Opinion: Imagine 5P3A Global Health

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Imagine the day when you will be making decisions about your health and therapeutic interventions based on both the detailed information about yourself and the history of your closest relatives as well as on health information from a cohort of people who are the most similar to you—the “twins” precisely selected from a database of billions of people. It will be a group matched for their genetics, disease and therapeutic history, lifestyle, “biomarkers,” and other factors deemed important for your health. And, for sure, you and they will throw into the mix the personal microbiomes as these may turn out to be one of the key factors for the happy homeostasis for you and people like you.

5P3A—What is it and What Could Be in it for You?

If you *Participate* in this global information sharing system, you will get advice which will be as *Precise* for you as possible because it will be based on detailed data from you and a matched group *Personalized* for you. Every day, the inputs from you and your cohort will be used to improve the precision of your healthcare aiming at achieving your personal health goals. And this feedback will be based also on information from people “like you” who are already ahead of you in their health history—it should be therefore strongly *Predictive* and could be used for *Preventive* action against diseases and their progression—whether “natural” or iatrogenic.

Effectively, as a member of this health alliance, you will sign up for a life-time $n = 1$ “adaptive clinical trial” in which your key health management decisions will be made on the best information available in real time from the analyses of a large number of $n = 1$ “trials” of participants similar to you

and, naturally, including yourself with your longitudinal history (from “pre-womb to tomb” [1].

And you will be doing something good for many others: your daily data contributions will become a valuable addition to the continuous improvement of the global health management. Sounds familiar to some of you? Yes, there is a prototype version of this on www.patientslikeme.com [2].

Naturally, I expect that you would not want to participate with much enthusiasm unless this “system” is *Attractive* for you. And this grand dynamic Wikipedia of health must be *Accessible* to you and all to derive the full benefit of the experience of as much of the humankind as possible—breaking through political, legal, and other “protectionist” barriers. Last, but not least, all of this must be *Affordable* to you and all the millions, and perhaps, billions of participants. These 3 As form the foundation of the 5P3A global healthcare (Fig. 1).

What else is Coming in 5P3A?

If you are not into your personal data collecting wearables yet, think about it: your life is unlikely to be a straight line or a smooth curve in time without kinks in your well-being. Yet, your health status is assessed mostly from sporadic events such as the occasional visit to the doctor prompted by an acute health problem or the annual check-up, missing all the twists and turns on the way. Continuous or frequent data collection is now facilitated by small wearable devices that enable you to monitor many of the daily variables important for assessment of your health such as general physical activity, cardiovascular and respiratory functions, inhaled and exhaled gases, diet, quantity and quality of sleep, etc. [3].

Before long, you will find that most if not all of the medical devices for your personal use will have incorporated connectivity to internet. For example, if you have respiratory problems and you need to use an inhaler, it will probably have a two-way communication system to collect data about the medication you are using and your response to it so that the best real-time advice on this intervention can be

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Figure 1. Key Interlocking Aspirational Components of the 5P3A Healthcare that Guide the Design of the Underlying Infrastructures and Technologies.

promptly provided to you [4]. And based on the contextual information such as altitude, air pollution, and pollen count, it may also warn you that you are close to a danger zone [5–8]. You will get reminders if you forget to take your medication—and if it turns out that despite you sticking to all instructions from your healthcare team, you are not getting better, the doctor will know from the electronic records for sure that it is time to try something different than lamenting that you do not follow their advice [6].

Similarly, if you have diabetes, your injector and glucose meter will be connected for helping you continuously to manage your condition [9]. You may want to give it a try first by participating in one of the many clinical trials that use wearables to monitor your response to therapy. For example, those who are participating in a trial on a new treatment of pulmonary arterial hypertension collect their physical activity data (“actigraphy”) and other quality of life measures using a consumer-type wearable device. This way you and the trial sponsor would get detailed information about your physical ability throughout the whole trial, and not just from snapshots taken during the walk in the doctor’s office [10].

You Can also Make Important Contributions to Finding New Medicines!

Importantly, for the maximum benefit for the society, 5P3A must also incorporate a seamless transition between finding new treatments and cures and their best use in the real world.

You are quite unique—and you change with time. The most meaningful information in the therapeutic development trials would likely come from the longitudinal *trends* in the key health-related attributes prior, during, and after the trial in you—they would be the source of very valuable information for people similar to you.

Fantasy land? Not really. For example, people with cystic fibrosis are already participating in this kind of treatment evaluations by having their health care records stored in a registry that can be used for retrospective analyses to provide

advice on benefits and risk of medicines for patients who share similar “risk factors,” i.e., important personal traits [11].

But even if you do not enroll in any clinical trials with new drugs, you will make an important contribution by being a part of a cohort of people similar to you in the global data base that could act as a virtual control group in development trials, thereby reducing the cost of clinical development by ~50%, overcoming the barrier to participation by people reluctant to take the chance to be receiving placebo and therefore removing the key barrier to their enrollment. This should significantly speed up the development of new therapies as well.

The Benefits to You and People Like You Will Grow in Time

Naturally, your participation will contribute to the information about how any treatment you take affects you, providing real-life evidence of safety and efficacy of therapies for people like you. This “post-marketing surveillance” greatly adds to the Real-World Evidence (RWE) whose importance is already acknowledged by those who make the decisions about approval—and withdrawal and warnings on therapies—so that better and more affordable drugs and advice to use them become available for you faster [12].

Worried About Hackers Stealing Your Healthcare Information?

Well, there are good hackers and bad hackers! Without the good ones, you would not be enjoying the rapid access to an immense amount of information and your ability to sort it out on your small portable device no matter where you are! There is a lot to learn from the open access culture of these good hackers [13].

So, are you still worried that 5P3A will be too intrusive for you and someone may be able to find intimate information about you despite all the precautions? You are not alone—I worry about it, too. But, on balance, I have decided to accept that risk if in return I will get friendly reminders to go to bed earlier or stay longer to get adequate sleep, have that daily dose of exercise and eat my dinner early to prevent reflux or a warning that I should join the cohort of people like me who benefit from controlling their blood pressure. I just have to set up my cell phone so that 5P3A messages come first, ahead of the daily insidious offerings from someone who already hacked into my deepest secrets and hopes that one day I will cease to resist the temptations and will buy another lens for my camera, make it to snorkel at Ningaloo reef again and get a high-performance folding bicycle...

So, it is up to you—and each one of us—to decide if we believe the slogan on the Apple website “The future of healthcare is in your hands.” [14]

I did not invent the components of 5P3A. This Opinion Piece integrates these attributes previously expressed by others as I believe that each one of them is essential for us to succeed with the aspiration of better healthcare for all.

Hood et al. published on the 4P concept in a series of papers [15 and refs. therein]. The missing P was “Precision”: Hood et al. were concerned that the “signal to noise ratio” from the analyses of “big data” was too large (yet) and that this did not fit the concept of P4 (“systems medicine”). In contrast, I see the participatory nature of 5P3A as being utilized for continuous improvement of the precision of the outcomes of healthcare interventions (i.e., getting closer to the optimal benefit/risk ratio for each individual). This is akin to the adaptive control in clinical pharmacokinetics which fits very well into 5P3A [16].

The use of “twin simulation” in pharmacokinetic/pharmacodynamic clinical decisions is an example of recent work that would be an integral component of 5P3A [17].

The Affordability and Accessibility to good healthcare have been the goals of most if not all progressive societies; the opportunities to achieve this goal through “digital medicine” were recently presented in a report by Deloitte [18].

5P3A would have never been conceived and even less likely able to succeed without the existence of Attractive “consumer electronics” and in particular smartphones and various apps and wearables. The enormous success of these new technologies is reflected in that the majority of the global population has them and uses them frequently or even continuously for communications with each other, data bases and analytics. 5P3A should leverage and emulate the attractiveness of consumer electronics and internet infrastructure to make all stakeholders enthusiastic about full participation as contributors and users of this global system.

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Compliance with Ethical Standards

Conflict of interest

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