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Aiming for equitable precision medicine in diabetes

New initiatives aimed at reducing the burden of diabetes are laudable, but they will have to account for the disease's complexity and heterogeneity to be truly effective and equitable at a global scale.

Estimates from the 10th International Diabetes Federation Atlas reveal that approximately 537 million people worldwide had diabetes in 2021, of whom 90% had type 2 diabetes, making this complex disease one of greatest public health challenges to emerge over the past 40 years. The health, societal and economic costs of the expansive prevalence of diabetes are by no means trivial. Indeed, the absolute global economic burden of diabetes is projected to reach US $2.5 trillion by 2030 if current epidemiological trends continue unabated. The underlying causes of this quadrupling in diabetes prevalence since the 1980s are multifaceted and include rapid urbanization, increased availability of highly processed, calorie-dense foods, and climate change, each of which has contributed to fundamental shifts in population-level dietary and physical activity behaviors. These shifts have resulted in perturbation of complex gene–environment interactions in populations that may have been previously naive to such risk factors. With approximately 75% of cases of type 2 diabetes occurring in low-income and middle-income countries (LMICs), this raging metabolic epidemic also highlights widening gaps in health inequities on a global scale.

World Diabetes Day, marked each year on 14 November, provides an opportunity to reflect on progress toward tackling this devastating and often insidious disease. In recognition of the grave public health threat that diabetes poses, in 2021 the World Health Organization established the Global Diabetes Compact, which aims to support countries in the effective prevention and management of diabetes. As part of the work program of this compact, the first-ever global coverage targets for diabetes were adopted at the 75th World Health Assembly in May of 2022. The following five targets for 2030 have been set: (1) 80% of people living with diabetes are diagnosed; (2) 80% have good control of glycemia; (3) 80% of people with diagnosed diabetes have good control of blood pressure; (4) 60% of people with diabetes who are 40 years of age or older receive statins; and (5) 100% of people with type 1 diabetes have access to affordable insulin and blood-glucose self-monitoring.

Although they are new in diabetes management, such global target-setting approaches have been used with success in other contexts. Notably, the 90-90-90: Treatment For All targets that were developed for HIV and AIDS and were implemented in 2016 have accelerated progress toward the lofty goal of ending the AIDS epidemic by 2030. Similar approaches have also been proposed for non-communicable diseases, including hypertension, but have yet to be implemented on a global scale. The focus on diagnosis, holistic clinical management and access to medication in diabetes is a welcome change, but how the targets will be achieved at the global and national levels remains uncertain.

High-level targeting setting alone is not enough to drive action toward meaningful outcomes at the individual and population levels, especially for diabetes and its complications. Unlike AIDS, whose etiology is known, the underlying causes, subsequent phenotypic presentation and clinical trajectories of the many forms of diabetes are often heterogeneous, particularly for type 2 diabetes. A growing body of evidence supports the idea that variation exists not only in disease presentation and progression but also in individual responses to therapy, which suggests that a 'one-size-fits-all' approach to meeting the global coverage targets will be insufficient.

The availability of several classes of drugs for glycemic management that target different pathways allows a precision-medicine approach to diabetes management. A consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes defines precision medicine as optimization of the prevention, diagnosis or treatment of diabetes using integration of multidimensional data, accounting for individual differences in biology, environment and/or context. This is distinct from a personalized approach, which focuses on adaptation of clinical management to a patient's specific characteristics, social circumstances and preferences, among other factors.

Effective precision diabetes medicine relies on the generation and availability of multiple data types, including genetic, epidemiological and clinical trial data, as well as routine medical records. However, although the majority of people living with type 2 diabetes reside in LMICs, the bulk of available data are derived from populations and cohorts comprising people of predominantly European ancestry. This paucity of data is a major barrier to implementing tailored therapies in low-resourced settings and widens already existing health inequities in many parts of the world. However, although improved data collection underpins the development of specific management strategies in diabetes globally, without access to the full spectrum of available therapies, technologies and education (for physicians and patients), a precision approach falls flat.

Given these and other challenges, it is unlikely that precision medicine as defined in high-income settings will be able to be feasibly implemented in many LMICs in the near future. Instead, new models of precision diabetes medicine that use data-driven approaches and are both tailored to the unique biology of specific populations and culturally acceptable must be developed. What form such models take is yet to be determined, and more research in those countries and regions most impacted needs to be prioritized, with urgency.

Precision diabetes medicine offers an enormous amount of hope for patients and their families, and could be harnessed to meet the new World Health Organization global diabetes coverage targets. However, unless physicians, patients and families in LMICs drive and are included in local research, the global targets will ultimately languish unmet.

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