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Strengthening primary health care in Europe with digital solutions

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Abstract This article provides an in-depth analysis of digital transformation in European primary healthcare (PHC). It assesses the impact of digital technology on healthcare delivery and management, highlighting variations in digital maturity across Europe. It emphasizes the significance of digital tools, especially during the COVID-19 pandemic, in enhancing accessibility and efficiency in healthcare. It discusses the integration of telehealth, remote monitoring, and e-health solutions, showcasing their role in patient empowerment and proactive care. Examples are included from various countries, such as Greece's ePrescription system, Lithuania's adoption of remote consultations, Spain's use of risk stratification solutions, and the Netherlands' advanced use of telemonitoring solutions, to illustrate the diverse implementation of digital solutions in PHC. The article offers insights into the challenges and opportunities of embedding digital technologies into a multidisciplinary healthcare framework, pointing towards future directions for PHC in Europe.

PALABRAS CLAVE
Salud digital;
Atención primaria;
Telesalud;
Respuesta sanitaria COVID-19

Fortaleciendo la atención primaria en Europa a través de soluciones digitales

Resumen Este artículo proporciona un análisis profundo de la transformación digital en la atención primaria (AP) en Europa. Evalúa el impacto de la tecnología digital en la provisión y en la gestión de la atención sanitaria, destacando las variaciones en la madurez digital en el contexto europeo. Enfatiza la importancia de las herramientas digitales, especialmente durante la pandemia causada por la COVID-19, para mejorar la accesibilidad y la eficiencia en la atención sanitaria. Se discute la integración de la telemedicina, la monitorización remota y las soluciones

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de e-salud, mostrando su papel en el empoderamiento del paciente y el cuidado proactivo. Se incluyen ejemplos de varios países, como el sistema de prescripción electrónica de Grecia, la adopción de consultas remotas en Lituania, el uso de soluciones de estratificación de riesgo poblacional en España y el uso avanzado de soluciones de telemonitorización en los Países Bajos, para ilustrar la diversa implementación de soluciones digitales en AP. El artículo ofrece perspectivas sobre los desafíos y las oportunidades de incorporar tecnologías digitales en un marco de atención sanitaria multidisciplinario, apuntando hacia futuras direcciones para la AP en Europa.

Background

Digital transformation is expected to have a significant impact on primary care, improving both its delivery processes, including service planning, design, organization, and management, and its outputs, such as accessibility, quality and safety, effectiveness, and responsiveness.[1,2]

Digitalizing primary healthcare (PHC) increasingly appears in national health policy agendas while exciting solutions are designed and implemented in many countries. Digital innovations are already playing a critical role in the management and delivery of PHC and also have the potential to facilitate the integration of care provided at different levels of the health system and across sectors.[3] Yet, due to technological, financial, professional, and other barriers, there remains a significant variability in the digital maturity of primary care systems within and across countries, leading to uneven distribution of its potential benefits.[4] For example, within the European Union (EU), a recent report found that the use of digital health in primary care increased between 2013 and 2018, with the implementation being the most advanced in countries such as Denmark, Estonia, Finland, Spain, Sweden and the United Kingdom, and the least progress in countries such as Greece, Luxembourg and the Slovak Republic.[5]

Following the outbreak of the COVID-19-pandemic, digital solutions presented themselves as a tool to bridge gaps and ensure continuity of service provision, and the perception of many such solutions changed from being viewed as 'interesting potential opportunity' to a necessity, facilitating their accelerated adoption.[2,6] For example, the use of remote consultations increased exponentially in many countries following the suspension of non-essential care, particularly at the level of primary care.[7–9] This greater use of digital health tools during the pandemic has been facilitated by policy changes to regulation and reimbursement, investment in technical infrastructure, and training for health professionals.[2] To maximize the benefits of increased utilization of digital health tools and ensure their continued value in primary care and other parts of the health system, even after the pandemic is brought fully under control, proactive measures must be taken to capitalize on the current momentum surrounding their implementation.[2]

In the European region, digital health has been acknowledged as an important lever to PHC strengthening and was a key theme of the 71st session of the WHO Regional Committee for Europe.[10] It has been agreed that harnessing digital solutions will be essential for modernizing and improving PHC delivery models, supporting the delivery of hybrid services safely during emergencies and helping to optimize the pursuit of health and well-being. Digital solutions carefully combined with face-to-face services delivery and mobile teams, can extend the reach of PHC in rural and remote areas, taking into consideration digital literacy and comfort using digital solutions in different groups.[2,11] In emergencies, using digital solutions in primary care allows for remote services delivery and resource prioritization. Investment in digital solutions, such as integrated health databases and risk stratification tools, can also make a difference in identifying and reaching the vulnerable populations. Digitalization of primary care should also take into account the broader goals of primary care and can help to promote and strengthening multidisciplinary approaches, improving access to healthcare, proactive and targeted service delivery and patient empowerment for self-care.[2,12]

The objective of this paper is to explore and articulate the evolving dynamics of digital transformation within PHC. It aims to analyze the impact of technological advancements on healthcare delivery, patient engagement, and operational efficiency by providing a comprehensive overview of current trends, challenges, and opportunities in healthcare IT, emphasizing the role of innovation in enhancing patient care and organizational effectiveness. Through a set of examples, this paper intends to contribute valuable insights and recommendations for healthcare professionals and policymakers navigating the digital healthcare landscape.

Promoting and strengthening multidisciplinary approaches to healthcare

Multidisciplinary approaches to healthcare have become increasingly important in recent years. This recognizes that healthcare is not just about treating illness, but rather about supporting the health and well-being of individuals, families, and communities as a whole. Such approaches involve collaboration between healthcare professionals from different disciplines, including physicians, nurses, pharmacists, social workers, and mental health professionals, amongst others, to provide comprehensive care that addresses the physical, emotional, and social needs of patients.[13,14] Digital

COUNTRY EXAMPLE 1
GREECE ePRESCRIPTION

In Greece the pandemic caused by the COVID-19 acted as a catalyst to paperless ePrescriptions.[16] Even though the ePrescription system became mandatory in 2012 for all medication prescriptions and diagnostic test referrals, many barriers prevented its full implementation.

During the pandemic and under the leadership of the Ministries of Health and Digital Governance, new legislation was published between March and August 2020, removing most of the barriers and facilitating the adoption of paperless prescriptions across the country.

The implementation of paperless ePrescriptions in Greece has greatly improved the capacities of primary health care services and has fostered the elimination of accessibility barriers

solutions can support multidisciplinary primary care teams by facilitating communication and collaboration between team members, improving information sharing, and enabling remote consultations with, for example, shared calendars, task lists, and communication platforms. The effective implementation of digital solutions also requires efforts to strengthen the digital literacy of healthcare professionals, involve patient perspectives and address regulatory and privacy concerns.[2]

Shared or integrated electronic health records (EHRs) are key enablers for this multidisciplinary approach. These aim to improve patient safety and outcomes by increasing the accessibility, comprehensiveness and portability of health information, enhancing connectivity between healthcare professionals involved in patient care, encouraging patient engagement and facilitating collaborative care.[15] Integrated EHRs can also facilitate population health management by enabling PHC professionals to identify health trends and manage chronic diseases.[16] By having access to comprehensive patient data, PHC professionals can develop more effective care plans and interventions, monitor patient progress, and track health outcomes.

Other tools for electronic clinical communications (often integrated with EHR) are designed to support patient referrals, specialist letters, the sharing of hospital discharge documentation, electronic health event summaries, e-prescribing, test ordering, laboratory results access, healthcare provider and service directories, shared care planning, appointment booking, etc. All of these tools can enable care to be integrated and coordinated around the person and assist PHC professionals with monitoring their patients' interactions across different health settings. Improving technical and data interoperability and standards is important for the efficient implementation of such collaboration tools. Increasingly EHR and communication platforms will integrate social, and patient reported data from patient-face health apps, acknowledging the role of patients and families within multidisciplinary care teams.

Improving access to the healthcare system

Improving access to healthcare in a person-centred approach involves putting the individual at the centre of their care and tailoring services to meet their unique needs. It prioritizes effective communication, timely access, health equity, patient-centred services, and the use of technology. There are several challenges that can impact access to primary healthcare, including accessibility and equity issues due to workforce gaps, rising chronic disease, ageing populations, and financial constraints. Digital solutions can help to ameliorate these through supporting new ways of working, such as hybrid care or integration of automated administration, but changing patient expectations while preserving care continuity and safety requires careful handling.

Telehealth includes audio or video conferencing between patients and professionals, often supported by EHR, remote monitoring, often integrating decision aids and alerts, as well as semi-automated administrative and triage tools. During the COVID-19 pandemic, for example, remote triage using humans and algorithms helped to connect patients with appropriate services. This included medical teleconsultation for acute illness, nurse-led chronic disease reviews, remote therapeutic interventions (e.g. for mental telehealth) and remote pregnancy monitoring. It also offers convenient professional-to-professional interaction, such as advanced video links for early stroke detection, teleradiology and assisted surgical procedures.[7,17]

A key aspect of remote patient monitoring is the collection of patient data to inform safe and supportive care beyond traditional health and care settings. This ability is driving the widespread update of remote monitoring technologies. Hybrid approaches include well equipped community nurses visiting patients in rural areas and connecting them to digital ECG, as well as the use of digital stethoscopes, point of care devices for basic lab parameters, mobile ultrasounds, and smart glasses, all of which can transmit data for processing.[18]

The amount of data being generated and captured is growing exponentially and this can be used to train AI and machine learning models to monitor health conditions, provide more precise diagnostic support, allow for early warning alerts for health emergencies, support clinical decision making and monitor the performance and safety of digital solutions. All of this combined will create a recognizable value proposition to the patient in the near future, including the delivery of personalized health insights and

COUNTRY EXAMPLE 2
LITHUANIA REMOTE CONSULTATIONS

The impact of the COVID-19 pandemic in Lithuania came together with a set of strict public health measures that limited the accessibility to primary care services.[42] With the idea to ensure the continuity of care while protecting both the citizens and healthcare professionals from possible infections the country initiated a strong shift from in-person to remote services. The transformation process was led by the Ministry of Health, operationalised by the Family Medicine Committee, and required from rapid changes in the legal framework. Representatives from the government, scientific societies and professional associations in primary care actively participated in the process which greatly contributed to the acceptability of the new care delivery model.

From March 2020, all primary care teams in Lithuania shifted to remote consultations. Face to face consultations were only possible after a remote triage process. The role of community nurses expanded and became key to deal with chronic and COVID-19 patients. Furthermore, the model also served the purpose of establishing the communication channel between primary care and hospital specialists. As the different waves of the pandemic succeeded, primary care had an increasing role becoming essential for the control and management of the pandemic in the country.

recommendations. While much discussion of AI and machine learning in medicine involves biomedical and research applications, such as its potential in clinical trials, examining neurological disorders via the analysis of real-time digital biomarkers,[19] such patient-level health intelligence also offers opportunities to enrich and improve primary healthcare through informing clinical decision making and rendering complex information accessible and actionable to members of multidisciplinary care teams.[42]

Enabling proactive and targeted service delivery

Using data and technology to identify areas of need and inform targeted interventions can improve patient outcomes and reduce healthcare costs, on a population level, provided these are implemented.

On an individual level, it can help to provide the right care to the right person at the right time, this supporting a key principle of the European Pillar of Social Rights.[20]

The identification and timely provision of the right care to vulnerable individuals requires shifting from a diagnosis-centred to a person-centred approach that considers the entire situation of the individual, which can be difficult to achieve in time-pressured primary care setting, particularly where care continuity by a known family doctor cannot be guaranteed. Digital information systems and decision aids can help to surface and summarize complex health needs; for example, using tools that summarize comorbidity burden and aggravating situations in a single measure. Although the final appraisal of complexity should be made by considering clinical, individual and social factors measuring them separately allow identifying the source of vulnerability or which sphere contribute more to this vulnerability.

Digital case-mix tools also offer primary care organizations with the means to easily understand the complexity of their patient population, to support strategic decision making around clinical priorities and resource allocation.[21] This principle has been confirmed in benchmarking analysis of tools for stratifying the population based on the comorbidity burden. In these analyses, models such as the Adjusted Morbidity Groups, which considers and weighs all possible diagnoses (both chronic and recent acute conditions), predicts better relevant outcomes of health and resource utilization than other tools based on limited lists of diagnoses or unweighted measures of multimorbidity.[22,23] These case-mix tools for summarizing health complexity can be tailored to specific conditions, such as COVID-19, for which the measurement of risk at the population level is mainstay for stratify-and-shield strategies.[24]

The exhaustivity and completeness of a case-mix tool for describing the health complexity of the population is constrained by the amount and types of information recorded in routine care. However, according to a regional initiative of various European countries for Advancing Care Coordination and Telehealth Deployment (ACT),[25] population-based health risk assessment tools should meet some characteristics that are only possible in healthcare s with appropriate information systems.

Although the main interest within a public health strategy is to identify people at risk among the general population, these tools can be developed for hospitalized population for stratifying patients on admission and planning the allocation of health care resources.[26,27]

In the last decade, the number of wearable devices for supporting self-care in patients with non-communicable diseases has risen substantially, particularly in the context of cardiovascular disease, diabetes, and mental health. Although evidence of their efficacy is mixed, successful examples have been shown to improve the self-care of patients with NCD in a cost-effective way.[28] Aside from encouraging and empowering patients to engage in healthy behaviours, adhere with medication and track their symptoms, these devices allow healthcare professionals to remotely monitor disease progression and schedule visits in the event of signs of exacerbation or decline.

A number of digital interventions have been specifically designed to promote and monitor medication adherence in patients with polypharmacy. Although their effectiveness is

COUNTRY EXAMPLE 3
SPAIN RISK STRATIFICATION TOOLS

For many years, Spain has been a frontrunner in the implementation of risk stratification tools and solutions. In primary care these solutions have been widely used for case-finding, care management programmes for complex chronic patients and lately for decision support on admission pathways.[43] The Spanish Ministry of Health has fostered the implementation of the Adjusted Morbidity Groups (AMG) across the regions, a tool which has shown better performance than other measures of multimorbidity.

In the region of Catalonia, all primary care professionals can access the AMG scoring for all 7.7M citizens from the electronic medical record and actively use the scoring for case-finding and chronic care management. Also, a recent risk stratification model for COVID-19 based on the AMG has proven to be a great predictor of severe outcomes such as hospital admission, transfer to intensive care unit and death.[16]

as yet unproven[29] there is growing awareness of the features likely to improve their quality.[30,31]

Another class of technology with potential to augment primary care is 'digital therapeutics' (DTx). These use software programmes to deliver tailored evidence-based therapeutic interventions for clinical conditions such as diabetes or depression. These can be used independently or in concert with medications, devices, or other therapies to optimize patient care and health outcomes. In primary care, there is potential for such tools to be integrated within an extended portfolio of prescribable non-pharmaceutical interventions, such as exercise classes.

In addition to digital tools aimed at patient adherence with medication, digital solutions can offer useful solutions for community pharmacies as part of the primary care family. These healthcare entities are ideally placed for monitoring medication uptake and identifying potential drug-related health problems. For this reason systems that allow the timely sharing of information between community pharmacies, doctors, and nurses can help to support medication reconciliation, optimize clinical and cost-effectiveness and improve patient safety.[32,43]

Empowering patients towards self-care

Patient empowerment in self-care involves providing patients with the knowledge, skills, and resources they need to manage their own health and well-being. Self-management can encompass a wide range of activities, including medication management, symptom monitoring, lifestyle changes, and disease management.

A patient portal is a secure online website that gives patients 24-h access to their health records and other personal health information. Using different authentication methods, patients may grant access rights to different health professionals to view information such as prescriptions, scheduled appointments, lab results, discharge letters, etc. Patient portals can enable communication between citizens and PHC professionals; for example, by sharing care plans created in the clinic, or patient data uploaded from home testing devices (e.g., glucometer), or education and information which, together, may improve patients; self-care, well-being and sense of empowerment.

From a policy perspective, the use of smartphones and tablet devices creates opportunities for health authorities to release clinical burdens by enabling and motivating preventive self-care and self-management of minor conditions. Integration of information from these digital technologies will also allow clinicians to tap into a rich ecosystem of data, provided patients consent. As consumer demands and stronger regulation improve the security of mobile technologies, health professionals may increasingly integrate mHealth solutions within their standard health and care practices.

The global wearable health technology market has continued to expand and normalize in society. While the largest segment is wellness tech, such as fitness and mood monitors, requiring low levels of regulatory approval, clinical applications of remote monitoring and digital therapeutics are also migrating to wearables, often the same ones already owned by consumers, such as the Apple watch. Alongside this we are seeing a rise in pervasive home-based sensors and imaging technologies. These are being driven by an ageing population, improved supply and affordability, enhanced functionality and better integration with other technologies and services. The separation between bespoke devices such as ambulatory EEG monitoring equipment, and personal mobiles is narrowing, with smart watches now detecting biomedical parameters such as blood pressure, heart rate and movement, with reproductive health, diabetes, and sleep apnoea trackers expected to follow.[33] However the software or apps that measure and process health metrics need to be recognized as 'medical devices' to meet the regulatory requirements needed by health payers' if they are to be safely harnessed in primary care. Once this has been achieved then data from smart watches and other wearables may be integrated with healthcare systems, enabling more informed and shared decision making between the patient and their healthcare providers.

While futuristic biomedical sensors such as smart clothing and tattoos have languished at the 'innovations' stage, others, such as implanted diabetes pumps are a thriving reality based largely on their convenience for patients and their data is already proving useful for self-care, clinical management and research.[34]

COUNTRY EXAMPLE 4
NETHERLANDS WEREABLES FOR SELFCARE

The Do CHANGE project[44] builds on the principle that empowering citizens to manage their own health and disease will result in more cost-effective healthcare systems by improving utilisation of healthcare, enabling the management of chronic diseases outside institutions, improving health outcomes, and by encouraging healthy citizens to remain so.

Do CHANGE developed a health ecosystem for integrated disease management of citizens with high blood pressure and patients with ischemic heart disease or heart failure. The system gives them access to a set of personalized health services in a near real-time fashion. This disruptive system incorporates the behaviour change methods, such as "Do Something Different", in conjunction with new innovative wearable/portable tools that can scan nature and volume of food and fluid intake, monitor behaviour and clinical parameters in normal living situations.

The complex digital intervention proven its ability to shift the behaviour of patients towards better cardiac lifestyle routines,[35] its clinical effectiveness[36] and cost-effectiveness.[37]

The network of hardware that connect and communicate to each other via the internet, with health and care sector has allowed for the smart management of standard healthcare processes, self-care and self-management, falls detection, remote monitoring, and more.

Online social networks could act as a trustworthy online platform for the communication of health information and education to citizens (e.g. for infodemic management) and as a useful communication interface between PHC providers organizations and citizens, although not for providing healthcare as such, given the risks to confidentiality and safety.

There are examples of complex digital interventions including a variety of technologies seamlessly integrated that have proven its ability to shift the behaviour of patients towards better cardiac lifestyle routines,[35] its clinical effectiveness[36] and cost-effectiveness.[37]

As we move through the decade, we are likely to see integration of 'AI' innovations such as natural language processing for medical record summarization, humanoid chatbots, in-clinic biomedical screening and real-time predictive, personalized health interventions, alongside seamless data sharing between primary care, public health and clinical research. Public engagement, privacy, good-governance and tangible benefits will be necessary for this to be acceptable, fair and safe.[38,44]

Conclusion

Digitalization is set to have profound impact on the delivery, quality, efficiency and outcomes of primary healthcare and is essential for responding to major crises like the COVID-19 pandemic. Although digital maturity levels vary across Europe, digital solutions, from telehealth to ePrescriptions, are crucial in improving healthcare accessibility and efficiency, while also offering new ways to achieve the vision for integrated care. However, embedding these innovations into existing healthcare systems comes with technological, infrastructural, professional, and cultural challenges, and change is likely to be incremental.[38] Long-term policy efforts to encourage institutional and professional collaboration, regulatory maturity, public engagement and innovation will be needed to fully realize the benefits of digital transformation in primary healthcare across Europe. The World Health Organization for the European Region has recently set out its agendas for digital health[39] and primary care[40,41] and we encourage all countries to participate in taking this forward.

Ethical approval

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Conflict of interest

The authors declare that they have no conflicts of interest relevant to the content of this manuscript.

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