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Big data, social determinants of coronary heart disease and barriers for data access

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Coronary heart disease (CHD) accounts for half of the cardiovascular deaths worldwide, about 170.3 million disability-adjusted life years and high health costs.[1] Favourably, the scientific and social advances during the last few decades have led to a better understanding of cardiovascular diseases (CVDs) and the development of effective diagnostic, preventive and therapeutic strategies that have reduced CHD health impact. However, CHD is still an important public health problem, especially in low and middle-income countries.

Social determinants

For a better understanding of CHD, it is important to consider some broader and classic approaches. The 'health field' concept introduced by Mark Lalonde in 1974, and the social model of health proposed by Dahlgren-Whitehead in 1991 are useful to 'think big' about the determinants of CHD, taking into account all the potential causes of the disease, and more than just its biological or biomedical aspects.[2] According to the World Health Organization (WHO), social determinants of health are 'the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life'. Even though we largely know the significance of these determinants on health status (see Figure 1), we still have not counteracted the impact of social inequalities in CHD. However, big data could lead us to a better understanding of the problem and how to solve it.

Big data

Currently, a large amount of data is produced from electronic health records, medical images and administrative sources, among others. Usually, these data accomplish the five 'Vs' that characterise big data: variety, volume, velocity, value and veracity.[3,4] Therefore, big data could be used to advance our understanding of the social determinants of CHD, and to elaborate policies focused on reducing social inequalities. Furthermore, addressing social determinants by big data analytics could help us develop personalised medicine, identify regions and risk factors in specific populations, contribute to decision support and 'practice-based' medicine with real-time data, and evaluate the impact of public interventions, among others.[3–5] Through a better and more complex understanding of these social determinants and multilevel interactions, big data provides clinicians, directives and policymakers with the supplies to overcome social inequalities in CHD, from the individual to the population level (Figure 1). Although big data are usually analysed with artificial intelligence approaches, classic statistical methods could also be useful in public health for some purposes.

Example of success

In this issue of the *European Journal of Preventive Cardiology*, Mnatzaganian et al. report a population-based study that included 137,408 CHD patients treated in primary care in Australia.[6] The research aimed to evaluate whether disparities in the

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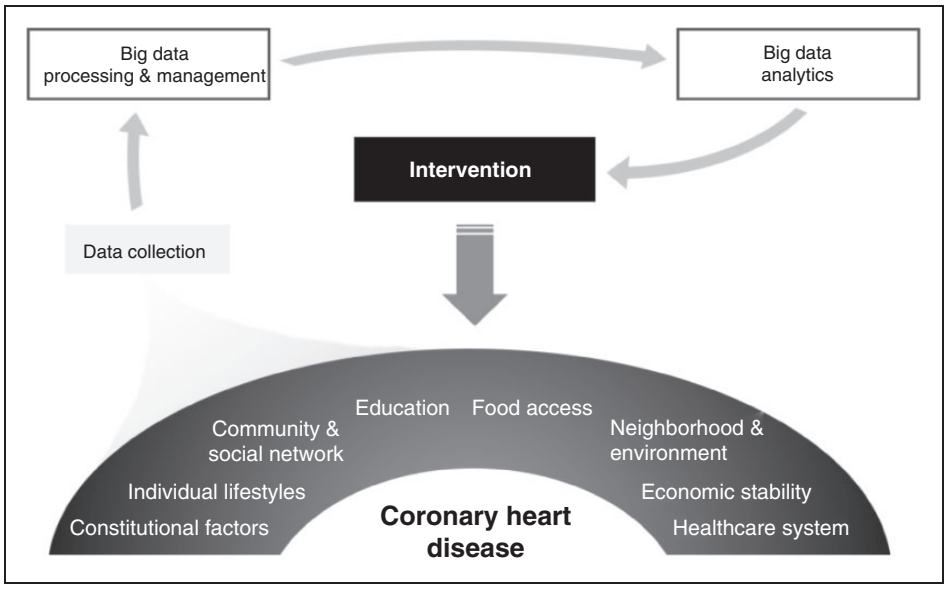

Figure 1. The utility of big data to improve social inequalities in coronary heart disease. Information about social determinants of coronary heart disease and individual factors can be collected from different sources in real time. After proper data handling, big data analysis is useful to plan interventions and monitor their effect on health inequalities.

Table 1. Management of coronary heart disease assessed in the study.

1. Prescribed drugs	2. Risk factors	3. Treatment targets
Antiplatelet agents	Blood pressure	Blood pressure $<$130/80 mmHg
Statins	Lipids	HDL-cholesterol $>$1.0 mmol/L, LDL-cholesterol $<$1.8 mmol/L; triglycerides $<$2.0 mmol/L
Beta-blockers	Diabetes	Screening for diabetes or HbA1c $<$7% in patients with diabetes
ACE inhibitors/ angiotensin II receptor antagonists	Healthy weight	Waist circumference $\leq$94 cm (men) or $\leq$80 cm (women)
		Body mass index between 18.5 and 24.9 kg/m^2
Short-acting nitrates	Smoking status	Complete smoking cessation

ACE: angiotensin-converting enzyme; HbA1c: haemoglobin A1c; HDL: high-density lipoprotein; LDL: low-density lipoprotein.

management of CHD could be explained, in part, by social determinants (such as socioeconomic indicators and remoteness). The management of CHD was assessed according to a local plan that included prescription of secondary prevention drugs, assessment of cardiovascular risk factors and treatment targets (Table 1), and all data were obtained from electronic health records. Following these clinical recommendations, the researchers determined the number of secondary prevention drugs prescribed, the assessment for biomedical risk factors (considering missing records as no assessment) and the number of treatment targets achieved. Socioeconomic status was obtained from a national score (index of relative socioeconomic disadvantage), based on the patients' residential addresses.

The authors found that only 48% of patients received three or more secondary prevention drugs, that 56% of patients were not screened for CHD-associated risk factors, and that a low proportion achieved more than four treatment targets (45%). Even though prescriptions of combined secondary prevention therapies were similar to European countries (EUROASPIRE study),[7–9] some individual drugs in particular were less prescribed than in Europe; in fact, about 70% of patients in the present study received statins and only 55% received antiplatelet agents. Furthermore, the proportion of treatment targets achieved in the study were as low as in European reports, except for blood pressure and smoking, which were quite better controlled in this Australian study.[9,10] On the other hand, although in this research most disadvantaged patients had a greater number of medical encounters and 8% more probability of receiving secondary prevention drugs, compared with the more

socioeconomically advantaged patients, most disadvantaged patients also showed a 4% lower probability of achieving treatment goals, maybe due to drug adherence problems or unhealthy lifestyles.

We would like to acknowledge the authors because this high-quality research advances our current knowledge about CHD management and its social determinants. Despite some methodological limitations, such as a cross-sectional design, data quality and incompleteness of medical records, selection bias (exclusion of patients with less than three medical encounters and general practitioners not sharing data), and lack of information about non-prescription drug causes, among others, the study represents a good example of big data utility in public health.

The research article referred to used data collected by MedicineInsight, a large-scale national general practice dataset obtained from electronic health records and funded by the Australian government. Big data from this resource is provided to the National Prescribing Service MedicineWise, and used to research, elaborate policies, evidence-based interventions, and health decisions.[11] For example, the results of the cited research article could be useful to investigate further the causes of differences in CHD management based on socioeconomic status. Moreover, it also constitutes a call to health professionals and managers to improve secondary prevention and treatment targets, and to be more aware of the most socioeconomically vulnerable CHD patients. Thus, this national initiative using big data successfully helps to improve the care of patients with CVD.

Barriers in least developed economies

Low and middle-income countries, like most Latin American countries, still have resource problems to produce big data because they lack technological infrastructure, software and trained professionals. In fact, gross country income is directly associated with its digital adoption index and the number of available datasets that they have access to.[4,5,12] Furthermore, the least developed economies usually have paper clinical files instead of electronic health records, but in those cases where electronic health systems are used, the informatic interoperability does not usually exist. Thus, even though CHD is an important public health problem in low and middle-income countries, and that social factors are a more critical issue in those countries, paradoxically they have more barriers to access and use big (and real) data as a tool to combat CHD and its social determinants.

On the other hand, some countries with a 'rich' income, but important social inequalities, as is the case of Chile, have also encountered barriers to produce and use big data. In Chile, people who belong to the public health system have a higher prevalence of CVD,[13] and also a 50% higher mortality from myocardial infarction than people who belong to the private health system.[14] These, and many other health inequalities and social problems, have recently been claimed by the Chilean population in big protests, and big data could help provide possible solutions for this complex scenario. However, although a large effort has been developed to implement and improve electronic health registers, the Chilean health system has not yet achieved informatic interoperability, the current electronic registers are not sufficiently distributed, and there are limitations to produce and access big and real-time data.

Conclusion

Using big data is a good approach for a better understanding of social determinants of CHD, allowing the implementation of public policies to tackle them. The research article of Mnatzaganian et al.[6] gives us an example of how big data, on a national scale, can bring an opportunity to improve the management of CHD, especially in the most socioeconomically disadvantaged patients. However, low and middle-income countries lack the necessary supplies to produce big data and use it appropriately. Thus, it is urgent to improve the access to big data in the least advantaged countries to provide them with more tools to manage social inequalities in CHD and CVD. The UN Global Pulse is a good initiative to advance in the use of big data for the study of non-communicable diseases and thus, reduce the informatic barriers that some countries confront.[15]

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