EDITORIAL

Precision public health: is it all about the data?

Elena N. Naumova[1]

In our modern world of information overload, new buzzwords arrive and disappear rapidly. A few take root, emerge on a national agenda, provoke societal change and lasting transformation. *Precision Medicine* and *Precision Public Health* are the newcomers; what do these terms mean precisely, and will the whole idea stick? Their definitions of them are sprawling, conversations and contradictions bustling, and a growing interest among scientists, practitioners, the public, and policymakers is about whether *precision* can bring new solutions to complex public health issues.

The essence of being precise is to come closer to truth, to be more accurate, or to achieve results with better efficiency then traditionally or commonly used tools. Striving for truth, quality, and efficiency is the ultimate goal of health-related fields. The advancement of science is driven by the push for more precision and accuracy. Microbiologists developed powerful microscopes to discover new pathogens more quickly and with higher precision; immunologists established and coded blood types to ensure successful organ transplantation; epidemiologists set up global monitoring systems to learn when, where, and how an outbreak would strike. It is logical to see 'precision' in public health, medicine, and industry as a well-tested approach based on solid evidence and grounded theory. So, if medicine and public health already strive to be precise, what is new here?

In 2016, the US White House Office of Science and Technology Policy and the Bill & Melinda Gates Foundation convened the Precision Public Health Summit at the University of California, San Francisco, to explore how precision approaches can be successfully applied to improve population health and address health disparities. The event promoted a *Precision Medicine* approach to public health. Leaders in the field define *Precision Medicine* as a set of activities aiming "to collect, connect, and apply vast amounts of scientific research data and individuals' health records—from the basic molecular understanding of disease to clinical, environmental, psychosocial, and mobile lifestyle data—to understand why people respond differently to treatments and to guide more precise and predictive medicine and health for populations worldwide." [1]. Advocates of this new idea claimed that precision public health goes beyond personalized treatment for individuals and the

✉ Elena N. Naumova
  elena.naumova@tufts.edu

[1] Friedman School of Nutrition Science and Policy, Tufts University, Boston, USA

word 'precision' in the context of public health refers to improving "the ability to prevent disease, promote health, and reduce health disparities in populations by (1) applying emerging methods and technologies for measuring disease, pathogens, exposures, behaviors, and susceptibility in populations; and (2) developing policies and targeted public health programs to improve health" [1].

In 2019, the Rockefeller Foundation launched a $100-million *Precision Public Health Initiative*, dedicated to applying predictive analytics to prevent health threats and exploit big data to address the social factors that lead to poor health, such as discrimination and poverty [2]. Such investments indicate that there are strong beliefs that predictive analytics can be a powerful tool for solving public health problems. Now the challenge is how to apply such investments and train both the developers and the users to ensure a high return on this investment.

The payoff of global investments in information technologies, biomedical sciences, and intergovernmental agencies became apparent during the COVID-19 pandemic. The rapid deployment of data repositories and dashboards to collect and share pandemic-related data in timely manner and the remarkable speed of developing and distributing new vaccines at mass scale have demonstrated impressive accomplishments of global research and public health communities. At the same time, the pandemic tested our reliance on data and technical solutions. It revealed the flaws in our expectations that data and technical solutions alone could control the disease spread. The human factor—a constellation of human behavior, social norms, and political will—appeared to be a mighty force. It was not enough to produce and to distribute safe and efficient vaccine; there was also the need to convince the public of the safety and efficacy of the vaccine. It was not enough to set up data repositories but also necessary to provide clear messages to the public on potential risks. It turned out that being precise about who, when, and why is getting sick or cured, with the available data, was not enough to stop the pandemic. A recent article in *Nature* raised a timely question: Is precision public health all about the data and technical solutions? [3].

This question forced me to return to basic definitions to understand what is missing.

The long-standing tradition in public health is to devise targeted interventions for populations using the core concepts of modern epidemiology: person, place, and time, all the while striving for precision. So, what is new? Strong advocates of *Precision Public Health* see it as an approach for modernization of the 150-year-old field of epidemiology, similarly to how precision medicine has transformed health care [4].

Precision Medicine equates to 'personalized medicine,' or medical care, designed to target *the right treatments to the right patients at the right time* by optimizing efficiency and benefits for specific groups of patients, often through genetic or molecular profiling. Some argue that *Precision Public Health* is like *Precision Medicine* except that the former aims to provide *the right intervention to the right population at the right time* based on extensive population-specific data [4]. Some claim that precision allows scientific tailoring of disease prevention and treatment that account for differences in people's genes, environments, and lifestyles [5]. Some see an analogy between public health and health care

approaches, equating the use of genomic information in precision medicine to pathogen genomics in precision public health for applications such as tracking infectious disease outbreaks [4–6]. For some researchers, it includes "a sweep of data-driven techniques, such as sequencing pathogens to detect outbreaks and turbo-charging data collection to monitor harmful environmental exposures" [3].

There are clear tendencies to combine precision medicine and precision public health under one umbrella—*Precision Health.* In his insightful and comprehensive book *Discovering Precision Health*, Lloyd B. Minor, Dean of Stanford University School of Medicine at Stanford University, stated that a combination of human behavior, genetics and individual biology contributes ~ 50% of health-related problems, social and environmental factors add ~ 40%, and 10% of the health improvement could be directly attributed to clinical medicine [7]. His powerful vision for future medicine and healthcare is for it to be predictive and preventive, personalized and precise, patient-centered and participatory, cost-effective, and well balanced as a combination of science and art.

While these general requisites fit Lloyd Minor's vision for future public health, I argue that equating or combining medicine and public health approaches in solving public health problems distorts causality. The direct analogy between public health and health care unintentionally forces false causality, or a 'wag the dog' story, when attention to and resources for disease prevention are diverted to treating maladies that could be prevented. I also argue that by equating medicine and public health, we miscue what human behaviors, social norms, and political will mean for these two approaches.

It appears that the mighty data and hi-tech tools to manipulate them are essential in defining *Precision Public Health.*

I argue that the missing ingredient in the current definition is the human factor—human behavior, social norms, and political will—ingredients that are difficult to measure. Yet, their impact on data-driven solutions is immense. They determine data credentials: quality, accessibility, usefulness, longevity, and everything we can learn from data. They determine how useful and impactful *Precision Public Health* could be.

In designing any work environment, considerations for 'human factors' is key for success. This common-sense practice calls for fitting work environment to human needs and behaviors, not the other way around. The practice emphasizes the design according to how humans think and behave rather than forcing humans to adapt their behavior to a system. Ideally, developers apply what they know about human behavior to the design to ensure effective and efficient workflow for the users.

For public health professionals, the work environment contains the systems for public health policy programming, interventions, monitoring, and assessments. We examine how human behaviors, social norms, and policies affect population health, and how we pursue our activities depend on human behaviors, social norms, and policies. We monitor what we often want to change: cognitive constructs (perceived risk) and social constructs (social norms). We make decisions about what should and could be changed, and when, and how. To be successful, the target must be set and executed with the desirable precision.

There are many examples in public health when such efforts brought remarkable success: implementation of smoking bans in public places, reinforcement of vehicle seat belt use, bolstering the vaccination campaigns, provision of school lunches, and expanding oral health prophylactics. In fact, the *Journal*'s mission is to help mobilize the efforts for these global initiatives to succeed. Yet, many public health efforts had setbacks driven by controversies, lack of public support, and decision makers' neglect.

I suggest defining *Precision Public Health* as a concept of using effective, fair, and reliable data and social enterprise to improve the health of all and, especially the most marginalized populations. The specific requirements—to be effective, fair, and reliable—are driven by data credentials and analytical tools provided by and to public health professionals and ethical standards for inclusiveness and transparency. Our ability to recognize what human factors or the social enterprise means in the current conditions will define whether *Precision Public Health* is here to stay.

To advance the public health agenda in the modern era, we need public- and data-powered solutions to address looming public health challenges that are both complex and costly. The delay in responding to climate change, failures to prevent military conflicts and famines, and breakdowns to provide safe water and sanitation to nearly half the world's population—each of these crises can't be solved by technical solutions alone. If we are willing to view *Precision Public Health* as a strategy to modernize the field, the investment in public health education, communication, and workforce development should take the national and global priority.

In modernizing public health by developing surveillance systems and compiling environmental risk data repositories and nutritional dashboards, we must ensure high data quality and data usability in the short and long terms. It means that agencies responsible for data collection must establish strategies for ensuring data security, credibility, and longevity.

I regard data security as an integral part of the data social enterprise. Data can be misused, lost, disclosure forbidden, and corrupted accidentally or intentionally. Data security is relatively well regulated in healthcare settings, as it appeals to privacy concerns. In the healthcare industry, data security implies the use of updated anti-virus software support, proper language for data security agreements, the ability to track data usage, and the ability to identify security breaches. In public health fields, personal data security is amorphous. While public health researchers are scrupulously developing protocols for studies exploring human behaviors and risks, ensuring data safety and confidentially, such data may already be for sale or used for profit. With the expansion of social platforms and remote devices, public health data on daily human routines—eating, sleeping, exercising, smoking, drinking, and many other activities that are the key to tracking health—are routinely compiled, often without informing those to whom these data belong.

Success in adopting the *Precision Public Health* concept begins with clear agreements on how data are collected and used. Yet, regulations of individual data on health-related behaviors concerning their use and the rights of people from whom such data are collected are in their infancy. We need comprehensive discussions of principles and technologies that safeguard personal data against deliberate or inadvertent disclosure, modification, or damage. It means we must have the

knowledge and the support of a broad spectrum of experts with social, technical, legal, and humanitarian perspectives.

Precision begins with a collective understanding of the potential of data, models, and information. This concept emphasizes the need for public health agencies to strategize the data usability at each stage of the data life cycle: from collection to analysis to dissemination to maintenance and archiving. I strongly believe that we need to establish a culture of fair and transparent contracts and data use agreements that define what data are to be shared, for what purpose, for how long, and any access restrictions or security protocols that data providers and recipients must follow. We also need proper allocation of resources to train the workforce globally to be able to sustain the investment in the data-intensive enterprise. To be in step with the global data enterprise, legal considerations, and rights to know, we need to better recognize who, how, and what should be protected. To be in step with transparency and accountability principles, we need to find ways to share acquired knowledge with respect to the public—for whom and from whom this knowledge was generated.

Precision Public Health calls for understanding of the value of cooperation and teamwork. The real hurdle in assembling data from multiple sources is the multiplicity of terms, units, naming conventions, and varying formats for recording time and locations. Working together, we can streamline and enforce systematic and uniform terminology and create built-in translators and glossaries as essential parts of public health data enterprises. We must view the development of metadata summaries with detailed descriptions of data sources and data quality as best practices in justifying the reproducibility and generalizability of research. By offering information on data completeness, reporting gaps, and limitations, we could build better recommendations for future steps and strive for precision on every occasion.

Our *Journal* is committed to open data sharing and clarity of communication. We have a long-standing tradition of asking authors to provide their glossaries and definitions to help readers to see similarities and differences. We ask for clarity in defining actors and actions, current and past contributions to the knowledge, and clear messages to the media on how authors want to highlight their findings. We strongly believe that shared methodology, data, codes, and developed material enable the expedited transformation of data into actionable information.

As we define *Precision Public Health* as a concept of using effective, fair, and reliable data-rich social enterprise, we expand its most common description as *the right intervention to the right population at the right time* by emphasizing the lasting public health's historical ideals of improving the well-being of all with human-centered decision making.

As the story goes, the Tower of Babel was not completed due to confusion of tongues and fragmentation of human languages. In the rush for modernization and emphasizing precision in the 150-year-old fields of epidemiology and public health, we might face confusion about data, models, and algorithms. However, just as we have created technologies to better understand each other across languages, we can find ways for public-centered and data-powered solutions to improve precision and advance public health to our high aspirations.

Elena N. Naumova,
Editor-in-Chief

References

1. Cisneros L. White House and Gates Foundation to Convene Precision Public Health Summit at UCSF. Campus News. May 27, 2016. https://www.ucsf.edu/news/2016/05/403091/white-house-and-gates-foundation-convene-precision-public-health-summit-ucsf. Accessed 13 August 2022.
2. Using Data to Save Lives: The Rockefeller Foundation and Partners Launch $100 Million Precision Public Health Initiative. *Press Releases*. 25 September 2019. https://www.rockefellerfoundation.org/news/using-data-save-lives-rockefeller-foundation-partners-launch-100-million-precision-public-health-initiative/ Accessed 13 August 2022.
3. Arnold C. Spurred by COVID, public health gets precise. *Nature: News Feature*. 4 January 2022. https://www.nature.com/articles/d41586-021-03819-2. Accessed 13 August 2022.
4. Khoury MJ, Engelgau M, Chambers DA, Mensah GA. Beyond public health genomics: can big data and predictive analytics deliver precision public health? Public Health Genomics. 2018;21:244–9.
5. U.S. Food and Drug Administration. Precision Medicine. https://www.fda.gov/medical-devices/in-vitro-diagnostics/precision-medicine. Accessed 13 August 2022.
6. Rasmussen SA, Khoury MJ, del Rio C. Precision public health as a key tool in the COVID-19 response. JAMA. 2020;324(10):933–4. https://doi.org/10.1001/jama.2020.14992.
7. Minor LB, Rees M. Discovering precision health: predict, prevent, and cure to advance health and well-being. Hoboken: Wiley; 2020.