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Editorial

COVID-19's impact on the future of digital health technology in primary care

Pandemic effects on use of digital health

The current COVID-19 pandemic is affecting primary care practice in many ways. In the past year, the use of digital health technologies (DHTs) has been growing without precedent. DHTs have a broad scope including telemonitoring, wearable health devices, apps and also artificial intelligence. While implementation and uptake of DHTs used to be challenging and proceed slowly, the COVID-19 crisis seemed to suddenly expand possibilities and adoption rates. The acquaintance with digital health might have planted a seed for more ideas. After all, it has been proven that DHTs can improve (the quality of) care (1–4), and promising applications are currently being developed. We should not waste this window of opportunity created by the COVID pandemic for implementing DHTs in daily practice, yet we still face some challenges. In this commentary, we will discuss the influence of the COVID-19 pandemic on the use of DHTs in primary care prior, during and ideas for implementing DHTs after the pandemic. We propose three main areas of interest to stimulate further application of DHTs: evidence, education and reimbursement strategies.

It has been more than a year since the WHO declared the worldwide COVID-19 pandemic. General practitioners (GPs) have been busy playing an important role in COVID-19 care, from diagnosing to treatment and palliative care, to prevention and vaccination campaigns. In the meantime however, GPs noticed a dramatic decrease in the amount of non-COVID-19 consultations, new (cancer)diagnoses and referrals to secondary care (5). It was found that patients tended to postpone their visit to a doctor because they did not want to bother health care staff even more (6). In addition, COVID-19 also challenged GPs' workflow. Often, primary practices had to cope with less capacity due to quarantine measures, and hospitals were often unable to accommodate for non-acute specialized care. This led to the necessity of finding alternative and creative solutions to guarantee proper quality of care to patients. Since then, the use of DHTs in both primary and secondary care has been growing at rates hereto unseen (7,8).

Prior to the COVID-19 pandemic

Over the past few years, DHTs were gradually introduced in primary care. Websites providing reliable and accessible information about symptoms and diseases, containing instructions for selfcare and when to contact a doctor (e.g. thuisarts.nl, gpinfo.nl or nhs.uk) were developed before the COVID-19 pandemic already, and seemed to reduce the amount of telephone consultations compared with usual care (1). Also, secure messaging applications enabling (visual)

communication between different health care providers became increasingly popular (9). Interestingly, video consultations or home monitoring applications were only scarcely used in family practice before the pandemic, although we were used to these technologies in our personal lives on a daily basis. This is also reflected by the paucity of studies investigating remote consultations in primary care before March 2020.

One of the few studies that already described remote consultations in primary care shows promising results. In this study, McManus *et al.* investigated the effect of telemonitoring in the titration of antihypertensive medication in patients with poorly regulated blood pressure. It was found that telemonitoring leads to significantly lower blood pressures than titration guided by clinical readings. Also, it was more cost effective than regularly care (10,11). Another study conducted in Spain studied the effect of telemonitoring on high risk patients with chronic conditions like hypertension, diabetes, heart failure and chronic obstructive pulmonary disease. Patients' weight and blood pressure were significantly reduced after 1 year. In addition, telemonitoring of high risk patients led to fewer GP and emergency department encounters compared with the year prior to the intervention (3). Nevertheless, large-scale implementation of DHTs in daily practice failed, most likely because of consistent barriers such as technical challenges, lack of reimbursement and difficulties with adapting DHT to the everyday workflow (12).

Effect of the pandemic

Just after the onset of COVID-19, comprehensive guidance on remote monitoring was developed rapidly. It covered technical set up to actual decision making for patients with (suspected) COVID-19, and practical applications followed soon (13). An increase in the use of remote consultations in primary care was seen in April 2020: 64–80% of GPs in the UK and the Netherlands performed video consultations, 13% used telemonitoring and 73% used electronic (asynchronous) consultations (14). The effect was strongest just after the onset of the pandemic; a decrease was observed between April and July 2020 again (15).

In hospitals, the use of DHTs seemed to grow and expand even more. One academic hospital in New York even reported an increase of 8729% in the use of video consultations. Patient satisfaction levels also improved significantly when compared with in-person visits, from 92.5% to 94.9% using Press Ganey scores ($P < 0.001$) (16). Another study reported a high satisfaction level among 90% patients that used video consultations (17). In addition to video consultations, remote monitoring applications for (suspected) COVID-19 patients also evolved in hospitals. One

example is the COVID-19 box, where patients monitor their vital parameters three times a day from home, and perform daily video consultations with the hospital (8). It was proven effective and safe, and led to a 3-fold decrease in the number of hospital admissions (2). In family practice, remote monitoring of patients with a high risk of deterioration to moderately or severe COVID-19 would also be of added value. Unnecessary visits to the emergency department could be prevented, and recovery at home could be facilitated. In our region, GPs started to hand out the primary care COVID-19 box since December 2020. Instead of being monitored by specialized nurses or doctors from the hospital, patients are monitored by home-care nurses from primary care, who are specifically trained in assessing COVID-19 patients remotely. If deemed necessary, they contact the patient's GP for further assessment.

In addition, initiatives in which primary and secondary health care professionals collaborate on the remote management of COVID-19 patients started (18). This has great potential, since it may enable patients staying at home, optimize capacity and reduce further risk of viral transmission. Nevertheless, this is a rather pristine field of expertise, in which the application of novel techniques also creates new challenges, such as shared responsibilities, costs and research. The fact that many different stakeholders interact can be complicating. Importantly, the responsibility of doctors to patients in 'doing good and do no harm' is extensive (19). Specific guidance describing the duties of health care professionals in the context of digital health is still absent. In addition, evidence and experience are still scarce. As such, legal and ethical dilemmas rise. These aspects are important topics of future research. In the meantime, the interests of patients remain vital. Excellent communication about the expectations and responsibilities of patients and health care providers when engaging with digital health is essential.

Harvesting the potential of DHTs

After a year of COVID-19, it is fair to say that the pandemic accelerated the implementation of DHTs in health care. Despite the unpleasant cause, many health care providers and institutions got rapidly acquainted with digital health care. Although the application of more digital health is not an end in itself, the potential to improve the quality of care is substantial (16,17). Thus, in our opinion, we should not waste this window of opportunity, and focus on three areas to substantiate the positive developments for DHT during the COVID-19 pandemic:

1. **Evidence.** As we are only gradually starting to learn about DHTs in primary care, primary care scientific departments should assist the field in building the evidence to support the use of DHTs in primary care. It is of utmost importance to share experience, and to scientifically and critically evaluate innovations. Both positive and negative outcomes should be published in peer-reviewed journals in order to allow for knowledge exchange and evolution of DHTs. Since DHTs mainly pose a complex intervention for which traditional methodologies may not always suffice, alternative approaches have been proposed which could be helpful to design research efficiently and distinguish the quality of digital health interventions (20).
2. **Education.** There is practically no place for digital health in current health care education at present. Curricula have to be modernized in this respect, since working with digital health requires

knowledge of health applications, digital data and conditions for successful implementation. Also, a different skill set to cope with changes in patient-provider or provider-provider relationships is required. To this extent, we recently published a guide on how to incorporate eHealth education in primary care training (21).

3. **Costs and reimbursements.** To harvest the potential of DHTs, we stress the importance of investing in research and development. Through the pandemic we have seen an increase in available funds for such initiatives (22). In addition, many initiatives are currently in their pilot phase and need to evolve into robust reimbursement that can provide the basis for use in future (post-pandemic) daily practice. A good example is the broad acceptance of reimbursement for telemonitoring that the Dutch National Health Authority declared during the pandemic (23).

In conclusion we found that COVID-19 has accelerated the implementation of DHTs and we should further stimulate the application of DHTs with evidence, education and reimbursement strategies.

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Data availability

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