S36. Nigeria map of travel time to the nearest hospital for adults aged ≥ 60 years

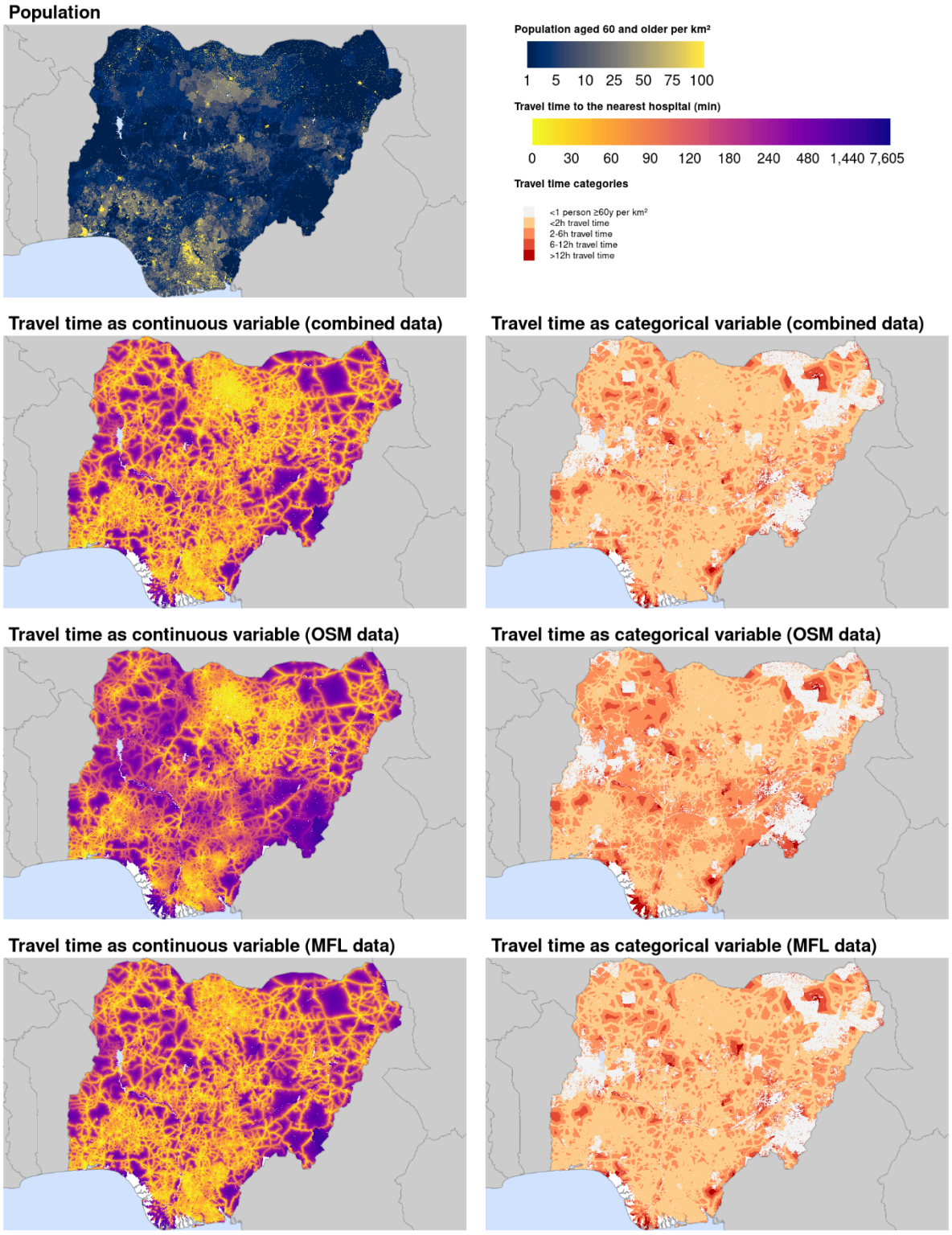


Figure S37. Republic of the Congo map of travel time to the nearest hospital for adults aged ≥ 60 years

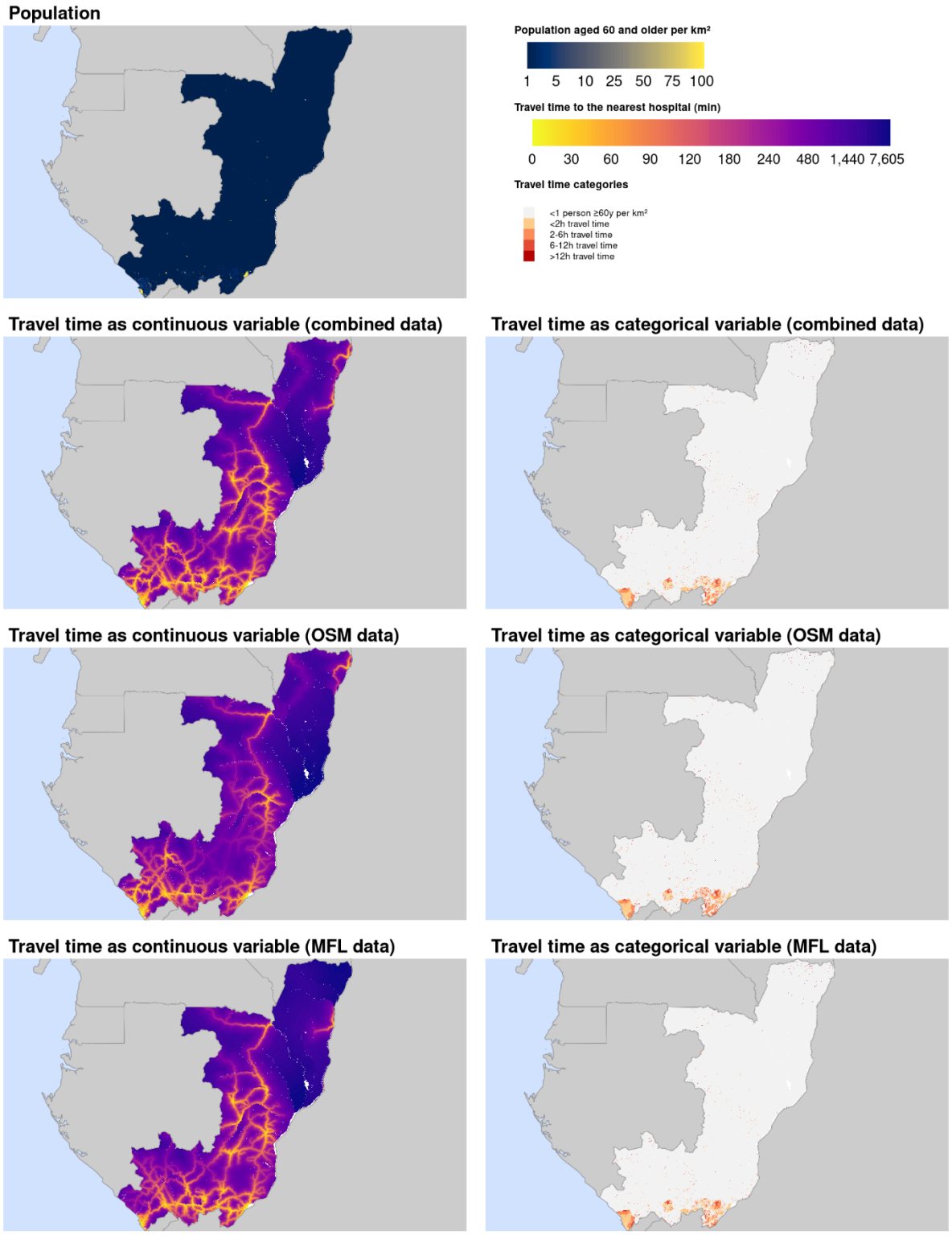


Figure S38. Rwanda map of travel time to the nearest hospital for adults aged ≥ 60 years

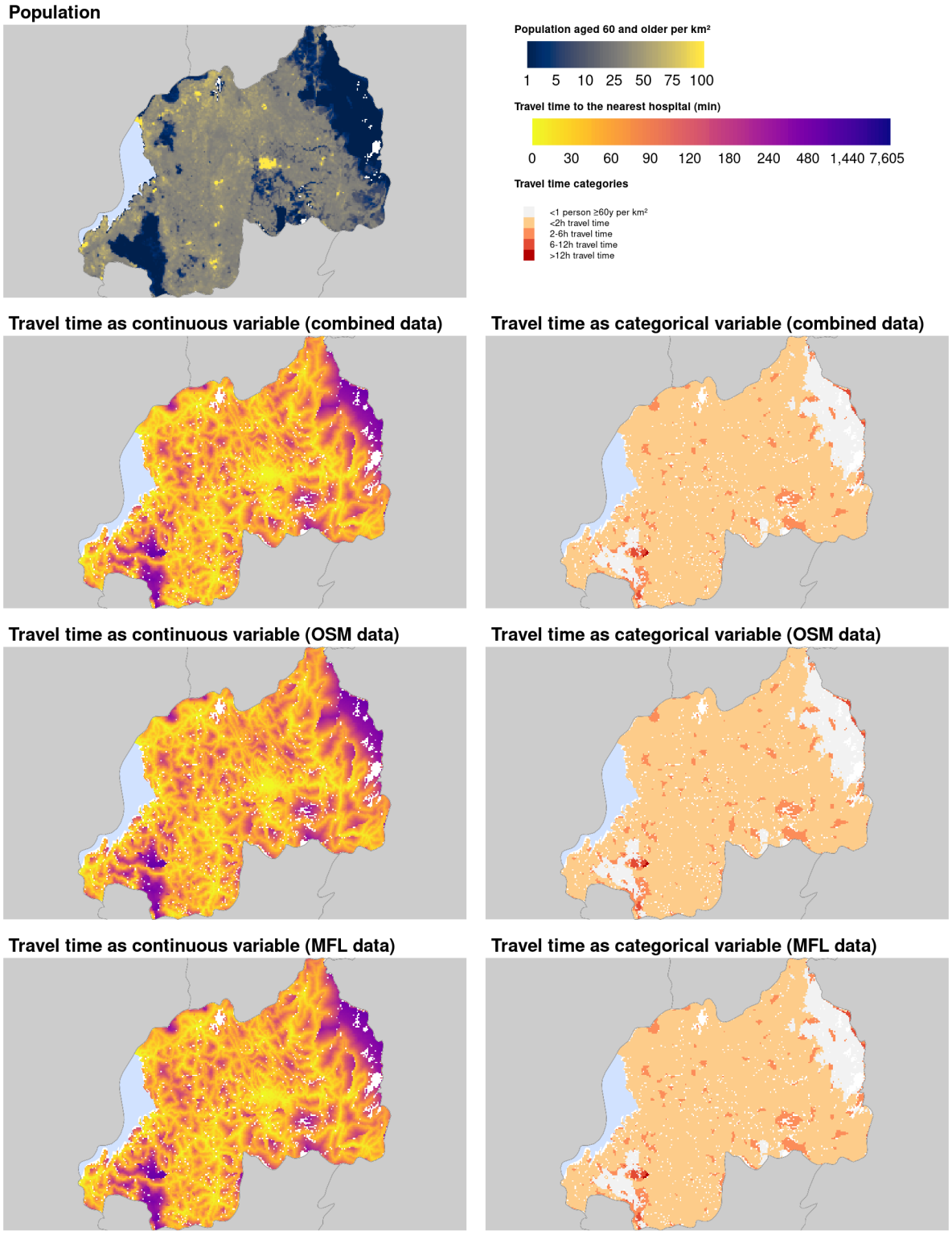


Figure S39. Senegal map of travel time to the nearest hospital for adults aged ≥ 60 years

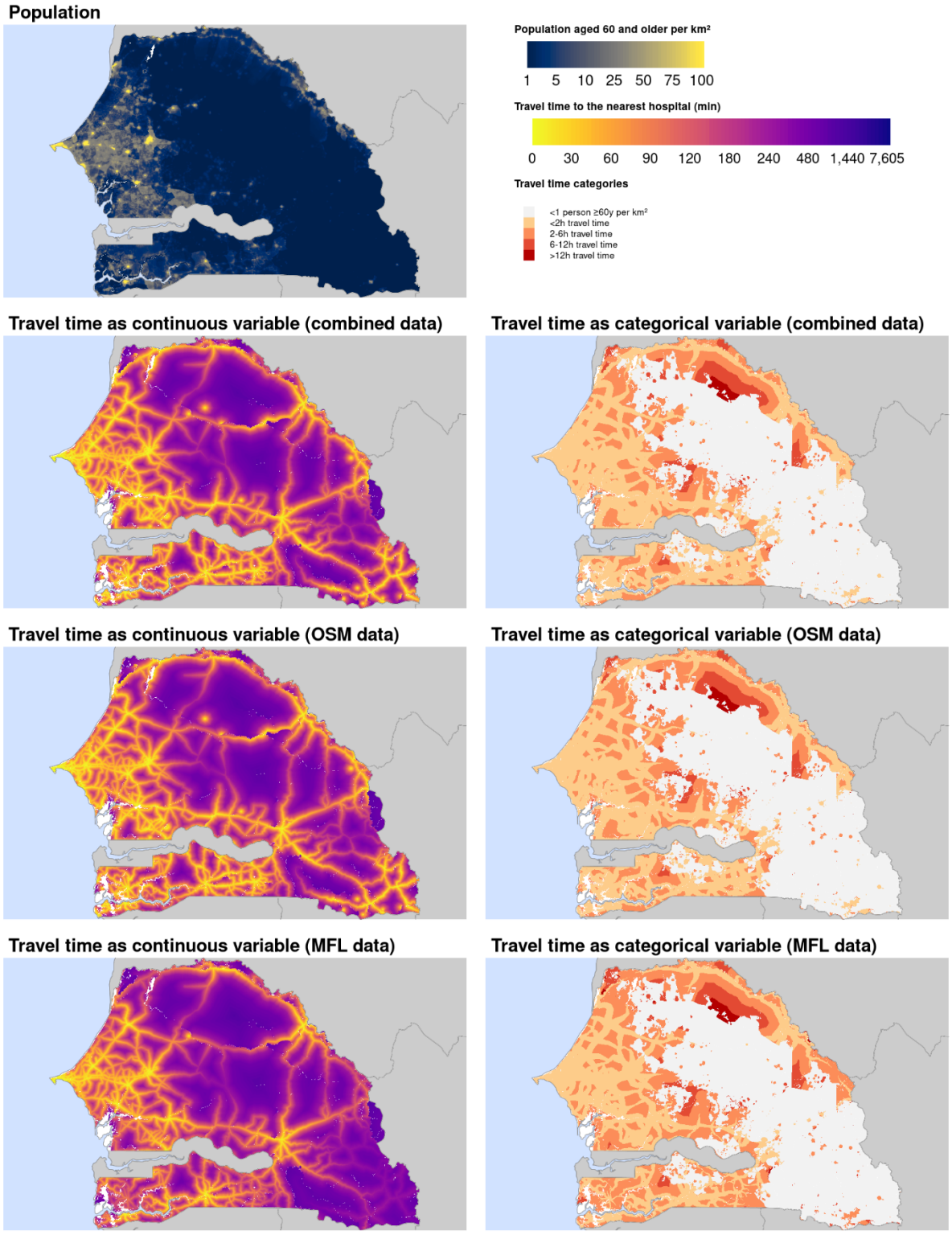


Figure S40. Sierra Leone map of travel time to the nearest hospital for adults aged ≥ 60 years

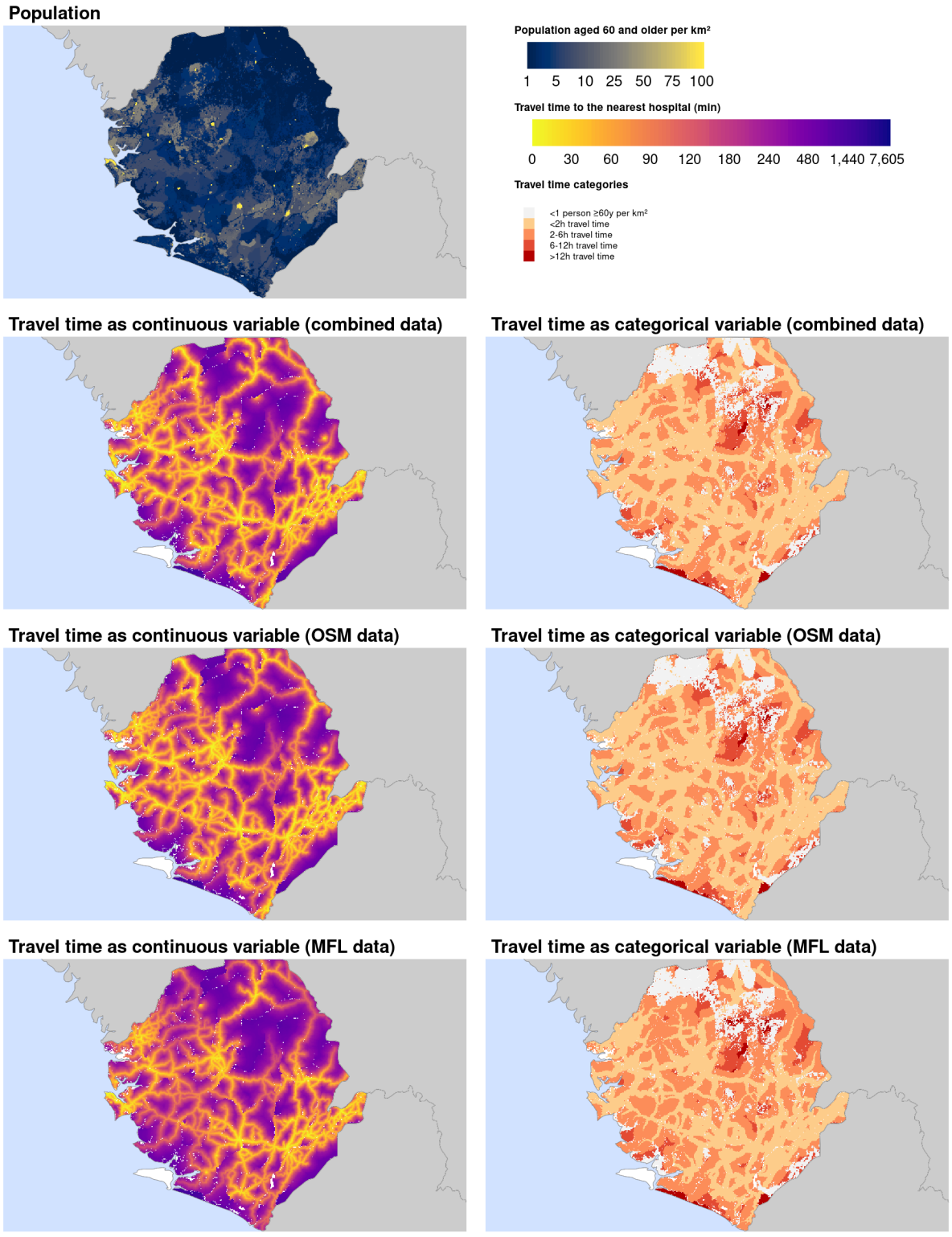


Figure S41. Somalia map of travel time to the nearest hospital for adults aged ≥ 60 years

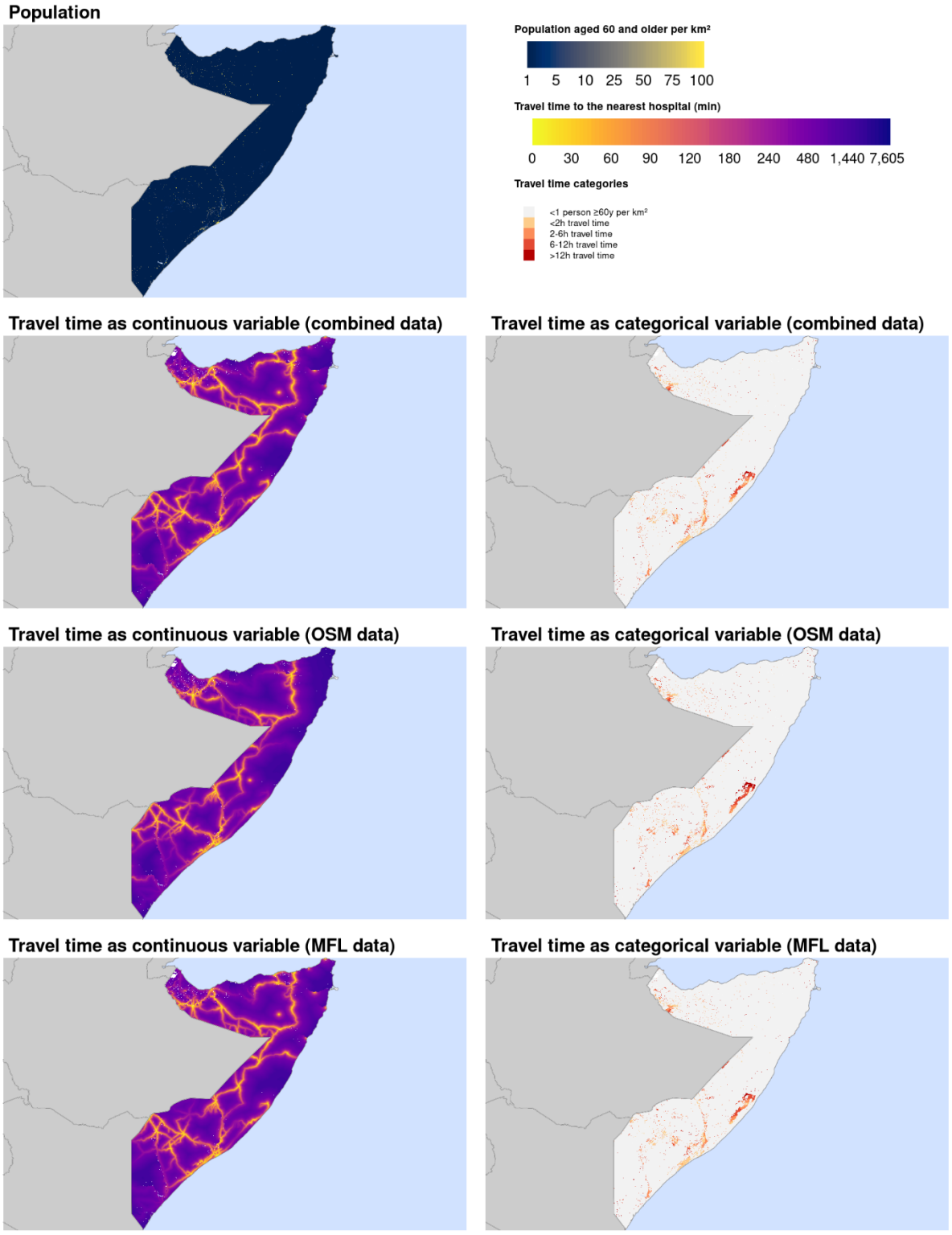


Figure S42. South Africa map of travel time to the nearest hospital for adults aged ≥ 60 years

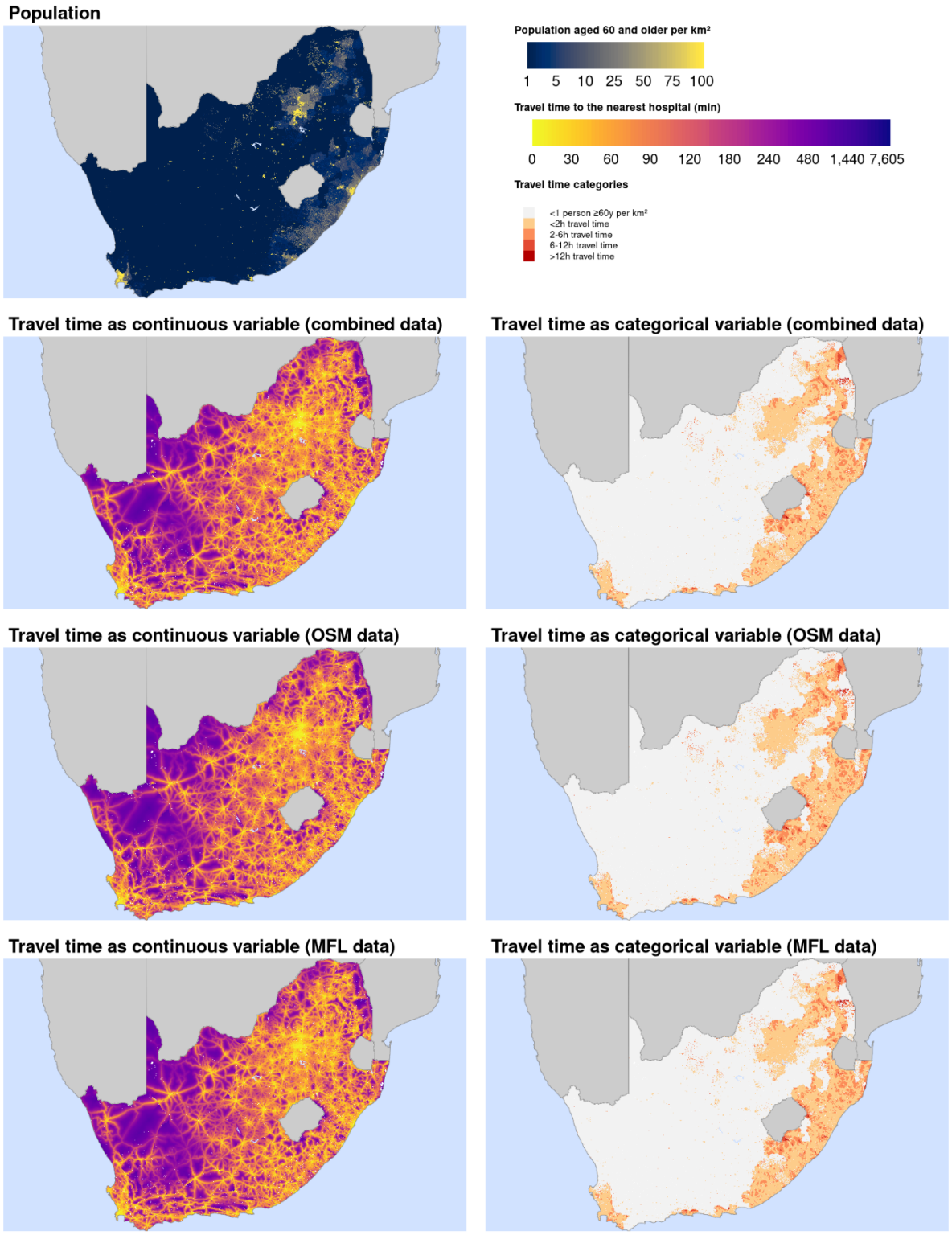


Figure S43. South Sudan map of travel time to the nearest hospital for adults aged ≥ 60 years

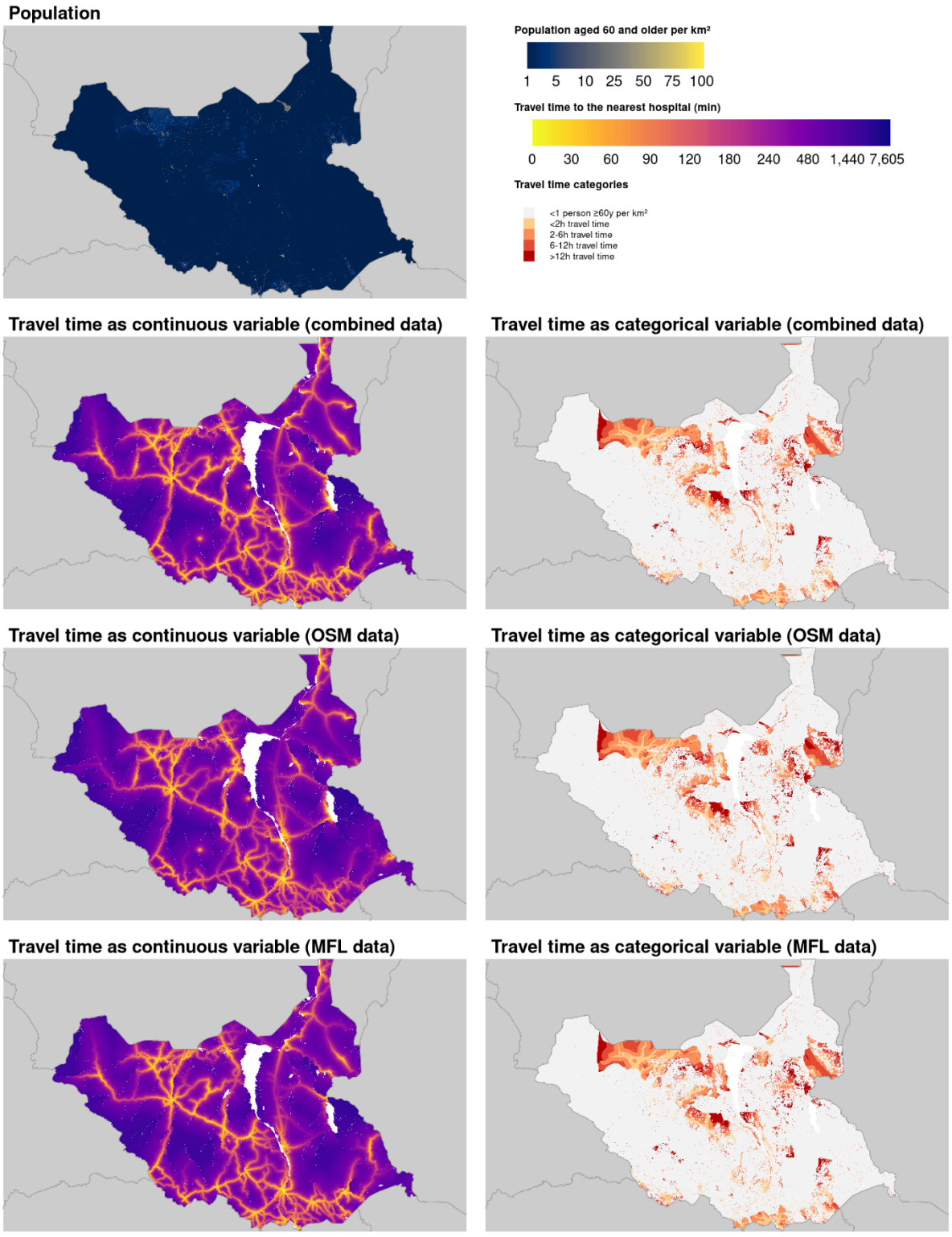


Figure S44. Sudan map of travel time to the nearest hospital for adults aged ≥ 60 years

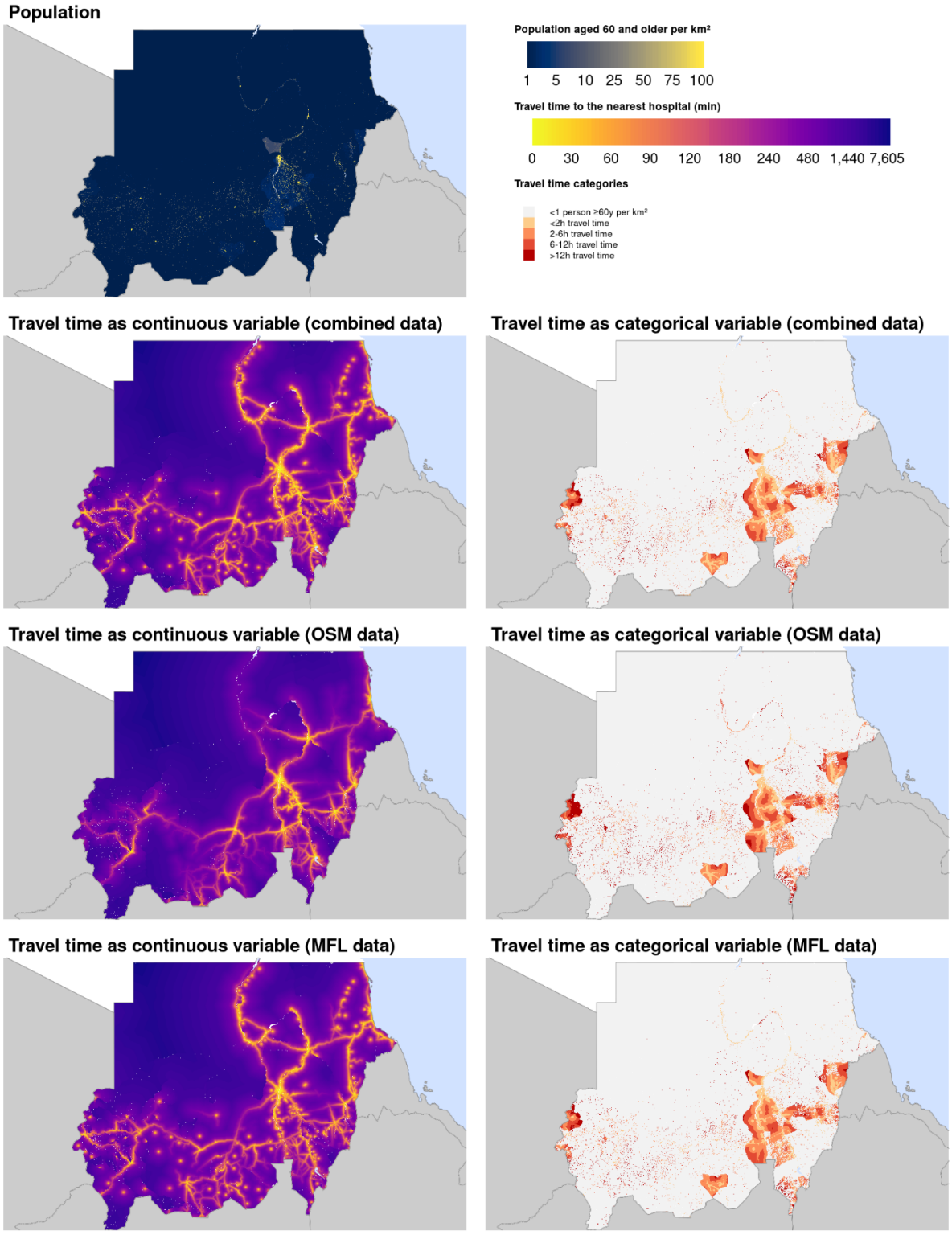


Figure S45. Tanzania map of travel time to the nearest hospital for adults aged ≥ 60 years

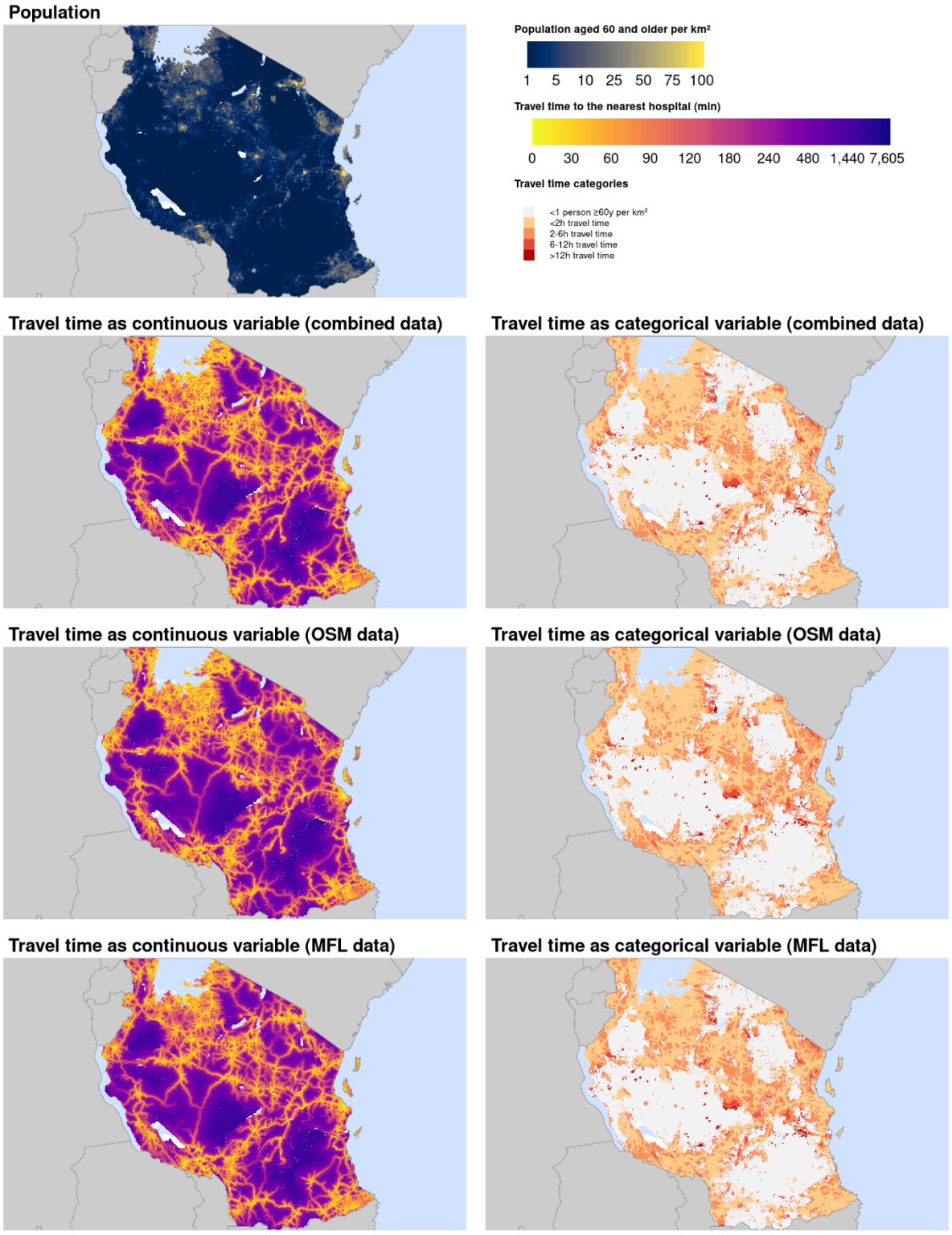


Figure S46. The Gambia map of travel time to the nearest hospital for adults aged ≥ 60 years

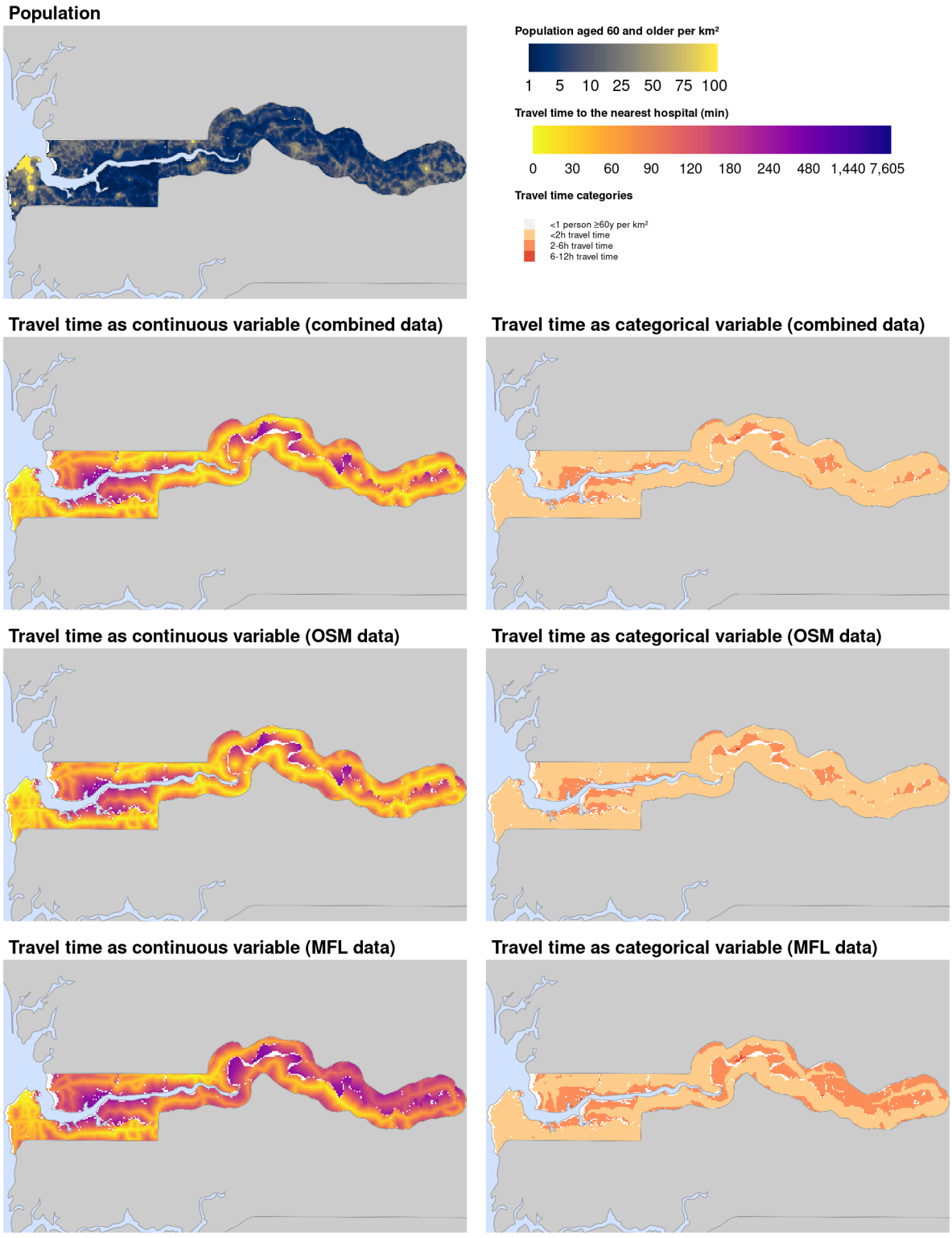


Figure S47. Togo map of travel time to the nearest hospital for adults aged ≥ 60 years

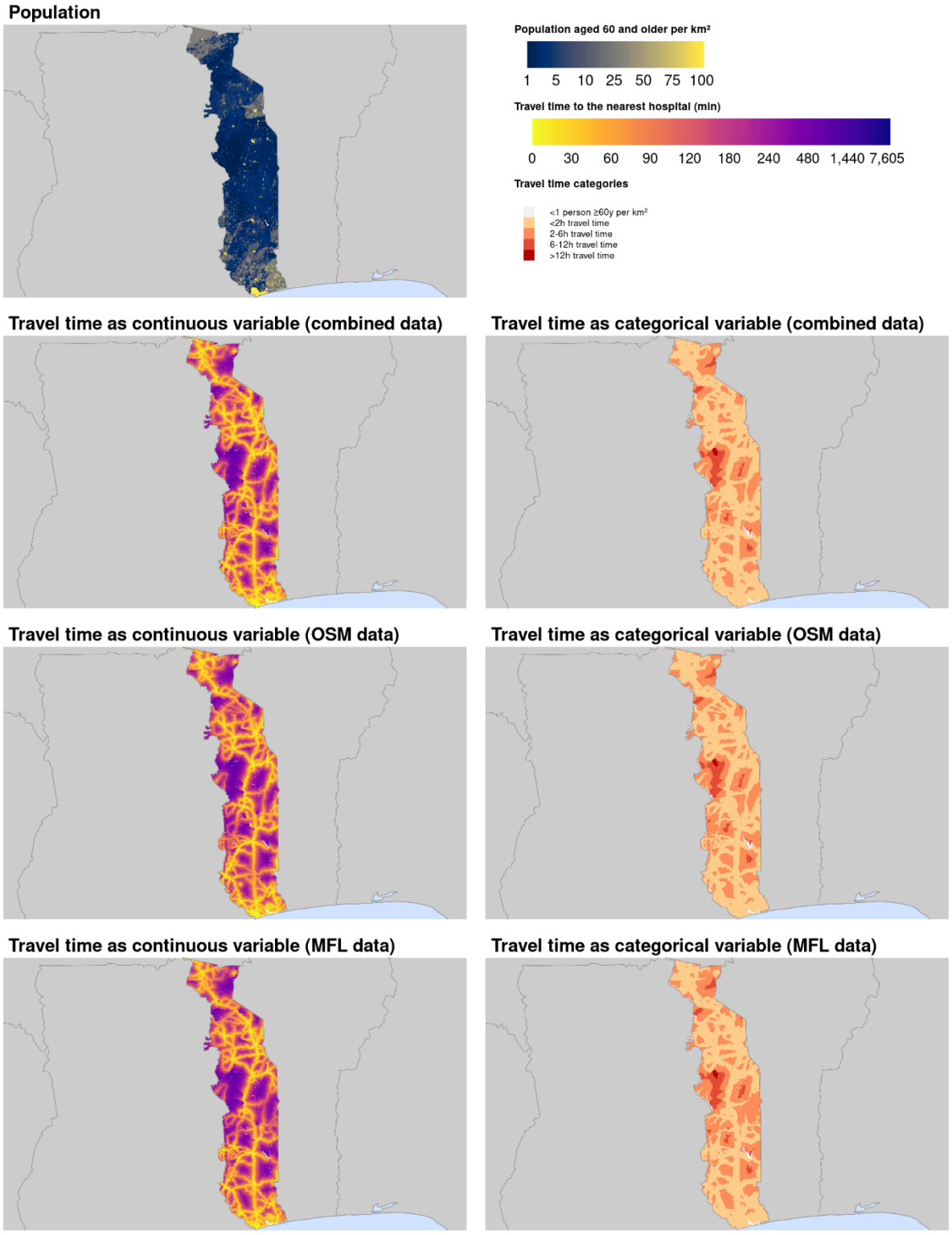


Figure S48. Uganda map of travel time to the nearest hospital for adults aged ≥ 60 years

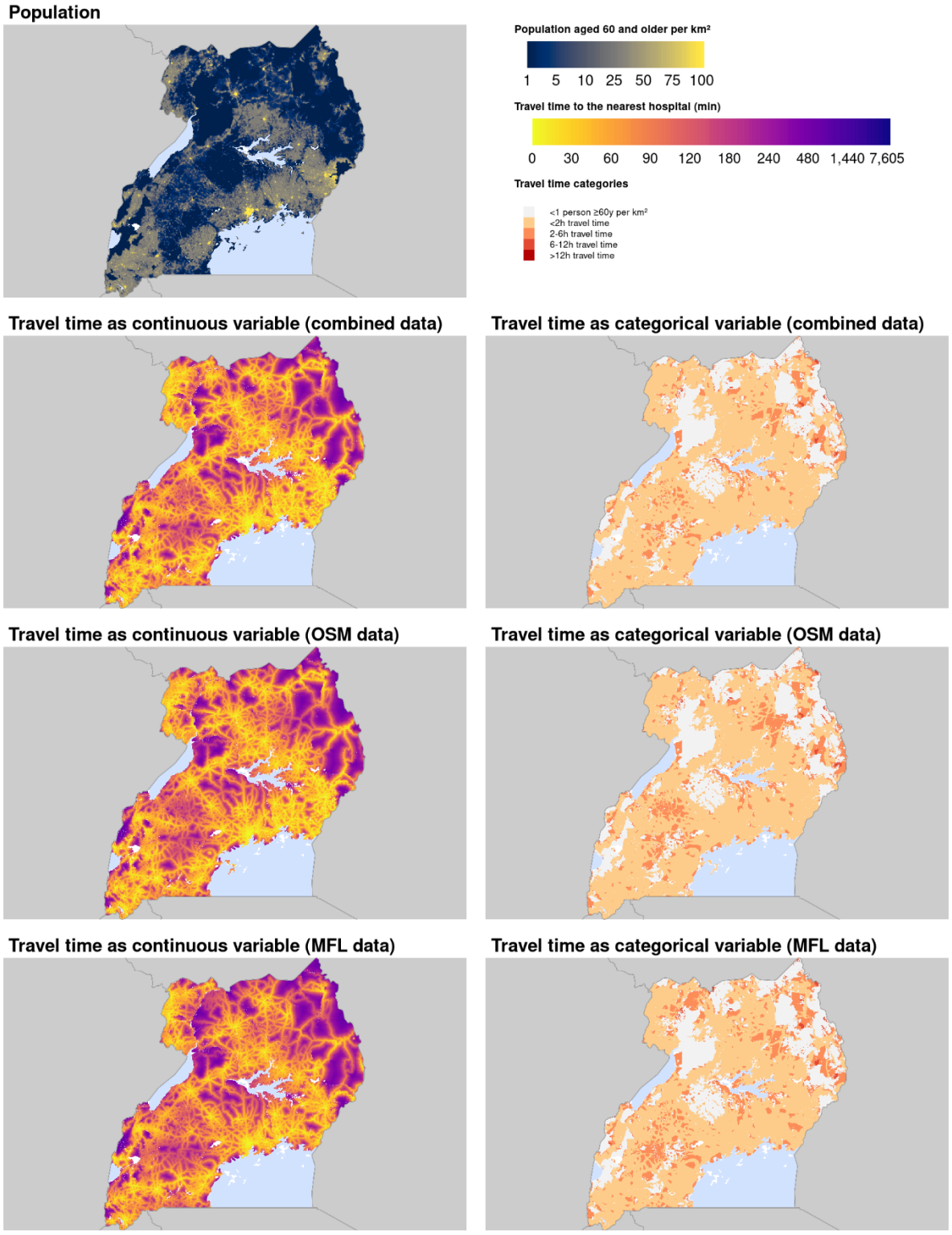


Figure S49. Zambia map of travel time to the nearest hospital for adults aged ≥ 60 years

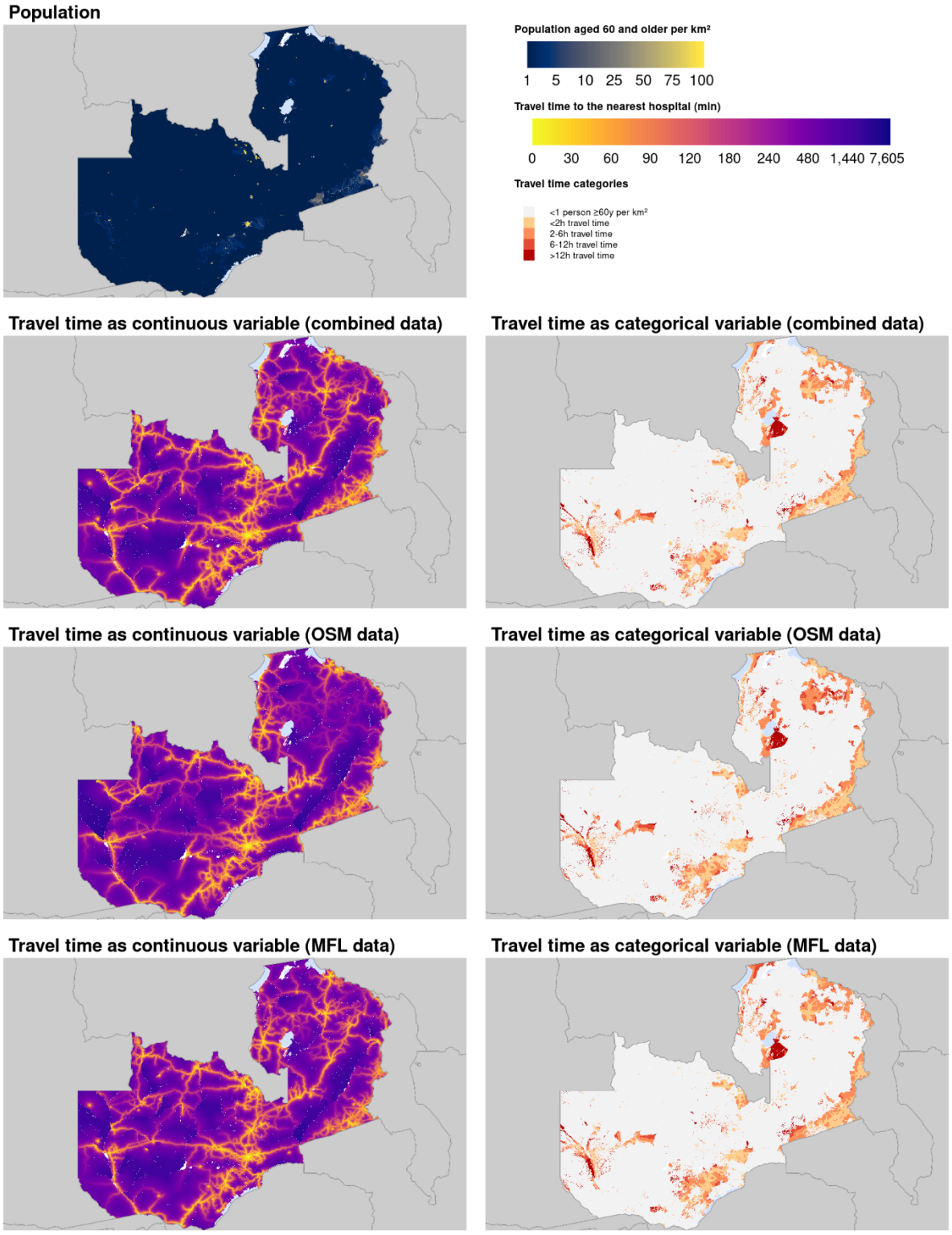
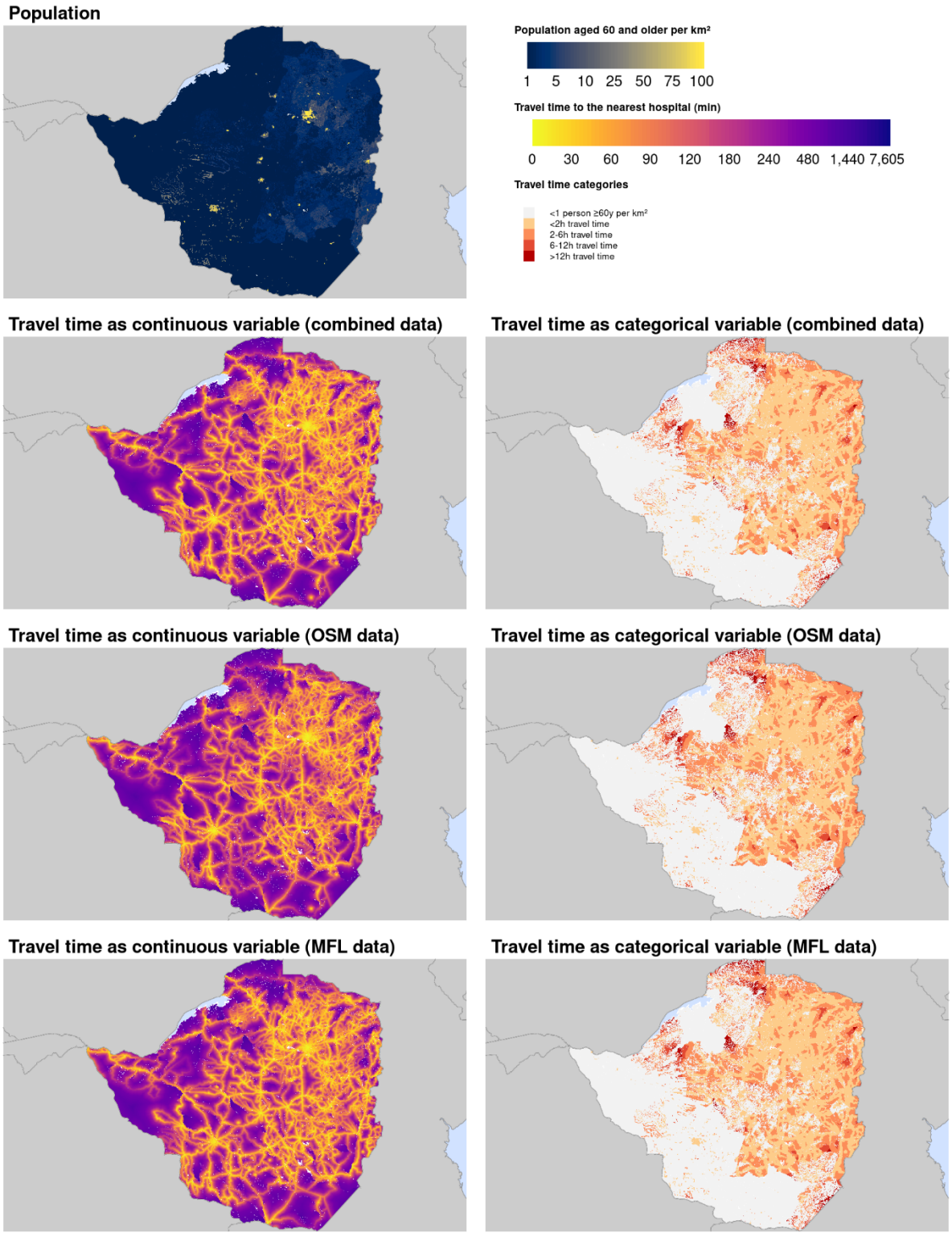


Figure S50. Zimbabwe map of travel time to the nearest hospital for adults aged ≥ 60 years



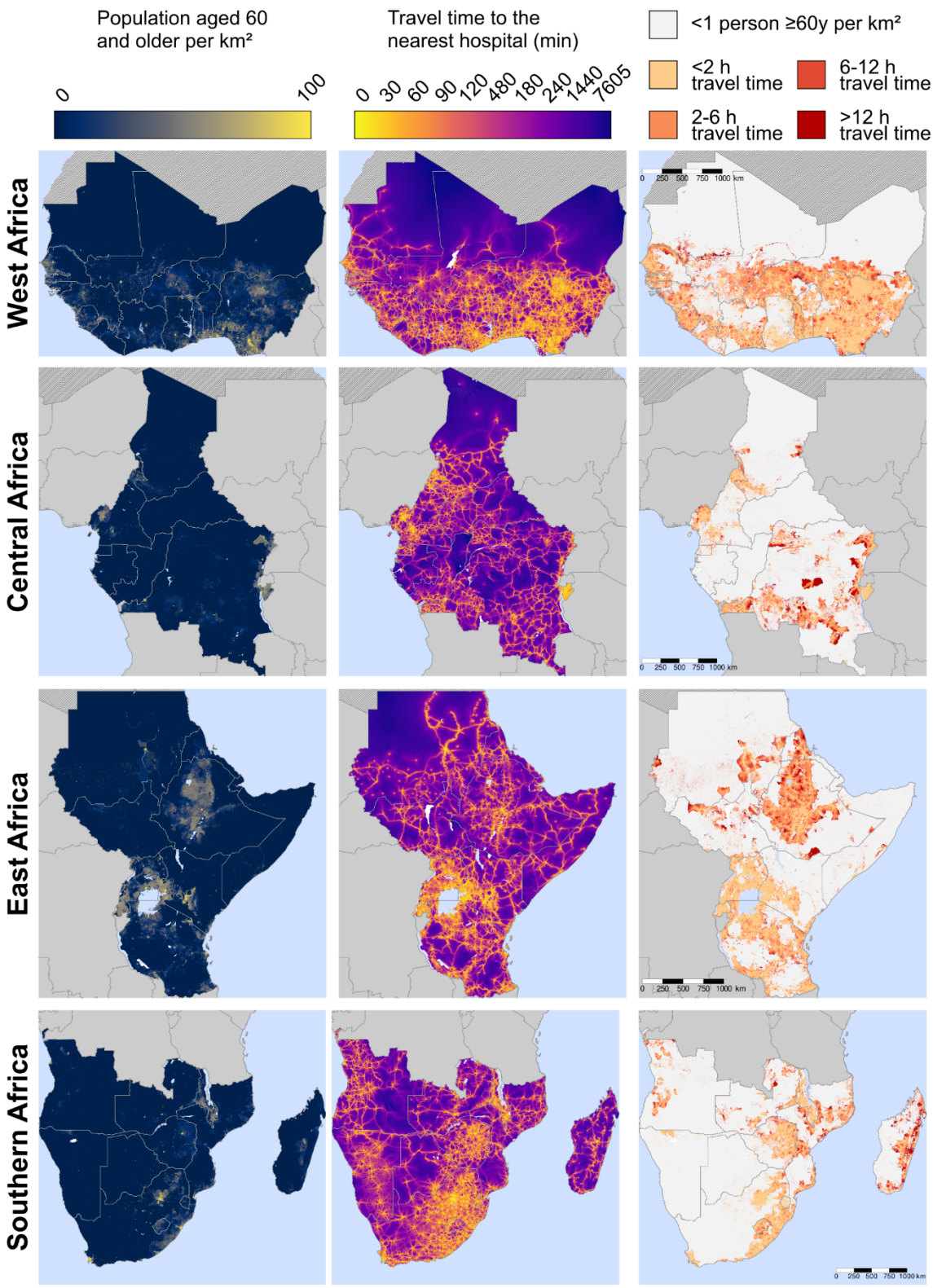


Figure S51. Maps of travel time to the nearest hospital for adults ≥ 60 years, by region based on the MFL dataset

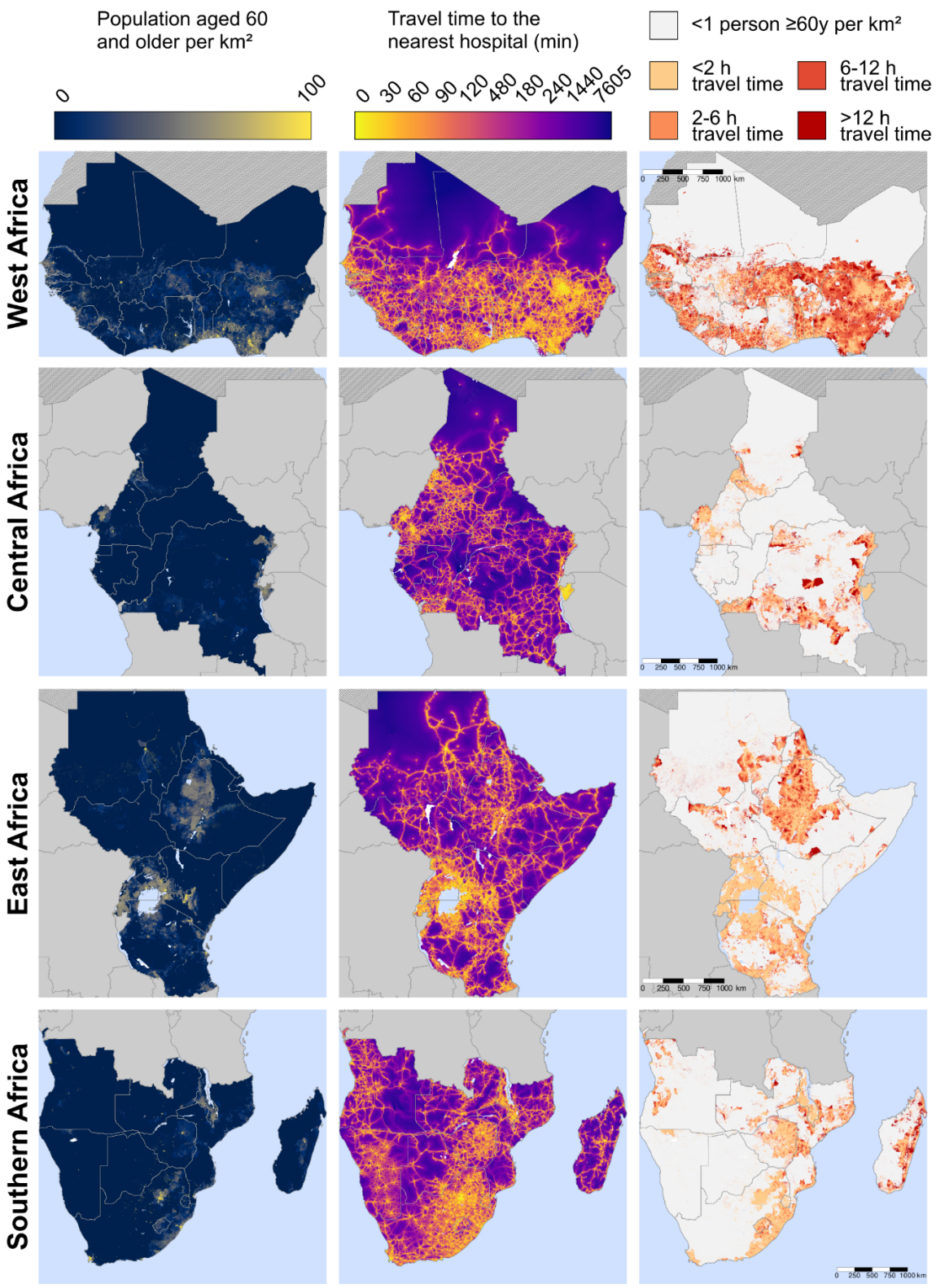


Figure S52. Maps of travel time to the nearest hospital for adults ≥ 60 years, by region based on the OSM dataset

Figure S53. Angola map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

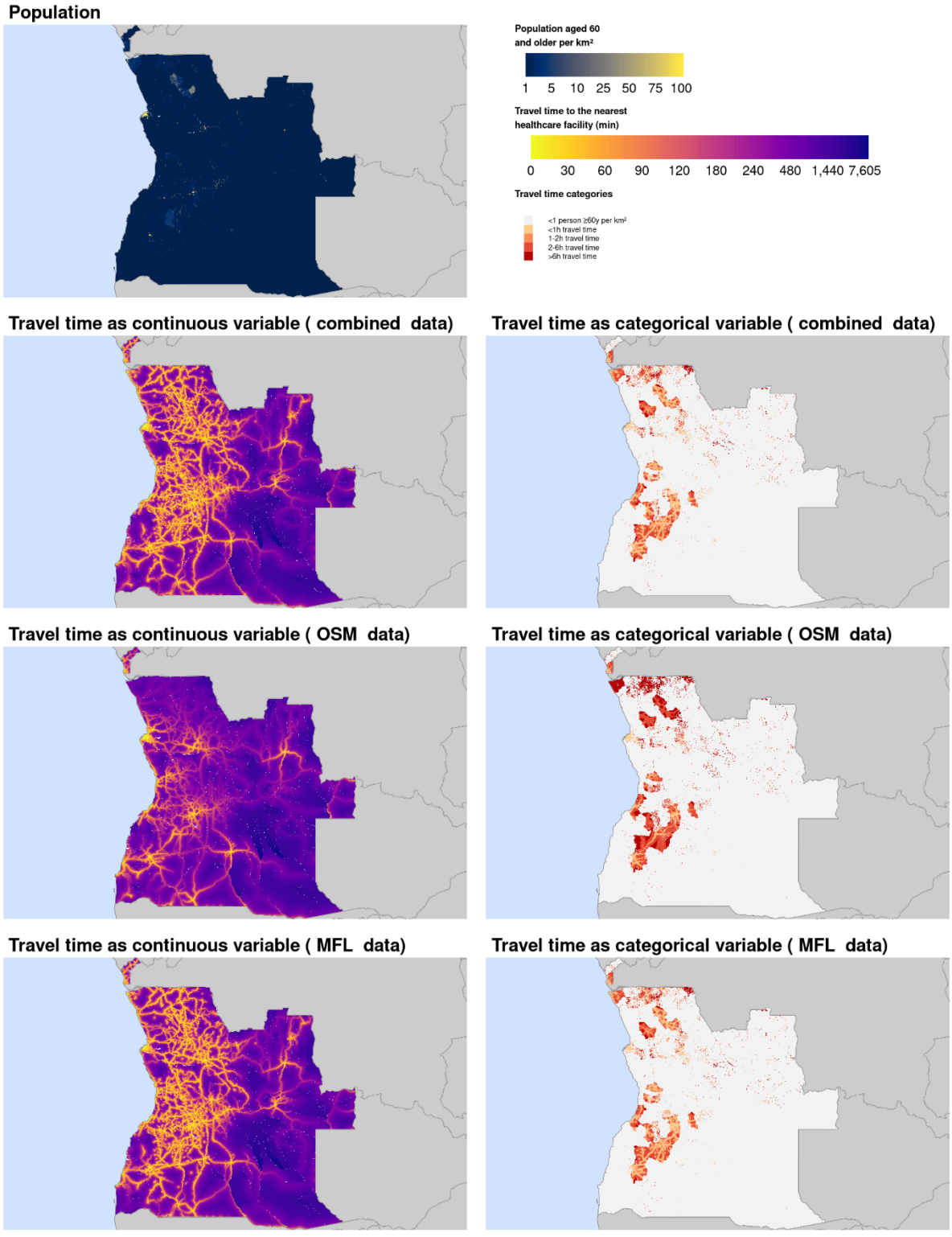


Figure S54. Benin map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

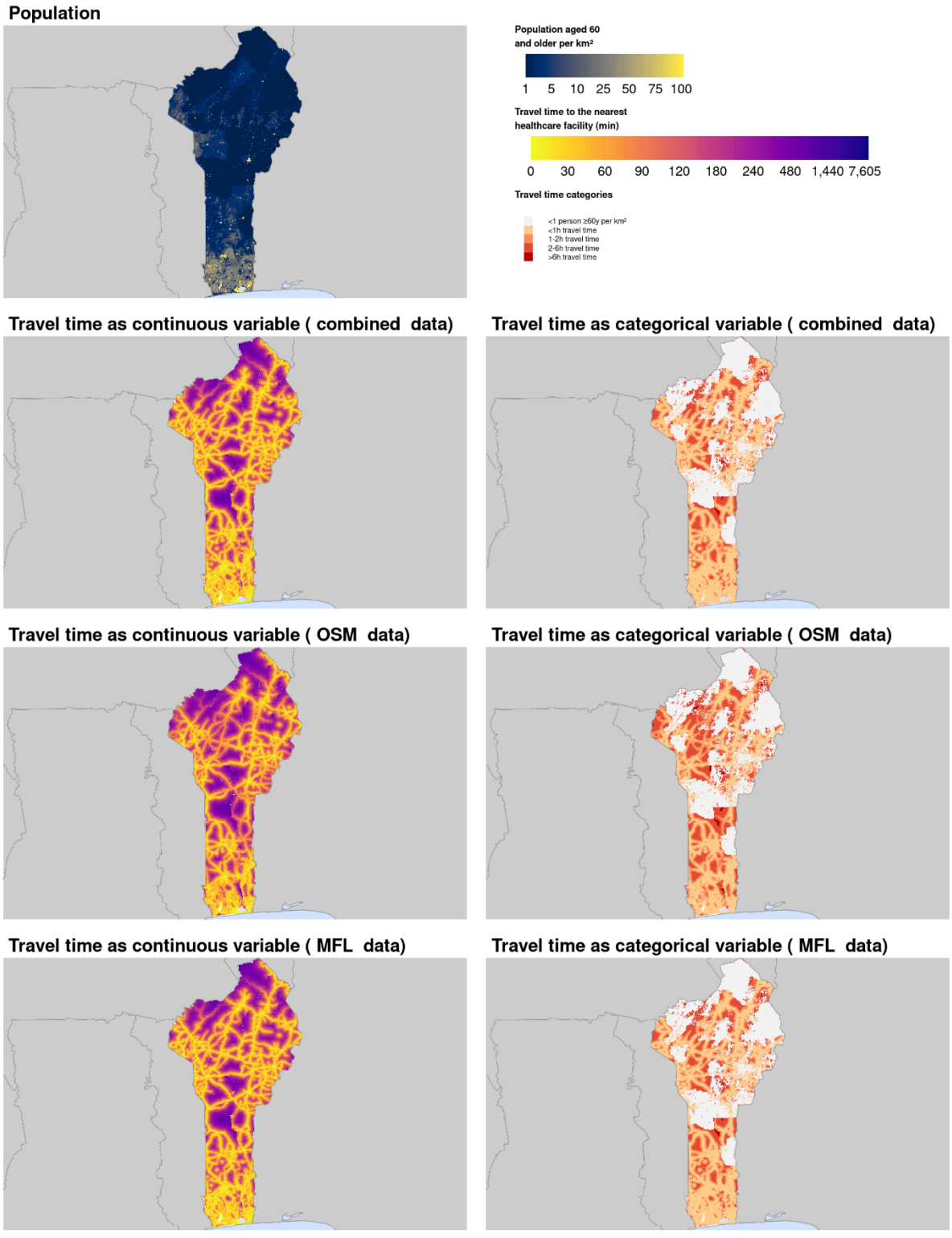


Figure S55. Botswana map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

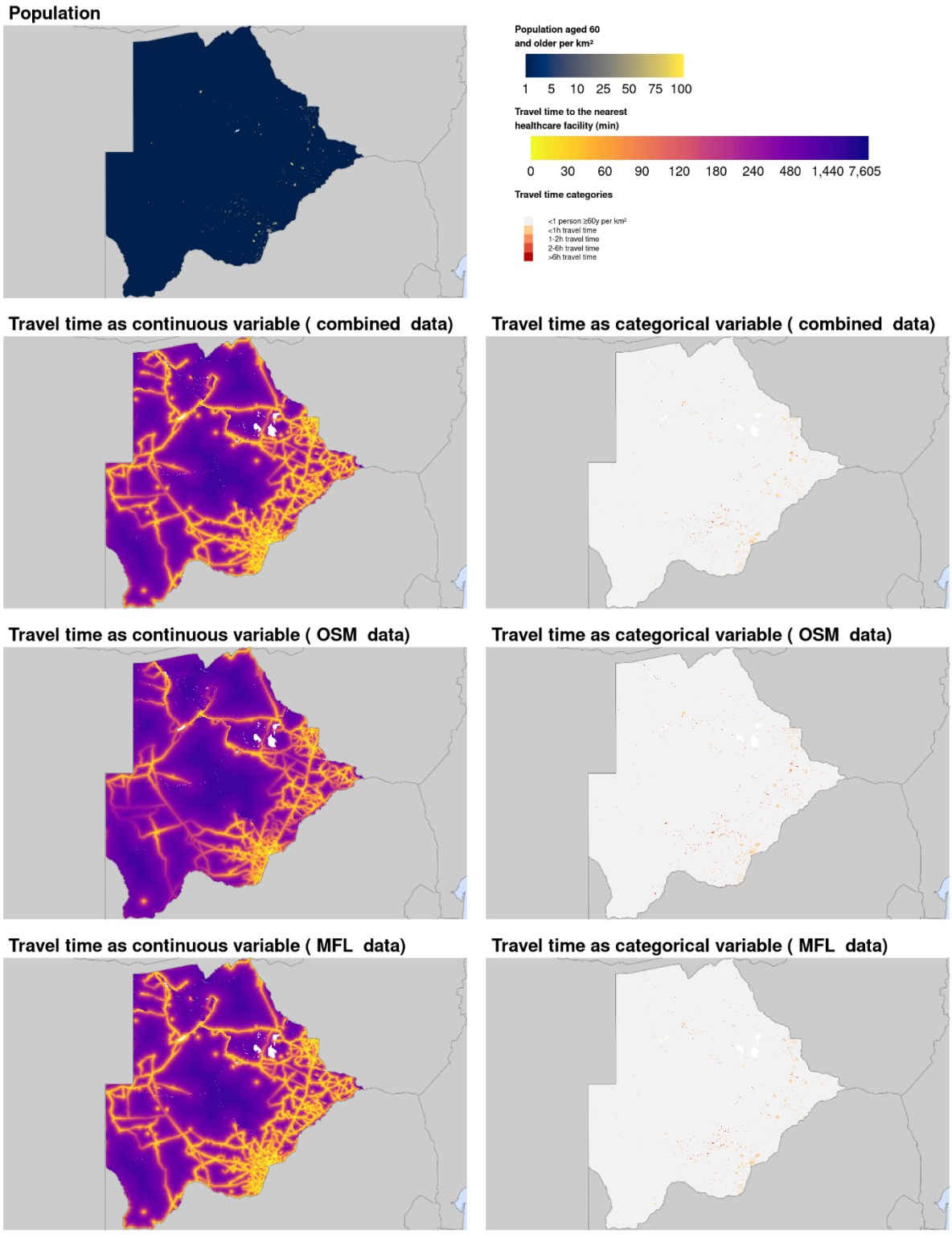


Figure S56. Burkina Faso map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

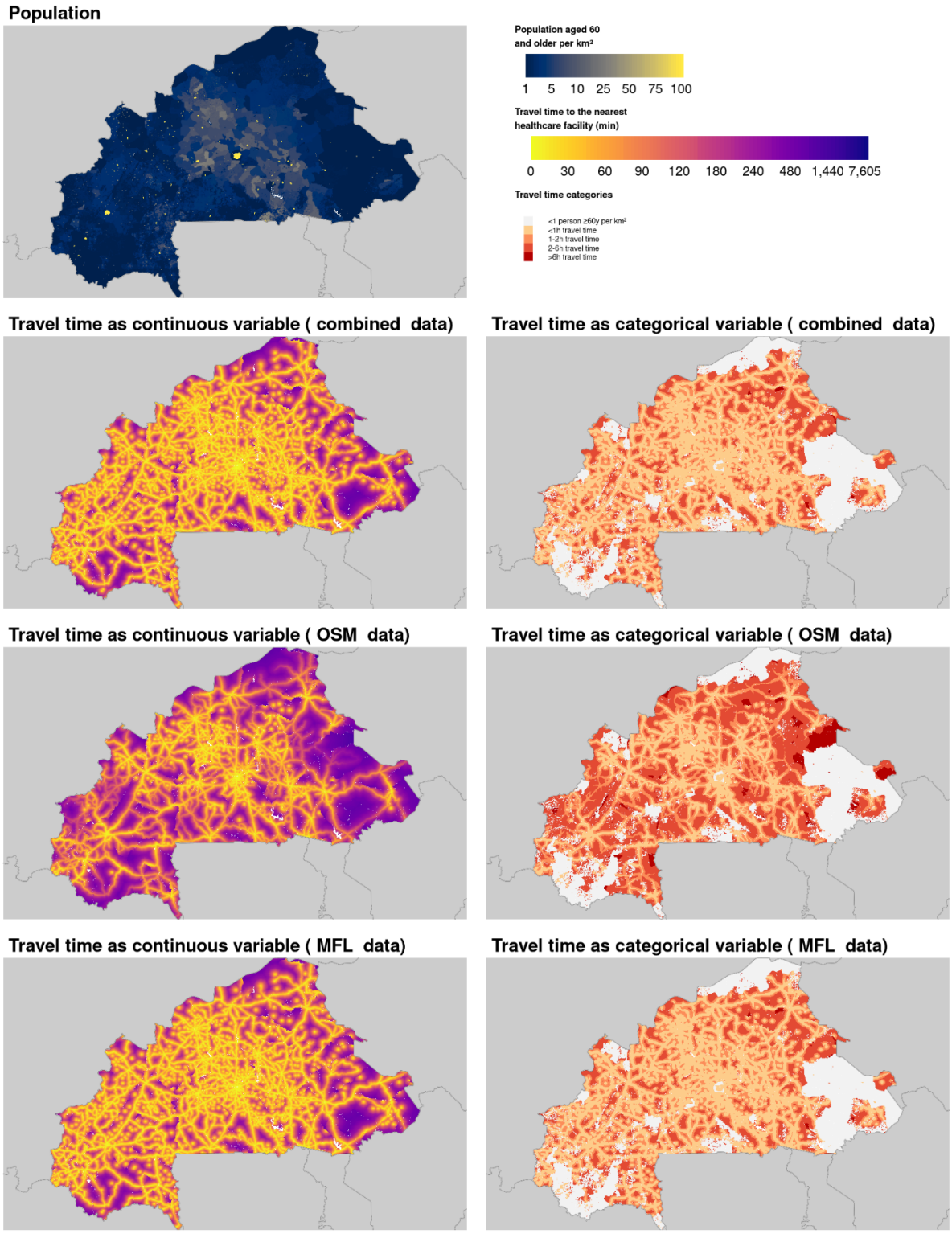


Figure S57. Burundi map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

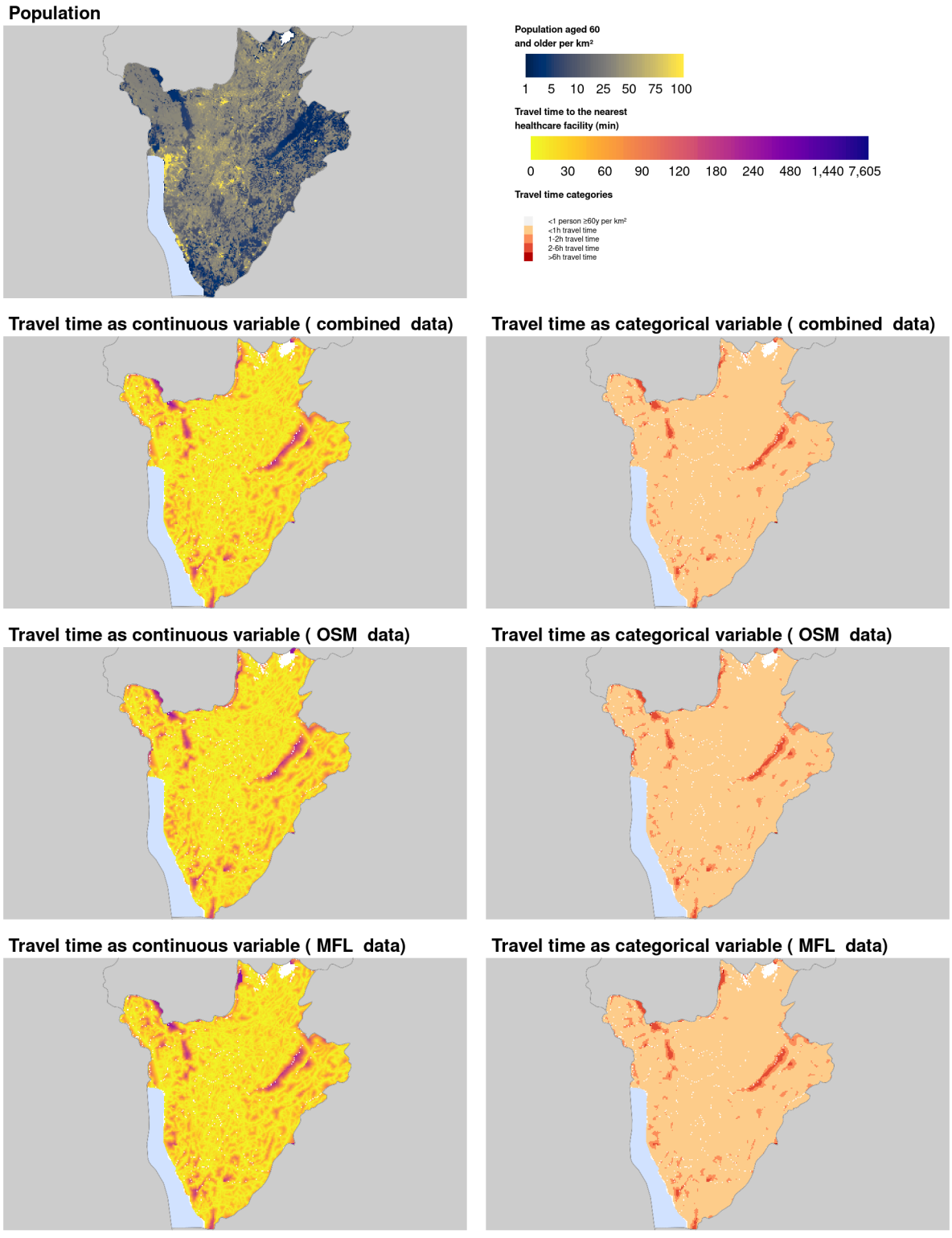


Figure S58. Cameroon map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

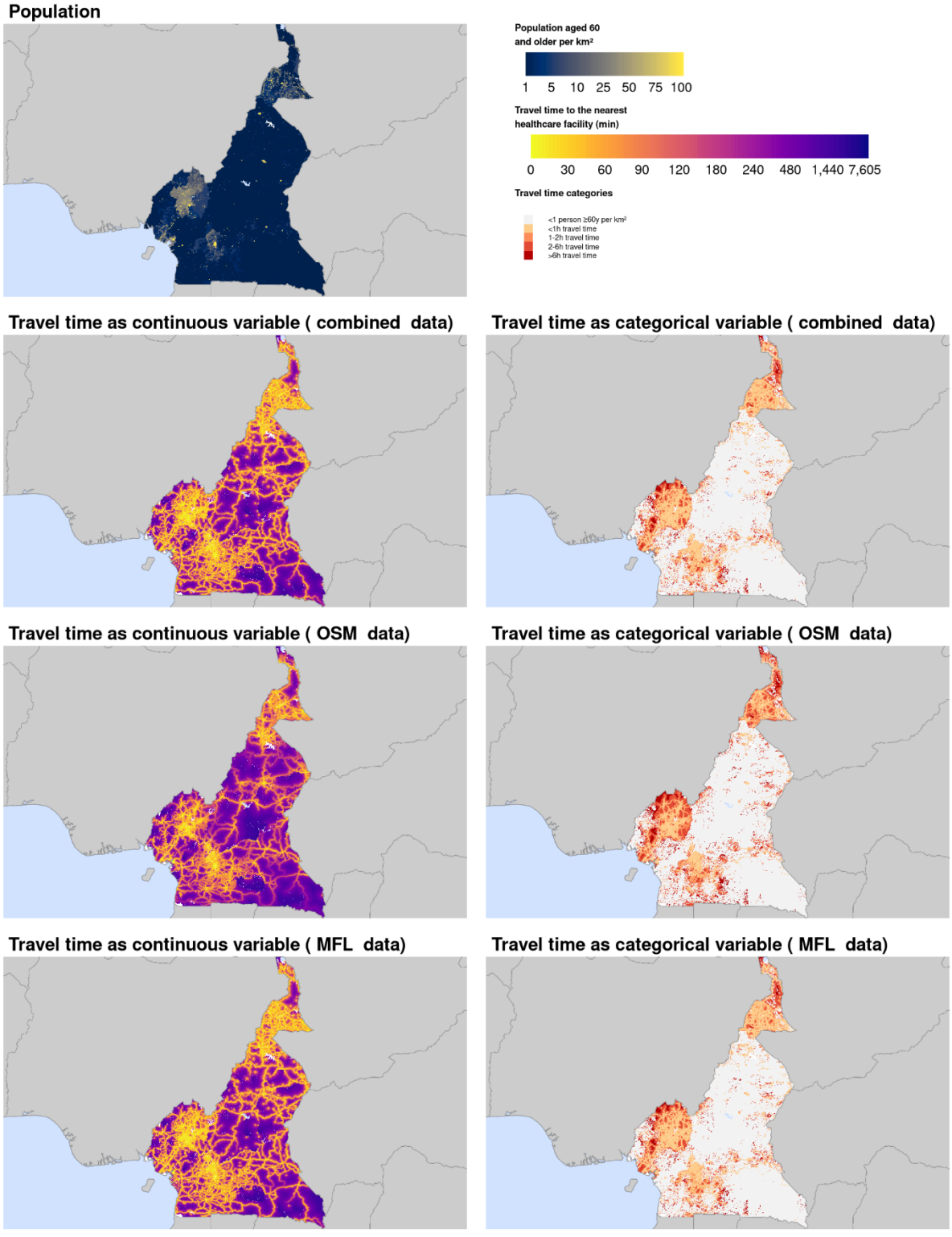


Figure S59. Central African Republic map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

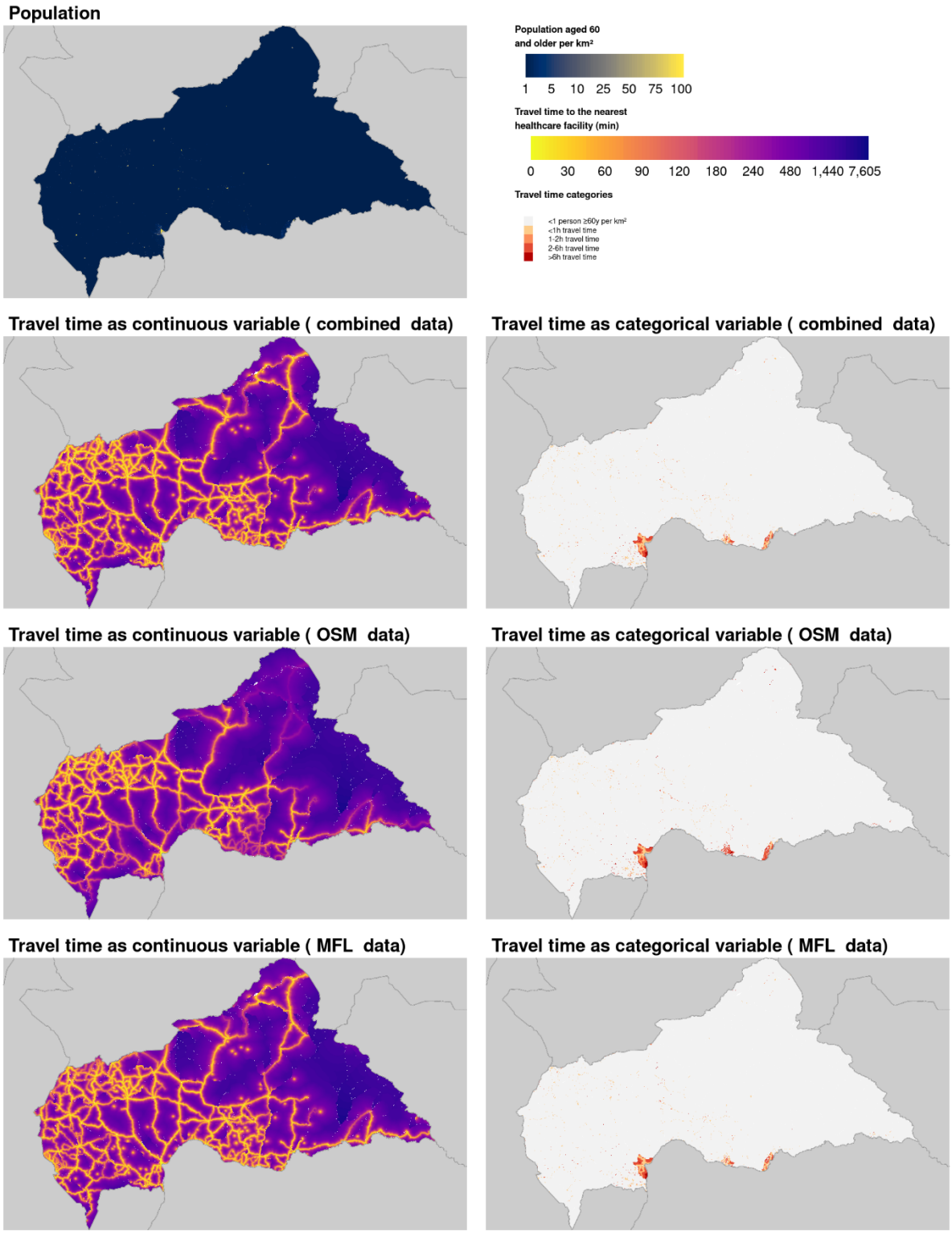


Figure S60. Chad map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

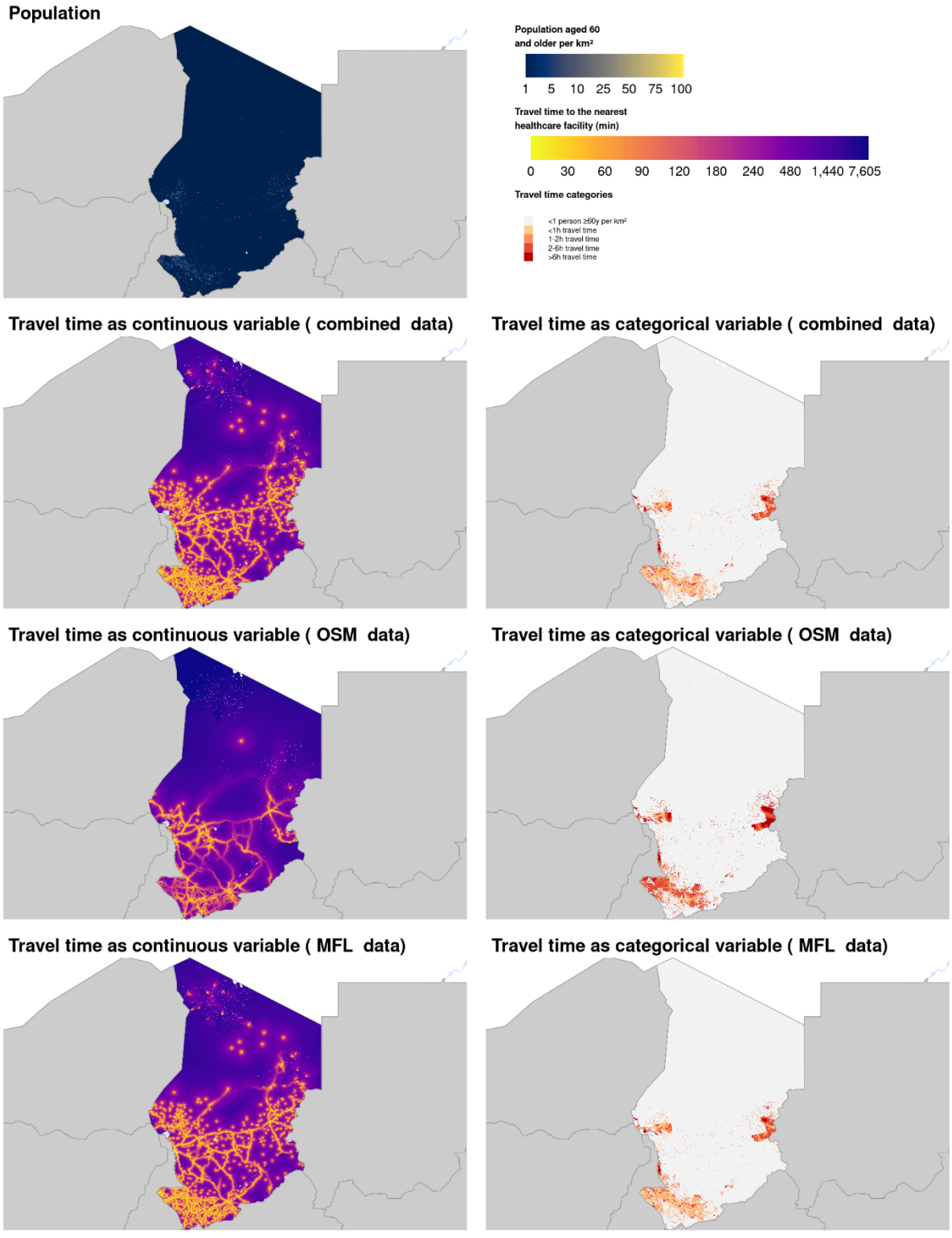


Figure S61. Djibouti map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

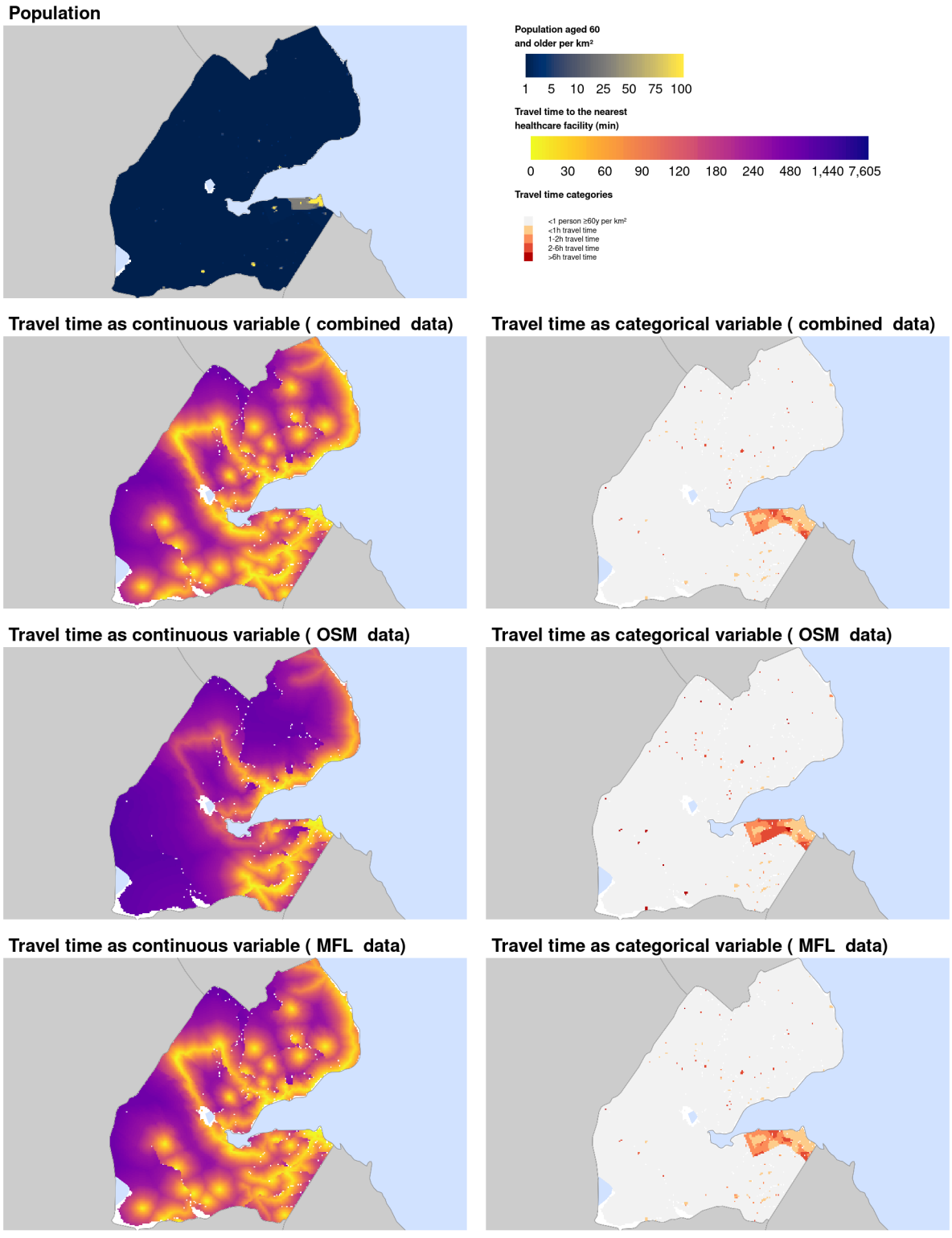


Figure S62. DRC map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

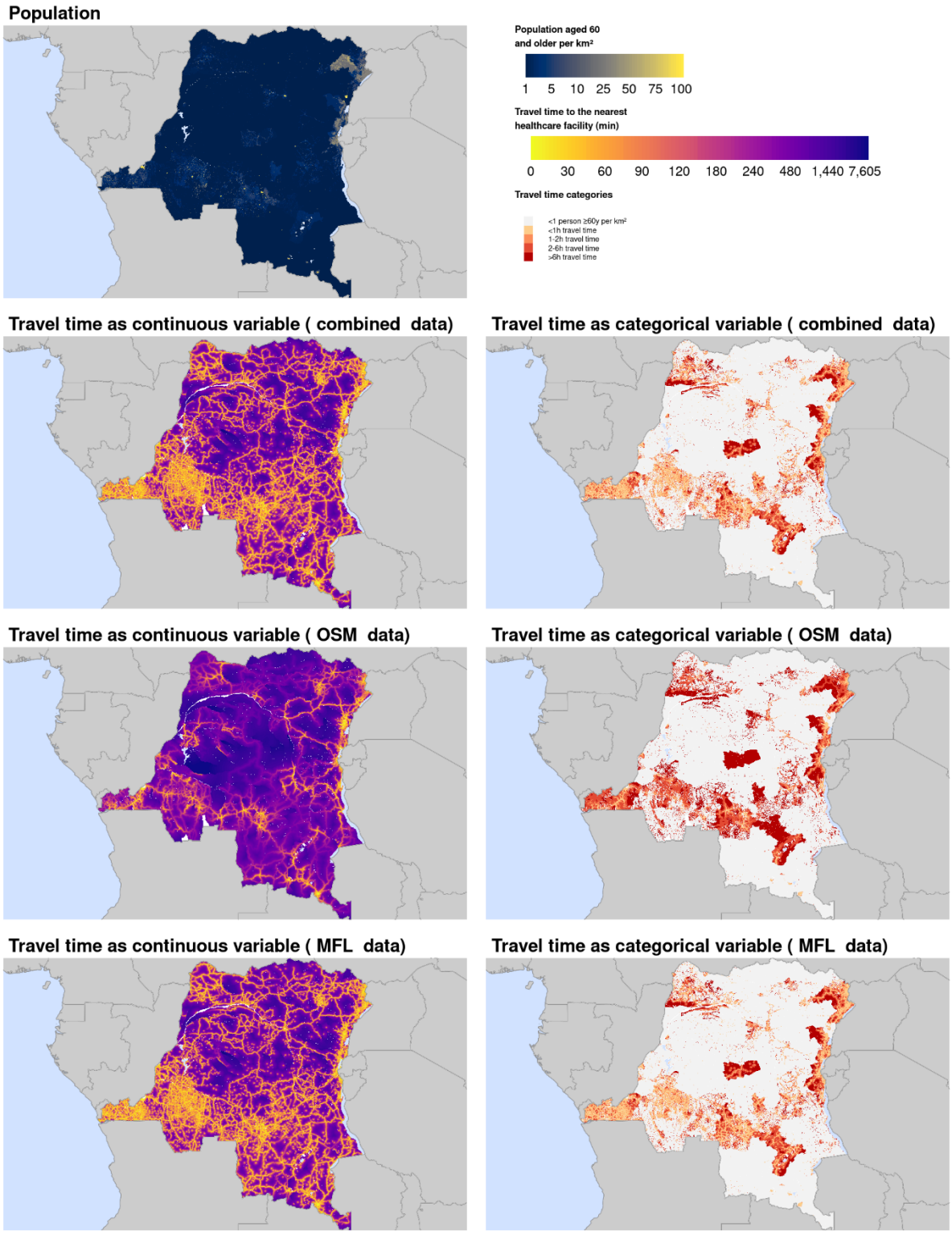


Figure S63. Equatorial Guinea map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

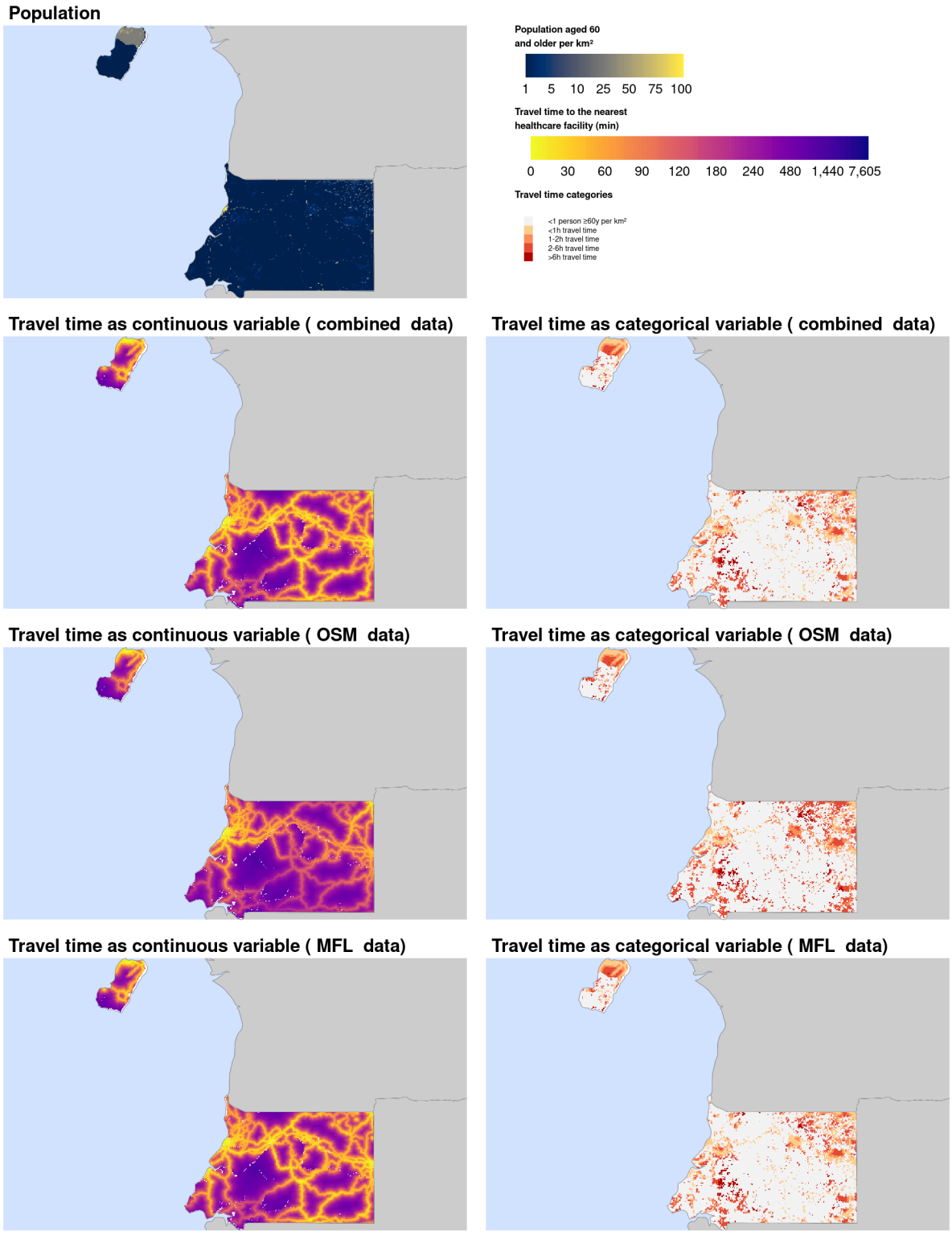


Figure S64. Eritrea map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

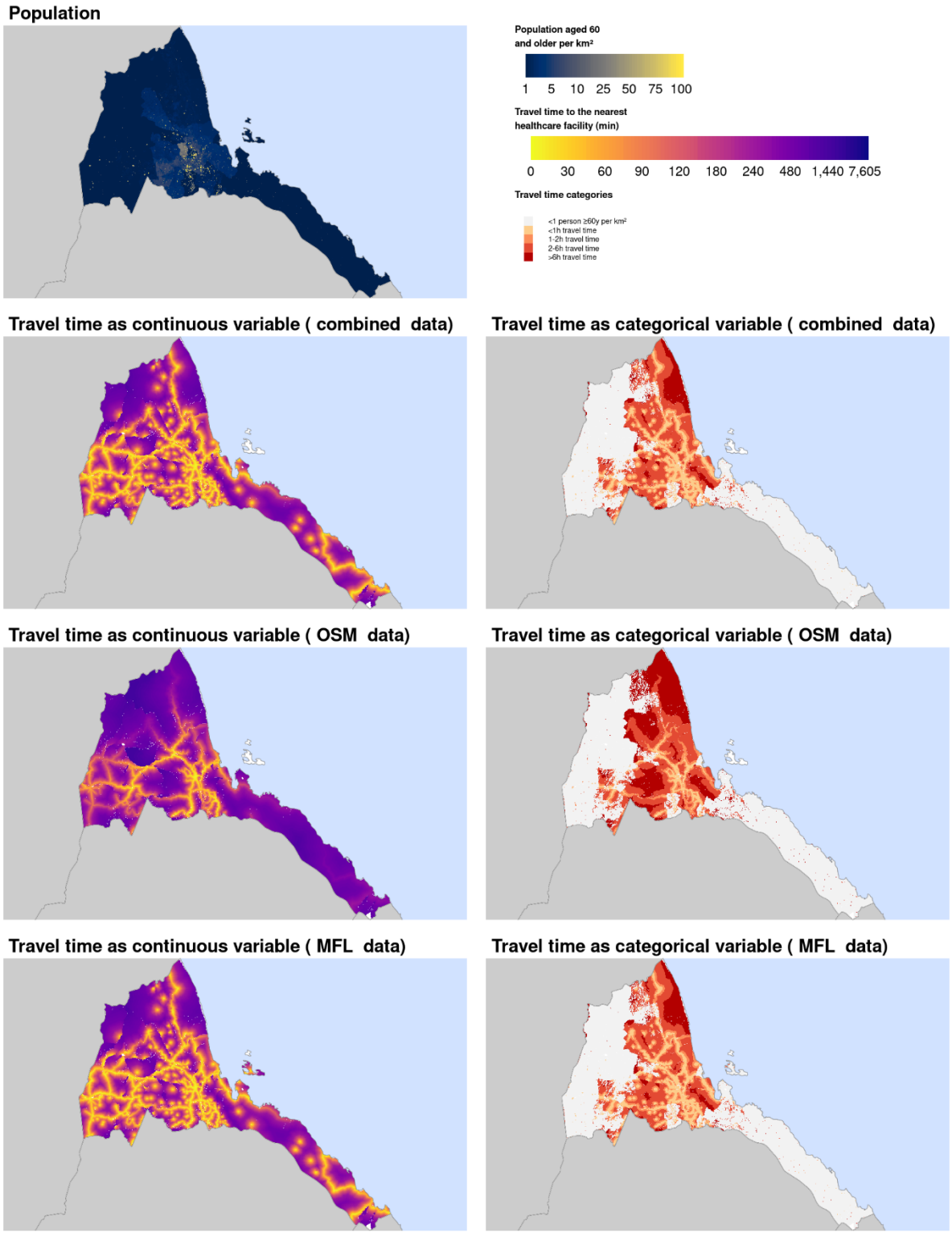


Figure S65. eSwatini map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

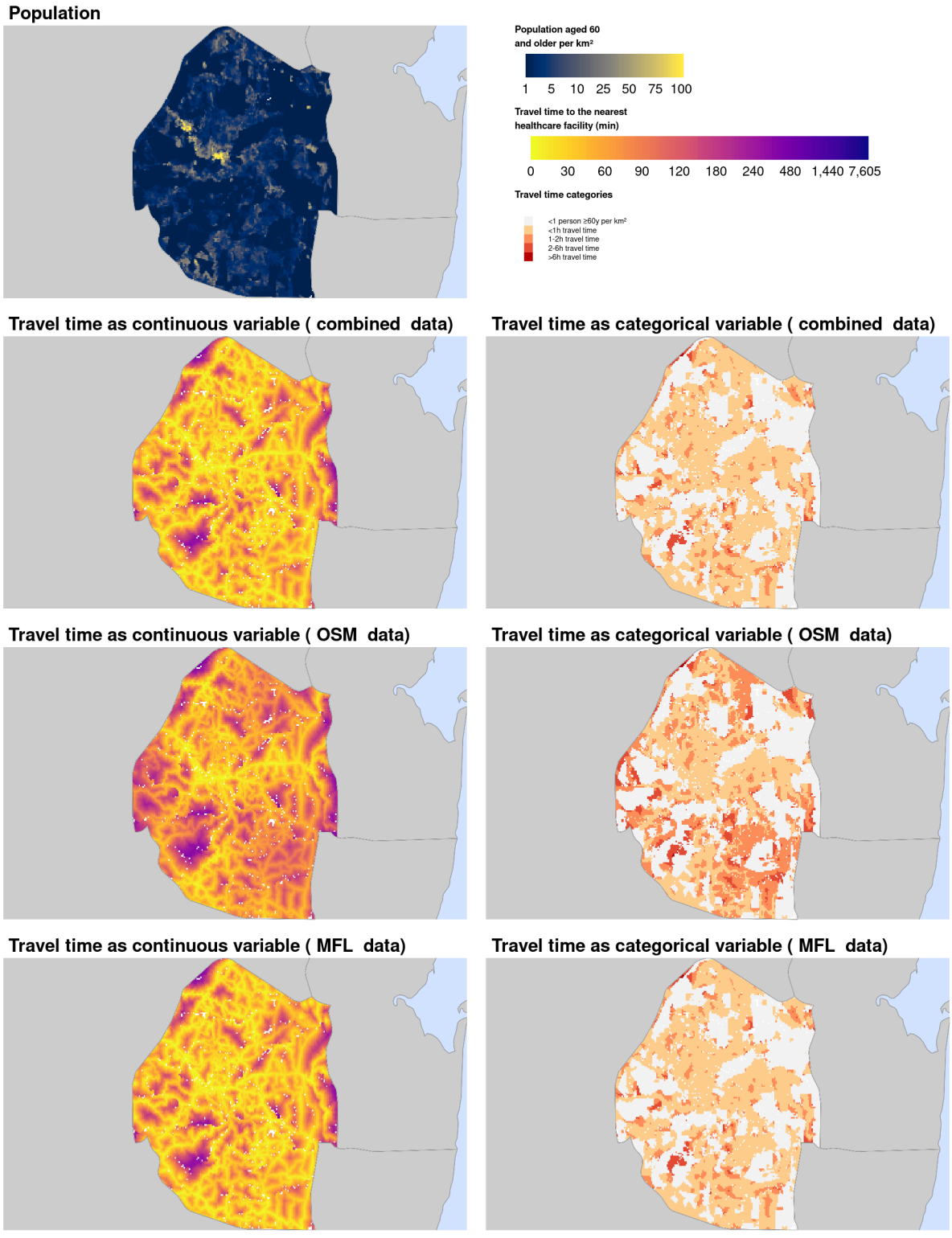


Figure S66. Ethiopia map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

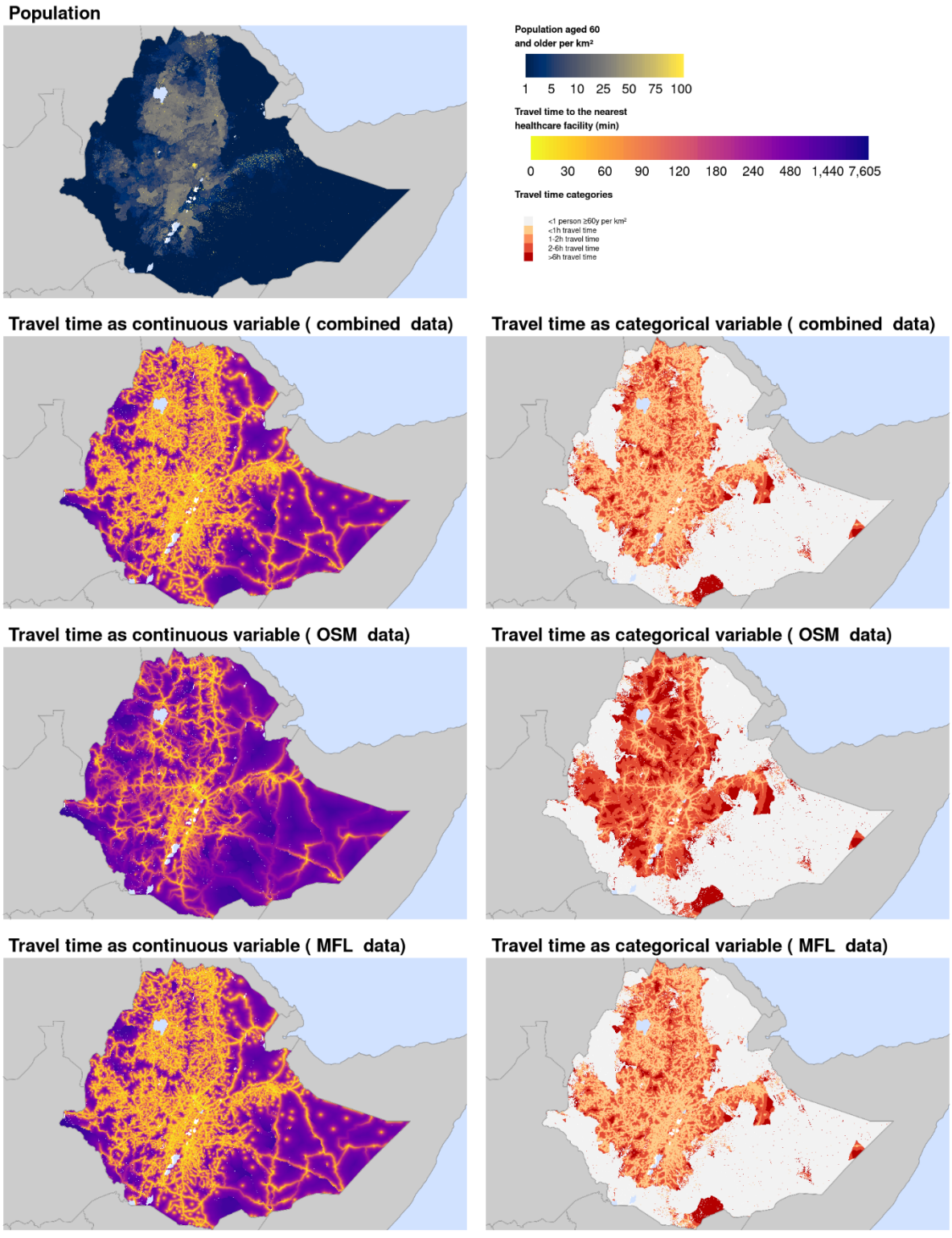


Figure S67. Gabon map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

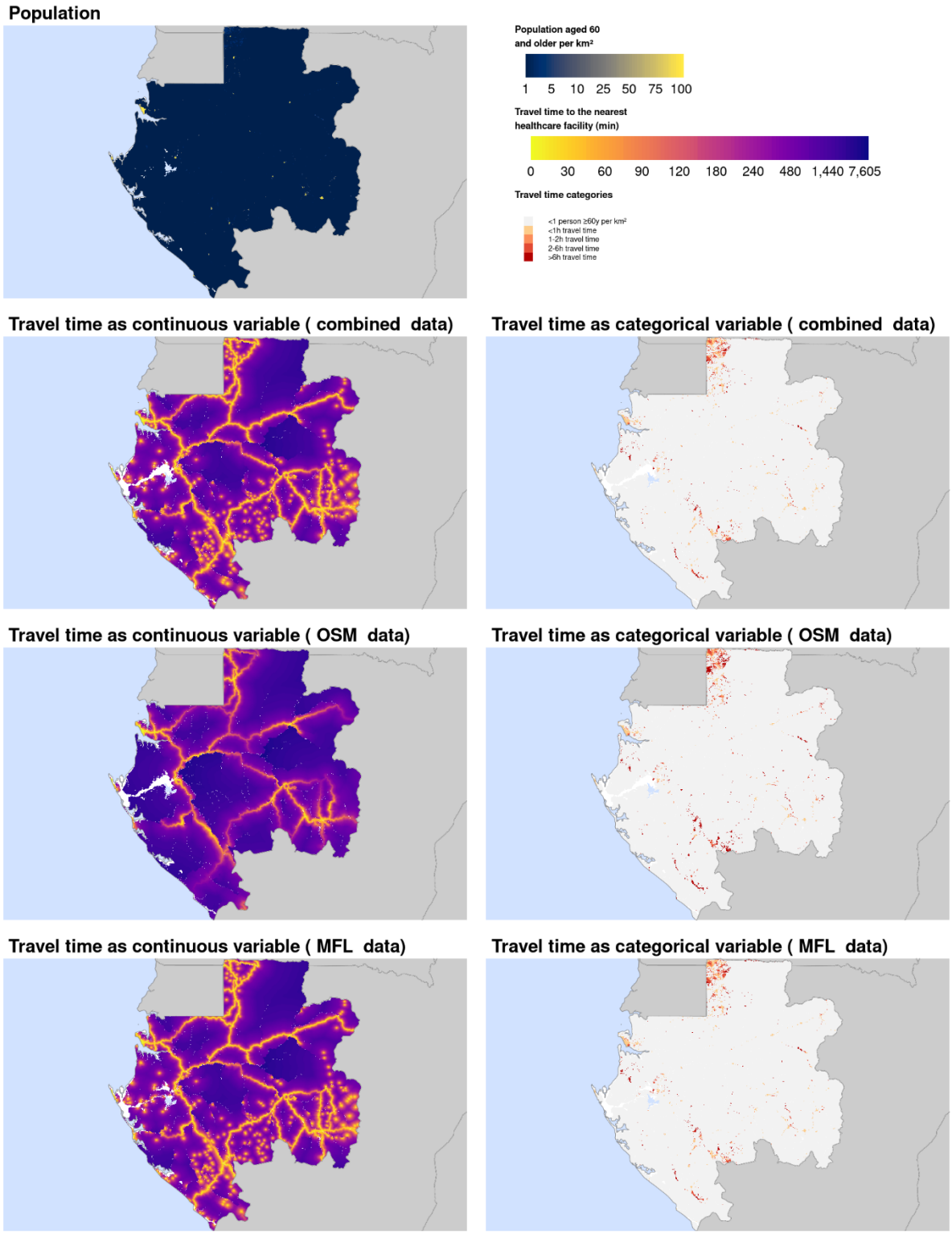


Figure S68. Ghana map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

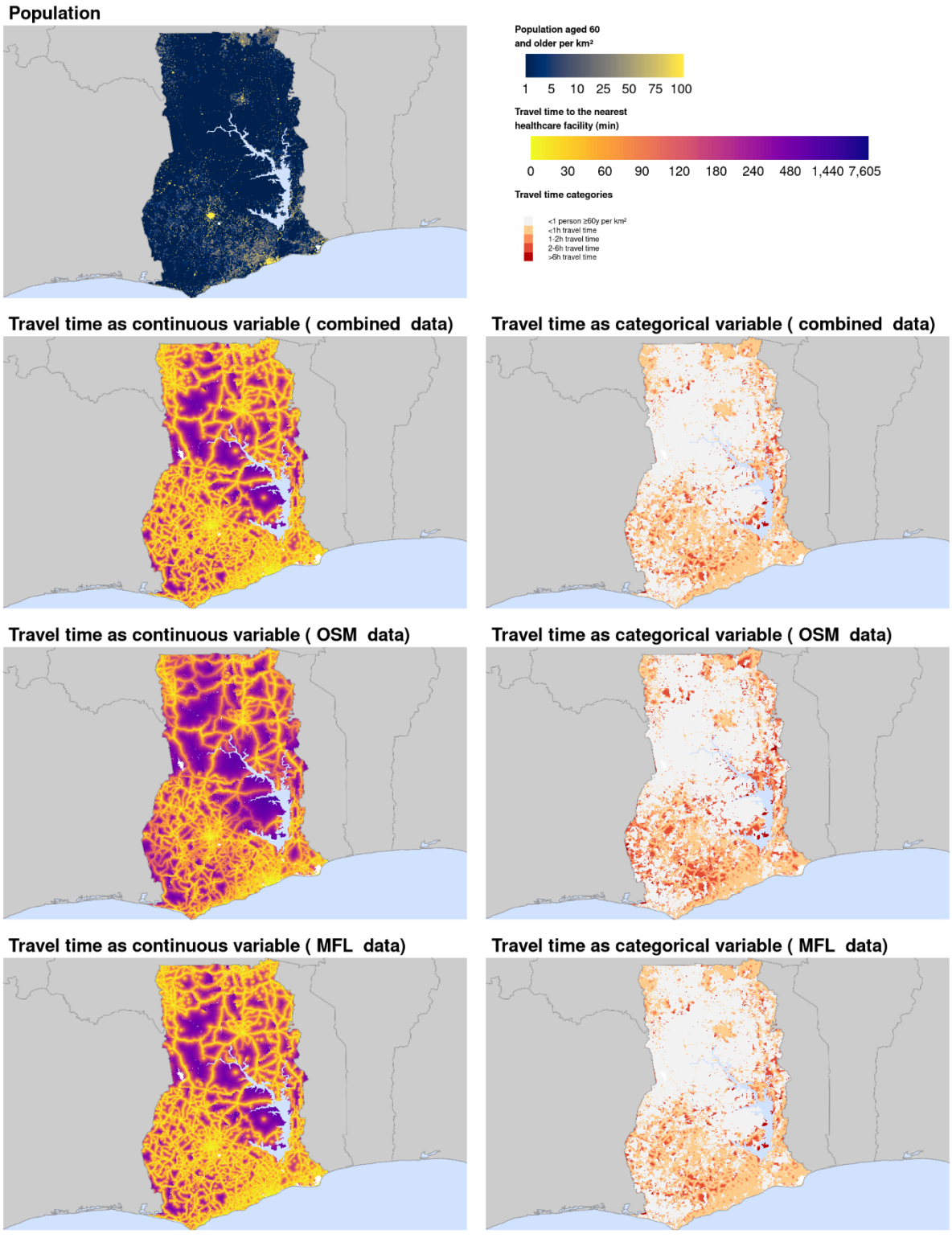


Figure S69. Guinea map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

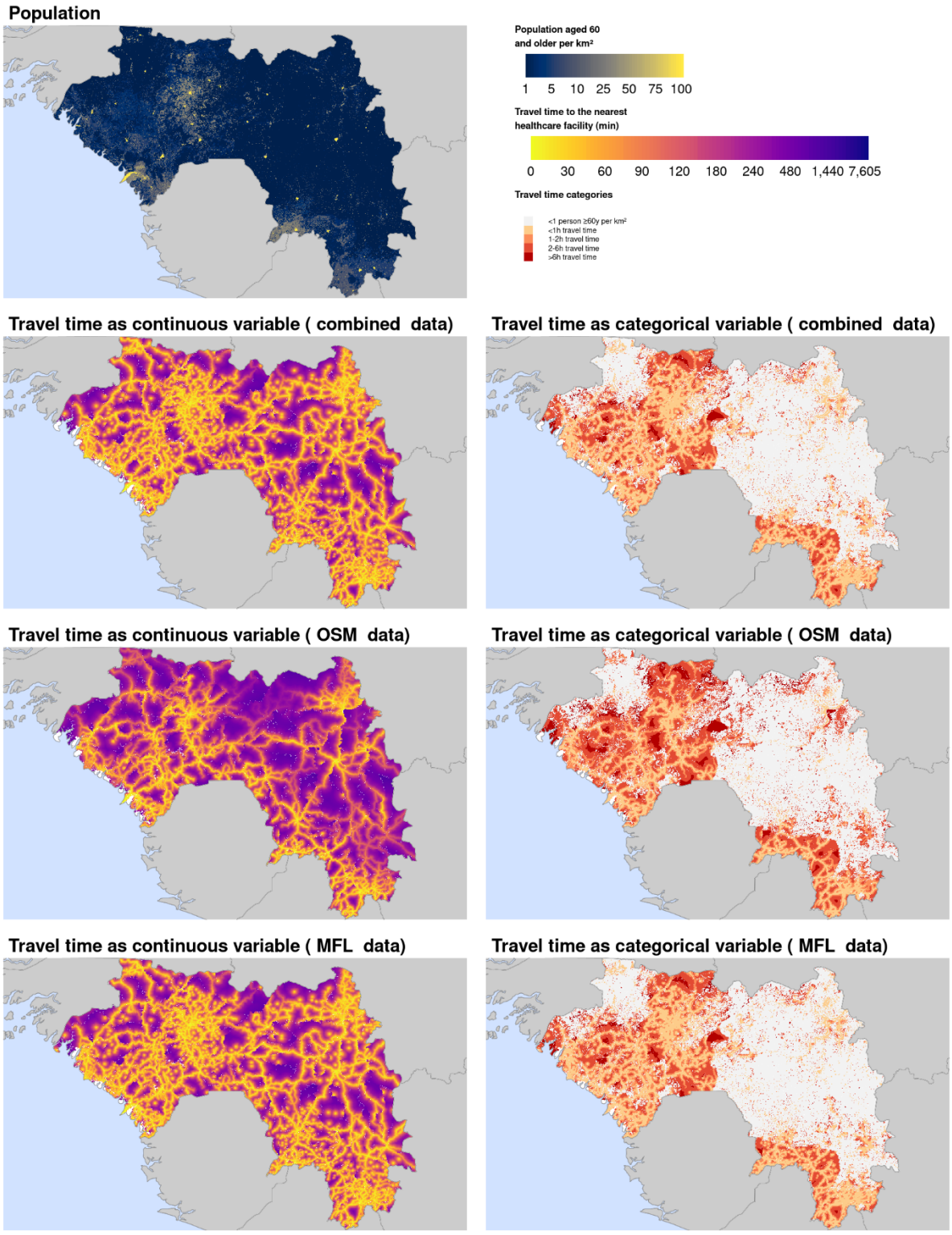


Figure S70. Guinea-Bissau map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

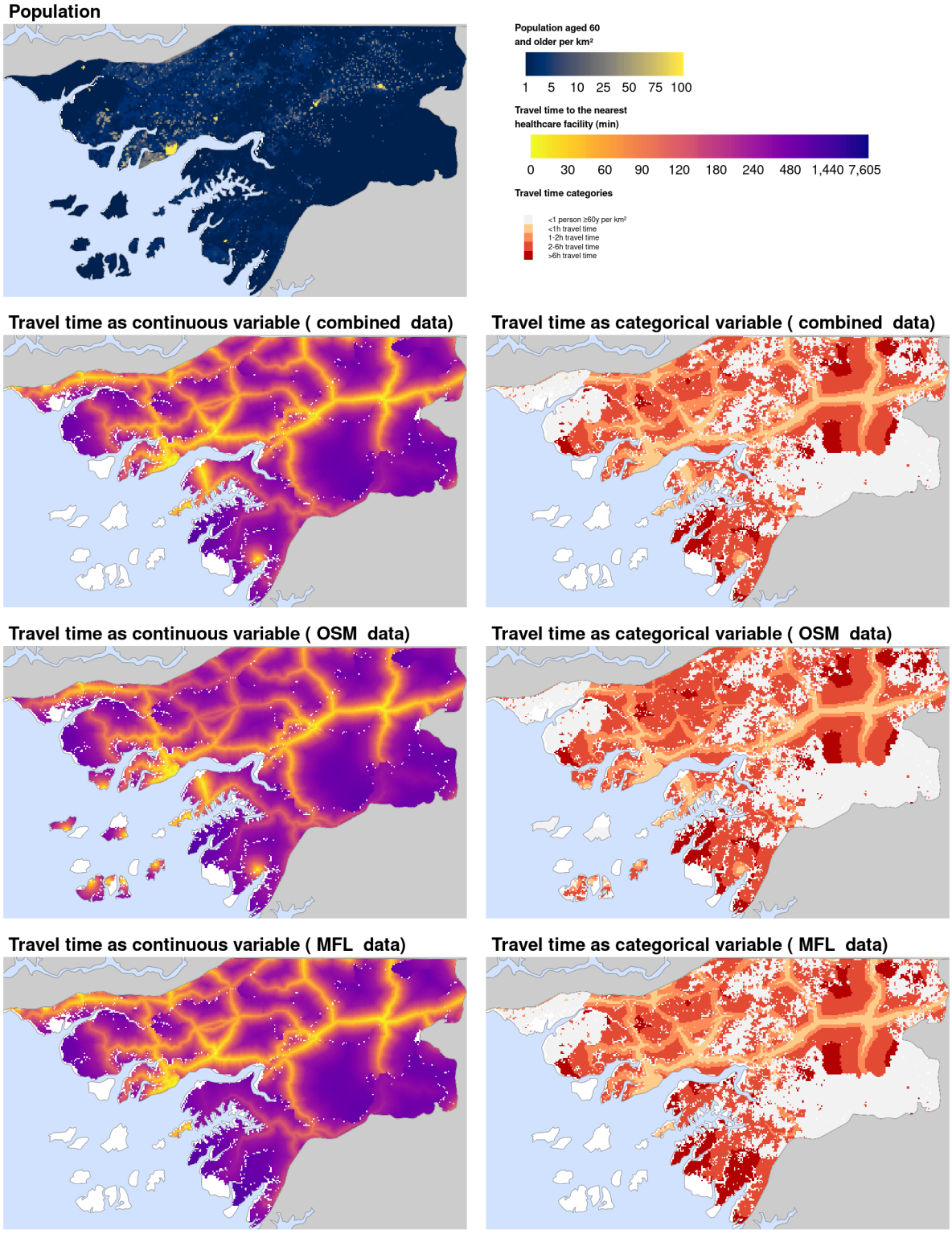


Figure S71. Ivory Coast map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

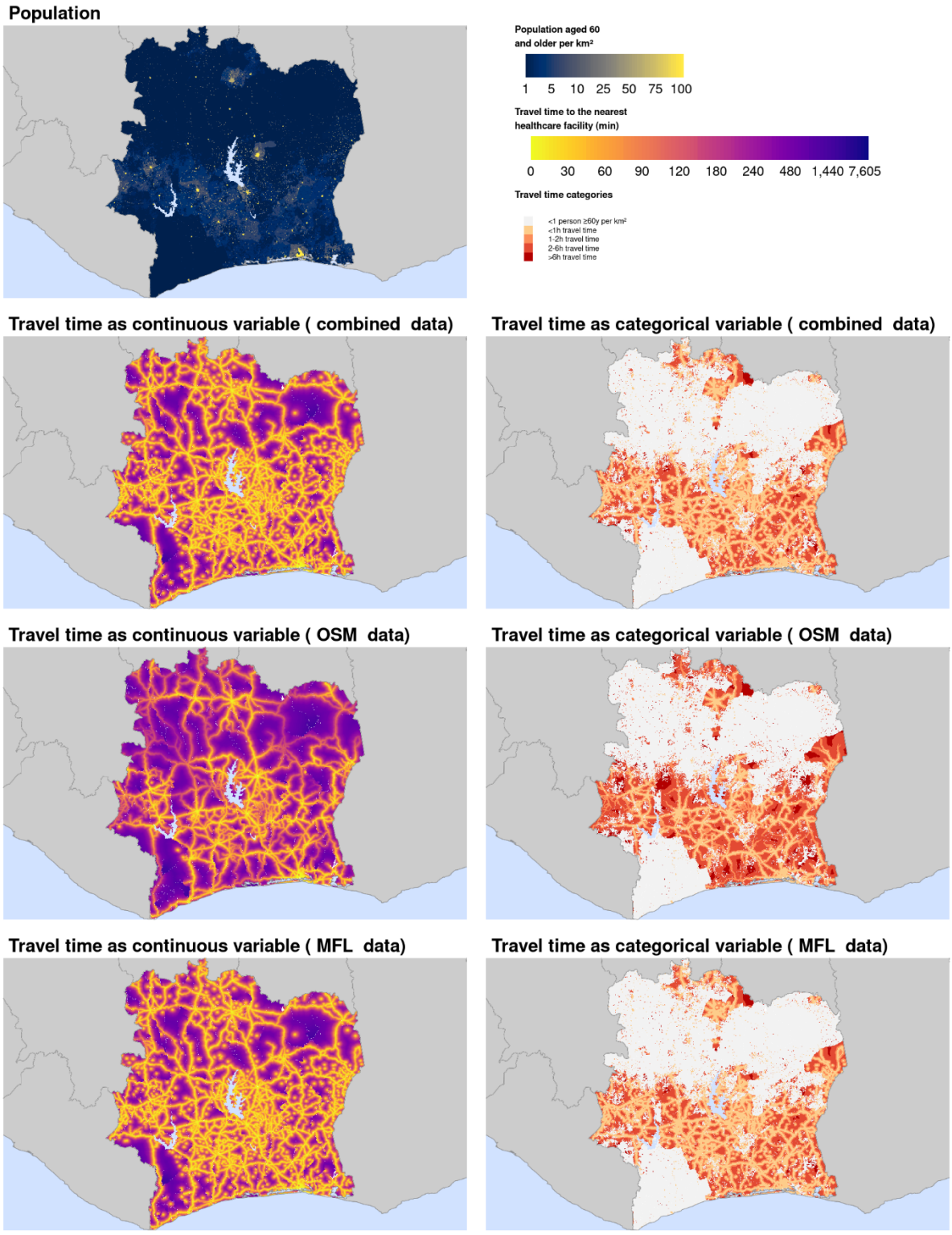


Figure S72. Kenya map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

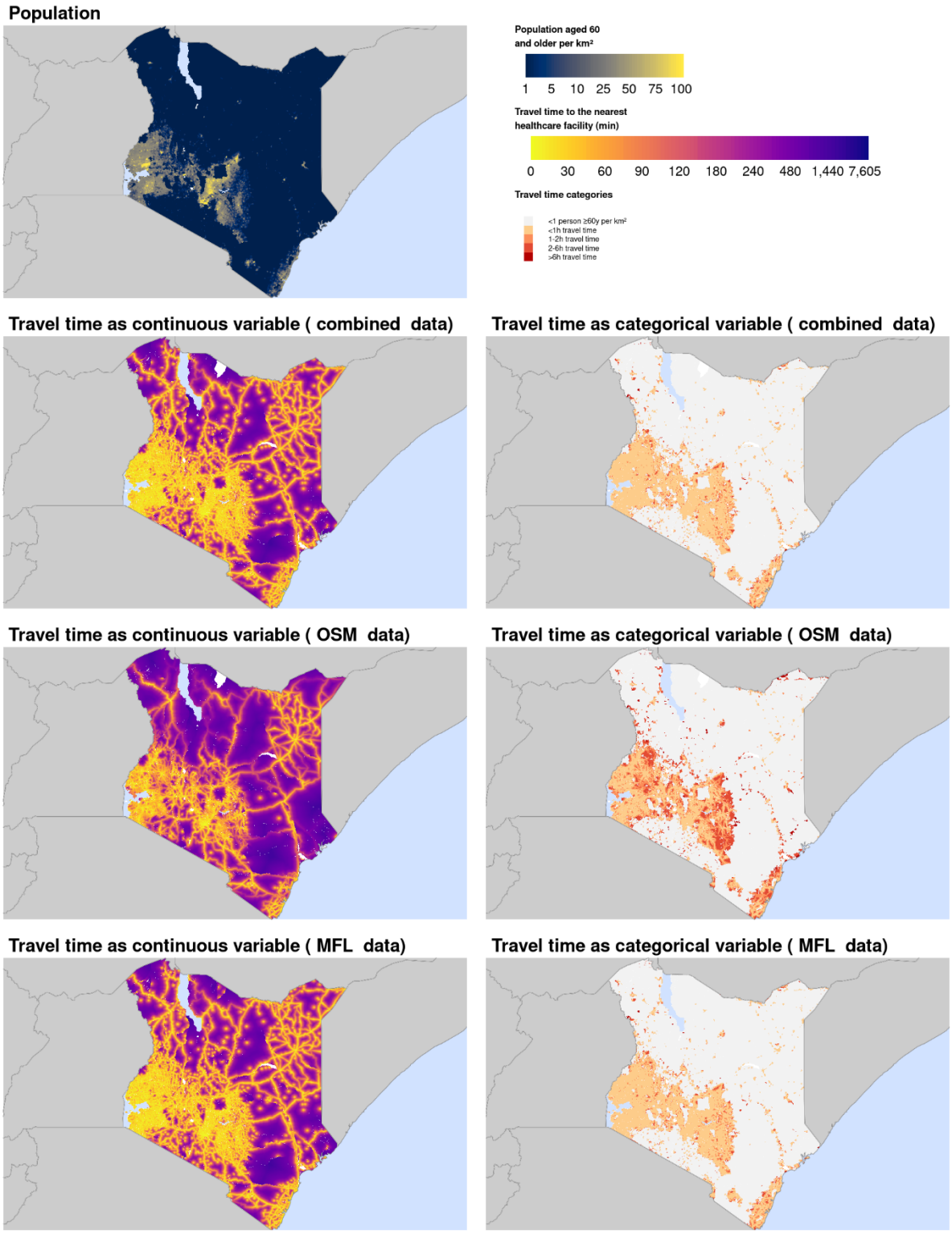


Figure S73. Lesotho map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

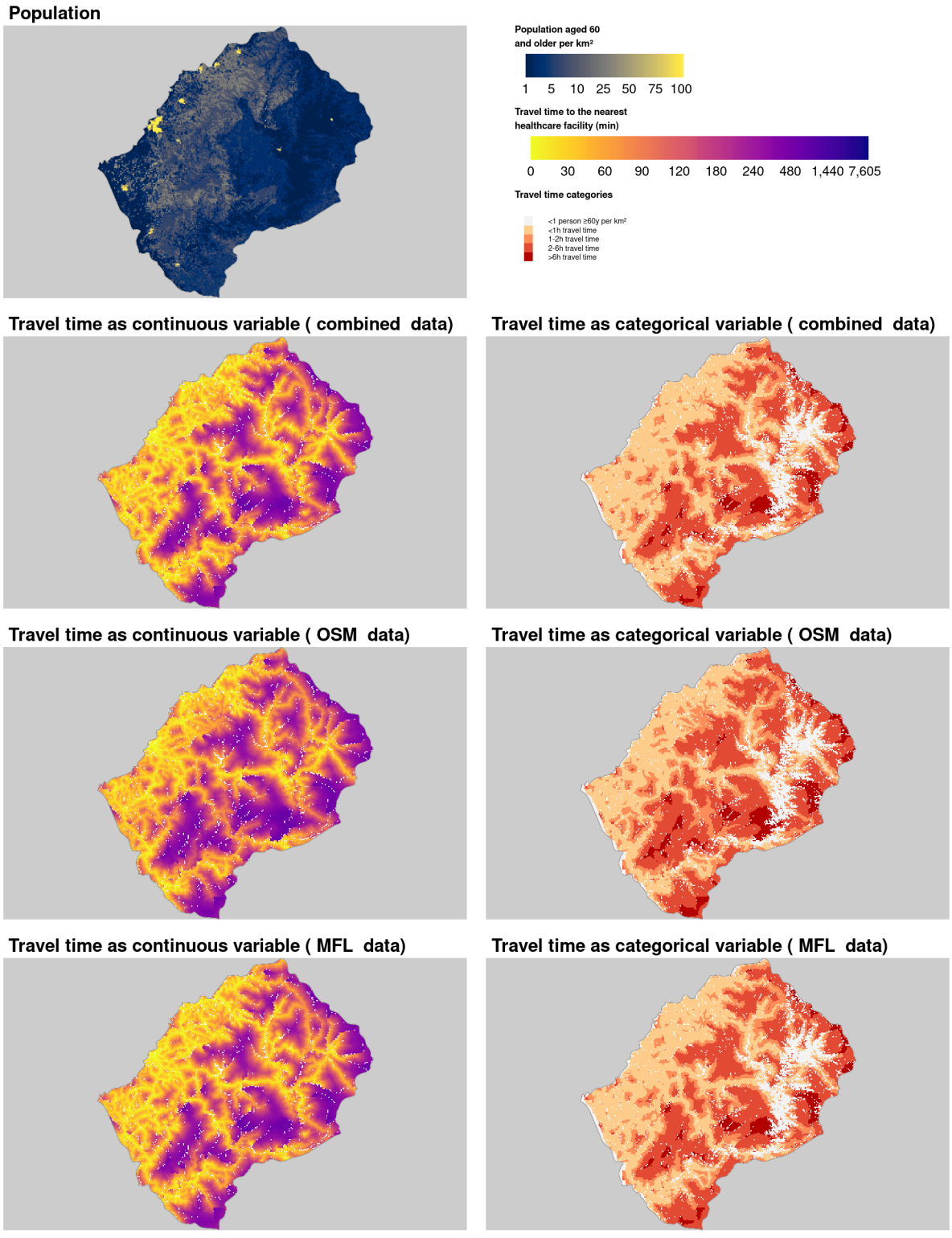


Figure S74. Liberia map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

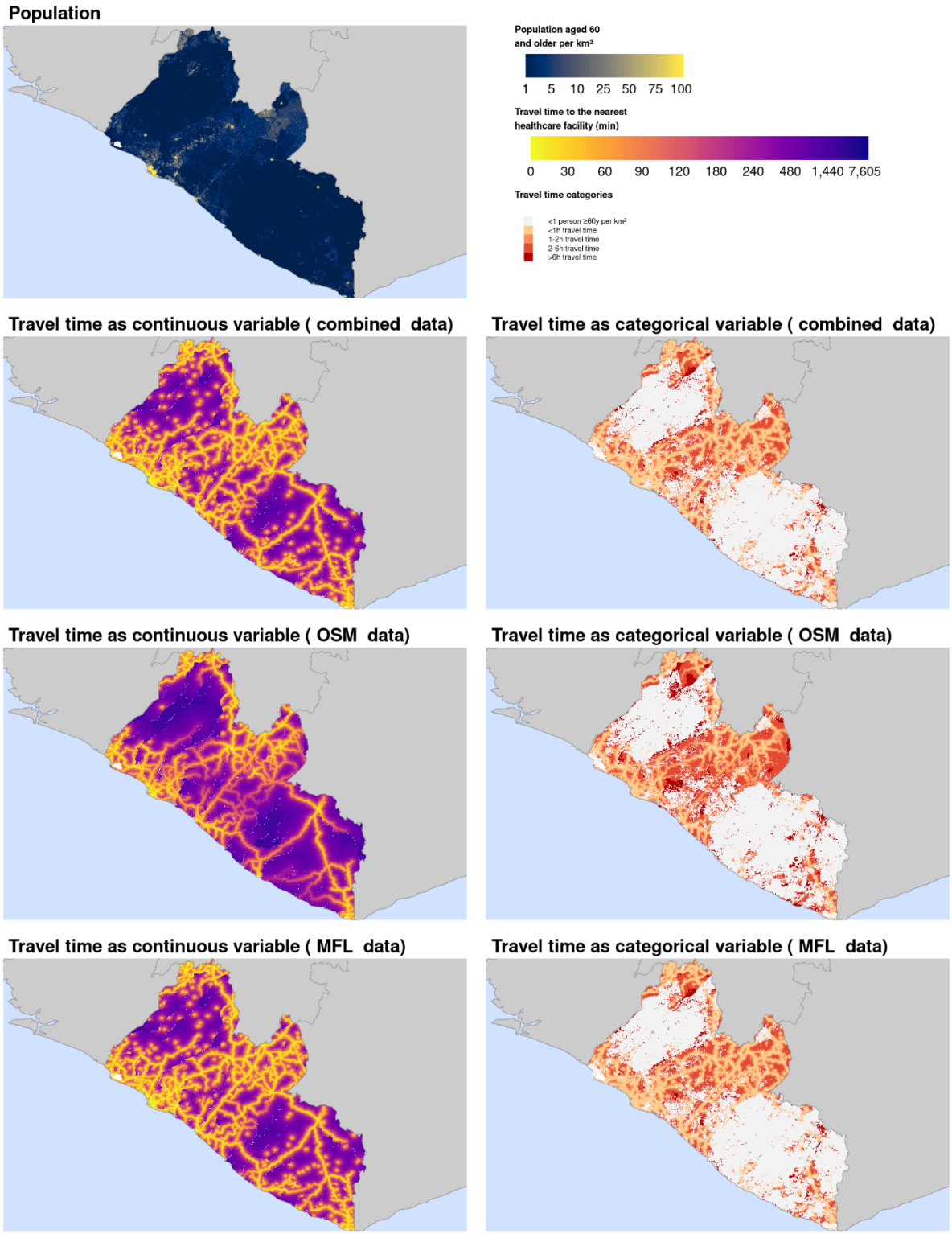


Figure S75. Madagascar map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

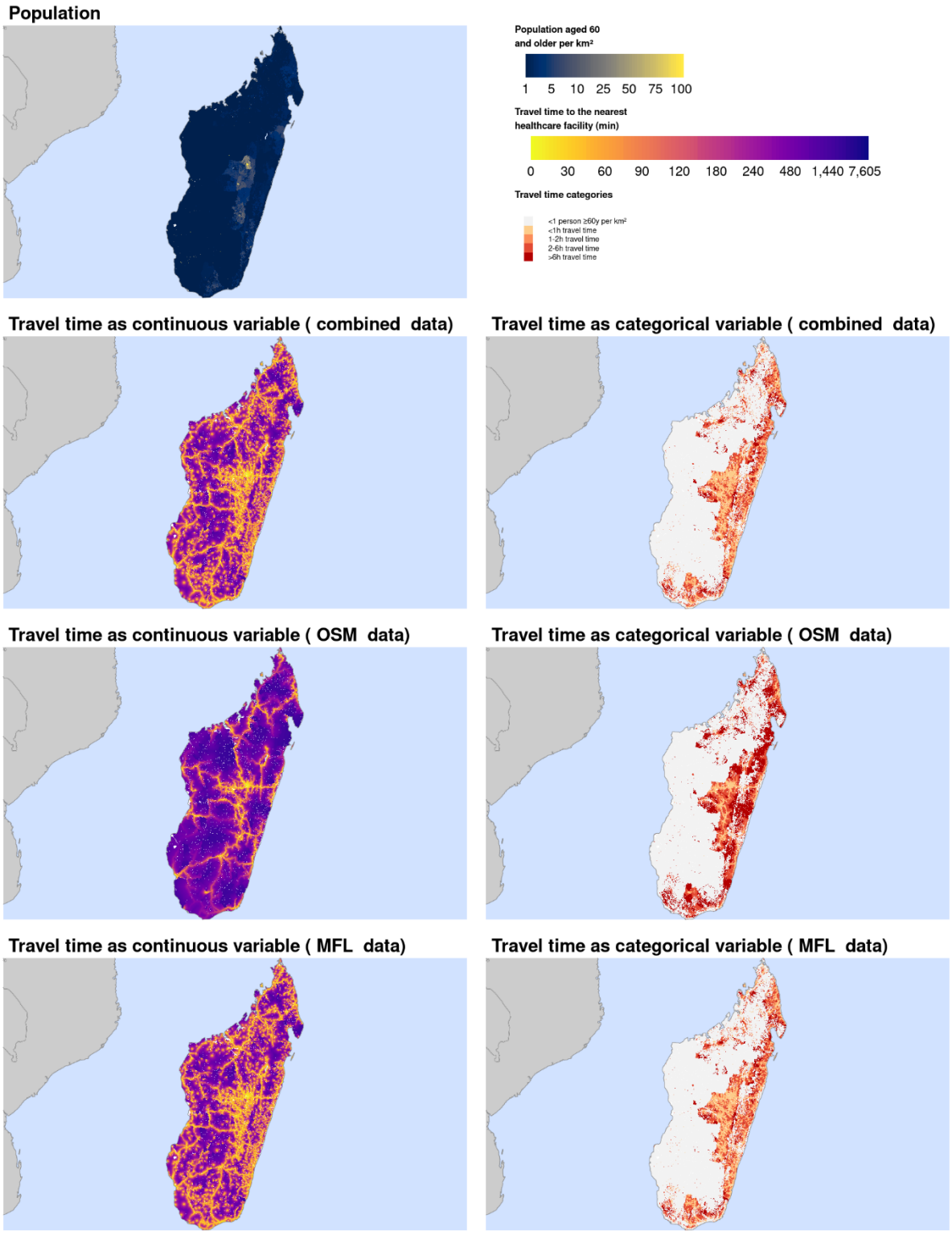


Figure S76. Malawi map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

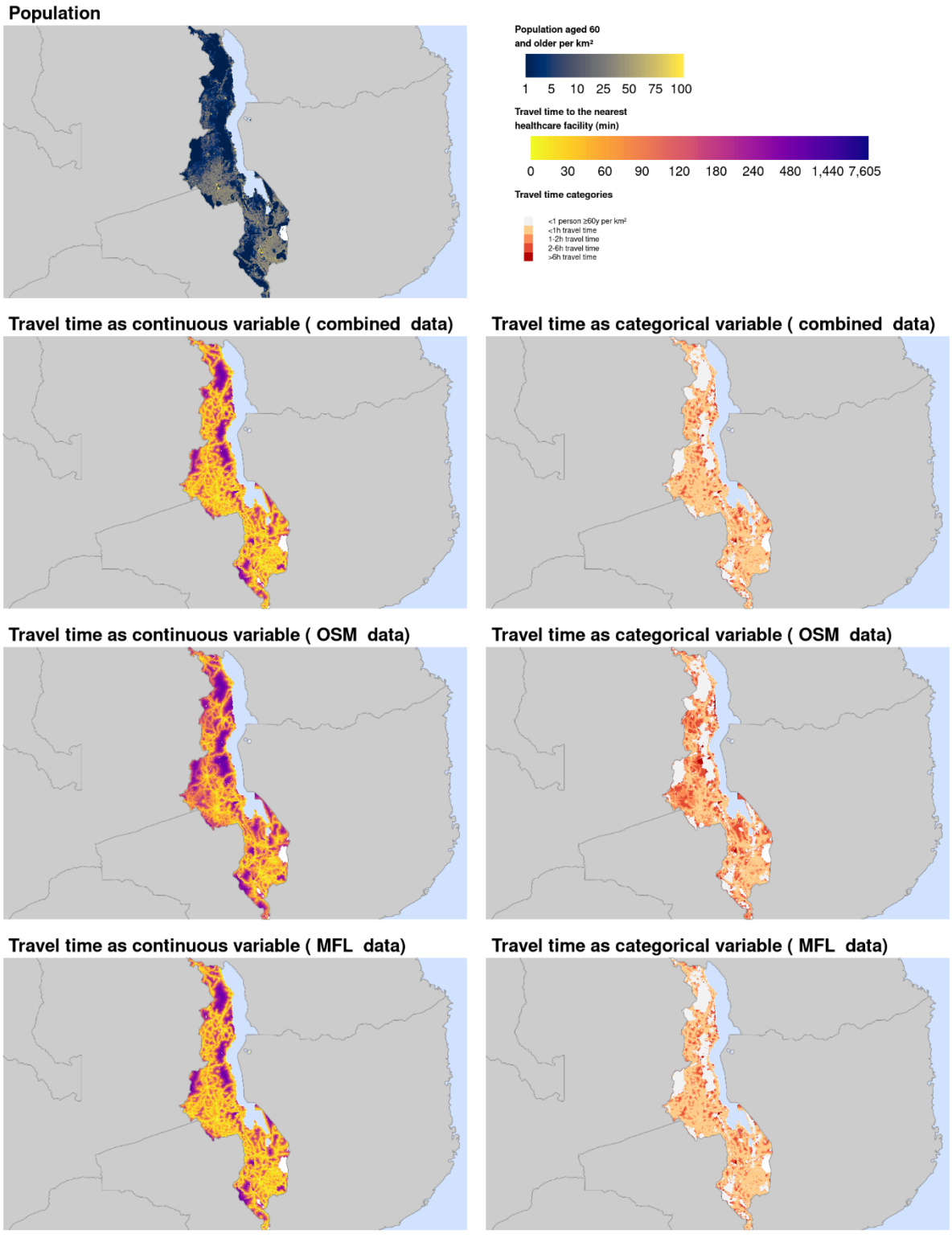


Figure S77. Mali map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

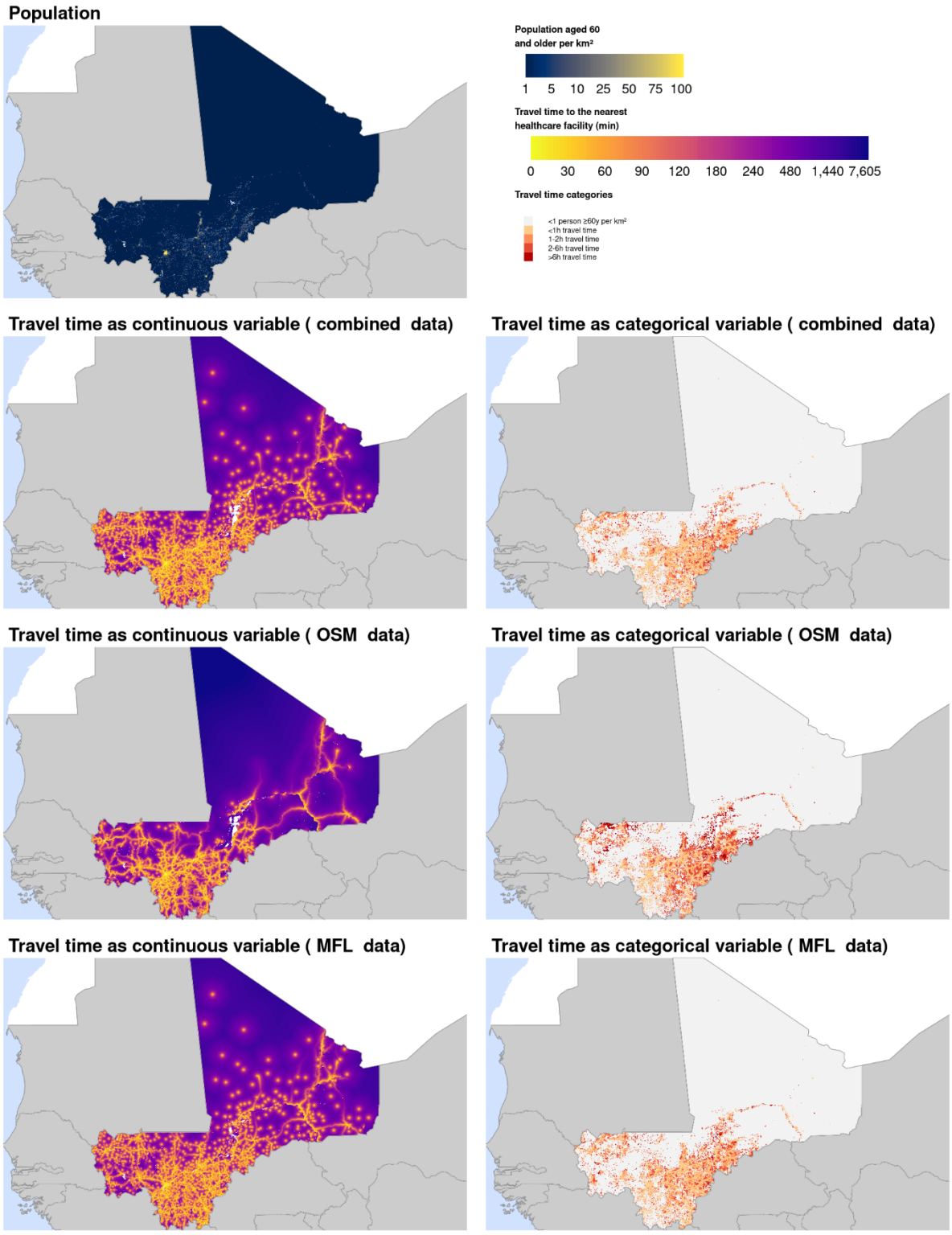


Figure S78. Mauritania map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

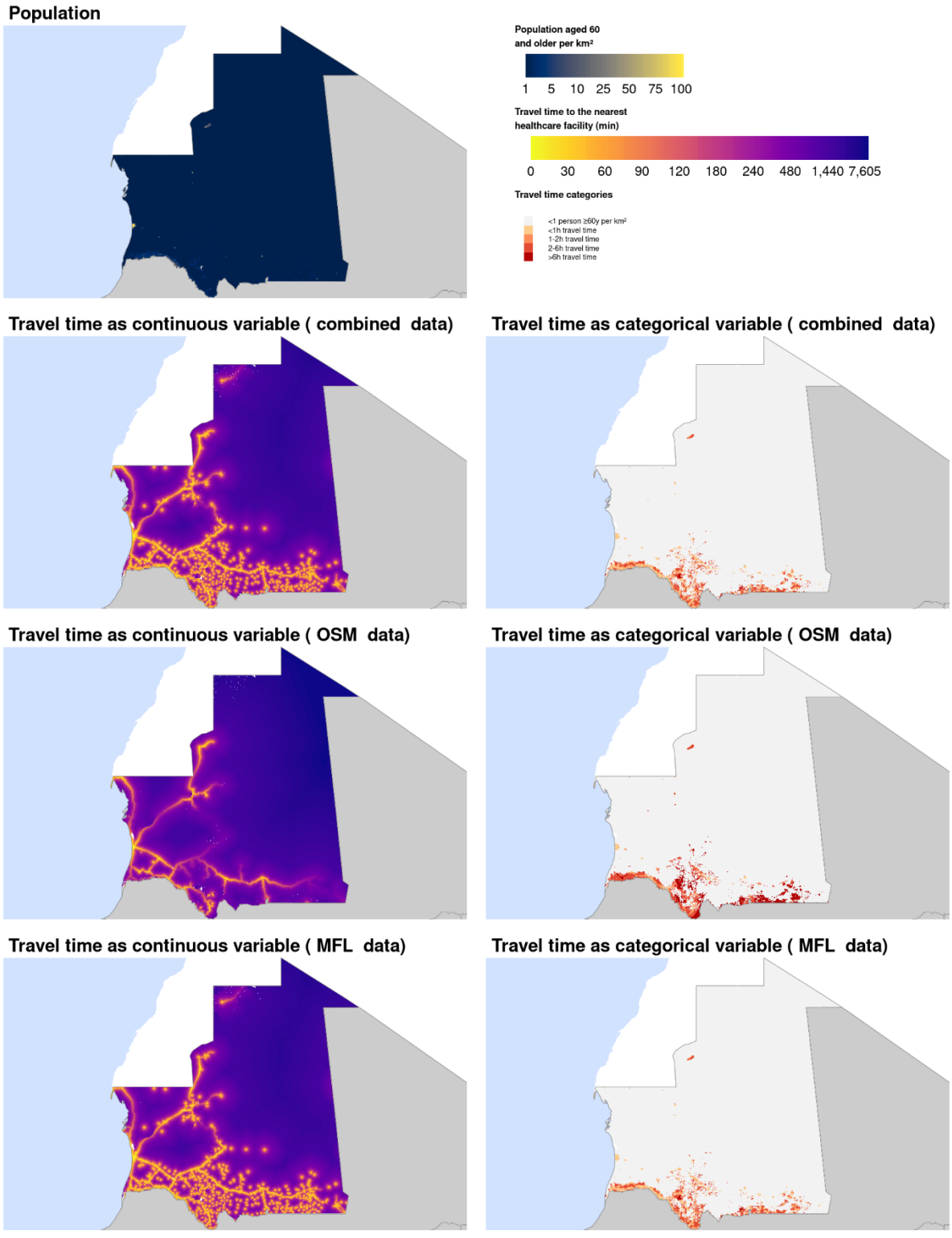


Figure S79. Mozambique map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

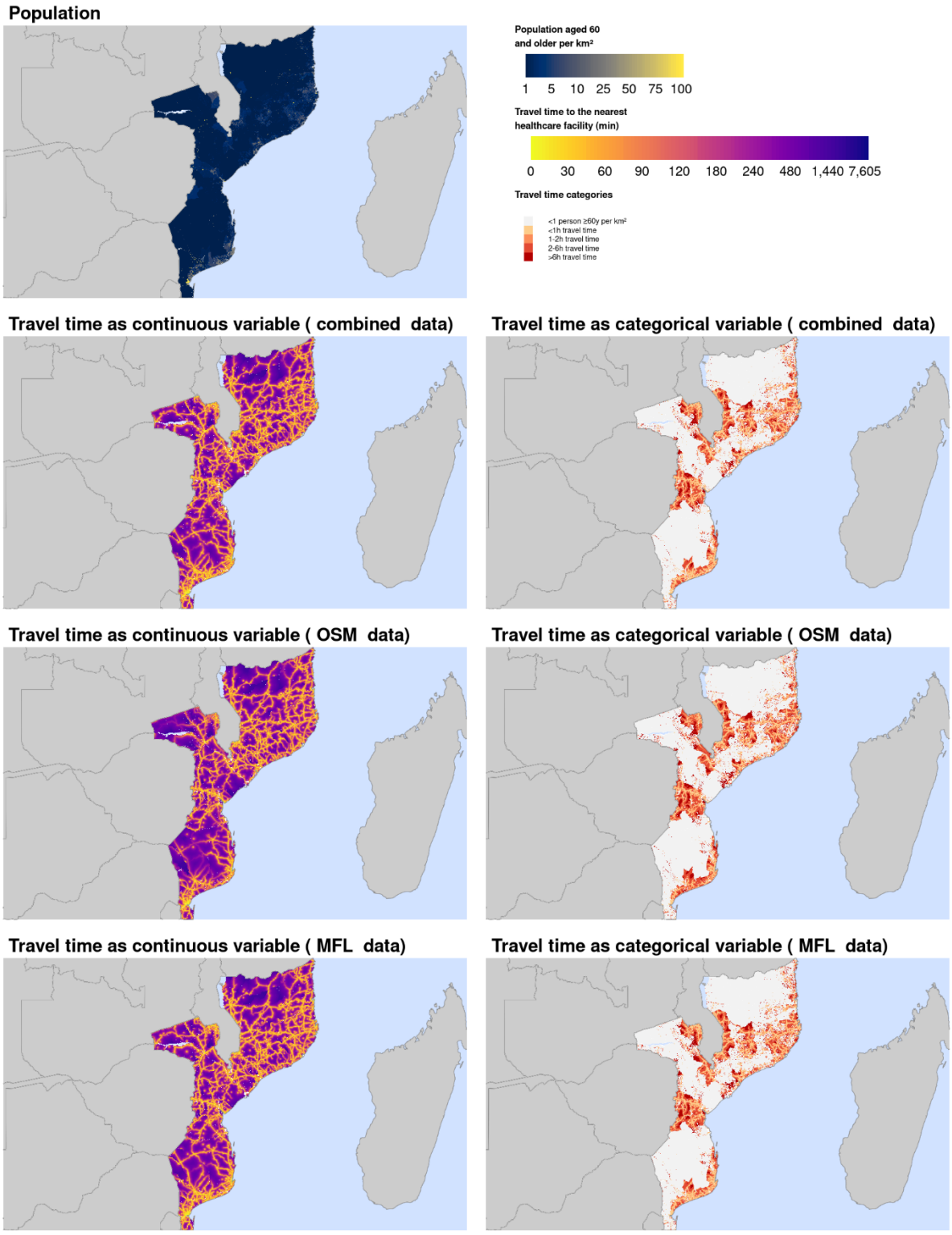


Figure S80. Namibia map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

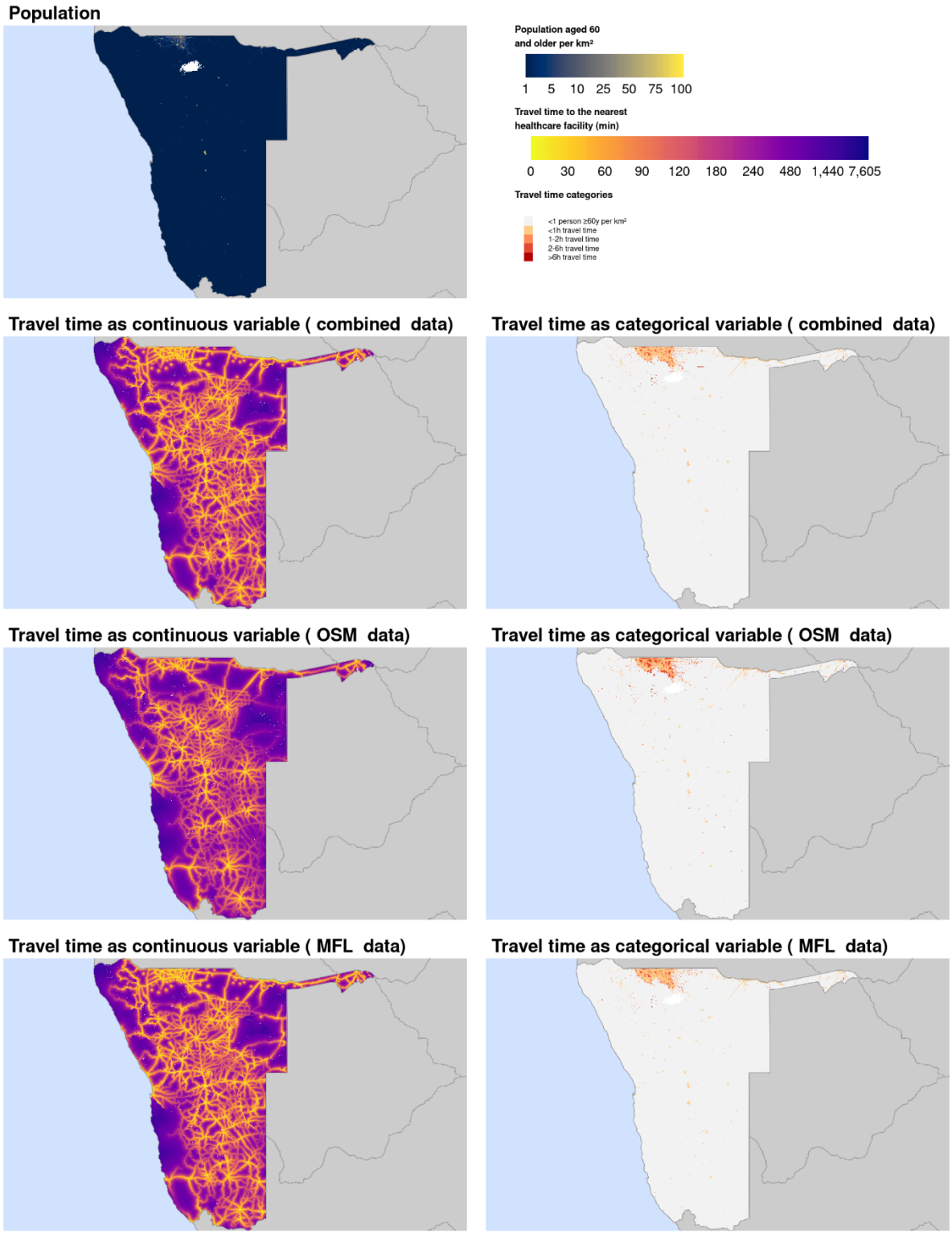


Figure S81. Niger map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

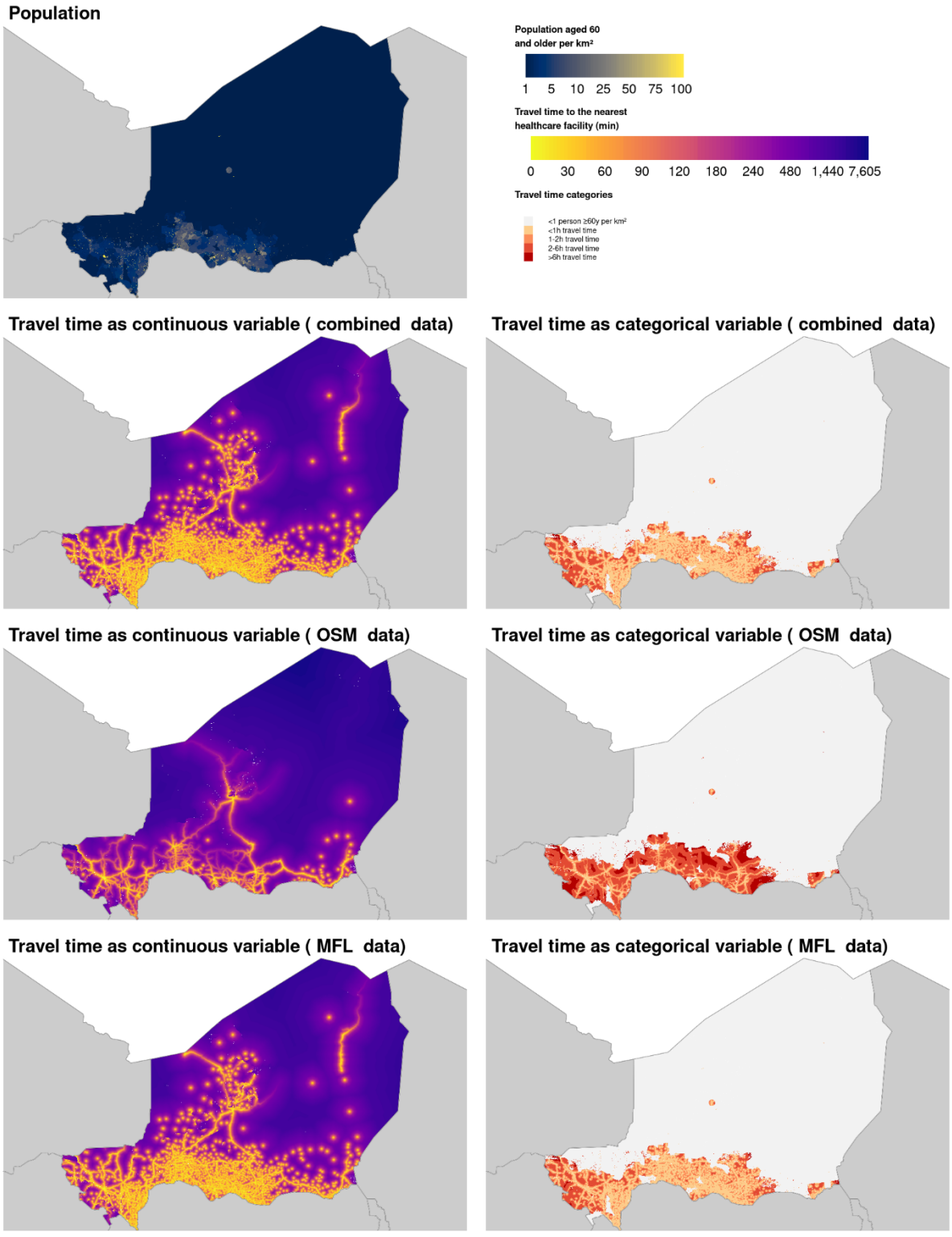


Figure S82. Nigeria map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

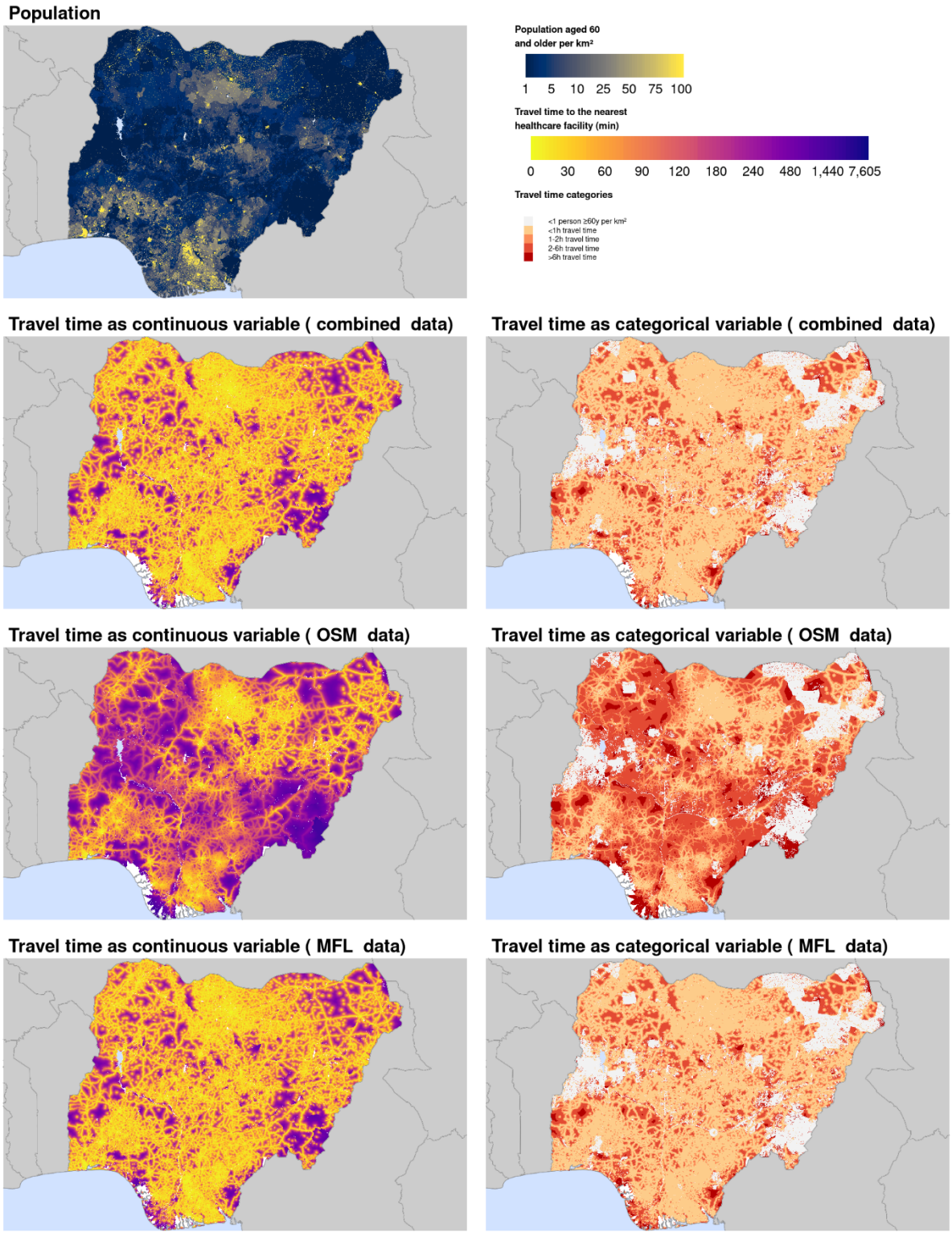


Figure S83. Republic of the Congo map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

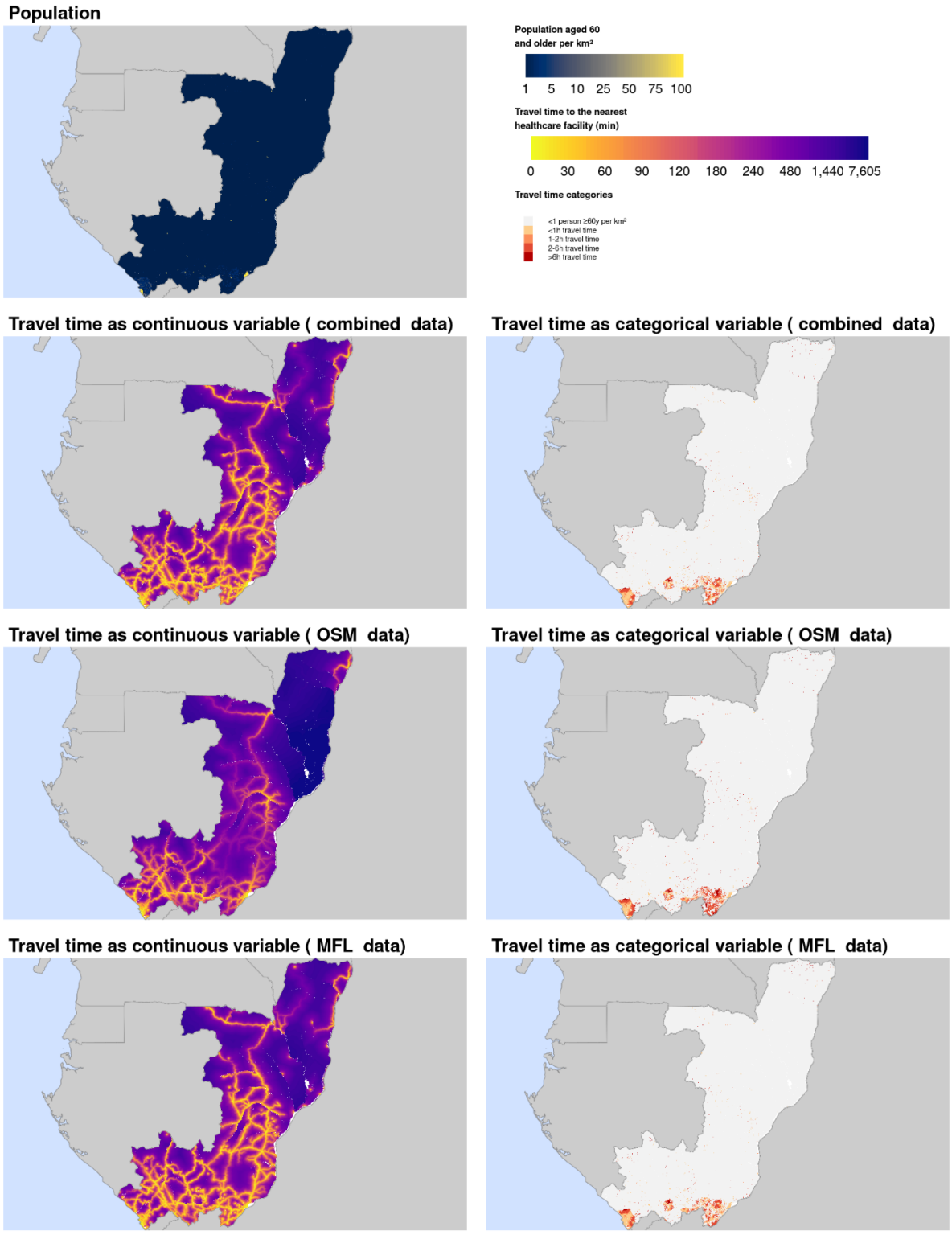


Figure S84. Rwanda map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

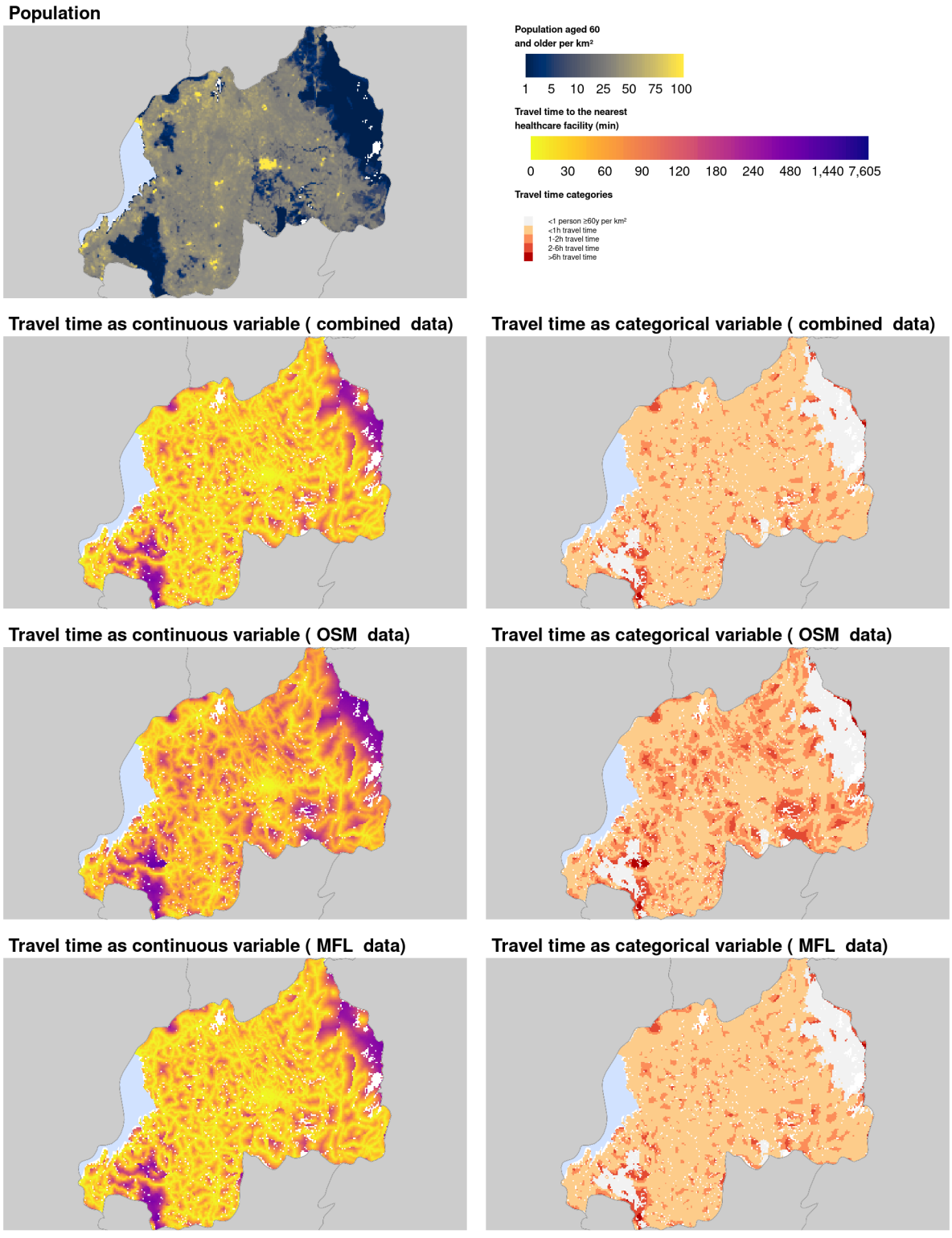


Figure S85. Senegal map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

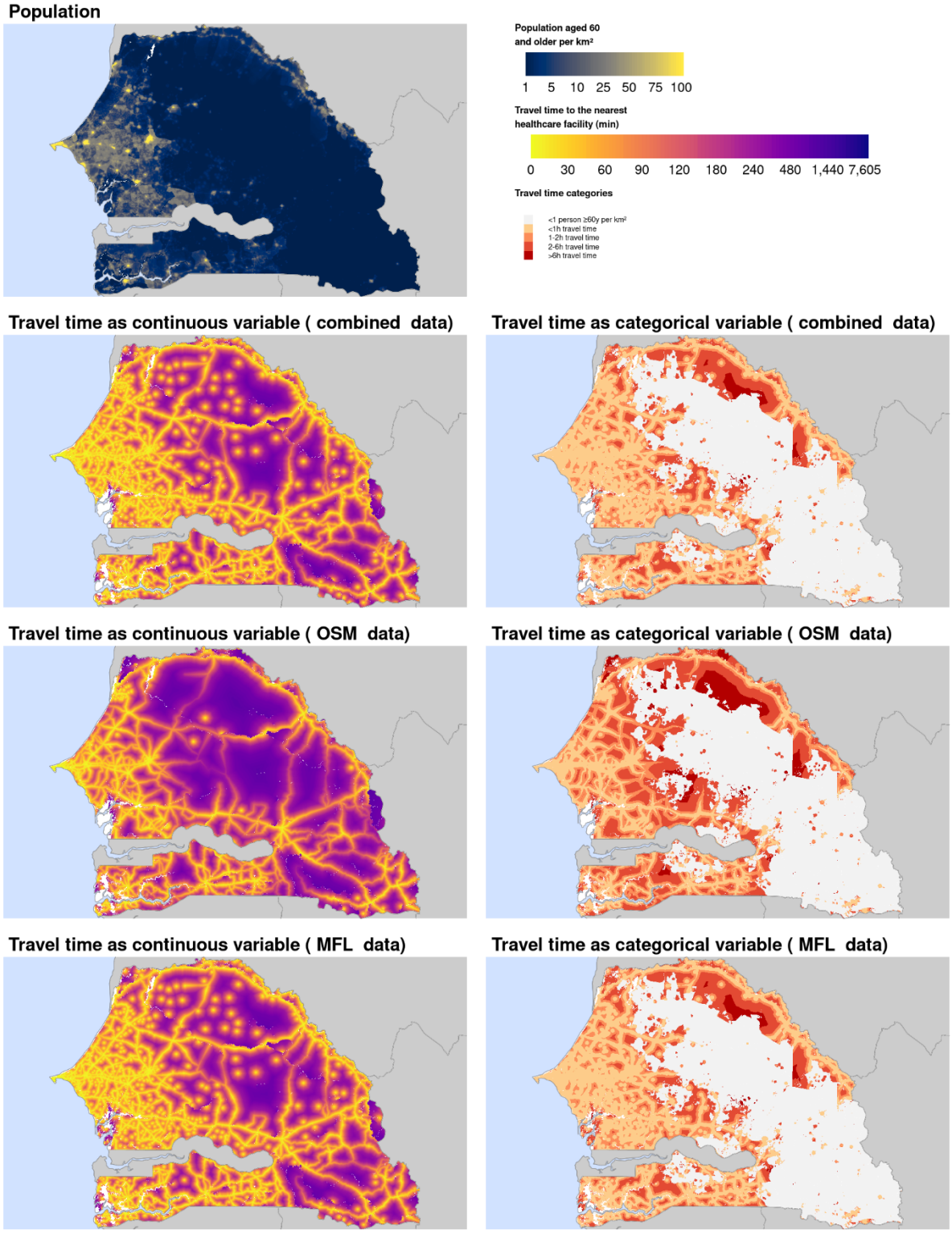


Figure S86. Sierra Leone map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

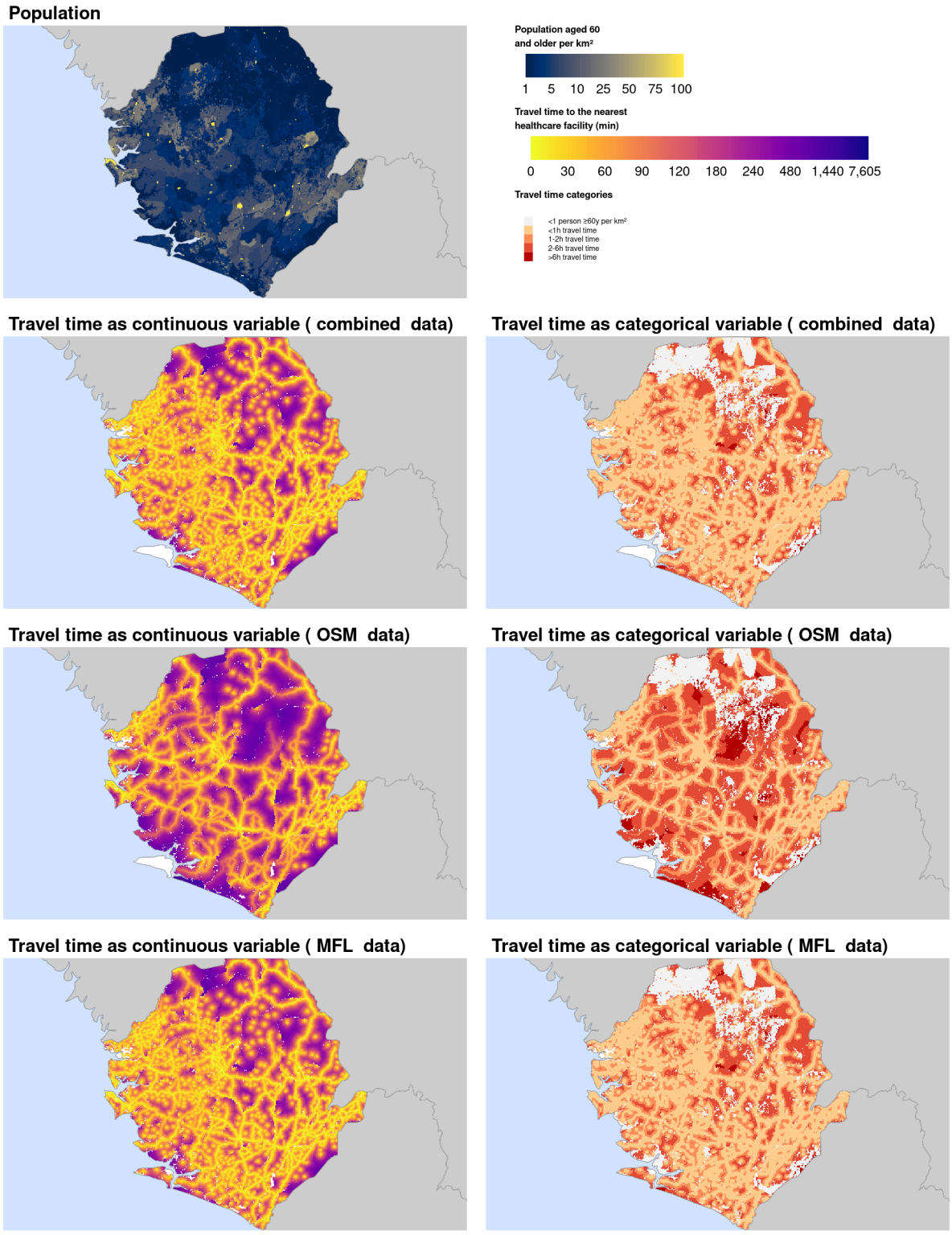


Figure S87. Somalia map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

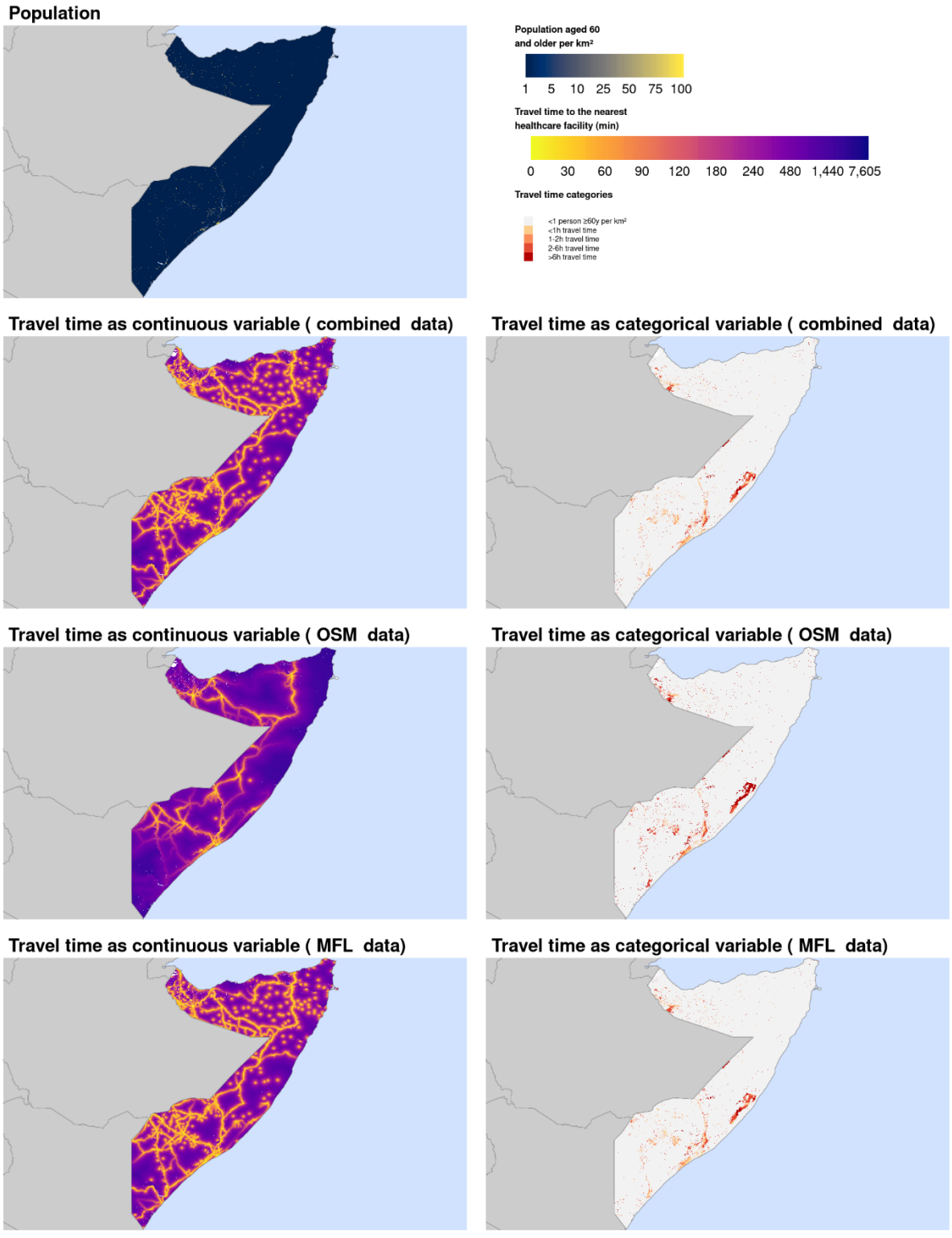


Figure S88. South Africa map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

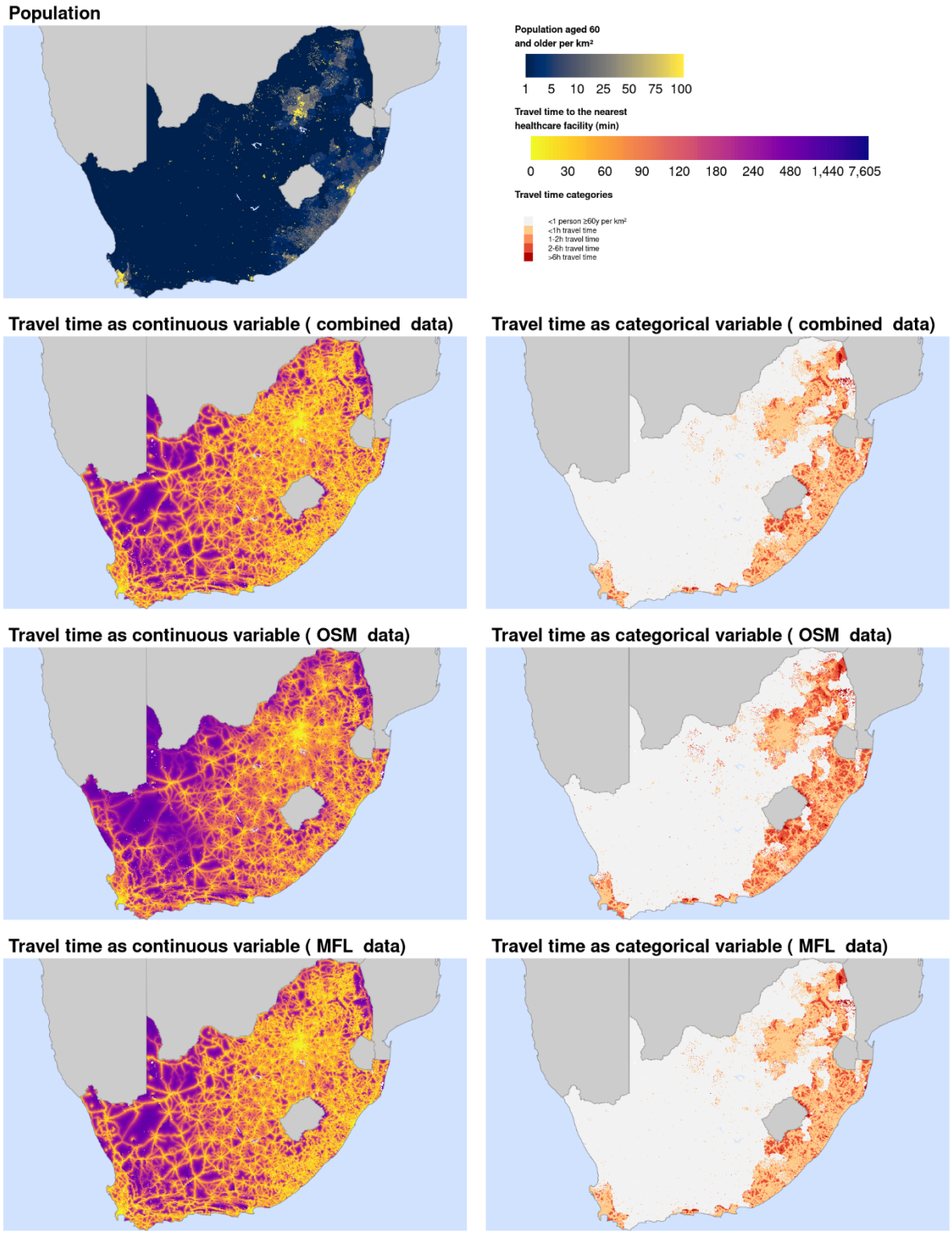


Figure S89. South Sudan map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

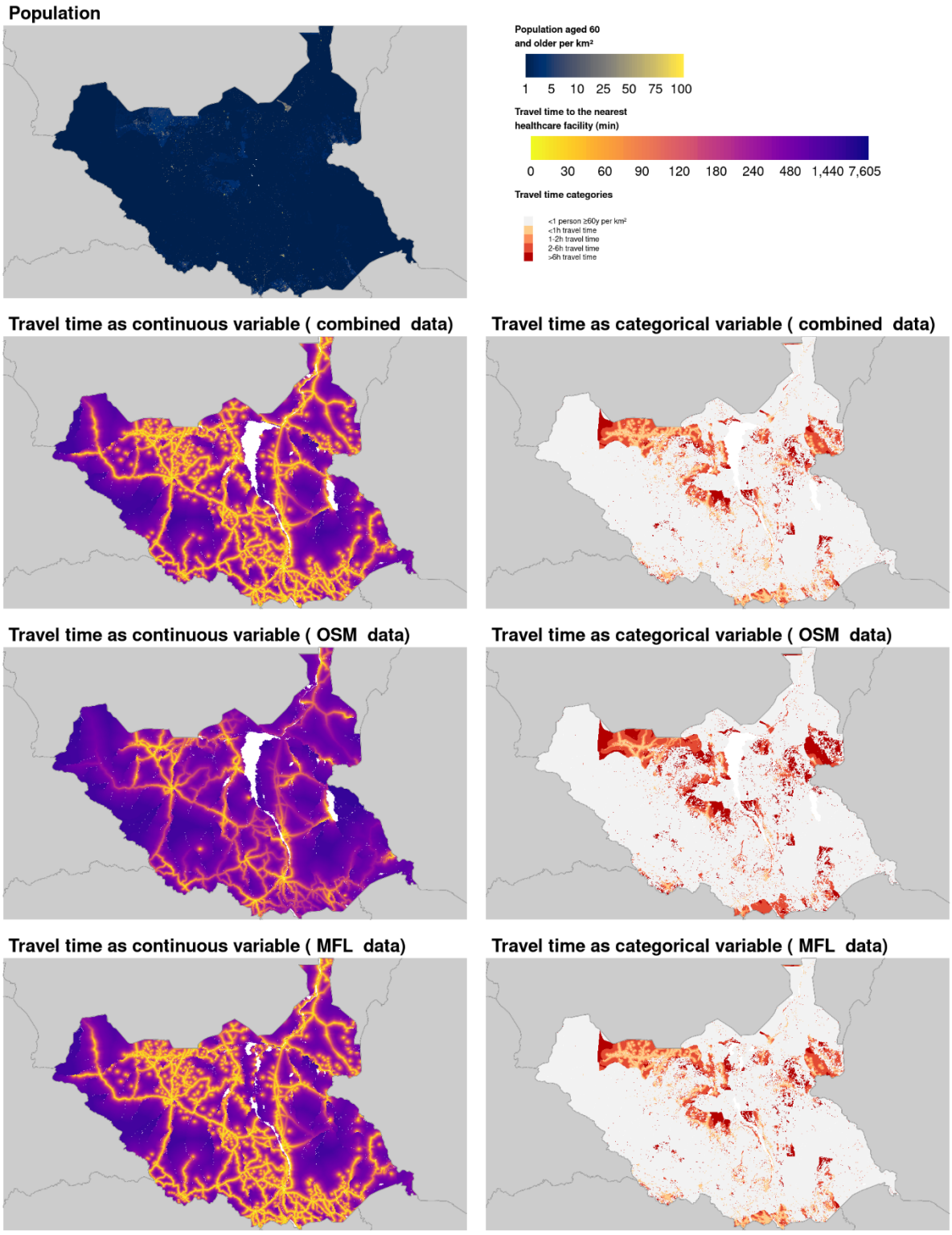


Figure S90. Sudan map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

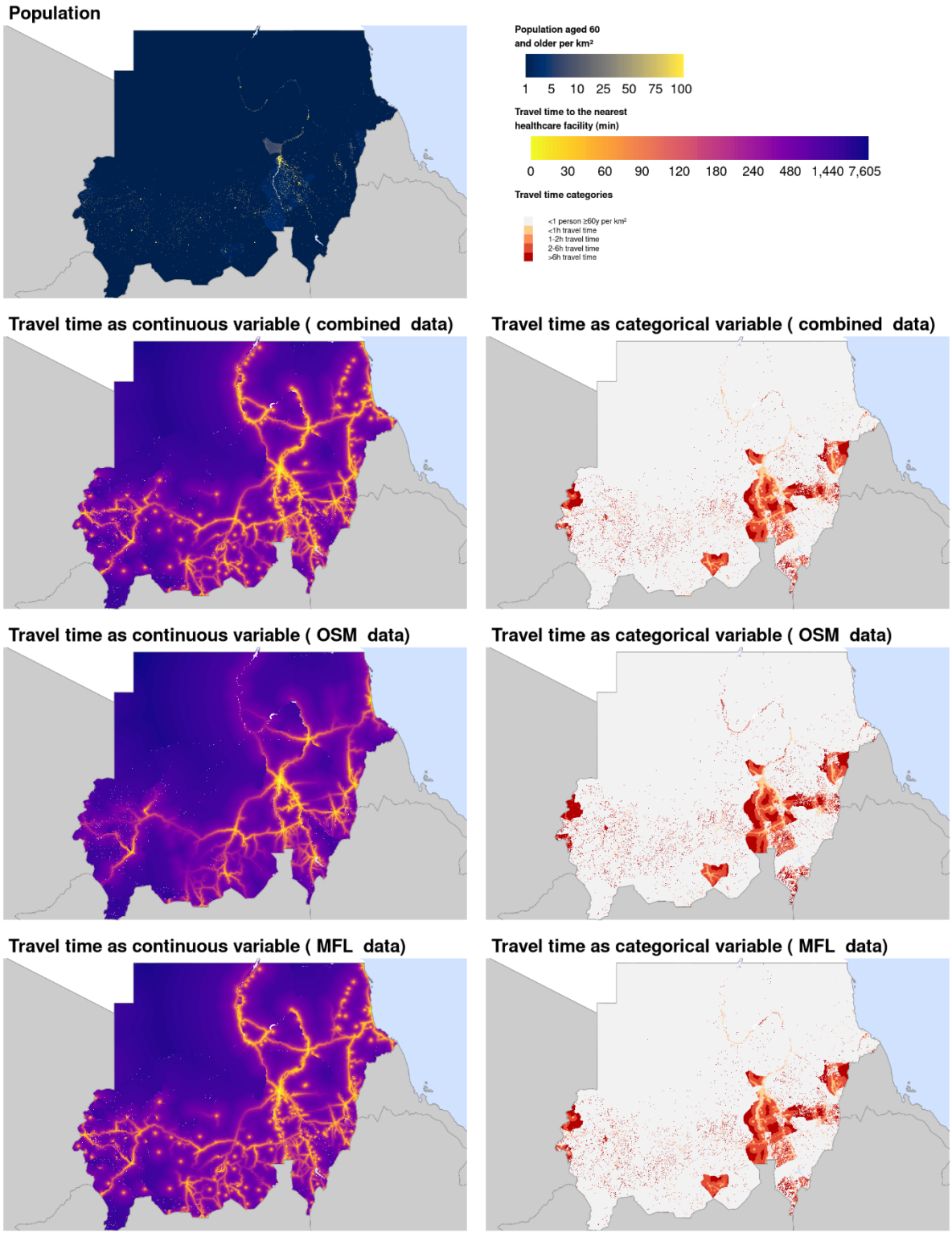


Figure S91. Tanzania map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

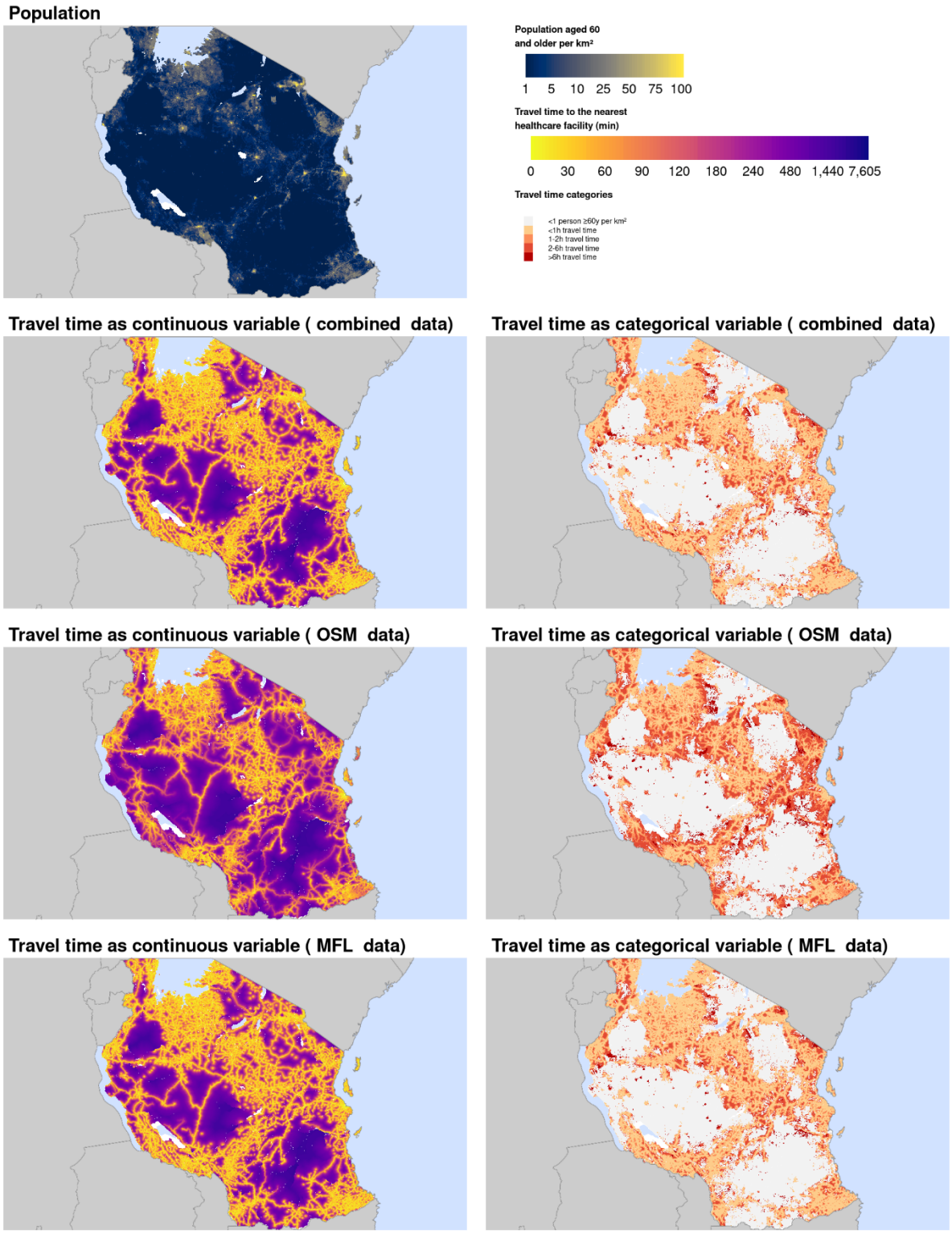


Figure S92. The Gambia map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

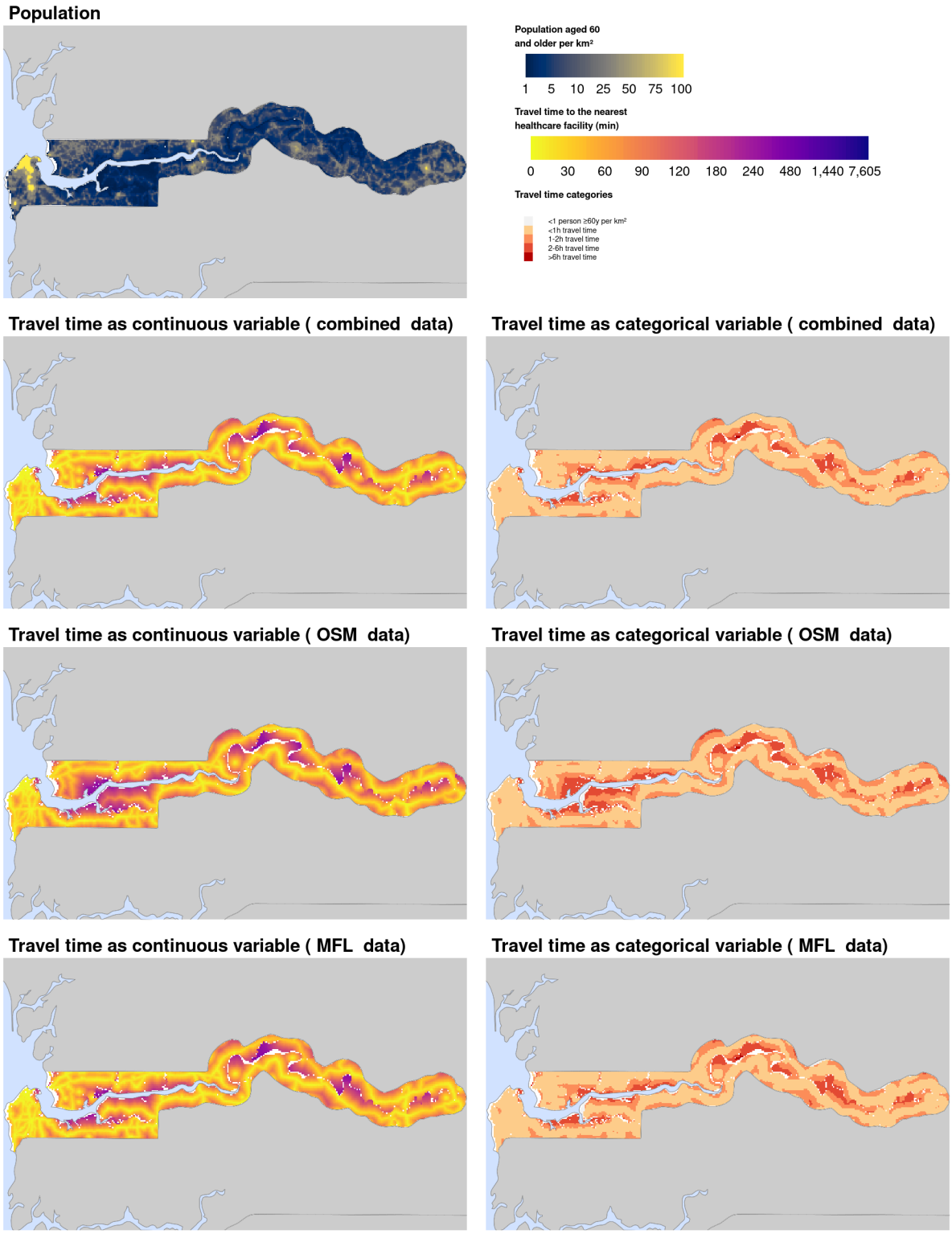


Figure S93. Togo map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

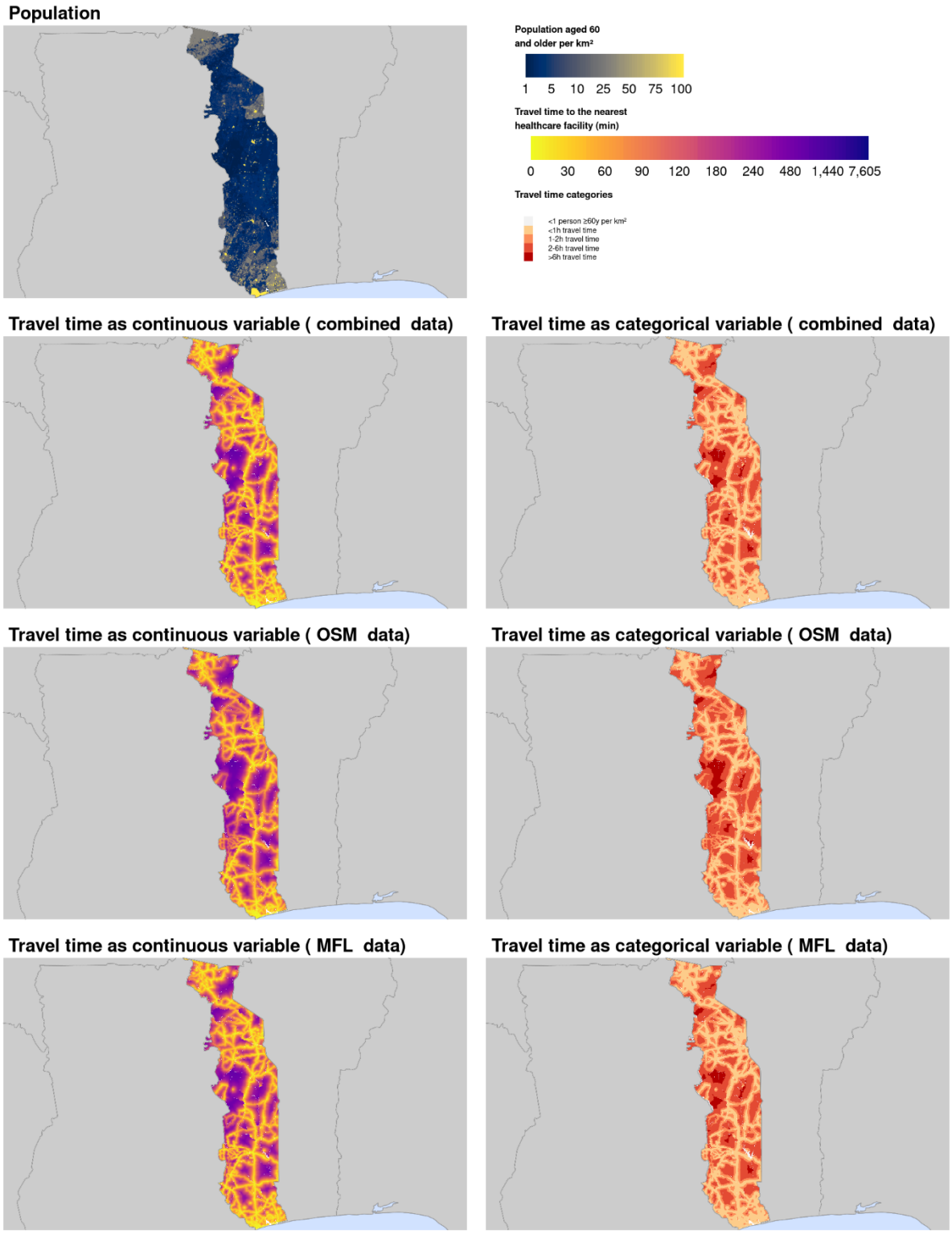


Figure S94. Uganda map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

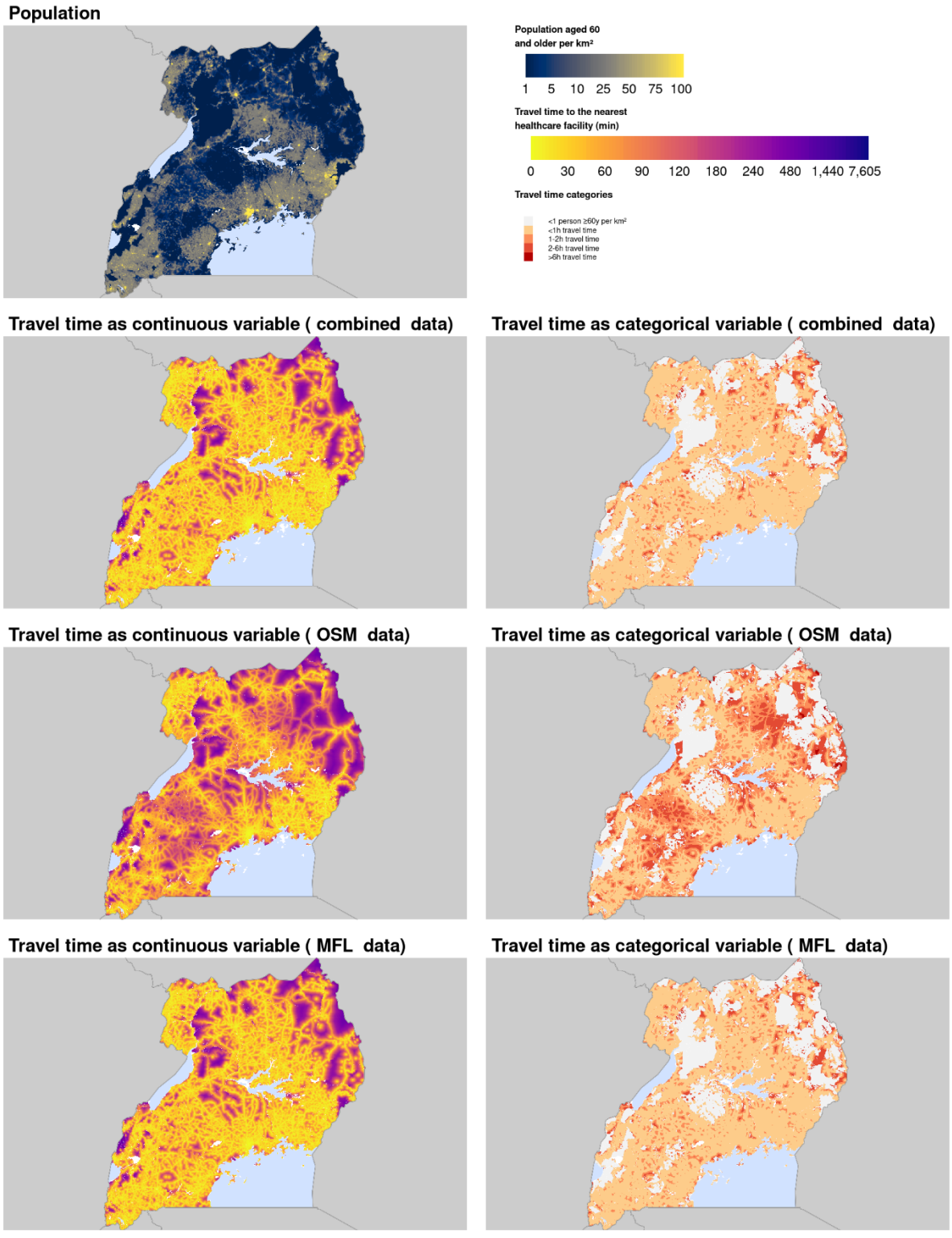


Figure S95. Zambia map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

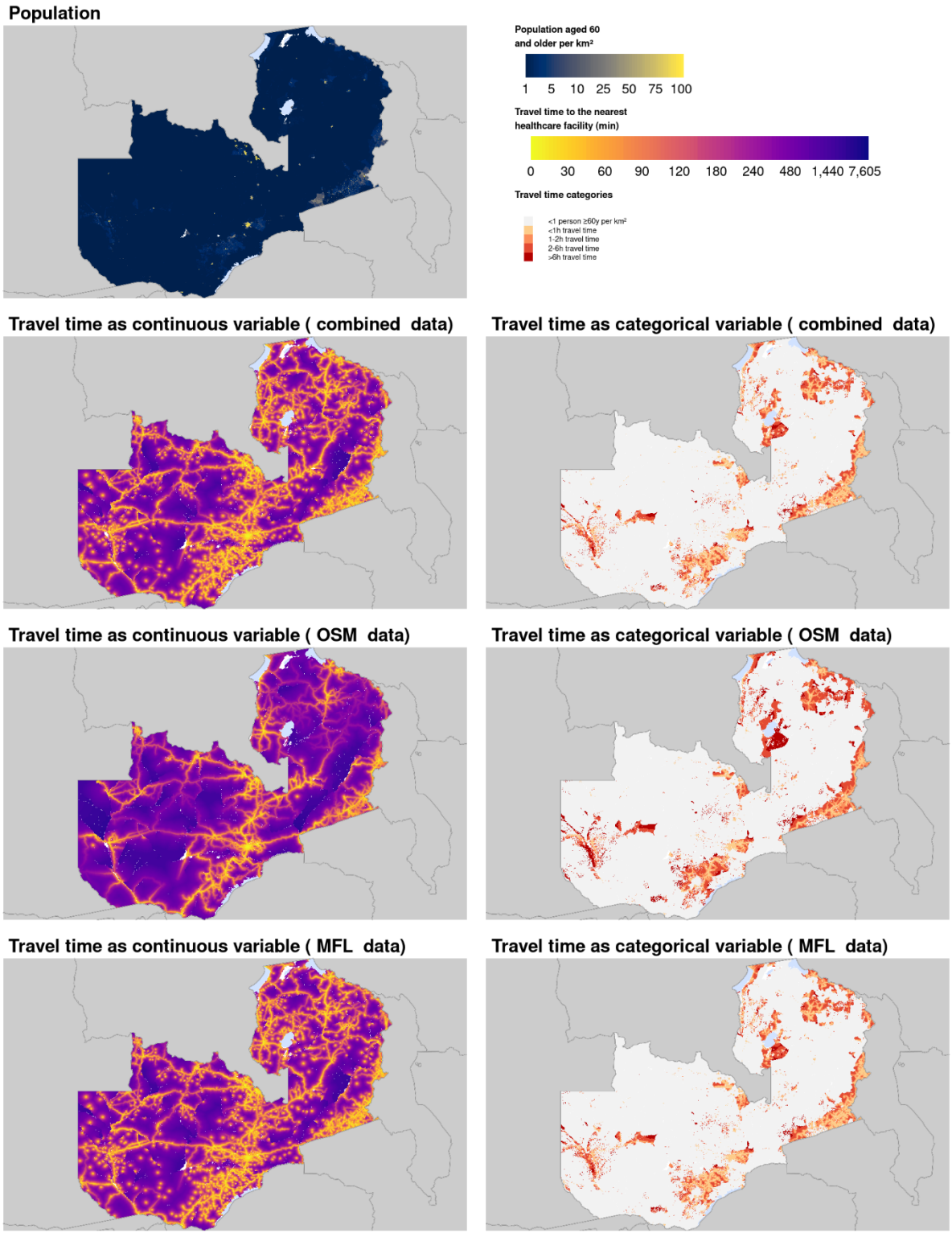


Figure S96. Zimbabwe map of travel time to the nearest healthcare facility for adults aged ≥ 60 years

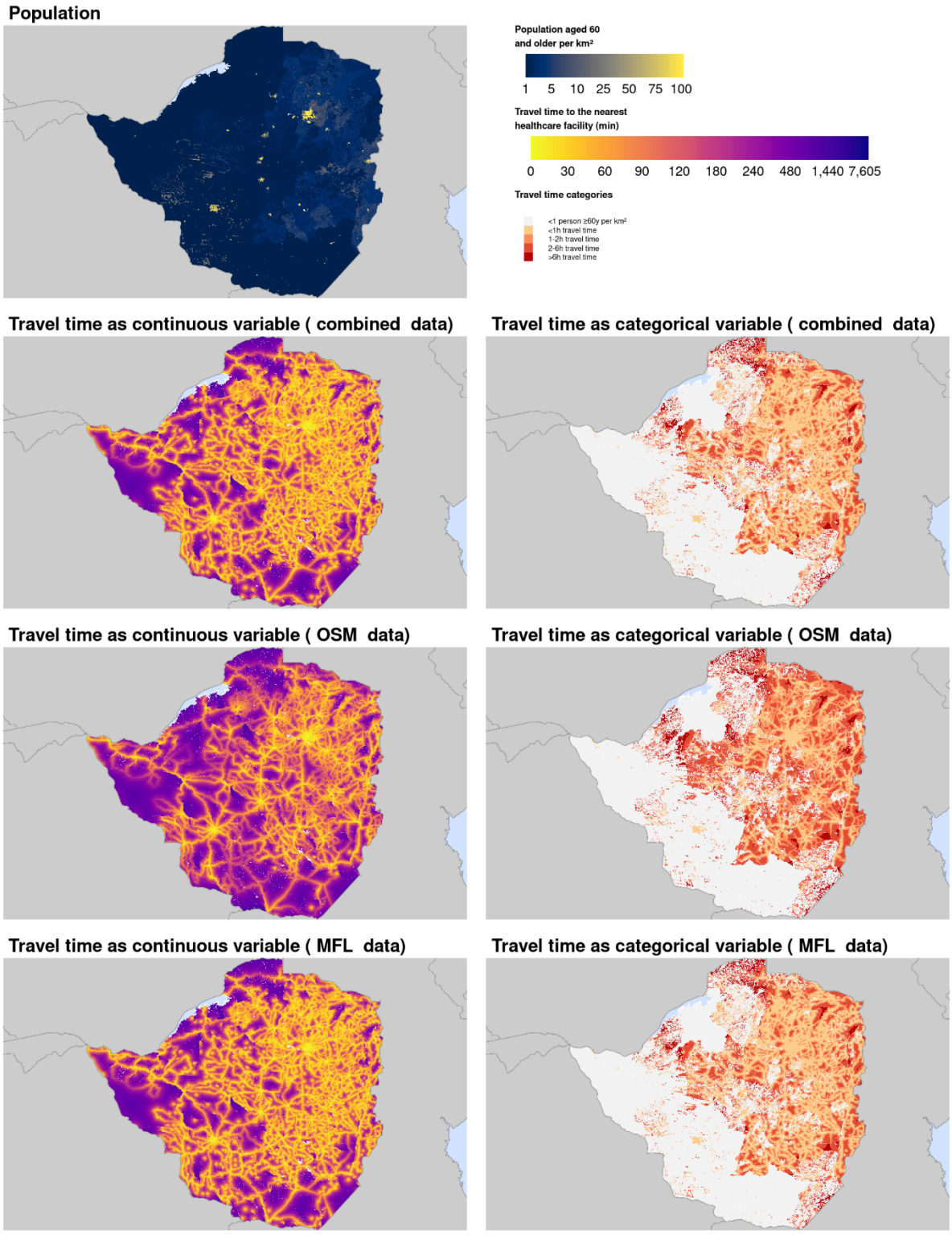


Figure S97. Maps of travel time to the nearest healthcare facility for adults ≥ 60 years, by region based on the MFL dataset

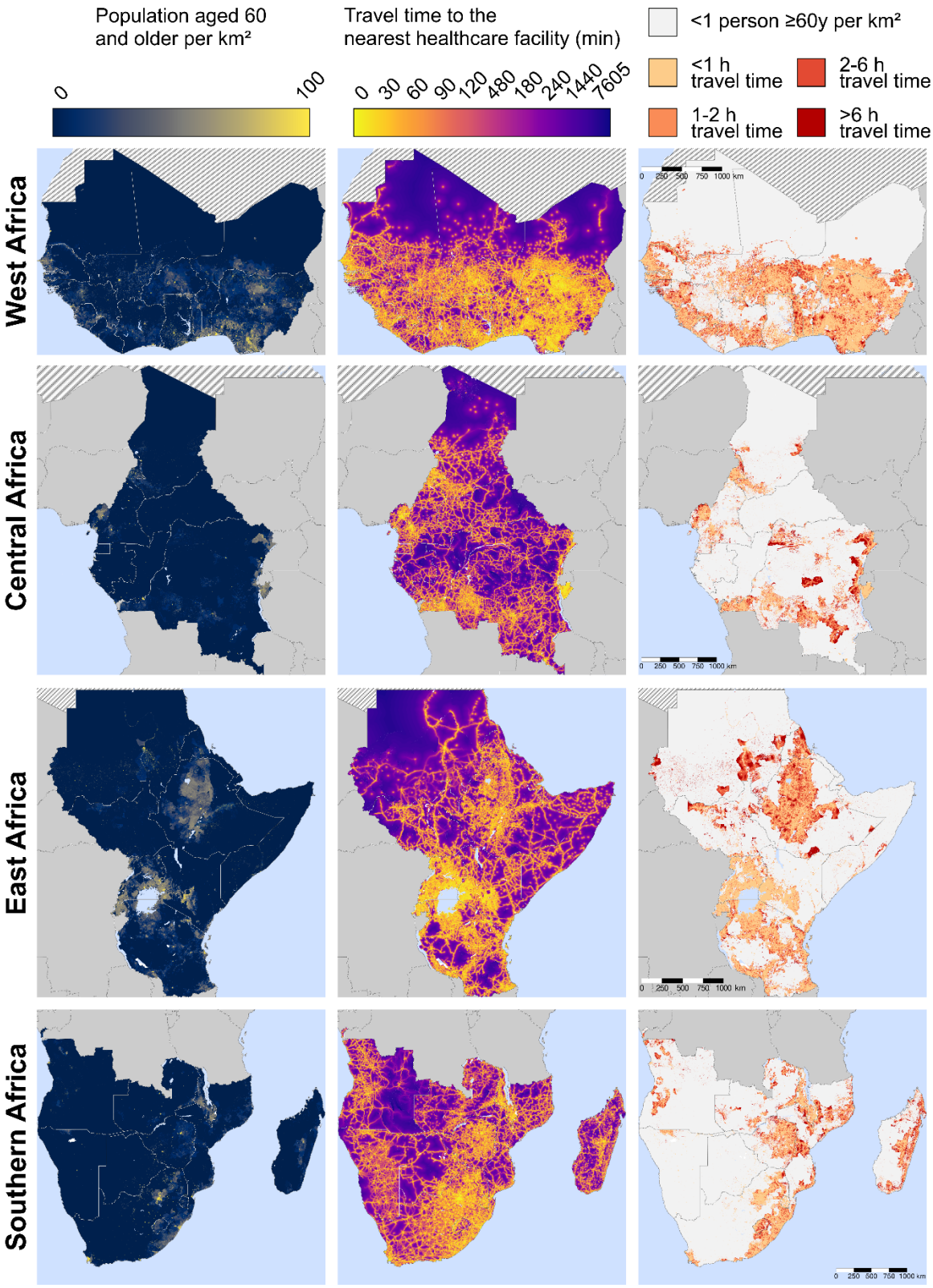


Figure S98. Maps of travel time to the nearest healthcare facility for adults ≥ 60 years, by region based on the OSM dataset

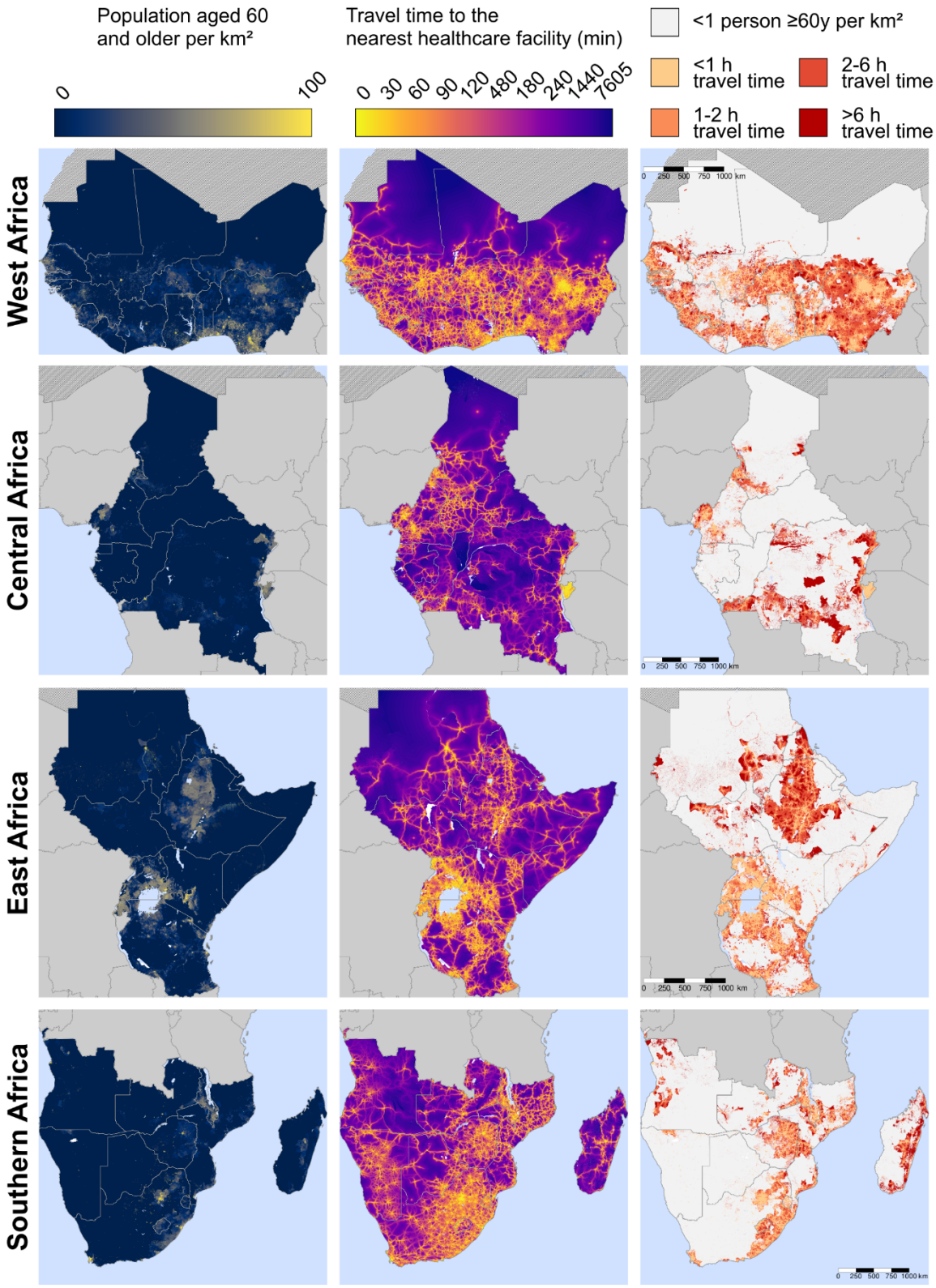


Figure S99. Location of healthcare facilities in OSM and MFL data for Angola

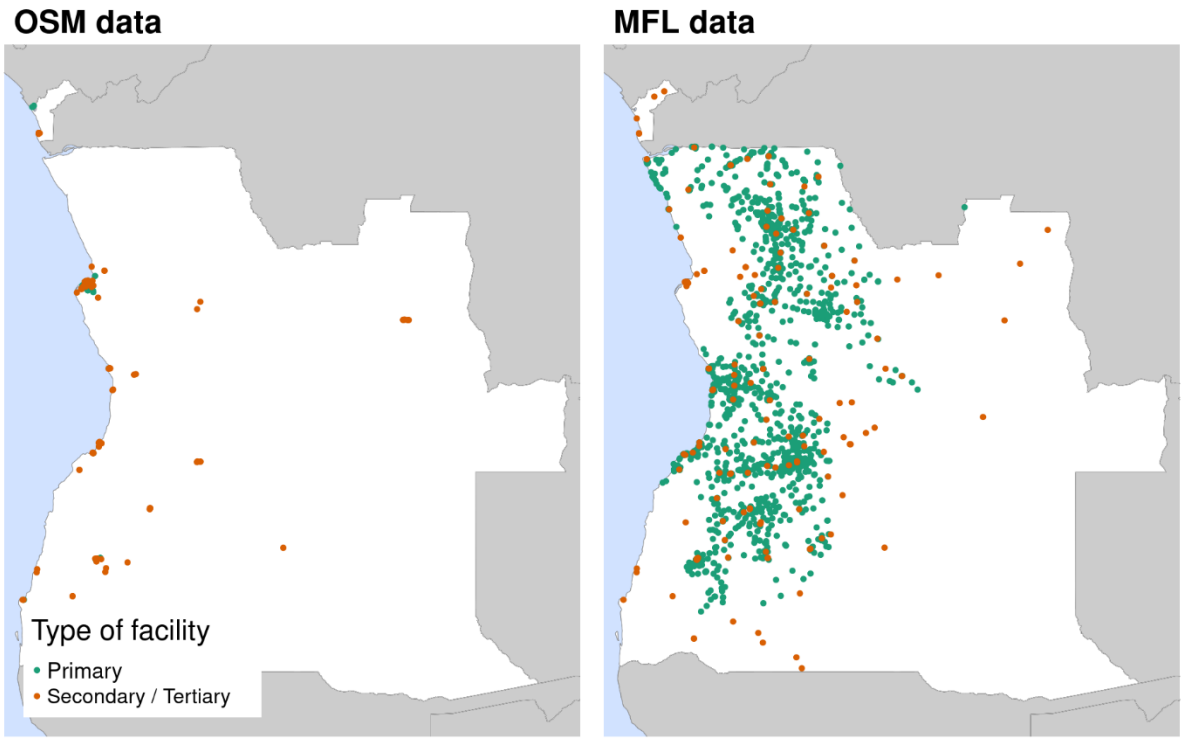


Figure S100. Location of healthcare facilities in OSM and MFL data for Benin

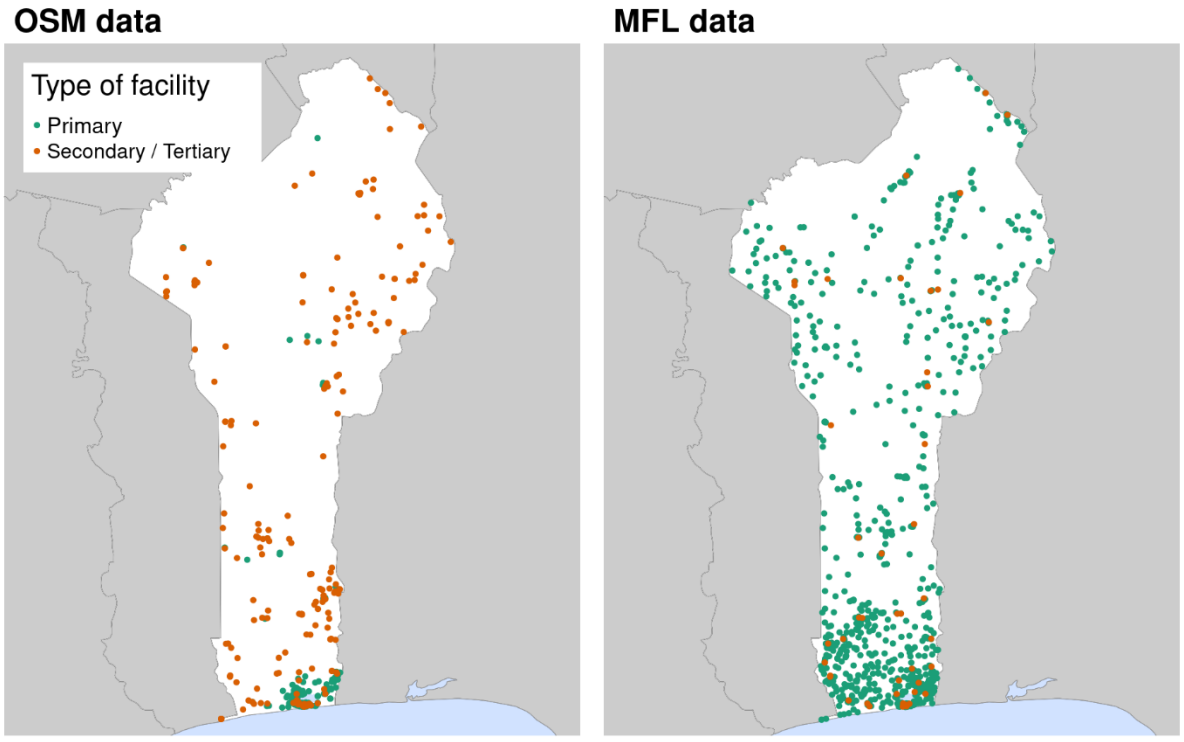


Figure S101. Location of healthcare facilities in OSM and MFL data for Botswana

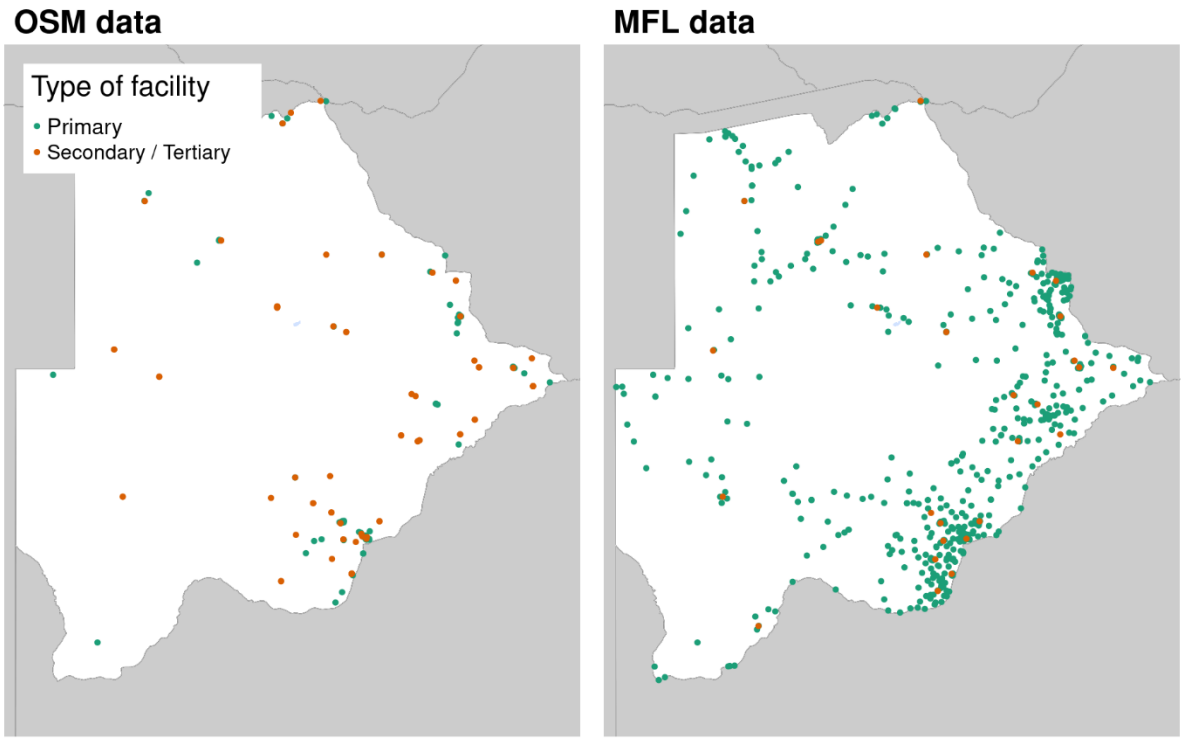


Figure S102. Location of healthcare facilities in OSM and MFL data for Burkina Faso

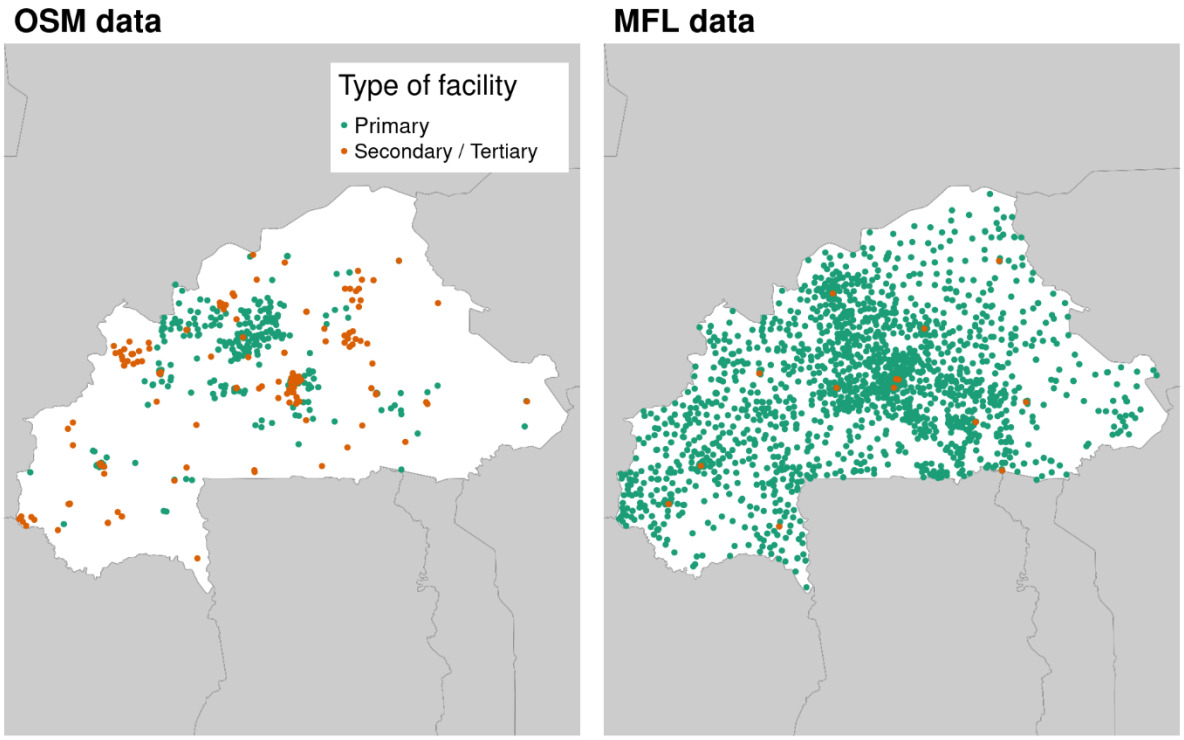


Figure S103. Location of healthcare facilities in OSM and MFL data for Burundi

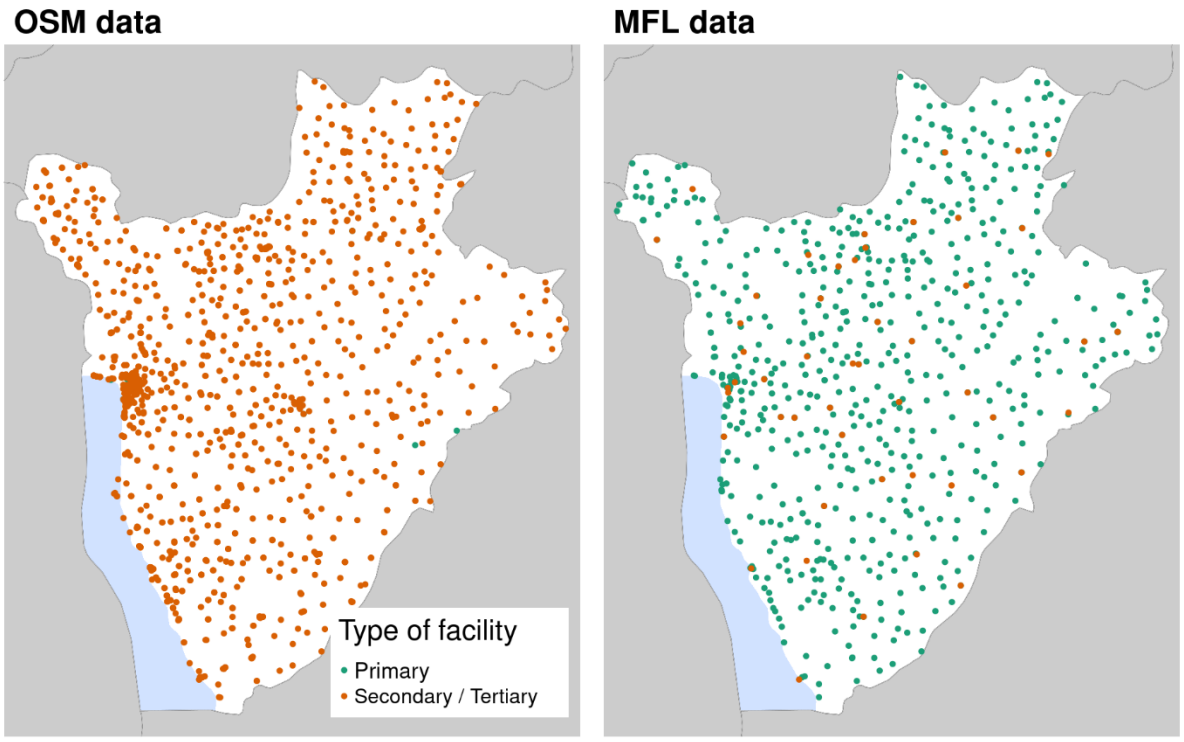


Figure S104. Location of healthcare facilities in OSM and MFL data for Cameroon

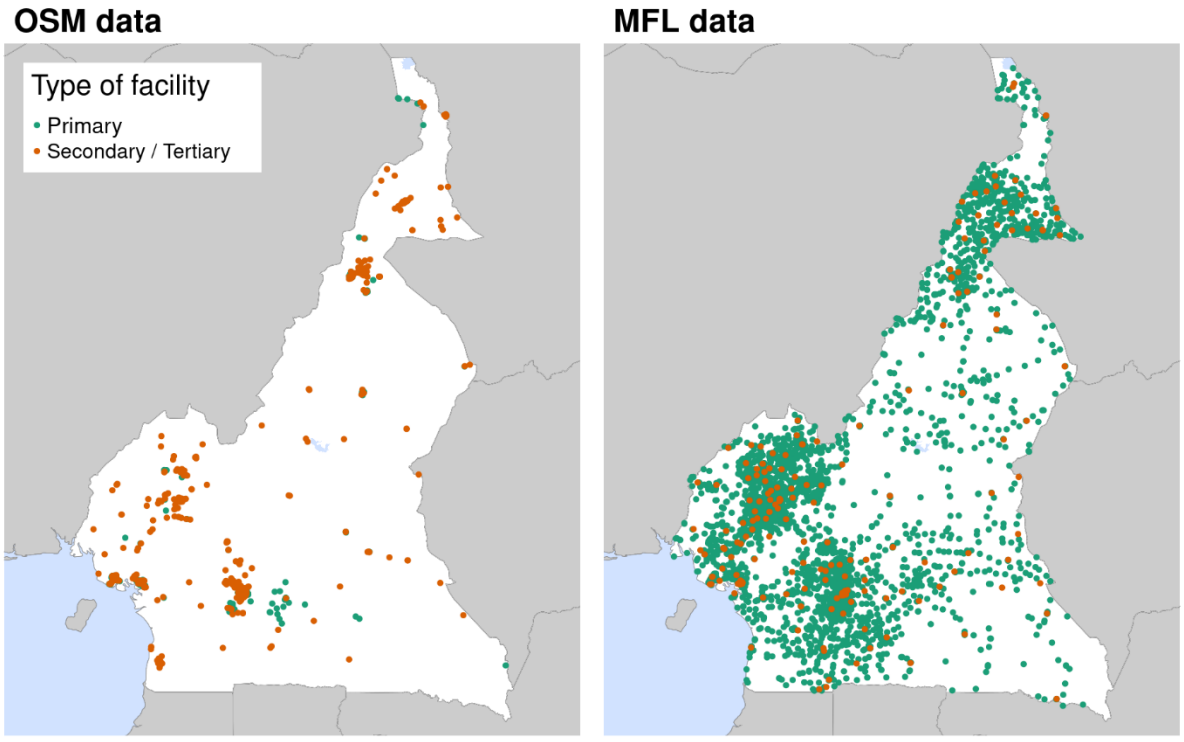


Figure S105. Location of healthcare facilities in OSM and MFL data for Central African Republic

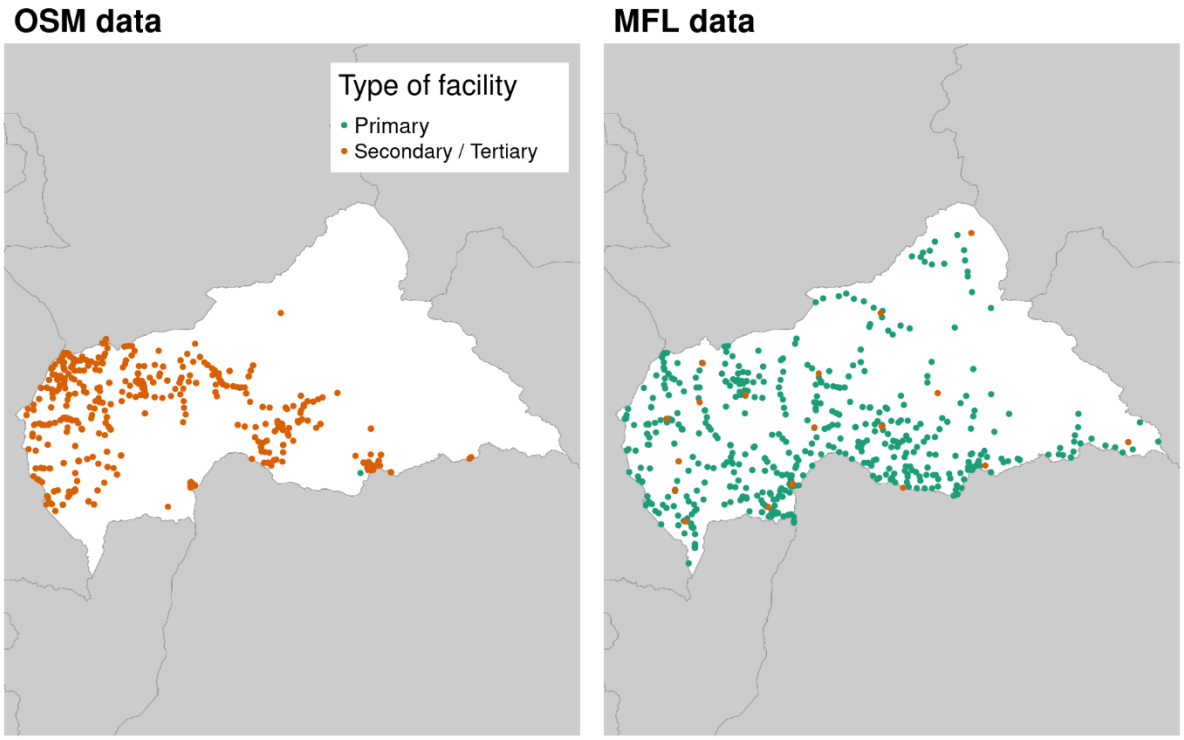


Figure S106. Location of healthcare facilities in OSM and MFL data for Chad

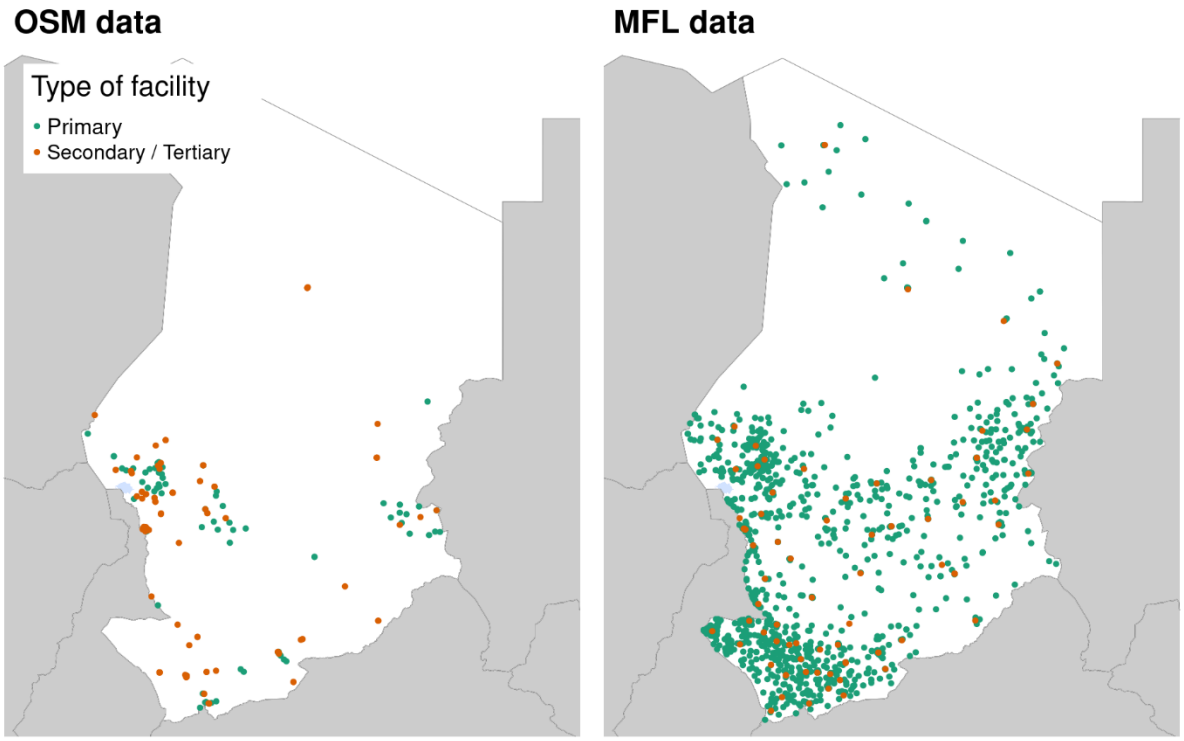


Figure S107. Location of healthcare facilities in OSM and MFL data for Djibouti

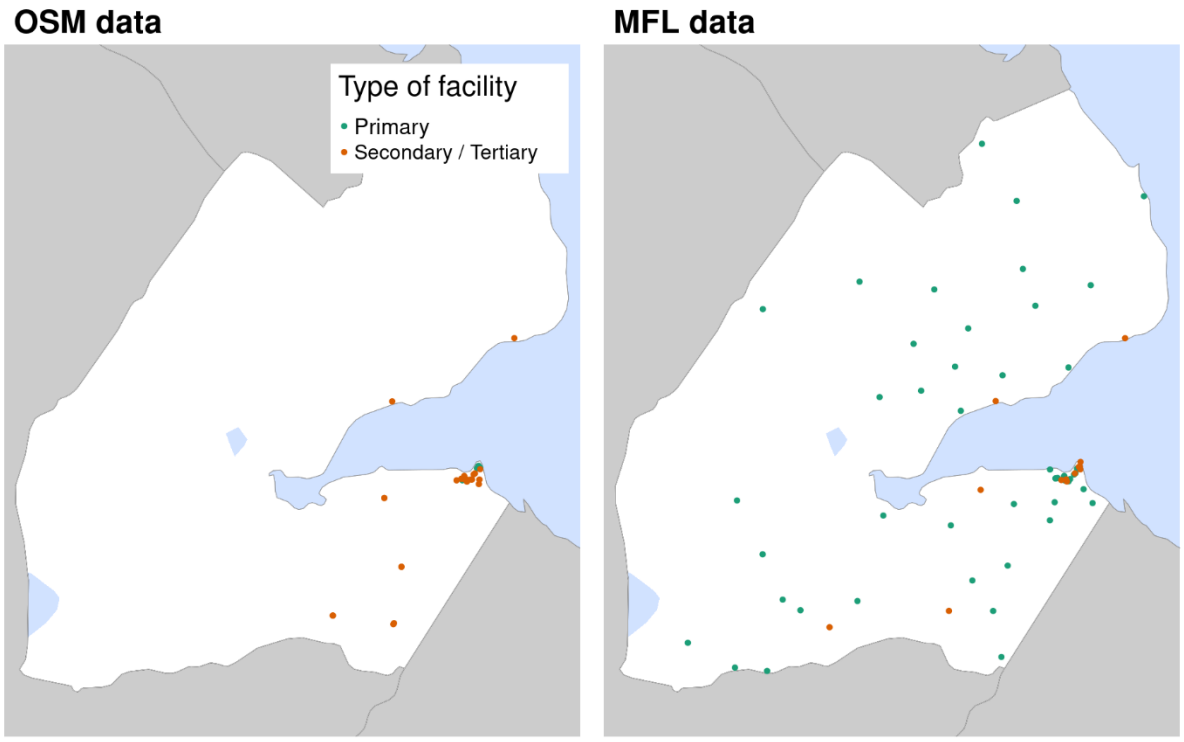


Figure S108. Location of healthcare facilities in OSM and MFL data for DRC

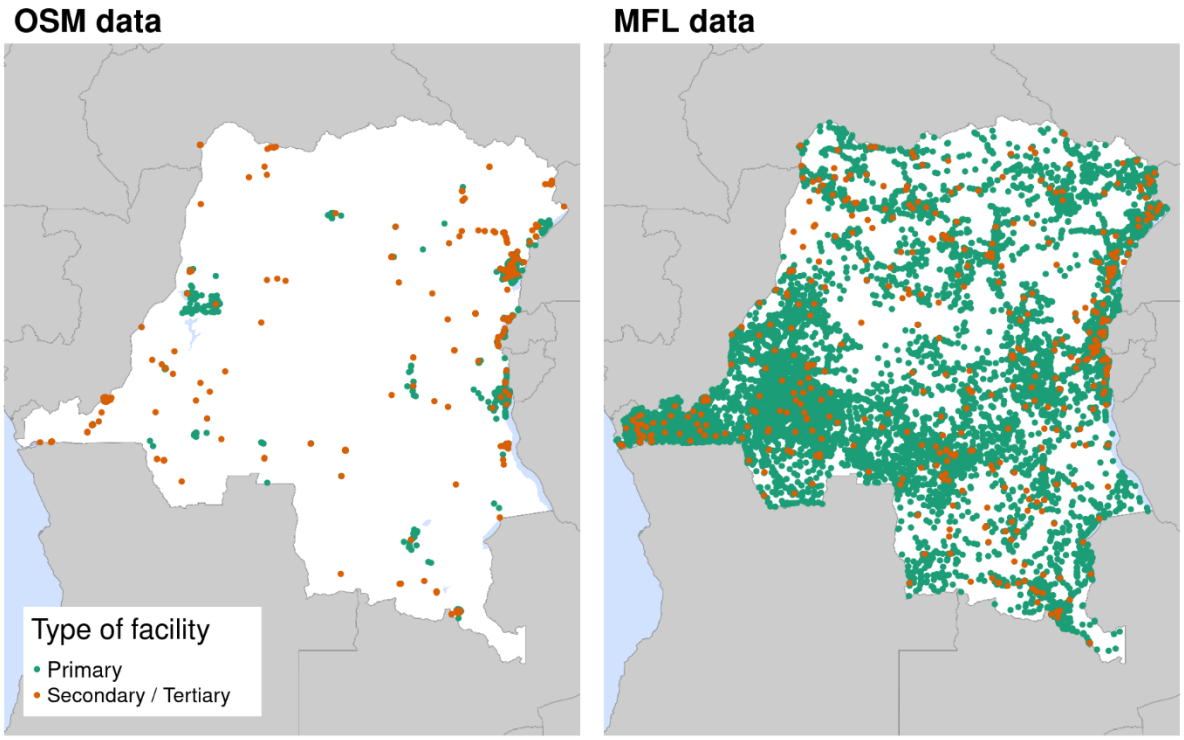


Figure S109. Location of healthcare facilities in OSM and MFL data for Equatorial Guinea

Figure S110. Location of healthcare facilities in OSM and MFL data for Eritrea

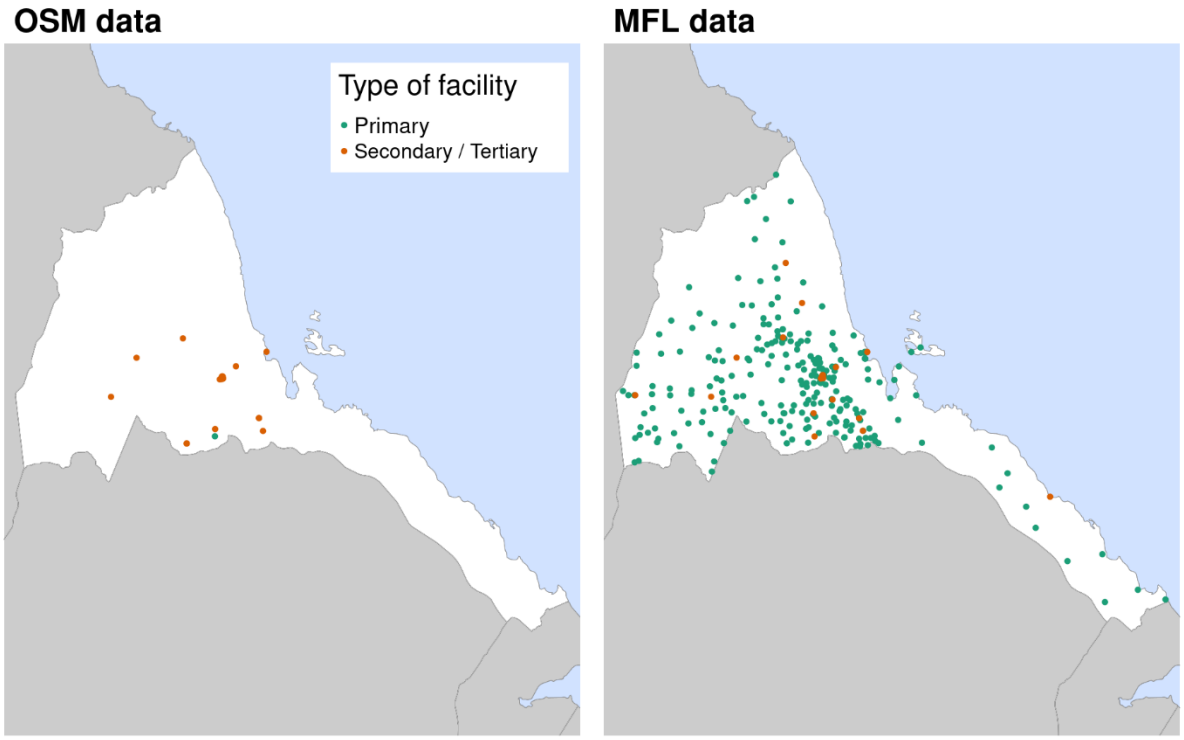


Figure S111. Location of healthcare facilities in OSM and MFL data for eSwatini

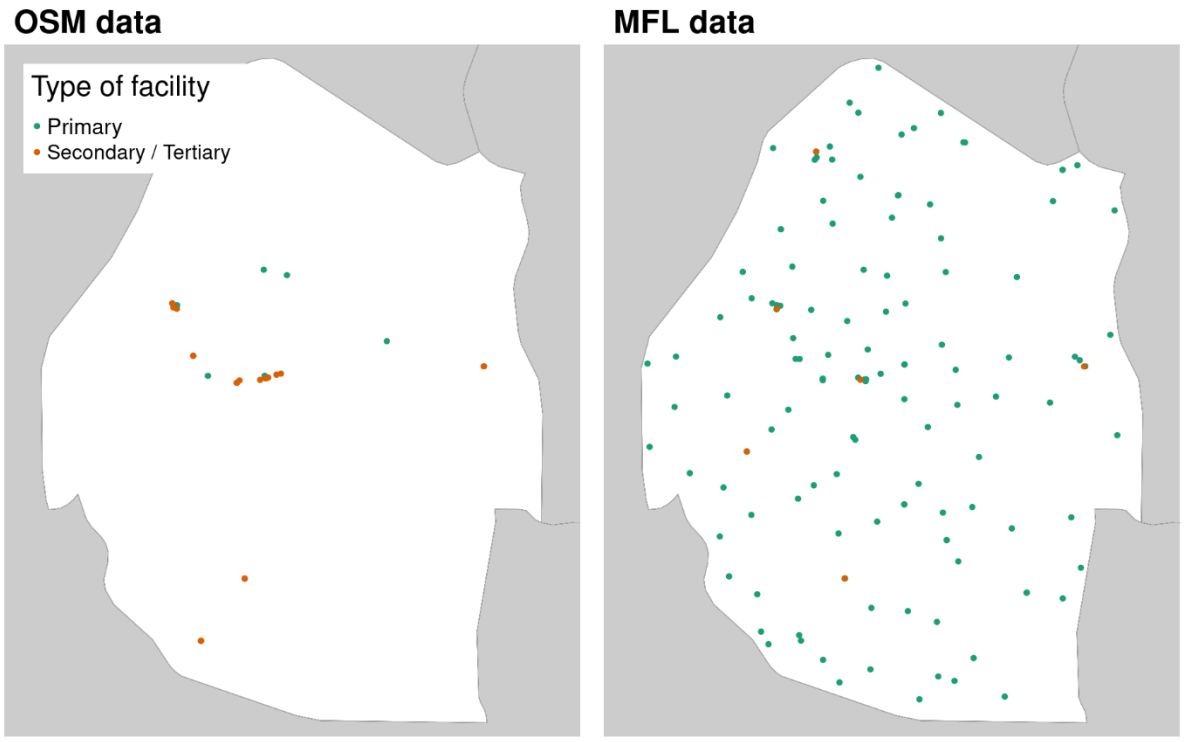


Figure S112. Location of healthcare facilities in OSM and MFL data for Ethiopia

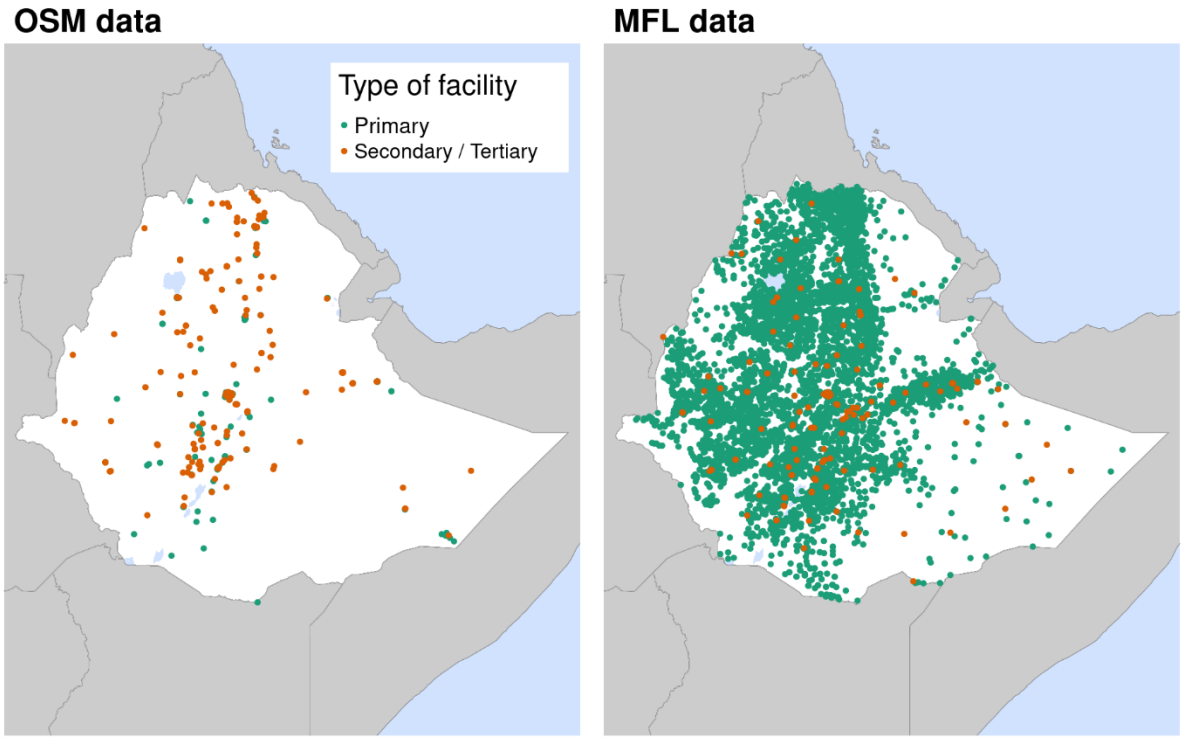


Figure S113. Location of healthcare facilities in OSM and MFL data for Gabon

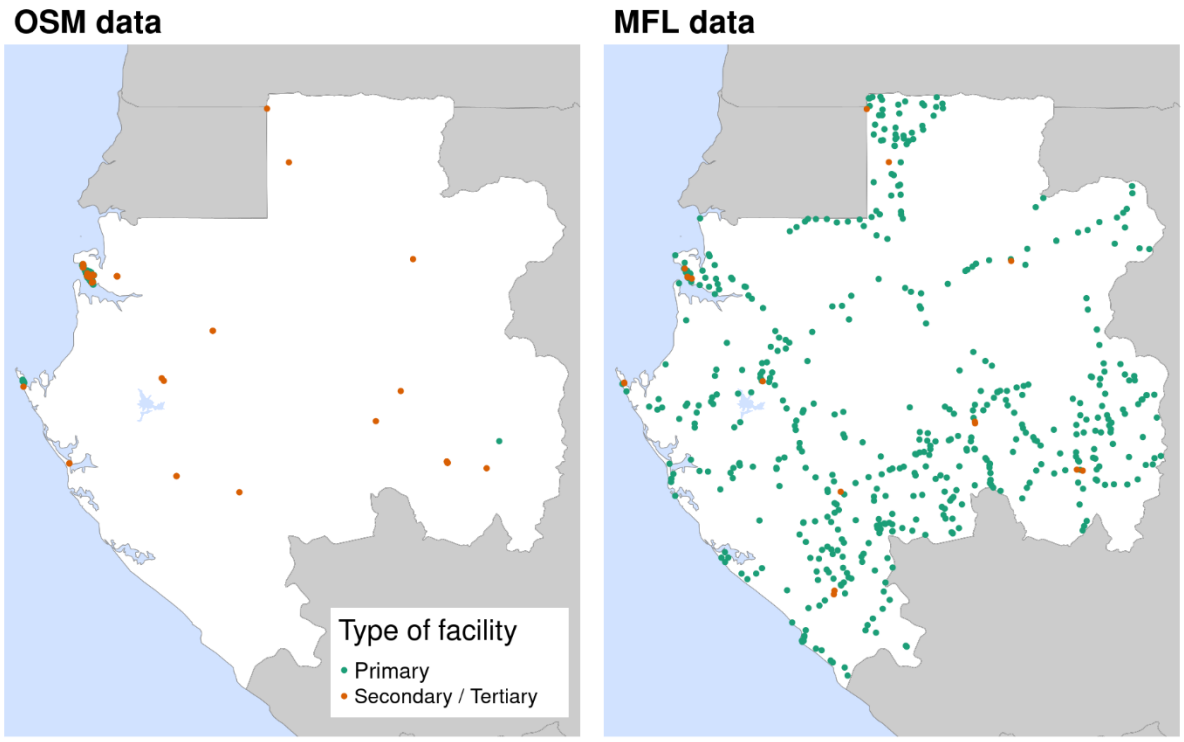


Figure S114. Location of healthcare facilities in OSM and MFL data for Ghana

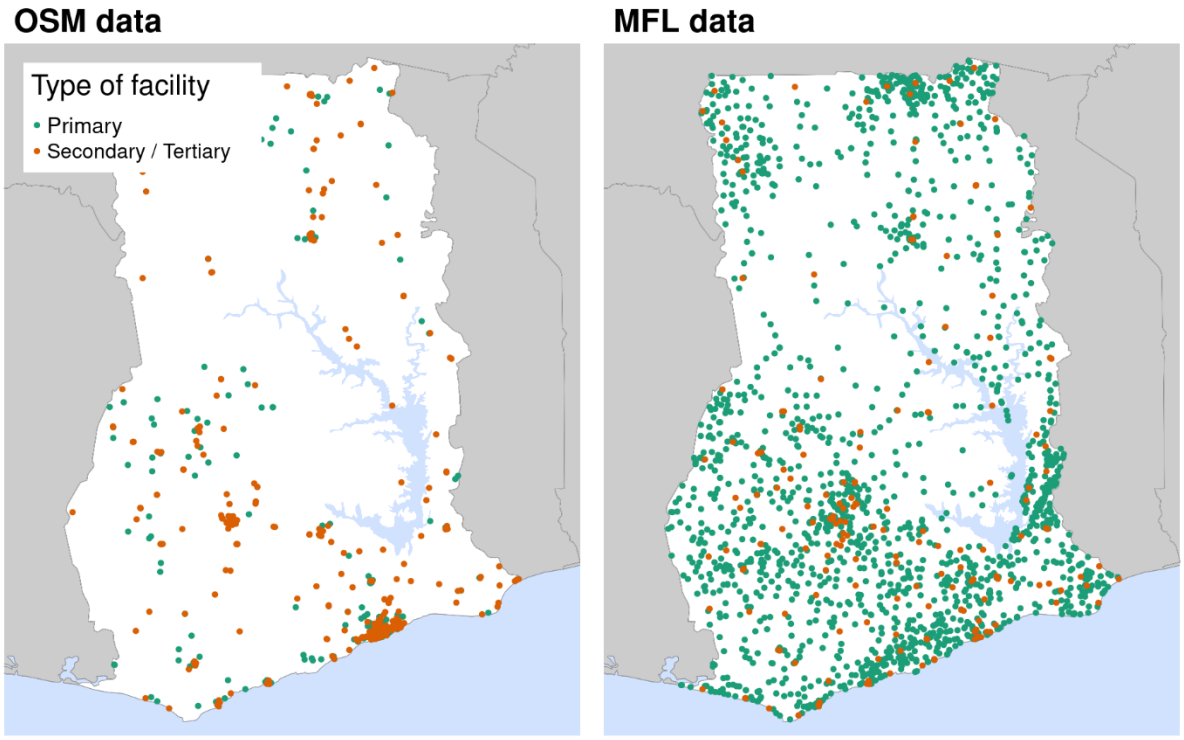


Figure S115. Location of healthcare facilities in OSM and MFL data for Guinea

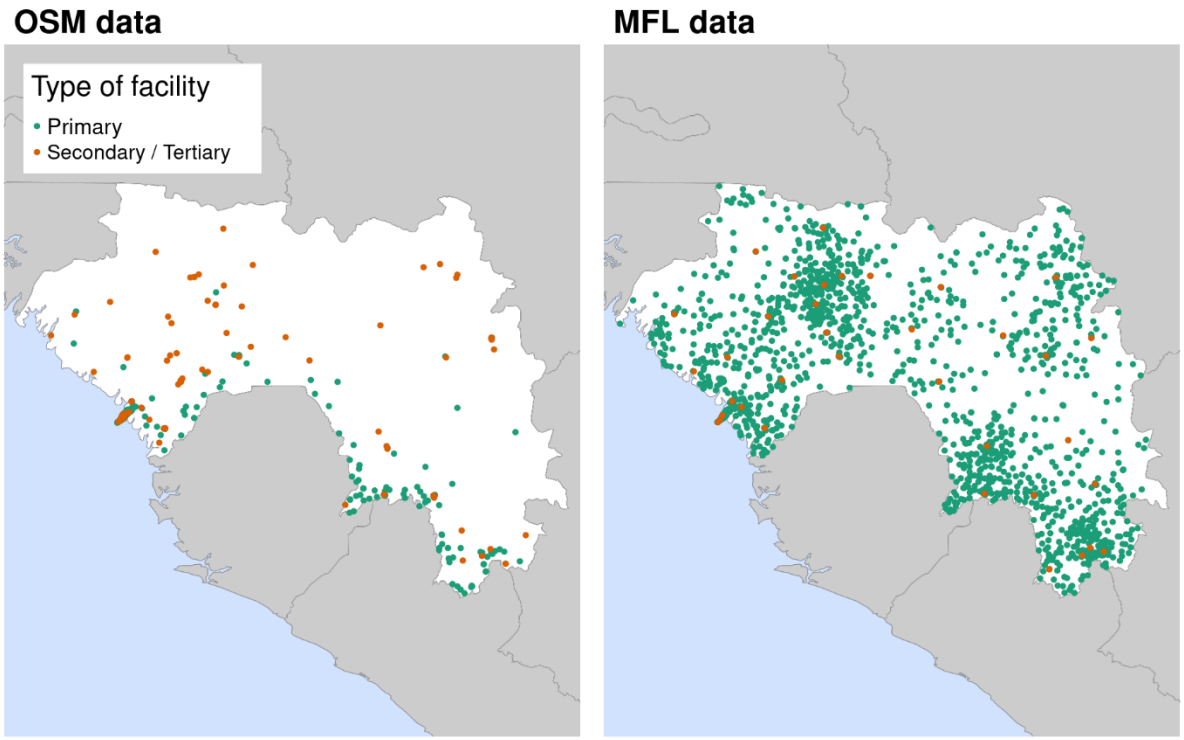


Figure S116. Location of healthcare facilities in OSM and MFL data for Guinea-Bissau

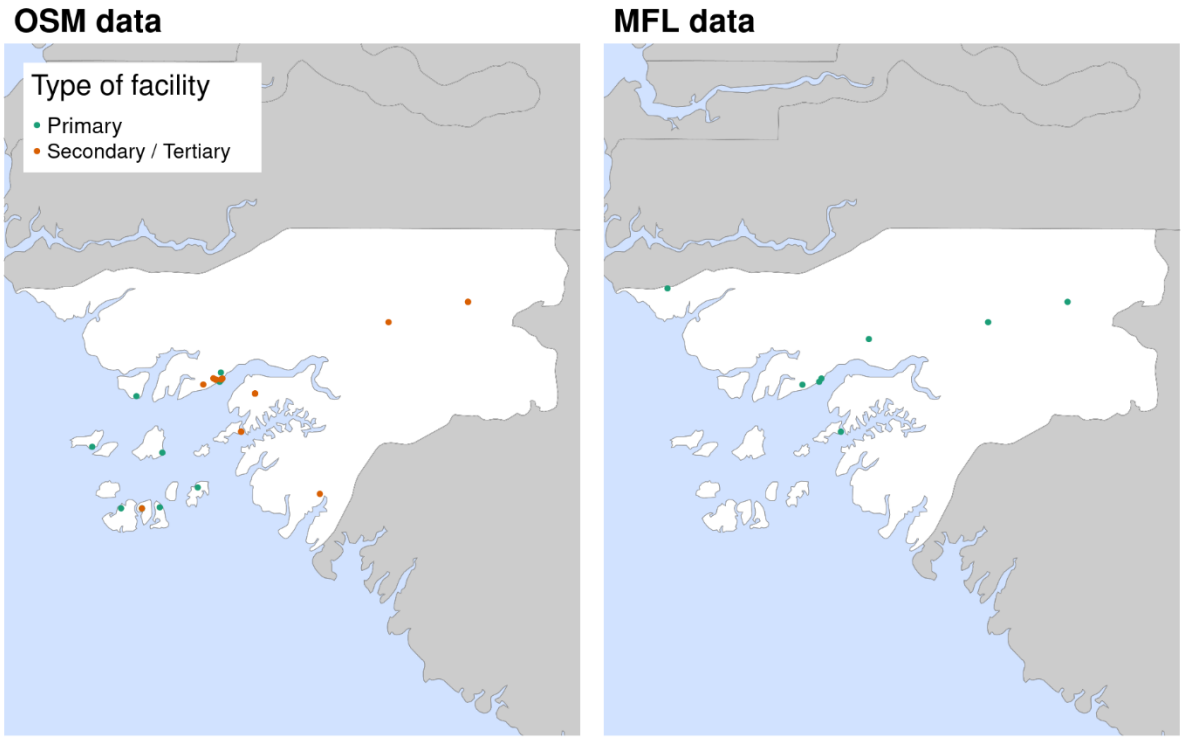


Figure S117. Location of healthcare facilities in OSM and MFL data for Ivory Coast

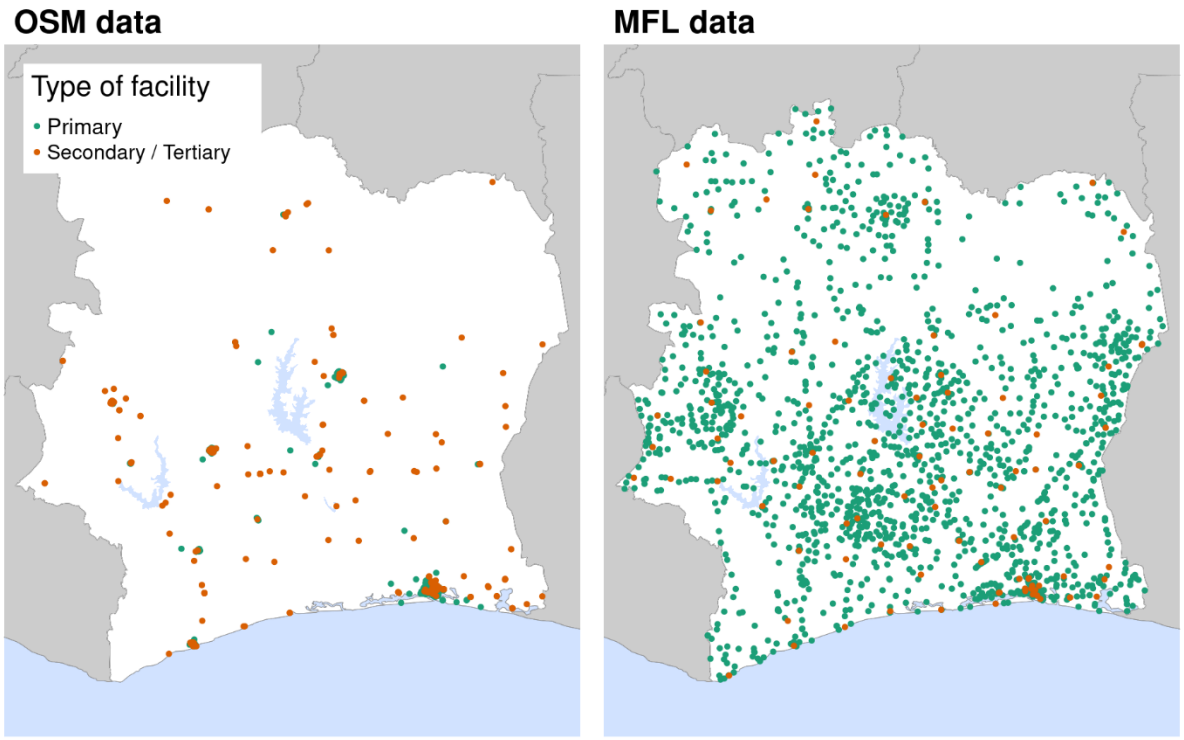


Figure S118. Location of healthcare facilities in OSM and MFL data for Kenya

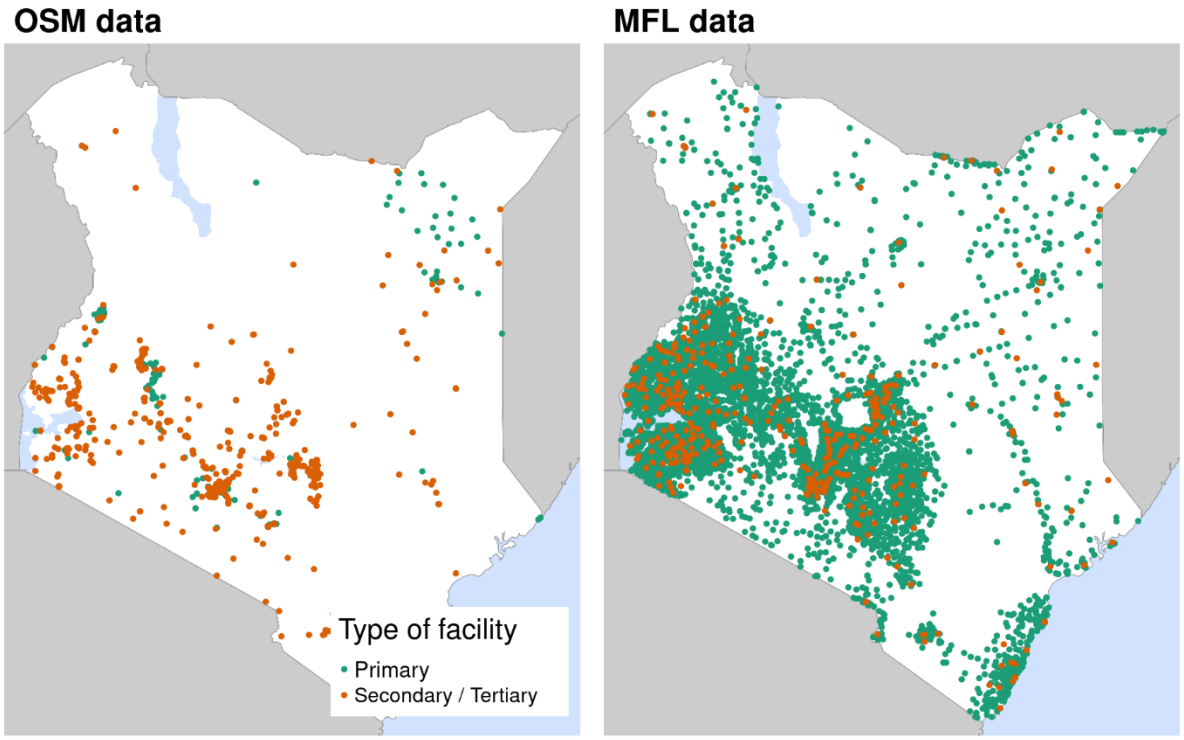


Figure S119. Location of healthcare facilities in OSM and MFL data for Lesotho

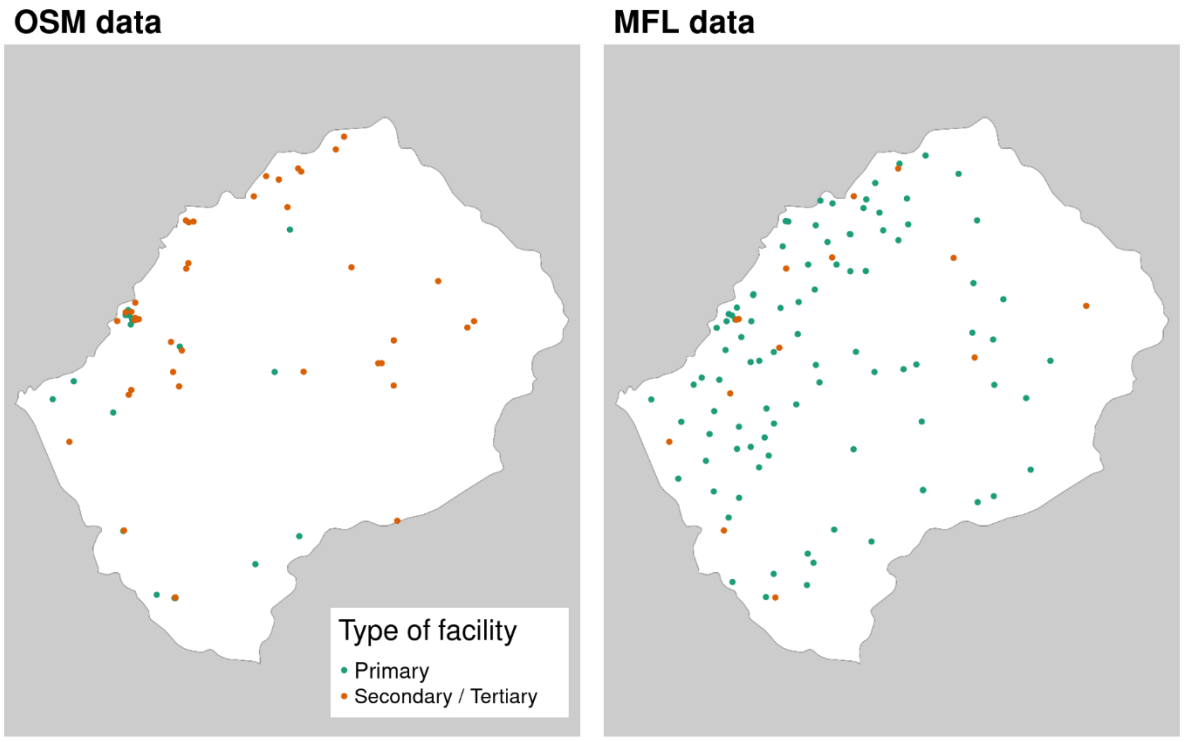


Figure S120. Location of healthcare facilities in OSM and MFL data for Liberia

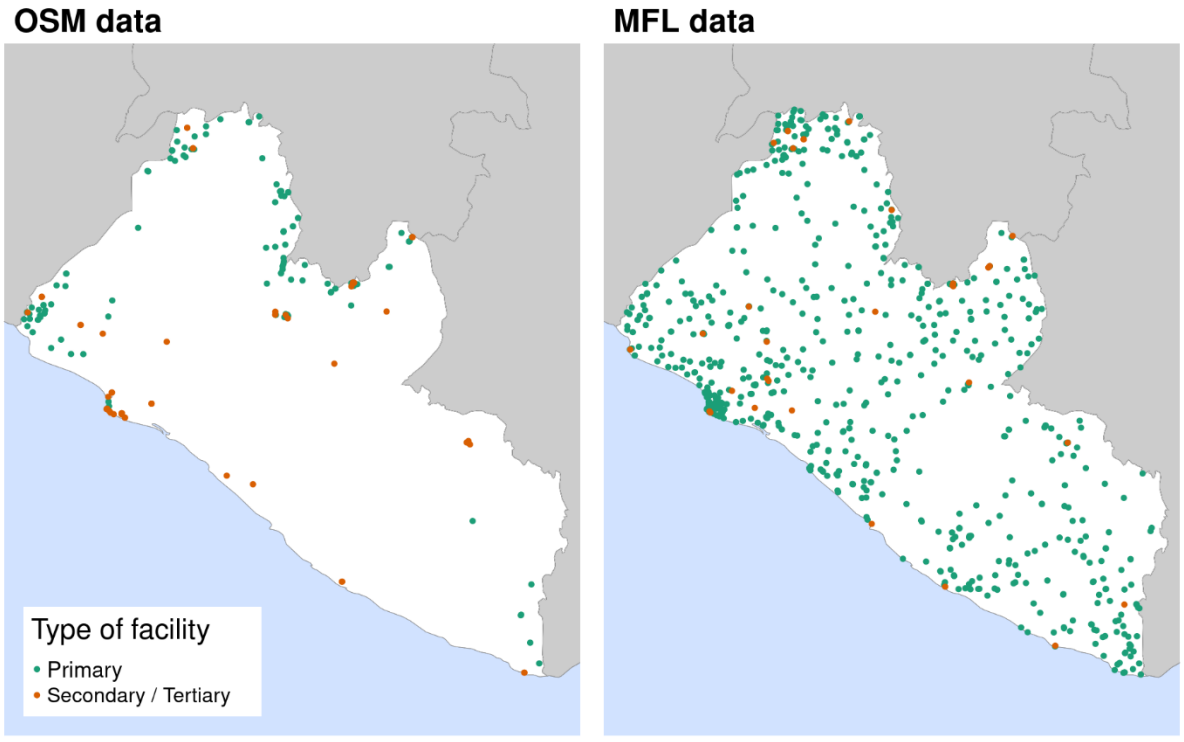


Figure S121. Location of healthcare facilities in OSM and MFL data for Madagascar

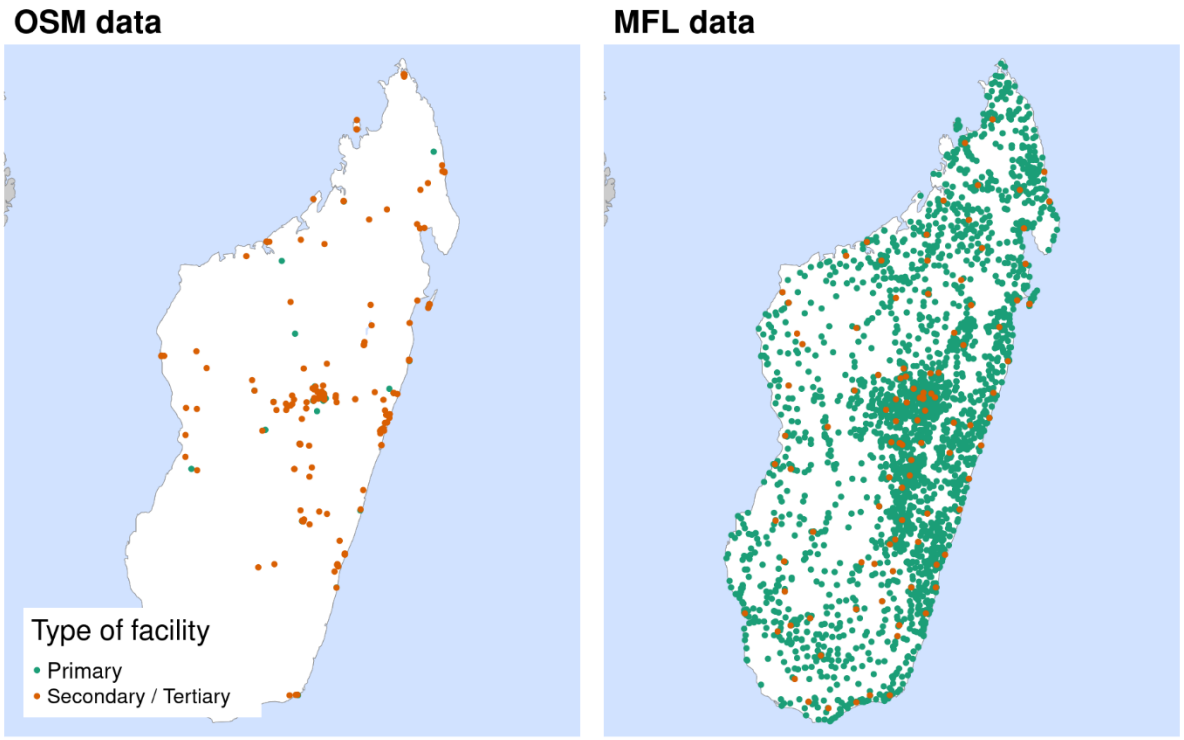


Figure S122. Location of healthcare facilities in OSM and MFL data for Malawi

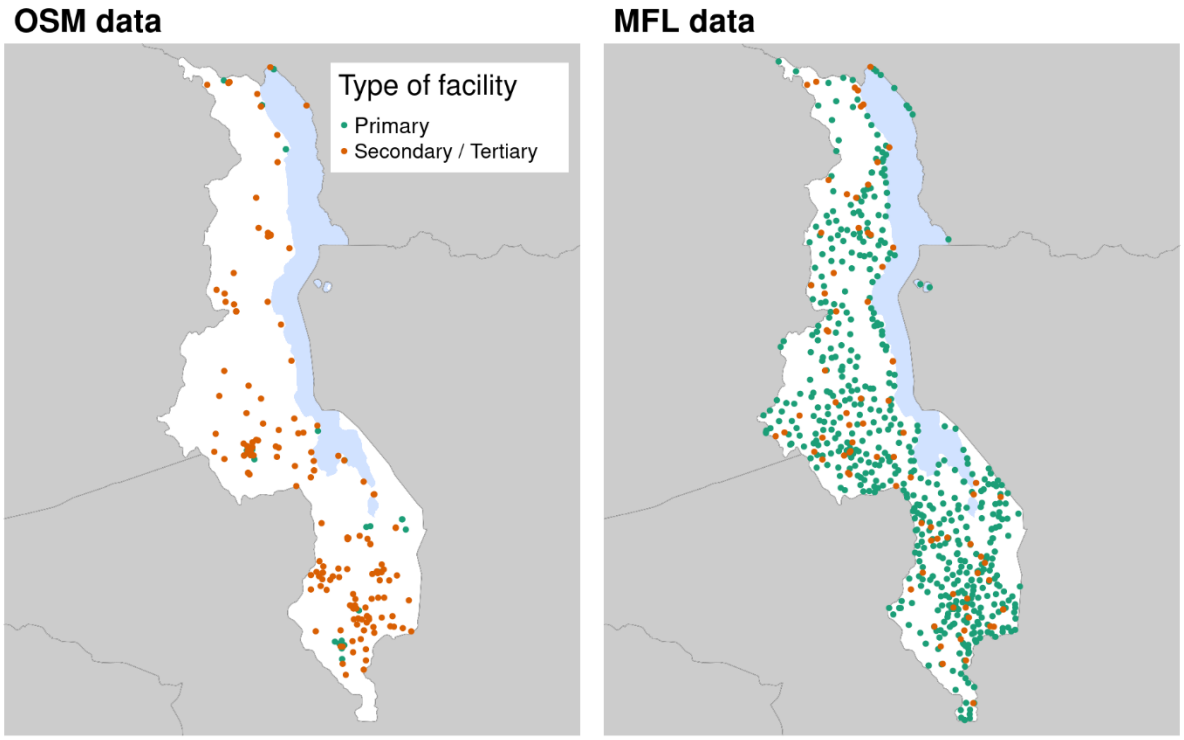


Figure S123. Location of healthcare facilities in OSM and MFL data for Mali

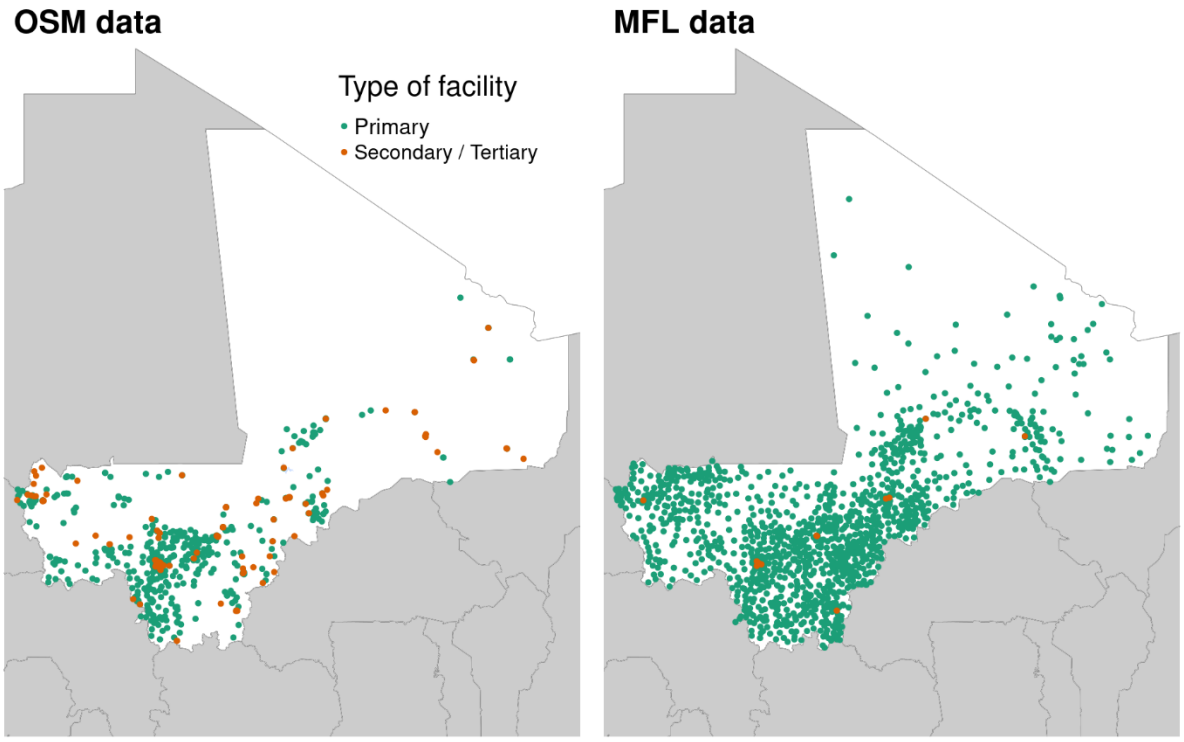


Figure S124. Location of healthcare facilities in OSM and MFL data for Mauritania

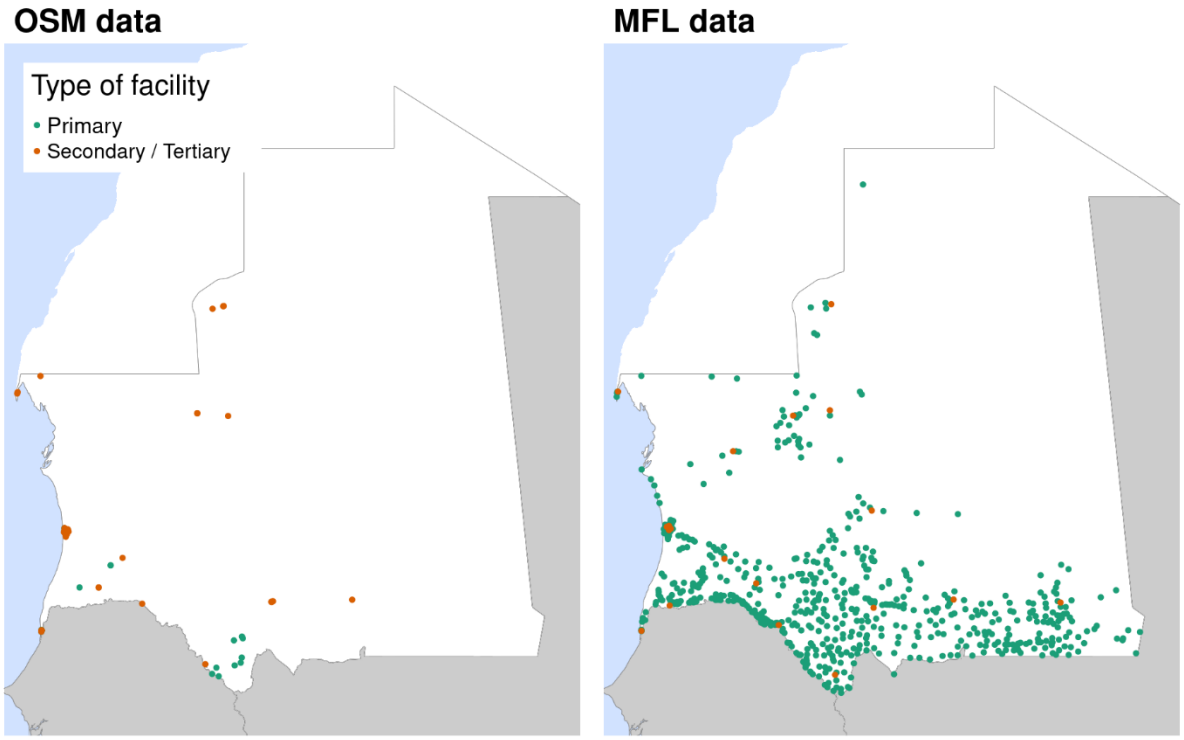


Figure S125. Location of healthcare facilities in OSM and MFL data for Mozambique

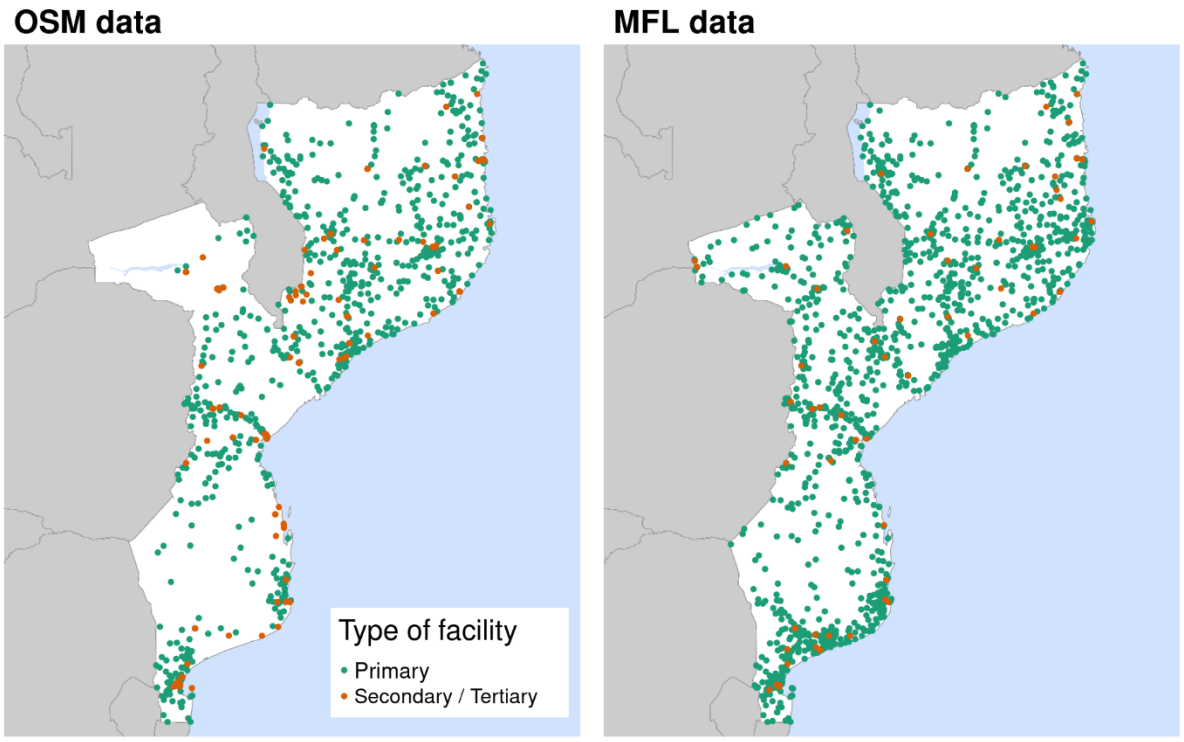


Figure S126. Location of healthcare facilities in OSM and MFL data for Namibia

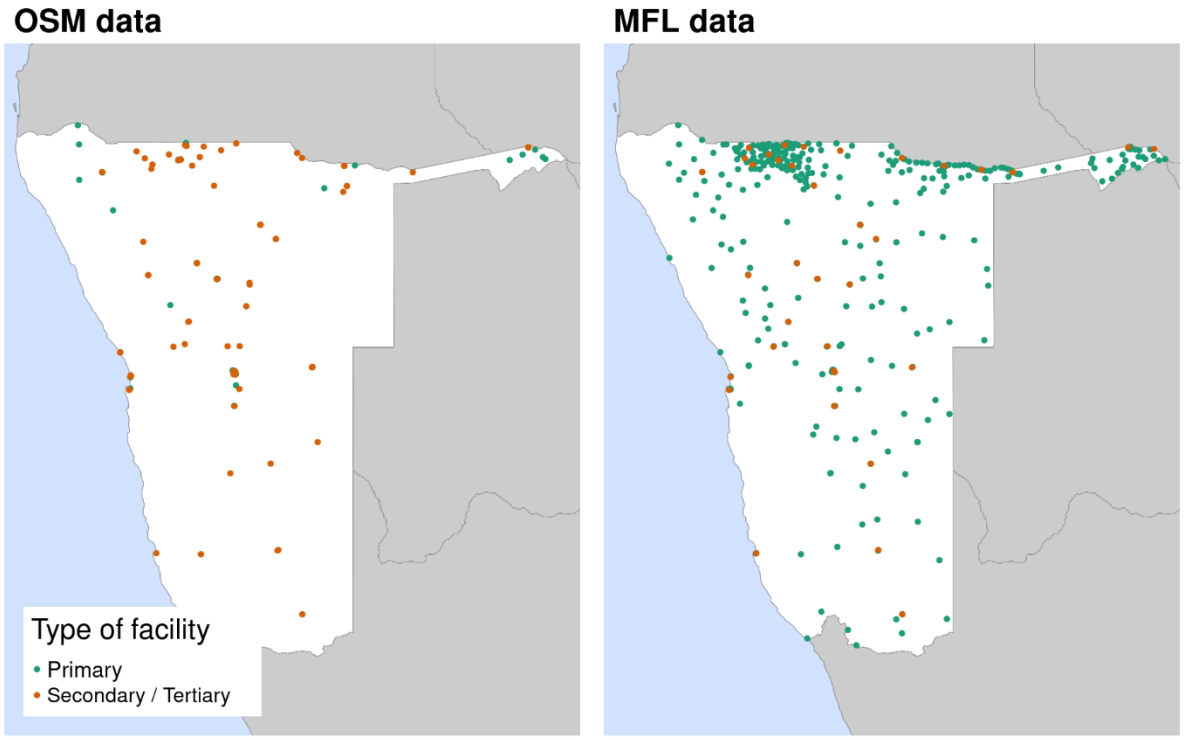


Figure S127. Location of healthcare facilities in OSM and MFL data for Niger

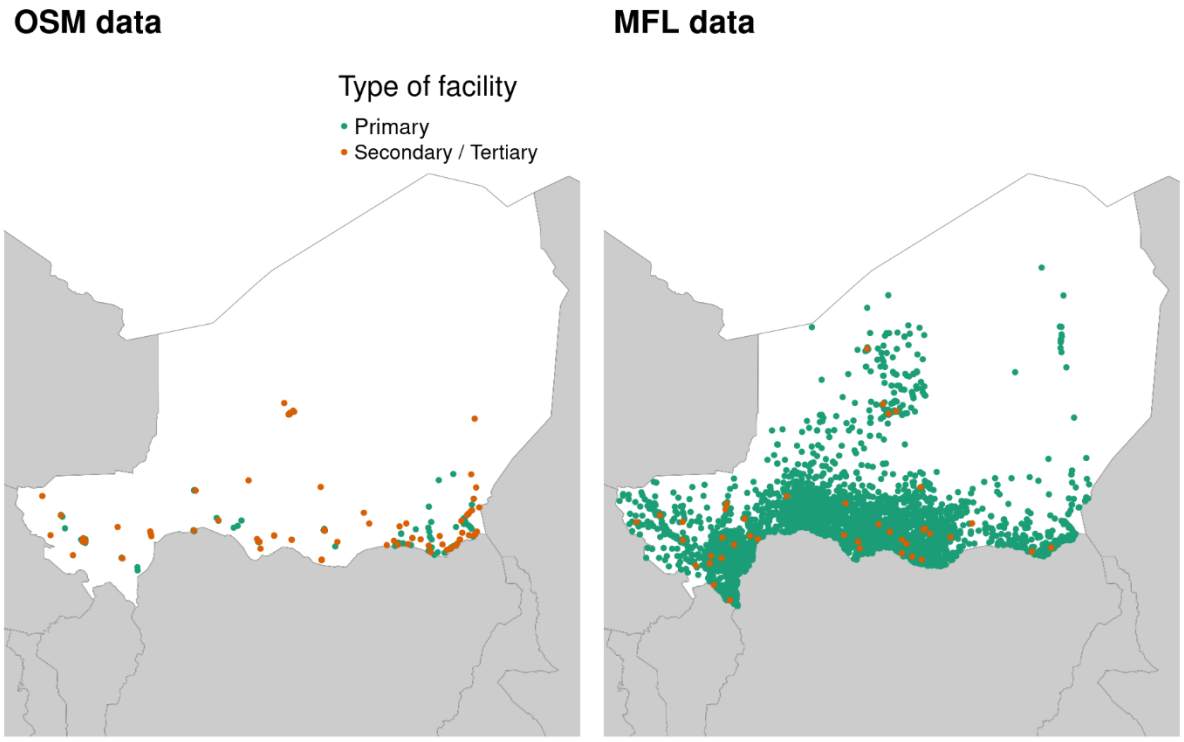


Figure S128. Location of healthcare facilities in OSM and MFL data for Nigeria

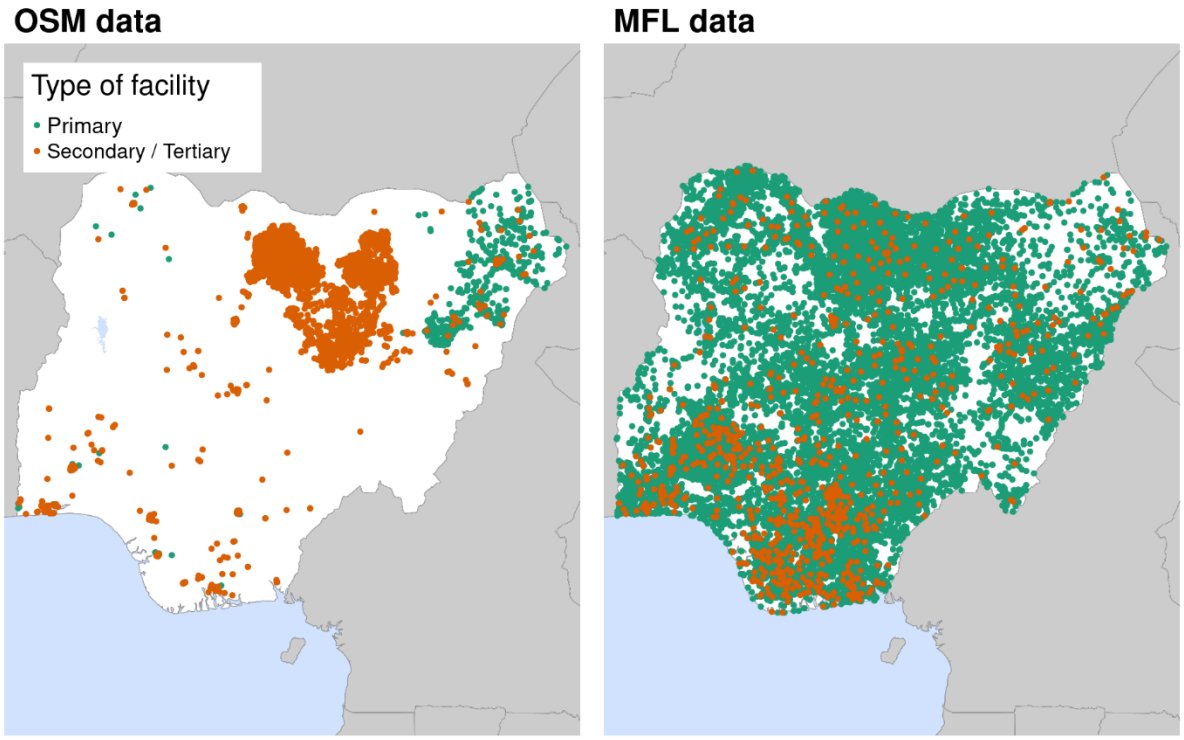


Figure S129. Location of healthcare facilities in OSM and MFL data for Republic of the Congo

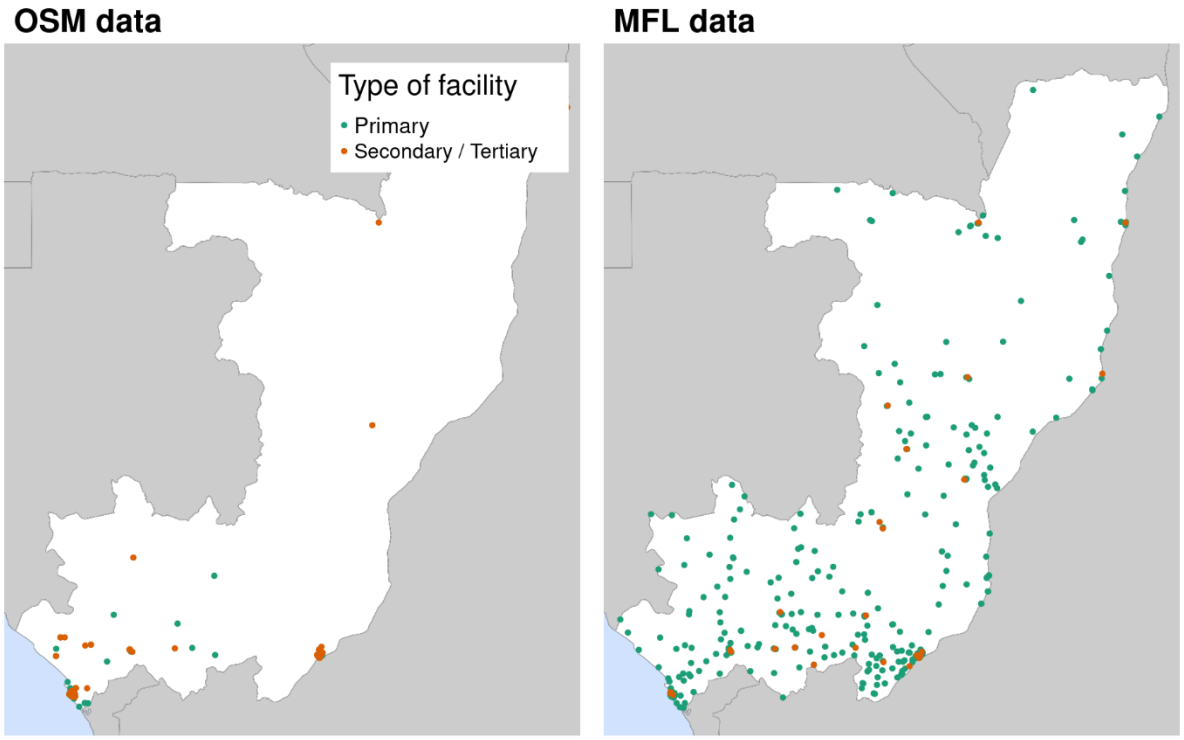


Figure S130. Location of healthcare facilities in OSM and MFL data for Rwanda

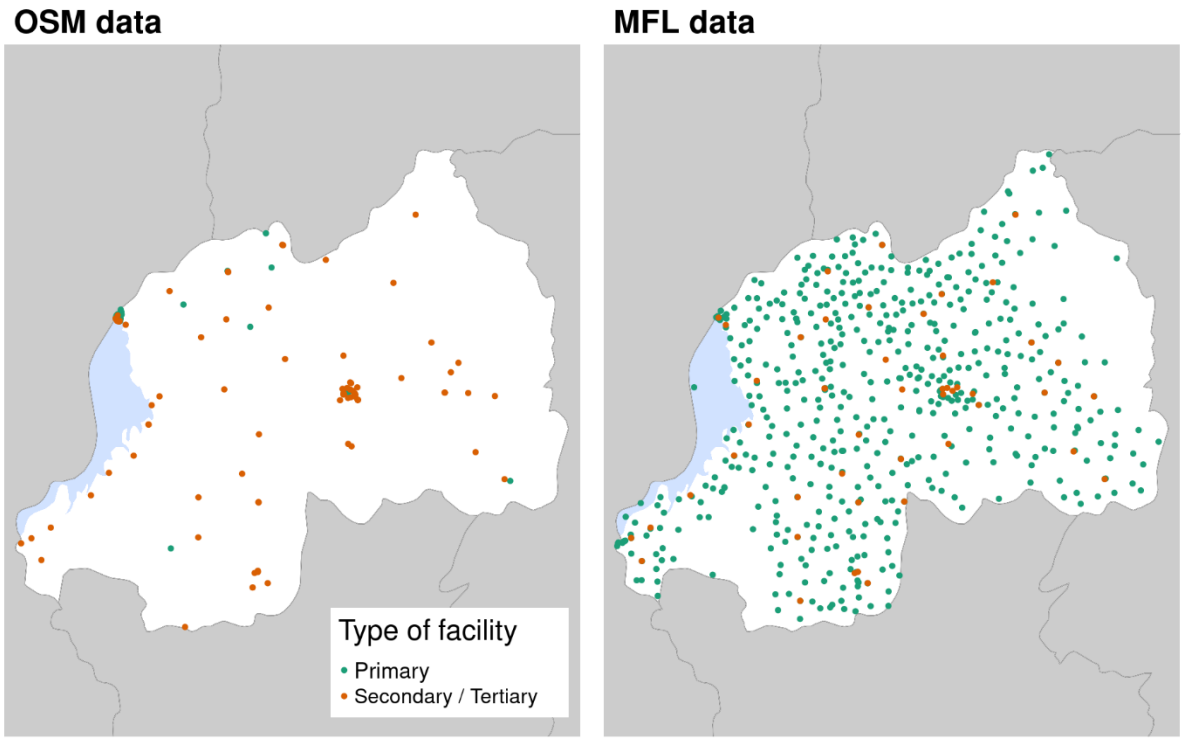


Figure S131. Location of healthcare facilities in OSM and MFL data for Senegal

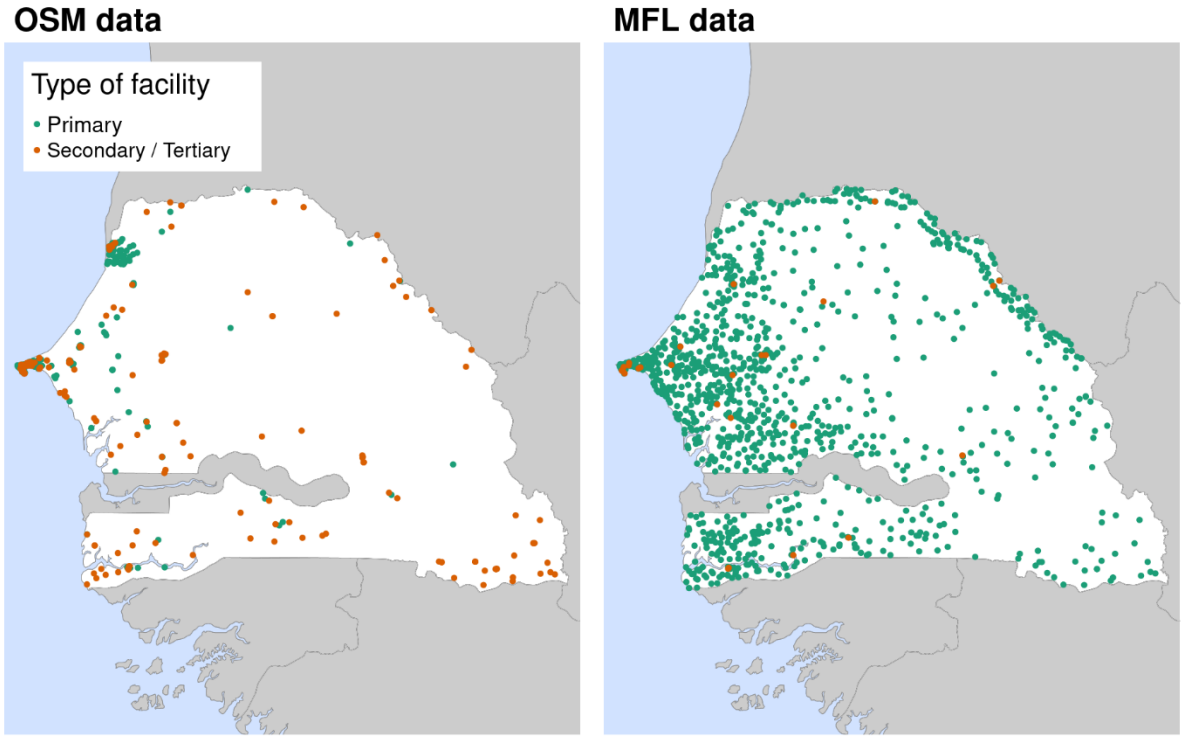


Figure S132. Location of healthcare facilities in OSM and MFL data for Sierra Leone

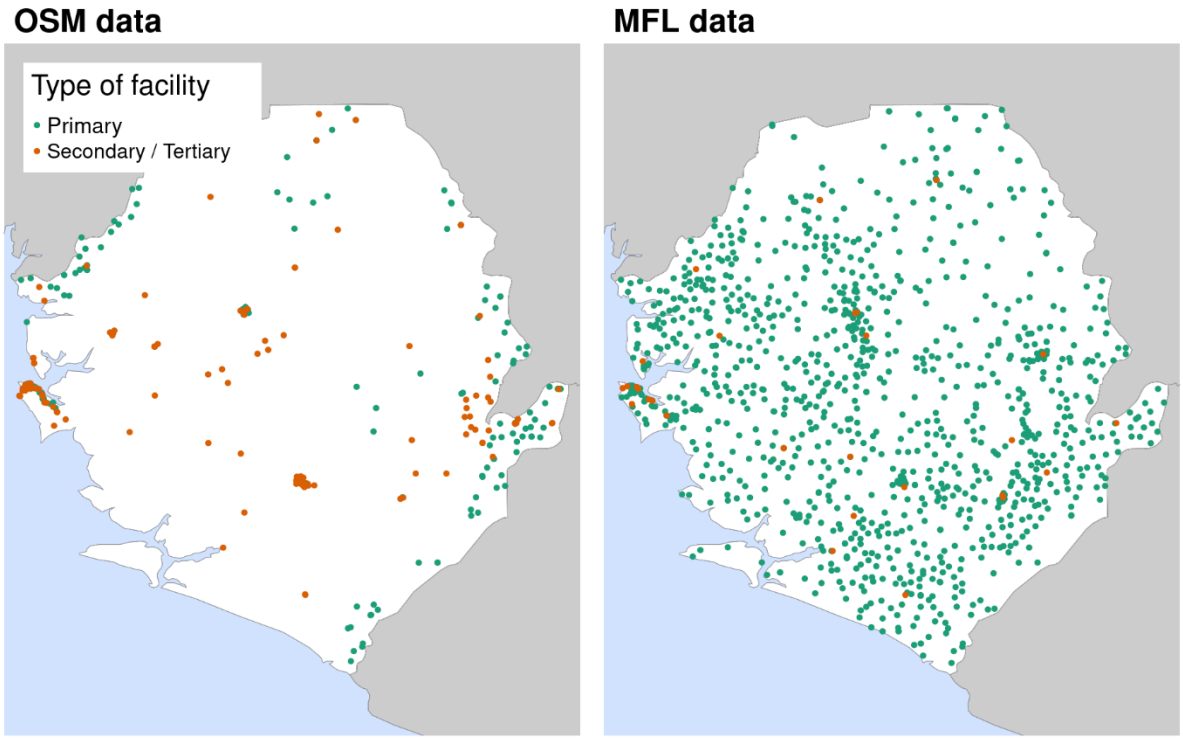


Figure S133. Location of healthcare facilities in OSM and MFL data for Somalia

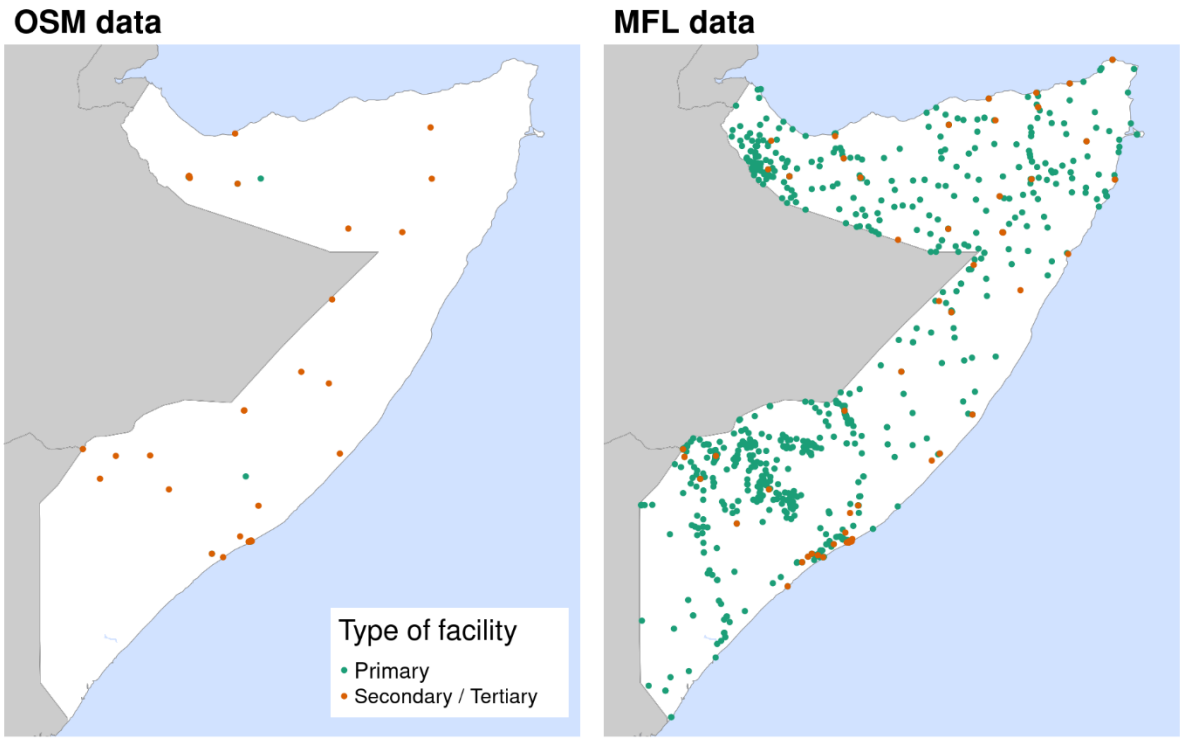


Figure S134. Location of healthcare facilities in OSM and MFL data for South Africa

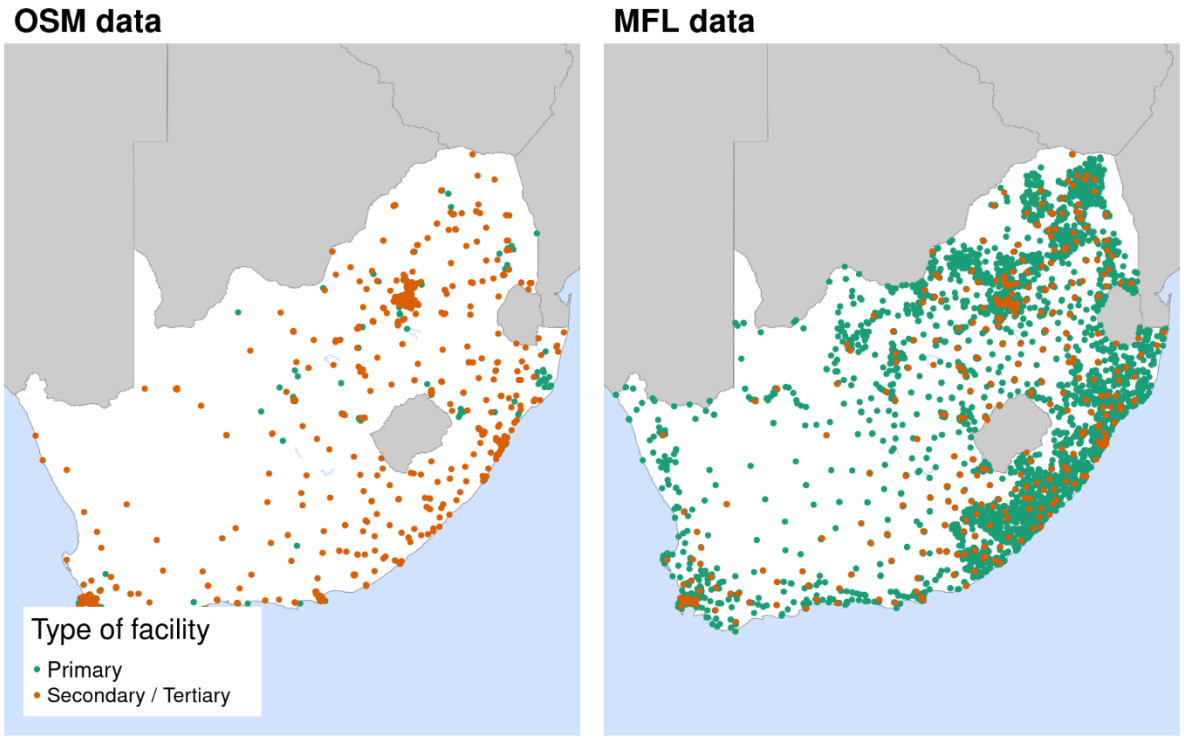


Figure S135. Location of healthcare facilities in OSM and MFL data for South Sudan

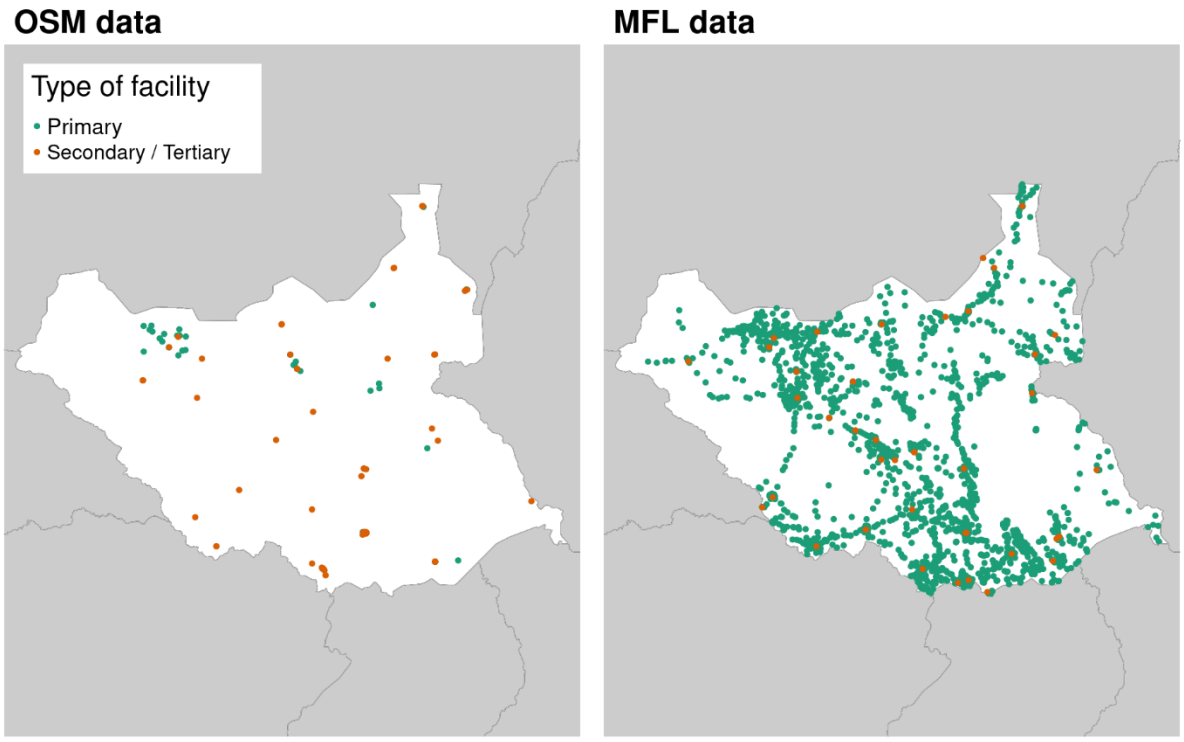


Figure S136. Location of healthcare facilities in OSM and MFL data for Sudan

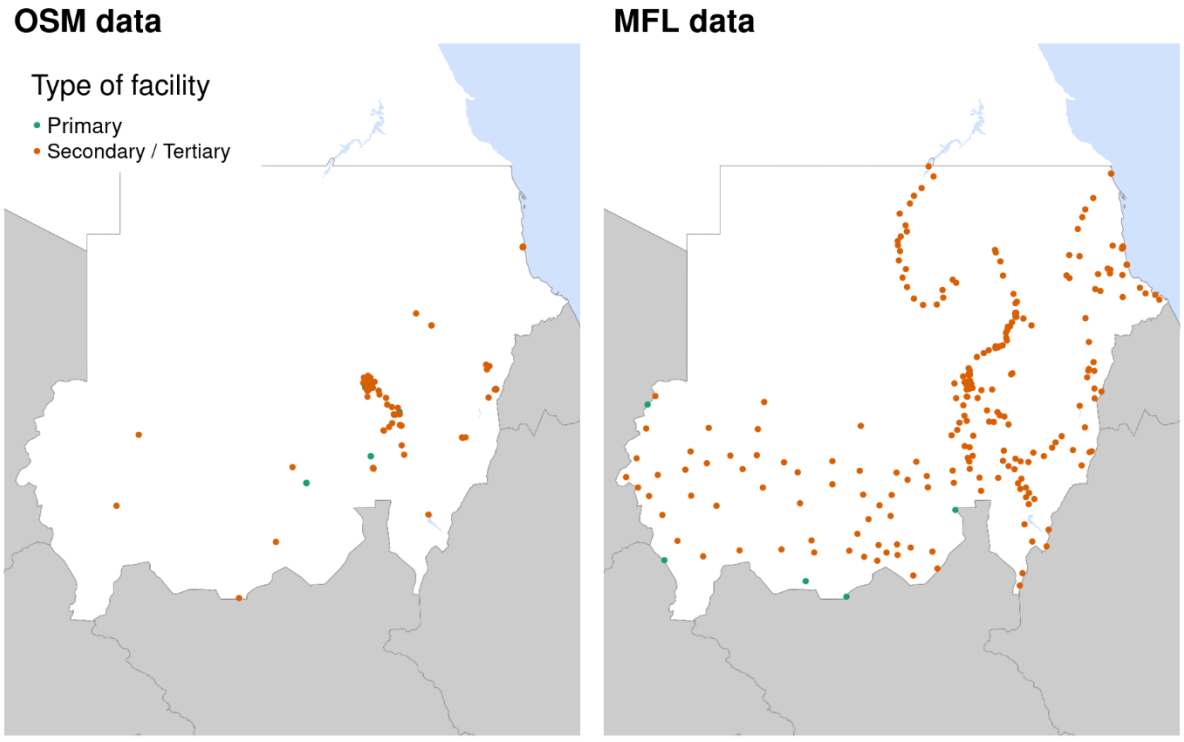


Figure S137. Location of healthcare facilities in OSM and MFL data for Tanzania

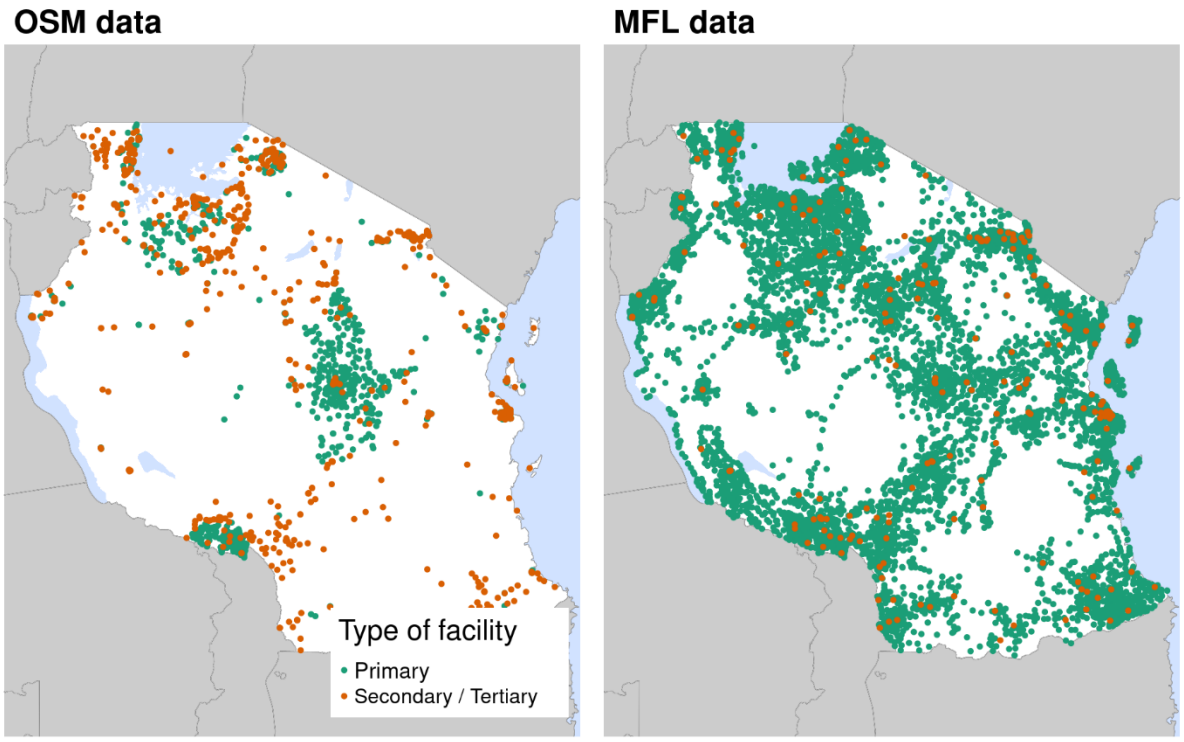


Figure S138. Location of healthcare facilities in OSM and MFL data for The Gambia

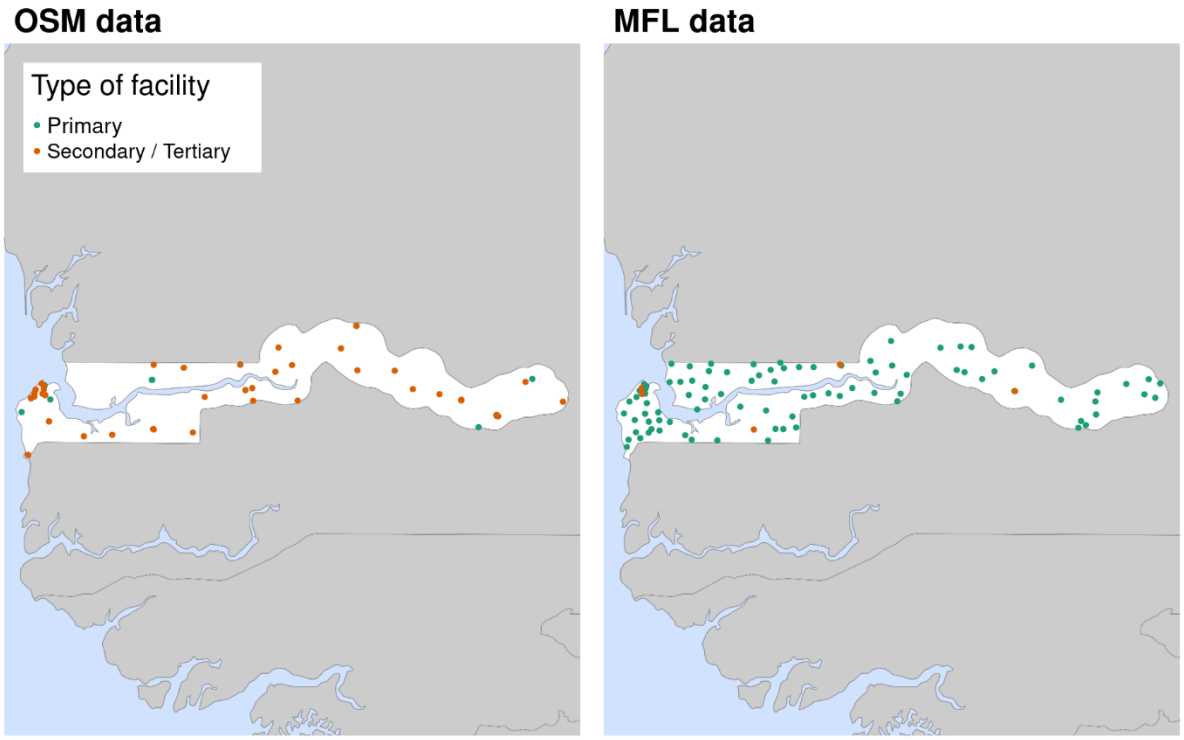


Figure S139. Location of healthcare facilities in OSM and MFL data for Togo

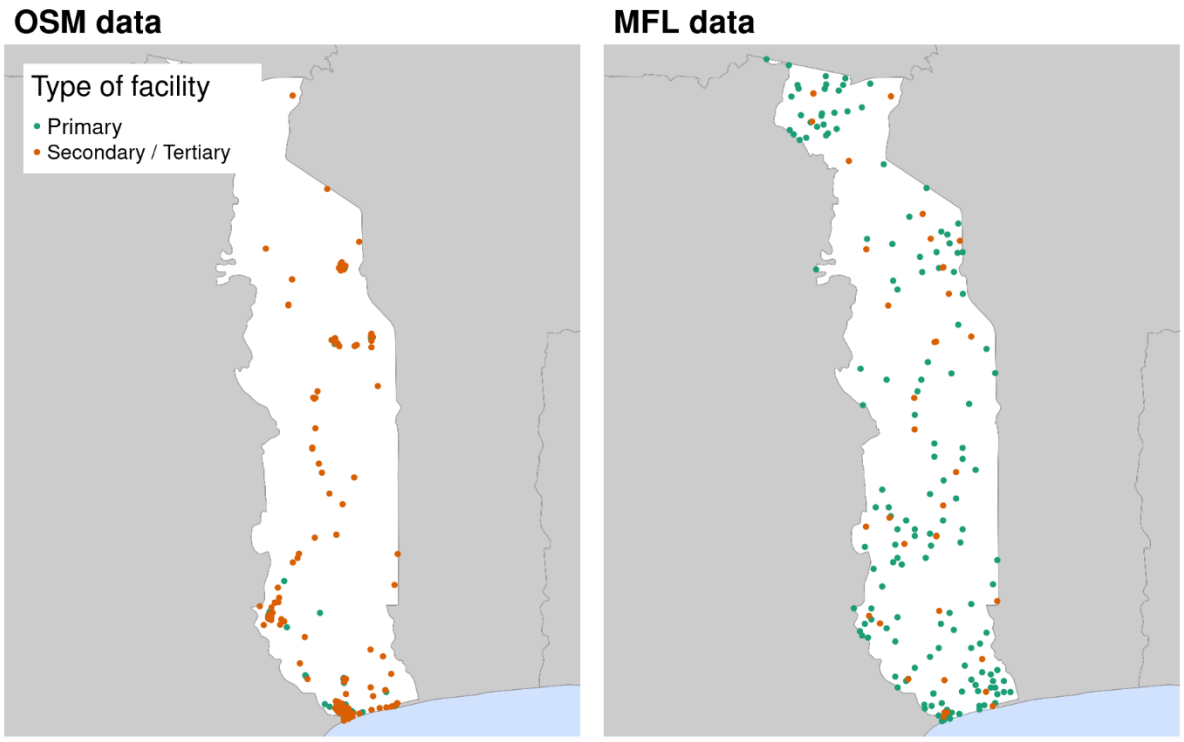


Figure S140. Location of healthcare facilities in OSM and MFL data for Uganda

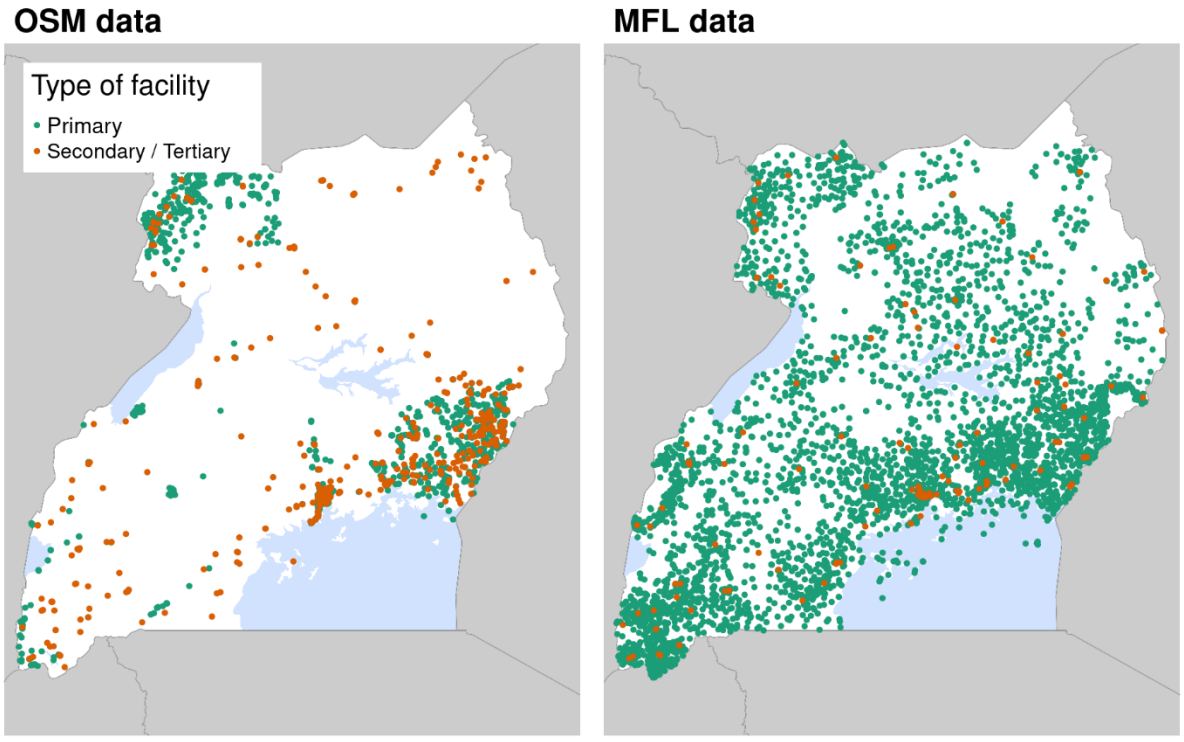


Figure S141. Location of healthcare facilities in OSM and MFL data for Zambia

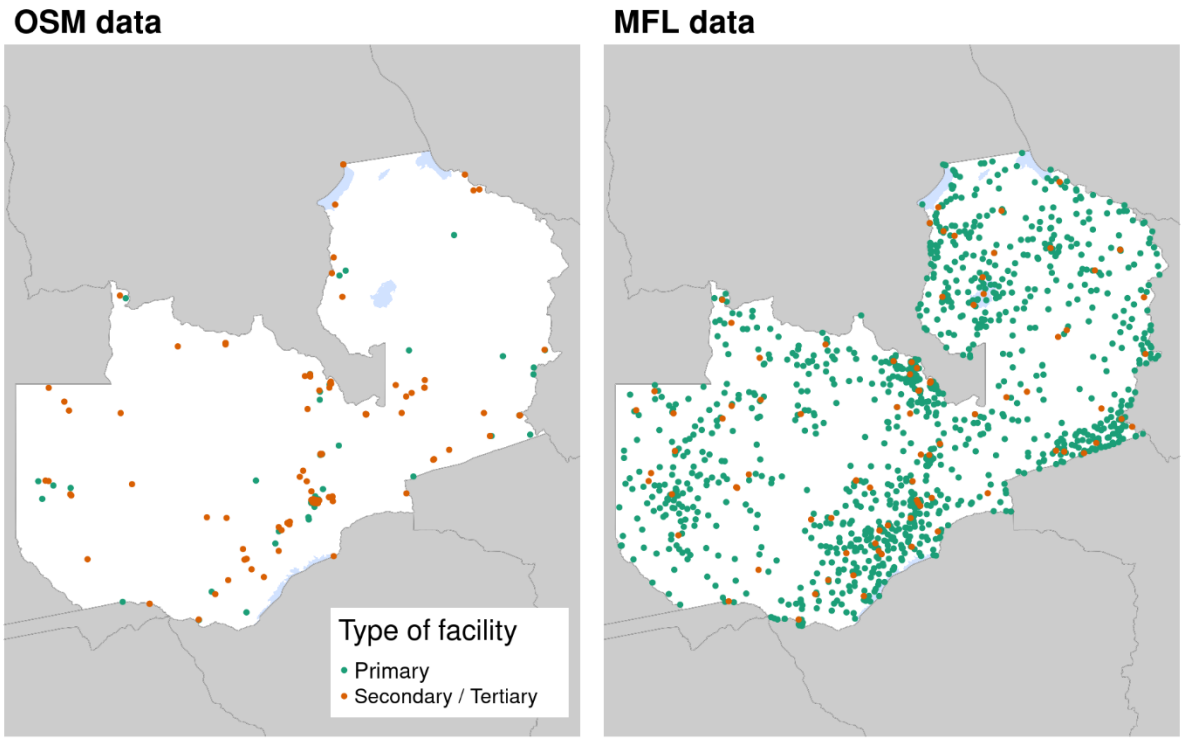


Figure S142. Location of healthcare facilities in OSM and MFL data for Zimbabwe

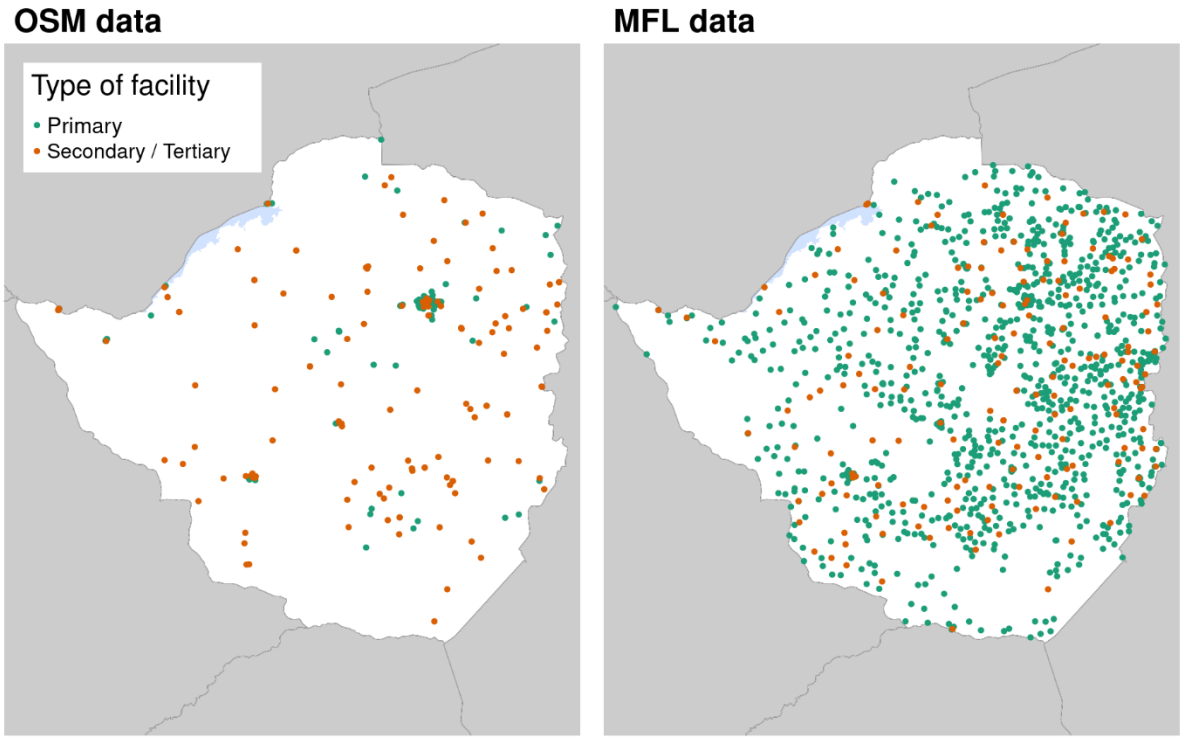


Table S1. Overlap of the GPS location of healthcare facilities with a building footprint and settlement locations in Bing satellite imagery

Dataset	Facility type	Facilities examined	Overlap[1] with building footprint		No overlap but near to a settlement[2]		No overlap and not near to a settlement[2]	
			N	*%*	*N*	*%*	*N*	*%*
OSM	Primary care	80	66	82.5%	13	16.3%	1	1.3%
OSM	Hospital	80	68	85.0%	10	12.5%	2	2.5%
MFL	Primary care	80[3]	47	60.3%	20	25.6%	11	14.1%
MFL	Hospital	80[3]	53	68.0%	16	20.1%	9	11.5%
Total	-	*320*	*234*	*74.1%*	*59*	*18.7%*	*23*	*7.3%*

[1] Overlap with a building footprint was defined as a building being visible within a five meter radius around the GPS location of the healthcare facility.
[2] "Near to a settlement" was defined as being within 1,000m of a settlement.
[3] We were unable to conduct this validity exercise for four healthcare facilities (two primary care facilities and two hospitals in MFL data) because the satellite image was either covered by clouds or of insufficient resolution.

Table S2. Travel time estimates from OpenRouteService versus Google Maps for each of 40 randomly selected locations in sub-Saharan Africa

Any healthcare facility		Hospitals	
Google Maps	***ORS***	***Google Maps***	***ORS***
No. of minutes	*No. of minutes*	*No. of minutes*	*No. of minutes*
25	23	9	16
91	105	18	18
NA	47	NA	24
50	97	21	44
NA	268	4	18
12	11	12	11
78	79	23	20
25	27	7	12
115	102	6	8
25	68	16	32
21	28	1	3
34	55	21	42
43	37	7	12
12	19	5	14
54	59	54	59
26	24	10	8
34	36	15	23
23	32	19	26
30	31	30	31
NA	330	NA	171
65	125	18	45
82	91	43	42
154	111	61	78
39	72	32	53
NA	16	NA	16
51	72	14	24
NA	421	NA	74
28	23	14	12
NA	44	NA	28
26	22	4	6
121	132	93	112
104	66	61	37
10	19	8	9
32	52	18	36
58	38	58	38

41	59	27	38
84	77	4	6
15	19	15	19
147	144	16	18
38	42	31	19
1793	3123	795	1302

Abbreviations: ORS=OpenRouteService
NA = Google Maps did not detect any road near to this location and did, thus, not provide a travel time estimate.

Table S3. Jaccard Index for OSM primary care facilities and MFL primary care facilities[1]

Country[2]	Radius	
	500m	***1000m***
DRC	0.356	1.237
Mozambique	0.354	0.403
Mali	0.320	0.995
Senegal	0.296	0.868
Uganda	0.251	0.716
Republic of the Congo	0.216	0.620
Rwanda	0.199	0.514
Tanzania	0.168	0.356
Djibouti	0.161	0.286
Guinea	0.160	0.408
Gabon	0.153	0.419
Kenya	0.152	0.399
Botswana	0.144	0.420
Ethiopia	0.142	0.483
Burkina Faso	0.133	0.244
Liberia	0.126	0.200
Ivory Coast	0.121	0.422
Cameroon	0.117	0.407
Benin	0.091	0.376
Sierra Leone	0.083	0.138
Ghana	0.073	0.164
Chad	0.069	0.156
Namibia	0.065	0.122
Niger	0.060	0.141
South Africa	0.054	0.120
The Gambia	0.049	0.127
eSwatini	0.046	0.077
Lesotho	0.045	0.116
Mauritania	0.038	0.127
Zimbabwe	0.033	0.073
Central African Republic	0.029	0.059
Malawi	0.028	0.048
Togo	0.025	0.100
Burundi	0.023	0.073
Madagascar	0.020	0.063

Nigeria	0.017	0.030
South Sudan	0.016	0.030
Angola	0.014	0.023
Zambia	0.008	0.017
Eritrea	0.008	0.028
Somalia	0.004	0.033
Equatorial Guinea	0.000	0.067
Guinea-Bissau	0.000	0.000
Sudan	0.000	0.000

[1] When interpreting the Jaccard Indices, it has to be born in mind that indices above one are possible because a healthcare facility in one dataset was judged to overlap with a facility in the other dataset if their GPS locations fall within a certain radius of each other. As such, duplicates are possible.

[2] Countries were sorted in descending order for the Jaccard Index with a perimeter of 500m.

Table S4. Jaccard Index for OSM hospitals and MFL hospitals[1]

Country[2]	Radius	
	500m	***1000m***
Sudan	0.492	1.016
Ethiopia	0.385	0.950
Djibouti	0.385	0.846
Rwanda	0.369	0.492
Namibia	0.367	0.475
Guinea-Bissau	0.346	0.423
Botswana	0.333	0.343
eSwatini	0.323	0.452
Chad	0.320	0.594
South Africa	0.300	0.396
Eritrea	0.282	0.513
Malawi	0.282	0.336
Tanzania	0.274	0.442
Angola	0.269	0.612
Somalia	0.265	0.735
Ghana	0.258	0.393
Kenya	0.253	0.473
Madagascar	0.245	0.666
Lesotho	0.241	0.397
Guinea	0.218	0.331
Republic of the Congo	0.202	0.474
Mozambique	0.201	0.273
South Sudan	0.193	0.339
Ivory Coast	0.192	0.327
Senegal	0.171	0.332
Mali	0.165	0.386
Zimbabwe	0.160	0.245
Cameroon	0.155	0.404
Benin	0.153	0.363
Liberia	0.143	0.262
Uganda	0.142	0.372
Togo	0.134	0.378
Burundi	0.122	0.212
DRC	0.114	0.312
Burkina Faso	0.079	0.159

The Gambia	0.079	0.190
Sierra Leone	0.075	0.225
Zambia	0.073	0.124
Central African Republic	0.056	0.110
Equatorial Guinea	0.053	0.053
Niger	0.052	0.078
Nigeria	0.048	0.105
Gabon	0.041	0.219
Mauritania	0.034	0.079

[1] When interpreting the Jaccard Indices, it has to be born in mind that indices above one are possible because a healthcare facility in one dataset was judged to overlap with a facility in the other dataset if their GPS locations fall within a certain radius of each other. As such, duplicates are possible.

[2] Countries were sorted in descending order for the Jaccard Index with a perimeter of 500m.

Table S5. Jaccard Index for OSM primary care facilities and MFL hospitals[1]

Country[2]	Radius	
	500m	***1000m***
Djibouti	0.579	1.158
Gabon	0.276	0.565
Ethiopia	0.239	0.845
Namibia	0.224	0.365
Rwanda	0.194	0.476
Cameroon	0.168	0.531
Sudan	0.144	0.294
Benin	0.131	0.462
Republic of the Congo	0.130	0.454
Madagascar	0.125	0.477
Kenya	0.123	0.294
Senegal	0.123	0.502
Mauritania	0.122	0.143
Lesotho	0.118	0.176
Chad	0.112	0.249
Ivory Coast	0.098	0.333
Uganda	0.095	0.359
Togo	0.093	0.364
Eritrea	0.091	0.136
Tanzania	0.088	0.246
Liberia	0.088	0.264
Burundi	0.085	0.239
eSwatini	0.083	0.167
Ghana	0.074	0.230
Guinea	0.069	0.174
Botswana	0.065	0.222
Mali	0.065	0.181
The Gambia	0.063	0.125
Angola	0.058	0.199
Guinea-Bissau	0.053	0.158
Somalia	0.050	0.263
Zambia	0.047	0.067
South Africa	0.041	0.122
DRC	0.037	0.153
Mozambique	0.036	0.051

Sierra Leone	0.034	0.085
Niger	0.031	0.108
Nigeria	0.028	0.060
South Sudan	0.026	0.078
Burkina Faso	0.020	0.065
Zimbabwe	0.011	0.030
Central African Republic	0.000	0.054
Equatorial Guinea	0.000	0.000
Malawi	0.000	0.059

[1] When interpreting the Jaccard Indices, it has to be born in mind that indices above one are possible because a healthcare facility in one dataset was judged to overlap with a facility in the other dataset if their GPS locations fall within a certain radius of each other. As such, duplicates are possible.

[2] Countries were sorted in descending order for the Jaccard Index with a perimeter of 500m.

Table S6. Jaccard Index for OSM hospitals and MFL primary care facilities[1]

Country[2]	Radius	
	500m	***1000m***
Burundi	0.623	0.947
DRC	0.439	1.559
Djibouti	0.329	0.842
Kenya	0.306	0.786
Central African Republic	0.265	0.380
The Gambia	0.181	0.329
Chad	0.172	0.437
Ethiopia	0.166	0.611
Cameroon	0.156	0.453
Benin	0.151	0.292
Tanzania	0.146	0.369
Senegal	0.145	0.383
eSwatini	0.141	0.356
Namibia	0.133	0.240
Somalia	0.126	0.248
Uganda	0.124	0.338
Rwanda	0.123	0.231
Nigeria	0.122	0.242
Republic of the Congo	0.122	0.519
Burkina Faso	0.111	0.220
South Africa	0.103	0.231
Malawi	0.094	0.238
Mozambique	0.094	0.171
Sierra Leone	0.088	0.202
Mali	0.077	0.279
Guinea	0.076	0.162
Eritrea	0.074	0.166
Botswana	0.072	0.176
Liberia	0.070	0.125
Ghana	0.069	0.153
Lesotho	0.066	0.125
Madagascar	0.061	0.159
Togo	0.059	0.159
Ivory Coast	0.054	0.146
Angola	0.048	0.132

Mauritania	0.040	0.172
Equatorial Guinea	0.030	0.091
Niger	0.030	0.076
Zimbabwe	0.027	0.060
South Sudan	0.027	0.081
Gabon	0.016	0.090
Zambia	0.012	0.046
Guinea-Bissau	0.000	0.000
Sudan	0.000	0.000

[1] When interpreting the Jaccard Indices, it has to be born in mind that indices above one are possible because a healthcare facility in one dataset was judged to overlap with a facility in the other dataset if their GPS locations fall within a certain radius of each other. As such, duplicates are possible.

[2] Countries were sorted in descending order for the Jaccard Index with a perimeter of 500m.