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Introduction

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1.1 What Is Personalised Medicine?

Hippocrates famously advised physicians that it is more important to know *what person the disease has* than *what disease the person has*. So it might well be thought that all good medical practice is personalised, and that there is nothing new about that. But the phenomenon that has been widely presented as a paradigm shift in medicine – and which is our concern in this volume – is both more specific and more general.

In the specific sense, *personalised* or *precision medicine* builds on the achievements of genomic science, aiming to offer doctors and patients more sophisticated tools of molecular profiling to identify and treat genetic variants implicated in disease risk and treatment. Pharmacogenetics, probably the most advanced arm of personalised medicine, aims to minimise adverse drug reactions and produce better responses by tailoring pharmaceutical regimes in cancer care and other branches of medicine to the patient's individual genome. For example, the application of whole-genome sequencing to the care of a patient with early onset breast and ovarian cancer but no significant family history revealed unsuspected genetic defects, enabling clinicians to change her treatment plan from bone marrow transplantation to successful targeted chemotherapy.[1] Outside oncology, treatment for the liver disease hepatitis has been successfully personalised to avoid the worst side effects for patients whose genetic variation makes them more responsive to a lower drug dosage.[2] The discovery of a 'Goldilocks' gene affecting patients' inflammatory

[1] Daniel C. Link et al., 'Identification of a novel PT3 cancer susceptibility mutation through whole-genome sequencing of a patient with therapy-related AMI' (2011) 305 *Journal of the American Medical Association* 1568–76.
[2] Amy Maxmen, 'Pharmacogenetics: playing the odds' (2011) 474 *Nature* S9–S10.

response to tuberculosis could be crucial, particularly in the Third World, in determining who will contract the disease and who would benefit from steroids.[3]

Such is the sense captured in the following description:

> Precision medicine is an approach to disease treatment and prevention that seeks to maximize effectiveness by taking into account variability in genes, environment and lifestyle. Precision medicine seeks to redefine our understanding of disease onset and progression, treatment response, and health outcomes through the more precise measurement of molecular, environmental, and behavioral factors that contribute to health and disease. This understanding will lead to more accurate diagnoses, more rational disease prevention strategies, better treatment selection, and the development of novel therapies. Coincident with advancing the science of medicine is a changing culture of medical practice and medical research that engages individuals as active partners—not just as patients or research subjects.[4]

This is the goal underpinning the announcement made by President Obama in January 2015 of a $215 million Precision Medicine Initiative (PMI), coupled with plans to recruit a million participants into the accompanying 'PMI-Cohort' programme. As a junior senator, Obama had already championed the bill that was to become the Genomics and Personalized Medicine Act 2007, remarking: 'We are in a new era of the life sciences, but in no area of research is the promise greater than in personalized medicine.' In these initiatives the language of *individualisation* was powerfully dominant, despite the 'rhetorical reform' implicit in the change of nomenclature from 'personalised' to 'precision' between the 2007 statute and the 2015 initiative.[5] In the words of the White House statement accompanying the PMI announcement:

> Until now most medical treatments have been designed for the 'average patient'. As a result of this 'one-size-fits-all' approach, treatments can

[3] Linda Wijlaars, '"Goldilocks" gene response to TB suggests best treatment' (6 February 2012) *Bionews*.

[4] Precision Medicine Initiative (PMI) Working Group Report to the Advisory Committee to the Director, NIH, *The Precision Medicine Initiative Cohort Program – Building a Research Foundation for 21st Century Medicine* (2015), September 17, p. 1. See also Maya Sabatello and Paul S. Appelbaum, 'The precision medicine nation' (2017) 47(4) *Hastings Center Report* 19–29.

[5] Eric Juengst, Michelle L. McGowan, Jennifer R. Fishman et al., 'From "personalized" to "precision" medicine: the ethical and social implications of rhetorical reform in genomic medicine' (2016) 46 *Hastings Center Report* 21–33.

> be very successful for some patients but not for others. Precision Medicine, on the other hand, is an innovative approach that takes into account individual differences in people's genes, environments, and lifestyles.[6]

1.2 The Personalisation of Medicine and the Common Good

However, this emphasis on individualisation – 'Me Medicine', as one of us has termed it[7] – is controversial, despite Hippocrates' dictum. To begin with, it is extremely unlikely that completely individualised treatments are ever going to be feasible. Many commentators and clinicians acknowledge that the best aspiration is to deliver diagnoses and treatments stratified into patient groups by genomic science:

> I don't think that we can ever, ever become truly personal and truly individualized . . . [T]he way I look at personalized medicine is whereby we can stratify patient groups respective of ancestry, ethnicity, into individuals who are more likely to respond using novel technologies . . . So I see a way of being able to subphenotype individuals in the way they're going to respond to drugs, and that's what I see as personalized medicine. So I don't see it as individual.[8]

The term 'stratified' medicine, however, lacks the powerful appeal of 'personalised' medicine, with its promises of greater *individual choice* and patient empowerment. These claims have been made most explicitly by the direct-to-consumer (DTC) genetic testing sector, in which firms offer customers whole- or partial-genome sequencing analyses of their risks for particular diseases. As one firm put it, 'We use the latest science and technology to give you a view into your DNA, revealing your genetic predisposition for important health conditions and empowering you with knowledge to help you take control of your health future.'[9] Direct-to-consumer genetic testing is the self-proclaimed vanguard of the personalised medicine movement, with leading proponents advocating a proactive approach

[6] Quoted in J. Patrick Woolley, Michelle L. McGowan, Harriet J. A. Teare et al., 'Citizen science or scientific citizenship? Disentangling the uses of public engagement rhetoric in national research initiatives' (2016) 17(33) *BMC Medical Ethics*, pp. 7–8.
[7] Donna Dickenson, *Me Medicine vs We Medicine: Reclaiming Biotechnology for the Common Good* (New York, NY: Columbia University Press, 2013).
[8] A senior editor of a genomics journal, interviewed in Juengst et al., 'From "personalized" to "precision" medicine', p. 23.
[9] Navigenics advertising, quoted in Dickenson, *Me Medicine vs We Medicine*, p. 32.

to individual health that stresses the importance and validity of DTC tests in taking control of one's own health.[10]

But are these promises of empowerment illusory? 'The weakness of "personalized genomic medicine", as a promissory label for what genomics might bring to health care, is that it promises more than genomics can actually deliver – both in terms of increased patient empowerment and in terms of the individualization of care.'[11] Perhaps personalised medicine might even *diminish* patient choice by denying patients treatments which they would like to have but to which they are unlikely to respond. Or it might leave that decision more firmly in the hands of physicians and genetic counsellors, operating on the pharmacogenetic ethos of 'the right treatment for the right patient at the right time'. But the inevitable corollary is 'the wrong treatment for the wrong patient at the wrong time', conceivably meaning 'no treatment' for patients whose genomic profiles make them less likely to respond.[12]

Rationing decisions such as these are only the start of the ethical and social issues arising from personalised medicine. Interpreted broadly, personalised medicine can encompass a whole gamut of new biotechnologies, united mainly by their common emphasis on patient choice and empowerment. As a prominent example, 'enhancement technologies', such as neurocognitive stimulation techniques, brain–computer interfaces, drugs to improve mental functioning, and, most controversially, germline genetic modification, can be seen as a form of personalised medicine. They are typically predicated on the individualistic ethos of 'being the best Me I can possibly be'.[13]

Yet the original ideals behind the rise of genomic medicine were communitarian, not individualistic: they symbolise 'We' rather than 'Me' Medicine. This 'We' may refer to a variety of concerns: our genetic relatedness, ideals of solidarity and distributive justice, or global public goods such as the genetic commons. The ideal of the genome as the common heritage of humanity permeates the international scientific community's 1996 'Bermuda statement', which declares: 'All human genome sequence information from a publicly funded project should be freely available in the public

[10] E.g. Francis Collins, *The Language of Life: DNA and the Revolution in Personalized Medicine* (New York, NY: Harper Collins, 2010).
[11] Juengst et al., 'From "personalized" to "precision" medicine', p. 30.
[12] Dickenson, *Me Medicine vs We Medicine*, p. 72.
[13] Dickenson, *Me Medicine vs We Medicine*, p. 113.

domain.'[14] Likewise, article 1 of the 1997 UNESCO Universal Declaration on the Human Genome and Human Rights stipulates: 'In a symbolic sense, the human genome is the common heritage of humanity.'

Does personalised medicine undermine and threaten this conception of the 'common good'? If more resources are dedicated to precision medicine, for example, will less attention be paid to public health?[15] That could be counterproductive in overall population terms, bearing in mind that it was public health initiatives such as improved sanitation and screening that radically improved lifespan figures in the twentieth-century Western world by lessening the incidence of contagious disease.

This phenomenon is not 'merely' historic; nor is it limited to infectious disease. 'Most of the recent successes in cancer care have resulted from the traditional public health measures of screening, early detection and smoking reduction as well as some immunologic therapies.'[16] Even two of the most prominent 'poster children' for genomic medicine, the BRCA1/2 genes implicated in some breast and ovarian cancers and the discovery of specific cystic fibrosis mutations responsive to recently developed drugs, have arguably had less effect than 'We Medicine'. 'Although well-deserved recognition has accompanied these genetic discoveries, neither has been a significant factor in the substantial reduction in mortality from the two target diseases during the past 25 years. The commitment to screening technology and adherence to best practices has proven far more important to the lives of affected patients.'[17] More broadly, it has been argued that a solidarity-based 'We Medicine perspective' could allow us to formulate better policies in areas ranging from palliative care to organ donation.[18]

[14] HUGO (Human Genome Organization), *Summary of Principles Agreed at the International Strategy Meeting on Human Genome Sequencing ('Bermuda Statement')* (London: Wellcome Trust, 1996).

[15] W. Burke et al., 'Extending the range of public health genomics: what should be the agenda for public health in an era of genome-based and "personalized" medicine?' (2010) 12 *Genetics in Medicine* 785–91.

[16] Michael J. Joyner and Nigel Paneth, 'Seven questions for personalized medicine' (2015) 314(10) *JAMA* 999–1000, p. 999.

[17] Ibid.

[18] Barbara Prainsack, 'The "We" in the "Me": solidarity and health care in the era of personalized medicine' (2018) 43(1) *Science, Technology and Human Values* 21–44.

1.3 Digital Health and Personalised Medicine

All these developments regarding personalised medicine need to be seen in connection with the digital health (or e-health) revolution. In 2017 the digital health industry was already worth US$25 billion globally.[19] Digital health includes diverse technologies, e.g. automated algorithm-based decisional support systems, mobile health apps (m-health) monitoring health-related behaviours, remote consultations (or 'telemedicine') and Electronic Health Records (EHRs). Staggeringly, 153,000 m-health apps have been released since 2015, bringing the worldwide total to 320,000.[20] For most of these technologies, robust governance is lacking.[21]

These technologies also result in an increasing 'pile' of Big Data. Increasingly, as in other contexts (not only businesses but also election campaigns, for example), in healthcare, too, attempts are made to link disparate data sets at the individual person level. New kinds of data collection, linkage and analysis are expected to profoundly transform clinical medicine, public health and epidemiology.

In her hugely impressive article in *The Lancet* on 'The art of medicine', Inmaculada de Melo-Martin analyses the impact on current-day medicine of the Cartesian concept of the human body as a machine. Although this model has resulted in unquestionable benefits from the biomedical sciences, she adds this caveat:

> [I]t also underlies the belief that the goal of medicine is to somehow eliminate human vulnerability. Because contemporary biomedical sciences ask questions oriented to that end, it is not surprising that their responses tend to sustain medical practices that are directed to produce cures. Of course, we cannot emphasise enough the importance of curing human diseases. But excessive emphasis on this goal runs the risk of disregarding those things that cannot be cured, such as disabilities and chronic illnesses. This goal also underscores the emphasis on individual solutions to problems that might best be addressed by attending to social and economic aspects, and hence the common lack of attention given to public health solutions.[22]

[19] 'Does mobile health matter?' (2017) 390 *The Lancet* 2216. doi:10.1016/S0140-6736(17)32899–4.

[20] IQVIA, 'The growing value of digital health in the United Kingdom: evidence and impact on human health and the healthcare system' (7 November 2017). www.iqvia.com/institute/reports/the-growing-value-of-digital-health (Accessed 11 February 2018).

[21] Rishi Duggal, Ingrid Brindle and Jessamy Bagenal, 'Editorial: Digital healthcare: regulating the revolution' (2018) *British Medical Journal* 360:k6. doi:10.1136/bmj.k6.

[22] Immaculada de Melo-Martin, 'The art of medicine – Vulnerability and ethics: considering our Cartesian hangover' (2009) 373 *The Lancet* 1244–45.

Promises of ever more cures where none were previously available can be found throughout the 'personalised medicine' rhetoric, to an increasingly embarrassing extent, as explained powerfully by Stanford epidemiologist John Ioannidis:

> I have had great excitement about the prospects of omics, big data, personalized medicine, precision medicine, and all. Much of my effort has been to put together these efforts with rigorous statistical methods and EBM (Evidence-Based Medicine) tools. But I am tired of seeing the same overrated promises recast again and again. For example, several years ago I gave an invited lecture at a leading institution on the danger of making inflated promises in personalized medicine. Right after my talk, everybody rushed to hear the launch of a new campaign, where the leader of the institution singled out this unique historic moment: that institution would single-handedly eliminate most major types of cancer within a few years. Several years have passed, and none of these cancer types have disappeared. I recently tried to find the name of that campaign online but realized that this institution has launched many similar campaigns. Which among many was the unique historic moment that I happened to be at? Multiply this by thousands of institutions, and there are already millions of unique historic moments where cancer was eliminated. The same applies to neurologic diseases and more. I do not understand why academic leaders and politicians need to make such self-embarrassing announcements now and then.[23]

1.4 Me Medicine vs We Medicine

To examine these wide-ranging and global questions, this volume brings together an international array of scholars from various disciplines, including law, bioethics, anthropology and sociology, to exchange ideas on the tensions between Me Medicine and We Medicine.

One of the recurring questions in the contributions to this book is what *Me* and *We* exactly mean in this context. As various authors argue, personalised medicine gives rise to new conceptions of the self and the communal. What kind of concept of the person is implied by the notion of personalised medicine: a geneticised self, quantified self, potential self, fictional self, consumer self? And what is the nature of community and the common good implicit in We Medicine: collective morality, social solidarity or rather new types of commons, such as 'genome-commons' (e.g. the human genome as common heritage of mankind), 'bio-

[23] John Ioannidis, 'Evidence-based medicine has been hijacked: a report to David Sackett' (2016) 73 *Journal of Clinical Epidemiology* 82–6.

commons' (e.g. sharing DNA samples) and 'data-commons' (e.g. promotion of early data disclosure and release)?[24]

Moreover, many of the chapters offer reflection on the causes of the spectacular rise of the rhetoric of personalised medicine. One of us has argued[25] that four possible explanations can be distinguished, with some emerging from further analysis as more plausible than others. These four explanations also resurface in most of the chapters and can be characterised as follows.

A first possibility is that the personalisation of healthcare is rooted in a more general sense of threat and contamination in society. For example, the fear of contamination can be recognised in the growing lack of confidence in public health resources. Second, the popularity of products and services in the field of Me Medicine, such as DTC tests, could be understood against the background of a broader trend towards narcissism and a fixation on the self. Third, it seems likely that corporate interests also fuel the fascination for personalised medicine. The highly lucrative and still expanding market in products and services based on personalised medicine suggests a correlation between the emergence of personalised medicine on the one hand, and the rise of neoliberal politics and the privatisation of most domains of life on the other. Last, the rhetoric surrounding personalised medicine alludes to a celebration of personal choice, personal empowerment and personal autonomy. From this perspective, the belief in personalised medicine as the new panacea is intimately connected to modern society's belief in the 'sacredness of personal choice and individualism'.[26]

These four hypotheses have engaged the attention of many of our contributors, allowing a more sophisticated and multi-disciplinary analysis of the phenomenon of personalised medicine to be united under a shared framework. In the next section we summarise each of their contributions separately.

1.5 Overview

In their chapter, 'Personalised Medicine and the Politics of Human Nuclear Genome Transfer', philosopher and bioethicist Françoise

[24] Bartha M. Knoppers and Vural Özdemir, 'The concept of humanity and biogenetics' in Britta van Beers, Luigi Corrias and Wouter Werner (eds.), *Humanity across International Law and Biolaw* (Cambridge: Cambridge University Press, 2014).
[25] Dickenson, *Me Medicine vs We Medicine*, pp. 10–29.
[26] Dickenson, *Me Medicine vs We Medicine*, p. 24.

Baylis and feminist political scientist Alana Cattapan offer an important contribution to the debate on the governance of human nuclear genome transfer, commonly (but incorrectly) known as 'mitochondrial replacement'. This emerging reproductive technology aims to provide women who are genetic carriers of certain mitochodrial diseases with the possibility of reproducing without passing on their mitochondrial DNA to their offspring. The result would be the creation of 'three-parent babies', with genetic material from two women and one man. In their thought-provoking analysis Baylis and Cattapan argue that the rise of human nuclear genome transfer should be understood as part of the current movement towards the personalisation of healthcare; as such, they claim, it deserves a critical examination. They subsequently argue against the implementation of this technology by fruitfully engaging with Dickenson's aforementioned four possible explanations for the rise of personalised medicine. According to Baylis and Cattapan, Dickenson's first explanation resurfaces in the context of human nuclear genome in the shape of a fear of genetic contamination of one's familial DNA, against which this technology would offer protection. They then engage with Dickenson's second hypothesis – narcissism and bowling alone – by highlighting how an important part of this technology's appeal rests on a short-sighted prioritisation of genetic relatedness above all other interests. As to Dickenson's third explanation, Baylis and Cattapan describe how the fertility industry's huge commercial interests are steering the development and marketing of this reproductive technology. Finally, they argue that 'the sacredness of personal choice' has also clearly affected the reception of human nuclear genome transfer. The rhetoric surrounding this technology emphasises the right to have genetically related children who are free of mitochondrial disease, and obfuscates the risks that are at stake, such as the intergenerational effects of altering the genome.

Extending the scope of personalised medicine beyond genomic science into an unexpected and novel area, bioethicist Heidi Mertes applies the concept to 'Stem Cell-Derived Gametes and Uterus Transplants'. Although both of these experimental techniques are far from being mainstream, they implicitly rely for their justification on the conventional view of 'reproductive autonomy' as a personal right. The sacredness of personal choice and the importance attached to genetic parenthood chime with this view. Likewise, the hypothesis that 'Me Medicine' derives its popularity from a fear of threat and contamination also seems to be supported by fear of third-party involvement in the

formation of a family, Mertes suggests. However, she concludes that 'it is far from obvious that the desire for genetic or gestational parenthood can trump considerations for the welfare of the future child and for the safety of the other parties involved (in the case of uterus transplantation), or that it can justify resource allocation to these new reproductive technologies.' She ends her analysis by exploring what measures a less individualistic approach to infertility might entail: one rooted in the 'We Medicine' concept of the common good.

Reproductive ethics is also the concern of Jyotsna Agnihotri Gupta, a sociologist who works on reproductive and genetic technologies from a gender perspective, in her original and important study combining media analysis, interviews and participant observation: 'Personalising Future Health Risk through "Biological Insurance": Proliferation of Private Umbilical Cord Blood Banking in India'. Private cord blood banking epitomises 'Me Medicine' in its ostensible concentration on the individual's future well-being, rather than the collective's health, which is better served by public banks. In India, however, public banks are few and far between, whereas private banking is very much on the rise. Gupta provides extensive detail on the Indian private cord blood industry – potentially the largest supplier in the world – along with interview results from patients and doctors alike. Locating the private cord blood phenomenon not only within the 'Me Medicine' framework but also in the literature on risk theory, Gupta documents the construction of a new kind of patient: the 'at-risk' individual who needs a form of personalised medicine from birth: the moment when cord blood is taken.

A different dimension of the tensions between We Medicine and Me Medicine is explored in the chapter, 'Combating the Trade in Organs: Why We Should Preserve the Communal Nature of Organ Transplantation' by Kristof Van Assche. Van Assche, who is a legal expert on organ donation and transplantation, offers a powerful and highly critical examination of recent proposals to introduce elements of free market economics into systems of organ donation. Even if organ selling is still banned in most legal systems, 'as altruistic kidney donation symbolizes We Medicine at its noblest',[27] the call for a regulated market in organs is becoming louder in reaction to the continuing shortage in organs. Van Assche's ardent defence of the existing altruistic system rests on two lines of argumentation. His first argument is that a regulated organ market is likely to lead to the exact opposite of what proponents

[27] Dickenson, *Me Medicine vs We Medicine*, p. 72.