



# THE FUTURE OF HEALTHCARE

UNLIMITED THINKING . EXPONENTIAL POTENTIAL

BY MATTHEW GRIFFIN  
311 INSTITUTE

# HEALTHCARE: BECAUSE THE **FUTURE** MATTERS

By MATTHEW GRIFFIN, Founder 311 Institute for Legal & General Investment Management

**A**T SOME POINT in our lives we all struggle not just with our mental health but also our physical health. After all, biologically speaking we humans were only designed to live to around the age of thirty, and societally speaking our minds were never designed to withstand the mental onslaught that we experience today – whether that’s from today’s lifestyles or the often overwhelming impact of being plugged into and aware of almost every event on the planet, no matter how big or small, so in this thought piece we’re going to be taking a closer look at the future of health and wellbeing and some of the revolutionary technologies that will help us keep our mental and physical health in tip top condition.

With more than 8 billion people living on our pale blue dot, which is growing at an average rate of just over 1 percent per year, and with an expected population of over 10 billion by the year 2050, it’s clear that in the future there’s going to be an even greater demand for health and wellness services of all kinds – that is if we’re all going to live long and happy lives.

Today various independent organisations estimate that about 13 percent of the world’s population, or almost 1 billion of those 8 billion, suffer from some kind of mental disorder, and that on a yearly basis a further 800 million people are affected by cardiovascular diseases, cancers, neurological, neonatal, and respiratory disorders – all of which is before we dig into the number of people who are affected by serious injury which, as far as records are concerned at least, is at least another 250

million people, with other diseases adding a further 400 million people into the mix.

The back of a post it note calculation therefore means that at any particular point in time almost 2.5 billion people on our planet “aren’t feeling well” – and that’s all before we think about the future impact that climate change, environmental destruction, pollution, poor diets, stress, and other factors, will have on our long term health and well-being.

When you dig into the data further another surprising fact is that in spite of an increasingly aging global population, only 35 percent of people over the age of 50 suffer from some form of affliction versus 65 percent below the age of 50, and that out of all the age groups only the under 5 age groups have a seen steady and continuous reduction of their overall “disease burden” since 1990.

## **NEW DISEASES FOR THE NEW AGE**

Since 1990 though, when countries started keeping more comprehensive health records, the kinds of afflictions we suffer from has changed significantly and noticeably.

There’s been an enormous decrease in the number of people suffering from Diarrhoea and common infectious diseases, as well as from neonatal disorders and nutritional deficiencies, but while on the one hand the world can rejoice, on the other there’s been a corresponding marked increase in the number of people afflicted by new more so called “Modern Age” diseases and diseases of affluence including, unsurprisingly cancer,

cardiovascular, and respiratory diseases – as well as, unfortunately and perhaps unsurprisingly given the pressures of modern day life, mental disorders.

### **OLD AGE BECOMES THE NORM**

As for the big one though, life expectancy, well, except for what hopefully turns out to be nothing more than a blip in recent US life expectancy data, where life expectancy there fell for the first time since 1918, overall global life expectancy has surged from an estimated 32 years in the year 1900, when most records began, to an average of 72 years today with countries like Japan, South Korea, and the UK topping the global charts with average life expectancies in those countries of between 81 and 83 years.

Now though as we look to the future, and certainly in the West, more and more biotech and healthcare organisations are talking in terms of “Defeating death” rather than just “Conquering disease” with many of them believing they can reach what they term “Escape velocity,” the point where advances in healthcare will add more than a year’s worth of life to people for every year that passes, by the year 2028. And if recent sci-fi like breakthroughs are anything to go by then they could be onto something.

So, now, with our bases covered, let’s have a deeper look at what the future of healthcare, which is by far and away one of the most active sectors I track, has in store for us all.

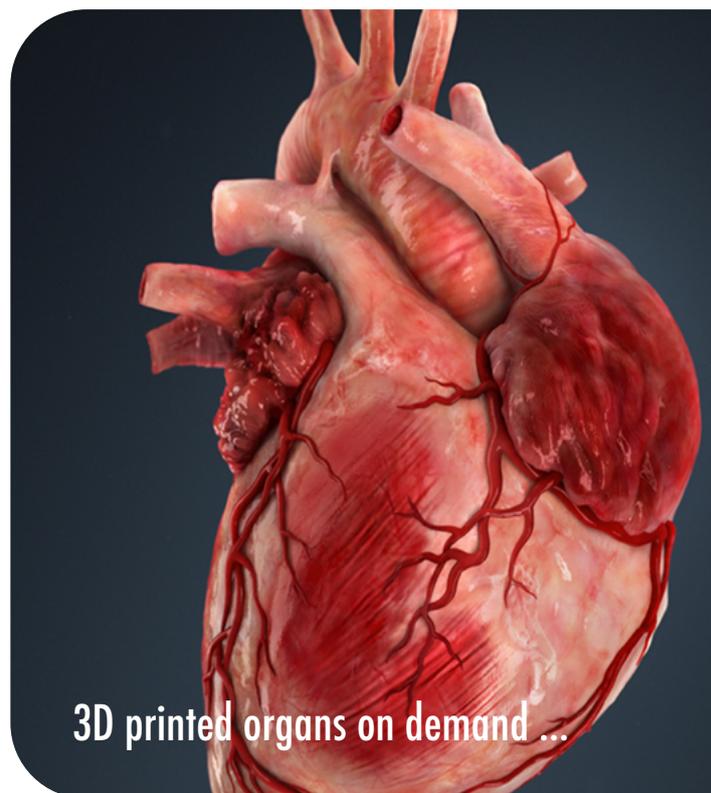
### **TACKLING THE MENTAL HEALTH CRISIS HEAD ON**

Today, it’s no surprise that the pressures of everyday life and an always-on society, where people are continuously bombarded by all manner of events which are often then distorted and intensified by internet disinformation, echo chambers, fractured and fractious leadership, and trolls, among many other things, including the recent pandemic, are taking their toll on people’s mental health.

***“In 2028 we reach ‘Escape Velocity’ where new medical breakthroughs will be able to extend people’s life expectancies at an accelerating rate.”***

Furthermore, take into consideration a world where the rate of change is accelerating and where everything, every cultural corner, every industry, and every part of society, is being disrupted and transformed at an unimaginable rate in previously unimaginable ways, with the omni-present spectre of global displacement and job automation casting long shadows, and you could easily argue that the mental pressure people experience is only going to increase from here on in and that a toxic cocktail is brewing. A cocktail that if left unchecked could soon turn into the mental equivalent of a Molotov Cocktail – with consequences, for the individual and society at large, to match.

When it comes to tackling what many experts and people around the world are increasingly calling a mental health crisis and turning the



3D printed organs on demand ...

time there are a number of tall obstacles that we need to overcome.

Firstly, there's the issue of identifying sufferers, secondly there's the issue of correctly diagnosing their symptoms and their root causes, and then finally there's the no small matter of providing the right point in time support and appropriate follow up treatments.

When it comes to the issue of identifying individuals who are struggling, for whatever reason, historically the responsibility has always fallen on their shoulders, or onto the shoulders of the people around them such as colleagues, family, and friends, who, societally at least, have hitherto been expected to be able to identify the symptoms and surface the issues so they can start getting the help and support they need. And while all this sounds perfectly reasonable lest we forget very few, if any, of the people involved in this first and arguably most crucial step aren't trained professionals which in many cases then means that sufferers' problems either go unnoticed or undiagnosed then, in a double whammy, they never receive the support they need, which can sometimes, unfortunately, have tragic consequences.

Once an issue has been identified being able to accurately diagnose it and its cause in order to prescribe the right treatment is also difficult – even for professionals. Then there's the issue of what happens and how the people who are struggling fare when they're out of arm's length of the people who are there to support them.

Inevitably, when you look at the issues holistically the gaps in education, knowledge, resources, support, trained professionals, as well as other areas, are clear to see which inevitably means that far too many people fall between the cracks – some never to emerge again. Consequently, it is vital we use all the resources and tools at our disposal to close as many of those gaps as possible. And fortunately, as is often the case, technology provides us with a number of new tools and solutions which we can leverage.

Looking at how we can use technology today, let alone as its capabilities improve in the

future, to identify or diagnose mental health issues and provide support there are a host of ground breaking innovations emerging that we can leverage, the vast majority of which are digital, powered by AI, and which can be easily accessed by the billions of connected people via their computers, tablets, smart assistants, smart devices, and even connected home devices.

Take, for example, the humble smartphone – a rich source of information if ever there was one. Today, we can get an accurate measure of your mental health by analysing the way you use it, the angles you hold it at, how often and how fast you pick it up, what you type and how fast you type it, the speed you scroll at, and all that's before we discuss how we can use it to monitor your posture, analyse your voice patterns, and track your minute by minute movements, or use the camera to gather a whole host of interesting biometric data.

# SCAN ME



**Science fiction like Tricorders are arriving - it's your smartphone.**

Many of these new AI powered tools are getting so good that they can detect everything from the onset of dementia and Post Traumatic Stress Disorder (PTSD), all the way through to depression and even a person's risk of suicide, and do it better, in some cases than even the best human experts.

Next, from a support perspective, some of these same AI powered platforms are using many of these same "privacy busting techniques" to provide point in time Robo-counselling services, like Woebot, that cost little to nothing and that are always with you – no matter where you are. And, if a Robo-counsellor isn't your cup of tea then you can always get in touch with



**In vivo gene editing has arrived ...**

a real human using a more conventional video chat or a tele-psychology system.

When it comes to some of the more serious conditions such as addiction, dementia, and other neurological conditions, things get sci-fi like very quickly with the arrival of new memory editing technologies that can erase people's addictions, fears, and memories, as well as other technologies that can increasingly boost, rejuvenate, store, transfer, and re-write their very memories – much in the same way we edit word documents.

So, as you can see, when we look at how, in the future, we can leverage new technologies in new ways to deliver new outcomes, it's no stretch to say that we're on the cusp of a revolution that will benefit all of us.

## **REPAIRING THE HUMAN BODY**

When you look back in time to humanity's early ancestry it's clear that we were built for one thing and one thing alone – survival, whether it's our own survival or the survival of the species. From gathering and hunting for food in the forests and savannahs, to looking after and caring for one another, everything came down to this. And biologically our bodies

were built to last on average thirty years, not eighty or a hundred as we all expect today, which is just one of the reasons, for example, why cancer, a new age disease, is now so prevalent in today's society.

As humanity moves further and further away from its natural roots, whether it's by artificially extending our life spans using medical technology, or from our connection with the land and the goodness of nature's own larder, and increasingly uses technology to design and shape our own future evolution the effect on our bodies is clear to see – for both better and worse.

On the one hand we can now all live longer more productive lives than we ever could before and spend significantly more time with our loved ones as we walk our mortal coil, while on the other our bodies are now having to try to deal with and reconcile the new paradigm we've created for ourselves.

***“As we unlock the mysteries of the human body in the future we will be able to repair it in much the same way as we repair car today.”***

Furthermore, as today's biotech and healthcare companies, as mentioned above, and new healthcare breakthroughs help us approach aging's “Escape velocity” and for the first time talk openly about “Conquering death,” as a society we are now beginning to reach the point where the age of 100 will be the new 60, and where living beyond the age of 120, let alone longer, could become not just feasible but commonplace. And while that will bring great opportunity, it will also unsurprisingly bring new challenges from a whole raft of quarters – both mental and physical, as well as cultural and societal.

In order to extend our lives to this degree though we need new healthcare technologies and tools – whether it's to identify and diagnose disease, monitor and track it, or to develop new treatments and cures. And, as researchers and scientists everywhere work diligently it's increasingly clear that many of the tools in our arsenal make even the most outrageous science fiction technologies look tame by comparison.

Firstly, when it comes to the initial identification and diagnosis of a person's ailment or suffering the continued digitisation and democratisation of increasingly powerful technologies including Artificial Intelligence and Machine Vision, combined with other technologies such as sensors and bio-sensors, that in some cases can now even detect disease in the air around us, now mean that it's possible to smartphones and assistants, like Alexa and Google Home, into increasingly sophisticated tricorder-like devices. Devices that in mere seconds, and in the comfort of your own home, can diagnose everything from the onset of cancers, dementia, diabetes, general disease, including COVID-19, heart disease, pre-existing genetic conditions, and even the impact of ambient noise on your hearing – all for starters. And when combined with digital telehealth and telemedicine services our devices can automatically close the loop and send all of our healthcare data back to a certified medical professional, a human, an AI, or a hybrid combination of the two, who can use it to create a tailored treatment plan.

Bring health focused wearables as well as Smart Tattoos, let alone brainwave reading smart tattoos, into the mix and the concept of the so called "Quantified Self," and bringing in activity, blood pressure, brainwave, environmental, heart rate, metabolic, metabolite, postural, respiration, and sleep tracking data, becomes a breeze that, when combined with other data sets, provides us with even richer health insights.

In time the variety and volume of data all these different devices can gather and analyse will only increase, exponentially, and it won't be long until they're able to analyse your

body's health at such a granular level that they'll be able to detect, analyse, and monitor abnormalities at the genetic level, as well as tell you how long you have left to live. And needless to say the earlier all these devices can detect health issues the sooner people can get the help they need – which will inevitably also help save countless lives.

Next, as we dive deeper into our future wormhole and beyond the activity of identifying and diagnosing of early stage conditions, and start looking in more depth at more serious conditions and how they'll be treated the story becomes even more astounding with game changing breakthroughs and innovations not just in one area but many – in fact there are so many that it's a challenge trying to figure out where to begin.

So, I'll start here. When your car breaks down you take it into the garage who diagnose the problem and replace the faulty part, but it's well known that the human body is one of the most complex machines in the known universe – with the human brain being an order of magnitude harder to understand and fix. While, from an evolutionary standpoint at least, this complexity's done us proud when it comes to healthcare it means that when something goes wrong with us physically not only is diagnosing the problem more complex, but repairing it is a whole new level of complexity.

Today, however, we can replace roughly 70 percent of the human body with alternative parts, whether they take the form of artificial joints or prosthetic limbs, or whether they're more complex in the form of heart and liver transplants. And, aside from the most basic prosthetics, which first appeared in earnest in the 15th Century, none of these alternatives were available until the 1940's onwards – a mere blink of an eye in the timeline of human evolution.

As our timeline jogs along, however, and as the rate of technological advancement continues to accelerate exponentially previously dumb, and often clunky and uncomfortable prosthetics, will increasingly be 3D printed cheaply using custom lightweight materials that

give users a comfortable millimetre accurate fit. They'll increasingly incorporate advanced robotics and robotic control systems including plug and play Artificial Intelligence which will learn the user's behaviours and provide automatic autonomous support, and they'll be coated in either real 3D printed human skin or synthetic skins that give users back their sense of touch, and as we continue to unravel the mysteries of the brain and learn how to build more effective Brain Machine Interfaces (BMI) they'll increasingly be mind controlled. All of which will help users, from the man and woman in the street to quadriplegics, regain some semblance of normality and help give them their lives back.

However, as advanced as future neuro-prosthetics will be the fact remains that they'll still just be sci-fi like add-ons, even if they do in some cases provide users with super-human capabilities, and from a human perspective it's always going to be tough for people to get used to wearing them.

Here too though we can already see breakthroughs in the field of Regenerative Medicine that would let people re-grow lost limbs and body parts in much the same way that many animals do. Recent advances include the discovery that the human genome has the inherent ability to regenerate body parts but that it "just needs turning back on," as well as the development of a so called Silk Bioreactor, a piece of cloth with little more than a very special hormonal cocktail, that so far has been used to successfully regrow frogs' limbs, and which researchers hope could one day allow humans to do the same.

When it comes to the matter of extending the human lifespan there have been plenty of other breakthroughs too. Breakthroughs that include the ability to 3D print, 4D print, and even just grow all manner of human organs and tissues on demand before they're transplanted into patients that need them, including bones, brains, cartilage, corneas, hearts, kidneys, skin, and more. But why print any of these outside of the human body when, increasingly, we now have the technology to print them in vivo using Bio-printing robots.

Then there's the development of new senescent

drugs that, in trials, have extended the lives of rats by over a third, and which are now moving to human trials, as well as a whole host of gene therapy treatments that, for the first time ever, have given doctors the ability to easily edit people's genomes in vivo, or even via simple nebuliser sprays, to cure all manner of previously incurable genetic diseases like inherited blindness, Cystic Fibrosis, Hunters Syndrome, as well as HIV.

But things get even stranger as we look further into the future with the development of new AI designed contagious vaccines, and drugs, autonomous robot surgeons capable of performing intricate human surgeries, including brain surgeries, and nanobots that can patrol the body for disease, drill into and kill cancers on sight, and swarm together to repair internal injuries.

## LIKE NEW



### **Slowly we are unlocking the secrets of regenerative medicine and learning how to re-grow human organs after injury.**

Then, of course, there's our ability to use genetic engineering to create designer humans that are immune to disease, the creation of the world's first artificial humans, born and grown ex vivo without natural parents using the first completely synthetic genomes designed by AI's, all of which is before we even begin to discuss our ability to turn people into disease fighting bio-computers running multiple genetic codes with six or eight base pair DNA, or our ability not just to 3D or 4D print "traditional" human organs on demand, but also specially genetically engineer and augment them with all manner of new fangled technologies to monitor them and keep them running, from new computing paradigms and electronics to new sensing systems and beyond. At which

point science fiction looks positively tame by comparison, and at which point we have likely completely transformed what it means “to be human” and the human condition.

Oh, and just in case you do die you might also be happy to know researchers, tentatively, have several ways to bring you back from the dead – even if you died hundreds of years ago. And no, I’m not talking about putting your dead body into cryo – although that’s also, obviously, an option.

## **THE IMPLICATION OF 125 BEING THE NEW 60**

Obviously, nothing today exists in a bubble and everything has an impact with ripples spreading far and wide. And, arguably, few other advancements will have as great an impact on our global culture, industries, and society as adding decades to people’s life spans.

Firstly, there’s the emotional and mental impact of realising that we’ll be able to spend more time with our friends and family, including being involved in the lives of many more generations, as well as the realisation that we have the opportunity to contribute even more to this world which, as the rate of technology development continues to accelerate, and as each of us increasingly becomes capable of changing the lives of billions, could itself have radical consequences for everyone and everything living on our planet. Imagine, for example, what the world would, or could, look like if Elon Musk or Jeff Bezos lived to beyond the age of 125...

And then there’s the impact that extending people’s lives will have on society and resource consumption as well as on food provision, government policy, healthcare, housing, investment planning and wealth management, and many other things besides.

All of which leaves us with only one question: What would you do differently with your life today if you knew you were going to live to 125 or beyond? You better get planning ...

