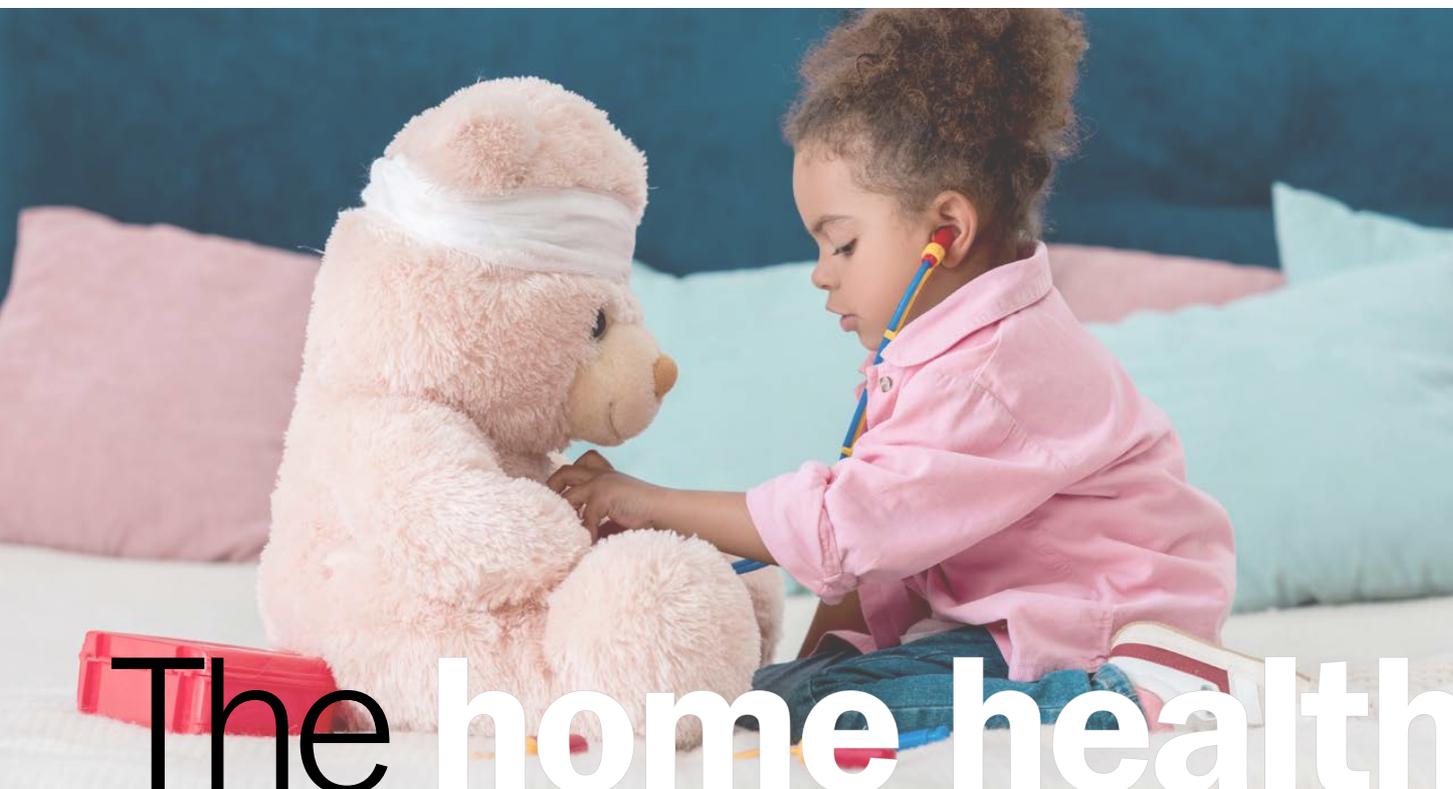


Home health testing technology has come a long way in recent years and, driven in part by the pandemic, is set to be worth \$8.15bn by 2030. **Dr Michelle Tempest** and **Alina Trabattoni** of Candesic examine the exponential growth and, given the right investment, the democratisation of healthcare it could unleash globally



The home health testing boom

Although many companies are currently at an early stage, bio-hacking is expanding past the longevity trend into government policy and investors are looking to leverage health data to join up care pathways.

Global demand for home health-testing technology has experienced substantial growth in recent years, gaining 2.8% a year since 2017 to \$5.2bn in 2020, and is set to reach an estimated \$8.15bn by 2030, according to Candesic calculations (see Figure One). Acceleration has been boosted by the pandemic and consumer desire for such products and services.

This revolution in healthcare reflects the reworking of technology to offer the general population personalised and often professionally-monitored access points. Moreover, demand for personalised services is gaining, proportionate to individu-

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als' growing awareness of the importance of health and wellbeing.

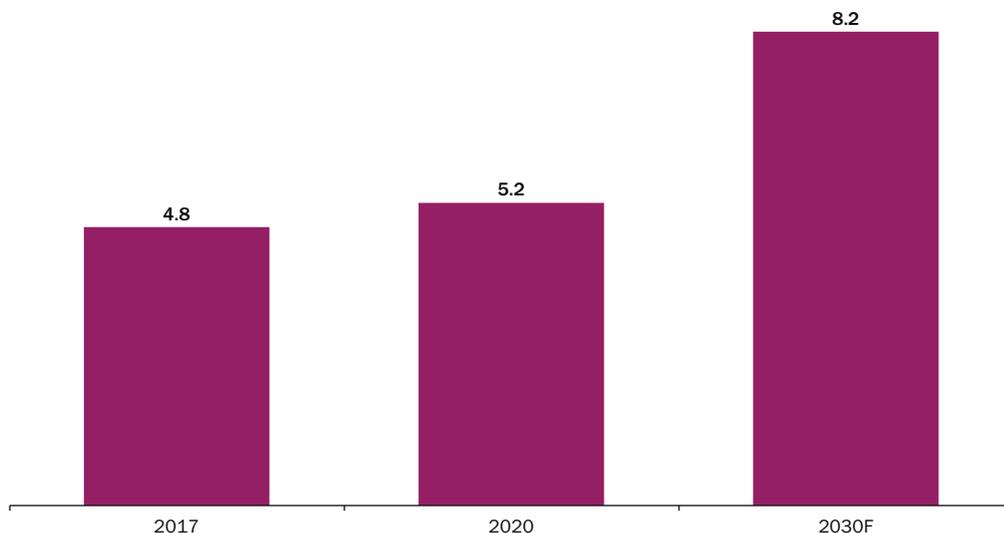
Quality improvements combined with increasing volumes in health tech services and hardware being rolled out to this underserved market not only offer health amelioration possibilities but also pave the way for substantial cuts in future state spending. Today, large swathes of the global population could potentially tap into continued health monitoring services, presaging a world in which wide-scale, individual preventive measures may become the norm for most.

Healthtech offerings are much advertised, from street-side billboards to online promos publicising on-the-spot tests for anything ranging from cancer markers, food intolerance, urine analysis, thyroid functionality, through to DNA tests for the mapping of the microbiome. Undoubtedly, at-home health apps and medical testing

FIGURE ONE
GLOBAL PROJECTED MARKET VALUE OF HOME DIAGNOSTICS IS EXPECTED TO BE \$8.2BN IN 2030

HOME DIAGNOSTICS GLOBAL MARKET SIZE, \$BN

CAGR, % (2017-20) CAGR, % (2020-30)
 2.8 4.6



NOTE F - FORECAST

SOURCE FIORMARKETS; PRECEDENCE RESEARCH; CANDESIC RESEARCH AND ANALYSIS

kits today are a far cry from the first over-the-counter pregnancy tests that went on sale almost four decades ago.

Modern home test kits offer a wide range of health-related services and cost anywhere between £40 to £500. Market offerings have evolved to include the diagnosis of a wide range of conditions including stomach ulcers, kidney failure and sexually transmitted infections. Clients receive details on physical and genetic makeup and are advised on how to improve their health in exchange of blood, saliva, urine, stool and breath. In addition, individuals suffering long-term medical conditions are now able to monitor their body functions at home using these very kits, including blood glucose levels and heart metrics.

Healthtech configuration

Home-testing health kits can be broadly divided up into five categories:

- Breathalysers measure Co2 levels in your breath to investigate digestion and calorie burn (FoodMarble, Lumen)
- DIY blood tests are used to analyse health markers (Thrive, LiveSmart, Medicecks, Forth)
- DNA testing investigates the

genes (Nutrigenomix, FitnessGenes, DNAFit)

- Microbiome testing examines the gut to determine its individual makeup (Viome, Carbiotix, Atlas Biomed) and urine tests check for infections (Healthy.io)
- Hardware and Apps like the Mira fertility tracking device and continuous glucose-tracking system, such as Supersapiens

Breathalysers

Breathalysers study levels of carbon dioxide (CO₂) and other chemicals in exhaled breath to create a snapshot of an individual's 'breathprint' and a unique breath profile of their health.

They currently diagnose a slew of medical conditions, including ulcers, lactose intolerance and jaundice in newborns. Lumen and FoodMarble are two breath-analysing technology companies aiming to provide guidance on nutrition and health improvement.

Lumen users blow into a sleek, pocket-sized device that is paired up with a smartphone app to determine how they are digesting their food and burning calories. Each breath into the device is broken down into a score of between 1 to 5 to reflect

whether the body is burning fat stores or carbohydrates, after which a recommended meal plan is drawn up indicating how many fat, carbohydrate and protein servings should be eaten to make the metabolism more efficient. The ultimate aim is to permit users to reach fitness and weight objectives by 'hacking' their metabolism. 'When you have a flexible metabolism, you can easily shift from burning carbs to burning fat as an energy source,' Michal Mor, Lumen co-founder and chief scientist said in an interview. 'The benefits are huge, starting with consistent energy levels, better sleep and weight maintenance.'

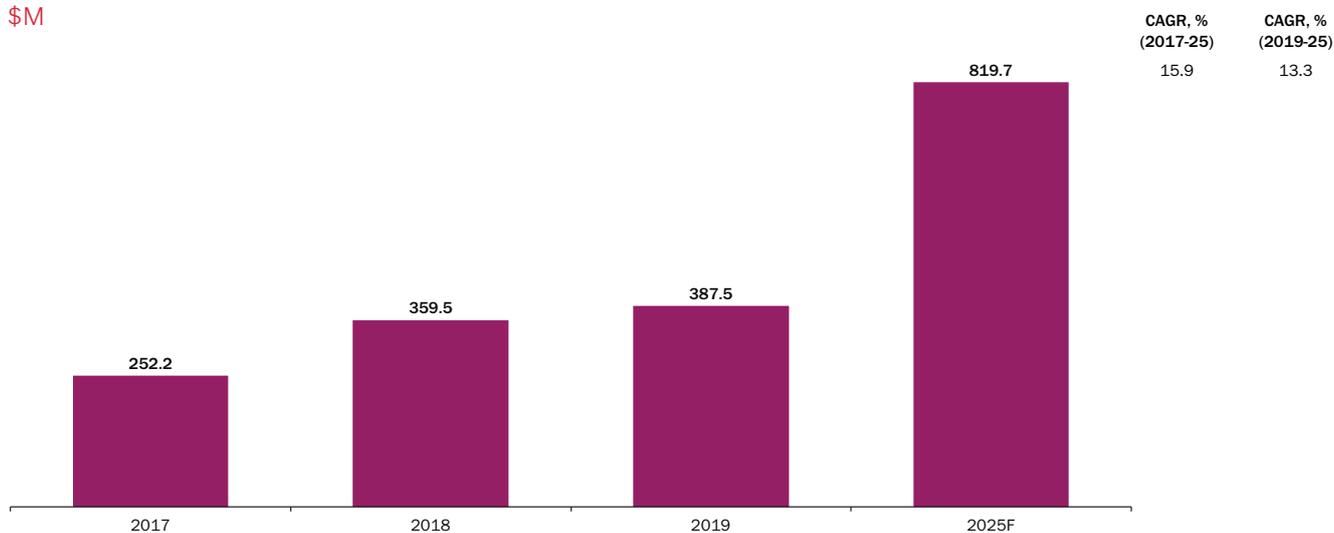
FoodMarble also ventures out into the medical sphere aiming to help manage certain conditions including irritable bowel syndrome (IBS). Similar to Lumen it pairs up with a smartphone app on which meals are logged before a breath sample provided to measure how efficiently the body is digesting food.

In an interview, FoodMarble CEO and founder Aonghus Shortt said: 'I did this to help my wife. She had been on a lengthy journey to figure out what was affecting her digestion. Eventually she got a diagnosis of IBS and after researching technology that could help, I built a prototype device for her.'

Other assorted devices measure ketones and are geared towards epilepsy, where a keto diet has been proven to re-

FIGURE TWO
THE NUTRIGENOMICS MARKET IS PREDICTED TO GROW TO \$819.7M IN 2025

NUTRIGENOMICS GLOBAL MARKET SIZE,
 \$M



NOTE F - FORECAST

SOURCE GLOBAL MARKET INSIGHTS; EMERGEN RESEARCH; CANDESIC RESEARCH AND ANALYSIS

duce seizures in children with uncontrolled epilepsy.

Blood tests

An alternative approach is to sample at a more functional level by measuring the concentration of specific vitamins and metabolism-regulating hormones in the blood with samples obtained via finger prick using a lancet. Levels tested include kidney function, thyroid hormone as well as cortisol and testosterone, providing insight into an individual's metabolic state.

Blood testing services are also looking to take over the home health MOT market, historically delivered by NHS primary care providers. Consumer insight studies and focus groups done by Candesic have highlighted that comfort gained with access to home lateral flow tests for Covid is translating into wanting immediate and convenient diagnostics from the sofa.

'There's a powerful reality driving the adoption of consumer-led diagnostics: the intrinsic human desire to want to get more out of life,' said Hamish Grierson, CEO and co-founder of Thriava.

'In practice, while diagnostics (like blood tests) are a useful insight, helping people to understand what the results mean, how to improve them, and then helping them to make changes is what fundamentally increases their health confidence which in turn leads to people making healthier lifestyle decisions.'

DNA tests

Populations and governments the world over are currently embroiled in waistline warfare as the significant financial burden of obesity takes its toll both on general population health levels and on state coffers. Globally, the combined direct and indirect costs of obesity, inclusive of musculoskeletal issues and premature death, amounted to £1,027 trillion for the 2018 full-year, according to the Milken Institute.

While a healthy diet benefiting from food variety is beneficial to health, controversy over what actually constitutes it may be due, in part, to individual genetic variances. With diet one of the most basic and influenceable components of an individual's external environment, the field of nutrigenetics, which considers genes to determine individuals' responses to nutrients, is amongst one of the most promising developments to have emerged in recent years in addressing obesity.

The nutrigenomics sector is expected to expand by 15.9% a year in the coming years to reach \$819.7m in 2025 (see Figure Two). A substantial portion of it will be driven by retail genetic-testing companies like Nutrigenomix, 23andMe, Ancestry, Atlas Biomed and MapMyGenome.

'The genie is already out of the bottle,' said Ahmed El-Sohemy, founder of genetic-testing company Nutrigenomics, in an interview. 'We know there is no going back to the one-size-fits-all approach,' and 'as

the cost of genetic testing comes down we will see this being incorporated into the lives of more and more consumers.'

Self-testing methods are still nascent and so companies like Nutrigenomics suggest the home-test kits are best used in combination with the guidance of clinical experts. Nutrigenomics to date has shipped its products to over 10,000 healthcare practitioners in 40 countries, and is poised to benefit as demand continues to grow.

'Clinician involvement means next steps can be outlined clearly and the person's expectations dealt with appropriately to optimise the clinical outcome and the value of doing the test in the first place,' said Dr Millicent Stone, CEO of clinician patient engagement tool iOWNA. 'All too often tests are done at home with the person then left without guidance or direction on next steps which can fuel anxiety and lead to inappropriate referrals, and ultimately may lead to a poor outcome for the individual.'

Gut microbe tests

Gut microbiome testing is a novel, emerging field that is increasingly commanding the attention of the scientific community. Companies in this space offer sequencing of an individual's gut bacteria as determined from a stool sample and offer diets, pre- or probiotics, as well as personalised supplements tailored to an individual's own gut bacteria with the objective of achieving both physical

and mental wellbeing and improving overall health.

'Gut health more generally has become a hot topic with a growing number of people becoming interested in the gut microbiome and its impact on health,' said Sergey Musienko CEO and co-founder of Atlas Biomed which also has DNA tests. 'As research continues to link the microbiome with everything from mood to metabolism, interest will only continue to grow.'

Current forecasts suggest the global microbiome industry will grow 20% a year to \$2.9bn in 2028 from \$0.7bn in 2021 (see Figure Three).

Apps and Hardware

People's hunger for information on their health and their bodies has spawned a global industry which is a digitised, interconnected powerhouse tracking the body metrics of millions of people globally through apps like fertility tracker Mira, glucose monitoring hardware Super Sapiens and body metrics tracker ring Oura.

Wearable devices and Apps are touted as having introduced a revolutionary element into biomedicine with their ongoing, continual biometric tracking during everyday life, generating volume data and information through digital connectivity that has never been had before. This hybrid space traditionally the domain of health-care enthusiasts and athletes has been growing from year to year and is now also straddled by medical experts and patients' prevention, intervention and prediction interest - suffice to say that Apple Watch sales in 2019 outsold the entire Swiss watch industry.

The Mira 'fertility monitoring system has already helped over 30,000 women to conceive naturally, by providing them with actionable insights and guidance,' said Mira founder and CEO Sylvia Kang. 'We see home-testing and owning your health as the trend.'

Conclusion

The health consumer market has sky-rocketed during the pandemic with some companies, such as DNA Nudge, even setting up stalls as a high street brand. The sector is evolving and rumblings of regulatory and privacy issues are likely to remain in the headlines. Companies that lack scientific rigor and clinical evidence may yet exit the market and fail – hopefully

faster than scandal-ridden Theranos. It's likely consumers will drive uptake and demand clinical accuracy meaning that businesses will work more closely together and later consolidate.

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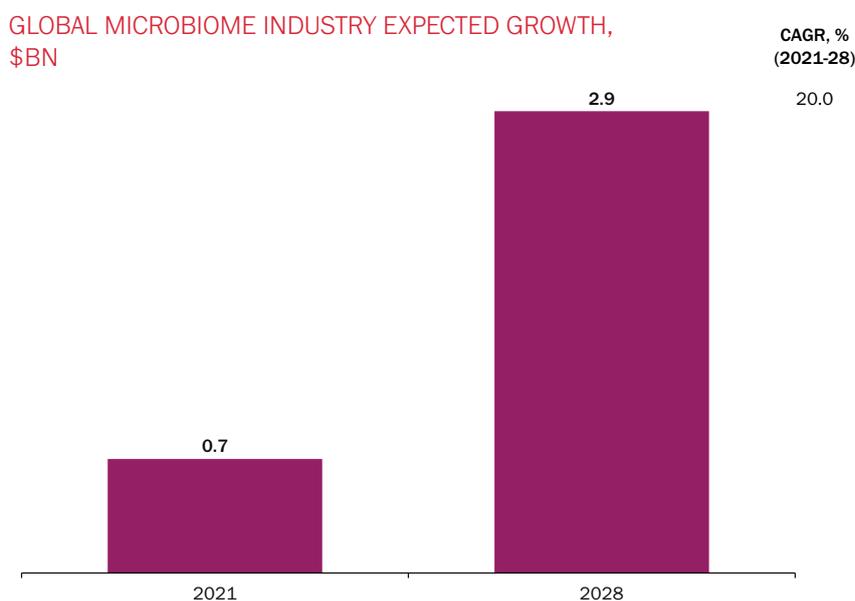
'Pros include the convenience for patients, offering quicker results, and reducing burden on general practice and clinics,' said Dr. Juhi Tandon, clinical director of health technology company, Cognitant. 'They give patients more autonomy, save time and are better for the environment with less travelling.'

'Unfortunately, in some cases, tests may not be fully validated or evidence-based,' Tandon added. 'The user may suffer increased health anxiety when faced with the results without a professional on hand to help interpret them and to separate the significant from the insignificant.'

In summary, this new dawn in consumer health offers personalised health tracking along with education around how to extend a healthy happy life. This could be welcome news for governments, given their growing financial health and social care burdens globally. Innovative new technology will help prevent illness and predict disease earlier, poised as a fun and more affordable option to longevity.

This growing market is likely to develop into full-stack end to end care offerings – but this will take time, investment and clinical outcome monitoring. In the interim, rest assured the Candesic team are testing and trialling a plethora of products to monitor clinical validity and running research – feel free to follow progress on social media.

FIGURE THREE
GLOBAL MICROBIOME INDUSTRY IS EXPECTED TO GROW FROM \$0.7BN IN 2021 TO \$2.9BN IN 2028 WITH A CAGR OF 20%



SOURCE TIP; CANDESIC RESEARCH AND ANALYSIS