Next generation public health: towards precision and fairness

Developments in big data and artificial intelligence are transforming medicine, but public health has somehow been lagging behind in embracing their potential. Public health policy and practice are being outpaced by rapid technological advancements in digital health, which are already being applied in the real world. Given that the choices made over the next decades will determine the success and fairness of our digital health future, now is a critical time to reflect on this digital revolution and what it means for public health.

On April 12, 2019, *Next Generation Public Health* was held in London, UK. This timely meeting, co-hosted by the Fondation Botnar, the London School of Hygiene & Tropical Medicine, and the Wellcome Trust brought together academics and digital health experts to debate how big data and artificial intelligence could enhance public health and the challenges involved.

The demand for health services is set to grow dramatically over the coming decades and projections suggest that global needs-based shortage of health-care workers will be more than 14 million in 2030. In low-income countries in particular, where health resources are already scarce, the need for cost-effective and scalable public health interventions will become especially important. The continuing penetration of digital technologies and the growth of available data could provide the means to develop so-called smart public health services and the vehicle to deliver them to hard-to-reach populations.

From genomic and digitised demographic databases to individual health tracking recorded on smart watches to local pollution and weather monitoring data, the digital revolution is providing more and better data on the determinants of disease. The ability of artificial intelligence and machine learning algorithms to analyse these multiple and rich data types at a scale not previously possible could bring a step change in public health and epidemiology. Artificial intelligence could offer unprecedented accuracy and precision in predicting disease spread or the vulnerability of certain groups and to determine the most effective targets for interventions or the populations with the greatest need. Nevertheless, several issues lie in the way of developing an equitable and secure digital public health approach. Data availability and quality are limi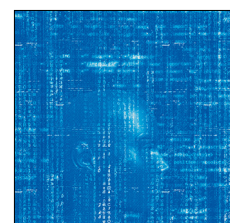ting factors. At present, most of the data for digital tool development comes from high-income countries and advances might not be transferrable to other national contexts. Algorithms that are trained on limited or flawed data could end up integrating racial, cultural, or gender prejudices. In many low-income countries, the electronic medical records and detailed contextual data required for a big data approach are simply not available and acquiring these data is hampered by uneven penetration of communications technologies. Not only would digital approaches have to be tailored to specific populations, they would also have to contend with highly variable local health systems and administrations.

The expansion of digital technologies and data collection also present a range of ethical and governance concerns. At the state level, many governments might lack the experience and capacity to create sufficient legal frameworks and protections for their citizens. At the individual level, people might be uninformed about what data they are sharing and with whom. This leaves both populations and individuals vulnerable to mishandling and commercial exploitation of their data. Furthermore, although the development of more powerful disease risk models is a good thing, there is potential that these could be used to marginalise particular at-risk groups or regions. Finally, some public health researchers caution that governments might be tempted to implement cheaper, targeted big data approaches, rather than investing in broader, more expensive, albeilt more effective, interventions.

During the *Next Generation Public Health* meeting, several recommendations emerged to ensure the best possible digital health future: development must happen in partnership with local stakeholders from the beginning and use diverse data. Governance structures should be in place early to avoid digital exploitation. By cleverly harnessing the power of data, next generation public health can provide the right intervention to the right population at the right time and improve fairness and health equity; but as WHO Director-General Dr Tedros noted on April 17, for the release of the first WHO guideline on digital health, "digital technologies are not ends in themselves;" but tools to promote health.

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