

HEALTHTECH

Laurent-Dominique Piveteau, CEO Debiotech SA

REMOTE PATIENT MONITORING

Since the beginning of the wide diffusion of the internet and of the first cell phones at the turn of the century, the idea of offering remote health services has been proposed, described, detailed. The vision was to improve the quality of care provided to patients, to intensify their follow-up by the medical world, doctors, nurses and even by their relatives, to simplify the collection of their health parameters and thus to better understand their diseases and to make the therapies more relevant. By making treatments more effective and also by making them less intrusive in one's daily life, one wanted not only to give years to life but also to give life to years.

Today, such an approach has become obvious. Patients themselves are asking to be treated at home as much as feasible. The medical world and the payers agree on the benefits for the quality of life and for the health of the patients as well as on the possibility to reduce costs for society. But all this comes with several challenges that need to be solved by medical device developers, service providers or by the medical centers themselves.

In this short introductory article, we will look at some of these challenges faced by the device developers.

Why bringing patients home?

Having a patient treated at home offers many benefits. The first one that comes to mind is obviously the quality of life. Chronic diseases are becoming more and more common in our western societies where we live longer. They follow us over the long term and often require regular attention. Being able to take care of them without going to a doctor's office, a pharmacy or a medical center is simply indisputable. First, it saves a lot of time in terms

of travel. It gives also the possibility to stay in a pleasant and familiar environment to remove the medical aspect of these regular procedures. It is also the opportunity to perform these procedures when they fit into one's schedule and not to have to organize one's day, activities, professional or personal life around them. This greater flexibility additionally allows for more physiological treatments. It is possible to ask patients to treat themselves more regularly if the act to be performed does not disturb their daily life too much. Many chronic diseases involve the deterioration or loss of a physiological function. So being able to replace it more regularly will make the approach more effective. This effectiveness will be measured in the medium and long term with a reduction in the complications induced. Fewer complications mean a better quality of life for the patient and less financial costs for society. Let's take the example of dialysis, whose objective is to replace the kidneys that have become inactive and therefore to filter the blood and ensure the balance of fluids in the body: being able to treat a patient at home means shorter daily sessions instead of sessions in a center every two or three days. It is easy to understand that such an approach will be more physiological, and will limit the side effects as well as the long-term complications.

If home treatment can lead to new costs that did not exist before - 24-hour assistance to patients or the need for regular home visits by medical personnel - these costs are quickly offset by the savings made on the reduction of complications to be treated. These improvements are also made possible by a better involvement of patients in their treatment. It is important to remember that the people best placed to treat themselves are often the patients themselves. They know their disease, feel the symptoms and know very quickly if the actions taken are beneficial.



Laurent-Dominique Piveteau

Laurent-Dominique Piveteau joined Debiotech in 2005 and was appointed as Chief Executive Officer in 2015. In 2020 he co-founded NextKidney, a spin-off of Debiotech. Prior to this, he held several positions in R&D and in business development. During his PhD, he collaborated closely with the Robert Mathys Foundation. Afterwards, he was a researcher at M.I.T. in Boston, worked in technology transfer at EPFL in Lausanne, and also taught Innovation Economics at EPFL. Since 2021 he is additionally non-executive director of RSP Systems in Denmark. He holds an MSc in Physics from the ETH Zürich, a PhD from the University of Fribourg and an MBA from INSEAD in Singapore and Fontainebleau.

Monitoring needs

As we can see, there are many arguments for offering patients the possibility of treating themselves at home. Such an approach requires however the implementation of special tools. This is what is commonly called remote patient monitoring. This includes all the digital technologies (hardware and software) necessary to collect medical data or other forms of data on an individual's health in one place and to transmit them electronically and securely to medical staff located in another place to enable them to conduct an analysis and make recommendations. Data is therefore collected regularly on and from the patient and sent for review and, if necessary, adjustment of the therapy. It is possible to monitor many vital parameters with small sensors in a continuous way. A well-known example is the monitoring of blood sugar level for diabetic patients: it is today possible to measure it continuously, to anticipate its variations and thus to take any necessary measures. The collected data is sent to the cloud for a posteriori analysis or even be used with algorithms and make the right decisions on the spot.

Therefore, remote patient monitoring should also include the sending, by the same electronic and secure means, of the prescription corrected according to the received data to the patient's medical device in order to adapt the programming. This possibility, which poses challenges in terms of security as we will see later, is beginning to appear on certain devices. The number of devices equipped

with such functionality is still very limited, but the pressure from the market and from patients is being felt and it will soon be impossible to do without.

The challenges

Many things can be imagined around monitoring and adapting remotely a treatment, but there is one point that will always remain non-negotiable in the healthcare market: the quality of the provided care shall not be impacted. It is essential to be able to always guarantee patient safety and security. Such an approach will therefore require the implementation of an important infrastructure, both in terms of hardware and software. And infrastructure means challenges that must be addressed and solved.

By far, the main challenge to tackle is cybersecurity. It is about protecting patients both by ensuring that their treatment runs smoothly and that no one can take control of their device remotely. Additionally it must also by ensure the protection of their personal data. Unfortunately, this aspect has long been neglected by the industry and is still too often neglected today. One of the problems is that too many players in the industry are not aware that their product is concerned by cybersecurity. Or, for products under development, it is perceived as a minor problem, a constraint that will be managed later when all the rest has been solved. However, this type of threat must be considered from the very beginning of the design of a device. The architecture of the system must include protection



measures for both the medical risks for the user and the cyberthreats that could arise. And it is up to the designer to demonstrate to the regulatory authorities that he has put in place all what was necessary.

The possibilities offered by connected devices are multiple. They allow the integration of health data with behavioral data. They also make it possible to collect data that will help improve the functioning of future devices or to improve the service offered to the patient by sending him, for example, automatically and without any action on his side, the consumables necessary for the conduct of his therapy when necessary. The law now requires that the patient can at any time give or withdraw his consent to this data sharing. Furthermore, if all this data is collected and stored on the same device, access to it must be strictly controlled. If a device is sent back to the manufacturer for repair, the manufacturer should not have access to the user's medical data under any circumstances. Here again, special attention must be paid to the system architecture to ensure proper data segregation.

One must not forget the issue of the access over time to the data. The fact of remotely following a treatment, of being able to enhance it with remote medical assistance, must not in any way prevent its proper execution. It is therefore necessary to deploy high-performance cloud solutions at all levels and/or to think of the design of the systems in such a way that they can function under all circumstances. For example, a device that ensures a vital function must be able to operate even if contact with the

servers is lost. The minimum intelligence must therefore be located in the device itself. It is also important to take into account the latency in the communication. This becomes particularly critical if the device needs to call on centralized data for its operation.

All choices that will be made in the architecture will have an important impact on the user experience. They will also have a significant impact on the tests to be conducted during development, the validations to be performed and the documentation to be produced. For companies working on such systems, this potentially means additional costs and enhanced development time.

One can see that remote patient monitoring offers many possibilities to improve the quality of life of patients, to envisage more effective treatments with fewer side effects and even to reduce healthcare costs. There is no doubt that remote patient monitoring will become increasingly important in the health field. The tools exist and can be deployed. One can also see that this transition will require the industry to take into account certain constraints, to meet certain challenges that it is not used to. There is much to learn from what others have done and adapt existing solutions to the specific requirements of medical devices. At Debiotech, we have been working for more than ten years on these issues, which makes us confident about our ability to provide effective solutions and help other companies to succeed in their transition to connected health.. ■