Perspectives in Bioethics: Precision Medicine a Threat to Health Equity

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ABSTRACT

Precision medicine promises to transform medicine by utilizing genetic and genomic information to offer personalized care to each patient based on the individual nature of their disease. This relatively new approach in medicine has the potential to greatly improve patient care, however advancing a precision medicine agenda raises significant ethical concerns, particularly in smaller, resource-strapped developing nations like those in the Caribbean basin. Drawing on examples from Trinidad and Tobago, this viewpoint highlights some of these concerns specifically resource allocation, privacy and confidentiality, scientific merit and sociopolitical influence as well as health equity within and between countries. We contend that while precision medicine has extrinsic value, unless a precision medicine agenda complements efforts to address existing systemic pitfalls in the public health system, it will substantially widen the health disparities gap.

Keywords: Caribbean, health equity, precision medicine, Trinidad and Tobago

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INTRODUCTION

Variability in effectiveness and side effects of certain medical interventions among patients is well accepted. Indeed most doctors would agree that a "cookie-cutter approach" to medicine is not best practice and a more concrete approach that offers some predictability about which patients are more or less likely to benefit from an intervention is favored. Precision medicine offers such an approach. Briefly precision medicine involves factoring in individual variability in genes, environment and lifestyle into the decisions that guide the prevention, diagnosis, and treatment of disease (1).

In recent times, the precision medicine approach has gained tremendous support and scientific validity since compelling evidence has shown that targeting tumors at the molecular levels can improve survival and other patient outcomes. One example is Herceptin, a monoclonal antibody that has shown to increase breast cancer survival rates (2, 3) among patients with high expression of HER-2 (4). Other current applications of precision medicine include tailoring dosages of anticoagulant warfarin based on variation in cytochrome P450 gene polymorphisms (5) or the discovery of *EGFR* mutations that confer sensitivity to tyrosine kinase inhibitors in lung adenocarcinomas (6, 7). Additionally, through the advent of projects like "My Cancer Genome" (8) clinicians can offer targeted treatment based on the patient's mutational profile.

Despite the scientific and medical advances associated with precision medicine, there is considerable discourse about the ethical implications of investing in precision medicine especially in developing countries. Given more pressing concerns such as the lack of basic staff, beds and the availability of medicine that often plague many developing nations, precision medicine is viewed as a quantum lead leaving one to wonder how much reasonable emphasis should be placed on its development. Of even greater concern, is the potential of inequitable introduction of precision medicine to increase the health disparities gap within and between nations.

Context: Trinidad and Tobago

One developing nation in the Caribbean that should be considering these issues is Trinidad and Tobago (TT). In TT despite large government budgetary allocations to the health sector and the existence of a free, universal public health system, health indicators are consistently poor as the country struggles with prevention and control of several chronic, non-communicable diseases such as cancer and cardiovascular disease (9, 10, 11). Further despite the existence of clinically relevant genetic tests capable of predicting disease risk and improving disease prognosis, currently treatment strategies in TT tend to be largely non-specific and do not take into full account inter-individual variability. Therefore advancing a precision medicine agenda may be seen as an attractive option to improve the management and prognosis of individual patients in TT. Opponents may argue that rather than investing in precision medicine, a more systemic approach must be taken to improve existing challenges in the health system. Given this backdrop, this viewpoint explores some of the major ethical considerations of advancing a precision medicine agenda in TT.

Ethical Considerations

Health Equity

Egalitarian theory holds that individuals who are morally similar should be treated similarly. In the consideration of precision medicine then, it follows that there should be equality in access to individuals within the population who have similar health needs. In the case of precision medicine implemented through the public health system in TT, the egalitarian concept of equality of opportunity may be relevant as access to this technology will be assured despite income and social wealth inequalities (12).

However a free market system exists in TT, so like many other advanced interventions, precision medicine is being introduced primarily through the private health sector. This current model creates a serious financial barrier to patients who may have a great need for, but simply cannot afford precision medicine. To put this in perspective, one BRCA genetic test for breast cancer in TT costs more than 15 times the minimum monthly wage, and almost ten times the average cost of a similar panel in the United States. Additionally, when it comes to health, this free market system operates independent of several typical drivers. For example, in many private hospitals in the country an increase in demand for services does not typically result in a decrease in prices. Therefore, from the perspective of egalitarian theory, it is clear - that having precision medicine accessible only through the private health sector is unjust and has the potential to exacerbate already existing health disparities.

Resource Allocation

To add complexity, the current costs of precision medicine seem to prohibit its integration into the universal public health system. The amount of resources needed for any one disease, say breast cancer for example, are considerably large and include physical resources, human resources, and upgraded/novel patient management systems. It has been argued that "if widely implemented, it (precision medicine) could be a distraction from low-cost and effective population-wide interventions and policies (13)." This suggests that in TT the implementation of precision medicine requires a major trade-off: a decreased 'quantity' of health interventions for the majority of the population, to provide an increased 'quality' in health interventions for a subset of the population.

This tradeoff may not auger well, as the utilitarian ethical framework that typically guides the distribution of resources favors a cost-benefit approach that promotes resources being allocated to less expensive treatments or services that provide the greatest benefit. Rawls' theory of justice however may offer an alternative ethical guide. According to this theory, the just distribution of social goods would aim at providing all individuals within the population an equal opportunity to satisfy themselves (14). Thus, it allows for unequal distribution as long as it works to the advantage of all, but especially to the least advantaged. In other words, according to Rawls' theory of justice, resources should be allocated to ensure that those in poorest health, or greatest need, are given a fair chance at access to services that can improve their health. This does not suggest that the government must ignore the majority, rather it highlights that with respect to precision medicine, in considering how to make the best use of limited resources the government will be required to balance the need to improve public health for all with the need to improve health outcomes for some.

One short term solution might be a public-private partnership, where persons identified through the health system as having the greatest need, receive subsidized care through the private system. This safety-net which will help make the technologies available to those who cannot afford them, is a model currently widely used in TT for specialized services, for example radiotherapy. However this approach will require regulation to guard against corrupt practices. Additionally, a public-private partnership will require price negotiations because if the costs of precision medicine remains as high as it is currently thorough the private system, this model may not be the most cost effective solution and therefore not sustainable.

Sociocultural barriers, privacy and confidentiality

Even if issues of availability and access are addressed through the public health system, it is sociocultural factors that will determine who *actually* accesses precision medicine interventions. Health care providers will play a key role in utilizing a precision medicine approach and patients will have to be knowledgeable enough to make an informed choice. Differences in 'genetic literacy' among doctors, varying public perceptions about genetics, and skepticism about government motives and spending may serve as formidable barriers. These sociocultural factors will have to be well assessed and addressed as the disparate access of services by various subgroups may serve to contribute to or create a gap. National discourse will be required and genomics education will have to be a priority across the board.

National discourse will also be required to address fears related to misuse and abuse of information collected under a precision medicine banner. Precision medicine requires the collection and congregation of large-scale data on an individual's genome sequence, microbiome composition, health history, lifestyle, and diet. The data will need to be collected using the same "language" to ensure it is portable, that is easily shared between providers, researchers, patients and other stakeholders. In this regard, the national e-health card proposed by the Ministry of Health in TT might offer a solution (15). However if placed in the wrong hands, this data can be used to target and discriminate against individuals and subgroups within the population. Who would have access to the data? What are the limits of use? What standards would have to be built in to ensure privacy and confidentiality of data? How would breeches be treated? A precision medicine agenda should not be advanced without the necessary regulations to pre-empt discriminatory and other unethical practices that can result from breeches of confidentiality. This would not only reduce the temptation of harvesting and using this data for untoward purposes but could assist with public acceptance as the average citizen would now have a legal basis that could address misuse or abuse of their data.

Scientific basis & political will

Believing that targeted, patient-specific treatment can translate into better patient outcomes, many developed countries have started promoting a precision medicine agenda. In the U.S.A. for example, President Barack Obama recently launched a Precision Medicine Initiative (16) and the European Alliance for Personalised Medicine has had a similar mandate since 2012 (17). Similarly several countries in the developing world (18, 19, 20) have advanced a precision medicine agenda. In Mexico, the Mexican National Institute of Genomic Medicine (INMEGEN public), established in 2004, aims to describe the genetic variation in the Mexican population, the etiology of certain diseases and to educate the public on genomic medicine. Similarly, in Thailand, the Thai SNP discovery project sought to create an SNP database containing allele frequency and linkage disequilibrium blocks patterns for all annotated human genes.

It is becoming increasingly obvious that the main driver of a precision medicine agenda is the political will. It therefore stands to reason that politicians may prefer to invest in interventions that represent the priorities of current leadership or offer some strategic benefit. As such, since precision medicine is still in its infancy, it may not be well supported by politicians in resource-strapped nations. As a result more research will be conducted in developed nations as opposed to developing nations and the value of importing precision medicine interventions may not be certain in countries like TT where the genetic diversity is largely uncharacterised and environmental causal factors continue to be not well understood. In the final analysis, the scientific basis that is informing precision medicine and the political will that is driving it pose considerable danger, especially to developing nations, as the advancement of precision medicine in more developed countries threaten to perpetuate the health disparities gap that exists between nations.

CONCLUSION

Precision medicine has the ability to improve the health of a subset of the population. Although worthwhile, it must not circumvent rather it should be aligned with efforts to strengthen other systemic flaws in the public health system. While it may be premature for TT to invest substantial amounts into a precision medicine agenda, we must bear in mind that to not get on board in some tangible manner, may result in a widening of the health disparities gap between TT and other developed nations. This issue is even more immediate as some precision medicine technologies already exist in the country but are only accessible by those who can afford them. As a result the government must be more proactive perhaps through a public-private partnership in the short term, to ensure equitable distribution with the aim of making precision medicine technologies available to those persons in the population with greatest need. This will require national discourse to improve awareness and knowledge not just among the public but also among health care professionals who will have to recommend the technology. It will also require the conducting of population specific research – to ensure that these technologies have scientific and clinical value for the members of TT’s population.

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