

Less is more: the dynamic epidemiology of cardiovascular diseases

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Noncommunicable diseases (NCD) have surpassed communicable disease as the world's major disease burden.^{1,2} The leading causes of NCD, accounting for approximately half of the annual deaths, are cardiovascular diseases (CVDs) with 17.9 million mortalities throughout 2015.³ Furthermore, globally, the top 2 causes of years of life loss and disability-adjusted life years (DALYs) are ischemic heart disease (IHD) and stroke (ischemic and hemorrhagic).^{2,3} Following the latter trends, in 2011, the UN General Assembly adopted a declaration that set a target, for all nations, to reduce the risk of premature death from NCDs by 25% by the year 2025 (known as 25 by 25). As a result, the World Health Organization (WHO) and Global Cardiovascular Disease Taskforce disseminated information and approaches to reach the WHO 2025 targets, where control of risk factors plays a pivotal role.⁴

Considering the above, it is clear that global and local investigation and monitoring of secular trends in cardiovascular (CV) morbidity and its related outcomes are one of the cornerstones for developing evidence-based, cost-effective, and region- and country-specific prevention programs.

Recent investigations have shown that global mortality from CVD increased by 12.5% between 2005 and 2015; however, the age-standardized mortality rates fell by 15.6%. These reductions were largely driven by declining mortality rates due to cerebrovascular disease and age-standardized mortality rates for IHD.³ However, the latter trends were most prominent in Western high-income countries, while progress in other parts of the world was slow to nonexistent.^{3,4} It has been suggested that approximately 90% of the decline can be explained, with half attributed to improved control of risk factors and the other half—to improved treatments.^{5,6}

In this context, the study by Gąsior et al,⁷ published in the October issue of *Polish Archives of Internal Medicine* (*Pol Arch Med Wewn*) and reporting

the results of data regarding the characteristics and outcomes of about half million CV patients between 2006 and 2014 in Poland, is both interesting and important. The main findings of the latter study include the following temporal trends: 1) no significant change in the annual number of hospital admissions for CVD; 2) a shorter length of in-hospital stay for CVD admissions; 3) a decrease in the overall readmission rate; and 4) stable, with some tendency towards a decrease, in-hospital and 12-month adjusted mortality rates. The authors suggested that these findings could possibly result from better access to cardiology services, improvement in diagnostic and therapeutic measures, and in primary and secondary prevention. These findings are consistent with and largely confirm recent reports from other countries.

A significant limitation of this work is the absence of evaluation and report of temporal trends in patients' characteristics, especially CV risk factors and major comorbidity, and the potential effect of such changes on investigated outcomes. This limitation is major because, as previously mentioned, changes in risk factors are a significant driving force behind changes in CVD morbidity and mortality and a focus for intervention.^{5,6}

A recent analysis of 79 modifiable risks divided into 3 broad groups of behavioral, environmental and occupational, and metabolic risk factors in 188 countries showed that together they accounted for 88.5% of global CVD deaths and nearly 88% of global CV DALYs.⁶ Although data on trends in important CV risk factors are much more limited than on mortality or some of the other CV outcomes and are rarely based on population-based studies,⁵ several prominently observed changes should be mentioned. First and foremost, life expectancy is rising and population is getting older in most countries. This results in CV patients with an increased prevalence of CV risk factors and comorbidity, hence greatly

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influences trends in CV morbidity outcomes.⁵ It has been reported recently that the proportion of first-time admitted patients with HF and low comorbidity burden (measured with the Charlson score) fell from 66% to 48%, whereas the percentage of patients with moderate, severe, and very severe comorbidity increased from 19%, 10%, and 5% during 1983–1987 to 21%, 16%, and 16% during 2008–2012, respectively.⁸ Actually, a rise in the absolute number of CV deaths is occurring mostly in people older than 70 years.⁵

Although diet patterns and components vary substantially across countries and comprise multiple inherent measurement errors, the aggregation of the 14 specific components of diet accounted for nearly one-tenth of global DALYs in 2013.⁶ At the global level, the most important contributors to the overall burden of diet, which have shown improvement, are low fruit, high sodium, low whole grains, low vegetables, and low nuts and seeds.^{5,6,9}

Although the prevalence of tobacco use seems to be declining or stable in most countries and the age-standardized DALY rate has fallen by 32% between 1990–2013, smoking remains the second major determinant of global health.⁶ Blood pressure has declined globally, more prominently in high-income countries.⁵ Nevertheless, in 2013, high blood pressure remains a leading global risk factor for DALY.⁶ Cholesterol levels have decreased in the last decades, especially in Western countries and in patients with high risk of IHD.⁵ The prevalence of obesity in the world has doubled between 1980 and 2008, and similarly, the prevalence of diabetes increased in most regions as well.^{5,10}

It should be emphasized, however, that significant disparities in the temporal trends in the prevalence of CVD risk factors, comorbidity, and outcomes of CV patients were reported according to different socio-demographic characteristics such as geographic location (country),^{5,10} sex, age group, ethnicity/religion, and educational level.^{5,10,11}

These trends in the prevalence of CV risk factors largely result from a combination of behavioral changes and pharmacologic treatments. Additionally, reports based on long-time series of data showed signals that decline in CVD mortality may have begun before the decline was observed in major classic risk factors, thus suggesting the possibility that other factors play a role in the mortality decline.⁵

Throughout the past decades, major developments and innovation occurred in the medical and interventional treatment strategies of CVD.^{12,13} Furthermore, the paradigm, of “evidence-based cardiovascular care” based on high-quality clinical trials that are incorporated into international guidelines, has been widely adopted.^{12,13} Adherence with such guidelines has been shown to improve care of patients with acute myocardial infarction.¹² Yet again, treatment improved more in Western countries than in others, with

best-performing countries associated with about 25% larger decline in case fatality rate than those in those with the smallest improvement.^{5,14} Moreover, strong associations between change in treatment intensity and change in event rates, with treatment change explaining 41% of change in coronary event rates and 64% of change in overall IHD mortality rate—both larger than the corresponding numbers for the proportion explained by changes in risk factors.¹⁴ The above changes that led to improved survival and longevity of CV patients have shifted leading mortality causes (both of CV patients and general population) towards non-CV causes.^{15,16}

It should be mentioned that although NCD, and especially IHD and stroke, are the main CV causes of death globally, rheumatic heart disease, cardiomyopathy, myocarditis, and endocarditis, which are often communicable, account for an estimated 800 000 deaths worldwide.⁵ Hence, infection-related CVD remains a major cause of CVD deaths in many developing countries, especially in children and young adults. In this context, the HIV/AIDS epidemic, whether untreated or when treated by some antiretroviral treatment, is associated with CVD.⁵

Interestingly, the significant and relatively rapid temporal changes in the epidemiology of CVD over time could potentially compromise the validity of classic clinically and epidemiologically relevant risk-stratification tools, such as the Framingham risk score, atherosclerotic cardiovascular disease, and Global Registry of Acute Coronary Events scores.

Based on currently observed trends, the expected future trends in “premature” (ie, under 70 years of age) mortality from 4 main NCDs is expected to decline by 18% between 2010–2025 (the set target was 25% by 2025). However, if the specific globally agreed targets on smoking, alcohol use, salt intake, obesity, and elevated blood pressure and glucose levels are achieved, the decline would approximate 34% and additional 37 million deaths will be delayed or prevented.⁴

In conclusion, CVDs are a leading cause of morbidity and mortality worldwide. Control of modifiable risk factors and therapeutic developments throughout the last decades have resulted in improved overall outcomes of CV patients. Thus, the contemporary epidemiology of CVD and CV patients is characterized by a shift towards elderly patients who present with an increasingly large number of comorbid conditions and health care utilization. These changes are not uniform worldwide, but rather they are more prominent in high-income countries. In low-income countries, the change is hardly evident, while communicable CVDs, such as rheumatic fever, still pose a significant challenge. Moreover, the currently observed trends of improved outcomes, driven by control of modifiable risk factors, are insufficient to reach the UN targets by 2025. Hence, a rigorous global investigation of secular trends for CV morbidity and its related outcomes, followed

by a prudent assessment and implementation of policies and intervention programs aimed at accelerating the decline in CV morbidity and mortality are warranted.

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