WEBAPPENDIX:

Global burden of cancer attributable to excess body mass index in 2012

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* contributed equally to the paper

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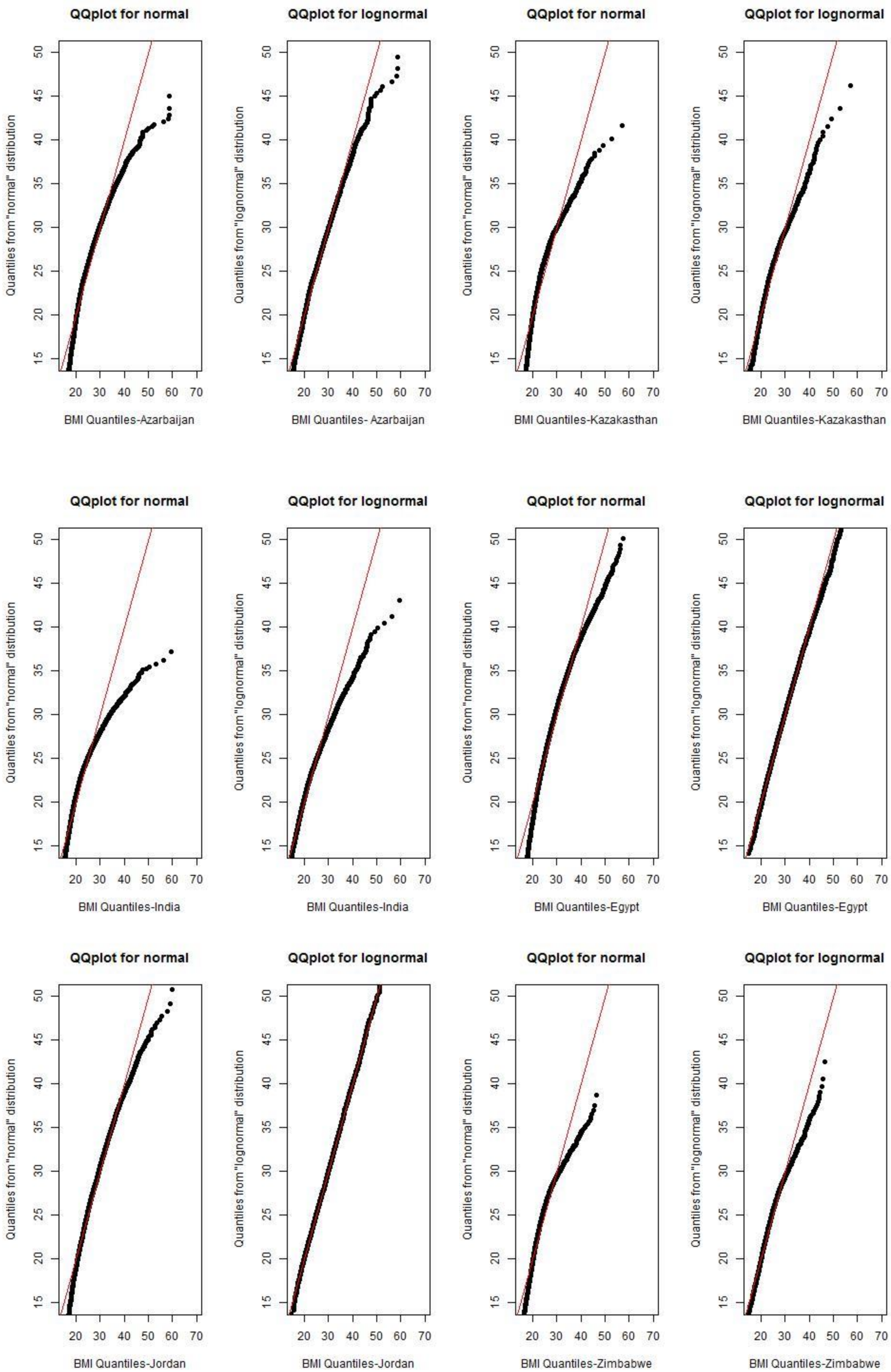
i. Inputs I: Finding the best distribution for Body Mass Index

This study used the estimated BMI reported by Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (GBMRF). The details of the applied model and its assumptions in estimating mean BMI have been published elsewhere.[1] In summary, GBMRF global estimates were obtained using the systematic analysis of published and unpublished data from health examination surveys and epidemiological studies identified through a systematic review of the literature, the WHO Global Infobase and data and studies known to the investigators.[1] BMI was estimated using only measured (not self-reported) height and weight from the surveys. Estimates of mean BMI by age, sex, country and calendar year were obtained using a Bayesian hierarchical model, systematically addressing issues such as missing data and studies that were only representative of a subnational population.[2]

With the observed increase in BMI in the past few decades[2], the population distribution of BMI has shifted slowly with a stretched right tail suggesting log-normal to be a better fitting distribution.[3] This was confirmed after we scrutinized several publicly available databases containing unit level BMI collected from various population-based surveys worldwide. Based on this assumption, we used country, age and sex specific mean and standard deviation of BMI from the GBMRF database to estimate continuous BMI distributions and used this as input in the analysis.

To calculate PAF of cancer related to body mass index (BMI), we required (1) prevalence of BMI including mean and standard deviation and (2) relative risk (RR). In order to select the parametric family of distributions to be fitted to the summary statistics available for the various populations considered, we obtained publicly available unit BMI data from various databases. The individual measurements of BMI were available in the Survey of Health, Aging and Retirement in Europe (SHARE), the National Health and Nutrition Examination Survey (NHANES) and the Health survey for England, representing populations from Europe, the USA and the UK respectively. Data on BMI were obtained from the Demographic and Health Survey (DHS) for women from countries in less developed regions. Collectively these databases covered countries in all regions of the world. We selected 25 countries that represented the world regions that we studied in the main manuscript namely: (1) 12 in Europe, (2) 7 in Asia, (3) 2 in Africa, (4) 2 in Latin America, (5) 1 in North America, and (6) 1 in Oceania.

Figure 1 illustrates QQ-plots of BMI in 25 countries, using the normal and the lognormal distribution. For all the countries shown below the population BMI has a right-skewed distribution. The normal QQ-plots show a higher distance between the normal theoretical quantiles (y-axis) and the population BMI (x-axis) at the lower and upper extremes of the distribution. In contrast, the lognormal QQ-plots better explain the population BMI density for all countries. Based on the distribution of BMI observed for these countries we concluded that a log normal distribution was a better fit for BMI distribution than a normal distribution.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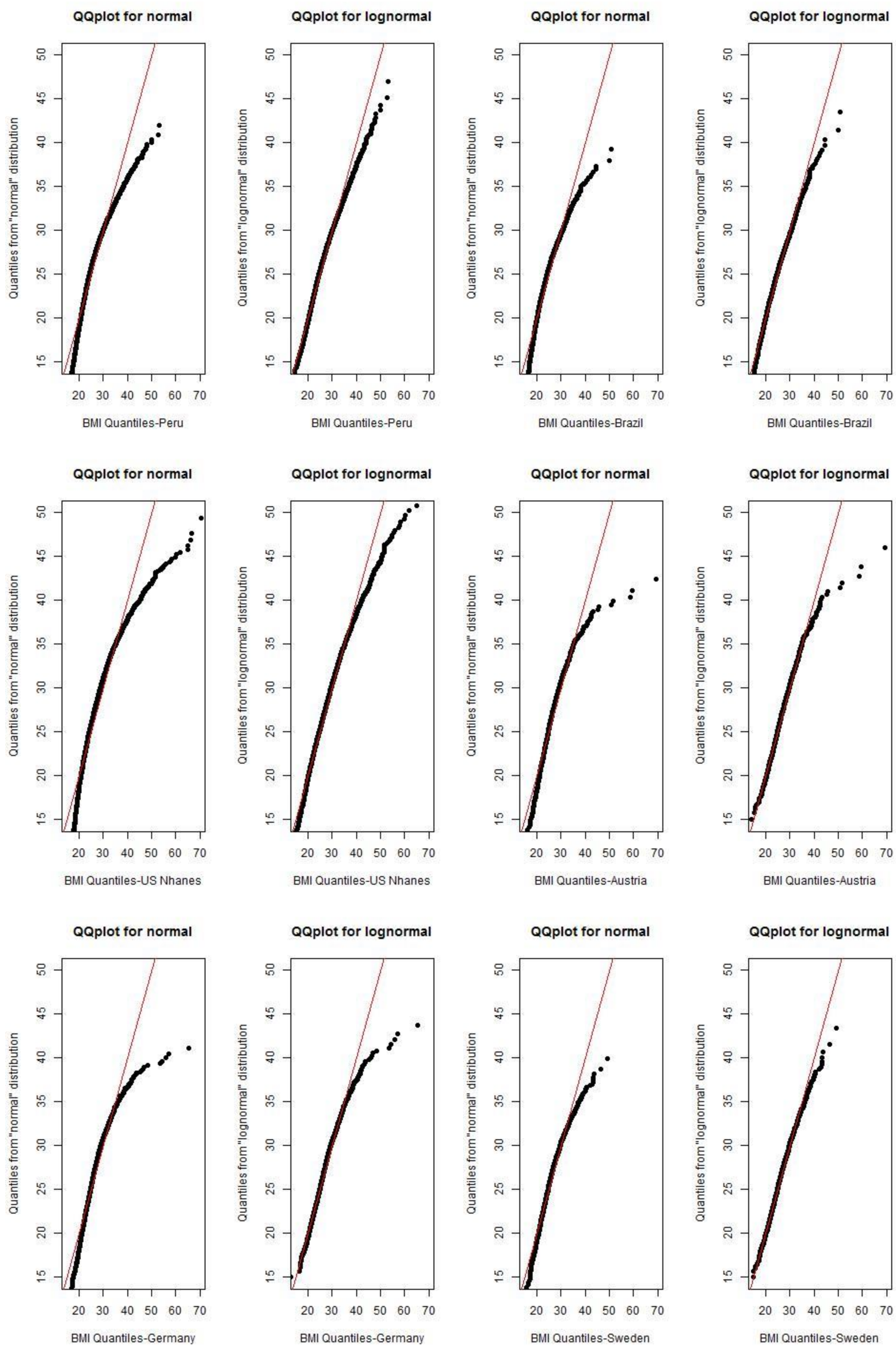
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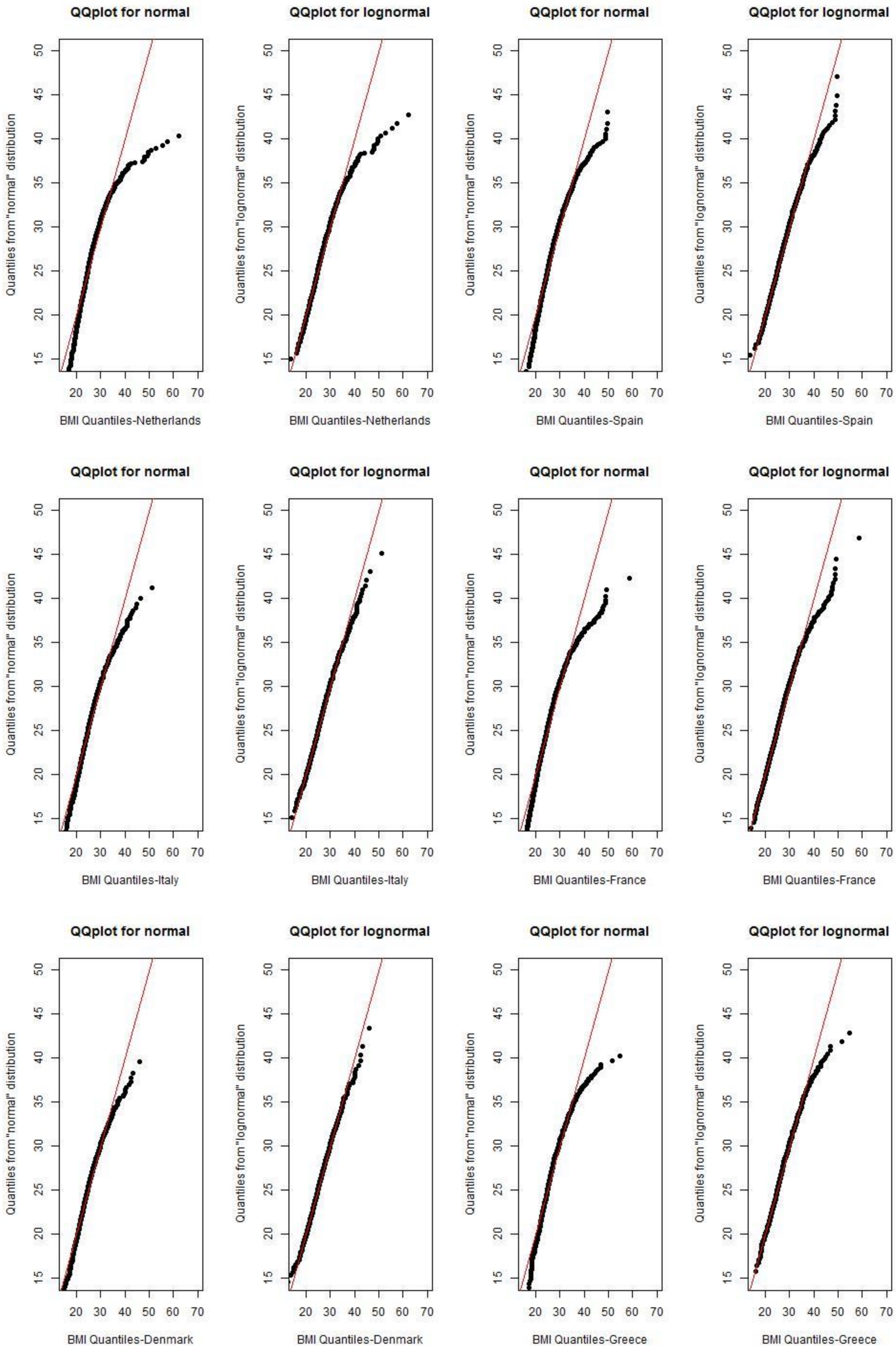
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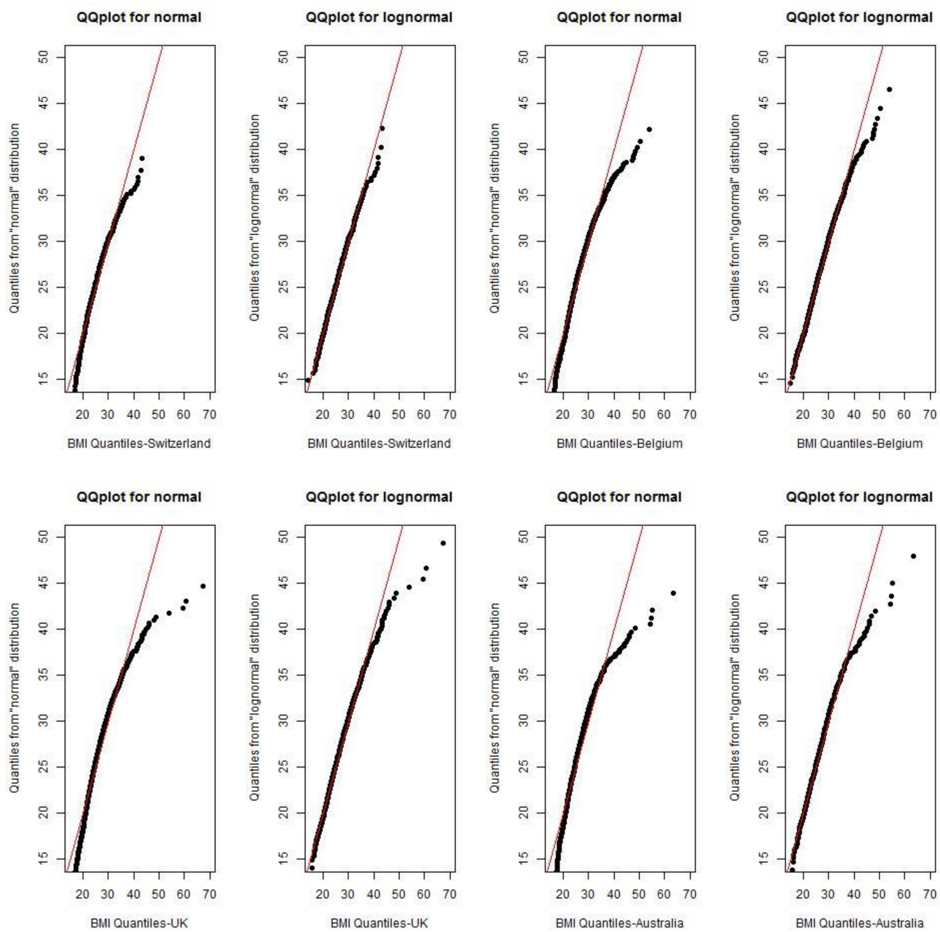
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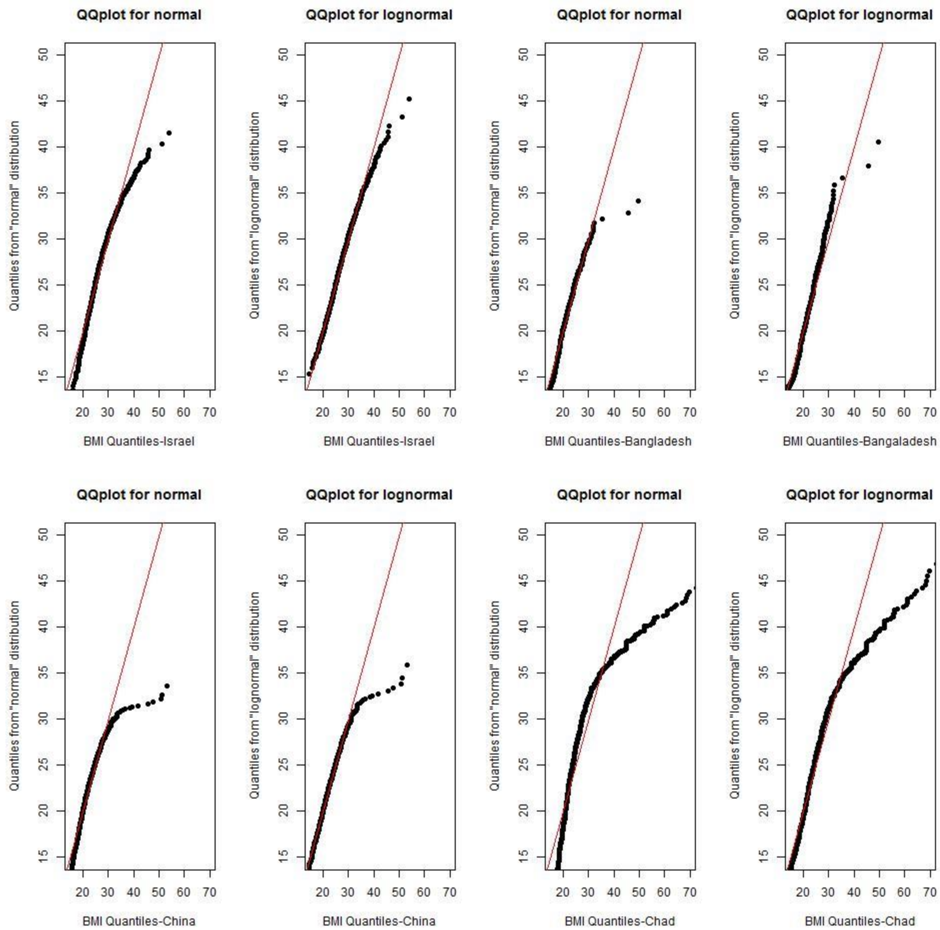

Figure 1. QQ-plots of body mass index in 25 countries comparing plots for normal (left panel) with lognormal density (right panel)

ii. Inputs II: Relative Risks

Only cancers suggested by the World Cancer Research Fund (WCRF) as having sufficient evidence to be associated with excess BMI were included in the primary analysis.[4-8] These include oesophageal adenocarcinoma, and colon, rectal, kidney, pancreatic, gallbladder, postmenopausal breast, corpus uteri and ovarian cancers, (referred to as obesity-related cancers from here onward). Our secondary analysis included additional cancer sites that have recently been suggested to be associated with excess BMI but were not listed by WCRF as sufficient.

Given the differences in risk of colon and rectal cancer associated with obesity, PAF was estimated separately for the two sites. Similarly, only adenocarcinomas of the oesophagus were included because of lack of association between excess BMI and oesophageal squamous cell carcinoma. The sex-specific relative risks (RR) for the sites included in the analysis were obtained from the published standardized meta-analysis estimates by Renehan et al.[9] and the WCRF Continuous Update Project (CUP). In these meta-analyses, risk estimates were pooled from cohort studies and also for studies that have used cancer incidence as outcome i.e. excluding mortality from cancer (Table 1).

Our primary approach in this study was to include only cancer sites reported by WCRF as being convincingly associated with excess BMI. For the relative risks, however, we decided to only rely on the most comprehensive, including mainly cohort studies and updated estimates available from the literature using the same source for males and females, which is the Renehan review published in the Lancet (search up to November 2007) alongside the WCRF estimates resulting from the Continuous Update project (updates of the Second Expert Report, searches from January 2006 until most recent). To test the impact of adding emerging new cancer sites, we included two additional cancer sites (thyroid cancer and Non-Hodgkin Lymphoma) which were not included in the WCRF list of cancers with a convincing or probable link with excess BMI in the sensitivity analysis (appendix xi). As for gallbladder cancer, the evidence for males was unclear in the WCRF report and statistically non-significant in the Renehan review, therefore we decided not to include this site for males.

Table 1. List of cancers associated with excess body mass index in this study and their relative risks (RR).

Cancer site (ICD-10)	RR (per 5kg/m^2)*	
	Men	Women
Oesophagus (adenocarcinoma) (C15) [9]	1•52 (1•33-1•74)	1•51 (1•31-1•74)
Colon (C18) [8]	1•20 (1•18-1•25)	1•10 (1•05-1•15)
Rectum (C20) [8]	1•10 (1•05-1•10)	1•05 (1•00-1•10)
Gallbladder (C23) [9]	NS	1•59 (1•02-2•47)
Pancreas (C25) [7]	1•13 (1•04-1•22)	1•10 (1•04-1•16)
Breast (C50) [6] (postmenopausal)	-	1•13 (1•08-1•18)
Corpus Uteri (C54) [5]	-	1•50 (1•42-1•59)
Ovary (C56) [4]	-	1•06 (1•02-1•11)
Kidney (C64) [9]	1•24 (1•15-1•34)	1•34 (1•25-1•43)

NS: No statistically significant association reported hence not included in PAF calculation
*RRs were transformed to per-unit-increase in BMI using linear interpolation

Relative Risk function

Being derived from a log-linear model, the default choice for a function of RR estimates in its continuous form for higher order exposures is a log-linear function. The log-linear function however results in a steeply increasing RR at the right tail of the distribution, predicting unreasonably large number of cancer cases attributed to high BMI at the extreme ends, despite both the exposure and the RR being poorly estimated at these extreme values. To mitigate this effect, we used the log-logit function for RR, where the shape of the RR function is similar to that of log-linear but with a less abrupt rise at the extreme values. Furthermore, since RR estimates beyond these points were scant, no risk for BMI below 22 and flat RRs above 40 were assumed. A pictorial illustration of these assumptions is presented in Figure 2. In appendix viii, we tested the influence of the different RR functions on the final PAF estimates, resulting in only very subtle differences when using the log-linear compared to the log-logit RR function.

For the primary analysis, global risk estimates (relative risk: RR) were applied uniformly across all age groups with the exception of breast cancer, where RR was only applied for women above age 50 (assumed as postmenopausal age). Due to broad consistencies in RRs across geographic populations for cancers included in the primary analysis of this study (namely, North American, European and Australian, and Asian-Pacific),[9,10] we thereby assumed no variations in the RR across geographic regions. Difference of the final estimates to those if regional-specific RR was used is presented in appendix vii.

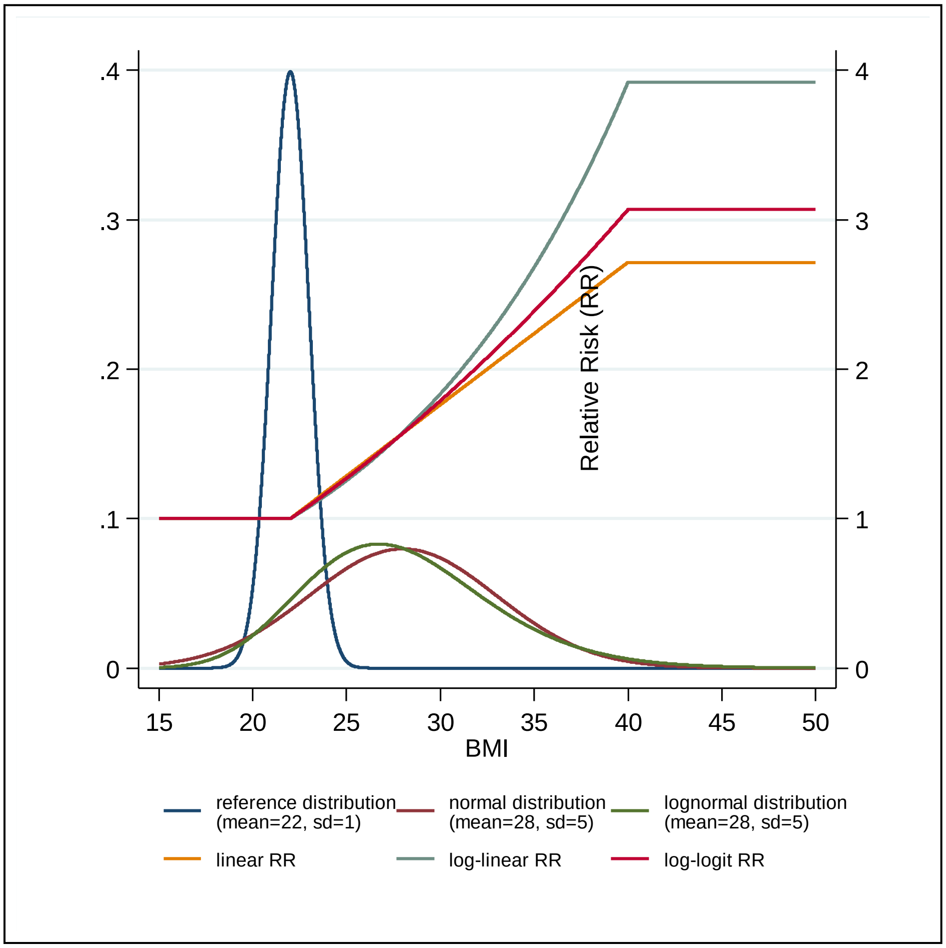

Figure 2. Normal (in dark red) and equivalent log normal (in green) distribution for the population body mass index. Distribution of the reference population in blue. Linear (in orange), log-logit (in red) and log-linear (light green) function for the corresponding relative risk.

iii. Inputs III: Cancer data

As the incidence of colon and rectal cancers (separately) and oesophageal cancer by histological subtypes are not reported in GLOBOCAN[11], the number of cancers by subtypes were estimated based on country- and sex-specific proportions reported in Cancer Incidence in Five Continents volume X (CI5 X). [12] For oesophageal adenocarcinomas also age-specific (<65; ≥ 65 years) proportions were estimated by dividing the number of adenocarcinomas by the sum of all carcinomas of the oesophagus.[13] Cancer registries with zero cases in one of our four substrata (male/female; <65, ≥65 years) were excluded. Data from regional cancer registries were aggregated to obtain national proportions. For countries without data in CI5 X, we calculated proportions for 9 broad regions derived from the same registry data used for the GLOBOCAN 2012 project. The total number of incident cancers by subtype was then calculated by multiplying these proportions with the total incidence reported in GLOBOCAN 2012.

iv. Statistical methods for PAF

The following formula was used to compute the PAF:

$$\text{PAF} = \frac{\int RR(x)P(x)dx - \int RR(x)P^{*}(x)dx}{\int RR(x)P(x)dx}$$

Where P(x) is the population distribution of BMI, P*(x) is the distribution of theoretical minimum BMI and RR(x) the relative risk of cancer associated with BMI at level x. The theoretical minimum distribution of BMI was defined as a BMI distribution with a mean of 22 kg/m^2 and a standard deviation of 1, where the disease burden is assumed to be lowest at the population level.[14]

Estimation of global and regional PAF

First, age-, sex- and country-specific PAFs were calculated for individual obesity- related cancer sites. The number of cancer cases attributable to excess BMI was then derived by multiplying age-, sex-, country-, and cancer-specific PAFs by the corresponding incident cancers in 2012. Overall country, region and global estimates of the total attributable proportion of cancer related to excess BMI were calculated by summing up the number of attributable incident cases and dividing them by the total number of cancer cases in each subgroup.

v. Statistical methods for uncertainty analysis

We attempted to account for uncertainty arising from three different sources:

1. The form of relationship between BMI and excess risk (linear, log-linear or power-law);
2. The size of the effect, measured in log(OR)/ unit of BMI. Since under some models this will be a function of BMI, we adjusted the parameters to achieve the same slope at a reference BMI of 25;
3. The population distribution of BMI. We considered both normal and log-normal distributions, with uncertainty of the parameter values taken from posterior distributions, as discussed in more detail below.

The categorical choices (response relationships, distribution families) were treated as sensitivity analysis: it was found that the results varied very little compared with the uncertainties arising from the uncertainties in the parameter values. For the parameters we used a Monte Carlo approach, in which the uncertainties of odds-ratios were independent between different cancer sites, but applied equally across all countries. For the population distributions of BMI, we preferred to use log-normal distributions as they appeared to be a slightly better fit where detailed data was available (and the difference was small). The population mean and SD values from Ezzati were therefore mapped to the log-scale and shape parameters of the log-normal distribution which would result in the correct mean and SD.

Accounting for the correlation of the uncertainties in these population distribution parameters was the most complex task. Although we could have drawn the means directly from the list of draws provided, we observed that these were consistent with having been drawn from a multivariate normal distribution, independent between countries and between genders in each country, but with strong correlations between age groups within country and gender. Hence it was more computationally convenient to generate draws directly from these multivariate normal distributions, using the covariance structures estimated from the posterior draws.
It was also necessary to account for the population standard deviations and their relationship with the means. We found that these were highly correlated with the population means (median correlations above 95%) and in fact all appeared to have been generated as
$SD=A+0{\cdot}274 \times Mean + C \times (-B+\delta) + \varepsilon$,where δ and ε are a normally distributed random noise, A and B are positive constants and C indicates that the country is included in a list of 31 (in year 2000) or 32 (year 2009) countries where the mean SD is lower but with less variability.
Note that this relationship between mean and SD is consistent with a family of log-normal distributions with equal shape parameter and varying log-scale $\sigma=0{\cdot}7$, supporting our observation of approximately log-normally distributed population BMI.

Using this approach, five hundred estimates of PAF by age, sex, country and cancer site were generated. Finally, 90% uncertainty limits were derived from the resulting PAF estimates.

vi. Estimating Population Attributable Fraction: Categorical versus continuous Body Mass Index

So far, the conventional approach when calculating the PAF was to use categorized exposure information. This however leads to a substantial loss of information as compared to using the full exposure distribution. In order to compare our results to those of earlier studies and to assess the difference between the conventional, categorical approach to the continuous approach, we recalculated the PAF using categorized BMI information. We calculated the proportions of overweight and obese population based on the lognormal distribution and calculated the PAF using the methods suggested by Hanley.[15]

Using categorical BMI information resulted in very similar PAF when compared to using continuous BMI data (Table 2).

Table 2. Population attributable fraction (PAF) using categorical body mass index (BMI) and difference (PAF Δ)* compared with the main results (Table 1a for males and 1b for females)
*PAF Δ= PAF main analysis – PAF sensitivity analysis

MALES

region	*Oesophageal adenocarcinoma*		*Colon*		*Rectum*		*Pancreas*		*Kidney*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	15%	0%	5%	-1%	7%	-1%	6%	-1%	3%	0%
Middle East and Northern Africa	33%	1%	12%	-1%	21%	-1%	18%	-1%	9%	-1%
Latin America & Caribbean	34%	1%	11%	-1%	20%	-1%	17%	-1%	9%	-1%
North America	46%	-2%	16%	-2%	27%	-2%	23%	-2%	13%	-2%
East Asia	17%	1%	5%	0%	9%	0%	7%	0%	4%	0%
South-East Asia	14%	0%	3%	0%	6%	-1%	5%	-1%	2%	0%
South-Central Asia	10%	0%	3%	-1%	6%	-1%	5%	-1%	2%	0%
Eastern Europe	37%	2%	12%	-1%	20%	-1%	17%	-1%	9%	-1%
Northern Europe	42%	2%	14%	-2%	23%	-2%	20%	-2%	11%	-1%
Southern Europe	41%	2%	14%	-2%	23%	-2%	20%	-2%	11%	-1%
Western Europe	41%	2%	14%	-2%	23%	-2%	21%	-2%	11%	-2%
Oceania	43%	2%	15%	-2%	24%	-2%	21%	-2%	11%	-2%

FEMALES

region	*Oesophageal adenocarcinoma*		*Gallbladder*		*Pancreas*		*Corpus uteri*		*Ovary*		*Kidney*		*Colon*		*Rectum*		*Breast (postmenopausal)*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	26%	1%	20%	1%	7%	-1%	27%	-2%	3%	0%	12%	-1%	6%	-1%	3%	0%	7%	-1%
Middle East and Northern Africa	41%	3%	49%	4%	13%	-2%	50%	-2%	8%	-1%	35%	0%	13%	-2%	7%	-1%	16%	-2%
Latin America & Caribbean	39%	2%	45%	4%	11%	-1%	44%	-2%	6%	-1%	31%	0%	11%	-1%	5%	-1%	14%	-2%
North America	46%	3%	49%	4%	13%	-2%	50%	-2%	8%	-1%	35%	0%	13%	-2%	7%	-1%	16%	-2%
East Asia	21%	1%	24%	1%	5%	-1%	22%	-2%	3%	0%	14%	-1%	5%	-1%	2%	0%	6%	-1%
South-East Asia	22%	1%	22%	1%	4%	-1%	21%	-2%	3%	0%	14%	-1%	4%	-1%	2%	0%	6%	-1%
South-Central Asia	18%	0%	13%	0%	4%	-1%	19%	-2%	2%	0%	13%	-1%	4%	-1%	2%	0%	5%	-1%
Eastern Europe	44%	3%	48%	4%	12%	-2%	47%	-2%	7%	-1%	33%	0%	12%	-2%	6%	-1%	15%	-2%
Northern Europe	41%	2%	44%	3%	11%	-1%	44%	-2%	7%	-1%	30%	0%	11%	-1%	6%	-1%	13%	-2%
Southern Europe	42%	2%	45%	4%	11%	-2%	44%	-3%	6%	-1%	30%	0%	11%	-1%	6%	-1%	14%	-2%
Western Europe	40%	2%	45%	4%	11%	-1%	43%	-3%	6%	-1%	30%	-1%	11%	-1%	6%	-1%	13%	-2%
Oceania	41%	2%	46%	3%	11%	-2%	45%	-3%	7%	-1%	31%	0%	11%	-2%	6%	-1%	14%	-2%

vii. Estimating Population Attributable Fraction: Changing distribution of body mass index

We assumed that BMI follows a log-normal distribution (web appendix i), which assigns more weight to higher BMI values (right-skewed) than the normal distribution. We are aware that either the normal or lognormal distribution is at best an approximation to real population data. Comparing the normal to the lognormal distribution allows us to consider the possibility that the distribution is or is not right-skewed. Within population BMI distributions we also observed heterogeneity with regard to population subgroups; for example, lognormal distribution fits slightly better for females than for males and for older than for younger ages. Hence, as a method of incorporating our uncertainty, we estimated PAFs with both distributions.

We found that the choice of BMI distribution (normal vs. lognormal) made no appreciable difference, resulting in changes that were small relative to the effects of uncertainties in the relative risks (Table 3). If there is any difference, assuming a normal distribution slightly overestimated the PAF (maximum by 1%, except for oesophageal adenocarcinoma in North American males). This was mainly observed for cancers that have strong relationships with BMI (oesophageal and gallbladder cancers) and for regions with higher BMI. This can be explained by the similarity of the two distributions between the upper and lower limit of BMI, beyond which the RR was assumed to be constant.

Table 3. Population attributable fraction (PAF) using normally-distributed body mass index (BMI) and difference (PAF Δ)* compared with the main results (Table 1a for males and 1b for females)
*PAF Δ= PAF main analysis – PAF sensitivity analysis

MALES

region	*Oesophageal adenocarcinoma*		*Pancreas*		*Kidney*		*Colon*		*Rectum*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	15%	0%	4%	0%	6%	0%	5%	0%	3%	0%
Middle East and Northern Africa	35%	0%	11%	0%	20%	0%	16%	0%	8%	0%
Latin America & Caribbean	35%	0%	10%	0%	19%	0%	15%	1%	8%	0%
North America	49%	-4%	14%	0%	25%	0%	21%	0%	11%	0%
East Asia	18%	0%	5%	0%	8%	0%	7%	0%	4%	0%
South-East Asia	14%	0%	3%	0%	6%	0%	4%	0%	2%	0%
South-Central Asia	9%	0%	3%	0%	5%	0%	4%	0%	2%	0%
Eastern Europe	39%	0%	11%	0%	19%	0%	16%	0%	8%	0%
Northern Europe	45%	-1%	13%	0%	22%	0%	19%	0%	10%	0%
Southern Europe	43%	-1%	12%	0%	22%	0%	19%	0%	10%	0%
Western Europe	43%	-1%	13%	0%	22%	0%	19%	0%	10%	0%
Oceania	45%	-1%	13%	0%	23%	0%	20%	0%	10%	0%

FEMALES

region	*Oesophageal adenocarcinoma*		*Gallbladder*		*Pancreas*		*Corpus uteri*		*Ovary*		*Kidney*		*Colon*		*Rectum*		*Breast (postmenopausal)*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	28%	0%	20%	0%	6%	0%	25%	0%	2%	0%	11%	0%	5%	0%	2%	0%	6%	0%
Middle East and Northern Africa	45%	-1%	54%	0%	12%	0%	49%	-1%	7%	0%	36%	-1%	12%	0%	6%	0%	15%	0%
Latin America & Caribbean	42%	-1%	49%	-1%	10%	0%	42%	-1%	6%	0%	31%	-1%	10%	0%	5%	0%	13%	0%
North America	49%	-1%	54%	-1%	12%	0%	49%	-1%	7%	0%	35%	-1%	11%	0%	6%	0%	15%	0%
East Asia	19%	2%	24%	1%	4%	0%	20%	0%	2%	0%	14%	0%	4%	0%	2%	0%	5%	0%
South-East Asia	23%	0%	23%	0%	4%	0%	19%	0%	2%	0%	13%	0%	4%	0%	2%	0%	5%	0%
South-Central Asia	17%	0%	13%	1%	3%	0%	16%	0%	2%	0%	12%	0%	3%	0%	1%	0%	4%	0%
Eastern Europe	47%	-1%	53%	-1%	11%	0%	46%	-1%	6%	0%	34%	-1%	11%	0%	6%	0%	14%	0%
Northern Europe	45%	-1%	48%	-1%	10%	0%	42%	-1%	6%	0%	31%	-1%	10%	0%	5%	0%	12%	0%
Southern Europe	45%	-1%	50%	-1%	10%	0%	42%	-1%	6%	0%	31%	-1%	10%	0%	5%	0%	12%	0%
Western Europe	43%	-1%	49%	-1%	10%	0%	41%	-1%	6%	0%	30%	-1%	10%	0%	5%	0%	12%	0%
Oceania	44%	-1%	50%	-1%	10%	0%	43%	-1%	6%	0%	31%	-1%	10%	0%	5%	0%	13%	0%

viii. Estimating Population Attributable Fraction: Changing the shape of the relative risk

The dose effect association between BMI and cancer risk differs by cancer site. While a linear relationship is a reasonable assumption for most of these cancers, non-linear associations have been found for endometrial and pancreatic cancer. [7,16]
In our main analysis we calculated PAF assuming a log-logit increment in RR per unit increase in BMI. This was done because the log-logit function mitigates the effects of steeply increasing RR at the right tail of the distribution using the log-linear function. To investigate the impact of different assumptions about the shape of the RR, we repeated our analysis assuming a linear and a log-linear RR shape (Figure 2).

All in all, there was a small difference in PAF between assuming a linear or log-linear RR shape (Table 4 and 5). When compared to the log-logit, PAF was up to 11 percent points lower when using the linear and up to 5 percent points higher when using the log-linear RR shape.

Table 4. Population attributable fraction (PAF) using linear relative risk shape and difference (PAF Δ)* compared with the main results (Table 1a for males and 1b for females)
*PAF Δ= PAF main analysis – PAF sensitivity analysis

MALES

region	*Oesophageal adenocarcinoma*		*Pancreas*		*Kidney*		*Colon*		*Rectum*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	12%	4%	4%	0%	5%	1%	4%	1%	2%	0%
Middle East and Northern Africa	26%	8%	10%	1%	17%	2%	15%	2%	8%	0%
Latin America & Caribbean	27%	9%	10%	1%	17%	2%	14%	2%	7%	0%
North America	37%	7%	14%	1%	22%	3%	19%	2%	11%	0%
East Asia	13%	4%	4%	0%	7%	1%	6%	1%	3%	0%
South-East Asia	10%	3%	2%	0%	5%	1%	4%	0%	2%	0%
South-Central Asia	7%	3%	3%	0%	4%	1%	4%	0%	2%	0%
Eastern Europe	29%	9%	10%	1%	16%	2%	14%	2%	8%	0%
Northern Europe	34%	10%	12%	1%	19%	3%	17%	2%	9%	0%
Southern Europe	33%	10%	11%	1%	19%	3%	16%	2%	9%	0%
Western Europe	33%	10%	12%	1%	19%	3%	17%	2%	9%	0%
Oceania	34%	10%	12%	1%	20%	3%	17%	2%	10%	0%

FEMALES

region	*Oesophageal adenocarcinoma*		*Gallbladder*		*Pancreas*		*Corpus uteri*		*Ovary*		*Kidney*		*Colon*		*Rectum*		*Breast (postmenopausal)*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	21%	7%	15%	6%	5%	0%	19%	6%	2%	0%	9%	2%	5%	0%	2%	0%	6%	0%
Middle East and Northern Africa	34%	10%	40%	13%	12%	0%	37%	11%	7%	0%	29%	6%	11%	0%	6%	0%	14%	0%
Latin America & Caribbean	31%	10%	36%	13%	9%	0%	32%	10%	6%	0%	25%	5%	9%	0%	5%	0%	12%	0%
North America	37%	11%	40%	13%	11%	0%	37%	11%	7%	0%	29%	6%	11%	0%	6%	0%	14%	1%
East Asia	16%	6%	18%	7%	4%	0%	15%	5%	2%	0%	11%	3%	4%	0%	2%	0%	5%	0%
South-East Asia	17%	6%	16%	7%	3%	0%	14%	5%	2%	0%	11%	2%	3%	0%	2%	0%	5%	0%
South-Central Asia	13%	4%	9%	4%	3%	0%	12%	4%	2%	0%	10%	2%	3%	0%	1%	0%	4%	0%
Eastern Europe	36%	11%	39%	13%	10%	0%	34%	10%	6%	0%	27%	5%	11%	0%	6%	0%	13%	1%
Northern Europe	33%	10%	35%	12%	9%	0%	32%	10%	6%	0%	25%	5%	9%	0%	5%	0%	11%	0%
Southern Europe	34%	10%	36%	13%	10%	0%	32%	10%	5%	0%	25%	5%	9%	0%	5%	0%	11%	1%
Western Europe	32%	10%	36%	13%	9%	0%	31%	9%	5%	0%	24%	5%	9%	0%	5%	0%	11%	1%
Oceania	33%	10%	37%	13%	10%	0%	33%	10%	6%	0%	25%	5%	10%	0%	5%	0%	12%	1%

Table 5. Population attributable fraction using log-linear relative risk shape and difference (PAF Δ)* compared with the main results (Table 1a for males and 1b for females)
*PAF Δ= PAF main analysis – PAF sensitivity analysis

MALES

region	*Oesophageal adenocarcinoma*		*Pancreas*		*Kidney*		*Colon*		*Rectum*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	16%	-1%	4%	0%	6%	0%	5%	0%	3%	0%
Middle East and Northern Africa	37%	-2%	11%	-1%	21%	-1%	17%	-1%	9%	0%
Latin America & Caribbean	38%	-2%	11%	-1%	20%	-1%	16%	-1%	8%	0%
North America	52%	-7%	15%	-1%	27%	-2%	23%	-2%	12%	-1%
East Asia	18%	-1%	4%	0%	8%	0%	7%	0%	3%	0%
South-East Asia	14%	0%	3%	0%	6%	0%	4%	0%	2%	0%
South-Central Asia	10%	0%	3%	0%	5%	0%	4%	0%	2%	0%
Eastern Europe	41%	-3%	11%	-1%	20%	-1%	17%	-1%	9%	0%
Northern Europe	47%	-4%	13%	-1%	23%	-2%	20%	-1%	10%	-1%
Southern Europe	46%	-3%	13%	-1%	22%	-1%	19%	-1%	10%	-1%
Western Europe	46%	-3%	13%	-1%	23%	-1%	20%	-1%	10%	-1%
Oceania	48%	-3%	14%	-1%	24%	-2%	20%	-1%	11%	-1%

FEMALES

region	*Oesophageal adenocarcinoma*		*Gallbladder*		*Pancreas*		*Corpus uteri*		*Ovary*		*Kidney*		*Colon*		*Rectum*		*Breast (postmenopausal)*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa	30%	-2%	22%	-2%	6%	0%	27%	-2%	2%	0%	12%	-1%	5%	0%	2%	0%	6%	0%
Middle East and Northern Africa	48%	-4%	58%	-5%	13%	-1%	52%	-5%	7%	-1%	38%	-3%	12%	-1%	6%	-1%	16%	-1%
Latin America & Caribbean	45%	-4%	53%	-4%	10%	-1%	45%	-4%	6%	0%	33%	-3%	10%	-1%	5%	0%	13%	-1%
North America	53%	-4%	58%	-5%	12%	-1%	52%	-4%	7%	-1%	38%	-3%	12%	-1%	6%	0%	16%	-1%
East Asia	23%	-1%	27%	-2%	4%	0%	21%	-1%	2%	0%	14%	-1%	4%	0%	2%	0%	5%	0%
South-East Asia	24%	-2%	24%	-2%	4%	0%	20%	-1%	2%	0%	14%	-1%	4%	0%	2%	0%	5%	0%
South-Central Asia	19%	-1%	14%	-1%	3%	0%	18%	-1%	2%	0%	13%	-1%	4%	0%	2%	0%	4%	0%
Eastern Europe	51%	-4%	57%	-5%	12%	-1%	49%	-4%	6%	0%	36%	-3%	12%	-1%	6%	0%	15%	-1%
Northern Europe	48%	-4%	52%	-4%	10%	-1%	45%	-4%	6%	0%	33%	-3%	10%	-1%	5%	0%	13%	-1%
Southern Europe	48%	-4%	53%	-4%	11%	-1%	45%	-4%	6%	0%	32%	-3%	10%	-1%	5%	0%	13%	-1%
Western Europe	46%	-4%	53%	-4%	10%	-1%	44%	-3%	6%	0%	32%	-3%	10%	-1%	5%	0%	12%	-1%
Oceania	47%	-4%	54%	-4%	11%	-1%	46%	-4%	6%	0%	33%	-3%	11%	-1%	5%	0%	13%	-1%

ix. Estimating Population Attributable Fraction: Global relative risk versus region-specific relative risk

Recent evidence suggested varying effects of high BMI on cancer risk by ethnicity and geographical location. For example the protective effect of obesity on premenopausal breast cancer is confined to African and Caucasian women, while it is the opposite in Asian women, where a significant positive association has been observed.[17] We recalculated the PAF using regional RRs for North America, Europe, Australia and Asia Pacific and compared this to the PAF calculated using common RRs for all world regions (RRs are summarized in Table 6). Region-specific RRs were not available for oesophageal adenocarcinoma and kidney cancer for both genders, and for gallbladder cancer in females. Therefore PAFs were not recalculated for these cancer sites.

In general, the region-specific PAF was similar to the PAF obtained from our main analysis (Table 7). The largest difference observed was for pancreatic cancer in North America, where estimated PAF was 41% and 18%, in males and females respectively, when regional-specific RRs were used compared to 14% in males and 11% in females in our main analysis. This was caused by the high RR found for North American population in the study by Renehan and colleagues.[9] Furthermore, the PAF of breast cancer due to excess BMI varied by region/ethnic group; the PAF for postmenopausal breast cancer in Asian females increased from 4-5% to 10-13% using the region-specific RR estimates. For premenopausal breast cancer, Asian females were the only group with an increased risk (PAF 1-2%), whereas an inverse association and corresponding zero or negative PAFs were observed for African and Caucasian females. This suggested an overestimation of the negative PAFs of premenopausal breast cancer in **part ix** of this document when using region-specific RRs, particularly for Asian females.

Table 6. Regional relative risk estimates

A. Colon cancer

Region	*Sex*	*Unit (kg/m²)*	*RR*[a]	*95%CI*[b]	*Source*
USA	Males	1	1•06	1•04-1•08	CUP/WCRF 2011[8]
Asia	Males	1	1•05	1•01-1•09	
Europe	Males	1	1•04	1•03-1•04	
Australia	Males	1	1•05	1•01-1•10	
USA	Females	1	1•03	1•01-1•04	
Asia	Females	1	1•02	0•99-1•05	
Europe	Females	1	1•01	1•00-1•01	
Australia	Females	1	1•01	0•98-1•04	

[a]RR: Relative risk; [b]95%CI: 95% confidence interval

B. Rectal cancer

Region	*Sex*	*Unit (kg/m²)*	*RR*[a]	*95%CI*[b]	*Source*
USA	Males	1	1•01	0•99-1•02	CUP/WCRF 2011 [8]
Asia	Males	1	1•01	0•97-1•04	
Europe	Males	1	1•02	1•01-1•03	
Australia	Males	1	1•02	0•97-1•07	
USA	Females	1	1•03	1•01-1•05	
Asia	Females	1	1•02	1•00-1•04	
Europe	Females	1	1•00	1•00-1•01	
Australia	Females	1	1•00	0•95-1•04	

[a]RR: Relative risk; [b]95%CI: 95% confidence interval

C. Pancreatic cancer

Region	*Sex*	*Unit (kg/m²)*	*RR*[a]	*95%CI*[b]	*Source*
North America	Males	5	1•43	1•19-1•72	Renehan et al. 2008[9]
Asia-Pacific	Males	5	0•77	0•54-1•11	
Europe/Australia	Males	5	1•08	0•93-1•24	
North America	Females	5	1•16	1•03-1•31	
Asia-Pacific	Females	5	1•34	0•98-1•83	
Europe/Australia	Females	5	1•14	1•05-1•23	

[a]RR: Relative risk; [b]95%CI: 95% confidence interval

D. Breast cancer

Region	*Status*	*Unit (kg/m²)*	*RR*[a]	*95%CI*[b]	*Source*
Asian (ethnic)	Premenopausal	5	1•05	1•01-1•09	Amadou et al. 2013[17]
African (ethnic)	Premenopausal	5	0•95	0•91-0•98	
Caucasian (ethnic)	Premenopausal	5	0•93	0•91-0•95	
North America	Postmenopausal	5	1•15	1•08-1•23	Renehan et al. 2008[9]
Asia-Pacific	Postmenopausal	5	1•31	1•15-1•48	
Europe/Australia	Postmenopausal	5	1•09	1•04-1•14	

[a]RR: Relative risk; [b]95%CI: 95% confidence interval

E. Ovarian cancer

Region	*Unit (kg/m²)*	*RR*[a]	*95%CI*[b]	*Source*
North America	5	0•97	0•85-1•11	Renehan et al. 2008[9]
Asia-Pacific	5	1•39	0•66-2•89	
Europe/Australia	5	1•03	0•98-1•07	

[a]RR: Relative risk; [b]95%CI: 95% confidence interval

F. Corpus uteri cancer

Region	*Unit (kg/m²)*	*RR*[a]	*95%CI*[b]	*Source*
North America	5	1•56	1•29-1•88	Renehan et al. 2008[9]
Asia-Pacific	5	1•72	0•94-3•16	
Europe/Australia	5	1•58	1•49-1•67	

[a]RR: Relative risk; [b]95%CI: 95% confidence interval

Table 7. Population attributable fraction using regional relative risk estimates and difference (PAF Δ)* compared with the main results (Table 1a for males and 1b for females)
*PAF Δ= PAF main analysis – PAF sensitivity analysis

MALES

region	*Pancreas*		*Colon*		*Rectum*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
North America	41%	-27%	30%	-9%	6%	5%
East Asia	0%	4%	9%	-2%	2%	2%
South-East Asia	0%	3%	5%	-1%	1%	1%
South-Central Asia	0%	3%	5%	-1%	1%	1%
Eastern Europe	6%	4%	16%	0%	8%	0%
Northern Europe	8%	5%	18%	0%	9%	0%
Southern Europe	7%	4%	18%	0%	9%	0%
Western Europe	8%	5%	17%	1%	10%	0%
Oceania	8%	5%	23%	-4%	10%	0%

FEMALES

region	*Pancreas*		*Corpus uteri*		*Ovary*		*Colon*		*Rectum*		*Breast (premenopausal)*		*Breast (postmenopausal)*	
	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ	PAF	PAF Δ
sub-Saharan Africa											-2%	-1%		
Middle East and Northern Africa											-4%	-2%		
North America	18%	-6%	52%	-4%	0%	7%	16%	-5%	16%	-11%	-7%	0%	17%	-3%
East Asia	14%	-10%	29%	-9%	15%	-13%	4%	0%	4%	-2%	1%	-3%	13%	-8%
South-East Asia	12%	-9%	27%	-9%	15%	-13%	4%	0%	4%	-2%	2%	-4%	12%	-7%
South-Central Asia	11%	-8%	24%	-7%	11%	-9%	3%	0%	3%	-1%	1%	-3%	10%	-6%
Eastern Europe	14%	-4%	50%	-5%	3%	3%	5%	5%	0%	5%	-4%	0%	10%	4%
Northern Europe	13%	-4%	47%	-5%	3%	3%	5%	5%	0%	5%	-5%	0%	9%	3%
Southern Europe	14%	-4%	46%	-5%	3%	3%	5%	5%	0%	5%	-3%	0%	9%	3%
Western Europe	13%	-4%	46%	-5%	3%	3%	5%	5%	0%	5%	-3%	0%	8%	3%
Oceania	14%	-4%	48%	-5%	3%	3%	5%	5%	0%	5%	-5%	0%	9%	3%

x. Adjusting Population Attributable Fraction: effect modifier and confounder

a. Confounding: Smoking, body mass index and pancreatic cancer

A pooled analysis of 7 prospective cohorts[18] has shown a higher risk of pancreatic cancer due to high BMI among never and former smokers compared to current smokers. The reduced risks associated with BMI have also been reported for oesophageal squamous cell carcinoma and lung cancer, among smokers; however this has been postulated due to competing risk of tobacco carcinogens or mortality among smokers compared to non- or former smokers. [19]

We calculated stratified PAF estimates for pancreatic cancer for past and current smokers (as the risk is similar in never and past smokers), using data from the WHO Study on global AGEing and adult health (SAGE) study for six countries, namely China, Ghana, India, Mexico, Russia and South Africa, as well as the NHANES study from the USA (2007-2010) and the Health Survey for England (2007-2010). RR estimates were taken from Genkinger et al (RR: 1·07 and 1·22, for current and past smokers respectively, the latter being very similar to the RR in never smokers (1·19)).[20] Thereafter, we calculated the combined PAF by treating smoking status as a discrete variable in the PAF equation (this is referred to as "PAF adjusted"). [21] This is compared with the PAF calculated using BMI and RR not stratified by smoking status (referred to as "PAF unadjusted").

Table 8 shows that on average the BMI is higher among never and past smokers compared to smokers in all countries and both sexes when. As expected, PAF of pancreatic cancer due to excess BMI is much lower among current smokers as compared to never and past smokers. PAFs for current smokers ranged from 0-7% in males and 1-8% in females. When PAF for pancreatic cancer was adjusted for smoking and compared to the PAF using unadjusted RR estimates, we observed a 0-5% point difference in males and 0-9% point difference in females. This difference was largest in the UK for both males and females.

Table 8. Mean body mass index (BMI), population attributable fraction (PAF) of excess BMI on pancreatic cancer in current and past smokers and overall PAF adjusted and unadjusted for smoking, by sex

	mean BMI		*PAF, pancreatic cancer*			
males	Current smokers	Never and past smokers	Current smokers	Never and past smokers	PAF unadjusted[a]	PAF adjusted[b]
China	23•1	24•0	2%	9%	4%	3%
Ghana	21•0	22•2	1%	6%	2%	3%
India	20•1	20•7	0%	3%	1%	1%
Mexico	27•0	27•6	6%	21%	12%	14%
Russia	26•1	28•0	5%	22%	11%	11%
South Africa	25•7	27•3	5%	20%	11%	10%
UK	26•5	28•0	6%	22%	13%	18%
USA	27•2	29•2	7%	25%	14%	17%
females						
China	23•4	24•7	3%	12%	4%	5%
Ghana	21•4	24•0	2%	11%	4%	5%
India	20•2	21•3	1%	6%	1%	1%
Mexico	28•8	29•2	8%	25%	12%	17%
Russia	26•9	29•1	6%	25%	10%	15%
South Africa	27•5	29•4	5%	26%	10%	11%
UK	26•7	27•4	6%	20%	9%	18%
USA	28•3	29•6	8%	26%	12%	17%

[a] Using the RR from the main analysis, irrespective of smoking status
[b] Treating smoking as a discrete variable in the PAF equation

b. Effect modification: Hormonal Replacement Therapy (HRT) and cancer of the corpus uteri and postmenopausal breast

HRT usage has been recently associated with an increased breast cancer risk. Its usage has declined considerably in many high income countries since this harmful effect was reported in 2002.[22] Yet among women with excess BMI, HRT usage has also been found to attenuate the negative effects of excess BMI on breast cancer risk (RR: 0·98 and RR: 1·04 (per 2kg/m^2 among HRT users and HRT non-users, respectively[6]). This observation was also found with the relation of HRT usage on risk of cancer of the corpus uteri and ovary (RR: 1·15 and RR: 1·73 for corpus uteri cancer among HRT users and HRT non-users[5]; RR: 0·95 and RR: 1·10 for ovarian cancer among HRT users and HRT non-users[23], respectively, all per 5kg/m^2). In order to assess the impact of HRT on the estimates, we recalculated the PAF for postmenopausal breast, ovarian and endometrial cancer, using BMI data in HRT users and non-users from the WHO MONICA study. In a next step, we calculated the PAF adjusted for the population level of HRT usage by treating HRT use as a discrete variable in the PAF equation ("PAF adjusted") [21]. This was then compared to the PAF ("PAF unadjusted") which was calculated without taking into account the varying effects of BMI on cancer risks among HRT users and non-users.

Table 9 shows that the mean BMI is in general slightly higher among HRT non-users when compared to users. This, together with the larger risk of cancer related to obesity in HRT non-users, translated into a higher PAF in this group, ranging from 50-65% for corpus uteri cancer and from 8-12% for postmenopausal breast and ovarian cancer. When comparing the adjusted to the unadjusted PAF, the difference was small for most countries, however, largest in countries were HRT usage was high.

Table 9. Mean BMI, population attributable fraction (PAF) for hormonal replacement therapy (HRT) users and non-users for breast, ovarian and corpus uteri cancer in postmenopausal women and overall PAF adjusted and unadjusted for HRT use

.	*Mean BMI*		*PAF Corpus uteri cancer*				*PAF Postmenopausal breast cancer*				*PAF ovarian cancer*			
	HRT no	HRT yes	HRT no	HRT yes	PAF unadjusted[a]	PAF adjusted[b]	HRT no	HRT yes	PAF unadjusted[a]	PAF adjusted[b]	HRT no	HRT yes	PAF unadjusted[a]	PAF adjusted[b]
Australia	28•0	26•9	59%	13%	42%	40%	10%	-5%	12%	4%	10%	-5%	6%	4%
Belgium	27•5	26•4	56%	12%	40%	46%	10%	-4%	11%	6%	10%	-4%	6%	6%
Canada	27•9	28•2	59%	16%	45%	44%	10%	-6%	13%	5%	10%	-6%	6%	5%
Czech Republic	29•4	28•1	64%	16%	50%	64%	12%	-5%	15%	12%	12%	-5%	8%	12%
Finland	28•8	26•9	62%	13%	46%	51%	11%	-5%	13%	8%	11%	-5%	7%	8%
France	27•6	25•5	58%	10%	40%	43%	10%	-3%	11%	5%	10%	-3%	5%	5%
Germany	27•9	25•8	58%	10%	43%	55%	10%	-4%	12%	9%	10%	-4%	6%	9%
Iceland	27•6	27•3	56%	14%	42%	46%	10%	-5%	12%	6%	10%	-5%	6%	6%
Italy	26•6	25•0	50%	9%	37%	49%	8%	-3%	10%	8%	8%	-3%	5%	8%
Lithuania	29•6	30•7	65%	21%	51%	64%	13%	-8%	16%	12%	13%	-8%	8%	12%
Poland	29•2	28•8	64%	17%	49%	63%	12%	-6%	15%	12%	12%	-6%	7%	12%
Russia	28•0	28•3	59%	16%	44%	58%	10%	-6%	13%	10%	10%	-6%	6%	10%
Spain	28•7	28•1	61%	15%	47%	59%	11%	-6%	14%	10%	11%	-6%	7%	10%
Sweden	26•5	25•9	51%	11%	36%	41%	8%	-4%	10%	5%	8%	-4%	5%	5%
Switzerland	26•5	25•0	51%	9%	36%	43%	8%	-3%	10%	6%	8%	-3%	5%	6%
UK	26•8	26•5	53%	12%	39%	46%	9%	-4%	11%	6%	9%	-4%	5%	6%
USA	27•1	26•0	57%	12%	41%	41%	9%	-4%	11%	4%	9%	-4%	5%	4%

[a] Population attributable fraction estimated using the RR from the main analysis, irrespective of HRT usage
[b] Treating HRT use (yes/no) as a discrete variable in the PAF equation

xi. Adding cancer sites to the obesity-related cancers: Impact of thyroid cancer, non-Hodgkin lymphoma and premenopausal breast cancer

We added two more cancer sites in our PAF estimates due to the emerging new studies showing convincing evidence of a positive association with excess BMI, namely cancer of the thyroid gland and non-Hodgkin lymphoma (NHL). In this section, we also estimated PAF of premenopausal breast cancer since multiple studies have shown an inverse relationship between excess BMI and premenopausal breast cancer suggesting a protective effect.[6,9,16] The corresponding RRs and sources are presented in Table 10.

Table 11 summarizes the PAF estimates and the attributable cancer cases after including thyroid, premenopausal breast cancer and NHL as obesity related cancers in the analysis. Overall, including these additional cancer sites changed the percentage of the global cancer burden attributable to excess BMI from 3·6 to 3·8%, with about 32,000 additional cases when compared to the main analysis. With the additional cancer sites, 11% of obesity-related cancers and 2·2% of total cancers in males were attributable to excess BMI. In females, these figures were 10% and 5·6%; very similar to our main model. This was mainly due to the introduction of premenopausal breast cancer and its inverse association with obesity, which resulted in negative PAFs. This was, however, largely set off by the additional burden due to thyroid cancer and NHL.

Table 10. Relative risks (RR) for additional cancer sites that have been suggested as having a relationship with excess body mass index

Cancer site (ICD-10)	***RR* per 5kg/m²***	Source
Males		
Thyroid gland	1•33 (1•04-1•70)	9
NHL[a]	1•09 (1•04-1•14)	24
Females		
Thyroid gland	1•14 (1•06-1•23)	9
NHL[a]	1•07 (1•02-1•13)	24
Breast (premenopausal)	0•93 (0•86-0•98)	6

[a] NHL: Non-Hodgkin Lymphoma; *RRs were transformed to per-unit-increase in BMI using linear interpolation

Table 11. Population attributable fraction (PAF, %) and number of new cancer cases (N) attributable to excess body mass index for additional cancer sites by sex

MALES

Region	*Thyroid*		*NHL* [a]		***Total*** [b]		
	PAF	N	PAF	N	N	PAF obesity[c]	PAF all cancers[d]
sub-Saharan Africa	5%	75	2%	165	1107	4%	0•5%
Middle East and Northern Africa	24%	758	7%	803	6542	13%	2•6%
Latin America & Caribbean	22%	936	7%	896	11841	14%	2•4%
North America	32%	4299	10%	3661	39690	20%	4•4%
East Asia	11%	1887	3%	1119	24404	6%	1•0%
South-East Asia	7%	327	2%	227	2310	3%	0•6%
South-Central Asia	6%	263	2%	326	3063	3%	0•5%
Eastern Europe	23%	664	7%	571	16753	14%	3•3%
Northern Europe	27%	298	8%	806	11347	17%	4•3%
Southern Europe	26%	900	8%	979	15923	16%	3•8%
Western Europe	26%	1018	8%	1492	22746	16%	3•8%
Oceania	28%	189	9%	270	3264	17%	4•0%
Low HDI[e]	5%	116	2%	209	1220	3%	0•4%
Medium HDI[e]	9%	1649	3%	1461	21694	5%	0•8%
High HDI[e]	21%	1841	6%	1548	24916	13%	2•5%
Very high HDI[e]	26%	8008	8%	8099	111158	15%	3•7%
World	19%	11615	6%	11316	158989	11%	2•2%

[a] NHL: non-Hodgkin lymphoma
[b] Represents the total together with the cancer sites included in the main analysis (Table 1a)
[c] PAF obesity: proportion of cancer attributable to obesity out of obesity-related cancers i.e. oesophageal adenocarcinoma, pancreas, kidney, thyroid, NHL, colon, rectum
[d] PAF all cancers: proportion of cancer attributable to obesity out of total cancers excluding non-melanoma skin cancers
[e] HDI: Human development index

FEMALES

region	*Thyroid*		*NHL*[a]		*Breast (premenopausal)*		***Total***[b]		
	PAF	N	PAF	N	PAF	N	N	PAF obesity[c]	PAF all cancers[d]
sub-Saharan Africa	5%	197	3%	188	-2%	-1043	5754	4%	1•8%
Middle East and Northern Africa	13%	1654	8%	705	-6%	-2136	17241	12%	7•1%
Latin America & Caribbean	11%	2150	6%	762	-5%	-2515	34074	12%	6•4%
North America	5%	3050	3%	712	-2%	-1924	83656	16%	9•9%
East Asia	5%	580	2%	244	-3%	-1107	50030	7%	3•1%
South-East Asia	4%	450	2%	242	-2%	-1586	8181	4%	2•2%
South-Central Asia	13%	1898	7%	630	-5%	-1090	11788	3%	1•6%
Eastern Europe	14%	5494	8%	2483	-7%	-3306	51863	16%	10•1%
Northern Europe	11%	384	7%	532	-5%	-711	19897	13%	8•0%
Southern Europe	11%	1041	6%	653	-4%	-847	27876	13%	8•4%
Western Europe	10%	972	6%	984	-4%	-1152	38658	12%	7•9%
Oceania	12%	239	7%	169	-5%	-248	4883	12%	7•4%
Low HDI[e]	4%	281	2%	206	-2%	-1352	6183	3%	1•3%
Medium HDI[e]	5%	2624	3%	1156	-2%	-4834	60422	6%	2•7%
High HDI[e]	12%	4647	7%	1423	-5%	-4430	78265	13%	7•7%
Very high HDI[e]	10%	10557	7%	5519	-5%	-7049	209030	13%	8•1%
World	9%	18108	5%	8304	-3%	-17666	353901	10%	5•6%

[a] NHL: non-Hodgkin lymphoma
[b] Represents the total together with the cancer sites included in the main analysis (Table 1b)
[c] PAF obesity: proportion of cancer attributable to obesity out of obesity-related cancers i.e. oesophageal adenocarcinoma, pancreas, kidney, thyroid, NHL, breast, ovary, corpus uteri, gallbladder, colon, rectum
[d] PAF all cancers: proportion of cancer attributable to obesity out of total cancers excluding non-melanoma skin cancers
[e] HDI: Human development index

xii. Counterfactual scenario : Maintaining the 1982 BMI

In view of the globally growing obesity prevalence, a population mean BMI of 22 (or 21 in many earlier studies[25]) as the theoretical minimum value in the PAF calculations measures the full disease burden that can be ascribed to any BMI value beyond this threshold. It is therefore more of a conceptual value of the full impact of BMI reduction to this minimum, rather than a realistically attainable value through preventive interventions. In order to shed light on the realistically attainable fraction (i.e. the achievable part of the attributable fraction), we recalculated the PAF using historical mean BMI values as theoretical minimum (only if it was above BMI=22). We thereby assessed the burden of cancer that could potentially be avoided if the mean BMI of a population was that of 30 years ago, i.e. in 1982, as compared to that of 2002. Using a baseline BMI value that was prevalent in the same population in the recent past seems to be a more reasonable assumption – and therefore was used here to illustrate the potential effect of prevention.

In total, 0·5% of all cancers in males and 1·3% in females were realistically avoidable (Table 12). This also means that between 1982 and 2002, the proportion of cancers attributable to excess BMI has increased by 0·5% and 1·3% in males and females respectively. Altogether, this represents about one fourth (or 118,000 cases) of all cancers attributable to excess BMI in 2012. In some world regions such as sub-Saharan Africa and (South-East) Asia, the realistically avoidable fraction was zero, meaning that the average population BMI has not grown larger than 22 during this period.

Table 12. Attributable fraction using historical BMI distribution

MALES

region	***Oesophageal adenocarcinoma***		***Colon***		***Rectum***		***Pancreas***		***Kidney***		***Total***		
	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	N	PAF obesity[a]	PAF all cancers[b]
sub-Saharan Africa	5%	37	1%	67	1%	32	1%	43	1%	22	201	1%	0•1%
Middle East and Northern Africa	13%	152	6%	800	3%	240	4%	260	8%	444	1895	6%	0•7%
Latin America & Caribbean	17%	581	6%	1700	3%	476	4%	545	8%	960	4262	6%	0•8%
North America	19%	1822	7%	4039	4%	947	5%	1182	8%	3016	11006	7%	1•2%
East Asia	1%	49	1%	1160	0%	399	0%	270	1%	440	2318	1%	0•1%
South-East Asia	3%	17	0%	83	0%	31	0%	14	1%	31	177	0%	0•0%
South-Central Asia	2%	62	1%	198	0%	43	0%	39	1%	89	432	1%	0•1%
Eastern Europe	5%	79	2%	670	1%	267	1%	181	2%	455	1652	1%	0•3%
Northern Europe	17%	873	6%	1204	3%	411	4%	254	7%	646	3388	6%	1•3%
Southern Europe	10%	122	3%	1328	2%	351	2%	250	4%	601	2653	3%	0•6%
Western Europe	11%	472	4%	1754	2%	562	2%	389	5%	1042	4219	4%	0•7%
Oceania	16%	133	6%	409	3%	130	4%	77	8%	204	953	6%	1•2%
Low HDI[d]	1%	16	0%	34	0%	12	0%	10	0%	17	88	0%	0•0%
Medium HDI[d]	1%	107	0%	365	0%	113	0%	168	0%	190	944	0%	0•0%
High HDI[d]	13%	679	4%	2270	2%	705	2%	696	4%	1268	5617	3%	0•6%
Very high HDI[d]	16%	3596	5%	10744	2%	3060	3%	2630	6%	6475	26505	4%	0•9%
World	11%	4399	3%	13413	1%	3889	2%	3503	4%	7951	33155	3%	0•5%

[a] PAF obesity: proportion of cancer attributable to obesity out of obesity-related cancers i.e. oesophageal adenocarcinoma, pancreas, kidney, postmenopausal breast, ovary, corpus uteri, gallbladder, colon, rectum

[b] PAF all cancers: proportion of cancer attributable to obesity out of total cancers excluding non-melanoma skin cancers

[c] HDI: Human development index

FEMALES

region	*Oesophageal adenocarcinoma*		*Colon*		*Rectum*		*Gallbladder*		*Pancreas*		*Breast (postmenopausal)*		*Corpus uteri*		*Ovary*		*Kidney*		*Total*		
	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	N	PAF obesity [a]	PAF all cancers [b]
sub-Saharan Africa	4%	21	1%	53	0%	19	3%	35	1%	37	1%	566	5%	418	0%	40	2%	29	1216	1%	0•4%
Middle East and Northern Africa	14%	56	3%	342	2%	91	19%	540	3%	144	4%	2037	15%	1402	2%	184	11%	390	5185	6%	2•1%
Latin America & Caribbean	15%	187	3%	954	2%	204	21%	2109	3%	496	4%	4382	17%	3339	2%	328	12%	904	12905	6%	2•4%
North America	20%	293	4%	2242	2%	368	23%	1329	4%	973	5%	11082	20%	10836	2%	570	14%	3213	30906	8%	3•7%
East Asia	8%	213	1%	1312	1%	387	9%	3534	1%	551	2%	2735	6%	5396	1%	280	4%	1311	15719	3%	1•0%
South-East Asia	6%	14	1%	98	0%	25	4%	137	0%	22	1%	442	3%	385	0%	54	2%	44	1222	1%	0•3%
South-Central Asia	5%	76	1%	128	0%	28	2%	255	0%	32	1%	777	2%	469	0%	71	3%	121	1958	1%	0•3%
Eastern Europe	0%	1	0%	14	0%	5	0%	25	0%	6	0%	37	0%	49	0%	4	0%	14	157	0%	0•0%
Northern Europe	16%	217	3%	537	1%	124	13%	183	3%	197	4%	2351	14%	1857	2%	164	9%	521	6151	5%	2•5%
Southern Europe	4%	10	1%	196	0%	42	3%	138	1%	66	1%	556	3%	648	0%	44	2%	152	1853	1%	0•6%
Western Europe	7%	66	1%	475	1%	110	7%	400	1%	194	2%	1973	6%	1502	1%	100	4%	567	5386	2%	1•1%
Oceania	19%	29	4%	243	2%	49	22%	100	4%	64	5%	726	19%	577	2%	45	14%	189	2022	7%	3•1%
Low HDI[d]	2%	21	0%	43	0%	15	2%	160	1%	23	1%	811	4%	417	0%	58	2%	44	1592	1%	0•3%
Medium HDI[d]	7%	268	1%	1137	1%	342	7%	3181	1%	507	1%	3847	6%	6243	0%	393	4%	1248	17166	2%	0•8%
High HDI[d]	11%	220	1%	937	1%	232	13%	1627	2%	430	2%	4304	6%	3336	1%	366	4%	891	12343	3%	1•2%
Very high HDI[d]	14%	674	2%	4478	1%	863	11%	3817	2%	1823	3%	18701	12%	16882	1%	1067	8%	5273	53578	4%	2•1%
World	10%	1184	2%	6596	1%	1453	9%	8785	2%	2783	2%	27663	9%	26877	1%	1884	6%	7455	84679	3%	1•3%

[a] PAF obesity: proportion of cancer attributable to obesity out of obesity-related cancers i.e. oesophageal adenocarcinoma, pancreas, kidney, postmenopausal breast, ovary, corpus uteri, gallbladder, colon, rectum

[b] PAF all cancers: proportion of cancer attributable to obesity out of total cancers excluding non-melanoma skin cancers

[c] HDI: Human development index

xiii. Number of new cancer cases and proportion of the new cases attributable to excess body mass index by country and sex

Table 13. Estimated population attributable fraction (PAF, % out of obesity-related cancers (PAF obesity) and total cancers (PAF all cancer)) and cancer cases (N) associated with excess BMI by country and cancer site in 2012, males.

	Oesophageal adenocarcinoma		Colon		Rectum		Pancreas		Kidney			Total	
	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	N	PAF obesity	PAF all cancer
sub-Saharan Africa													
Angola	10%	1	4%	4	2%	1	2%	1	4%	1	10	3%	0•3%
Benin	12%	0	4%	3	2%	1	3%	0	6%	2	6	4%	0•4%
Botswana	10%	0	3%	0	2%	0	2%	0	4%	0	1	4%	0•2%
Burkina Faso	6%	0	2%	1	1%	0	1%	0	3%	1	3	2%	0•1%
Burundi	9%	2	3%	2	2%	1	2%	1	3%	0	5	3%	0•2%
Cameroon	21%	1	8%	8	4%	3	5%	5	8%	1	17	6%	0•4%
Cape Verde	15%	0	6%	0	3%	0	0%	0	0%	0	0	5%	0•3%
Central African Republic	6%	0	2%	1	1%	0	1%	0	3%	0	2	2%	0•2%
Chad	10%	0	3%	2	1%	1	2%	1	4%	1	5	2%	0•2%
Comoros	12%	0	5%	0	2%	0	0%	0	0%	0	0	5%	0•2%
Congo	11%	0	4%	2	2%	1	3%	0	4%	0	6	1%	0•0%
Cote d'Ivoire	14%	1	5%	8	2%	3	3%	6	6%	1	3	3%	0•3%
Democratic Republic of the Congo	3%	1	1%	3	0%	1	0%	1	0%	0	19	4%	0•4%
Djibouti	19%	0	7%	1	3%	0	0%	0	9%	0	1	6%	0•7%
Equatorial Guinea	18%	0	6%	0	3%	0	5%	0	0%	0	1	5%	0•4%
Eritrea	6%	0	2%	1	1%	0	1%	0	2%	0	2	2%	0•2%
Ethiopia	2%	0	1%	5	0%	2	0%	1	1%	2	11	0%	0•1%
Gabon	25%	0	9%	2	4%	0	6%	0	12%	0	3	8%	0•7%
Gambia	6%	0	2%	0	1%	0	2%	0	0%	0	21	4%	0•4%
Ghana	14%	0	5%	11	2%	4	3%	4	6%	2	3	4%	0•1%
Guinea	14%	0	5%	2	2%	1	4%	0	6%	0	1	3%	0•2%
Guinea-Bissau	9%	0	3%	0	2%	0	2%	0	5%	0	37	3%	0•3%
Kenya	9%	8	3%	13	2%	7	2%	5	4%	4	1	4%	0•1%
Lesotho	8%	0	2%	0	1%	0	2%	0	4%	0	1	3%	0•2%
Liberia	11%	0	4%	1	2%	0	3%	0	5%	0	15	2%	0•2%
Madagascar	8%	2	3%	6	1%	3	2%	2	3%	2	7	4%	0•2%
Malawi	8%	4	3%	1	2%	1	2%	0	4%	0	7	2%	0•3%
Mali	8%	0	3%	3	1%	1	2%	1	4%	2	2	4%	0•4%
Mauritania	14%	0	5%	1	2%	0	4%	1	6%	0	19	9%	1•9%
Mauritius	21%	0	12%	8	6%	4	8%	3	14%	3	7	3%	0•1%
Mozambique	9%	3	3%	1	2%	1	2%	2	0%	0	2	4%	0•3%
Namibia	14%	0	5%	1	2%	0	3%	0	6%	1	6	2%	0•3%
Niger	6%	0	2%	2	1%	1	1%	1	3%	1	134	4%	0•4%
Nigeria	16%	1	6%	64	3%	21	4%	35	6%	13	7	4%	0•2%
Rwanda	14%	1	5%	2	2%	1	3%	2	5%	1	5	3%	0•3%
Senegal	12%	0	4%	3	2%	1	3%	1	5%	1	2	4%	0•3%
Sierra Leone	11%	0	4%	1	2%	0	3%	1	6%	0	9	3%	0•4%
Somalia	11%	1	4%	4	2%	2	3%	1	5%	1	385	12%	1•1%
South Africa	36%	59	14%	129	7%	66	9%	88	17%	43	10	4%	0•3%
South Sudan	12%	2	4%	4	2%	2	3%	1	5%	1	1	6%	0•2%
Swaziland	17%	0	6%	0	3%	0	4%	0	8%	0	27	5%	0•2%
Togo	10%	0	3%	2	2%	0	2%	1	4%	0	0	2%	0•1%
Uganda	13%	10	5%	12	2%	5	3%	5	5%	3	3	3%	0•3%
United Republic of Tanzania	14%	10	5%	9	2%	5	3%	1	6%	2	35	4%	0•3%
Zambia	4%	1	1%	1	1%	0	1%	0	2%	0	3	1%	0•1%
Zimbabwe	13%	11	4%	5	2%	3	3%	1	5%	2	23	5%	0•4%
Middle East and Northern Africa													
Algeria	26%	10	10%	98	5%	32	7%	20	13%	25	185	9%	1•3%
Armenia	31%	4	12%	34	6%	8	8%	17	15%	8	71	10%	1•3%
Azerbaijan	32%	25	13%	27	6%	7	8%	8	15%	14	81	14%	1•2%
Bahrain	41%	2	19%	7	10%	2	12%	1	19%	2	14	17%	3•3%
Egypt	40%	64	17%	194	8%	54	11%	166	20%	187	665	15%	1•4%
Georgia	32%	3	13%	26	7%	6	8%	8	16%	19	63	12%	1•0%
Iraq	41%	12	17%	66	9%	17	11%	27	20%	54	176	16%	1•8%
Israel	44%	21	19%	289	10%	64	13%	56	23%	141	571	18%	3•9%
Jordan	46%	3	20%	74	10%	19	13%	13	23%	18	127	17%	4•5%
Kuwait	44%	1	21%	15	11%	4	13%	4	25%	5	30	18%	3•9%
Lebanon	42%	2	18%	48	9%	12	12%	8	21%	20	91	16%	2•2%
Libya	41%	4	17%	34	9%	10	11%	15	20%	16	80	15%	2•7%
Morocco	34%	22	14%	108	7%	34	9%	31	16%	30	225	12%	1•4%

Oman	42%	3	18%	19	9%	5	13%	3	22%	11	17	13%	2•4%
Qatar	35%	1	15%	8	7%	2	9%	2	17%	3	20	18%	3•5%
Saudi Arabia	44%	1	19%	9	10%	2	12%	2	22%	6	290	18%	4•0%
Sudan	45%	17	20%	148	10%	38	13%	28	23%	58	39	17%	2•8%
Syrian Arab Republic	12%	20	4%	14	2%	4	3%	3	5%	6	47	5%	0•6%
Tunisia	43%	11	18%	148	9%	38	12%	34	21%	56	287	16%	3•0%
Turkey	31%	3	13%	45	6%	15	8%	11	15%	19	94	11%	1•5%
United Arab Emirates	41%	142	17%	655	9%	244	11%	228	20%	434	1703	15%	2•1%
West Bank and Gaza Strip	45%	3	20%	22	10%	6	13%	4	24%	9	45	18%	3•4%
Yemen	27%	17	10%	23	5%	6	7%	7	11%	6	59	11%	1•5%
Latin America & Caribbean													
Argentina	47%	221	21%	1069	11%	194	14%	267	24%	616	2367	20%	4•5%
Bahamas	42%	0	17%	4	9%	1	12%	1	22%	2	8	16%	2•3%
Barbados	36%	1	15%	7	8%	1	10%	1	19%	1	11	14%	2•0%
Belize	37%	0	16%	1	8%	0	10%	0	20%	1	3	15%	1•8%
Bolivia	25%	3	10%	18	5%	5	6%	5	12%	20	51	9%	1•3%
Brazil	33%	625	13%	1266	7%	424	9%	408	16%	565	3288	13%	1•5%
Chile	42%	33	18%	172	9%	60	12%	63	21%	169	498	17%	2•5%
Colombia	30%	64	12%	175	6%	57	8%	56	14%	80	432	11%	1•3%
Costa Rica	37%	6	15%	38	8%	11	10%	11	19%	20	86	14%	2•0%
Cuba	28%	40	10%	115	5%	24	7%	29	13%	42	251	10%	1•1%
Dominican Republic	27%	5	11%	34	5%	7	7%	10	13%	5	61	10%	0•9%
Ecuador	32%	7	13%	55	7%	14	8%	19	16%	33	128	12%	1•3%
El Salvador	34%	5	14%	17	7%	5	9%	8	17%	8	43	13%	1•3%
Guatemala	29%	6	12%	14	6%	4	8%	7	14%	10	42	11%	0•8%
Guyana	23%	0	9%	1	4%	0	6%	0	11%	1	4	8%	1•1%
Haiti	22%	4	8%	10	4%	2	5%	5	11%	2	23	8%	0•7%
Honduras	28%	3	12%	12	6%	3	7%	6	14%	6	29	10%	1•1%
Jamaica	21%	3	8%	12	4%	2	5%	3	8%	1	20	7%	0•7%
Mexico	42%	79	18%	509	9%	144	12%	235	22%	489	1457	17%	2•5%
Nicaragua	36%	2	14%	12	7%	3	9%	6	16%	6	31	12%	1•6%
Panama	34%	3	14%	22	7%	6	9%	5	18%	9	45	13%	1•8%
Paraguay	34%	9	14%	27	7%	8	9%	11	16%	8	63	12%	1•8%
Peru	29%	16	11%	90	6%	26	7%	42	14%	77	251	10%	1•5%
Puerto Rico	44%	11	19%	103	10%	22	12%	18	23%	38	192	17%	3•2%
Suriname	31%	0	12%	4	6%	1	8%	1	16%	1	8	10%	2•0%
Trinidad and Tobago	38%	1	16%	23	8%	5	11%	5	19%	3	37	14%	2•3%
Uruguay	40%	21	17%	94	9%	24	11%	25	20%	60	222	16%	3•3%
Venezuela	39%	23	17%	151	9%	45	11%	48	21%	94	360	15%	2•0%
North America													
Canada	46%	409	20%	1609	10%	495	13%	296	23%	792	3601	19%	3•8%
United States of America	44%	3884	21%	9843	11%	2297	14%	3094	25%	9010	28128	21%	3•5%
East Asia													
China	18%	1236	6%	5231	3%	2040	4%	1634	8%	3453	13594	6%	0•8%
Democratic People's Republic of Korea	14%	7	5%	93	2%	36	3%	23	6%	44	5779	6%	1•4%
Japan	20%	127	7%	2936	4%	910	5%	813	9%	992	204	4%	0•8%
Mongolia	30%	2	11%	3	6%	1	7%	3	13%	3	1808	7%	1•6%
Republic of Korea	21%	16	8%	856	4%	398	5%	152	10%	386	13	10%	0•6%
South-East Asia													
Brunei Darussalam	4%	0	10%	3	5%	1	7%	0	13%	0	4	8%	2•0%
Cambodia	4%	0	1%	3	1%	1	1%	0	1%	1	6	1%	0•1%
Indonesia	8%	5	3%	272	1%	85	2%	51	4%	69	481	2%	0•4%
Lao PDR	7%	0	2%	2	1%	1	1%	0	3%	1	4	2%	0•1%
Malaysia	27%	33	10%	148	5%	55	7%	23	13%	49	308	9%	1•8%
Myanmar	5%	5	2%	21	1%	7	1%	5	2%	5	43	2%	0•1%
Philippines	15%	23	6%	157	3%	48	4%	29	7%	42	300	5%	0•8%
Singapore	24%	3	9%	77	5%	29	6%	14	11%	31	154	8%	2•0%
Thailand	17%	19	6%	245	3%	68	4%	39	8%	45	416	5%	0•7%
Timor-Leste	6%	0	2%	1	1%	0	1%	0	2%	0	1	1%	0•2%
Viet Nam	3%	3	1%	21	0%	6	1%	2	1%	5	37	1%	0•1%
South-Central Asia													
Afghanistan	5%	4	1%	3	1%	1	1%	1	2%	3	12	2%	0•2%
Bangladesh	3%	24	1%	9	0%	4	1%	3	1%	5	45	1%	0•1%
Bhutan	15%	0	5%	0	3%	0	4%	0	8%	0	1	5%	0•5%
India	7%	146	2%	373	1%	169	1%	95	3%	172	956	2%	0•2%
Iran (Islamic Republic of)	32%	86	13%	344	6%	57	8%	54	15%	141	681	13%	1•6%
Kazakhstan	38%	39	16%	136	8%	63	10%	63	18%	51	353	13%	2•0%
Kyrgyzstan	30%	3	11%	8	6%	3	8%	7	14%	7	29	10%	1•1%
Maldives	17%	0	6%	0	3%	0	0%	0	0%	0	0	6%	0•4%
Nepal	5%	2	2%	3	1%	1	1%	1	2%	3	10	2%	0•1%
Pakistan	14%	33	5%	64	2%	29	3%	10	6%	56	193	5%	0•4%
Sri Lanka	10%	7	3%	7	2%	3	2%	2	4%	7	26	4%	0•3%
Tajikistan	23%	8	7%	5	4%	2	5%	2	10%	4	22	9%	1•0%
Turkmenistan	31%	12	12%	9	6%	4	8%	3	14%	6	35	13%	1•3%
Uzbekistan	35%	23	14%	34	7%	16	9%	14	15%	25	111	13%	1•3%
Eastern Europe													
Belarus	37%	18	15%	138	8%	71	10%	43	18%	162	433	13%	2•7%

Bulgaria	40%	22	17%	246	8%	100	11%	75	20%	113	557	14%	3•4%
Czech Republic	49%	92	22%	605	12%	258	15%	162	26%	546	1663	20%	5•5%
Hungary	43%	41	19%	461	10%	217	12%	112	22%	220	1051	16%	4•0%
Poland	27%	4	10%	43	5%	20	7%	15	12%	17	2527	15%	3•3%
Republic of Moldova	42%	62	18%	1081	9%	451	12%	300	21%	632	99	9%	2•0%
Romania	34%	42	14%	421	7%	194	9%	155	16%	203	1015	12%	2•4%
Russian Federation	37%	255	15%	2273	8%	869	10%	700	17%	1871	5969	13%	2•8%
Slovakia	42%	12	18%	223	9%	100	12%	52	21%	138	525	15%	4•3%
Ukraine	33%	89	13%	590	7%	305	9%	215	16%	481	1679	11%	2•5%
Northern Europe													
Denmark	37%	63	16%	227	8%	82	10%	53	18%	89	514	14%	2•8%
Estonia	39%	2	16%	32	8%	13	10%	10	19%	31	88	14%	2•8%
Finland	43%	41	18%	162	10%	62	12%	68	22%	102	435	16%	2•9%
Iceland	43%	4	18%	10	10%	2	12%	2	22%	7	25	19%	3•3%
Ireland	45%	83	20%	175	10%	60	13%	34	23%	82	433	19%	3•9%
Latvia	40%	6	17%	47	9%	21	11%	19	20%	51	144	15%	2•7%
Lithuania	42%	10	18%	68	9%	35	12%	29	21%	98	241	16%	3•4%
Norway	40%	41	17%	204	9%	65	11%	41	20%	102	454	16%	2•9%
Sweden	39%	77	16%	323	8%	108	11%	53	19%	130	691	15%	2•5%
UK	44%	1933	19%	2506	10%	891	13%	536	23%	1350	7217	20%	4•4%
Southern Europe													
Albania	39%	3	16%	18	8%	5	11%	13	19%	28	67	15%	1•9%
Bosnia and Herzegovina	39%	5	16%	64	8%	19	11%	16	19%	33	135	14%	2•7%
Croatia	41%	13	17%	162	9%	74	11%	40	20%	104	393	15%	3•3%
Cyprus	47%	3	20%	32	11%	7	13%	6	24%	7	55	18%	3•2%
Greece	40%	18	17%	222	9%	65	11%	93	20%	141	86	13%	2•3%
Italy	41%	164	17%	3112	9%	714	11%	563	20%	1539	539	15%	2•3%
Malta	39%	2	16%	43	8%	12	11%	19	19%	10	6091	16%	3•2%
Montenegro	47%	4	20%	19	10%	6	13%	6	24%	9	43	18%	4•4%
Portugal	39%	1	17%	16	9%	5	11%	4	19%	7	32	15%	3•0%
Serbia	41%	50	18%	511	9%	111	12%	77	21%	135	883	16%	3•2%
Slovenia	41%	18	17%	278	9%	154	12%	77	20%	144	672	14%	3•1%
Spain	45%	5	19%	94	10%	42	13%	22	23%	56	220	16%	3•5%
FYR Macedonia	46%	240	20%	2433	10%	715	13%	444	23%	994	4826	18%	3•8%
Western Europe													
Austria	41%	61	17%	296	9%	93	12%	90	20%	166	706	16%	3•2%
Belgium	43%	151	18%	552	10%	165	12%	82	22%	244	1193	17%	3•4%
France	41%	362	17%	2247	9%	751	12%	523	20%	1457	5340	16%	2•6%
Germany	46%	817	20%	4361	10%	1495	13%	1069	24%	2654	10397	18%	3•9%
Luxembourg	45%	6	20%	22	10%	7	13%	4	23%	11	50	18%	3•9%
Netherlands	39%	430	16%	757	8%	244	11%	123	19%	318	677	17%	2•9%
Switzerland	43%	84	18%	301	9%	92	12%	67	21%	133	1872	16%	3•9%
Oceania													
Australia	44%	292	19%	1015	10%	335	13%	198	23%	510	2350	18%	3•4%
Fiji	36%	1	15%	2	8%	1	10%	1	0%	0	5	13%	1•5%
New Zealand	44%	66	19%	179	10%	58	13%	31	23%	87	421	18%	3•8%
Papua New Guinea	28%	2	11%	13	6%	4	7%	2	14%	3	25	10%	1•0%
Samoa	0%	0	26%	1	14%	0	17%	0	0%	0	1	20%	2•4%
Solomon Islands	35%	0	19%	1	10%	0	13%	0	0%	0	2	15%	1•3%
Vanuatu	0%	0	17%	0	9%	0	12%	0	0%	0	1	14%	1•0%

Table 14. Estimated population attributable fraction (PAF, % out of obesity-related cancers (PAF obesity) and total cancers (PAF all cancer)) and cancer cases (N) associated with excess BMI by country and cancer site in 2012, females.

	Oesophageal adenocarcinoma		Colon		Rectum		Gallbladder		Pancreas		Breast (postmenopausal)		Corpus uteri		Ovary		Kidney		Total	PAF	PAF
	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	PAF	N	N	obesity	all cancer
sub-Saharan Africa																					
Angola	18%	1	3%	4	2%	1	21%	2	3%	1	4%	31	19%	27	2%	3	11%	4	75	6%	1•3%
Benin	25%	0	4%	2	2%	1	30%	2	4%	1	6%	26	24%	21	2%	2	15%	2	56	8%	2•1%
Botswana	39%	1	8%	1	4%	0	46%	1	9%	1	11%	11	38%	11	5%	1	28%	1	28	15%	3•7%
Burkina Faso	11%	0	2%	1	1%	0	12%	0	2%	1	2%	10	10%	9	1%	2	7%	1	24	3%	0•5%
Burundi	9%	1	1%	1	1%	1	9%	0	2%	0	2%	8	9%	7	1%	1	5%	1	19	2%	0•5%
Cameroon	27%	0	6%	6	3%	2	0%	0	6%	1	7%	59	29%	48	3%	10	17%	2	129	9%	1•8%
Cape Verde	0%	0	6%	0	3%	0	0%	0	0%	0	7%	2	30%	2	3%	0	0%	0	5	9%	2•5%
Central African Republic	12%	0	2%	1	1%	0	13%	0	2%	0	3%	7	13%	5	1%	1	8%	1	15	4%	1•0%
Chad	11%	0	2%	1	1%	0	13%	1	2%	0	3%	13	11%	10	1%	2	7%	1	30	3%	1•0%
Comoros	13%	0	3%	0	1%	0	0%	0	0%	0	3%	1	13%	0	2%	0	0%	0	1	4%	0•5%
Congo	19%	0	3%	1	2%	0	0%	0	4%	0	4%	12	18%	5	2%	1	9%	0	127	3%	0•6%
Cote d'Ivoire	20%	0	4%	7	2%	2	25%	19	4%	6	5%	58	21%	47	3%	5	15%	3	20	5%	1•7%
Democratic Republic of the Congo	9%	2	1%	8	1%	3	10%	1	2%	2	2%	48	9%	54	1%	6	5%	4	148	7%	2•5%
Djibouti	28%	0	5%	0	3%	0	33%	1	6%	0	7%	4	28%	2	3%	1	18%	1	9	9%	2•7%
Equatorial Guinea	26%	0	4%	0	2%	0	0%	0	0%	0	6%	2	23%	3	2%	0	0%	0	5	8%	2•0%
Eritrea	9%	0	1%	0	1%	0	10%	2	2%	0	2%	5	8%	3	1%	1	5%	1	12	2%	0•7%
Ethiopia	6%	3	1%	5	0%	4	7%	31	1%	2	1%	60	5%	29	0%	11	3%	18	163	2%	0•4%
Gabon	33%	0	7%	1	3%	0	37%	1	8%	0	9%	4	33%	13	4%	1	19%	0	21	15%	3•9%
Gambia	0%	0	5%	0	2%	0	0%	0	5%	0	6%	1	24%	1	3%	0	0%	0	169	8%	2•0%
Ghana	24%	0	5%	6	2%	2	30%	11	5%	3	6%	75	25%	60	3%	9	16%	3	24	5%	0•9%
Guinea	16%	0	3%	1	1%	0	16%	0	3%	0	3%	10	15%	11	2%	1	10%	1	6	5%	1•3%
Guinea-Bissau	0%	0	3%	0	2%	0	0%	0	4%	0	5%	3	19%	2	2%	0	0%	0	362	7%	1•7%
Kenya	19%	13	4%	11	2%	8	22%	38	4%	11	5%	130	20%	125	2%	15	13%	14	16	17%	2•3%
Lesotho	41%	1	9%	0	4%	0	0%	0	9%	0	11%	5	42%	7	5%	1	28%	1	18	7%	1•7%
Liberia	18%	0	4%	1	2%	0	24%	2	4%	0	5%	8	20%	7	2%	1	15%	0	41	2%	0•5%
Madagascar	7%	1	1%	2	1%	1	9%	5	1%	2	2%	15	7%	12	1%	1	4%	2	41	5%	0•5%
Malawi	15%	6	3%	0	1%	1	0%	0	3%	0	4%	15	17%	15	2%	2	10%	2	56	4%	1•1%
Mali	14%	0	3%	4	1%	1	18%	2	3%	1	4%	22	15%	20	2%	3	10%	3	30	12%	2•9%
Mauritania	38%	0	7%	2	4%	1	44%	1	8%	1	10%	14	36%	10	4%	2	21%	1	105	15%	7•4%
Mauritius	41%	0	9%	4	4%	3	47%	5	9%	2	12%	45	40%	38	5%	3	30%	4	90	7%	0•8%
Mozambique	18%	4	4%	1	2%	1	21%	17	3%	7	5%	35	17%	24	2%	1	0%	0	21	10%	3•2%
Namibia	32%	0	6%	1	3%	0	0%	0	6%	0	8%	10	32%	6	4%	1	20%	2	37	4%	1•3%
Niger	13%	0	2%	2	1%	1	14%	2	2%	0	3%	12	13%	14	1%	4	8%	2	1266	7%	2•2%
Nigeria	22%	2	4%	47	2%	15	27%	24	4%	32	6%	712	24%	366	2%	36	14%	31	24	3%	0•6%
Rwanda	9%	0	2%	1	1%	1	12%	0	2%	1	2%	5	9%	13	1%	2	8%	1	69	9%	1•8%
Senegal	21%	0	5%	3	2%	1	33%	2	5%	1	8%	30	28%	25	3%	4	16%	3	26	7%	1•7%
Sierra Leone	18%	0	4%	1	2%	0	26%	2	4%	1	5%	11	22%	8	2%	1	14%	1	70	6%	1•6%
Somalia	18%	2	3%	2	2%	2	20%	9	3%	2	4%	26	18%	19	2%	4	11%	5	2382	20%	6•4%
South Africa	52%	85	13%	139	6%	52	58%	75	13%	112	16%	981	52%	799	7%	83	37%	57	71	6%	1•6%
South Sudan	20%	2	3%	2	2%	2	23%	6	4%	2	5%	27	20%	22	2%	4	12%	4	14	24%	3•4%
Swaziland	49%	0	11%	0	6%	0	0%	0	12%	0	15%	4	48%	9	6%	1	0%	0	123	5%	0•7%
Togo	14%	0	3%	1	1%	0	18%	1	3%	0	4%	10	15%	11	2%	2	10%	1	2	7%	1•1%
Uganda	12%	4	2%	5	1%	3	14%	2	2%	3	3%	38	14%	40	1%	8	8%	7	26	5%	1•3%
United Republic of Tanzania	17%	6	3%	10	2%	7	20%	1	3%	0	4%	61	18%	32	2%	5	9%	0	111	4%	0•8%
Zambia	19%	2	3%	2	2%	1	12%	2	4%	2	5%	22	20%	21	2%	3	12%	2	57	6%	1•1%
Zimbabwe	34%	14	7%	10	3%	7	38%	10	7%	15	9%	73	33%	129	4%	10	9%	1	267	13%	3•3%

Middle East and Northern Africa																					
Algeria	36%	2	8%	77	4%	27	44%	253	9%	16	11%	402	38%	82	5%	36	27%	37	932	13%	4•8%
Armenia	47%	2	11%	34	5%	7	53%	8	11%	23	13%	171	41%	246	6%	11	34%	7	510	18%	9•5%
Azerbaijan	45%	12	10%	23	5%	5	52%	12	10%	9	14%	109	46%	70	6%	7	24%	8	255	16%	4•0%
Bahrain	50%	0	11%	3	6%	1	56%	2	11%	1	14%	12	48%	7	7%	1	35%	2	29	17%	7•1%
Egypt	54%	54	13%	135	7%	41	60%	270	13%	115	17%	1963	53%	746	8%	181	39%	209	3715	20%	7•2%
Georgia	39%	1	9%	18	4%	4	47%	7	9%	7	11%	126	37%	159	5%	7	28%	11	340	16%	5•6%
Iraq	49%	6	11%	49	6%	10	55%	48	12%	25	15%	360	48%	67	6%	27	35%	67	659	16%	5•3%
Israel	49%	7	12%	156	6%	29	55%	47	12%	49	14%	457	47%	393	7%	25	34%	119	1281	18%	9•5%
Jordan	57%	1	13%	37	7%	8	61%	34	14%	9	18%	130	54%	51	8%	8	40%	13	290	20%	9•8%
Kuwait	59%	0	14%	7	7%	2	60%	5	15%	2	19%	34	56%	23	9%	2	43%	3	77	22%	10•6%
Lebanon	48%	1	12%	28	6%	6	57%	26	12%	8	15%	189	49%	91	7%	12	35%	13	372	18%	8•2%
Libya	47%	0	12%	31	6%	6	58%	45	14%	11	17%	48	54%	43	7%	9	39%	14	207	20%	7•7%
Morocco	39%	7	8%	55	4%	17	46%	116	9%	18	11%	380	35%	158	5%	34	26%	40	824	13%	4•9%
Oman	54%	1	12%	14	6%	3	57%	25	14%	5	17%	42	50%	43	7%	4	35%	6	33	15%	5•5%
Qatar	39%	0	9%	3	4%	1	42%	2	8%	1	12%	12	40%	9	5%	1	28%	3	25	19%	7•3%
Saudi Arabia	50%	0	11%	3	6%	1	57%	2	13%	0	16%	9	49%	6	7%	1	36%	2	742	23%	9•2%
Sudan	52%	6	13%	75	6%	16	59%	119	13%	21	17%	216	53%	225	7%	19	38%	46	143	21%	9•3%
Syrian Arab Republic	19%	13	3%	7	2%	2	23%	15	4%	3	5%	76	20%	48	2%	14	12%	12	189	6%	2•0%
Tunisia	53%	4	12%	86	6%	18	58%	82	13%	25	16%	391	51%	120	7%	24	37%	51	802	18%	7•7%
Turkey	47%	2	11%	36	6%	12	54%	77	11%	9	14%	141	48%	88	7%	15	34%	31	410	18%	8•1%
United Arab Emirates	50%	40	12%	359	6%	115	58%	298	13%	145	16%	1360	51%	1910	7%	164	36%	552	4942	22%	8•5%
West Bank and Gaza Strip	51%	1	13%	7	7%	2	58%	5	12%	2	17%	32	53%	21	8%	5	38%	6	81	19%	6•3%
Yemen	39%	13	8%	11	4%	2	46%	5	9%	10	11%	101	36%	3	5%	11	29%	4	161	10%	3•3%
Latin America & Caribbean																					
Argentina	48%	79	11%	529	6%	75	53%	596	11%	229	14%	2108	46%	1007	6%	133	33%	452	5208	17%	8•9%
Bahamas	54%	0	13%	4	6%	1	60%	2	13%	1	16%	19	53%	16	7%	1	0%	0	43	20%	9•2%
Barbados	47%	0	12%	6	6%	1	57%	2	12%	1	15%	24	51%	38	8%	1	34%	1	75	23%	12•7%
Belize	53%	0	12%	1	6%	0	52%	1	12%	1	15%	5	52%	6	8%	0	36%	1	15	22%	9•3%
Bolivia	38%	1	9%	20	4%	5	45%	193	8%	8	11%	48	40%	61	5%	13	27%	19	369	21%	5•8%
Brazil	39%	273	8%	843	4%	250	44%	1127	8%	430	11%	4883	37%	2327	5%	258	26%	585	10976	13%	5•4%
Chile	46%	18	10%	137	5%	27	52%	833	10%	66	13%	405	46%	299	6%	44	33%	177	2006	22%	10•3%
Colombia	41%	22	9%	156	5%	43	47%	398	9%	82	12%	709	40%	341	5%	69	28%	105	1924	15%	5•5%
Costa Rica	44%	2	10%	27	5%	6	49%	30	10%	10	13%	104	43%	78	6%	7	31%	20	284	16%	6•9%
Cuba	40%	16	9%	140	4%	24	45%	68	9%	39	11%	388	39%	486	5%	26	28%	48	1235	15%	7•4%
Dominican Republic	40%	5	8%	31	4%	5	43%	11	8%	12	11%	109	40%	72	5%	4	27%	1	249	13%	3•7%
Ecuador	41%	6	9%	50	4%	10	47%	193	9%	20	12%	173	42%	105	5%	18	28%	46	622	17%	5•4%
El Salvador	39%	2	9%	19	4%	4	47%	36	9%	13	12%	48	43%	208	6%	6	28%	14	352	23%	6•9%
Guatemala	38%	5	8%	13	4%	3	44%	41	8%	11	11%	37	40%	321	5%	5	26%	16	451	25%	6•4%
Guyana	38%	0	9%	2	5%	0	47%	3	9%	1	12%	12	42%	27	5%	1	28%	1	47	20%	7•5%
Haiti	14%	2	3%	6	1%	1	24%	9	3%	2	4%	18	19%	22	2%	2	10%	3	64	6%	1•6%
Honduras	36%	1	8%	11	4%	2	43%	26	8%	8	11%	34	40%	150	5%	3	25%	8	243	21%	6•2%
Jamaica	38%	1	9%	13	4%	2	45%	10	8%	5	11%	60	40%	70	5%	4	28%	4	169	16%	6•5%
Mexico	48%	35	11%	298	6%	65	55%	760	11%	256	15%	1858	48%	1296	7%	190	35%	484	5242	20%	6•8%
Nicaragua	42%	0	10%	12	5%	3	48%	30	9%	8	13%	45	43%	27	6%	2	30%	6	133	17%	5•0%
Panama	41%	1	10%	13	5%	3	50%	5	10%	5	12%	62	44%	60	6%	6	32%	6	161	16%	6•1%
Paraguay	38%	3	8%	15	4%	4	43%	24	8%	10	10%	71	35%	55	4%	6	25%	6	194	13%	4•8%
Peru	38%	8	8%	92	4%	23	45%	347	8%	58	11%	239	39%	194	5%	30	27%	88	1080	16%	4•7%
Puerto Rico	54%	5	13%	68	7%	11	60%	27	13%	18	17%	217	53%	241	8%	10	40%	39	636	23%	11•6%
Suriname	45%	0	10%	2	5%	1	51%	1	10%	1	14%	11	38%	4	6%	1	33%	1	22	14%	5•2%
Trinidad and Tobago	0%	0	10%	11	5%	2	52%	5	10%	4	13%	41	45%	57	6%	5	31%	4	128	18%	8•6%
Uruguay	44%	11	10%	61	5%	11	49%	65	10%	23	12%	178	43%	115	6%	12	30%	49	525	16%	8•5%
Venezuela	45%	9	10%	92	5%	23	51%	87	10%	55	14%	496	45%	338	6%	39	33%	85	1223	17%	5•8%

North America																					
Canada	44%	69	10%	723	5%	141	49%	304	10%	221	12%	2333	43%	2133	6%	150	31%	644	6719	16%	7•9%
United States of America	49%	637	11%	5329	6%	867	54%	2827	11%	2405	15%	27408	48%	23948	7%	1404	35%	7440	72266	20%	9•5%
East Asia																					
China	22%	537	4%	2556	2%	812	25%	6935	4%	1053	5%	5576	20%	14460	2%	732	14%	2982	35643	9%	3•0%
Democratic People's Republic of Korea	13%	3	2%	44	1%	13	15%	64	2%	18	3%	91	12%	90	1%	13	8%	44	9356	7%	3•2%
Japan	20%	34	4%	1256	2%	251	24%	2538	4%	599	5%	1891	17%	1905	2%	158	13%	723	380	4%	1•3%
Mongolia	39%	3	8%	3	4%	1	43%	2	8%	4	11%	6	35%	7	5%	2	25%	9	2778	8%	2•8%
Republic of Korea	25%	5	5%	370	2%	150	30%	746	5%	123	7%	579	23%	458	3%	59	17%	287	36	13%	1•9%
South-East Asia																					
Brunei Darussalam	0%	0	4%	1	2%	0	28%	0	4%	0	6%	3	19%	5	2%	0	14%	0	10	8%	3•7%
Cambodia	11%	0	2%	5	1%	1	13%	16	2%	1	2%	17	10%	16	1%	3	7%	2	61	4%	0•8%
Indonesia	15%	5	3%	225	1%	56	18%	141	3%	76	4%	1175	18%	1183	2%	188	12%	117	3165	5%	2•1%
Lao PDR	13%	0	2%	2	1%	1	16%	11	2%	0	3%	7	13%	10	1%	1	8%	1	35	5%	1•3%
Malaysia	35%	21	7%	84	3%	24	38%	51	7%	17	9%	294	34%	237	4%	42	23%	40	810	11%	4•5%
Myanmar	14%	6	2%	27	1%	7	17%	140	2%	9	3%	96	14%	80	1%	17	9%	14	395	5%	1•3%
Philippines	22%	10	4%	100	2%	27	25%	47	4%	33	6%	559	22%	455	2%	48	14%	47	1325	7%	2•6%
Singapore	26%	1	5%	42	3%	10	32%	23	5%	9	7%	118	25%	131	3%	10	18%	23	367	9%	4•9%
Thailand	27%	10	5%	182	3%	43	31%	377	5%	50	8%	612	29%	539	3%	83	19%	64	1960	10%	3•3%
Timor-Leste	11%	0	2%	0	1%	0	14%	1	2%	0	3%	2	11%	4	1%	0	7%	0	7	4%	1•5%
Viet Nam	5%	1	1%	28	0%	7	8%	13	1%	3	1%	76	7%	181	1%	7	4%	14	330	2%	0•6%
South-Central Asia																					
Afghanistan	9%	3	1%	2	1%	1	10%	8	1%	1	2%	27	7%	50	1%	2	5%	3	96	3%	1•1%
Bangladesh	3%	9	0%	3	0%	1	4%	124	0%	1	0%	25	3%	29	0%	7	2%	4	204	1%	0•4%
Bhutan	15%	0	2%	0	1%	0	16%	1	3%	0	4%	0	0%	0	2%	0	8%	0	2	5%	1•1%
India	11%	77	2%	234	1%	107	13%	1478	2%	101	3%	2136	12%	1425	1%	287	7%	181	6026	4%	1•2%
Iran (Islamic Republic of)	41%	103	9%	211	4%	35	46%	197	9%	44	12%	583	40%	310	5%	76	28%	165	1724	14%	4•7%
Kazakhstan	45%	23	10%	99	5%	45	49%	11	10%	52	13%	560	39%	479	5%	45	30%	50	1364	15%	6•6%
Kyrgyzstan	42%	2	9%	8	4%	3	48%	13	9%	7	11%	45	35%	69	4%	6	23%	7	160	15%	5•5%
Maldives	49%	0	10%	0	5%	0	0%	0	0%	0	13%	3	45%	1	5%	0	0%	0	5	13%	5•1%
Nepal	5%	1	1%	1	0%	1	6%	36	1%	1	1%	9	5%	5	1%	3	3%	2	59	2%	0•6%
Pakistan	23%	37	4%	40	2%	18	28%	355	5%	11	6%	968	24%	494	3%	86	16%	75	2084	8%	2•7%
Sri Lanka	21%	10	4%	9	2%	4	23%	17	4%	3	5%	147	21%	44	2%	15	13%	8	257	6%	2•0%
Tajikistan	28%	4	5%	2	2%	1	32%	1	5%	2	7%	20	22%	71	3%	1	18%	3	106	13%	4•1%
Turkmenistan	30%	7	5%	5	3%	2	36%	1	6%	2	8%	23	26%	38	3%	2	20%	5	85	11%	3•0%
Uzbekistan	37%	13	8%	20	4%	9	42%	7	8%	13	10%	190	30%	226	4%	8	24%	23	510	14%	4•4%
Eastern Europe																					
Belarus	42%	5	9%	107	5%	43	47%	66	9%	34	12%	348	42%	597	5%	45	28%	177	1422	17%	9•2%
Bulgaria	44%	6	9%	126	5%	41	49%	87	10%	52	12%	374	41%	522	5%	46	29%	85	1339	16%	8•8%
Czech Republic	52%	19	13%	253	6%	81	58%	374	13%	132	15%	885	49%	923	7%	75	37%	440	3182	21%	12•0%
Hungary	46%	12	10%	222	5%	80	52%	214	11%	100	13%	546	44%	348	6%	58	31%	164	1743	15%	7•5%
Poland	46%	1	11%	45	6%	16	54%	15	11%	24	14%	129	44%	153	6%	11	34%	30	7419	19%	10•1%
Republic of Moldova	48%	20	11%	543	6%	173	53%	894	11%	269	13%	1926	44%	2623	6%	260	33%	711	424	17%	9•0%
Romania	40%	13	9%	224	4%	80	46%	171	9%	121	11%	781	39%	593	5%	89	27%	181	2254	13%	6•5%
Russian Federation	49%	113	11%	2461	6%	637	55%	1194	11%	831	14%	6643	47%	9832	6%	828	34%	2829	25367	19%	10•7%
Slovakia	42%	3	9%	89	5%	29	47%	123	9%	40	12%	256	42%	386	5%	28	29%	119	1073	17%	9•5%
Ukraine	40%	37	9%	473	4%	191	46%	312	9%	192	11%	1449	40%	2769	5%	200	28%	580	6203	16%	8•9%
Northern Europe																					
Denmark	36%	18	8%	113	4%	26	41%	59	8%	39	9%	419	35%	266	4%	24	25%	64	1029	12%	6•0%
Estonia	38%	0	8%	22	4%	6	45%	12	8%	8	10%	54	36%	75	5%	7	26%	30	214	14%	7•6%
Finland	44%	11	10%	83	5%	22	49%	75	10%	59	12%	452	42%	363	6%	25	30%	121	1210	16%	9•3%
Iceland	42%	1	9%	5	4%	1	48%	2	9%	1	11%	20	40%	12	5%	1	29%	4	48	14%	7•1%

Ireland	42%	19	9%	68	5%	16	48%	45	9%	24	12%	254	41%	153	6%	21	29%	62	660	14%	7•1%
Latvia	45%	3	10%	38	5%	12	51%	21	10%	20	12%	116	42%	164	5%	16	31%	58	448	17%	9•2%
Lithuania	49%	3	11%	49	6%	19	55%	35	11%	26	14%	163	45%	257	6%	22	34%	103	677	19%	9•5%
Norway	38%	9	8%	109	4%	22	43%	36	8%	30	10%	233	37%	281	5%	19	26%	73	813	13%	6•7%
Sweden	38%	17	8%	165	4%	37	43%	100	8%	39	10%	532	37%	525	5%	30	26%	110	1556	13%	7•0%
UK	44%	498	10%	1177	5%	279	50%	272	10%	450	12%	5269	43%	3612	6%	379	31%	1101	13037	15%	8•2%
Southern Europe																					
Albania	41%	1	8%	9	4%	2	46%	4	9%	6	11%	59	38%	82	5%	3	27%	20	187	17%	5•5%
Bosnia and Herzegovina	47%	2	10%	34	5%	8	52%	47	11%	12	13%	118	45%	143	6%	14	30%	35	413	18%	9•0%
Croatia	43%	4	9%	73	5%	28	48%	107	9%	31	12%	263	41%	243	5%	22	29%	86	857	16%	8•2%
Cyprus	50%	1	11%	17	6%	3	54%	9	12%	4	14%	60	46%	42	6%	3	32%	4	144	17%	9•1%
Greece	43%	4	9%	110	5%	26	47%	94	9%	65	11%	453	40%	343	5%	45	29%	106	319	16%	9•4%
Italy	41%	38	9%	1320	4%	246	46%	1052	9%	509	11%	4263	38%	3178	5%	278	28%	989	1246	14%	7•2%
Malta	38%	0	8%	20	4%	5	44%	11	8%	7	10%	91	37%	165	5%	7	26%	12	11874	14%	7•4%
Montenegro	51%	0	12%	9	6%	2	56%	3	12%	4	15%	38	49%	31	7%	3	34%	7	98	18%	11•2%
Portugal	39%	0	8%	6	4%	1	44%	7	8%	2	11%	19	37%	27	5%	2	26%	6	70	15%	7•2%
Serbia	46%	8	10%	216	5%	39	51%	98	11%	59	13%	576	45%	672	6%	36	32%	108	1811	17%	8•9%
Slovenia	44%	5	10%	111	5%	50	51%	129	10%	60	13%	560	42%	611	5%	49	31%	122	1697	17%	8•8%
Spain	43%	1	10%	38	5%	14	48%	61	10%	20	12%	126	43%	131	6%	11	30%	43	445	17%	8•9%
FYR Macedonia	48%	44	11%	979	6%	222	54%	572	11%	343	14%	2470	46%	2344	6%	200	33%	692	7868	17%	9•2%
Western Europe																					
Austria	42%	10	9%	124	5%	30	47%	99	9%	74	11%	470	40%	360	5%	33	29%	143	1343	15%	7•3%
Belgium	43%	34	9%	243	5%	55	48%	97	9%	58	11%	922	41%	618	5%	44	29%	180	2250	14%	7•8%
France	39%	104	8%	1035	4%	248	45%	605	8%	382	10%	4300	38%	2585	5%	215	26%	931	10405	13%	6•6%
Germany	45%	151	10%	1810	5%	430	51%	1616	10%	877	12%	7273	43%	4813	6%	387	30%	2190	19549	16%	8•9%
Luxembourg	46%	1	11%	9	5%	2	48%	1	11%	4	13%	35	45%	52	6%	2	31%	6	113	19%	9•8%
Netherlands	41%	98	9%	380	4%	86	46%	135	9%	90	11%	1150	39%	789	5%	50	28%	268	1148	12%	6•3%
Switzerland	37%	17	8%	106	4%	24	42%	77	8%	49	9%	432	35%	345	4%	27	25%	73	3046	13%	7•0%
Oceania																					
Australia	44%	53	10%	481	5%	101	50%	184	10%	132	13%	1412	43%	972	6%	81	31%	365	3782	15%	7•4%
Fiji	0%	0	11%	2	6%	0	58%	1	12%	1	15%	21	47%	22	7%	3	37%	1	52	19%	7•1%
New Zealand	44%	12	10%	101	5%	19	49%	32	10%	24	12%	266	43%	211	6%	17	31%	60	743	15%	7•6%
Papua New Guinea	34%	3	6%	5	3%	1	33%	5	6%	1	8%	30	32%	66	4%	6	20%	1	118	13%	2•9%
Samoa	56%	0	16%	0	8%	0	0%	0	0%	0	20%	2	61%	3	10%	0	0%	0	6	28%	8•2%
Solomon Islands	0%	0	11%	1	6%	0	0%	0	0%	0	14%	6	45%	8	6%	1	0%	0	16	19%	6•5%
Vanuatu	0%	0	11%	0	6%	0	0%	0	0%	0	14%	2	43%	3	6%	0	0%	0	6	20%	6•7%

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