

WHITE PAPER

New solutions for old healthcare challenges: how AI and data-driven health systems are transforming the industry



Executive summary

It is definitely impossible to not recognize the impact that the COVID-19 pandemic has had in the digitisation of the healthcare sector. According to McKinsey & Company, the global health crisis accelerated three to ten years of digital adoption in several industries, with reports of double the impact in the healthcare and pharmaceutical industries. Even though the demand for telemedicine consultations has stabilised since the end of the public health emergency, it seems like the digitisation of healthcare services is here to stay.

Recent reports show that two in five patients who used some type of remote care service during the pandemic still prefer them over traditional in-person care. At the same time, several countries have instituted remote care in government schemes and public health systems not only for acute care but also for remote patient monitoring. Yet, 75% of telemedicine initiatives still fail during implementation, bringing to light a gap in modern digital health services.

This could be due to the fact that the digital tools being provided nowadays by healthcare providers are not meeting the needs of their customers and patients, especially when it comes to preventive care and continuity of care. According to Deloitte's 2023 report "Integrating digital health tools to help improve the whole consumer experience", healthcare providers are offering digital solutions to some issues such as virtual triage and online scheduling, but are still lacking in integration and care continuity progression.

These indications lead us to conclude that although the digital transformation has hit the healthcare industry hard in 2020, it still seems that healthcare institutions are facing the same old challenges and underusing the array of digital tools available three years later. In this scenario, the rise of Generative Artificial Intelligence (AI) and data-driven systems are actively persuading healthcare providers and leaders to search for digital tools that present real solutions to their everyday problems while proving that digitalisation is the answer for a healthier future.

Old challenges that still haunt modern healthcare

Staff shortages

Healthcare professionals did not have any break during the COVID-19 pandemic. They weren't able to work from home or had any time to engage in self care, which are the main reasons for the growing levels of physician burnout. Due to reasons mainly related to training and retention of healthcare workers, the World Health Organization (WHO) predicts that the global deficit of skilled healthcare professionals will reach 10 million by 2030.

The exponential increase of staff shortages in healthcare since the COVID-19 pandemic has also caused operational inefficiencies with 34% of physicians claiming they saw a rise in medical errors as a result of staffing constraints, according to Survey Healthcare Global. On the other hand, while digital tools present a solution for many issues in healthcare delivery and workflow efficiency, they are also a reason for concern for many physicians, which results in low adoption rates on the clinical side.

Rising cost of care

Since the COVID-19 pandemic hospitals and healthcare centres have also been dealing with financial crisis. While more than half of hospitals in the United States finished the year of 2022 with a negative margin, a recent Bain survey of health system executives reported that 60% mentioned rising costs as their biggest concern.

The cost of care delivery has become a great reason for concern over the past few years due to a combination of staff shortages and the rising number of chronic patients. As reported by the WHO in 2023, non-communicable diseases, such as diabetes, cancer, and cardiovascular illnesses, are claiming around three quarters of all lives lost each year. This translates into 86% of the 90 million deaths each year by 2050, also according to the WHO.

These diseases represent a big stack of healthcare costs since they require ongoing treatment. The World Economic Forum had already reported in 2011 that the global economic impact of the five leading chronic diseases – cancer, diabetes, mental illness, heart disease and respiratory disease – could reach US\$47 trillion in the following decades, with cardiovascular disease and mental health conditions being the major contributors for this burden. Unfortunately, the impact of chronic diseases has only risen since 2020, creating an ever bigger sense of urgency to tackle this global issue.

Lack of patient engagement

Patient engagement is of uttermost importance in healthcare, especially when considering chronic disease patients. In fact, low patient engagement levels can result in reduced adherence to treatment, high no-show levels, increased readmission levels in urgent care and poor health outcomes. According to the 2017 Patient Engagement Perspectives Study conducted by CDW, over 70% of physicians indicated that patient engagement was a top priority, which means that patient compliance has been a long-lasting issue in the industry.

If patients are not compliant to their own health initiatives, it's practically impossible to see good health outcomes. Medication adherence, involvement in treatment and in preventive strategies are just some of the ways in which patients should be taking part in their personal healthcare.

Unfortunately, after the COVID-19 pandemic, many patients lost the habit of visiting hospitals and medical offices for check-ups, which decreased their overall engagement and compliance to preventive measures. Even with all the digital tools available to encourage the engagement of patients located in the most remote replaces, it seems like getting patients more involved with their own health is still a challenge for providers and payors.

Underused data

All implemented digital tools generate a numerous amount of health data that can allow for more patient-centric approaches, better business strategy decisions and overall streamlined processes. Electronic Health Records (EHRs), telemedicine consultations, wearable devices and monitoring apps are some examples of how digital health tools are constantly collecting information from various data points at the same time.

However, if these tools are not seamlessly integrated, structured and analysed, they simply generate an enormous amount of underused data that has the potential to transform care delivery based on real information owned by the institution. In a nutshell, all modern healthcare systems are actively collecting valuable health data, and it's time to start using them the right way. **Are you aware that all modern healthcare systems are actively collecting valuable health data?**






Modern Healthcare Levers



AI in healthcare: the time is now

Even though the whole world has been raving about AI, ChatGPT and other Large Language Model (LLM) platforms, the application of these systems in healthcare has always been followed by uncertainty. This is due to scepticism from the general public when it comes to new technology applied to care delivery as well as an insecurity coming from physicians who are not yet acquainted with these systems and how they can be a true ally to better health outcomes.

Industrial revolutions: Technology transformations x Healthcare

	year 1800  Mechanical machines	year 1900  Mass manufacturing	year 2000  Digital automation	year 2012  Mass connectivity	year 2025  Human-machine collaboration
General Knowledge & Skills	<ul style="list-style-type: none"> • Basic Engineering • Hands-on projects • Problem-solving abilities 	<ul style="list-style-type: none"> • Electro-mechanical Engineering • Manufacturing and assembly line production • Design and building abilities 	<ul style="list-style-type: none"> • Software tools • Artificial Intelligence • Mechatronics • Machine Learning models 	<ul style="list-style-type: none"> • Internet of Things • Big Data • Digital reality (AR & VR) • Communicating abilities 	<ul style="list-style-type: none"> • Human-centric design • Human-machine interactivity • Customisation
Healthcare Industry	<ul style="list-style-type: none"> • Individual patient diagnosis and treatment 	<ul style="list-style-type: none"> • Drug mass production • Community healthcare kickoff 	<ul style="list-style-type: none"> • EHRs • Telemedicine • Simulation healthcare training 	<ul style="list-style-type: none"> • Remote healthcare • Data-driven models • Digital health privacy 	<ul style="list-style-type: none"> • Personalisation • Engagement-based • Machine-in-the-loop • Health data and insights

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However, with the widespread use of AI in the past year, the benefits of these technologies in a healthcare setting became a main topic of debate, resulting in a bigger understanding of how AI and data-driven systems could transform care delivery into a more personalised approach. In fact, a recent survey conducted by the [Pew Research Center](#) found that 38% of U.S. adults believe that the use of Artificial Intelligence algorithms in diagnosis and treatment recommendations could lead to better health outcomes. Although 38% may seem like a passable percentage, it represents a significant increase of trust in AI technology in comparison to a couple of years ago.

At the same time, 94% of healthcare executives surveyed by [Deloitte](#) in 2020 believed that the use of AI would be efficient to enable earlier and proactive identification and intervention. This proves the motivation of healthcare organisations to implement digital solutions that will improve care delivery and efficiency while educating patients about the benefits of adhering to these tools.

However, to efficiently start using AI-driven systems, healthcare systems must invest in a true digital transformation, which most of the organisations are hoping to achieve by 2025, as reported by Innovaccer. Yet, 95% of healthcare executives believe that data readiness and interoperability, which are basic foundations for the efficient application of AI in healthcare, could be obstacles for the implementation of these technologies.

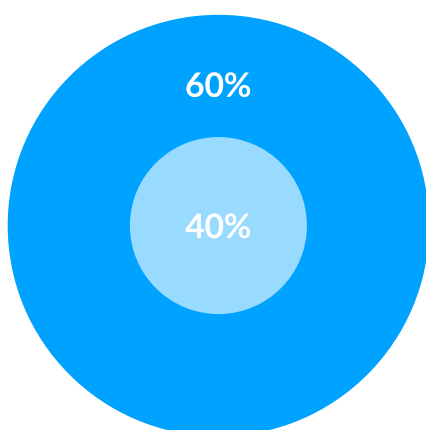
Most healthcare organisations are hoping to achieve digital transformation by 2025. What is the forecast for yours?

Source: Innovaccer

The reality of digital health

The application of AI algorithms and data-driven systems in healthcare can translate to several different benefits that are able to improve efficiency even in the case of staff shortages. They also allow healthcare institutions to offer better health outcomes through data collection and analysis combined with patient-centric engagement strategies. However, two of the main obstacles of proficiently implementing AI systems in healthcare are user scepticism and lack of organisational structure to adapt and make full use of these new technologies.

In regard to user scepticism over AI technologies related to healthcare, the scenario seems to be evolving. In 2019, around 7% of the searches performed by Google users were health-related, which meant over one billion online health questions made a day, as reported by [The Telegraph](#). In the past year, many of these users took their health-related searches to ChatGPT, with 60% of people claiming they would allow the LLM-based chatbot to offer medical advice and give health-related information, according to [Tidio](#).



60% of people would allow LLM-based chatbots to offer medical advice.

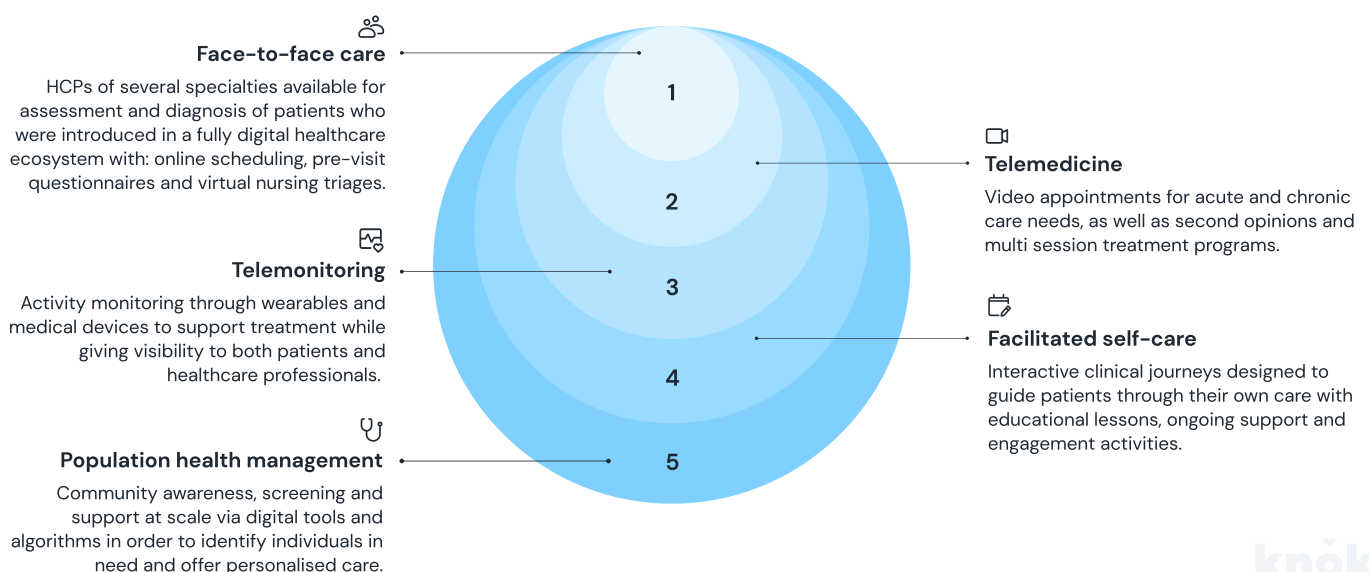
Source: Tidio

This means that users are already allowing Generative AI technology, such as ChatGPT, to influence their healthcare decision. Nonetheless, user adoption is pointless if organisations do not have the infrastructure to fully implement AI-driven systems, including trained personnel, data analytics professionals and IT staff to maintain the functioning systems.

In this case, it can be argued that the readiness to implement AI in an existing healthcare system is actually the most challenging part of the process. A successful implementation requires the compliance of several different aspects related to structure, integration and interoperability.

For some healthcare institutions, it may seem like a lot of time and financial investment for a new technology, even if the benefits are worth the expenditure. That is where digital health companies, such as knok, enable the AI digital transformation with their own infrastructure and service, allowing payors and providers to enjoy the results of a successful AI-driven system without having to worry about the technicalities of the process.

Digital Healthcare Onion Logic



Real-life solutions

There is no doubt about the advantages that AI data-driven applications can bring to any healthcare system. What may be hard to imagine is how they can apply to real-life scenarios and solve everyday challenges. Here are some examples of how AI and data analytics are transforming the industry and solving long-lasting issues faced by organisations in the healthcare sector.

Streamlined workflows and reduced costs

Virtual triage

In an era of staff shortages, technology must become an ally of workflow optimisation. In this situation, AI can act as a middleman between healthcare stakeholders and better health outcomes. In times of staff shortage, traditional triage, for example, leaves room for mistakes due to the manual input and transfer of information in between nurse shifts. That is where virtual triage comes in to collect more efficient health data from patients with customisable symptom checker questions based on their upcoming answers.

With knok's virtual triage module, generative AI algorithms are able to analyse information submitted by patients and provide the nursing team the right level of care – telemedicine appointment, home consultation or urgent care – to every specific case. This seamless combination between Generative AI technology and nursing professionals is the most efficient way to prevent unnecessary visits to the emergency room while also flagging urgent situations before they become critical.

In a moment of exponential rise of costs related to healthcare for all stakeholders involved, this method is also an effective strategy to lower costs for both payors and patients. At the same time, virtual triage can significantly reduce the waiting lines for emergency care, which, in times of staffing shortages, allows for doctors who are on-call to dedicate time and effort to the patients who really need it. For instance, our own AI triage solution showed an average reduction of 15% in service time while still maintaining a 90% satisfaction rate with the service provided.

knok's AI-triage

-15%

Service time

+95%

Satisfaction rate

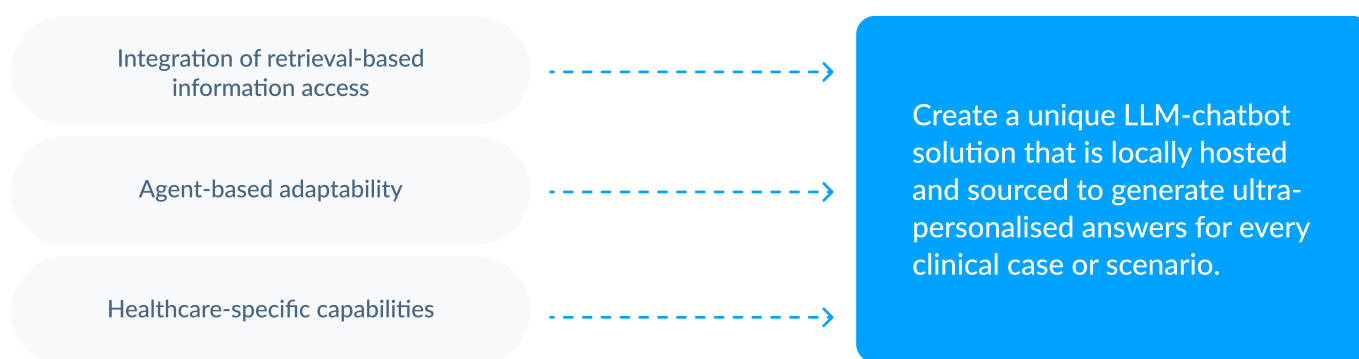
AI Chatbots

Going further into AI's possibilities to optimise workflows and reduce costs in a healthcare setting, a new trend has proven its great capability for the industry: chatbots. AI chatbots gained their popularity with the rise of ChatGPT but have been progressively becoming more specialised to the healthcare industry, like with Google's Med-PaLM.

These Generative AI systems are able to retrieve knowledge from various sources in order to provide accurate information, aid in diagnosis, and offer support to healthcare-related tasks.

Besides being able to retrieve knowledge from public archives, AI chatbots can also be fed with specific information, making them big allies of personalised healthcare. This is the case of knok's Retrieval Augmented and Agent Generation Applications (RAAGA), which was crafted as a unique solution in the market. By training the RAAGA knowledge library internally, we are enabling the merger of published scientific information with specific determined knowledge, allowing the chatbot to generate ultra-personalised results to any case or scenario.

Retrieval Augmented and Agent Generation Applications (RAAGA) by knok



knok

In terms of streamlining everyday healthcare processes, the RAAGA is able to perform everyday healthcare tasks, such as speech to text case summarisation, ICD-10 diagnostic classification, estimation of telemedicine resolution rates, triage of acute cases and many more. Apart from the advantages of automating these tasks, healthcare organisations can also benefit from reduced errors, high accuracy and reliability.

Increased engagement

Remote patient monitoring (RPM)

If data-driven digital health systems are able to really streamline a major part of healthcare delivery, that is definitely patient monitoring and engagement. RPM tools are constantly evolving and may include several devices and technologies like mobile apps or wearable devices such as smartwatches, activity trackers, connected medical equipment and more. These devices allow for patients to share real-time data with healthcare providers and professionals through safe platforms.

1

40-year-old patient with treated hypertension visits the doctor's office a few times a year with a stable condition, but presents complaints that can't be accurately diagnosed due to lack of information.

2

Doctor enrolls patient in RPM programme with connected device, in which patient is instructed to measure his blood pressure during different times of the day and take note about his symptoms.

3

The device collects data that empowers the physician to remotely analyse the condition of the patient and provide tailored treatment for his personal needs.

Besides allowing for more personalised care and treatments for each individual situation, remote patient monitoring offers increased access to health services for people from remote and rural areas and chronic patients. For providers who use RPM solutions combined with telehealth platforms this means reducing hospital readmission penalties. Also, according to a study published by the Journal of American Medical Association (JAMA), the implementation of remote patient monitoring strategies could lead to 87% less hospitalisations and 77% less deaths.

When it comes to the main issues of modern healthcare, remote patient monitoring is a great ally to improving health outcomes by engaging patients in their own care and allowing them to receive medical attention in their own environments. These characteristics are especially valuable to chronic patients, who can benefit from continuous remote care with personalised treatments and approaches.

knok's all-in-one suite of telehealth solutions offers a complete system for remote patient monitoring. The platform allows any enrolled doctor to have a global view of the patient, including EHRs, notes, past exams and/or diagnosis. The seamless integration between remote patient monitoring devices and the telehealth platform allows healthcare professionals and patients to stay connected asynchronously, while also allowing them to connect through a telemedicine consultation in only a few clicks.

Patient Journeys

Better healthcare is ultimately in the hands of patients, since even the most efficient treatment will have no effect if not followed correctly by the patient in question. Unfortunately, increasing patient engagement can be complicated for healthcare organisations who are still focused on the traditional "sick care" approach instead of engaging in the new "health care" model. That's because patient engagement goes beyond sick people that are seeking treatment, it quickly expands to preventive care and continuity of care strategies that result in longer cycles of interaction between patients and healthcare institutions.

In this sense, digital health platforms driven by data and AI algorithms are the most efficient solution to increase patient engagement while expanding care delivery services. Thinking about the best way to allow healthcare organisations to connect with patients through all stages of life, knok developed its own patient journey engine. By combining our clinical expertise with our technology foundation, we created a platform that enables automated structured interactions to engage with their patients whenever needed.

Each journey can include an unlimited number of patients and interactions and can cater to every specific need, from preventive cancer screening to chronic disease management. This means being able to send appointment reminders, educational content, PREMs or PROMs, surveys and many others through automated e-mail, SMS or WhatsApp messages.

Through personalised messages and interactions, we were already able to test our patient journeys for several purposes such as weight loss programmes, mental health promotion and elderly monitoring. The results were even better than expected:

knok's Patient Journeys results

< 6%

No-show rate

> 75%

Adherence to PROMs

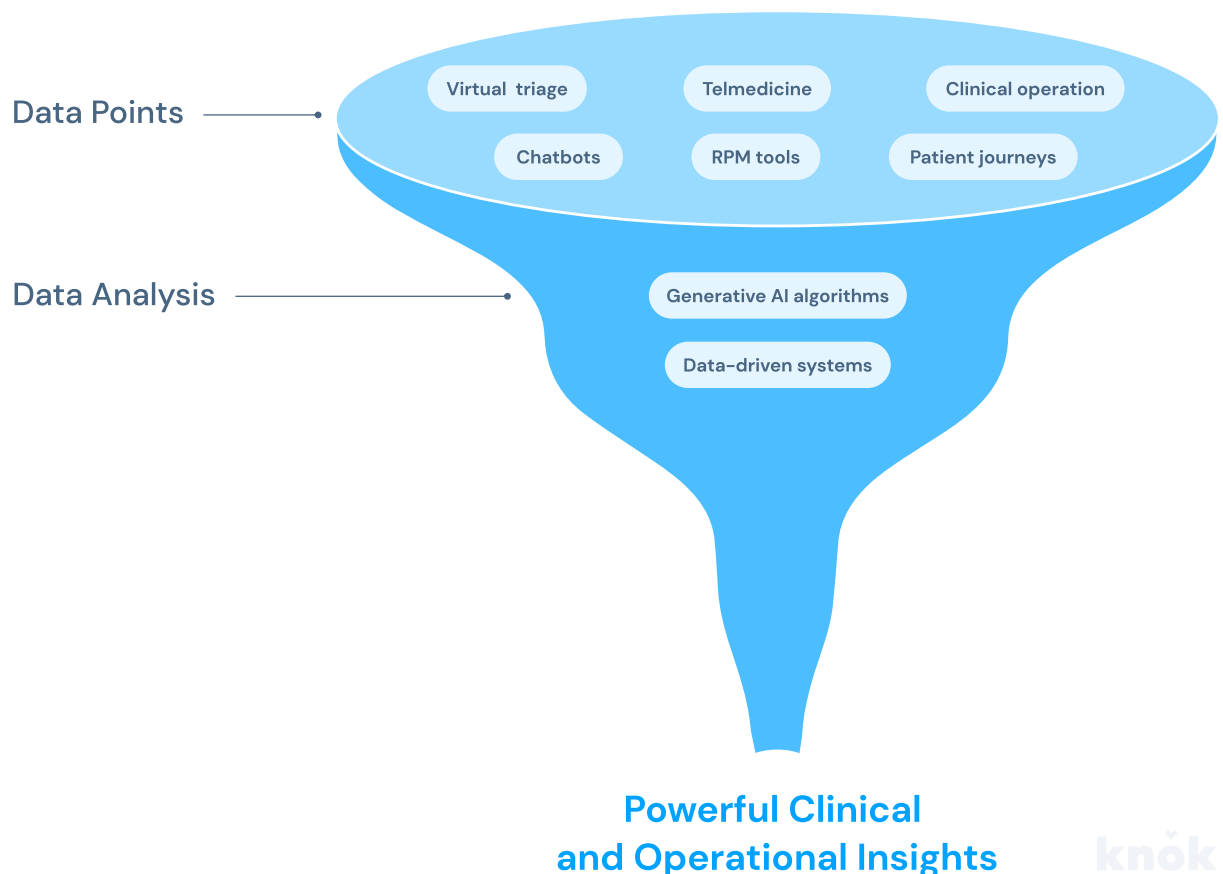
With a dedicated dashboard for every implemented journey, healthcare providers and payors can have access to valuable data regarding patient engagement and care delivery. By analysing the information, they are able to figure out which groups of patients are more or less engaged, which types of interactions work better and even gather insights for new service offerings. To make organisations' lives even more efficient, our patient journey engine can be seamlessly integrated with our white-label telehealth platform, enabling our clients to provide a complete offering.

The key to modern healthcare: a suitable data-driven system

According to Bain Health Systems Survey 2023, a high priority generative AI use case for health executives in short-term is structuring and analysing health data. This is actually one of the main uses of AI algorithms in healthcare, since with the variety of new health data available, the idea of efficiently analysing all of the data collected to create personalised treatments and care plans is not a futuristic plan anymore, we are doing it right now.

However, analysing health data collected from numerous fronts, such as telemedicine appointments, RPM devices, wearables, EHRs, PROMs and remote vital signs readings, is not an easy task. To use health data to extract valuable analytical insights in a secure way, healthcare organisations need to choose data-driven systems that allow them not only to receive data but to also act on it quickly. In our case, we collect information from over 150 data points that are treated in an anonymised way to extract powerful insights on healthcare service delivery and overall digital adoption. **Through our telehealth platform, we are able to collect data from over 150 data points.**

Health Data Funnel



To make sure we were taking the most out of the benefits of generative AI and all the collected health data, we use our RAAGA solution to analyse information in the most accurate and efficient manner. By combining the RAAGA with anonymised data, our system is able to generate valuable insights that can also improve clinical documentation and optimise workflows.

As mentioned before, most healthcare leaders are hoping to achieve digital transformation by 2025, but that's too far away. We are offering immediate digital transformation, and we can do in months what you expect to happen in two years.

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knok summary

Since 2015, knok has represented the forefront of digital health transformation evolving from virtual requests to home care appointments to an all-in-one suite of white-label telehealth solutions including a state-of-the-art telemedicine module, AI virtual triage and a fully customisable patient journey engine. We offer data-driven digital tools designed to make healthcare delivery more personalised and cost effective by promoting prevention and care continuity rather than only focusing on acute "sick care". With our turnkey solution, we allow healthcare providers and payors to implement a branded telehealth platform in a couple of weeks or a customised patient journey in just two hours. As a market leader in Portugal and with clients in over 12 countries, we truly believe digital health is the answer to bring healthcare to everyone, everywhere.

