

## Algorithm-driven e-health & nutrition

Henk Hoogenkamp, Author & Protein Specialist, explores the profound impact of technology, particularly artificial intelligence, on healthcare and nutrition. The relevance to the food industry lies in the transformative potential of personalised nutrition, leveraging AI and wearable technologies. The integration of e-health and nutrition not only addresses medical challenges but also presents opportunities for the food sector. Personalised nutrition, influenced by real-time health data, signals a shift towards holistic lifestyle choices and wellbeing, revolutionising the traditional paradigms of food, supplements, and healthcare networks.

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Each life stage has its own variety of dietary and medical challenges. Typically, people start to pay attention about their health and diet from the age of 40 onwards. It is a safe bet that these continuous-monitoring tools will reduce illness and disease, thus may prolong the quality of lives. For example, sensors embedded in a pulse watch can collect data on heart rate, skin temperature, fitness, or sleep patterns, providing valuable information to understand the health condition at a deeper level.

### Personalised target healthcare

Precision technologies — a combination of personal data, artificial intelligence (AI) and the internet — will ultimately develop as the key to unlock long-term health and wellbeing. Personalised nutrition will slowly develop into proactive health management, thus can be seen as a major disruptor to the traditional food nutrition, supplements, and medical networks known today.

Food in affluent societies will emerge as something much more than just a full stomach but also as a powerful tool, which will open a completely new way of thinking about the effects of nutrition on holistic lifestyle and wellbeing that will ultimately help people to live longer and healthier. To make all this possible, it is essential to have access to personal genomic data and real-time information on the nutritional intake — such as measuring salt, glucose, or alcohol after a meal. Choosing the right foods for the specific biology of a body also needs to be coupled with the important DNA-based analysis and gastrointestinal condition.

It is unfortunate that these personalised healthcare technologies will only be available for people living in affluent societies with the means to pay for these services. In the future, wearable biometric sensors will become lighter, cheaper, and more accurate. Personalised healthcare and competitive market forces will reduce operating costs, such as for home DNA kits and wearable devices, that require interacting with a mobile application to monitor user activities like daily physical routines, exercise, and sleep patterns. All these variables can alter nutritional needs and requirements for food consumption at the right moment in real-time for an individual's digital biological data.

To truly revolutionise healthcare, vast amounts of data on personalised information need to be handed over or shared with IP data banks and/or medical professionals to improve the accuracy of diagnosis with technologies like computer interpretation, assessment, and vision to read X-rays.

Personalised nutrition can be a solution for people suffering from ailments partially attributed to poor nutrition or for proactive people who want to ascertain that they follow the best possible dietary regimen. For AI to succeed, patients must be persuaded to willingly share sensitive personal data with healthcare professionals. What might seem to be initially a challenge for patients objecting to breach of privacy will ultimately ease because of the people's desire to live longer in good health.

### Interconnectivity

Companies such as Google, Amazon, and Apple will be at the forefront of the medical and health industry transformation by combining digital health records with data from genomes, smartphones, and sensors like the glucose monitors. Apps will become available to record not only eating habits and sleep patterns, or lung function by using a device like a flowmeter, but also inputs to improve the accuracy of cancer screening.

Detection of conditions such as intestinal health, glucose monitoring, depression or heart rate variability is another major advantage for doctors to use ultra-sophisticated and real-time information for diagnosis and possible treatment. For the new generation of medical doctors, the time has arrived to use artificial intelligence for monitoring patients in real time, inside and outside hospitals.

Algorithm-driven medicine platforms will increasingly help both patients and doctors to effectively evaluate the health status. These platforms will provide real-time analysis of personalised health management, which eventually becomes a strategic pillar for both care-providing companies and its patients or proactive customers. This means that physicians will be enabled to transform medical data into actionable health plans.

Digital medicine — especially wearable technologies to track heart rates and steps, calorie consumption, and sleep patterns — can be abundantly measured to gather real diagnostic information. However, it will not stop there. In the future, also urine biomarkers with known connections to consumption of coffee, alcohol, pharmaceuticals, and 'stimulants' will give essential feedback for the medical doctors in an early stage, which will enable the patient to take timely corrective action.

These consumer-grade wearable devices are also the way forward to stave off fast-growing healthcare costs, especially in a setting with rising life expectancy. The cost of sequencing a human genome has significantly

fallen since 2010 and, as a result, the timespan of clinical trials using biotech has also fallen dramatically. This bodes well with modern medicine, as it seems true that the current diagnostic route is not sustainable. It may take up to 15 years to get a pharmaceutical drug to market considering the huge research expenses, hence, diagnosed patients are wondering when new treatment options will become available to improve their quality of life.

What will really revolutionise healthcare is the use of telemedicine, which allows virtual and in-person care of people speaking with doctors through a smartphone or other devices based on real-time data that is immediately seen by doctors, allowing a meaningful discussion one-on-one. For example, ingestible gas-sensing capsules are now available to measure the dietary intake of probiotics in real-time, an indication of the status of digestive health, as well as sensing ability of changes in microbiome composition.

### E-health stores

With traditional healthcare lines blurring, "customers" will be able to get physicals, flu shots, and treatment for infections outside the routine visits to the doctors' offices. At these integrated healthcare centers offering pharmacy and nutri-food, patients can also receive cholesterol screenings or find help in monitoring chronic conditions such as diabetes.

Full-service pharma stores and pharmaceutical-benefit management, as well as medical foods and supplements, will play a complementary role of supporting customers or patients outside the classic doctor-run medical systems. For example, major medical and economic gains can be made for the many patients with chronic conditions by preventing such expensive and avoidable events as readmission or hospitalisation from happening.

### Medical vertical merger

It is likely that the future will evolve into an integrated healthcare system that is not built around medical doctors, but rather a vertical system combining full-service health stores, insurance, and pharmacy-benefit management. Looking further into the future in wider geographical areas, franchised 'health stores' will offer custom-made wellness programmes as well as therapeutic personalised nutrition, vision, hearing, and medical aid products. It is a one-stop-shop for wellness and healthcare, a place where pro-active people or patients can get blood drawn, see a first-line nurse practitioner, and pick up their pharma and medical food prescriptions. All these changes



will not sideline full-spectrum healthcare clinics for urgent care in hospitals. These facilities will remain in operation and staffed by specialists and physicians.

There is a clear shift from episodic care to lifelong healthcare to keep people healthy and, if they get sick, treat them correctly the first time. These healthcare systems are becoming increasingly sophisticated and efficient for diagnostic performance, ranging from sports to the rising demand from ageing populations. Real-time monitoring like vital signs of heart rates, blood pressure, and sleep allows these digital innovations to build on breakthroughs in miniaturised microchips and wireless technology. An example is a mobile app to help diabetics manage blood sugar levels.

Another development is mental health as a life science, including issues like brain disorders, depression, and schizophrenia. Companies like Google Life Science, not the traditional bodies of research, will likely take a leadership role in signaling and turning prominent translational research activities into full-scale business development projects. The symbiotic relationship between health professionals, pharmaceutical groups, and patients are the new platforms of the future.

### Interoperability

Expect great progress in healthcare and nutrition in the years ahead as more people are increasingly engaging in proactive health decisions. Interoperability, a term that defines mobile digital devices used to exchange and interpret health information, will be the future tool to securely send and receive electronic medical and nutritional information. Interoperability will signal the end of the endless paper trail. The bottom line is a reduction of medication errors, unnecessary readmissions, and especially improved diagnosis reflected by the entire medical or nutritional record —

as opposed to the small fragment that are usually the main reasons for a doctor's or dietician's visit.

Interoperability will undoubtedly become a game-changer to provide precision medicine and nutritional support based on genomic, environmental, and personal health information, which is far better than the often trial-and-error approach of the traditional healthcare treatments.

Electronic health allows remote monitoring to help people stay healthy, enabling better outcomes. This technology will greatly transform current standards by reducing diagnostic errors and costs, while possibly providing immediate access to medical specialists. For example, the ePatch – a small wearable device glued to the body checking heart rhythm irregularities, is based on AI software and can monitor the heart performance much longer and more accurately than the current short-span lived devices do.

### More than just the heart

Cardiovascular health is more than just the absence of clinically evident disease. It should also be seen as a holistic view related to physical, mental, and social lifestyle, as well as wellbeing. Variables such as digestive health, sleep, inflammation, and diabetes, all have positive or negative effects on the heart.

Cardiovascular disease is the leading cause of death globally, taking about 18 million lives each year. A point of concern is the regulatory differences between the US and EU that can cause consumer misunderstanding and even irritation when making health claims for certain heart-healthy foods or nutritional supplements. It seems that the European Food Safety Agency (EFSA) especially requires a higher level of scientific evidence than the US Food and Drug Administration (FDA) does. In the US, for example, structure function claims are approved for cardio-supporting products like vitamin K2. This little-known vitamin improves the maintenance of the elastic properties of the arteries by directing calcium deposits in the arteries to the bones.

The key focus of nutritional supplements and certain medical foods should be on prevention. This includes reducing behavioural risk factors and keeping the heart and blood vessels healthy, even before a rise in blood pressure or blood cholesterol occurs. **APFI**



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