

Annex 4 WHO subregions by latitude

The population of each region was divided according to 10 degree bands of latitude – 0-10, 10-20, 20-30, 30-40, 40-50, 50-60, 60-70. The population of those countries which fitted neatly into a latitude band were summed. For those countries which overlapped two or more bands of latitude, the proportion of the population within each band was estimated by reference to maps of population density⁷, as outlined below. Distribution of pigmentation is assumed to be even throughout the country.

Tables A4.1 and A4.2 show how countries have been categorized for the purpose of this assessment.

⁷ www.esri.com/data/online/esri/wothphysic.html

Table A4.1 WHO subregions and countries by latitude

Sub-region	Latitude (degrees)	States, percentage
AFR D	0-10 degrees	Cameroon, Equatorial Guinea, Gabon, Ghana, Liberia, Sao Tome and Principe, Seychelles, Sierra Leone, Angola 50%, Benin 90%, Nigeria 50%, Guinea 50%, Togo
	10-20 degrees	Cape Verde, Chad, Comoros, Gambia, Guinea-Bissau, Mauritius, Niger, Senegal, Angola 50%, Benin 10%, Burkina Faso, Guinea 50%, Madagascar 50%, Mauritania 50%, Nigeria 50%, Mali
	20-30 degrees	Algeria 10%, Madagascar 50%, Mauritania 50%
	30-40 degrees	Algeria 90%
AFR E	0-10 degrees	Burundi, Central African Republic, Congo, Cote D'Ivoire, Kenya, Rwanda, Democratic Republic of Congo 95%, Ethiopia 50%, Tanzania
	10-20 degrees	Eritrea, Malawi, Zimbabwe, Botswana 10%, Democratic Republic of Congo 5%, Mozambique 70%, Namibia 20%, Ethiopia 50%
	20-30 degrees	Lesotho, Swaziland, Zambia, Botswana 90%, Mozambique 30%, Namibia 80%, South Africa 80%
	30-40 degrees	South Africa 20%
AMR A	20-30 degrees	Cuba, USA 3%
	30-40 degrees	USA 55%
	40-50 degrees	USA 42%
	50-60 degrees	Canada 99%
	60-70 degrees	Canada 1%
AMR B	0-10 degrees	Colombia, Guyana, Panama, Suriname, Brazil 5%, Costa Rica 50%, Venezuela 30%
	10-20 degrees	Antigua and Barbuda, Barbados, Belize, Dominica, Dominican Republic, El Salvador, Grenada, Honduras, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Mexico 59%, Venezuela 70%, Brazil 30%, Costa Rica 50%, Chile 2%, Trinidad and Tobago
	20-30 degrees	Bahamas, Paraguay, Argentina 20%, Brazil 60%, Chile 17%, Mexico 40%
	30-40 degrees	Uruguay, Argentina 79%, Brazil 5%, Chile 80%, Mexico 1%
	40-50 degrees	Argentina 1%, Chile 1%
AMR D	0-10 degrees	Ecuador, Peru 50%
	10-20 degrees	Guatemala, Haiti, Nicaragua, Bolivia 90%, Peru 50%
	20-30 degrees	Bolivia 10%
EMR B	10-20 degrees	Oman 60%, Saudi Arabia 20%
	20-30 degrees	Bahrain, Kuwait, Qatar, United Arab Emirates, Iran 20%, Libya 50%, Morocco 10%, Oman 40%, Saudi Arabia 70%
	30-40 degrees	Cyprus, Jordan, Lebanon, Syrian Arab Republic, Iran 80%, Libya 50%, Morocco 90%, Saudi Arabia 10%, Tunisia
EMR D	0-10 degrees	Somalia, Sudan 20%
	10-20 degrees	Djibouti, Yemen, Sudan 79%
	20-30 degrees	Egypt 50%, Pakistan 50%, Sudan 1%
	30-40 degrees	Afghanistan, Iraq, Pakistan 50%, Egypt 50%
EUR A	30-40 degrees	Israel, Malta, Greece 50%, Italy 20%, Portugal 50%, Spain 50%
	40-50 degrees	Andorra, Austria, Belgium, Croatia, France, Luxembourg, Monaco, San Marino, Slovenia, Czech Republic 50%, Germany 40%, Greece 50%, Italy 80%, Portugal 50%, Spain 50%, Switzerland
	50-60 degrees	Denmark, Ireland, Netherlands, United Kingdom, Czech Republic 50%, Germany 60%, Norway 70%, Sweden 70%
	60-70 degrees	Finland, Iceland, Norway 30%, Sweden 30%
	EUR B	30-40 degrees
40-50 degrees		Albania, Bosnia-Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Romania, Slovakia, Macedonia, Armenia 60%, Azerbaijan 60%, Turkey 40%, Turkmenistan 40%, Uzbekistan 60%, Yugoslavia
50-60 degrees		Poland
EUR C	40-50 degrees	Hungary, Kazakhstan, Russian Federation 5%, Ukraine 70%, Moldova
	50-60 degrees	Belarus, Latvia, Russian Federation 90%, Ukraine 30%, Lithuania
	60-70 degrees	Estonia, Russian Federation 5%
SEAR B	0-10 degrees	Indonesia, Sri Lanka
SEAR D	10-20 degrees	Thailand
	0-10 degrees	Maldives, India 5%
	10-20 degrees	Bangladesh, Bhutan, India 40%, Myanmar 70%, Nepal
	20-30 degrees	India 45%, Myanmar 30%
	30-40 degrees	Democratic People's Republic of Korea 50%, India 10%
40-50 degrees	Democratic People's Republic of Korea 50%	
WPR A	0-10 degrees	Brunei, Singapore
	10-20 degrees	Australia 5%
	20-30 degrees	Australia 20%
	30-40 degrees	Australia 70%, New Zealand, Japan 90%
	40-50 degrees	Australia 5%, Japan 10%
WPR B	0-10 degrees	Kiribati, Malaysia, Marshall Is, Federated States of Micronesia, Nauru, Palau, Solomon Is, Tuvalu, Viet Nam 20%, Philippines 80%
	10-20 degrees	Cambodia, Cook Is, Fiji, Lao People's Democratic Republic, Niue, Papua New Guinea, Samoa, Tonga, Viet Nam 30%, Philippines 20%, Vanuatu
	20-30 degrees	China 25%, Viet Nam 50%
	30-40 degrees	Republic of Korea, China 70%
	40-50 degrees	Mongolia, China 5%

Table A 4.2 WHO subregions and their matching

Region code	WHO member states	Sub-region
RO 1	Algeria, Angola, Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Comoros, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Togo	AFR D
	Djibouti, Somalia, Sudan	EMR D
RO 2	Botswana, Burundi, Central African Republic, Congo, Cote D'Ivoire, Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Uganda, United Republic of Tanzania, Zambia, Zimbabwe	AFR E
RO 3	Canada, United States of America	AMR A
RO 4	Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela	AMR B
	Cuba	AMR A
RO 5	Bolivia, Ecuador, Guatemala, Haiti, Nicaragua, Peru	AMR D
RO 6	Bahrain, Iran (Islamic Republic Of), Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia	EMR B
	Cyprus	EUR A
RO 7	Egypt, Iraq, Morocco, Yemen	EMR D
RO 8	Andorra, Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom	EUR A
RO 9	Albania, Bosnia and Herzegovina, Bulgaria, Georgia, Poland, Romania, Slovakia, The Former Yugoslav Republic of Macedonia, Turkey, Yugoslavia	EUR B
RO 10	Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	EUR B
RO 11	Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine	EUR C
RO 12	Indonesia, Sri Lanka, Thailand	SEAR B
	Malaysia, Philippines	WPR B
	Brunei Darussalam, Singapore	WPR A
RO 13	Bangladesh, Bhutan, India, Maldives, Nepal	SEAR D
	Afghanistan, Pakistan	EMR D
RO 14	Australia, Japan, New Zealand	WPR A
RO 15	China, Mongolia, Republic of Korea	WPR B
	DPR Korea	SEAR D
RO 16	Cambodia, Lao People's Democratic Republic, Viet Nam	WPR B
	Myanmar	SEAR D
RO 17	Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu	WPR B

Annex 5 Distribution of skin pigmentation

Section 1: Skin pigmentation groupings

Populations were broken down by pigmentation into three groups – lightly pigmented, medium pigmentation, deeply pigmented⁸. Table A5.1 outlines the types of terms used in the race/ethnicity description and how these were allocated to different pigment groups.

Table A 5.1 Skin pigmentation terms

Lightly pigmented	Medium pigmentation	Deeply pigmented
European	Asian	Native African
White	Euro-African	Melanesian
Chinese	Indian	Afro-Caribbean
Greek	Mulatto	Black
Azerbaijani	American Indian	Tutsi
Arab	Polynesian	Twa
Japanese	Hispanic	Bush Creole
Uzbek	Mestizo	Somali
Tajik	Korean	Sotho
Iranian	Malay	Other African tribes
Turkish	Micronesian	

These are approximate estimates. It is very difficult to categorise accurately by race/ethnicity, as there is great individual variation within racial and ethnic groups. Pigmentation grouping is considered to be constant across all age groups within a country.

Section 2: Sub regional distribution of skin pigmentation

Table A5.2 summarizes the proportion of total population of each WHO subregion in each pigmentation group and latitude band.

Table A5.2 Subregional distribution of skin pigmentation

AFR D

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	0.04%	0.22%	41.04%	41.29%
10-20	0.04%	2.51%	42.29%	44.83%
20-30	0.00%	2.16%	2.08%	4.24%
30-40	0.00%	9.64%	0.00%	9.64%
Total	0.07%	14.52%	85.41%	100.00%

AFR E

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	0.14%	0.13%	59.43%	59.70%
10-20	0.06%	0.01%	22.03%	22.10%
20-30	1.41%	1.08%	13.32%	15.81%
30-40	0.33%	0.26%	1.79%	2.39%
Total	1.94%	1.48%	96.58%	100.00%

⁸ Information on race/ethnicity for each country was based on <http://www.infoplease.com/ipa/A0855617.html>

AMR A

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
20-30	3.28%	2.12%	0.70%	6.10%
30-40	35.80%	6.21%	5.73%	47.74%
40-50	27.34%	4.74%	4.37%	36.45%
50-60	8.36%	1.25%	0.00%	9.61%
60-70	0.08%	0.01%	0.00%	0.10%
Total	74.87%	14.33%	10.80%	100.00%

AMR B

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	3.87%	10.24%	0.78%	14.89%
10-20	9.40%	24.33%	2.16%	35.90%
20-30	16.17%	18.85%	1.49%	36.51%
30-40	11.25%	1.12%	0.21%	12.58%
40-50	0.12%	0.00%	0.00%	0.12%
Total	40.81%	54.55%	4.64%	100.00%

AMR D

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	4.12%	30.71%	0.89%	35.72%
10-20	5.25%	45.90%	11.95%	53.11%
20-30	0.12%	1.05%	0.00%	1.17%
Total	9.49%	77.66%	12.84%	100.00%

EMR B

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
10-20	3.13%	0.30%	0.05%	3.48%
20-30	22.07%	2.29%	0.03%	24.39%
30-40	70.46%	1.67%	0.00%	72.13%
Total	95.66%	4.26%	0.08%	100.00%

EMR D

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	0.85%	0.47%	3.54%	4.86%
10-20	7.71%	0.95%	4.11%	12.78%
20-30	0.03%	34.18%	0.05%	34.26%
30-40	13.93%	34.17%	0.00%	48.10%
Total	22.53%	69.78%	7.70%	100.00%

EUR A

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
30-40	11.54%	0.08%	0.11%	11.72%
40-50	49.08%	0.58%	0.43%	50.09%
50-60	35.46%	0.43%	0.00%	35.89%
60-70	2.30%	0.00%	0.00%	2.30%
Total	98.38%	1.08%	0.54%	100.00%

EUR B

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
30-40	29.06%	0.00%	0.00%	29.06%
40-50	52.68%	0.39%	0.00%	53.07%
50-60	17.87%	0.00%	0.00%	17.87%
Total	99.61%	0.39%	0.00%	100.00%

EUR C

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
40-50	29.84%	0.00%	0.00%	29.84%
50-60	66.61%	0.00%	0.00%	66.61%
60-70	3.56%	0.00%	0.00%	3.56%
Total	100%	0.00%	0.00%	100.00%

SEAR B

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	0.00%	79.00%	0.00%	79.00%
10-20	2.94%	18.06%	0.00%	21.00%
Total	2.94%	97.06%	0.00%	100.00%

SEAR D

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	0.00%	4.11%	0.00%	4.11%
10-20	0.08%	35.23%	0.00%	35.31%
20-30	0.03%	50.42%	0.00%	50.46%
30-40	0.00%	9.15%	0.00%	9.15%
40-50	0.00%	0.97%	0.00%	0.97%
Total	0.11%	99.89%	0.00%	100.00%

WPR A

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	1.83%	0.71%	0.00%	2.54%
10-20	0.58%	0.02%	0.01%	0.62%
20-30	2.34%	0.10%	0.02%	2.46%
30-40	84.77%	0.65%	0.09%	85.50%
40-50	8.85%	0.02%	0.01%	8.88%
Total	98.37%	1.51%	0.12%	100.00%

WPR B

Latitude (degrees)	Lightly pigmented	Intermediate pigmentation	Deeply pigmented	Total
0-10	0.57%	5.92%	0.03%	6.52%
10-20	0.11%	3.65%	0.31%	4.07%
20-30	19.61%	4.22%	0.00%	23.83%
30-40	53.54%	7.70%	0.00%	61.25%
40-50	3.83%	0.50%	0.00%	4.33%
Total	77.67%	21.99%	0.34%	100.00%

Annex 6 Estimation of disease incidence/prevalence for diseases with scanty epidemiological data

The following steps/hypotheses were taken for estimating diseases with scanty epidemiological data:

- For each disease, a complete, systematic review of the literature was undertaken. Grids of latitude band versus age group were drawn up for each gender and each pigment group (if there were gender or pigment group differences in incidence, prevalence or mortality).
- Studies outlining disease incidence (or prevalence or mortality) were sorted by latitude.
- For latitude bands in which there were a number of different incidence rates, these were averaged, for each pigment group.
- Data on populations other than lightly pigmented populations were rare – from the few available, incidence rates were compared to those in lightly pigmented populations to derive a multiplication factor which was then applied to the rates for lightly pigmented populations to derive rates for medium and deeply pigmented persons.
- DISMOD II requires at least three types of input data out of mortality rate, incidence rate, case-fatality rate, remission rate, and prevalence. Such data was not always available. In addition, if only a summary age-standardized rate is available, it is difficult to derive age-specific rates that conform to a particular known age distribution using DISMOD e.g. zero prevalence of pterygium before 15 years, uncommon before 25 years, then increasingly common until 80+ years, then falling prevalence. DISMOD was used mainly when the age-specific incidence rate, case-fatality rate and remission rate were known, to generate the mortality rate, or when a summary mortality rate was known to derive an age-specific rate (given a known age-specific incidence rate and one other input). DISMOD was also used to adjust age-specific rates into those required for use in the DALY template.

For some of the remaining latitude bands, summary figures were available, eg age-standardized rates. By graphing the known rates (from the procedure above) within each age group and then each latitude band, incidence rates that were compatible with the summary rates and fitted the age and latitude distribution of the known rates were derived. Where a graph of incidence rate for an age group, across the different bands of latitude suggested that the incidence rate in the 0-10 latitude band was infinitely large, this was adjusted down. Similarly, where a graph of incidence by age group in a particular latitude band suggested an infinitely large incidence rate in the oldest age group, this was adjusted down, to be in keeping with the known age distributions.

Example – Sunburn see Table A6.1 (1-5)

Distribution was developed for white populations (lightly pigmented). Figures for males and females in all age groups in the latitude bands, 10-20, 20-30, 40-50 and 60-70 degrees were derived from the literature in the following way:

- Each study providing incidence figures was allocated to the latitude band in which the study was undertaken.
- Age groups were adjusted (using DISMOD if necessary) to be comparable across all studies and compatible with those required for the BoD calculation
- The incidence rates for each age group and gender within a latitude band were averaged and that figure entered in the table below.

- Data for missing cells was extrapolated from graphs drawn from available data, epidemiological evidence of age and latitude distribution of disease. For sunburn, for example, good data were only available for two latitude bands, with data available only for a few age groups at other latitudes. Using the latitude bands for which data were available for all ages as the age distribution, and the latitudinal pattern for those age groups where those data were available, missing cells were filled. These estimates are relatively rough and carry an important uncertainty.

Table A 6.1 outlines the resulting estimates for sunburn, as an example, following the method described above.

Table A 6.1 Sunburn (any), annual incidence (percent) by age and latitudinal position

Fair-skinned populations. Male incidence = Female incidence							
Age group (years)	Latitude (degrees)						
	0-10	10-20	20-30	30-40	40-50	50-60	60-70
0-4	25.00	25.00	20.00	20.00	15.00	10.00	5.00
5-14	77.50	75.00	72.50	71.00	52.50	45.00	38.00
15-29	85.00	80.00	75.00	68.33	63.67	55.00	49.33
30-44	58.33	55.00	50.00	50.00	48.33	45.00	44.33
45-59	31.67	31.67	30.00	30.00	30.00	30.00	30.00
60-69	10.00	10.00	10.00	10.00	10.00	10.00	10.00
70-79	10.00	10.00	10.00	10.00	10.00	10.00	10.00
80+	10.00	10.00	10.00	10.00	10.00	10.00	10.00

References

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