

# Worldwide Obesity Trends: An Analysis of WHO Data

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## Abstract

Obesity, the largest contributor to global mortality and morbidity, increases the incidence of cardiovascular disease, type 2 diabetes mellitus, and stroke. It is also associated with social disengagement, reduction of labor productivity, and psychosocial burden. In the past decade, two collaborative reports on risk factors for non-communicable diseases have revealed the enormity of worldwide obesity. This study was an attempt to reanalyze global changes in body mass index [BMI (kg/m<sup>2</sup>)] and prevalence of obesity (%) using the only data and region stratification scheme provided by WHO. This report also analyzed the rate of changes in age-standardized mean serum total cholesterol level ( $\geq 0.5$  mmol/L) and age-standardized mean systolic blood pressure (mmHg). The results showed that the rate of change in BMI for males is generally lower than for females. The lack of information on menopausal status in the studied women population indicated that observed BMI increase in women population might have its etiology in biological aging and may be independent of poor dietary habits. There is a decrease in serum total cholesterol levels stratified by sex in the Americas, the EU, and Australia. An increase in systolic blood pressure defined nearly every country in Southeast Asia. North Korea is defined by positive changes in all parameters under consideration (sic!). The lack of apparent correlation between BMI, serum cholesterol, and systolic blood pressure occurs only in countries with policies allowing broad access to drugs for cholesterol and blood pressure increases.

**Keywords:** Epidemiology; Obesity; Systolic blood pressure; Total serum cholesterol

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stratification scheme using statements such as “English-speaking countries” was introduced. Moreover, the means of a graphical representation of the data, in particular Figure 1 of the CRS-RISC report [12], lead, in our view, to an erroneous understanding of the current world situation.

Taking into account the outline shortcomings, we briefly reviewed the WHO data [11,15] and reported worldwide changes in BMI, obesity (BMI  $\geq 30$ ), systolic blood pressure [SBP (mmHg)], and total serum cholesterol level [STChol (mg/dL)]  $\geq 5.0$  mmol/L.

## Materials and Methods

The statistical data, including age-standardized mean BMI, age-standardized STCh, age-standardized mean SBP, and obesity prevalence (%) by region, country, year, and sex, for 1975-2016 were taken directly from the WHO repository [15]. The methods of collecting and preparing the original data are described in a separate document [11]. The data were extracted from the WHO repository using the WHO Application Programming Interface (API) and custom-written software in the R programming language [16].

WHO includes 194 member states divided into the 6 following subregions: AFR=Africa; AMR=Americas; EMR=Eastern Mediterranean; EUR=Europe; SEAR=South-East Asia; WPR=Western Pacific. The following countries are incorporated in the following subregions: AFR-Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe; AMR - Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia (Plurinational State of), Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala,

## Introduction

The scientific literature indicates that obesity is the primary driver of global mortality and morbidity. For example, obesity increases the incidence of cardiovascular disease [1], type 2 diabetes mellitus [2], and stroke [3]. However, the validity of the association between obesity and stroke has recently been questioned [4].

Obesity is associated with social withdrawal [5], reduced labor productivity [6], and psychosocial burden [7]. Correlations between obesity and unemployment [8] rendered worldwide social and economic problems [9]. Some argue that global obesity is at a pandemic level [10]. As a result, the stress induced by obesity on economies and health services led to the construction and implementation of global guidelines to prevent obesity [11]. Despite preventive measures, the recent NCD Risk Factor Collaboration (NCD-RisC) study reported that obesity is still a global economic and health-related problem [12,13]. NCD-RisC: A worldwide health scientist's web providing data on risk factors for non-communicable diseases (NCDs).

Although the NCD-RisC report [12] showed Body Mass Index [BMI(kg/m<sup>2</sup>)=body mass (kg)/height<sup>2</sup>(m<sup>2</sup>)] to be a global “culprit” of non-communicable diseases, its conclusions omitted the U.S.A; the country with not only one of the globally highest rate of BMI increase but also one of the worst health care systems among developed nations [14]. Furthermore, NCDs-RisC reports [12,13] did not follow World Health Organization (WHO) regionalization scheme. Instead, a vague

Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, United States of America, Uruguay, Venezuela (Bolivarian Republic of); EMR - Afghanistan, Bahrain, Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen; EUR - Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, North Macedonia, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan.

The analysis encompassed changes in the age-standardized mean BMI, the age-standardized mean STChol, and the age-standardized mean value SBP levels for men and women aged 18 and older. Because changes in BMI levels are gender-based [12], sex stratification was used for all analyses. The rate of variation of the studied parameters was assessed using a linear regression model, a routine of “statistics v3.6.2” of the R -core project.

Results

Figure 1A, B shows the annual rate of change in age-standardized BMI from 1975 to 2016, stratified by country and gender. Figures 2A, B and Figures 3A, B illustrate the rate of change in mean SBP and STChol levels. Table 1 is a numeric compilation of the data shown in Figures 1-3. The annual rate of BMI, STChol, and SBP stratified by region, country and gender is presented in the Annex.

Parameter	WHO Region	Yearly Increase	
		men	women
BMI (kg/m²)	AFR	0.083	0.106
	AMR	0.091	0.116
	EMR	0.086	0.087
	EUR	0.072	0.047
	SEAR	0.083	0.103
	WPR	0.085	0.093
STChol (≥ 5 mmol/L)	AFR	-0.006	-0.012
	AMR	-0.01	-0.008
	EMR	-0.009	-0.007
	EUR	-0.019	-0.021
	SEAR	-0.002	0.002
	WPR	-0.004	0
SBP (mmHg)	AFR	0.05	0.099
	AMR	-0.006	-0.081
	EMR	0	-0.122
	EUR	-0.052	-0.182
	SEAR	0.109	0.113
	WPR	0.026	-0.013

Table 1: The rate of yearly changes of studied parameters, i.e., BMI, STChol (≥ 5 mmol/L), and SBP stratified by gender and WHO region.

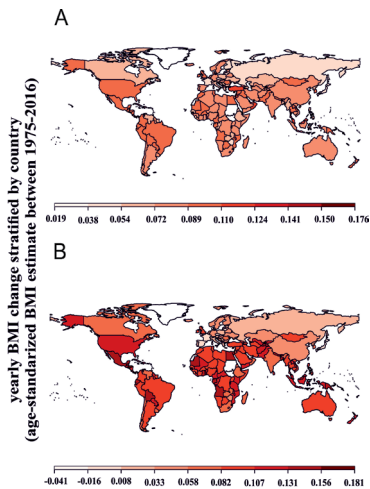


Figure 1: The rate of changes in age-standardized mean BMI in 1975 and 2014 by country A) men B) women.

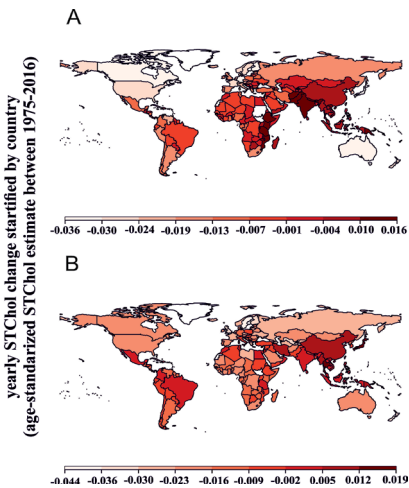


Figure 2: The rate of changes in age-standardized mean STChol levels in 1975 and 2014 by country A) men B) women.

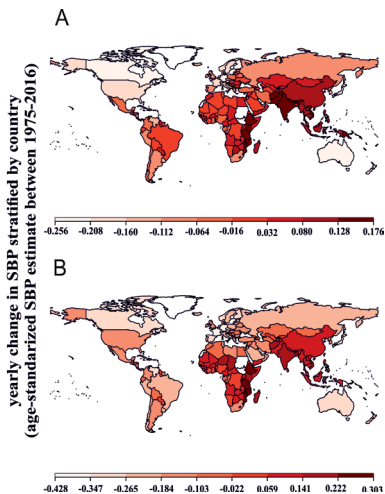


Figure 3: The rate of changes in age-standardized mean SBP levels in 1975 and 2014 by country A) men B) women.

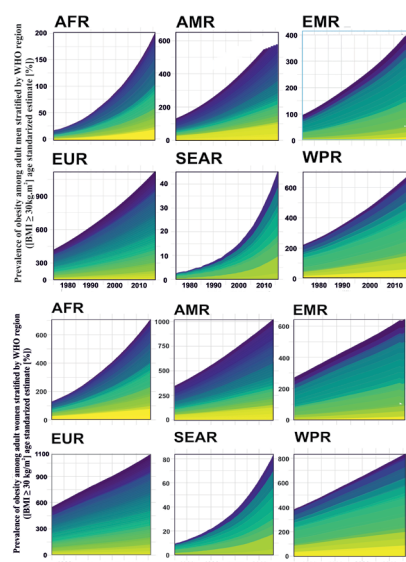
Analysis of Table 1 revealed that the overall rate of change in BMI in males was relatively 10.4% lower than in females. This phenomenon characterized the AFR, AMR, SEAR, and WPR regions.

The overall analysis of the rate of increase in BMI revealed the highest values for both genders in North and South America, Africa, and Australia. The minuscule increase and, in some cases, the near-constant level of BMI was observed for the EU Member States and the Russian Federation.

Analysis of STChol level changes, stratified by region and gender, unfolded decline in both Americas, the EU, and Australia for men and women (Figures 2A, 2B), respectively. There was a notable rise in STChol level in South Asia and East Africa. Furthermore, China, one of the world's largest nations, is defined by an apparent rise in the level of STChol in both genders.

Analysis of the worldwide rate of change in SBP (Figure 3A, 3B) unfolded U.S.A., Canada, and Australia as countries and continents defined by a decrease in SBP for both genders. The South Asia region experienced a noteworthy annual increase in SBP. Furthermore, highly populated countries such as China and India are defined by a substantial increase in SBP in both genders.

An increase in obesity prevalence ( $BMI \geq 30 \text{ kg/m}^2$ ) stratified by WHO region and gender is presented in Figures 4A, 4B. Analysis of Figures 4A and B identified Southeast Asia (SEAR) and Africa (AFR) as the regions with the substantial and exponential growth in the prevalence of obesity among men and women. Also, for both genders, the relative prevalence in obesity (%) in AFR was generally lower than in AMR, EUR, and WPR. The smallest increase in obesity prevalence was observed in SEAR for both genders. In women, the prevalence of obesity in AFR is similar to that of EMR, whereas the greatest obesity prevalence defined EUR and AMR.



**Figure 4:** Trends in age-standardized prevalence of obesity ( $BMI \geq 30 \text{ kg/m}^2$ ) categorized by WHO region: AFR=Africa; AMR=Americas; EMR=Eastern Mediterranean; EUR=Europe; SEAR=South-East Asia; WPR=Western Pacific; A) men, B) women; color codes within the graphs correspond to specific countries not listed for the clarity of the figure.

## Discussion and Conclusions

This study reviewed annual obesity trends already reported in NCD risk factor reports [12,13]. The latter showed a substantial increase in the incidence of obesity in the South Asia region. As a

result, it tripled for men (3.2 to 10.8%) and doubled (6.4 to 14.9%) for women between 1975 and 2014. This study confirmed the previous observation. However, in this study, the SEAR region was defined by a substantial exponential increase in obesity prevalence ( $BMI \geq 30 \text{ kg/m}^2$ ) for men and women.

The NCD Risk Report stated that “men and women in high-income English-speaking countries in 2014 had substantially higher BMIs than those in continental Europe, whereas in 1975 the rate of BMI changes had been similar or lower, especially for women”. In our opinion, the statement is very vague and unclear. The authors have not defined ‘English-speaking nations.’ Assuming that English is one of the official languages of a country, many countries in Africa and, in principle, the whole EU must be included in this category. Thus, in our opinion, Figure 1 of the NCD Report [12] may create confusion among readers.

This study also found that most EU countries are defined by almost constant BMI levels (Figures 1A, B, Appendix 1). There is also a decline in serum levels of STChol levels and SBP (Figures 2A, B and Figures 3A, B, Appendix 1) in the male and female populations. In our view, it is a remarkable example of a well-implemented and well-managed public health policy.

NCDs also compared “West Africa” with “Central Africa” (Ibid., Figure 1). Unfortunately, the respective graph highlighted the level rather than the slope (rates: annual changes in specific value) of obesity changes. To clarify this problem, we provide graphs (Figures 1A, 1B and Figures 3A, 3B, Appendix 1) showing only the slopes’ value, using color codes, for the respective rates of change in BMI, STChol, and SBP.

This study also showed that countries of the eastern Africa belt, i.e., Ethiopia, Kenya, Tanzania, and Mozambique, are defined by an apparent increase in serum STChol and SBP levels in men and women. Similar values were reported for the Southeast Asian region, particularly for India and China.

Figure 1 of the NRC report [12] did not specify North America as a separate geographical entity. Meanwhile, BMI has increased substantially in the United States. Analysis of Figures 1A, B - 3A, B and Appendix 1 presented in this report unfolded that in the U.S.A. the average annual increase in BMI is virtually equal to that observed for the African continent. Moreover, despite substantial differences in per capita income between the U.S.A. and the rest of the world, the rate of BMI increase in women is higher than that observed in India or China. However, China and India are defined by an increase in STChol and SBP levels, whereas decrease in these parameters defined the U.S.A. This phenomenon is probably rendered by the easy access of the US residents to drugs reducing blood pressure and cholesterol levels [17] generating excellent revenue for the pharmaceutical industry (<https://www.statista.com/statistics/275560/domestic-and-international-revenue-of-the-us-pharmaceutical-industry/>).

Analysis of the global prevalence in obesity ( $BMI \geq 30 \text{ kg/m}^2$ ) stratified by region, country, and gender revealed a substantial increase in obesity worldwide. For both genders, obesity has grown exponentially in AFR and SEAR regions. An amalgam of this observation with the previously reported relationship between income and obesity [18] revealed correlations between pauperization and obesity. In our view, the example of such is countries of the African continent [19], India [20], and China [21].

The main shortcoming of this and the previous study was the lack of stratification of the women population by menopausal status. It is well known that perimenopause is one of the most critical factors influencing an age-dependent increase in body weight [22-25]. Therefore, adjustment for menopausal status is essential for discussing changes in obesity in populations of aging women. The observed substantial increase in BMI in women may have its etiology in an aging society and be independent of poor dietary habits.

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## Appendix

WHO REGION	COUNTRY CODE	BMI (kg/m <sup>2</sup> )		STChol (≥ 5,0 mmol/L)		SBP (mm Hg)	
		men	women	men	women	men	women
AFR	AGO	0.089490317	0.132542	-0.00636	-0.01143493	0.06392	0.113902
AFR	BDI	0.081638441	0.088137	-0.0032	-0.009099	0.175714	0.259443
AFR	BEN	0.085868244	0.145734	-0.00481	-0.01501669	-0.00962	0.057613
AFR	BFA	0.089214812	0.088583	-0.00759	-0.01537264	0.048101	0.120209
AFR	BWA	0.097868892	0.104019	0.004205	-0.00498331	0.081551	0.119408
AFR	CAF	0.071307025	0.111109	-0.00625	-0.01314794	0.033084	0.07831
AFR	CIV	0.083396807	0.098622	-0.01164	-0.01926585	0.031115	0.047962
AFR	CMR	0.093314966	0.126578	-0.00492	-0.01657397	0.038711	0.084983
AFR	COD	0.074256543	0.099668	-0.01357	-0.02106785	0.008641	0.041812
AFR	COG	0.069500041	0.108541	-0.00925	-0.01334816	-0.02298	-0.02749
AFR	COM	0.08641115	0.150182	-0.00823	-0.01208009	0.075192	0.130314
AFR	CPV	0.106952435	0.13503	6.28E-17	-0.00907675	0.088641	0.103885
AFR	DZA	0.085519812	0.09761	-0.00925	-0.00776418	0.017213	-0.0966
AFR	ERI	0.053731464	0.073884	0.002136	-0.00427141	0.05899	0.088519
AFR	ETH	0.060359776	0.080391	-0.00358	-0.00849833	0.150105	0.235958
AFR	GAB	0.101928531	0.154931	-0.00857	-0.01310345	-0.0231	-0.0484
AFR	GHA	0.072619723	0.139332	-0.01039	-0.01541713	-0.02354	0.008589
AFR	GIN	0.081630338	0.103452	-0.00759	-0.01330367	0.082038	0.192787
AFR	GMB	0.128595738	0.146828	-0.00963	-0.01390434	0.043972	0.135279
AFR	GNB	0.096734462	0.126254	-0.00877	-0.01608454	0.060261	0.135348
AFR	GNQ	0.079385787	0.131408	0.011546	0.003070078	0.0323	0.063763
AFR	KEN	0.077165546	0.119342	-0.00492	-0.00901001	0.129355	0.178763
AFR	LBR	0.071225995	0.129584	-0.01744	-0.02393771	0.022561	0.066516
AFR	LSO	0.082594603	0.068333	-0.0057	-0.00963293	0.036812	0.145174
AFR	MDG	0.072660238	0.059784	-0.0075	-0.01301446	0.092613	0.158537
AFR	MLI	0.097885098	0.120339	-0.00723	-0.0152614	0.02899	0.119547
AFR	MOZ	0.091402642	0.115582	0.000734	-0.00758621	0.130157	0.228118
AFR	MRT	0.100453772	0.136456	-0.01014	-0.01944383	0.022927	0.091237
AFR	MUS	0.081006401	0.071639	0.002403	-0.00264739	0.060261	0.033937
AFR	MWI	0.089279637	0.093931	6.28E-17	-0.00589544	0.169983	0.243031
AFR	NAM	0.081249494	0.088007	-0.00912	-0.01388209	0.015226	0.029808
AFR	NER	0.073810874	0.092318	-0.01473	-0.02024472	0.027666	0.204634
AFR	NGA	0.076557815	0.085269	-0.01426	-0.02008899	-0.02172	0.014321
AFR	RWA	0.079345272	0.098955	6.28E-17	-0.00776418	0.12892	0.208136
AFR	SDF	0.09084353	0.116952	na	na	0.098223	0.124948
AFR	SDN	na	na	-1.5E-16	-0.00527253	na	na
AFR	SEN	0.068965238	0.087059	-0.00819	-0.01695217	0.012021	0.055767
AFR	SLE	0.065505226	0.081444	-0.0166	-0.02153504	0.034181	0.091882
AFR	STP	0.098419901	0.123669	-0.01473	-0.01993326	0.03669	0.085157
AFR	SWZ	0.094157686	0.105113	-0.00857	-0.01114572	0.030157	0.106272
AFR	SYC	0.103370878	0.097723	0.009477	0.000467186	0.021132	-0.05549
AFR	TCD	0.079450612	0.089887	-0.00819	-0.01561735	0.061864	0.151916
AFR	TGO	0.080909165	0.137412	-0.01152	-0.01915462	-0.00019	0.068275
AFR	TZA	0.075447695	0.111174	0.002136	-0.00171301	0.155732	0.252787
AFR	UGA	0.081630338	0.100357	-0.00154	-0.00571746	0.087857	0.170105
AFR	ZAF	0.073592091	0.079929	-0.01713	-0.01893215	-0.10171	-0.15868
AFR	ZMB	0.064978527	0.070667	-0.00885	-0.0098109	0.058955	0.106551

AFR	ZWE	0.049064095	0.035791	-0.01139	-0.01579533	0.034373	0.090923
AMR	ARG	0.075261324	0.097107	-0.01402	-0.0119911	-0.07491	-0.13676
AMR	ATG	0.080163682	0.113605	-0.00779	-0.00444939	0.062561	0.008362
AMR	BHS	0.08340491	0.089053	-0.01264	-0.01027809	-0.05483	-0.18023
AMR	BLZ	0.084377279	0.111879	-0.01493	-0.01205784	-0.03528	-0.11282
AMR	BOL	0.094514221	0.141002	-0.00857	-0.00749722	-0.00709	-0.07685
AMR	BRA	0.09124058	0.092432	-0.00189	-3.1386E-17	-0.01167	-0.18847
AMR	BRB	0.06445993	0.072652	-0.01571	-0.01406007	0.017108	-0.05291
AMR	CAN	0.067231181	0.079224	-0.01826	-0.01717464	-0.25641	-0.28627
AMR	CHL	0.082545985	0.067855	3.14E-17	-0.00278087	-0.0554	-0.22455
AMR	COL	0.10525079	0.097828	-0.00358	-8.8988E-05	-0.02732	-0.1222
AMR	CRI	0.09978932	0.14464	-0.00278	-0.00231368	0.005453	-0.05467
AMR	CUB	0.076979175	0.067725	-0.02174	-0.01802002	-0.12599	-0.20998
AMR	DMA	0.087164735	0.125298	-0.0077	-3.1386E-17	0.070139	-0.00526
AMR	DOM	0.086338222	0.125954	-0.00356	-0.0057842	0.030505	-0.05441
AMR	ECU	0.105647841	0.131967	-0.00859	-0.00803115	0.010105	-0.06974
AMR	GRD	0.079410096	0.127785	-0.00616	-0.00622914	0.091986	0.061516
AMR	GTM	0.091880723	0.141561	-0.01664	-0.01107898	0.035418	-0.02767
AMR	GUY	0.079061664	0.121287	-0.01324	-0.01067853	0.048833	0.033084
AMR	HND	0.098176809	0.18065	-0.0099	-0.0054505	0.052544	-0.00113
AMR	HTI	0.11422089	0.128182	-0.01232	-0.01234705	0.092997	0.077648
AMR	JAM	0.10279556	0.154177	-0.01161	-0.0116129	0.010714	-0.02678
AMR	KNA	0.101815088	0.134422	-0.00242	-0.00320356	0.077247	0.030697
AMR	LCA	0.175974394	0.170545	-0.001	-0.001802	0.118641	0.050993
AMR	MEX	0.0910299	0.138141	-3.1E-17	0.00378198	-0.02599	-0.14688
AMR	NIC	0.088720525	0.125922	-0.01715	-0.01254727	-0.02493	-0.0665
AMR	PAN	0.090187181	0.125484	-0.00779	-0.00391546	0.003118	-0.07075
AMR	PER	0.092018475	0.084207	-0.00885	-0.0072525	-0.06836	-0.20155
AMR	PRY	0.096718256	0.121749	-0.00676	-0.00391546	0.061254	-0.00664
AMR	SLV	0.101523377	0.148505	-0.00823	-0.00516129	0.001498	-0.08742
AMR	SUR	0.071047727	0.090082	-0.01402	-0.01196885	-0.01253	-0.11514
AMR	TTO	0.083121303	0.119699	-0.0119	-0.01047831	0.148902	0.116551
AMR	URY	0.08208411	0.068641	-0.01664	-0.01617353	-0.13956	-0.24594
AMR	USA	0.100445669	0.113232	-0.01922	-0.02053393	-0.18186	-0.17148
AMR	VCT	0.097885098	0.126538	-0.0026	-0.00126808	0.067892	-0.01223
AMR	VEN	0.066680172	0.070853	-0.02027	-0.01474972	-0.12763	-0.273
EMR	AFG	0.086459768	0.126983	-0.02107	-0.01659622	0.143624	0.154652
EMR	ARE	0.081695162	0.061519	-0.01733	-0.01481646	-0.17526	-0.35225
EMR	BHR	0.022088972	-0.041	-0.00679	-0.00491657	-0.1111	-0.32359
EMR	DJI	0.06261243	0.047557	-0.01306	-0.01543938	-0.07463	-0.10284
EMR	EGY	0.090454582	0.153586	-0.00492	0.003915462	0.039861	-0.0712
EMR	IRN	0.087035086	0.09543	0.00178	0.011390434	-0.04686	-0.16352
EMR	IRQ	0.095591929	0.105486	-0.00725	-0.0083871	-0.01549	-0.13563
EMR	JOR	0.110088323	0.081979	-0.00285	-0.00028921	-0.03436	-0.21296
EMR	KWT	0.093606677	0.061859	-0.01453	-0.01363737	-0.11739	-0.35977
EMR	LBN	0.105315615	0.08509	-0.00803	-0.00420467	-0.05725	-0.28291
EMR	LBY	0.081824812	0.091314	-0.02409	-0.02411568	0.01007	-0.11746
EMR	MAR	0.092844988	0.09919	-0.0032	-0.00046719	0.036115	-0.0642
EMR	OMN	0.107219836	0.065084	3.14E-17	0.000333704	0.062404	-0.10972
EMR	PAK	0.094635767	0.116117	-0.0089	-0.00622914	0.148153	0.131063



EMR	QAT	0.08857467	0.08398	-0.01232	-0.00925473	-0.11397	-0.36723
EMR	SAU	0.087966939	0.085285	-0.02472	-0.02053393	-0.01138	-0.22547
EMR	SDF	0.074727955	0.109747	na	na	0.098223	0.124948
EMR	SOM	0.080090754	0.092723	-0.00801	-0.01214683	0.075958	0.131376
EMR	SYR	0.091824001	0.099838	-0.0067	-0.00418242	0.039251	-0.09145
EMR	TUN	0.097593388	0.082311	0.007141	0.005406007	-0.01906	-0.20037
EMR	YEM	0.081922048	0.118913	-0.00563	-0.00391546	0.122387	0.074303
EUR	ALB	0.076420063	0.06104	-0.00465	-0.00556174	0.106324	-0.02427
EUR	AND	0.058415039	0.007649	-0.02062	-0.02416018	-0.16625	-0.35909
EUR	ARM	0.059452232	0.040726	-0.01933	-0.02238042	0.018362	-0.08181
EUR	AUT	0.060294952	0.022843	-0.02007	-0.02115684	-0.13692	-0.22516
EUR	AZE	0.06540799	0.092464	-0.02752	-0.02640712	0.02331	-0.06606
EUR	BEL	0.053909732	0.012398	-0.02461	-0.02551724	-0.14812	-0.26829
EUR	BGR	0.068957135	0.035054	-0.01341	-0.01508343	-0.00726	-0.19139
EUR	BIH	0.06746617	0.040791	-0.00992	-0.01016685	0.102613	-0.05056
EUR	BLR	0.074523945	0.055231	-0.01577	-0.01695217	-0.0331	-0.15157
EUR	CHE	0.068981444	0.017875	-0.02481	-0.0280089	-0.15554	-0.26146
EUR	CYP	0.08907706	0.063917	-0.00634	-0.01245829	-0.02836	-0.16617
EUR	CZE	0.047216595	-0.01126	-0.03244	-0.02967742	-0.09181	-0.29852
EUR	DEU	0.072011993	0.044137	-0.00983	-0.01517241	-0.25479	-0.40786
EUR	DNK	0.082943035	0.005713	-0.0133	-0.01904338	-0.13993	-0.20233
EUR	ESP	0.072036302	-0.00405	-0.01384	-0.01810901	-0.08639	-0.29706
EUR	EST	0.075625962	0.030719	-0.01724	-0.01837597	-0.07622	-0.28571
EUR	FIN	0.049380115	0.040937	-0.03622	-0.03016685	-0.23979	-0.30516
EUR	FRA	0.037144478	0.007131	-0.02365	-0.02389321	-0.20568	-0.35948
EUR	GBR	0.090276315	0.095171	-0.02999	-0.03072303	-0.09164	-0.16671
EUR	GEO	0.089676687	0.09855	-0.02754	-0.02925473	0.060627	-0.03469
EUR	GRC	0.066210194	0.031399	-0.01993	-0.02487208	-0.07707	-0.25906
EUR	HRV	0.093055668	0.08394	-0.01769	-0.01532814	0.064425	-0.09368
EUR	HUN	0.083680415	0.042136	-0.00565	-0.00500556	-0.01972	-0.1838
EUR	IRL	0.091329714	0.104408	-0.01617	-0.01957731	-0.09625	-0.15294
EUR	ISL	0.073235556	0.052435	-0.01793	-0.02471635	-0.13491	-0.18906
EUR	ISR	0.08773195	0.063407	-0.02832	-0.02518354	-0.18437	-0.31385
EUR	ITA	0.060473219	0.012706	-0.01186	-0.00820912	-0.13166	-0.24458
EUR	KAZ	0.068924722	0.039267	-0.01626	-0.02035595	0.045296	-0.08777
EUR	KGZ	0.076347136	0.124917	-0.02432	-0.02662959	0.072666	0.010592
EUR	LTU	0.046090268	-0.00886	-0.0273	-0.02711902	-0.01125	-0.20692
EUR	LUX	0.076233693	0.037679	-0.02432	-0.02667408	-0.19446	-0.24702
EUR	LVA	0.068446641	0.039227	-0.01927	-0.01895439	-0.05683	-0.23467
EUR	MDA	0.077805688	0.062531	-0.03079	-0.03125695	0.049355	-0.0143
EUR	MKD	0.070034843	0.039389	-0.02122	-0.01915462	0.030296	-0.14885
EUR	MLT	0.057296815	0.000373	-0.02207	-0.03092325	-0.20469	-0.42796
EUR	MNE	0.090292521	0.0739	-0.01448	-0.01541713	0.125958	-0.06833
EUR	NLD	0.079199417	0.043238	-0.02078	-0.02266963	-0.12777	-0.14052
EUR	NOR	0.079215623	0.050855	-0.02051	-0.02393771	-0.16172	-0.27277
EUR	POL	0.064824569	0.018832	3.14E-17	-0.0062069	-0.02493	-0.24345
EUR	PRT	0.072020096	0.027883	-0.00921	-0.01268076	-0.0278	-0.24768
EUR	ROU	0.092245361	0.078106	-0.01606	-0.01708565	0.063746	-0.08855
EUR	RUS	0.039048699	0.016911	-0.02852	-0.02767519	-0.09028	-0.24498
EUR	SRB	0.061469897	0.028879	-0.00859	-0.00411568	0.036341	-0.13003

EUR	SVK	0.063309294	0.026878	-0.0117	-0.01265851	-0.02057	-0.21246
EUR	SVN	0.066323637	0.052654	-0.0085	-0.01007786	0.047056	-0.11726
EUR	SWE	0.085373957	0.045199	-0.03146	-0.04353726	-0.1962	-0.2399
EUR	TJK	0.074807552	0.110032	-0.03497	-0.03641824	0.06622	0.026132
EUR	TKM	0.080811928	0.100616	-0.0257	-0.02429366	0.029094	-0.02841
EUR	TUR	0.111360506	0.102366	-0.00392	-0.00358176	-0.04141	-0.16495
EUR	UKR	0.068438538	0.033004	-0.02756	-0.0268743	-0.0028	-0.12756
EUR	UZB	0.085195689	0.127478	-0.03017	-0.03001112	0.07615	0.024268
SEAR	BGD	0.069273155	0.131626	-0.00765	-0.00625139	0.069059	0.07176
SEAR	BTN	0.105510088	0.141569	0.004917	-9.4157E-17	0.165296	0.184129
SEAR	IDN	0.077214164	0.108484	-0.0018	0.003581758	0.103955	0.12824
SEAR	IND	0.075463901	0.08052	-0.00925	0.000867631	0.136272	0.146864
SEAR	LKA	0.075261324	0.098728	-9.4E-17	0.003581758	0.109895	0.122369
SEAR	MDV	0.111409124	0.131156	0.007875	0.013147942	0.159233	0.194181
SEAR	MMR	0.069402804	0.08236	0.001246	0.004983315	0.094408	0.090993
SEAR	NPL	0.093963212	0.133377	-0.01146	-0.00887653	0.162213	0.183815
SEAR	PRK	0.066112957	0.044089	-0.01746	-0.01370412	-0.02976	-0.11012
SEAR	THA	0.096061907	0.094295	0.016018	0.01868743	0.120017	0.090192
SEAR	TLS	0.071963374	0.086865	-0.00343	0.000600667	0.104582	0.144704
WPR	AUS	0.080820031	0.092942	-0.02229	-0.02177976	-0.2481	-0.31566
WPR	BRN	0.105615428	0.096435	-0.01435	-0.01083426	-0.01726	-0.11671
WPR	CHN	0.075577344	0.053278	0.011746	0.011679644	0.112439	0.062718
WPR	COK	0.112357183	0.106717	0.005473	0.010144605	0.030139	-0.06535
WPR	FJI	0.100972369	0.116741	0.006785	0.005183537	0.087666	0.117857
WPR	FSM	0.077586905	0.104449	0.006785	0.008587319	0.088328	0.072753
WPR	JPN	0.040353294	-0.00788	0.014839	0.01243604	-0.24357	-0.33852
WPR	KHM	0.079531642	0.105275	0.000556	0.004471635	0.120941	0.086812
WPR	KIR	0.108402885	0.173689	-0.00538	0.001245829	0.092613	0.062021
WPR	KOR	0.092626205	0.063447	-6.3E-17	-0.00298109	-0.12589	-0.15831
WPR	LAO	0.090932663	0.110947	-0.0008	0.004449388	0.103275	0.110749
WPR	MHL	0.077797585	0.076817	-0.00836	0.004271413	-0.013	-0.11793
WPR	MNG	0.089538935	0.0962	-0.01435	-0.01964405	0.04399	-0.04125
WPR	MYS	0.110582611	0.132809	0.005095	0.011167964	0.101098	0.073223
WPR	NIU	0.104408071	0.126124	na	na	0.108206	0.07385
WPR	NRU	0.018709991	-0.02462	-0.01902	-0.00444939	-0.1507	-0.3253
WPR	NZL	0.095243497	0.113078	-0.03524	-0.03176863	-0.1799	-0.24627
WPR	PHL	0.061364557	0.100332	-0.00231	0.006874305	0.060732	0.025
WPR	PLW	0.068098209	0.047849	-0.00823	-0.00064516	0.048014	-0.02057
WPR	PNG	0.097366502	0.136934	-0.00485	0.010011123	0.165923	0.303362
WPR	SGP	0.047443481	-0.01603	-0.02316	-0.02278087	-0.17946	-0.30124
WPR	SLB	0.093655295	0.116911	-0.00645	0.0010901	0.081725	0.19784
WPR	TON	0.089725306	0.121595	0.012681	0.008921023	0.124913	0.134826
WPR	TUV	0.105785593	0.121635	na	na	0.067439	-0.02333
WPR	VNM	0.078478243	0.094295	0.004516	0.006518354	0.132265	0.088537
WPR	VUT	0.074402399	0.103257	-0.0067	-0.00055617	0.13162	0.23723
WPR	WSM	0.11730816	0.159039	-0.00712	-0.00382647	0.14824	0.07723

Appendix 1: The rate of yearly changes in BMI, STChol ( $\geq 5$  mmol/L), and SBP stratified by WHO region, country and gender.





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