

Has Health Improved Over the Past Decades due to Reduction of Risk Factors?: Disappointment or Hope

¿Mejóro la salud en las últimas décadas debido a la reducción de los factores de riesgo?: decepción o esperanza

The important thing is not what they make of us, but what we make of what they have made of us.

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INTRODUCTION

As the authors of the recently published “GBD 2016 Risk Factors Collaborators” state: “A core premise of public health is that prevention can be a powerful instrument for improving human health, one that is often cost-effective and minimizes harm to individuals from ill health. The core objectives of prevention include the reduction or modification of exposure to risks including metabolic, behavioral, environmental, and occupational factors. Quantifying risks to health and thus the targets of many public health actions is an essential prerequisite for effective public health.” (1)

The Global Burden of Diseases, Injuries, and Risk Factors Study 2016 (GBD 2016) provides a comprehensive assessment of risk factor exposure and attributable burden of disease.

By providing estimates over a long time series, this study can monitor risk exposure trends critical to health surveillance and provide policy debates on the importance of addressing risk management within the global, regional and national context and even in different regions of the most heavily populated countries.

Other sources of population-level risk estimates include WHO and UNICEF reports as well as independent scientific publications, but GBD remains the only peer-reviewed study with comprehensive and annual assessment of risk factor burden by age, sex, cause and location for a long time series that complies with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER).

A few years ago, the WHO established several statements about the management of different risk factors and targets over time (framework declaration on tobacco control, cardiovascular risk factors and non-communicable diseases, among others). These statements were used by the most important scientific societies of cardiology worldwide, as the American Heart Association (AHA) and American College of Cardiology (ACC) in the United States, and the European Society of Cardiology (ESC) as basis of different

specific programs, and were replicated in Latin American scientific societies of cardiology, as the Argentine Society of Cardiology (SAC) and the Argentine Federation of Cardiology (FAC).

But statements are mere words if they are not supported by factual evidence that this happens in the data to be recorded. Thus, we now have the necessary material to ask ourselves if statements (words) were accompanied by acts (results) demonstrating a reduction of risk factors in the population.

It is extremely important to answer this question, because if improvements have really been made, we must commit our dedication to strengthen the path taken. However, in case of stagnation or even worsening, this path of failure must be left behind and we should discuss the application of a different paradigm of primary prevention for the population (for example, staff cooperating and assisting health care professionals, as adequately trained “community health workers” reaching each member of the community, (2) inducing “lifestyle changes”, and (3) building bridges between members of the community and the health care system). (4)

RESULTS

The comparative risk assessment (CRA) used 84 risk factors including *metabolic factors* (high fasting plasma glucose, high total cholesterol, high systolic blood pressure, high body mass index (BMI), low bone mineral density and impaired kidney function), *behavioral factors* (child and maternal malnutrition, tobacco, alcohol and drug use, dietary risks, low physical activity, sexual abuse and violence), and *environmental and occupational factors* (unsafe water and sanitation, handwashing, air pollution, other environmental risks and occupational risks). The study was performed in 195 countries and territories grouped in 21 regions, in turn assembled in 7 super-regions, and finally globally.

Which was the trend of the global exposure to risks from 1990 to 2016?

The Summary Exposure Value (SEV) measures the prevalence of exposure for a population: 0% reflects no risk exposure in a population and 100% indicates that the entire population is exposed to the maximum possible level for that risk.

Trends in SEVs showed significant variations during the extended period.

Summary exposure values decreased by more than 40% for three risk factors: a) *diet high in saturated “trans” fatty acids* (51.3% reduction), *household air pollution from solid fuels* (43.1%), and *unsafe sanitation* (40.3%).

Summary exposure values increased by more than 40% for four risk factors: BMI (60.2%), *diet high in sugar-sweetened beverages* (44.7%), *occupational exposure to diesel engine exhaust* (41.8%), and *occupational exposure to trichloroethylene* (40.6%).

The relationship between SEV and an economic development index measured with the Socio-Demographic Index (SDI) was analyzed for the leading three metabolic, environmental and behavioral risk factors, evaluating changes between 1990 and 2016.

Within the three leading *metabolic risk factors* (high BMI, high fasting plasma glucose, and high systolic blood pressure), risk-weighted exposure shows an increasing trend with increasing SDI for only high BMI (the higher the economic development, the greater the body weight).

Looking at the leading three *environmental risk factors* (ambient air pollution, household air pollution, and unsafe drinking water), there is an inverse relationship with SDI for household air pollution and unsafe drinking water (the lower the economic development, the higher the proportion of household unsafe water), with SEV approaching zero at high levels of SDI, while the relationship is less consistent with ambient air pollution.

The relationship between SDI and the leading behavioral *risk factors* is more heterogeneous, with smoking and alcohol use having a positive correlation with SDI (the higher the economic development, the greater the use of tobacco and alcohol) and short gestation for birth having a negative correlation with SDI (the lower the development, the greater the prevalence of short gestation).

Global attributable burden for all risk factors (combined and without overlap)

Globally, 59.9% of deaths and 45.2% of Disability-Adjusted Life-Years (DALYs) could be attributed to the risk factors assessed in GBD 2016.

Within non-communicable diseases (NCDs), there was high proportion of causes of death and DALYs attributable to risk factors: *ischemic heart disease* (93.3% of deaths and 94.4% of DALYs), *hemorrhagic stroke* (88.2% of deaths and 89.5% of DALYs), and *COPD* (76.6% of deaths and 73.8% of DALYs).

Lung cancer also has a large proportion of total deaths and DALYs attributed to measured risk factors (84.1% and 83.2%, respectively).

Of interest, the importance of *metabolic risk factors* is growing steadily in low and low-middle SDI locations, while that of environmental and occupational risks has decreased during the same time period.

Changes in leading risk factors in 1990, 2006 and 2016

Table 1 shows the leading 10 risk factors in order of importance in 2016 and how they ranked from 1990 to 2006.

Unsafe sex markedly increased in men (198.8%) and women (204.0%) between 1990 and 2006, followed by declines of 43.8% for men and 46.7% for women between 2006 and 2016.

In women, unsafe sex declined from rank 24 in 1990 to 7 in 2006 and 10 in 2016 (Table 1).

High blood pressure was the 4th leading risk factor for both men and women in 1990 and rose to be the 2nd leading risk factor for men and the leading risk factor for women by 2016.

High BMI exhibited a similar trend (from rank 10 to 2 in women and from rank 13 to 6 in men between 1990 and 2016). *High fasting plasma glucose* and *high total cholesterol* also showed similar trends (from rank 9 to 3 in women and from 10 to 5 in men, and from 11 to 7 in women and 12 to 8 for men, respectively) over the same period (Table 1).

Table 1. Leading 10 RF in 2016 (expressed in DALYs and compared with 2006 and 1990)

Men	2016	2006	1990	Women	2016	2006	1990
Smoking	1	1	3	High blood pressure	1	2	4
High blood pressure	2	3	4	High BMI	2	5	10
Low birth weight and short gestation	3	2	2	Fasting plasma glucose	3	4	9
Alcohol use	4	5	8	Low birth weight and short gestation	4	1	2
Fasting plasma glucose	5	6	10	Child growth failure	5	3	1
High BMI	6	9	13	Ambient particulate matter	6	8	7
Ambient particulate matter	7	7	6	High total cholesterol	7	11	11
High total cholesterol	8	10	12	Household air pollution	8	6	3
Child growth failure	9	4	1	Smoking	9	12	12
Household air pollution	10	8	5	Unsafe sex	10	7	24

All 4 of these metabolic risk factors were globally within the leading 10 risk factors for men and women in 2016.

Body mass index and fasting plasma glucose had the worst increases in annual rate: 1.7% and 0.9%, respectively, from 1990 to 2016.

Drivers of changes in risk-attributable deaths and DALYs within the past 26 years

Changes in the number and proportion of deaths and DALYs over time are due to the relative contributions of drivers grouped into four mutually exclusive categories: population growth, population aging, trends in exposure to all risk factors measured in GBD 2016, and all other factors combined.

Population growth alone would have resulted in 12.4% (95% CI, 10.1–14.9) more deaths and 12.4% more DALYs.

The contribution of *population aging* is noteworthy in NCDs and accounts for 19.5% (17.3–22.0) more deaths and 14.0% (11.6–16.3) more DALYs.

The *residual categories*, which includes improvements in treatment along with other factors, accounts for a decrease of 15.3% for death and 16.5% (14.1–18.8) for DALYs across all causes.

All risk factors combined decreased deaths by 9.3% (6.9–11.6) and DALYs by 10.8% (8.3–13.1). Risk factors play a larger part in NCD, with a decrease of 14.9% for death and 15.0% for DALYs.

Across age groups, DALYs differ greatly. DALYs declined in children <5 years by 26.7% (24.3–29.7) in the post-neonatal period and 27.3% (24.9–29.7) between 1 and 4 years, 8.7% in older children (ages 5–9 years) and 9.0% in young adolescents (ages 10–14 years).

Key results for risks with significant changes in GBD 2016

In 2016, more DALYs were attributable to increased systolic blood pressure (SBP) than any other risk factor.

Increased SBP was the 2nd leading risk factor for men and the leading risk factor for women globally, accounting for 89.9 million DALYs among women and 124.1 million DALYs among men.

Myocardial infarction was the largest source of DALYs attributable to increased SBP, followed by *hemorrhagic stroke* and *ischemic stroke*.

Therefore, the prevalence (Summary Exposure Value - SEV) for increased SBP rose for men from 22.9% in 1990 to 24.6% in 2016, a 7.5% increase, and for women from 24.2% in 1990 to 24.2 in 2016, only a 0.7% increase. (Figure 1)

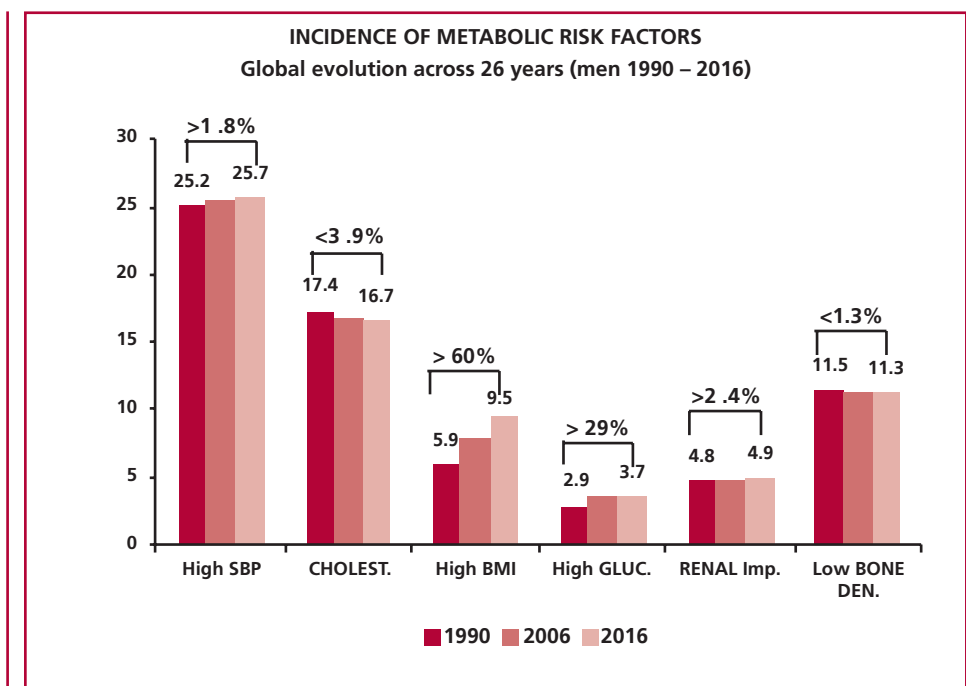
Smoking increased by 201% since 1990, with *smoking-attributable* 7.1 million deaths and 177.3 million DALYs in 2016.

Smoking is the 2nd leading risk factor for men for death and the leading cause for DALYs, accounting for 16.3% of deaths and 9.5% of DALYs, and is the 6th leading risk factor for death in women and the 9th for DALYs, and contributed as cause of death due to COPD in 30.3%, neoplasms in 19.2% and cardiovascular diseases in 18.8% of smokers.

From 1990 to 2016, deaths and DALYs attributable to *high fasting plasma glucose* have increased globally from 7.8% to 10.5% (3rd leading cause) and from 4.4% to 6.2% (4th leading cause), respectively, with 5.6 million deaths and 141.1 million DALYs.

In 2016, *BMI* was the 5th ranked risk factor, accounting for 4.5 million deaths and 135.4 million DALYs. High BMI has the fastest annual rate of increase in prevalence (SEV) since 1990. The burden

Fig. 1. Evolution of the six metabolic risk factors (1)



attributable to high BMI increases with increasing development. (Figure 1)

In 2016, 7.5% of deaths globally were attributable to *ambient air pollution* (4.1 million deaths), which was higher in China (11.1%) and India (10.6%).

Alcohol was the 7th leading risk factor in 2016 in terms of DALYs (99.2 million), and increased by 25% from 1990 to 2016.

In 2016, *suboptimal diet* was the 2nd leading risk factor for death and DALYs globally, accounting for 18.8% of all deaths and 9.6% of all DALYs, increasing by 50% cardiovascular disease in men and women (4.3% with diet low in fruits and 4.2% diet high in sodium).

A FEW COMMENTS

The authors state: “We found substantial heterogeneity across countries in the leading risk factors. Some notable patterns are the role of unsafe sexual practices as a driver of the HIV epidemic in Eastern and Southern Africa and the role of alcohol consumption in Eastern Europe and Central Asia. There are also marked spatial patterns for other risk factors such as high BMI in Central America, North Africa, the Middle East, and Oceania. Interpreting spatial patterns needs to take into account the fact that some risk factors have a strong relationship with socioeconomic development. Several environmental and behavioral risks, including water, sanitation, handwashing, household air pollution, and childhood growth failure decline profoundly with development. Another cluster of risks tends to increase with socioeconomic development, including high BMI, high SBP, red meat consumption, sugar-sweetened beverages, alcohol, and high fasting plasma glucose.” (1).

The findings of the GBD 2016 show that, despite the enormous potential of risk reduction to improve health outcomes, reduction in risk factors has not played an important role in this change over the past decade; yet, this was not the case of highly developed countries as the U.S.A (5) Therefore, the answer to the subtitle question should be “disappointment” rather than “hope”.

This analysis shows that *three metabolic risk factors* as “systolic blood pressure”, “fasting plasma glucose” and “body mass index (BMI)”, and *two behavioral risk factors* as “smoking” and “diet” are the most prominent to produce non-communicable diseases, disability and death. And, in fact, risk factors are increasing and imply a big problem, with different behavior in different countries with similar socio-economic development.

Let us make a deeper analysis of some of these metabolic and behavioral risk factors.

Tobacco

Increase in the prevalence of global tobacco use is due to the combination of three factors: population growth, population aging, and persistently high smok-

ing prevalence in some of the most highly populated countries of the world with a high proportion of men who smoke (China, Russia and Pakistan, accounting for one of two smokers worldwide).

Taken together, we can expect the burden of tobacco to remain high in years to come due to the power tobacco companies exert in many countries, unless the rate of progress is significantly accelerated.

Particularly worrisome are the trends among young men and women. For example, in Indonesia, more than half of men aged 20–24 years are daily smokers.

Fasting plasma glucose

Increase in fasting plasma glucose is closely tied to the increase in BMI and to low physical activity. Prevention trials show that weight loss and physical activity are useful to reduce fasting plasma glucose and delay the development of “clinical diabetes”; however, these interventions have not been implemented at a national scale and individual adherence in the long term is challenging.

While exposure is increasing, age-standardized attributable mortality rate is not; (in fact, death from diabetes has been declining) probably because clinical management of the macrovascular complications of diabetes has improved.

“Fasting plasma glucose” remains one of the risk factors that is most likely influenced at the primary health-care level, emphasizing the role of universal coverage for primary care in a multipronged response to this increasing problem.

Body mass index (BMI)

One of the most alarming risks in the analysis is increased BMI, not only in adults but also in children and adolescents, because its burden is large and growing, and is prevalent across all levels of socio-economic development.

The drivers of this global epidemic include changes in food industries (global food and sugar-sweetened beverage corporations), which increase availability, accessibility, and affordability of energy-dense foods, along with intense marketing of such foods, as well as reduced opportunities for physical activity in today's world.

Proposed personal policies, even if fully implemented, are unlikely to rapidly reduce the prevalence of obesity. (6)

While there is no solution to the rise of overweight and obesity, we will not be able to control increased SBP, cholesterol and fasting plasma glucose (major metabolic risk factors of cardiovascular disease) but we can mitigate some deleterious cardiovascular effects with clinical interventions that control them directly.

Expanded use of such interventions among obese people could effectively reduce the disease burden of high BMI.

Sustained progress, however, will require public policies at a population level that effectively control weight in childhood and in young and middle-aged adults.

Diet

Diet accounts for one in every five deaths (2nd leading risk factor for mortality).

This analysis demonstrated that poor dietary habits, particularly low intake of healthy foods, were the leading risk factor for mortality.

Comprehensive food system interventions are needed to promote the production, distribution, and consumption of healthy foods over time and across nations.

Putting risk factors into context

Although these risk factors are closely related, the daily “way of life” of individuals and communities is the real driver of this group of risk factors, (3) where the foods we eat are goods that are purchased in the market as ultra-processed foods. Home-made food cooked by women, when they still did not form part of the labor force, is almost disappearing (women work out to complete the families’ declining income and thus have money to buy the new goods that the current economic system develops to keep their revenues). Therefore, the obesity epidemic is an “industrial epidemic” or a “corporation epidemic” triggered by ultra-processed foods with excess sodium, fat and carbohydrates to make it tastier, and with many more calories per gram of food, increasing the necessity to eat more calories to sate the appetite, supplemented by sugar-sweetened beverages (which also have many calories) whose consumption has also increased, as this study has demonstrated.

This diet rapidly increases BMI in adults, children and adolescents, as demonstrated by a recently published article, (7) which reported that over the past 40 years, obesity in girls and boys aged 5-19 years has increased 8 times, from 0.7% to 5.6% and from 0.9% to 7.8%, respectively. In consequence, fasting plasma glucose and the prevalence of diabetes increase, together with higher blood pressure level in men.

Therefore, if those in charge of public health policies do not prevent the inductor management of fake marketing and do not regulate the three large corporations, the novel “food” industry and the old “tobacco” and “alcohol” industry, it will be impossible to start reducing the modern epidemic of NCD.

CONCLUSIONS

The global exposure to risk factors only decreased by more than 40% for 3 risk factors between 1990 and 2016: diet high in trans fatty acids, household air pollution from solid fuels and unsafe sanitation, and increased by more than 40% for 4 risk factors: BMI, diet high in sugar-sweetened beverages, occupational exposure to diesel engine exhaust and occupational exposure to trichloroethylene.

Over the past 26 years (1990-2016) all four of these metabolic risk factors are within the leading risk factors for DALYs globally for men and women. “High systolic blood pressure” was the 3rd leading risk factor and rose to be the 1st for women and from the 3rd leading risk factor to the 2nd for men. “High fasting plasma glucose” rose from rank 9 to 3 in women and from rank 10 to 5 in men, “high BMI” from rank 10 to 2 in women and from 13 to 6 in men, and “high cholesterol” from 11 to 7 in women and from 12 to 8 in men. Even the behavioral risk factor “smoking” rose from rank 12 to 9 in women and from 3 to 1 in men (Table 1).

Therefore, the fact that we have not made significant modifications in the leading metabolic and behavioral risk factors is profoundly disappointing, with the enormous potential they have to improve global and cardiovascular health.

Thus, we must stop insisting on a path of failure, and the medical community should discuss in depth a change in the paradigm of primary prevention. Probably we should discuss, among other possibilities, if physicians do not need the cooperation and assistance of adequately trained “community health workers” reaching each household within the community. (2) This almost population-based approach could induce the necessary changes in the “way of life” and maintain adherence to treatment while acting as a link between each member of the community and the institutional health care system.

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