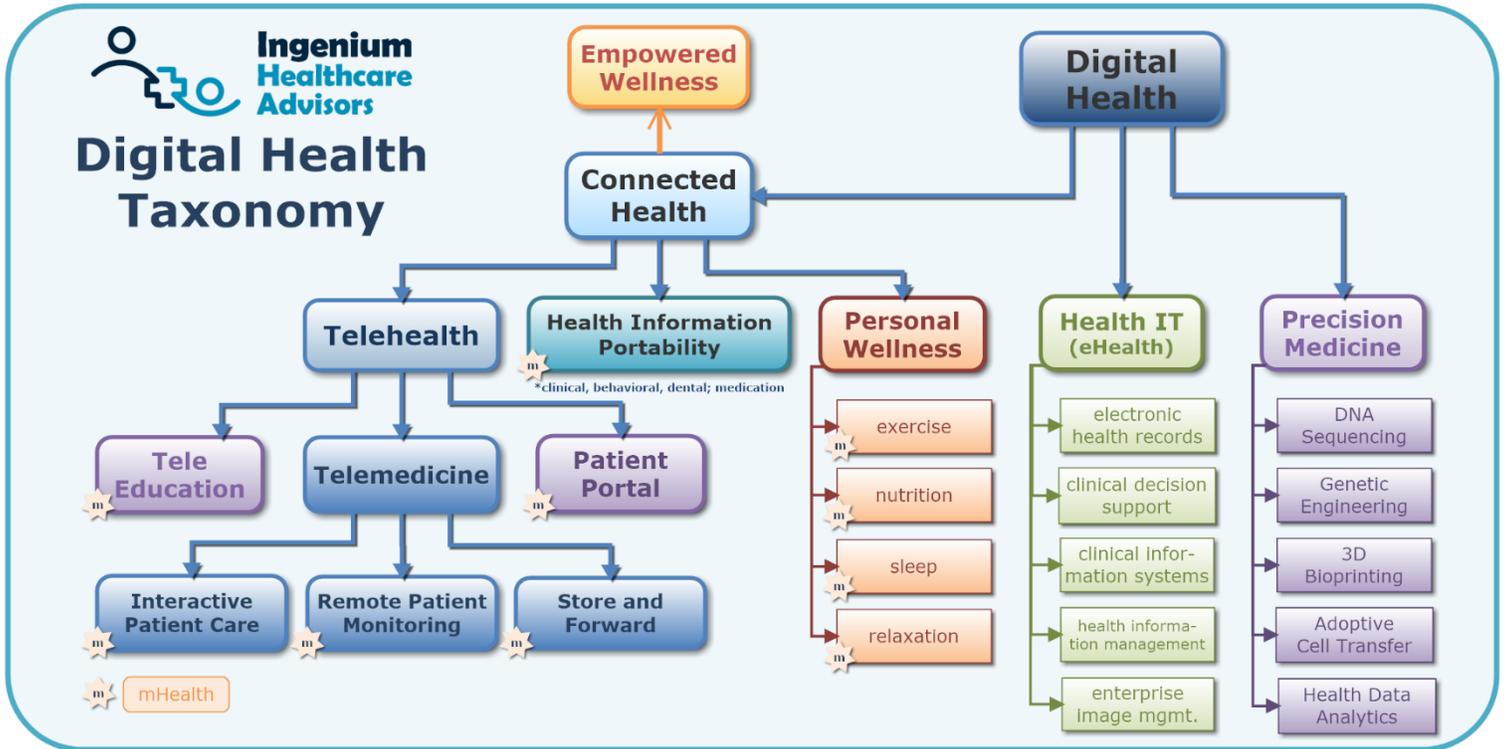


**Ingenium
Digital
Health**



Digital Health, defined

By Christian Milaster
Founder & CEO of Ingenium Digital Health

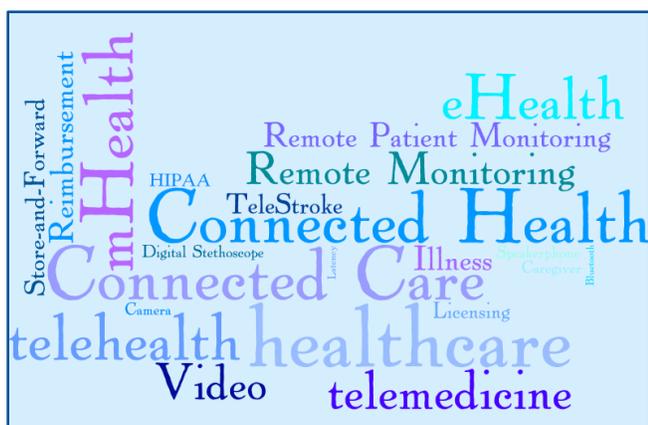
DIGITAL HEALTH, DEFINED

Everybody agreed until somebody defined it.

by Christian Milaster



Over 400 years ago, William Shakespeare asked the question whether a “rose by any other name would smell as sweet”, pointing our attention to the human need to name things – and to agree on their definition.



There is an ever-growing plethora of terms in the digital health world and in this section, I will share a pragmatic a set of definitions and put the various terms in relation to each other.

ON THE MERITS OF CLEAR, SHARED DEFINITIONS

During my time at a fine academic medical center two aphorisms emerged: “Everybody agreed until somebody wrote it down.” and “Everybody agreed until somebody defined it.”

So, why is the definition of terms so important?

Just as “you can’t manage what you don’t measure”, you cannot manage what you can’t describe. If we don’t have a word for a concept or if we are unsure about a word’s meaning or use, we are less prone to use the word or to apply the underlying concept.

How can we regulate or offer any Digital Health service, if the collaborators are not even on the same page regarding their understanding of the terms?

A Business Insider article ([“What is blue and how do we see color?”](#)) explains that the color blue did not enter modern languages until very late. In the beginning, people simply had no word for blue and poets as far back as Homer (who wrote about a “wine-dark sea”) had to use comparisons to capture the essence of “blue”. Thus, even though people were seeing the same thing, they could not agree on what to call it.

While we do have words for the various concepts in Digital Health, we don’t have broadly agreed-on definitions.

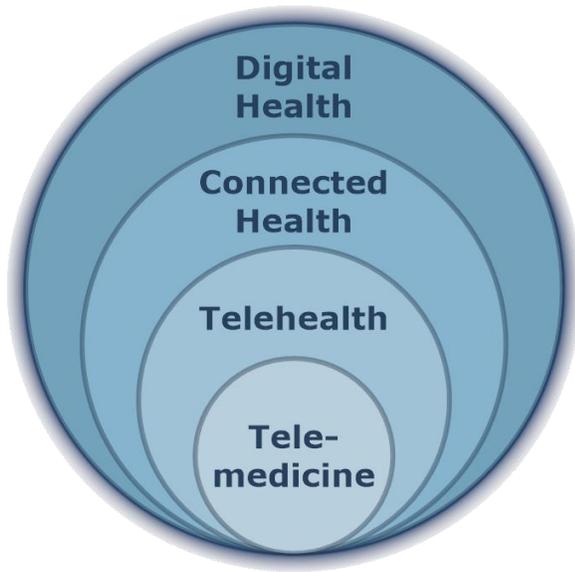
Now, I don’t claim that the definitions I am proposing here are the best ones. My goal is that everybody in healthcare can agree on a single set of clear definitions and move on.

In the meantime, I do urge any of you working on implementing any kind of connected health service to settle on clear definitions, starting with the ones provided here and to use them consistently.

Even though a “rose by any other name” might “smell as sweet”, not defining the key terms creates confusion, which is one of the key causes of resistance to change.

As side note: the main culprit here might actually not be the people practicing digital or connected health; more often than not the technology and solution vendors’ marketing departments are to blame for contributing to the confusion, owing largely to a short-sighted need to distinguish themselves from the competition.

A TELEHEALTH TAXONOMY



When I fully immersed myself in the field of telehealth in 2012, I wanted to make sure that I would be using the terms in this field correctly, naively believing that surely the industry had agreed on a set of definitions. I searched about two dozen articles on the definition of Telehealth and Telemedicine (including two or three articles comparing the scholarly definitions) and basically came up empty handed. There didn't seem to be any consensus! By analyzing and merging the definitions that appealed to my engineering mind, I settled on my own set of definitions and created a visual to better communicate my view of the telehealth world.

As a subset of Telehealth, I define Telemedicine as

Telemedicine: Practicing medicine at a distance.

This includes the examination, observation, consultation and treatment of patients by providers.

Telemedicine includes:

- **Interactive Patient Care** (i.e., consults, visits, and exams over a secure, live audio/video connection, sometimes augmented by sharing visual information)
- **Remote Physiological Monitoring** (e.g., periodic blood and weight or continuous monitoring and transmission of activity level and heart rhythm)
- **Store-and-Forward** (e.g., faxing EKGs, emailing pictures of melanomas, and TeleRadiology)

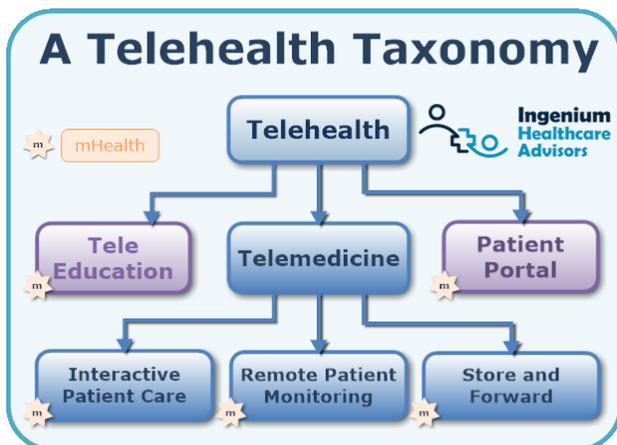
Simply put, Telehealth is an alternative way to deliver healthcare or to practice medicine. The only difference from traditional care is that the patient and the physician (or other providers, therapists, or educators) are not at the same physical location. Telehealth provides physicians an easy way to reach more patients outside of their clinic's current geographic area, thus making core competitive advantages (such as expertise in a specialty area such as oncology or genetic counseling) available to a larger population.

THE BENEFITS OF TELEHEALTH

Telehealth serves as an excellent strategic tool to meet the often-cited triple aim of improving the quality and experience of care (a home run for telehealth), improving the health of populations (which telehealth facilitates), and reducing the per capita cost of health care (think: preventing avoidable admissions, accelerating recovery, etc.).

Telehealth also facilitates patients' adherence to care plans, since care teams can reach out to and interact with patients more frequently, creating closer relationships, leading to improved outcomes and reduced long-term healthcare cost.

Telehealth further empowers caregivers, such as the patient's family, to participate more in the care, even though they might not be in close proximity to their loved one. Such participation further improves



My definition for Telehealth is

Telehealth: Delivering healthcare at a distance.

It includes health education (TeleEducation), self-service portals (Patient Portals) and Telemedicine.

care plan adherence. Family members can, for example, join an interactive telemedicine visit or see their loved one's regular vital signs or activity level, which also provides them with valuable peace of mind. Telehealth is also very effective for the efficient management of chronic diseases, since the tracking of the vital signs can facilitate early detection of the onset of disease, thereby preventing traumatic, dangerous, and expensive hospitalizations or readmissions.

Last but not least, Telehealth, in particular interactive Telemedicine, is especially appreciated by less mobile patients. If they can arrange transportation at all, it is often a financial burden owing to rising gas prices and fixed incomes. The ability to receive specialty care in the familiar comfort of their homes (or at least their hometown clinics) definitely improves health outcomes.

It is these advantages of Telehealth (delivering healthcare at a distance) and Telemedicine (practicing medicine at a distance) that really can help a healthcare organization to deliver the best care patients need, when they need it, where they want it.

CONNECTED HEALTH

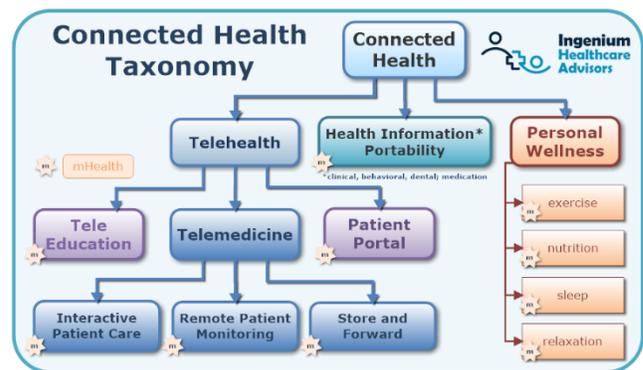
These days it seems that every month a new galaxy is discovered in the Digital Health universe. Social and internet media are abuzz with new terms, mostly without a clear definition and often used in conflicting ways: connected health, precision medicine, remote patient monitoring, quantified self, video visits, eHealth, mHealth, etc.

Telemedicine, i.e., practicing medicine at a distance, is the first link between traditional healthcare and digital healthcare, and has been around since the widespread adoption of the telephone. By now we all intuit that, in the near future, virtual visits and remote interactions with providers — without the need for a clinic visit — will become the norm for non-urgent care and even for urgent care triage. Over the past decades, with the advance of technology in all aspects of our lives, new terms, new concepts have been emerging at a rapid pace.

For the purpose of illustration, the higher up we go in the taxonomy hierarchy, the more we are leaving the traditional healthcare model. We are

expanding our healthcare universe. Not only is this expansion a reflection of our improved technical capabilities, but it also reflects our shift to a consumer-driven, consumer-empowered service economy that now affects all industries. We — as a society, as healthcare consumers — are increasingly involved in our own care.

So, let's expand the Digital Health Universe beyond the Telehealth galaxy to include **Connected Health**. As the following graphic illustrates, Connected Health includes Telehealth, Personal Wellness and, most important, Health Information Portability.



Connected Health is a vision, a new model for managing people's health. It transcends episodic care and takes a more comprehensive, long-term view. In a Connected Health world, providers, caregivers and patients have access to the right information at the right time in the right form to make better decisions. Connected Health not only connects providers to patients (as in Telehealth), but also consolidates health-relevant information from multiple sources inside and outside the system, to inform decision making. Ultimately, better outcomes are about better decision making — including the decisions patients make.

Connected Health is the vision of *knowledge empowered care*. A fully-connected healthcare system where patients and providers can easily connect with one another regardless of their locations — doctors connecting with patients, generalists connecting with specialists, and caregivers connecting with loved ones. A system where all pertinent information (patient condition, health history, treatment options) is readily available to facilitate quality decisions. The step from Telehealth to Connected Health is a big one and an evolution long in the making. No longer will

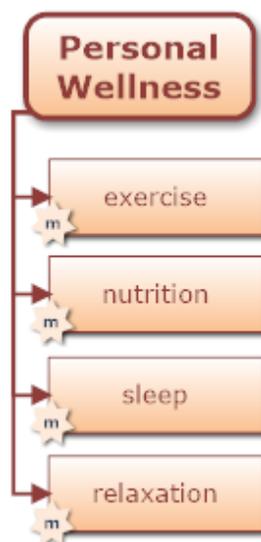
technology be driving care (as did telecommunications technology), but rather the prefix “connected” shifts the focus to relationships: closeness between people, interactions among systems, connections between bits of information. And that’s exactly the mindset I want my health system to be in, when I need it!

To make Connected Care happen, what we need most is the concept of Health Information Portability. Today, the free flow of healthcare information is very much in its infancy. While the creation of Health Information Exchanges (HIEs) over the past years has moved us in the right direction, we still have a long way to go to achieve true portability of health information. Encouragingly, Apple’s continuous to expand its iOS HealthKit, e.g., to support the receipt and transmission of clinical data in the industry standard HL7. This “infrastructure” capability — coupled with the widespread use of the iPhone — could significantly move Connected Health forward. That’s because without portability, we cannot have truly connected care, since our care (and even more so the maintenance of our health) is at present infuriatingly fragmented across a multitude of service providers and our own personal activities.

Which brings me to the newest shiny “star” in the Connected Care galaxy:

PERSONAL WELLNESS

While a small group of “worried well” have always cared about (and tracked) their personal fitness (and, by extension, their wellness), the tsunami of personal health apps with the mass spread of smartphones has created an unprecedented wealth of historical and anecdotal information — but this time in digital form. If this information could be seamlessly integrated into the care providers’ decision making (only after verifying and bolstering the high quality of the



data, of course) we would be one big step closer to realizing one part of the vision of truly connected care.

Connected Health differs from traditional care in that it aims to leverage the knowledge generated across the whole spectrum of healthcare — whether that’s the patient-collected data from health apps, or digitally-available medical records from other providers and clinical data from tests in the recent or distant past.

The explosive growth of interest in Personal Wellness over the last decade is a fascinating phenomenon, but it is also fraught with hype: by now it is public knowledge that most users of health tracking gadgets, yours truly included, abandon its use within 3 months. This explosion, however, is a reflection of our evolving attitude toward our health, the changes in our lifestyles, and our maturing roles in fostering our own well-being. On the extreme end is the Quantified Self Movement and on the other end the casual user who might mostly be motivated by the social (media) peer pressure.

One motivation that all have in common, though, is our frustration with the traditional healthcare system. The use of health apps to advance our personal wellness, in contrast, gives us at least some sense of control.

Talking about apps — Let me offer a brief discourse on one of the media’s favorite digital health terms: mHealth.

mHealth, or mobile health, is mostly referred to the collection of health or wellness-related apps that run on mobile platforms. As you can see by the little “m-stars” placed all over the Digital Health Taxonomy, mobile apps find their use in virtually any of the elements of the Connected Health and Telehealth Galaxies. Whether you are using an app to video chat (or text chat) with a provider, collect and record vital signs, watch a physical therapy video, read about your upcoming surgery in your hospital app, or track your latest exercise — “we’ve got an app for that”.

What I have found, though, is that in the media mHealth is mostly used synonymously for what I’ve

defined as Personal Wellness above, probably because those apps, of course, have the greatest mass appeal. But the use of mobile technology to enable better care is not limited to any element of the Digital Health Universe. I suspect (or: I'm hopeful) that within the next couple of years the media will drop the term mHealth since it will become the de facto mechanism by which we are using computing power and technology in healthcare. It'll merely become the way to receive or manage our care.

For me, Connected Health is the most exciting field to be in. Why? Mainly because it encompasses a vision of a different health system where the patient truly stands in the center. This is what gets me super excited about what the future holds.

But most importantly, Connected Health's ultimate beneficial outcome is "Empowered Wellness".

As I mentioned earlier, Connected Health is the vision of knowledge-driven care. In our traditional healthcare model that means that care providers will have the knowledge at the ready to provide the right care at the right time in the right location.

But what if we free ourselves from the constraints of our current thinking? Could we, maybe, provide knowledge-driven care to ourselves? What if we had the knowledge to avoid care (excluding scenarios such as becoming willingly pregnant and getting unwillingly hit by a car)?

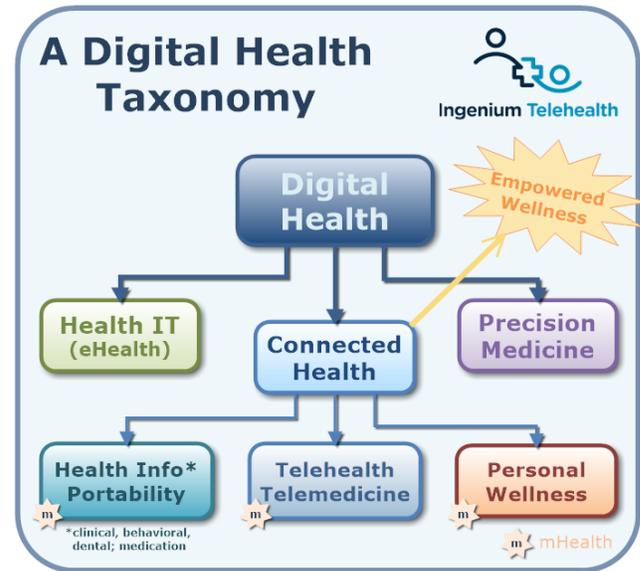
What if Connected Care becomes the catalyst to fully realize the potential of Empowered Wellness, where we, the people, are empowered to take charge of our wellness?

Now, that's a future that I'd like to see us create.

DIGITAL HEALTH

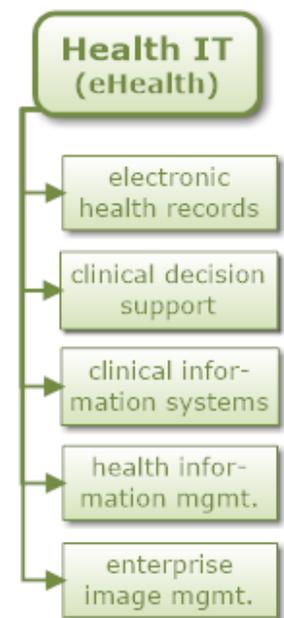
The topmost layer of the Digital Health Taxonomy combines three very different areas in medicine: Connected Health, Precision Medicine, and Health IT. Whereas Connected Health concerns the delivery of care, Precision Medicine enables care that is precise and personalized to the unique needs of a single patient or a group of patients with similar needs. And Health IT provides the underlying,

omnipresent set of technologies that actually make healthcare work.



HEALTH IT AND EHEALTH

Health IT thus combines all the various technologies that healthcare needs these days to deliver care. While one could argue that Health IT encompasses any healthcare technology (including those used in the other areas of the taxonomy), I prefer to use the term in the context of supporting the ongoing operations to deliver care, including electronic health records, clinical decision support, clinical information systems, health information management, enterprise image management, etc.



Another often used term is **eHealth**, which I consider synonymous with Health IT. With the 'e' standing for 'electronic', eHealth simply means electronic technology used in healthcare. Many of the technologies included in Health IT were introduced in the 1990s and early 2000s as "eHealth" projects. Yet since quite a few of those eHealth projects failed to deliver on their promises in the short term (mostly owing to poorly

understood user requirements), the term eHealth for many people, including myself, still has a negative ring to it. Though one could argue that eHealth is the same as Digital Health, I prefer to stay away from using that term altogether and have settled on using Health IT and Digital Health instead.

PRECISION MEDICINE

The final term in the Digital Health Taxonomy is the new, exciting field of Precision Medicine, which is healthcare tailored to the patient's unique specific biology.

Too much of healthcare is applied with a broad stroke: mammograms for every woman above 40, prostate exams for every man above 50, statins for everyone with high cholesterol, and beta-blockers for all people with cardiac arrhythmias. Consider this example: if a drug reduces the mortality rate from 8% to 4%, that's a 50% reduction of mortality. But it also means that the drug didn't do anything for the other 96%. That's not very precise, but wasteful and, as we all know, very costly.

Precision Medicine is largely enabled by the advances in DNA sequencing, yet still kept from its full potential by the limitations of such sequencing.

Over the past decades, the human genome project and the increasing affordability of DNA sequencing (from \$100M in 2001 to about \$1,000 in 2016 for a human genome) have significantly contributed to the progress in the field of precision medicine.

Precision Medicine encompasses many different technologies. For illustrative purposes I've included only a handful in the taxonomy:

- **DNA Sequencing** enables the analysis of the human genome to identify specific markers that can indicate a proclivity for a particular disease or incompatibility with certain drugs.
- **Genetic Engineering** is used to produce improved or novel organisms, e.g., in gene therapy where defective genes are replaced with effective ones.
- **3D Bioprinting** allows the fabrication of custom tissues or organs by stacking layers and layers of living cells. While still in its infancy, and currently mostly used for drug research, bioprinting holds great promise for the custom

creation of tissue or organs (including bones) uniquely fitted for a patient.

- **Adoptive Cell Transfer (ACT)** is the transfer of cells originating either from the patient or from another person and thus highly customized to the patient's unique condition. A rapidly growing field within ACT is the transfer of a patient's genetically modified cells (T cells) to strengthen a patient's immune system to help combat cancer — a highly personalized and precise treatment, albeit still in the experimental stages.

Last but not least, **Health Data Analytics** is quite a different technology that also finds its application in other areas, such as population health management, and as such it could be considered a technology listed under Health IT. For Precision Medicine, however, Health Data Analytics makes deidentified data from healthcare operations available for research, cross-referenced with patients' genetic profiles to find or validate novel treatments. One recently announced collaboration between a university and a biopharmaceutical company will look at the correlation between "abnormal anatomical variations of brain structure to the underlying genetic markers of the diseases".

The term's predecessor — and a subset of Precision Medicine — is **Personalized Medicine**. As the name implies, Personalized Medicine focuses on the delivery of care tailored to the unique needs and circumstances of a particular, singular patient. Precision Medicine shares this individualized care ambition but aims to find solutions for a broader subset of the population that shares diseases and common traits. This branch of medicine is concerned with finding treatments that more precisely target the causes of certain disease, for example by applying knowledge about the effect of certain genes or a better understanding of the inner workings of cancer cells.

With precision medicine a treatment can still apply to tens of thousands of patients, but care can be delivered more selectively, leading to better outcomes, fewer side effects, and ultimately reduced cost.

A DIGITAL HEALTH TAXONOMY

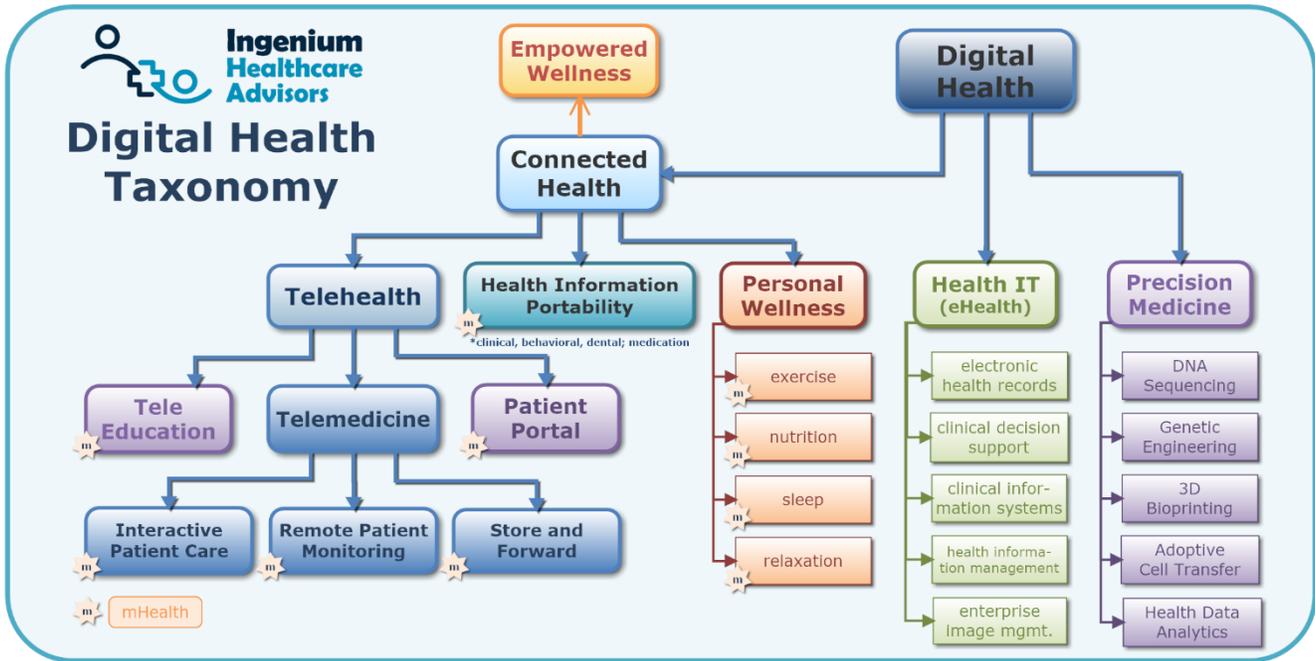
Digital Health matters to all of us because whether we like it or not, we all will come into contact with the healthcare system in one way or the other.

And digital health solutions can help us as patients and our providers a great deal to help us heal.

The field of Digital Health has shaped healthcare for the past 30 years and will continue to do so at

an ever-increasing pace. Just 10 years ago digital health domains such as “Personal Wellness” or “Precision Medicine” didn’t even exist, except in the minds of a few researchers and visionary entrepreneurs.

And I’m sure that when I’ll update this taxonomy in 2025, I’ll have to make room for another layer or two.



ABOUT CHRISTIAN MILASTER

Christian Milaster is a Digital Health implementation trail blazer who works with leaders in healthcare to optimize the delivery of care through Digital Health and Telehealth.

Christian is the founder and president of Ingenium Digital Health Consulting and the Executive Director of Healthcare Shapers USA. Born, raised and trained in Germany as an Engineer, Christian has worked at IBM Global Services and studied healthcare delivery for 12 years at the Mayo Clinic in Rochester, Minnesota. Since 2012 he has been a strategy, design, and implementation advisor at the intersection of Care Delivery and Technology to numerous health systems, behavioral health agencies, community health organizations, urgent care organizations, etc.

Christian’s communication and delivery skills empower healthcare leaders to effectively execute digital health and telehealth strategies that leverage their organization's strengths, accomplish its mission, and improve patient outcomes.



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