Transformations in the landscape of primary health care during COVID-19: Themes from the European region

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ABSTRACT

The COVID-19 pandemic has dramatically impacted primary health care (PHC) across Europe. Since March 2020, the COVID-19 Health System Response Monitor (HSRM) has documented country-level responses using a structured template distributed to country experts. We extracted all PHC-relevant data from the HSRM and iteratively developed an analysis framework examining the models of PHC delivery employed by PHC providers in response to the pandemic, as well as the government enablers supporting these models. Despite the heterogenous PHC structures and capacities across European countries, we identified three prevalent models of PHC delivery employed: (1) multi-disciplinary primary care teams coordinating with public health to deliver the emergency response and essential services; (2) PHC providers defining and identifying vulnerable populations for medical and social outreach; and (3) PHC providers employing digital solutions for remote triage, consultation, monitoring and prescriptions to avoid unnecessary contact. These were supported by government enablers such as increasing workforce numbers, managing demand through public-facing risk communications, and prioritising pandemic response efforts linked to vulnerable populations and digital solutions. We discuss the importance of PHC systems maintaining and building on these models of PHC delivery to strengthen preparedness for future outbreaks and better respond to the contemporary health challenges.

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1. Introduction

Since the start of the COVID-19 pandemic, many primary health care (PHC) providers across Europe have faced the challenge of maintaining essential health services while contributing to the COVID-19 emergency response. PHC includes primary care providers (e.g. family doctors or general practitioners) who act as the first level of professional care where people present their health problems and the majority of curative and preventative health needs are satisfied [1,2]. Yet PHC also includes public health and other community providers (e.g. pharmacists, opticians and in some cases social care providers), which if aligned with the World Health Organization's vision of a strong PHC system, would work as integrated health services with primary care to maximize the level and distribution of health and well-being across a population [3].

The mix of disciplines that make up the primary care workforce may differ from country to country, but general practitioners (GP) or family medicine practitioners are often considered to be the core of primary care [4]. Other than GPs/family practitioners, the most common primary care providers in Europe are general internists, general paediatricians, pharmacists, primary care nurses, physiotherapists, podiatrists, home care workers and mental health care professionals [4]. The skills and competencies employed by the workforce also vary significantly across countries, as does the training, system level funding and facilities, thus demonstrating the heterogeneity of PHC across different countries in Europe.

The models of care employed by PHC, the focus of this paper, are conceptualizations of how services are delivered. Models often co-exist, and will necessarily adapt with changing aims, priorities and required functions within a health system. Models are facilitated by structural elements such as governance, financing, workforce, information systems, etc. and thus will differ based on their context, whether it be in a fragile, conflict-affected setting or a

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stable upper-middle income country or between urban and rural communities [3].

There has been limited examination of the PHC models of care employed during the pandemic to date. Researchers have instead examined local or regional PHC levels of preparedness or response to the pandemic [5–7] or studied patient activity in PHC, noting decreases in the provision of chronic care [8] and screening [9], and declines in the number of physical consultations in both clinics [10,11] and pharmacies [12]. Publications of surveys of PHC providers have attempted to highlight their levels and causes of anxiety [13,14]. Additionally, a few multi-country papers, policy briefs and guidance have described key service changes, innovations across Europe, and the impacts on patients with chronic conditions [15–18]. We contribute to this literature base by bringing together examples of PHC delivery from international contexts.

In this article we aim to describe and discuss three prevalent models of PHC delivery that we saw either emerge or become strengthened in the WHO European region during the pandemic: 1) multidisciplinary primary care teams coordinating with public health; 2) PHC providers defining and identifying vulnerable populations; and 3) PHC providers using digital solutions for remote care. We also describe the strategic enablers employed by central and local governments that supported health systems to respond to the pandemic.

2. Methods

The examples presented in this article have been compiled from the methodology used and content reported in the Health System Response Monitor (HSRM), an online platform established in March 2020 in response to the COVID-19 outbreak to collect and organize up-to-date information on how countries in the WHO European region and Canada are responding to the crisis (see: www.COVID19healthsystem.org). It is a joint initiative by the European Observatory on Health Systems and Policies, the WHO Regional Office for Europe and the European Commission.

The HSRM content is structured broadly around the standard health system functions [19], capturing information on policy responses related to governance, resource generation, financing, and service delivery. In addition, the HSRM includes policy responses that aim specifically to prevent transmission of the virus and other non-health system measures. The information is collected and regularly updated by way of an evolving set of questions that serve as prompts for countries' health policy experts contributing to the platform. By following a structured questionnaire and having a team of Observatory staff editing the responses, information is collected in a way that enables broad comparisons across countries.

Data recorded in the HSRM between March 2020 and March 2021 serve as the primary source for this article. The analysis process started with the extraction of all PHC-related data followed by the inductive and iterative development of an analysis framework, which we agreed through reviews of the data and discussions among all co-authors. The final framework included three models of PHC delivery and four system enablers, each which had at least half of the countries populated with information on the theme. We additionally drew in relevant literature and personal knowledge of country case study examples.

This article does not aim to answer why some countries have responded better to the pandemic than others. Instead, we draw out interesting patterns that highlight how this period of time has transformed the PHC landscape. The absence of a country in a particular theme in the results section does not necessarily mean it did not employ the models or system enablers examined, but rather, that limited information was available at the time of data collection.

Attributing any causal link between PHC policy response and pandemic outcome presents a multitude of methodological challenges – while some would suggest that strong PHC systems have been a 'robust first line of defence' [20], others note that good PHC systems in advance of the pandemic have not in fact guaranteed a good response [21] – so this analysis instead intends to describe and assess policy responses and draw out critical lessons. This analysis can serve as a basis from which to continue investigating how models of PHC delivery respond to global crises across country contexts.

3. Results

To respond to the COVID-19 pandemic, PHC providers across Europe have delivered both essential (non-COVID) services and COVID-19-related services using varied approaches. Here we highlight three key models of PHC delivery drawing on reports by country experts and we describe four system enablers put in place by central and local governments to facilitate their rapid development. On the whole, we saw few examples of enablers that solely or directly targeted PHC providers or models of care.

3.1. Model of PHC delivery 1: Multi-disciplinary primary care teams and public health coordinated their contributions to the emergency response

While PHC roles differed across countries, in aggregate, PHC providers during the COVID-19 pandemic may have been involved in managing the testing, remote triage, treatment of mild and moderate COVID-19 cases, surveillance, data collection, reporting and monitoring, prevention messaging and vaccine delivery – all while also maintaining delivery of essential (non-COVID) health services. The locations in which the PHC-based emergency response was delivered varied across contexts, with testing and monitoring taking place in PHC-led centres, on the phone, and in private homes. Table 1 describes examples of coordinated efforts between PHC and public health.

3.2. Model of PHC delivery 2: PHC providers prioritised vulnerable patients

PHC providers play a crucial role in ensuring that vulnerable populations receive essential care, and given the disproportionate impact of COVID-19 on those most vulnerable, it was important that PHC providers quickly identified those who might have needed extra support. Country approaches have differed substantially in terms of defining and identifying who was 'vulnerable' or 'at risk' and also on what PHC actions supported these groups.

In some countries, such as Finland and the UK, PHC providers and local government labelled anyone using long-term care services as vulnerable and proactively offered PHC services. In Estonia, any older person living at home was offered home-based PHC support and treatment. In Croatia, family doctors were required to call their palliative patients and advise on action if they experienced potential COVID-19 symptoms or those symptoms worsened, and they offered home-based medical examinations or the taking of blood samples for those who were immunocompromised. Family physicians in Turkey gave telephone counselling to older patients with chronic diseases, and these same patient cohorts were offered home medicine delivery in Albania. In some countries, mobile services - or services provided in-person outside of a healthcare facility setting - were organized for vulnerable patients. For example, three-member PHC teams visited individuals in care homes and in private homes to deliver essential services in Lithuania, and in Luxembourg the general physicians had this role. In Kazakhstan, nurse-led teams triaged vulnerable patients for a PHC

Table 1

Select examples of primary care and public health coordination during COVID-19

Activity	Select country examples
PHC facility-based testing and triage	Health centres in Greece's capital region were designated for testing, triaging and treating COVID-19 patients. Similarly most testing and provision of medical advice in Belarus, Iceland and Spain were at PHC-led health centres. In Belarus PHC providers (GPs) led testing alongside physicians at designated hospitals. While some centres created separate routes within PHC provider locations that meant suspected cases did not meet with non-COVID related essential services (e.g. Spain), the advice to PHC providers in the Netherlands and Iceland was to operate separate office hours within the same sites for patients with respiratory complaints or COVID symptoms, respectively.
Telephone-based triage for COVID-19 diagnosis	Triage telephone lines were staffed by public PHC centre teams (e.g. Malta) or staffed by GPs in Hungary and Ireland. More specifically, in Hungary, PHC providers undertook telephone-based health checks and referred suspected cases to the National Emergency Ambulance Service who took samples and organised lab testing.
COVID-19 case-tracing	Where tracing capacity was limited, public health authorities in the Czech Republic were assisted by police investigators, civil servants and private sector call centre operators. In Albania, PHC providers supported public health surveillance teams in case detection and contact tracing. Regional laboratories in Ukraine organized contact tracing and monitoring with the involvement of PHC workers virtually, by telephone or in-person visits.
Home-based monitoring	PHC providers in Albania and GPs and the Bulgarian Regional Health Inspectorate provided consultations and medical surveillance during quarantine – providing surveillance and home treatment of confirmed cases and for referring patients to a hospital if necessary and followed-up post discharge. Following confirmed COVID-19 diagnosis, mobile teams in Kyrgyzstan, Montenegro and San Marino followed-up with people under home-quarantine. A telemedicine centre was used to support PHC outpatient/home visits for suspected COVID-19 cases and follow up on cases not needing hospitalization (Moscow, Russia).
Delivering vaccines against COVID-19	The Croatian Institute of Public Health has been distributing COVID-19 vaccines its local sites where family doctors coordinate vaccination clinics with other clinicians. In Israel a network of community-based health care providers, namely nurses, have been supporting the delivery of vaccinations. In Finland, PHC physicians plan and implement vaccination clinics, and health professionals including physicians, nurses, public health nurses and midwives who have received adequate vaccination training, administer jabs.

Source: HSRM (last accessed: March 2021)

Note: examples in table are not exhaustive but represent a selection of varied ways in which primary care and public health coordinated their efforts.

facility-based visit, provided by a multi-disciplinary mobile team including general practitioner, nurse, social worker and psychologist or for a remote consultation.

To ensure comprehensiveness of reach to all vulnerable people, some services required a much broader definition of vulnerability (beyond their chronic health conditions or current level of need as proxied by use of care services). For example, many countries encouraged all vulnerable people to remain at home, and in some cases obliged them to do so except in the case of emergencies (e.g. Uzbekistan). Other broad-brush measures included free flu vaccines for all those designated as vulnerable (e.g. Ireland), medicine delivery to anyone with a prescription during lockdowns in Israel, minimum durations of prescriptions were introduced (e.g. one month in Croatia, three months in Moldova), and the abolishment of any approvals required for repeat prescriptions in some countries, including for example, Turkey and the UK. In these cases, the definition of vulnerable was intentionally widened to include older people, anyone with illnesses or chronic disease requiring medicines.

In summary, the HSRM data suggested that vulnerable patients were identified and prioritised using narrow definitions for medical outreach based on age, condition or use of care services. It remains unclear how approaches for those with access to linked data (e.g. Finland, parts of the UK) differed to those who use more rudimentary approaches to identification, as this level of detail was not available. However, broader definitions for vulnerability were used for public health initiatives, such as prescription allowances and delivery, compared to pre-pandemic medical outreach approaches.

3.3. Model of PHC delivery 3: Digital solutions enhanced the effectiveness of the PHC response to both COVID and non-COVID related care

The pandemic has led to the development, or increased use of, a number of digital innovations to deliver non-COVID and COVID-related PHC services across Europe, such as remote consultations and electronic prescriptions (see Table 2). In some countries, the

additional capacity for digital solutions was bolstered by retired GPs and other clinicians who had the ability to consult with or refer to a GP if required (e.g. UK). Or in others, by doctors who had temporarily shifted away from their usual work (e.g. Monaco). Capacity to deliver remote services was cited as a barrier in some countries, such as Malta, the Netherlands and Uzbekistan, and some HSRM respondents suggested this may have led to increased presentation in emergency services and increased reliance on informal carers.

Digital solutions played a key role in enhancing the effectiveness of PHC to manage non-COVID health care needs. In many countries they were supported by legislative frameworks to manage new technologies but also policies to manage a possible digital divide. Some of these supportive enablers are further described below.

3.4. System enabler 1: Increasing workforce capacity across the system

HSRM evidence described central government efforts to increase workforce capacity and encourage multi-sector teams in line with international guidance [22]. Governments created surge capacity in the workforce by asking for volunteers, including: students training in health and long term care; retired, semi-retired, overseas health and care professionals and trainees; private sector professionals; and the army. National governance requirements were relaxed in many countries to enable the extension of licences of retired professionals and allow task-shifting among professionals to manage capacity. To ensure the workforce was prepared for the frontline, some governments provided mass training to multidisciplinary staff on: diagnosing COVID-19; using PPE; using contact tracing systems; and providing treatment to patients who tested positive (e.g. Moldova, Montenegro, Russian Federation, San Marino, Serbia, Ukraine). There was evidence in the HSRM that many countries had redeployed health workers to different settings. For example, staff were deployed to hospitals instead of the community or rotated between different facilities or to different

Table 2
Examples of PHC based digital solutions

Activity	Selected examples
Remote consultations	- In some countries, existing video, telephone or other alternative consultation modes were scaled up, including in Albania, Denmark, Estonia, Finland, Iceland, Kazakhstan, Russia (Moscow), Sweden, and the UK.
	- While in other countries, new digital platforms were developed that managed all or most PHC appointments (France, Israel, Luxembourg, San Marino, Turkey).
	- Telephone consultations dominated over digital options in some countries including Albania, Belgium, Czech Republic, Kyrgyzstan, and Turkey.
Remote 'sick leave certificates'	- Certificates of incapacity for work were issued by telephone or video consultation in some countries, including Austria, Azerbaijan, Czech Republic, Luxembourg, and Malta (private sector only).
Remote digital monitoring	Remote digital monitoring from PHC teams was offered to:
	- people who had presented at hospital-based 'fever clinics' in Georgia or at 'corona care centres' in the Netherlands (via daily reporting of key measures such as oxygen saturation levels);
	- symptomatic and asymptomatic cases in Kazakhstan, as well as those who required essential services for chronic conditions in Moldova; and
	- participants in the Sputnik vaccine's Phase 3 clinical trial in Russia.
Electronic prescriptions	- Electronic prescriptions were introduced in several countries, including: Albania, Austria, Czech Republic, Macedonia, Lithuania, and San Marino.
Electronic referral procedures and online signposting	- Electronic referral to specialist providers was introduced in Croatia, as well as to COVID-19 testing facilities in the Finnish private sector.
	- Hospital referrals in Russia (Moscow) were supported by an online system that provided 'live' criteria and AI-assisted CT scans.
	- Online signposting to PHC clinics treating COVID-19 in Georgia.
Online symptom self-checking tool	- An online self-checker application that sends results directly to PHC centres (to help professionals anticipate demand) in Serbia.

Source: HSRM (last accessed: March 2021)
Note: examples in table are not exhaustive but represent select examples of digital adaptations.

disciplines, most notably to assist in intensive care units (ICUs), emergency departments or in the provision of telehealth services in PHC.

3.5. System enabler 2: Managing demand through risk communication and digital innovations

Strategies organized by many national governments attempted to manage demand for health services, including in PHC. Early in the pandemic, governments and professional bodies disseminated messaging to patients to stay away from primary care (and broader health services) unless their needs were critical. There were initial temporary decreases in activity in PHC in several countries, likely related to the cancellation or postponement of non-essential health services – a finding captured in other reports [16].

Other centralized efforts to manage demand were made through the government-funded development of public-facing digital innovations to relieve pressure on the whole health system. Examples of these included: ChatBots to guide people with COVID-19 symptoms to appropriate services (e.g. Denmark, Poland, Spain); apps to detect and trace potential contact with infected individuals (Ireland, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, UK); and interactive location maps of infected people (e.g. Armenia and Israel) or live 'risk assessment' maps based on numbers of local cases (e.g. Turkey). However, it is unclear to what extent these tools were used and could have impacted PHC demand. Some governments also introduced national mental health telephone support lines (e.g. Latvia, North Macedonia, Portugal) and advice lines to manage symptom-related queries and anxiety (e.g. Romania, Russian Federation), as well as increased benefits packages to include referrals to psychologists or prescribing psychotherapists (e.g. Latvia, Germany) – suggesting that at least some proportion of people experiencing mental health concerns could have self-referred directly to mental health support. Except for the digital tools, the centralized strategies put forward to manage demand would have still required extra health care worker capacity, some of which would have come from PHC providers.

3.6. System enabler 3: Prioritising vulnerable population cohorts

Centralized outreach and provider reimbursement schemes prioritised vulnerable patients. As described, many governments undertook broad measures focused on the needs of vulnerable and disadvantaged segments of the population, such as the distribution of masks (e.g. Romania, Germany) and personal hygiene kits (e.g. Serbia), thus undertaking some public outreach that could have fallen on local PHC providers. Moreover, there was evidence of additional payments to support existing mobile health teams in Kyrgyzstan, and increased fee reimbursement for prioritising vulnerable patients among Belgian PHC providers. Patient co-payments for COVID-19 related treatment and investigation were waived in Belgium, Hungary, Romania and Ukraine, and for medicines in Georgia and Turkey, as well as free testing across a number of countries which intended to encourage public presentation in PHC services.

Local governments and charities mobilising their community networks played critical roles in supporting vulnerable populations. Many volunteer networks were created to assist older people in the procurement of groceries, medicines, and other necessities (e.g. Italy, Montenegro, Serbia) and to provide home care (Cyprus). In Georgia, private donations funded packages of food and other necessities for older and vulnerable people, which were delivered by local volunteers. The Serbian Red Cross mobilised thousands of volunteers to check on vulnerable groups (e.g. older people, homeless and Roma families) and local branches of the Czech Red Cross organized one-day training sessions for people to volunteer within hospitals and care homes (maintaining a database to enable them to be employed on temporary contracts wherever needed). Furthermore, the involvement of the Icelandic and Dutch Red Cross organisations strengthened the capacity of government telephone helplines to assist people experiencing COVID-19 related anxiety. While not aimed at directly supporting PHC efforts, these activities intended to assist.

3.7. System enabler 4: Prioritising remote care

In some countries, national governments supported PHC providers to deliver remote care by procuring digital technology.

Examples in the HSRM included new funding for rapid upgrades in health information system hardware and software in Germany and increased funding for diagnostic equipment in Italy (e.g. telecare, tele-health services, telemonitoring and tele-dermatology devices). The UK government purchased 40,000 laptops for PHC providers.

The HSRM also highlighted that in some countries, support payments or codes to fee schedules for remote care were developed to enable PHC providers to deliver digital services including: medical advice in Belgium, Denmark, and Switzerland; remote triage in Ireland; and any digital arrangements necessary (via telephone or email) in the Czech Republic and France. The digital technology and support payments were intended to enable the management of symptoms in PHC, although the effectiveness of this remains to be evaluated. We also saw an example in the UK of data protection practices being temporarily relaxed to enable PHC providers to easily share read/write access to detailed medical summaries (including risks relevant to COVID-19) with local pharmacists and urgent care providers.

4. Discussion

The results demonstrate that PHC providers across the European region took various innovative approaches that made significant contributions to the pandemic response. The three main models of PHC delivery we identified were multi-disciplinary primary care teams and public health coordinating to contribute to the emergency response, PHC providers prioritising vulnerable patients for outreach, and PHC providers using digital solutions to widen patient engagement options. The data examined was available at the national level and variations were visible within models – this likely reflected the differences in PHC systems across Europe. Within these models of care delivery, PHC providers undertook a range of responsibilities that required coordinated efforts with other partners in the health and care system, and for some PHC providers, new ways of identifying vulnerable patients and providing outreach, and again for some, new ways of digitally engaging with patients.

We discuss the implications of our findings for future epidemics as well as the future of essential services below and suggest three areas for PHC providers to build on (from their learning during the pandemic) that align with principles of strong PHC described in the World Health Organization's Operational Framework for PHC and the Alma-Ata Declaration. These include: the varied forms of multidisciplinary collaboration seen during the pandemic should remain to manage short- and long-term challenges; vulnerable patients could be better supported through improved risk stratification approaches at the PHC level and countries should share successful 'how to' approaches; and the momentum seen in the use of digital innovations should continue.

4.1. Build on the multidisciplinary collaboration employed

Coordination between primary care and other parts of health system at the frontline of an epidemic is essential [23]. Yet in some European countries, primary care collaboration outside of an emergency is not a common feature in their health systems. The HSRM data revealed joint initiatives in country settings we know have little communication and collaboration between parts of the health system and case reports from the literature corroborated this finding. For example, case reports from Italian PHC providers described new collaborations between PHC and secondary care as some of the few positive outcomes of COVID-19 [24,25].

Team-based working will be important in safely resuming normal care post-pandemic. This will not only include collaboration between primary care and public health, but also with other providers in the health and care system such as community-based

and outpatient care to help manage complex cases of chronic disease and diagnostic services and acute care teams to detect and begin managing all new incidence of disease. The novel collaborations that have emerged during the pandemic must be harnessed and built upon rather than seen as an exceptional one-off response because recovering from limited access to PHC and secondary care services will be challenging. PHC providers have already raised concerns about the potential health consequences of postponed treatment, changes to normal and preventative services (e.g. cancer screening, vaccinations), loss of PHC contact with vulnerable groups (e.g. migrants, victims of domestic violence), prolonged social distancing, and an undermined social and economic life that have occurred during the pandemic [15,16,26,27]. One study from the UK found a 50% reduction in incidence of Type 2 diabetes and mental health conditions within a deprived population [28], and another in Germany found significant decreases in new cancer diagnoses across a range of specialities and age groups in 2020 relative to 2019 [29], suggesting under diagnosis of many conditions during the pandemic. It is possible that the long-term effects of the pandemic may prove to be as challenging as the need to respond initially, and approaches to multidisciplinary working outside of the four walls of providers' buildings may help prevent a discipline or part of the system being singlehandedly overburdened with complex patients.

4.2. Build on the identification and outreach approaches used

Many countries described in their HSRM entries which parts of the population were labelled as socially and medically vulnerable, but only a few suggested how these groups had been identified. An assessment of European primary care from 2015 suggested that with some exceptions the necessary outreach and anticipatory approaches to provide strong primary care were not widespread [4]. To build on the progress made during the pandemic regarding tackling risk and inequalities, in line with the WHO Operational Framework for PHC, a discussion about *how to do* identification and outreach may be helpful.

Approaches to identifying at-risk groups can vary depending on the potential outcomes and risk factors. Models can be simplistic, such as those that use GP clinical judgement and/or threshold models based on factors such as age and disease status. Models can also be more complex involving multi-factor risk modelling, such as in Catalonia, Spain where risk stratification software for non-communicable diseases combines biomedical health data with socio-economic status indicators (and thus social determinants), holistically classifying the local population, and providing information to PHC providers to facilitate proactive care of chronically-ill patients [30]. Sophisticated risk algorithms have also been helpful during the pandemic in predicting mortality from COVID-19, including a study in the UK that had 8.2 million adults in a dataset and demonstrated a sensitivity for identifying over 75% of deaths. This algorithm found that over 94% of deaths from COVID-19 occurred in individuals in the top quintile of predicted risk [31].

The urgency and risk of the pandemic and recovery phase for vulnerable populations points to the need for PHC providers to work with their health and long-term care systems to determine how data could be linked and used for risk stratification and population health management, ensuring that groups are targeted with appropriate levels of interventions. This could include, for example, finding ways to link PHC enrolment information with that of local organisations providing non-medical support or local governments / non-governmental organisations providing long-term care. Because data driven risk-stratification mechanisms will always be imperfect, it is essential to develop strong relationships between PHC providers and local organisations that have strong ties with

the vulnerable and socio-economically deprived in local communities. Local governments can play an important bridging role.

4.3. Build on the rapid agility of digital innovation seen

The HSRM described digital tools being developed by many governments (and others, such as private companies) and then being rapidly implemented by PHC providers across Europe during the pandemic. Almost overnight, remote consultations became the norm and significant work went in at the systems- and local-levels to make this happen. Interestingly, many country experts suggested that their national influenza pandemic preparedness plans had been revised to develop approaches to manage COVID-19 – no doubt future plans should examine the strengths and weaknesses in remote care provided through digital innovations and update their national emergency preparedness and response plans accordingly.

Using the UK as a case study of a review, the switch to digital working (as we understood it happened) was supported by a range of enablers that included: the centralized purchase of 40,000 laptops; the pre-pandemic existence of smart telephony systems; video consultation tools being developed and procured rapidly by central government and being available for download for free by PHC providers within a month; and improved patient data sharing capabilities enabling read/write access to patient records among a number of providers (e.g. community pharmacy, urgent care centres, national health advice telephone helplines), which was facilitated by relaxed legislation. At the PHC provider level, it is reported that the agility has been driven by a new culture of 'getting on and doing' and 'not asking for permission', yet required significant effort to redesign workflows and introduce changes in processes enabling new ways of working. A number of researchers are currently examining the unintended consequences impacts of digitally-enabled remote consulting because while digital technologies offer benefits for certain population groups, such as those living in rural areas, these benefits need to be balanced with the risk of digital exclusion [32], disruptions to continuity of care, and the jeopardization of quality of care and patient safety.

5. Limitations

This research has potential limitations. The data in the HSRM database was written by country experts using a template and edited by staff at the European Observatory on Health Systems and Policies. The country authors used different approaches to report on their health systems, including case reports drawing on personal experience, and had gaps in data entry. HSRM contributors will have also made interpretations about PHC from within their various country contexts, which we tried to remain mindful of during analysis but cannot be certain we completely accounted for because we did not confirm our interpretations with the country experts. However, our authorship team included experienced PHC researchers and technical officers responsible for PHC in the WHO European region. Furthermore, the HSRM template did not contain a specific section related to PHC, because it was designed around the main health system functions (e.g. financing, workforce, provision), so the content used in this article spanned multiple sections. Some gaps we identified with regard to PHC were addressed with additional checks with other local researchers and the literature, but some topical and country gaps remained including two major gaps described below.

The first major topical gap was that countries implemented schemes at a national level, many of which did not explicitly state a role for PHC providers. This included nationally implemented schemes for PPE procurement, financing, workforce, and support for vulnerable groups. As a result, the HSRM did not adequately capture local level initiatives implemented by PHC providers. However, this gap also may point to an under-emphasis at the national level in creating policies for PHC providers during the COVID-19 pandemic.

The second gap relates to the limited discussion of the connections between PHC and long-term care (LTC). Some of the most vulnerable groups reside in the LTC setting, and a large proportion of the deaths occurred in such facilities. While the HSRM contained examples where local governments led initiatives to proactively check in and monitor vulnerable older people, the examples of shared responsibilities at the interface between long-term care and PHC were lacking. Again, it is unclear whether these omissions from the HSRM are due to a methodological limitations or country-level omissions of these policies.

There remain many unknowns about the pandemic, including the effectiveness of some of the centralized efforts to manage demand, such as digital apps and messaging to avoid health services. We would encourage more research in these areas to benefit future infectious disease preparedness plans.

6. Conclusion

During the pandemic we have witnessed significant transformation in PHC services across Europe. PHC providers in many countries rapidly adapted their activities to focus on advising, triaging and managing treatment of COVID-19 cases – all while reaching out to vulnerable patients and maintaining access to essential (non-COVID) services for the wider population using new in-person protocols or new digital solutions. There is an urgent need to capture learnings from the pandemic that are specific to PHC services, and to turn these into strategic action plans to strengthen preparedness for future outbreaks and better respond to the contemporary health challenges.

CRediT authorship contribution statement

Stephanie Kumpunen: Writing – original draft, Writing – review & editing. **Erin Webb:** Data curation, Writing – review & editing. **Govin Permanand:** Writing – review & editing. **Evgeny ZHELEZNYAKOV:** Supervision. **Nigel Edwards:** Supervision. **Ewout van Ginneken:** Methodology, Conceptualization, Writing – review & editing, Supervision. **Melitta Jakab:** Conceptualization, Supervision.

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