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Harnessing the Power of Digital Health

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From Acute Medicine to Managing Multiple Chronic Diseases for Decades

Thinking about the tremendous progress made in medicine over the past century, we have every reason to be proud. People used to die more frequently of infectious diseases, cardiovascular events, or cancer. Now people live longer, but many live with chronic diseases for decades – Diabetes, Cardiovascular disease or AutoImmune disease such as Multiple Sclerosis, or Rhumatoid Arthritis.

While we need to continue searching for new drugs to treat currently untreatable diseases, we are facing a new challenge: with an aging population, the cost of Healthcare has become a pressure point for all countries in the world.

The US currently spends 16% of GDP on healthcare. Germany is better, spending just 10.5%, and France and the UK spend 11% and 8.7% respectively. This pressure on national budgets is here to stay, and we need to find ways to cut this cost, while improving the care provided.

Our health systems were designed to respond to acute diseases, to prevent deaths by providing short-term treatment, hospitalization, and recovery at home. But these systems now need to evolve to support people living with multiple chronic conditions for years or decades, where treatment efficacy will of course depend on the drugs available, but also on patients' adherence to their treatment regime, their lifestyle and diet, and other environmental and behavioral factors. Today, the medical community generally accepts that, for patients suffering from chronic diseases, their long-term engagement in the management of their condition is a strong driver of better outcomes. Meanwhile, pharma companies are investing huge amounts of money in the development of new and better drugs, but if patients don't stay on treatment, the benefits are lost, and payers are now demanding proven results in a real-world context.

Democratizing healthcare

Patients feel the rising cost of healthcare. At the same time, we all have higher expectations of medicine than our grandparents had. With the quantity of information freely available to anyone today, more single-minded and better-educated patients consult their doctor when they already have an opinion on what treatment should be provided and are adamant that their treatment should be personalized.

The explosion of "quantified self" technology is clearly involving people more in managing their health. This technology gives patients a real opportunity to better understand their chronic diseases, as well as the impact of their lifestyle, activity, and diet. In other words, it gives them more effective tools to manage their health. Advances in technology have really paved the way to easy, reliable patient self-care. And improved experiences by their users boost patient engagement.

A revolution is happening...

But a revolution is changing the face of the entire healthcare industry: a digital revolution that embraces personalized medicine. The term may be over-used, but it heralds an exciting future. Put simply, it will mean medicines that actually work for everyone. For example, for diabetic patients it means replacing cumbersome BGM measuring kits and nervous guesswork with a simple patch applied to the arm or stomach that will automatically record their personal glucose levels onto their smartphone. Not only is this easier to manage, but the data can then be transmitted to their doctor, analyzed, and examined for trends.

Benefits of the revolution: the 4 P's

❱ **Patients love it.** It helps them better understand how their environment affects their health. When diabetic patients are able to calculate their insulin dose more accurately based on the glucose levels recorded on their smartphone, they become more engaged in their own care and pay closer attention to their diet. This, in turn, helps to reduce the chances of any debilitating complications.

❱ **Physicians love it.** Instead of keeping partially (and sometimes inaccurately) handwritten logbooks, or relying on anecdotal evidence from patients, they have real-time data that sharpens their focus on patterns, rather than discrete outlier points. This better-quality information helps them to work more cohesively with their patients.

❱ **Pharma companies love it,** because now they can run continuous clinical trials to monitor glucose levels in Type 2 diabetes patients, whereas previously this was impractical. Likewise, they can monitor a wide range of other parameters, such as blood pressure, heart rate, physical activity, and temperature, without patients having to come in for "check-ups". The resulting improved information about the effects and efficacy of drugs is taking our understanding of the condition to a whole new level.

These fresh insights then spawn new biological hypotheses, paving the way for the development of new drugs. Trials are also accelerated, saving money, and the measurement of outcomes is optimized.

❱ **Payers love it,** because better outcomes save billions on the cost of treating complications. Also, since outcomes are measurable, they can conclude risk-based contracts that pay for drugs in proportion to the results obtained.

IMAGINE A WORLD WHERE YOUR BIOLOGICAL PARAMETERS ARE RECORDED AND ANALYZED WITH A DECISION-SUPPORT ALGORITHM TO FLAG UP WHEN THEY START HEADING IN THE WRONG DIRECTION…

The future of the healthcare sector

The progress made by technology in recent years has been mind-blowing. Computing power has increased exponentially, and this combined with progress of sequencing technologies has had a multiplier effect on genomics. Back in 2002, sequencing one human genome cost $100 million. Today, a whole genome can be sequenced for just $1,000. This has heralded a new era of genomics, which will improve our understanding of human biology and of some rare diseases.

Some diseases were already found to be caused by a single mutation making one enzyme dysfunctional. Here, enzyme replacement therapies have already saved the lives of many – especially children. New cancer therapies, too, have been devised, focusing specifically on a subtype of cancer in patients carrying specific mutations.

Other technological advances have enabled miniaturization, data generation, and data sharing, driving an explosion in the development of quantified self tools. Pedometers and Fitbits started life as "toys" or "wellness gadgets", tracking activity levels and sleep, but as the quality of the software and the reliability of the information improves, medical-grade sensors are proliferating. Among others, Verily (ex-Google Life Sciences) and Apple are already developing watches capable of recording and monitoring biological parameters such as heart rate and movement. The Verily StudyWatch, developed mainly to monitor patients for better and faster clinical trials, includes a week-long battery life to encourage its use. It collects electrocardiograms (ECG's) and electrodermal activity from sensors, encrypts, and stores up to several weeks of data internally. By contrast, data collection on this scale used to require heavy, expensive equipment only available in a clinic.

Business start-ups are using artificial intelligence (AI) to help identify new drug targets and understand the roadblocks that would have once hindered their development. Connected care or digital health promise to enable the delivery of care for chronic disease in the future. Proteus, a digital healthcare company, is developing a biological sensor inserted into a pill to track drug intake, which could be a potential godsend for carers of Alzheimer patients.

Yes, it will *personalize* medicine (that word again!), giving doctors a better understanding of whom they are treating, involving patients more closely in their own care, and ultimately cutting costs.

Harnessing the power

But the real healthcare revolution will come from the convergence of technology and science. Imagine a world where your biological parameters are recorded and analyzed with a decision-support algorithm to flag up when they start heading in the wrong direction. As knowledge is extracted from the trillions of data generated by a variety of (often as yet non-interoperable) systems, we need to become skilled at analyzing, sharing, and above all, harnessing it. That is the challenge that lies ahead. ▪