

You've got your DNA kit—now what can you do with it?

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Credit: Google DeepMind from Pexels

Differences among people, such as eye colour or hair colour, come from slight variations in our genetic code. As technology advances, it's getting easier to unlock the secrets in our DNA to gain new insights into who we are and to apply that knowledge to dramatically change our lives and society.

This has led many to get personal reports on their own [genetic code](#) in exchange for payment and saliva samples. Excitement over these reports recently jumped after [Oprah Winfrey recommended the DNA test by 23andMe on her annual favourite things list](#).

But the applications of making DNA information more accessible stretch far beyond satisfying our curiosity about who we are and what our genes might say about us.

The availability of genetic data can potentially be tapped to treat medical conditions, leading to personalized health care and wellness regimens, with larger implications for personal, cultural, social and economic change. For example, companies such as Newtopia provide customers with [weight-loss plans that are tailored to one's own DNA](#).

As researchers trained in economics, we study the impact of how genetic and [environmental factors](#) influence the development of human capital measures such as education and health. As we learn more about our DNA, the possibilities that arise for policy and the economy as a whole are as numerous as our individual genomes are varied.

DNA data can pose public risk

Beyond private companies, the rapidly declining costs of both gene-sequencing and the technology to store genomic data has the potential to soon transform health-care delivery and policy.

[Our recent research considers the potential value from incorporating genetic data in the design of public policy](#) and [social science research](#), as well as the risks.

Decisions about genetic policies involve complex issues about ethics, costs, benefits and individual and societal interests.

Legislation is needed to prevent insurance companies and employers from using the results from genetic tests when making decisions. Canada was the last member of the G7 to introduce protections with the [Act to Prohibit and Prevent Genetic Discrimination](#) (formerly Bill S-201) this year—nine years after the United States passed similar legislation.

Since [genetic factors](#) may explain individual differences in socioeconomic outcomes, a growing number of social science data sets now involve biological-specimen collection activities that permit measuring genetic factors. Analyses of this data can extend and expand our knowledge on virtually every health condition—and on socioeconomic traits that have a genetic basis.

Environment also plays a role

However, genetic factors are only part of the story and other variables that are well-studied by social scientists—such as environment and lifestyle—also come into play. For example, an emerging body of evidence now indicates that genetic associations with [obesity may vary due to different prevailing environmental factors](#) like occupation and even urban design.

These differences in environments, lifestyles and genetic factors have important implications in areas ranging from health behaviours such as obesity and cigarette smoking to skill development and other socio-economic outcomes. Therefore the idea of a one-size-fits-all policy for any health, education or socioeconomic outcome is flawed.

Adopting one-size-fits-all policies assume that the same process can produce a health or socioeconomic outcome for all individuals. However, if and how substantial genetic variations change the way these outcomes develop, opportunities emerge to create more effective treatments and policies.

Within the health-care realm, understanding the [genetic basis](#) of specific medical conditions is valuable since it offers the potential to improve treatment decisions.

With this new knowledge, we could replace current health and medical practices and develop new ones to target personalized policies and treatments more efficiently for different individuals.

Heredity expands impact

The intersection of genetics and public policy stretches beyond the health-care sector. [Heritability](#) plays a role in nearly every socio-economic and education outcome. Heredity ensures policies that consider the role of genetics will have immediate and long-term implications.

The quality of evidence on the role of genetic factors on socioeconomic traits has increased sharply over the last decade.

With newer molecular DNA data available to empirical researchers, the flood of research findings linking specific genetic factors with individual health and socioeconomic outcomes will only continue to grow.

Yet it remains essential to ensure that these findings are interpreted correctly. Much of the evidence reflects only simple associations between individual genetic factors and socioeconomic outcomes—not causal relationships. And the impact of most genetic factors are often very small in magnitude.

Small effects, big outcomes

Nonetheless, there is often value from these findings. For example, [a](#)

[calculator developed by the Stanford Cancer Institute](#) provides individuals with information on how their chances of survival change in response to different preventive measures taken at different ages.

The calculation is based on several specific differences in genetic markers, and helps educate individuals on the trade-offs they face when choosing among possible treatments.

More generally, the speed at which molecular genetic data can be effectively integrated within policy design is directly tied to improving our understanding how genetic markers operate.

For example, if genetic screening can reliably predict complex learning disorders, the advantages would be huge. Even if a disorder is a function of many genes—each with very small effects—researchers can calculate a single aggregate summary score.

The summary score would measure an individual's risk for a specific disorder or trait, which, in many situations, may take psychologists years to diagnose.

Armed with knowledge of whether their child is at an elevated risk for a learning disorder or other conditions, for example, parents will be able to make different investments in their child years before receiving a formal diagnosis.

Change the conversation fast

These investments may additionally affect how the underlying genes manifest themselves and therefore reduce the risk for future poor outcomes. As knowledge advances, the predictive accuracy of these summary scores will increase.

All of this reinforces the need for policies that consider not only the benefits, but the potential costs, of this newly available genetic data source.

Whether Canadians will fully realize the significant potential benefits from incorporating [genetic data](#) in health and social [policy](#) design will depend on how fast policies that ensure appropriate safeguards are developed.

If Canada hopes to capitalize on the great potential of DNA data to improve the lives of Canadians, policymakers and stakeholders must determine how to maximize the benefits while minimizing the harm.

Just as it should have regarding the genetic discrimination law, Canada must take quicker action in the future to ensure its citizens benefit from the explosion of DNA data.

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