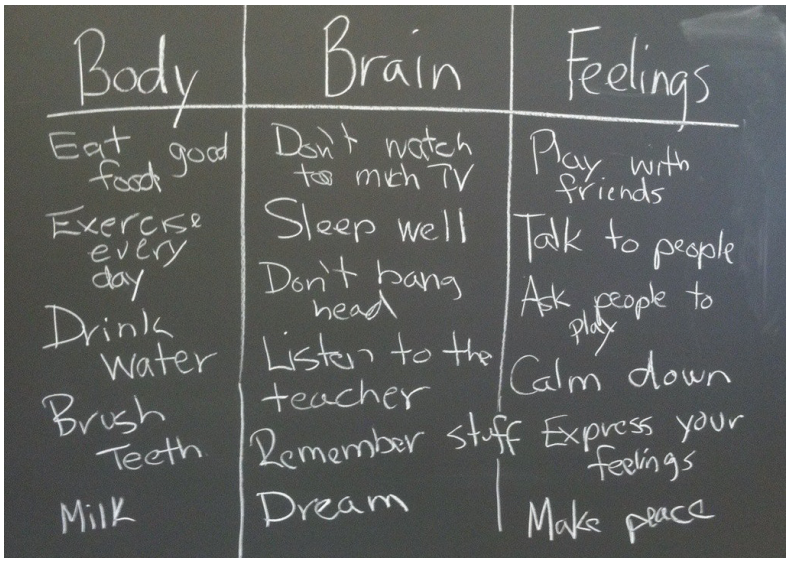
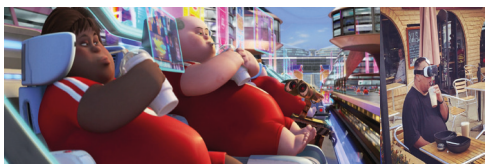
Chapter 1
Getting Sick No More, a Profound Change Eliminating Friction

If we're honest, all of us know well and good what living a healthy life means, but we haven't made a success of it. Not yet, at least. Look for instance what appeared on the black board when a kindergarten teacher asked a class to create rules for healthy living.[5] No rocket science. And yet.



It's hard to be healthy.



In Pixar's animated sci-fi story *Wall-E*, the people of the future zoom around in hovering chairs in a climate-controlled dome, with robots refilling their sodas. Their bodies are so flabby they can't even stand. It's the ultimate incarnation of the couch potato. The picture on the right is actually... real life.

It's really hard. **Therefore, we need to focus much more attention on how to make staying healthy more convenient.** In a fantastic series of articles, Steve Downs, Chief Technology & Strategy Officer at the Robert Wood Johnson Foundation, wonders how we can build health into the OS.[6] He argues that, "Over many decades we have engineered movement out of our daily lives. 'Exercise' has become a separate, add-on activity, as opposed to a natural part of going about our days. Processed, high-calorie, low-nutrition food is abundant, cheap, and engineered to appeal perfectly to our cravings. Entertainment, largely screen-based, available 24/7, and engrossing,lures us to our couches and keeps us up at night.

The fact that more than 40 percent of adults are overweight or obese (11% of men and 15% of women) is not due to the individual moral failings of millions of people. It is the result of many different industries, each individually optimizing our engagement for their particular goals, but lacking a coherent value system that prioritizes our overall well-being.

We have an automobile industry that works to get us to spend more time driving, by offering us cars that are ever more comfortable, safe, and desirable. We have real estate and building industries that push us toward more comfortable houses that we don't need to leave, toward neighborhoods where cars are the only viable transportation option. We have the entertainment, consumer electronics, and advertising industries that work symbiotically to command our time and attention by delivering an endless supply of outstanding, compelling entertainment and addictive opportunities for connection, through brilliantly engineered, seductive gadgets. We have the food industry, which has figured out what we crave and how to deliver it with maximum convenience and minimal cost."

Meanwhile, we are at a moment of extraordinary technology invention, potency, and possibility. Smartphones have already become boring, and they are only ten years old. We are at the dawn of AI and the Internet of Things turning into a commodity like electricity or tap water. We are at similar inflection points in areas like 3D printing, materials science, genome editing, synthetic biology, and nanotech.

We don't yet know how these and other technologies will be combined to form the services and habits that will create the new normal for our everyday lives. But for sure, they provide us with unseen possibilities to shape and create an optimal future.

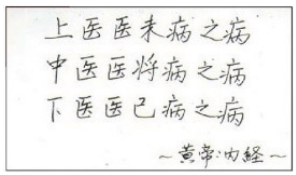
I introduced such a future in my first book, *Sick No More*. It described an evolution from medicine that tries to cure us into one that tries to keep us healthy and even wants to make us "better," to improve us. I described how the use of our personal biological code (our genetic layout or our genome, made permanently available for next to nothing) and other biomarkers, dozens of invisible sensors, smartphone apps, smart social media, games, and the internet promise to keep an eye on us.

Convergence with lightning-fast evolutions in (mobile) information and communications technology (ICT) and social media have already started to ensure that the knowledge and expertise that was once the exclusive domain of trained health care professionals is slowly shifting in the direction of the patient and – ultimately – each of us as healthy citizens.

However, that happens without the need to focus on technology, which is invisibly analyzing data to anticipate events before they become problematic. This way, we can use them to create completely novel, unexpected services and experiences to avoid disease from striking. Most often, that will happen based on fun, engagement, design, and warm human interaction.

This wasn't some completely futuristic peak into the future. It was a vision from the past. As I mentioned earlier, more than 2000 years ago, in some parts of China, doctors used to get paid as long as people in their village remained healthy. Once you got ill, you no longer had to pay.[7]

That is what we should aim for again. Therefore, **this book is no longer about seeing but rather about creating such a novel, healthy future**. We should aim to make this the definition of so-called **outcome-based medicine**, which would be impossible to top. That is in stark contrast to mostly service-based medicine, which has ruled the game until now.



Nowadays, people generally don't go to the doctor until they are sick, and by that time, it is extremely expensive to try and fix the problem. It's expensive not just for you, but also for the health care system. It's also expensive for your employer, and you are probably less productive. For individual investors and for society in general, it makes more sense to keep us healthy. Obviously, a bigger market exists for fixing people who are broken.

Let's start with the simple proposition that health is an asset. It might be our most important asset. And like any asset, if we cultivate it, we increase the value it returns. We're not talking about fixes when health is broken; those are important, but they happen too late.

Obviously, we have lost the Chinese model big time. Or better, "the system" has derailed big time. For every 100 euros (dollars/yen) we spend on health care these days, not a single euro (dollar/yen) is dedicated to prevention, while an average of 90 euros is spent on the last two years of our lives.

That's ridiculous, when you think about it. But what if we were to switch the ratios? And how do we get there? That's what this book is about.

"I think a lot about
the future since it's there I will
spend most of my life."

– Woody Allen

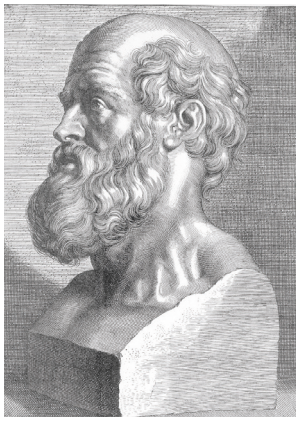
Incidentally, a recent, systematic review to examine the return on investment (ROI) of public health interventions delivered in high-income countries with universal healthcare (the UK, Western Europe, the USA, Canada, Japan, Australia and New Zealand), demonstrated a median return on investment of public health interventions of 14:1. Thus, for every €1, £1, or $1 invested in public health, €14, £14, or $14 will subsequently be returned to the wider health and social care economy. In national campaign this number sometimes even doubled. Some prevention interventions reported substantial effects within 6-12 months[8]. "Every ounce of prevention is worth a pound of cure", Benjamin Franklin knew already.

What can we, you, any corporate create in the 15 years preceding my diagnosis of type 2 diabetes? Cause once it's diagnosed, it's often too late to revert it. Even with the prospect of 3D-printed organ transplants, stem cell therapies, and newer augmentation tricks, the significant risk of losing your kidneys and your eyesight is not a pleasant idea. Actually, that is what diabetics fear most and why end of life is so expensive.

Exercise delays type 2 diabetes development (a result of being obese) and can even revert it.

One of the hallmark studies to show the power of exercise was published in 2014 in the leading medical journal *The Lancet*. Six thousand patients with type 2 diabetes, all treated with the same drug, got sent home with an accurate step counter. Half of the patients walked an extra 2000 steps a day. They turned out to be free from disease worsening (so-called comorbidities of the heart) in 20% of the cases.[9] This was the first real proof that exercise is one of the best drugs we can prescribe. Two years later, it was shown that, with 150 minutes of exercise per week, you are 35% less likely to die prematurely.[10] This is starting to be motivating.

More recently, we have started to understand how exercise helps to combat cancer and to stimulate the brain. To investigate the underlying molecular mechanisms, researchers of the University of Copenhagen in Denmark compared tumor growth in sedentary mice and in those that had access to an exercise wheel for over four weeks. Animals that ran had about 60% fewer tumors, which were also smaller in size. Exercise was associated with an increase in the number of a particular type of immune cell, the natural killer cell, found in the tumors. An exercise-induced surge in the hormone adrenaline mobilized these cells.[11]



But before going there, let's first answer why we have lost the Chinese model. I wouldn't be able to explain it better than how Molière, the 17th-century French playwright and actor who is considered to be one of the greatest masters of comedy in Western literature, once stated it: "Doctors pour drugs of which they know little, to cure diseases of which they know less, into patients of whom they know nothing."

Nevertheless, knowing your patient is what Hippocrates, the founding father of medicine, considered key: "It is more important to know what sort of person has a disease than to know what sort of disease a person has." In other sectors, that's been called "knowing your customer."

Let's put that in a proper perspective. When I send a package from place A to B using FedEx or UPS services, I can trace that package any single moment via a digital platform, website, or mobile app. I consider that "normal." In contrast, chronic patients[12] (whether it be a heart or diabetic patient, a cancer or Alzheimer's patient) are on their own on average 8755 hours a year, NOT connected to the health care system. In other words, a FedEx or UPS package is better off than me as a patient. That is not right.

As we would plan for a future of mainstream outcome-based personalized medicine (as you will see, we will aim even higher), we need to consider that many, if not most, of the personalization needs to occur outside of the clinical environment. Indeed, health monitoring at a hospital or office cannot monitor a patient during their normal course of life or as often as desired. This can be a serious limitation because a snapshot, rather than a trend, captured at a hospital or doctor's office may not accurately reflect the patient's health or may not be performed at all due to the infrequency of a patient's visits.

Data suggests that 60% of health outcome influencers are linked to behavioral and environmental determinants, compared to 10% for medical care, and less than five percent of a patient's time is spent interacting with the formal health care system.[13] So, as we struggle to drive real value for patients with our data, we need to be creating solutions that will:

- form a connection between all of the clinical and commercial entities, to enable outcome-based reimbursement models and support for more personalized therapies and prevention tools;
- augment the teams in those same organizations with both historical and real-time data, deriving insights automatically (using AI);

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of which they know little,
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– Molière

- be responsive to each patient on their own terms, to include not only the clinical elements of health care, but the financial, and behavioral aspects within the same context;
- redefine the conventional idea of a health care customer journey, knowing that most of that journey is invisible to the system today.

Luckily, there is a solution lurking on the horizon: our ability to introduce a new breed of guardian angels. That concept has a famous example from history, from the coalmine era. Miners used to take a canary with them when they went down into the mines. Even the tiniest amount of methane was enough to silence the canary and signal to the miners that it was time to evacuate.

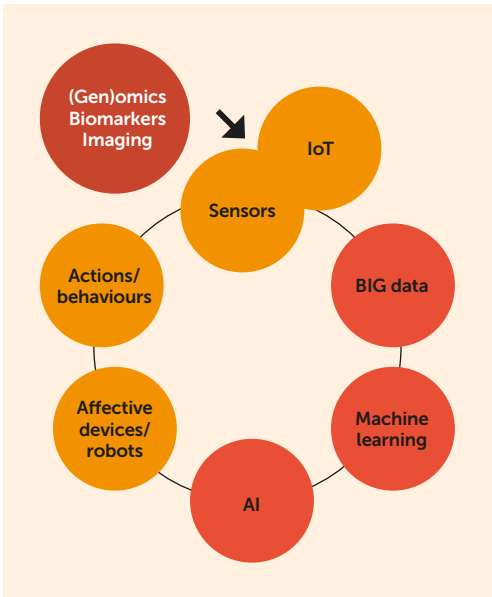
The current equivalent is the large number of sensors in our smartphone or in devices connecting to our smartphone. Now, you are aware of what they do (wristbands counting my steps), but in the not too distant future, they'll be at work in the background and invisible, e.g. in a sticking plaster on our skin, in our garments, or in a tiny gauge inside our body. Or hidden in our car, our house, ... These sensors (in wearables around the body, in dermals sticking to the body, in insideables inside the body, earables, ...) collect so-called **"real-world data." It is like user-generated content, collected in "natural habitats," not in the controlled environment of a hospital or during a clinical trial. It's the kind of data we need to anticipate, predict, and ultimately prevent disease.**

Network specialist Cisco Systems predicts that by 2020, 50 billion computers, appliances, and sensors (including thermostats, mirrors, bathroom scales, ...) will be wirelessly connected to each other in the Internet of Things or IoT,generating 600 zettabytes of information. That's 100x our current storage capacity of 6 zettabytes.

People are also talking about a variation of the IoT, namely the Internet of Everything (IoE) or the Internet of Bodies, where things are connected to people and every other possible process and form of information. The wearable gadgets and smartphone apps will serve as the perfect bridge to the Internet of Things. The fact that a fitness armband is connected to the internet will be the most normal thing in the world for your heart rate to be synchronized with the cloud, in the same way as your smartphone now synchronizes your email, calendar, and contacts, where an app will analyze your data in real time.

To paraphrase Lord Kelvin, **"The numbers tell the tale." They generate the knowledge we'll use as a starting point to create delight.** One of the best-known pioneers of the IoT is Nest (acquired by Google), the thermostat that adapts to whoever's at home, programs itself, and offers suggestions on how to save energy. Nest Labs' second product was a smoke detector called Protect. This is precisely the kind of product that illuminates the direction in which health care needs to evolve: towards prediction and prevention. Like the canary in the coalmine, a smoke detector is designed to sound the alarm when it detects smoke. But what happens when there's no one at home, or bacon starts to burn in a pan a couple of meters from the detector? How do you check the batteries? Nest Protect is also designed to detect carbon monoxide, communicate via your smartphone, and react to a hand gesture when it has reported something.

Together, technological innovations will occasion a new idea of **future medicine, where technology will allow us to anticipate events and be used to guide, and influence to the better, our actions and behaviors**. This way, they will keep us healthy as long as possible, in part by anonymously combining our personal measurement data with that of many other individual users and exploiting the knowledge we can distil from it. If, of course, we manage to get the weakest link in the chain on our side: ourselves. We will obviously come back to that in the following chapters.



All of the above is summarized in the graph on the previous page. Basically, that graph very much reminds me of Doctor Baymax in Disney's 3D computer-animated superhero movie *Big Hero 6*.[14] The film tells the story of the special bond that develops between plus-sized inflatable robot Doctor Baymax, offering preventive care, and prodigy Hiro Hamada, who team up with a group of friends to form a band of high-tech heroes. They almost become twins...

In summary, these technologies, and the data they collect and mine, offer the promise of helping to improve care in at least five ways:

1. From episodic to continuous, always ON.
2. From a focus on the average patient to a focus on each individual patient, **P**ersonalized or **P**recise.
3. From care based on precedent (previous patients) to care based on continuous, real-time feedback and learning, **P**redictive.
4. From patient-as-recipient of care to patient-as-participant (and owner or driver of care – we'll see how to co-create health), **P**articipatory.
5. From reactive to anticipatory to **P**reventive.

Using a strategy introducing delight (thinking), the following chapters present a hundred examples that serve to illustrate the evolution to a health care system with 4 **P**s[15]: **P**recise (or **P**ersonalized), **P**redictive, **P**articipatory, and most importantly, **P**reventive.

Along the way, we'll meet many ideas and projects at different stages of execution, such as Scranton.

Scranton, a city of 76,000 people in Pennsylvania, is the launch site for an innovative, exciting approach to an entire community's health. Geisinger Health System (a large health care provider) has engaged and convened a network of global, national, and local partners. The goal is to transform health care at its core by focusing on preventive care, behavioral health, and economic growth. Their vision: healthier families, stronger neighborhoods, resilient communities. Fresh Food Farmacy (FFF) was the first major project of Geisinger's new initiative.[16] FFF brings a "food-as-medicine" approach to communities, designed to combat high rates of obesity, pre-diabetes, and diabetes. The pilot stage of the FFF began in July 2016. Early data demonstrates improvements in blood sugar control and weight. In addition, most participants have begun exercising and report that they are more involved in managing their own health and the health of their families. Perhaps the most profound findings are that several participants have been able to reduce or even eliminate their diabetes medications.[17]

Data collected by the plenitude of sensors and information written in our biological code will generate knowledge to accumulate wisdom. **The wisdom to anticipate. That is what will create delight.**

Data → Information → Knowledge → Wisdom → Anticipation → Delight

The delight of not getting sick anymore. That sounds disruptive, but it shouldn't. This book will introduce delight thinking "to rescue" traditional health care players which currently make money from people being sick, from being disrupted.

You will learn how these guardian angels, collecting real-world data up to 24/7, allow us to enhance already current operations (richer clinical trials, tools for outcome-based medicine, ...). In doing so, these parties will start to realize how they too can use these data, combined with novel business models, to avoid sickness in the first place. To remove some serious friction, if you like. And be honest: which tagline would you like to run?

"We develop medication for unmet clinical needs"
OR
"We develop tools to keep you healthy"

Meanwhile, citizens (not patients yet) will get a plethora of options from the creation of health, sometimes even to monetize their health. **This book will provide a framework and a ton of examples to make these points.**

But let's focus on dealing with this upcoming change first.