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Sustainability and Resilience in the French Health System

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1. Introduction

The challenges faced by health systems worldwide have been rising over time with the rapid increase in costly new medical treatments and the mounting prevalence of non-communicable diseases in an ageing population. The French healthcare system is not spared by these pressures. In addition, the COVID-19 pandemic has tested its resilience to crises and increased the pressure on its long-term sustainability. Understanding the strengths and weaknesses of the French system and identifying potential solutions for its future sustainability and resilience is critical.

The Partnership for Health System Sustainability and Resilience (PHSSR) is an international research collaboration which aims to improve global health, by identifying issues and innovative solutions for strengthening health system resilience and sustainability worldwide (https://www.weforum.org/phssr/about). Sustainability and resilience are complex concepts without universally accepted settled definitions. They are determined by various aspects of how a health system is governed, organised and financed, and how services are provided.

Sustainability concerns the health system's ability to maintain key functions such as provision of services, financial protection, resource generation and responsiveness to population needs, by withstanding internal and external stresses (economic, social, epidemiological and environmental challenges). **Resilience** refers to a health system's ability to prevent, absorb, adapt and rebound stronger from a crisis while minimising negative impacts on population health, health services and the wider economy.

This rapid review on French health system is part of the pilot phase of the project developed by the PHSSR, running from September 2020 to January 2021, testing a common framework of analysis across eight pilot countries (England, France, Germany, Italy, Poland, Russia, Spain and Vietnam). The report uses the COVID-19 pandemic as a critical event to evaluate the sustainability and resilience of the health system in France across five key domains:

- Governance
- Health System Financing
- Workforce
- Medicines and Technology
- Service Delivery

The report additionally includes two case-studies, as examples of areas where local healthcare teams have shown innovation for improving the health system sustainability and resilience, either through long-term quality and efficiency objectives or as a response to the COVID-19 pandemic. The report draws on recent data, health policy reports and official evaluations of the COVID-19 policy response of the French government. The case studies are based on interviews with healthcare professionals and patients involved in these initiatives, as well as desk research.

Findings: key themes for sustainability and resilience

The COVID-19 pandemic has brought to light some structural weaknesses of the French health system, but also provoked changes which helped improving its resilience. Table 1 summarises the key findings for the five domains explored.

Table 1. Sustainability and resilience: summary of findings by key domain

	Sustainability	Resilience
Domain 1: Governance		
Strengths	▪ Clear objectives of universality and solidarity ▪ Strong national institutions supporting central governance	▪ Centralised response which allows for a quick reaction (emergency legislation, etc.) ▪ Accountability for government actions
Weaknesses	▪ High level of centralisation and bureaucracy ▪ Weak local health governance ▪ Disjointed management of primary, hospital and long-term care services ▪ Healthcare steering based on volume rather than care quality, access and efficiency objectives	▪ Little flexibility for adapting national policies to local needs ▪ Lack of coordination and communication between different levels of governance (region, *département*) ▪ Low level of involvement of patients and care providers in healthcare governance
Domain 2: Financing		
Strengths	▪ Universal health coverage ▪ Diversified revenue sources ▪ Structured monitoring of health expenditures by the parliament	▪ Quick allocation of new payments for supporting care providers ▪ Flexibility for increasing health budget from tax revenues ▪ Local innovation facilitated legally and financially
Weaknesses	▪ Segmented budgets for different healthcare providers ▪ Lack of connection between expenditure (resources allocated) and care quality and efficiency (performance of providers)	▪ Fee-for-service payment for providers which is a barrier for joint, integrated care provision ▪ Lack of clear funding rules for investment and prevention
Domain 3: Workforce		
Strengths	▪ Increase in the number of healthcare workforce over time ▪ High level reflections on the configuration of the health workforce, task shifting and new professional roles	▪ Flexibility in developing alternative solutions for patients during the COVID-19 pandemic (online consultations, back-up by medical care reserve or private hospital workforce…) ▪ Public-private partnerships in the hospital sector
Weaknesses	▪ Permanent geographical disparities ▪ A task-based rather than competency-based definition of health professionals remunerated on a fee-for-service basis	▪ Weak primary care and multidisciplinary training ▪ Inflexible staffing across organisations/sectors

	▪ Hard working conditions and low salaries in public facilities, especially for nurses and long-term care workers	▪ Underutilisation of nurses' competencies in the ambulatory sector ▪ Low staffing levels in long-term care facilities
Domain 4: Medicines and technology		
Strengths	▪ Strong national HTA with economic cost-benefit analyses incorporated into the process (value-based approach) ▪ Specific procedures to give access to innovative treatments ▪ Long-term investment in digital health & data	▪ Quick reaction to the strains on drugs during the COVID-19 crisis with a dedicated action plan (participation of the state in the procurement process) ▪ Strong support for tele-health solutions which enabled patient care continuity and may have longer-term impact in reinforcing patient centred care
Weaknesses	▪ Low national production capacity in preventive materials and some essential drugs and raw materials ▪ Low generic medication use ▪ Low public funding for fundamental health research ▪ Cautious evaluation process which does not encourage innovation	▪ Lack of sufficient stockpiles of PPE, medicines and other consumables to deal with the pandemic ▪ Difficulty in accessing health data for research ▪ Weak collaboration between universities and start-ups ▪ Slow/heavy administrative process
Domain 5: Service delivery		
Strengths	▪ High level of choice in healthcare delivery, both public and private ▪ Recent policies encouraging group practice and local care networks	▪ Relatively quick boosting of public-private hospital capacity ▪ Quick adoption of novel tele-health solutions
Weaknesses	▪ Highly fragmented care provision, with little collaboration between professionals across sectors ▪ Weak prevention and health promotion culture ▪ Healthcare governance by volume rather than quality and outcomes	▪ PPE and safety protocols were not available quickly across all sectors ▪ Failure to include primary care providers in the early pandemic response ▪ Failure to ensure all the care for non-COVID-19 patients

The French health system governance is highly centralised and shared between the government and the Statutory Health Insurance (SHI) funds. The fragmented governance of public health, primary, secondary and long-term care explains the uncoordinated response to the first wave of the COVID-19 pandemic where primary and long-term care providers were not initially part of the prevention and care strategy. The crisis has also highlighted the bureaucracy in the relations between the central government and its local institutions (especially ARS), the structural weaknesses of those for supporting local logistics and supply, and the difficulties, at the local level, of articulating health and social care policies.

The segmented approach to the management of primary, secondary and social care is also visible in funding. Sector level expenditure targets (separate for primary, secondary, long-term care providers) set by the

parliament have been quite successful in containing overall expenditure in the past decade. However, these also reinforced the division between healthcare providers at the local level, and reduced the capacity to improve the coordination of service delivery across sectors in order to strengthen the resilience of the health system to effectively serve an aging population with chronic diseases.

In order to assure financial sustainability, the sources of health funding have been broadened in the past two decades to include a broader range of income beyond payroll contributions considering the high rate of unemployment in France and the rapid ageing of the population. But, notwithstanding the high share of public funding of health expenditure and the strong emphasis on equity of access to care, high reliance on private complementary health insurance to cover the extra costs for patients raises concerns for solidarity, equity in access to care and efficiency of the system.

France benefits from a robust health workforce and a centralised planning of medical personnel volumes which has been increasing. However, healthcare workforce is unequally spread across the French territory as self-employed professionals are free to choose where they practise. Moreover, workforce planning takes little account of the changing nature of care, possibilities of task shifting between different providers and the need for modifying care models to look after an ageing population. Care providers are mostly paid on a fee-for-service basis and each has legally defined tasks and procedures that they can deliver. This reduces the promotion of task shifting from physicians to other health professionals.

In the past decade, France has been investing in health technologies, especially in tele-health solutions. During the COVID-19 pandemic, many healthcare professionals showed great resilience and capacity for innovation. They have been very reactive in adopting online solutions for maintaining the continuity of care outside of hospitals. The rapid adoption of tele-health solutions, including tele-monitoring and online consultations, has helped to expand access to care, reduce disease exposure among staff and patients, and reduce patient demand on hospitals. There are however significant variations in local care practices and organisations. The lack of regular monitoring and comparison of quality across care settings at local level reduces the capacity to identify high performing providers (areas) and promote system-wide quality and efficiency.

Recommendations for sustainability and resilience of the French healthcare system

Domain	Recommendations
Governance	▪ 1A: To develop a common "pandemic" plan, adapted to a wider variety of situations, defining the role of all care providers across sectors and establishing priority populations/services and critical resources required; ▪ 1B: To improve communication channels between central government agencies and local actors including care providers, local authorities and patient representatives; ▪ 1C: To give more priority to health decision-making at the local level involving healthcare professionals and patients; ▪ 1D: To reinforce local piloting of health policy with healthcare quality and efficiency targets set at the local level (for all providers) based on regional/*départemental* data.
Financing	▪ 2A: To revise the process of setting ONDAM targets to ensure that budgeting is not a barrier for allocative efficiency. The overall target should take into account estimations of resource needs (capital and workforce) in the medium/long term across all sectors (primary care, hospital and long-term care) and support integration, prevention and new care models. The sub-budgets should be fungible and managed locally for a given population;

	▪ 2B: To give greater financial latitude to the regional level in order to steer care provision across settings and to develop policies taking into account local needs; ▪ 2C: To establish an earmarked budget for regional investment (including prevention and early detection of disease and hospital capacity) to support a strategic investment plan across sectors; ▪ 2D: To reform the hospital payment model (prospective payment system, T2A) in order to provide appropriate incentives to care providers which are aligned with broader health system goals (care quality, efficiency, coordination, etc.). Prices for hospitals should reflect the costs of best practice in integrating prevention and care coordination; ▪ 2E: To support alternative performance or outcome-based payment models such as block contracts, bundled payments or capitation (rather than volume-based payments such as fee-for-service).
Workforce	▪ 3A: To change legal definitions of health professionals, referring to competencies and missions rather than exclusively predefined procedures; ▪ 3B: To encourage cooperation and flexibility in care provision (task-shifting) by appropriate remuneration and career perspectives for all health workers (new modes of payment); ▪ 3C: To renew the education curriculum to introduce multidisciplinary training reinforcing the recognition of the competencies of different health workers (including paramedics); ▪ 3D: To strengthen the role and missions of nurses in the health system with appropriate level of payment and different career opportunities (specialisation, etc.); ▪ 3E: To level-up wages of workers in the health and social care sector (including caregivers at home) working with frail elderly to sustain long-term care provision; ▪ 3F: To invest in new professions which are necessary to support new care organisations and tele-health solutions.
Medicines and technology	▪ 4A: To develop a multi-solutions framework to guarantee availability of essential drugs (ensuring multiple providers and routes) with transnational (notably European) collaborations; ▪ 4B: To strengthen the HTA capacity to improve the decision-making process in order to accelerate access to innovation; ▪ 4C: To increase public funds allocated to health research, both fundamental and organisational, and to continue efforts to strengthen collaborations between universities and start-ups; ▪ 4D: To evaluate and generalise innovative tele-health solutions developed during the crisis for improving patient care in the long-term.
Service delivery	▪ 5A: To increase the share of health resources devoted to prevention, early detection and treatment with targeted training programmes for all care providers; ▪ 5B: To have a holistic approach to care provision locally, with more flexibility in organising health services across settings for the local population; ▪ 5C: To use available data and refined indicators for benchmarking the quality of care (by disease areas) across settings, in particular to monitor and diffuse indicators which capture patient experience in and out of hospitals including

readmissions, complications rates, inappropriate prescriptions, etc. (for specific patient groups) across local areas and providers;

- 5D: To strengthen healthcare provision in nursing homes for the elderly, taking into account the health needs and preferences of the residents by establishing stronger links with other healthcare providers;
- 5E: To define priority health services to protect/maintain in emergency.

2. Domain 1: Health System Governance

2.1 Governance for health system sustainability

The French healthcare system is based on a social insurance model that guarantees universal coverage. Despite a complex hybrid public-private funding system, France promotes equity in access to healthcare through a number of regulatory tools and policies. The equity principle is rooted in law and reinforced by all health plans (article L. 1110-1 of the *Code de la santé publique*). The governance of the health system is strongly centralised and is shared between the state (parliament and government with the ministry of Health mainly) and the Statutory Health Insurance (SHI) funds. The government pilots the development and implementation of public health policies, sets out sector-level expenditure targets, regulates care quality and the level and training of health workforce, and defines priority areas for national programmes. The union of SHI funds functions as a single payer in France and plays the main role in defining the public benefit baskets and the levels of co-payment, and participates in regulating the prices of procedures, drugs, and devices. It also sets tariffs for health professionals in private practice (mostly in the ambulatory sector) through collective negotiations with professionals' unions.

The dual management of the health system is also visible in the fragmented management and commissioning of healthcare services. On the one hand, the SHI is mainly in charge of managing the ambulatory care sector, assuring the efficiency and quality of care provided by self-employed professionals. On the other hand, the hospital sector is managed by the Ministry of Health and, at the local level, by de-concentrated State services: Regional Health Agencies (*Agence régionale de santé*, ARS). These agencies were created in 2010 to bring together, along the lines of a "one-stop-shop", different public instances in charge of health-care policy at the regional and local level. They have the mission to improve regional health policy but have limited executive power. Instead of being the main actors in defining regional policy, they rather execute nationally defined policies with limited influence on ambulatory care providers. Moreover, long-term care services are partly managed and funded by the local authorities (*départements*) which are the level of government (with tax raising power) below the national one in France. This segmented approach to the management of health and social care complicates the coordination of primary care, hospital care and social services at the local level.

Moreover, the healthcare system is known to be fraught with bureaucracy. The central government relies on a number of national health agencies, which provide expertise in defined areas and are supervised and funded by the Ministry of Health. The Public health agency (*Santé Publique France,* SPF) is the institution responsible for health surveillance and prevention (including of pandemics) in France. Created in 2016, SPF brought together several agencies (including one specialised in managing sanitary emergencies) to rationalise the health organisation. SPF was then given six missions including surveillance of epidemics and health of populations, monitoring of health risks factors, health promotion, prevention and health education, preparing the response to potential epidemics and health crises and launching health alerts. During the COVID-19 pandemic, it has been actively monitoring and publishing statistics, including daily cases, hospitalisations and test numbers. However, during the first wave, the agency was criticised for being undersized in terms of skills and staff, and too little prepared for a pandemic (Borowczyk and Ciotti, 2020). The agency seems to lack expertise to build up and manage strategic stocks (including protective materials), but also to develop quick

operational responses to a health crisis. More generally, the role of SPF in designing and monitoring the public health strategy has been weak.

2.2 Governance for health system resilience

The centralised presidential regime, with a strong public administration, means that rapid and country-wide decisions can be made quickly in case of a crisis. During the first wave of COVID-19, the policy response was piloted at the national level by the President and the Prime Minister, together with the Minister of Health. Despite the high level of institutional expertise in health and crisis management, the government decided to set up several *ad hoc* scientific committees, mainly consisting of experts in epidemiology and medicine for backing up the decisions made during the crisis. Additionally, a new taskforce was set up for designing a pandemic plan given that existing plans were not adequate. Emergency legislation was adopted to introduce a state of health emergency, which allowed the government to take exceptional measures without any parliamentary procedure.

However, this strong central response overlooked the significant variations between regions in terms of local epidemiological situations and clusters, healthcare needs, health workforce and care configuration. Both of the national lockdowns were implemented on the whole territory while the epidemiological situations and pressure on hospitals varied considerably between regions. Decision-making at the local level was severely restricted; the State Council ruled in April that municipalities and local authorities were not allowed to take any decisions diverging from the national emergency legislation. Furthermore, the communication between different central agencies (including ARS) and local actors involved in health, including healthcare providers, was burdensome.

While strong central governance allowed quick national measures to be put in place, especially for protecting the population from the negative economic effects of restrictive measures, the speed of the decisions also meant that there was a lack of consultation and transparency in the decision-making process. During the first wave, the government's communication, which oscillated between dramatisation ("it's war!"), trivialisation ("a little bit of effort for a few months") and infantilisation of the population, instead of factual and clear communication, including on the debates preceding the decisions and divergences, weakened the trust in some measures put forward. The central management of the pandemic response was also criticised for being inefficient because of the proliferation of crisis units, coupled with the creation of new consultative bodies, which made it difficult for those in the field to have an identified contact (Borowczyk and Ciotti, 2020; Bergeron et al. 2020). The aftermath of the first lockdown was characterised by demands for greater accountability for the government’s actions during the first wave of the pandemic. Several public committees were set up to investigate the management of the COVID-19 pandemic by the government and its impact in various respects, including one by an independent scientific inquiry commissioned by President Macron, one by the Senate and one by the National Assembly. The government has been also making a visible effort to improve the transparency of the measures taken during the pandemic.

The COVID-19 crisis has revealed some structural weaknesses in the governance of the health system. The fragmented management of public health, primary, secondary and long-term care explains the uncoordinated response to the first wave during which primary and long-term care providers were not initially part of the prevention and care strategy. The crisis also highlighted the formalities in relations between the Ministry of Health and its local institutions (especially ARS), the structural weaknesses of those for supporting local logistics and supply, and the difficulties, at the local level, of articulating health and social care policies (Milon et al, 2020). More specifically, management of the crisis revealed the limits inherent to the ARS which are considered, paradoxically, both centralised and disconnected from their local environment (Pittet et al., 2020). While the ARS had an undeniable success in increasing rapidly the ICU capacities and organising patient transfers between hospitals to help better use of existing bed capacities, this hospital-centred emergency approach ignored the needs of the other care providers, in particular those in the long-term care sector.

Furthermore, the level of bureaucracy involved in health decision-making contributed to the difficulties in putting in place an effective "test/ trace/ isolate" strategy before the second wave. Health professionals in the community complained about the slow reaction of the administration to their needs and suggestions. The same problems appeared to surface when organising the vaccination strategy in early 2021.

Table 1. Synthesis of positive and negative points regarding resilience and sustainability of the French health system in terms of governance

	Sustainability	Resilience
Strengths	▪ Clear objectives of universality and solidarity ▪ Strong national institutions supporting central governance	▪ Centralised response which allows for a quick reaction (emergency legislation, etc.) ▪ Accountability for government actions
Weaknesses	▪ High level of centralisation and bureaucracy ▪ Weak local health governance ▪ Disjointed management of primary, hospital and long-term care services ▪ Healthcare steering based on volume rather than quality objectives	▪ Little flexibility for adapting national policies to local needs ▪ Lack of coordination and communication between different levels of governance (region, *département*) ▪ Low level of involvement of patients and care providers in healthcare governance

2.3 Recommendations

- Recommendation 1A: To develop a common "pandemic" plan, adapted to a wider variety of situations, defining the role of all care providers across sectors and establishing priority populations/services and critical resources required;
- Recommendation 1B: To improve communication channels between central government agencies and local actors including care providers, local authorities and patient representatives;
- Recommendation 1C: To give more weight to health decision-making at the local level involving healthcare professionals and patients;
- Recommendation 1D: To reinforce local piloting of health policy with healthcare quality and performance targets set at the local level (for all providers) based on regional/*départemental* data.

3. Domain 2: Health System Financing

France has an employment-based statutory health insurance (SHI) system, which attained universal coverage in 2000 by introducing a state-funded insurance scheme for the poorest. Mandatory public health insurance provides a broad benefit basket but, to finance this package, all essential services have cost-sharing, including doctor visits and hospitalisations. Therefore, patients rely on private complementary health-insurance (CHI) to defray these costs, leaving France with some of the lowest out-of-pocket expenditures in the OECD. 96% of the population own a private CHI, which accounts for about 13% of all spending, while SHI finances 78% of the healthcare spending and direct household payments represent only 7% (Commission des Comptes, 2020).

In 2019, health spending in France accounted for 11% of GDP, three percentage points higher than the European average of 8%. Between 2000 and 2009, this spending increased in real terms by 2% per year on average; however, this growth rate slowed to under 1% per year since 2010 (OECD, 2020). The specification of an overall expenditure target for healthcare, known as the National Objective for Health Insurance Spending (*Objectif National de Dépenses de l'Assurance Maladie*, ONDAM), has been the key strategy to contain health spending. The ONDAM is specified in monetary terms as the total amount of health spending for the forthcoming calendar year and gives all stakeholders a precise objective in terms of spending. Initially set only as objectives, these targets became binding over time. There is now a dedicated committee following the evolution of health expenditure and the SHI fund has the responsibility and powers to impose the policy for respecting spending targets.

3.1 Fiscal sustainability

Initially, the SHI system was almost entirely funded from wage-based contributions. Considering the high rate of unemployment in France and the rapid ageing of the population, sources of funding have been broadened in the past two decades to include a broader range of income beyond payroll contributions in order to assure financial sustainability. The most profound change has been the introduction of the General Social Contribution (*Contribution Sociale Généralisée*, CSG) over the course of the 1990s (Barroy et al. 2014). The CSG introduced a basket of taxes applied to a broader range of income than just wages (incomes from financial assets and investments, pensions, unemployment and disability benefits, gambling, etc.). The CSG also aimed to reduce labour costs. Gradually, the share of employee payroll contributions to health funding was reduced while CSG rates across various sources of income increased. Furthermore, a number of earmarked taxes have come to contribute to health financing needs. There are various taxes on targeted enterprises, such as on pharmaceutical companies, and a global tax above a certain level of net sales for all companies. There are also taxes on consumption, as a share of the value added tax (on sugar, tobacco, alcohol, etc.) and on private complementary health insurance. In 2018 and 2019, there was a significant drop in payroll contributions, compensated by tax revenues, following president Macron's reform to improve competitiveness of employment. In 2019, only about 35% of revenues for SHI came from payroll taxes, 34% from the CSG, and 27% from other taxes (Commission des Comptes, 2020).

Notwithstanding the high share of public funding of health expenditure, high reliance on private CHI to cover the extra costs raises concerns for solidarity, equity in access to care and efficiency of the system. This is mostly due to the basic functioning of the private insurance market, where premiums are often adjusted based on individual risk (age) without considering ability to pay and services covered vary as a function of the bargaining power of consumers. The solution proposed by successive governments has been to increase CHI coverage for a larger part of the population, including with public subsidies to purchase CHI. Moreover, the CHI market is closely controlled, using a mixture of regulatory measures and financial incentives, to reduce the difficulties that the sickest and the poorest would otherwise face in a competitive health-insurance market (Or and Pierre, 2019). However, it has been challenging to find a strategy, which provides CHI for the entire population without controlling the services included in the health basket, both for ensuring equity of access and for cost-efficiency. Therefore, the content of CHI contracts is increasingly regulated in an attempt to create alignment with the public sector objectives of controlling health-care costs. Nevertheless, the fact that CHI

prices are set without considering ability to pay raises equity issues. While only 5% of the population lacked CHI in 2014, this percentage was 16% and 12% among the unemployed and individuals in the lowest income quintile, respectively (Perronnin and Louvel, 2018). Social inequalities in CHI coverage are particularly troubling given that the poorest individuals are often also the sickest (Cambois and Jusot, 2007; HCSP, 2009).

The implementation of macro-level ONDAM targets has been quite successful in containing overall expenditure in the past decade (Table 2). However, this strict budgetary process represents a segmented approach to healthcare. The ONDAM overall target is split into three sub targets for the main health service providers: ambulatory care, hospitals, and long-term care facilities. The budgets for hospital and long-term care facilities are further divided into two distinct budgets, one for public and private non-profit hospitals and one for private for-profit ones. This division of budgets between providers reproduces the fragmented dual management of the health system (see Domain 1): ambulatory care expenditure is managed mainly by the SHI, and healthcare facilities are monitored by the Ministry of Health with very little financial power in regions. This organisation of funding ignores the fact that decisions made concerning expenditure in one sector have consequences on the others: care provision in the community determines the need for hospital care, home care services impact the need for long-term care facilities, etc. Splitting the overall expenditure into sub-targets creates a form of impermeability between the different sectors and hinders transversal management of budgets (for example considering that a new medication or care protocol reduces the length of stay in hospital) (Deroche and Savary, 2019; HCAAM, 2020). This reinforces the division of healthcare supply at the local level, and reduces the capacity to improve the coordination of service delivery across sectors in order to strengthen the resilience of the health system to effectively serve an aging population with chronic diseases.

Table 2. Comparison of the average annual growth rates of Ondam target and actual spending (%)

	2010-2013		2014-2018	
	Target	Spending	Target	Spending
Ambulatory care	2.58	2.13	2.16	2.46
Hospitals	2.70	2.28	2.00	1.78
Total Ondam	2.80	2.45	2.14	2.14

Source : Deroche C. and Savary RP. (2019), Commission des affaires sociales, using DSS data

In the hospital sector where a prospective DRG (Diagnostic related Groups) based funding model has been used since 2005, in order to respect spending targets, a volume-price control mechanism has been introduced at the macro-level. If the actual growth in total hospital volume exceeds the target, DRG prices go down the following year. The growth of activity is monitored at an aggregate level, and prices have been adjusted downwards regularly since 2006 as the hospital volumes have been increasing. This mechanism meant that the prices have become (progressively) unrelated to hospitals' costs, and created a financially unstable and opaque environment, which fostered frustration and resentment. (Or, 2014). In the absence of clear price signals and lack of cost and quality data for benchmarking hospitals, providers have been concerned with balancing their accounts, by increasing their activity, rather than increasing efficiency by quality improvements. Moreover, there has been a gradual underinvestment in public hospital infrastructure since the hospital prices were to cover partly the cost of investment (Ministry of Health, 2019a).

The prices of healthcare services in the ambulatory sector are effectively controlled by the SHI through formal negotiations with healthcare providers. However, low prices seem to have a mixed impact. Healthcare providers, paid on fee-for-service, tend to compensate for reduced revenues by increasing the volume of services provided. Uncoordinated care coupled with the high degree of independence and choice for both providers and patients appear to be a key driver of healthcare costs.

3.2 Financial Resilience

Since 2010, the SHI has been playing an increasingly proactive role in influencing overall healthcare spending and improving efficiency. In the past couple of years, it has been strongly promoting the dissemination of appropriate treatments and supporting digital transition.

During the first wave of COVID-19, the SHI was quick in sustaining tele-health solutions. The SHI fund simplified the conditions of entitlement and reimbursement: the full cost of teleconsultations will be covered until the end of the pandemic (i.e. no co-payment). A number of specific measures were also introduced quickly to facilitate access to care for vulnerable groups during the pandemic, including those who are chronically ill, homeless, or migrants benefiting from the state medical aid. The SHI has also enacted several protective mechanisms for health workers faced with reduced income because of the restrictions which impacted patient demand during the height of the pandemic.

In 2019, a new financing law with a dedicated budget (Article 51 of the 2018 Social Security Financing bill) was introduced to encourage new care models based on new funding modes. It waives regulatory barriers for testing innovations in care organisation and payment, encouraging bottom-up proposals. All health professionals and healthcare organisations were given the possibility of experimenting new healthcare models, including alternative funding models, provided that pilots aimed to improve quality of health and social care services and patient experience. This new bottom-up approach aims to remove financial barriers to innovation in order to promote efficiency, prevention and care coordination. During the first wave of the pandemic some of the initiatives created under this law have been responsive and developed quick solutions locally to assure continuity of care for their patients. The Ministry of Health has announced that this law will support the sustainability of innovations born during the COVID-19 crisis.

The COVID-19 crisis also triggered high-level reflections on how to improve the overall management of health budgets (HCAAM, 2020; Ministry of Health, 2020a). There are propositions for abolishing separate expenditure targets for hospital and ambulatory care in favour of a more outcome-oriented budgeting process. This will require better linking the resources allocated to different care providers with health system objectives, including prevention, equal access to care and efficiency. A more refined disease-specific approach taking into account the cost of diseases and encouraging the most efficient care delivery models and innovation of care pathways may be pondered.

Table 3. Synthesis of positive and negative points regarding resilience and sustainability of the French health system in terms of financing

	Sustainability	Resilience
Strengths	▪ Universal health coverage ▪ Diversified revenue sources ▪ Structured monitoring of health expenditures by the parliament	▪ Quick allocation of new payments for supporting care providers ▪ Flexibility for increasing health budget from tax revenues ▪ Local innovation facilitated legally and financially
Weaknesses	▪ Segmented budgets for different healthcare providers ▪ Lack of reflection on connection between expenditure targets (resources allocated) and quality, access and efficiency objectives	▪ Fee-for-service payment for providers which is a barrier for joint, integrated care provision ▪ Lack of clear funding rules for investment and preventive actions.

3.3 Recommendations

- Recommendation 2A: To revise the process of setting ONDAM targets to ensure that budgeting is not a barrier for allocative efficiency. The overall target should take into account estimations of resource needs (capital and workforce) in the medium/long term across all sectors (primary care, hospital and long-term care) and support integration, prevention and new care models. The sub-budgets should be fungible and managed locally for a given population;

- Recommendation 2C: To establish an earmarked budget for regional investment (including prevention, early detection of diseases and hospital capacity) to support a strategic investment plan across sectors;

- Recommendation 2D: To reform the hospital payment model (prospective payment scheme, T2A) in order to provide appropriate incentives to care providers which are aligned with broader health system goals (care quality, efficiency, coordination, etc.). Prices for hospitals should reflect the costs of best practice in integrating prevention and care coordination;

- Recommendation 2E: To support alternative performance- or outcome-based payment models such as block contracts, bundled payments or capitation (rather than volume-based payments such as fee-for-service).

4. Domain 3: Workforce

In France, about 5.3% of the population works in the healthcare sector (Chevreul *et al.*, 2015). In 2018, there were 226,000 practising physicians (3.4 per 1,000 inhabitants) and 600,000 nurses (10.5 per 1,000 inhabitants). Since 2012, the total number of physicians has increased by 4.5% (about 10,000 more physicians in six years); this is mostly driven by hospital and specialist physicians, while the number of general practitioners, accounting for 45% of all physicians, has stagnated. Nurses form the largest part of the health workforce, and the number of nurses per habitant has been increasing over the last decade. The Ministry of Health estimated that there will not be any shortage issues for them (unlike for some other health professionals) in the near future despite the ageing population (Ministry of Health, 2018). Some key data on the health workforce in France is provided in Table 4.

Table 4. Selected key data on the health workforce in France

Indicator	Figure
Number of doctors (total) per 1,000 population (2018)	3.4
Number of general practitioners per 1,000 population (2018)	1.5
Number of specialist physicians per 1,000 population (2018)	1.9
Number of nurses per 1,000 population (2018)	10.5
Number of dentists per 1,000 population (2018)	0.6
Number of pharmacists per 1,000 population (2018)	1.1
Number of nursing home workers per 1,000 population (2015)	6.4
Remuneration of hospital nurses, ratio to average wage (2017)	0.9
Remuneration of hospital nurses, USD PPP, thousands (2017)	42.4
Share of nursing homes experiencing difficulties in recruiting staff (2015)	44%
Share of nursing homes with vacancies of more than six months (2015)	63%

Sources: (INSEE, 2018), (OECD, 2019a), (Bazin and Muller, 2018)

4.1 Workforce for health system sustainability

The average numbers presented above hide contrasting realities. The healthcare workforce is unequally spread across the French territory as self-employed professionals are free to choose where they practise. This has resulted in medically underserved areas, which are especially pronounced in rural territories where access to both primary and specialist care can be very difficult. Some financial incentives have been implemented in these areas to encourage young and foreign health professionals, but these had limited success so far (Dumontet and Chevillard, 2020). Another challenge is the ageing of the physician workforce since half the practising physicians are older than 55 years old (Ministry of Health, 2018). To account for this ageing workforce, the annual limit on the number of medical students allowed in medical schools ('*numerus clausus*') has been increased progressively since the end of the 1990's. The same trends have also been observed for other health professionals (pharmacists, dentists and midwives) and nursing schools where the quotas have also been increased significantly in the past 20 years (Ministry of Health, 2016). Nevertheless, all this centralised planning of workforce takes little account of the changing nature of care, possibilities of task shifting between different providers and the need for modifying care models to look after an ageing population. Indeed, in France almost all care providers in the community (ambulatory sector) are mainly paid on a fee-for-service basis. Each provider has legally defined tasks and procedures that they can deliver (Brissy, 2019). As a consequence, attempts to promote task transfer from physicians to other professionals, such as nurses, have

not been successful given the potential impact on the revenues of the self-employed professionals concerned. Therefore, compared to many other European countries, nurses have little medical responsibility and power both in primary care and in hospitals.

There have been, however, two important developments in recent years. First, in the past 10 years, the number of primary care physicians working in solo practices has been decreasing as multidisciplinary health centres bringing together self-employed medical and paramedical professionals have been strongly supported by the SHI. There are several pilots aiming to test new funding mechanisms for these health centres, with the objective of improving multidisciplinary collaboration and task shifting. Second, in 2019, a position of "advanced nurse" (equivalent of specialist nurse) was created for the first time, allowing nurses to carry out some new responsibilities. While the autonomy acquired by these nurses is still very limited since a doctor must approve the patients they can follow up, the recognition of the advanced nurse position by law is a significant step forward. Moreover, discussions on the need for supporting primary care workforce led to the creation of new health "professions" to support care organisation and coordination, such as medical assistants which did not exist until now.

4.2 Workforce for health system resilience

Many health professionals (especially nurses and paramedics) in hospital and long-term care facilities have quite difficult working conditions and low salaries, which explains the difficulties in attracting and retaining workforce in some services (Bazin and Muller, 2018). When the COVID-19 pandemic hit France, many public hospitals were on strike and nursing homes had been struggling to recruit and retain staff (about 45% of nursing homes had difficulties in recruiting). In a sense, the COVID-19 crisis has shed light on the issues faced by the healthcare workforce beyond physicians, especially those providing care rather than a cure (medical treatment), and increased their visibility to the general public. On the positive side, in hospitals, the permanent healthcare workforce was quickly backed up by volunteers from the national medical care reserve (created in 2007 as part of a national strategy against exceptional health situations). In general, these volunteers had previous medical training, such as retired nurses or physicians and medical students, but also included non-medical staff, including medical secretaries or psychologists. At the same time, hospitals, despite the ongoing strikes in February, showed a great capacity to adapt to the circumstances by quickly training and mobilising health workers. At the local level, ICU capacities for COVID-19 have been increased quickly through extended authorisations for public and private hospitals to open new beds. While there were variations across regions, in some areas, nurses and paramedics of private hospitals, which did not have ICU capacity, worked in public hospitals during the first wave to support ICU teams. Rapid training programs were organised for nurses to work in ICU, and physicians working in public and private hospitals created new networks for sharing information and patients. All these initiatives have revealed some flexibility and solidarity within the health system removing the traditional borders of public-private sectors and the traditional boundaries between medical professions[1]. The need to maintain a certain level of hospital care during the second wave favoured further local collaborations between public and private hospitals, which are normally competitors. For example, some private hospitals opened their operation rooms to public surgeons for routine surgery. The resilience of the system is also underscored by a quick acceptance of tele-health solutions allowing more flexibility and online care provision both in the community and in hospitals. During the crisis, the rapid increase in tele-monitoring and online consultations helped to expand access to care, reduce disease exposure for staff and patients, and reduce patient demand on hospitals. These innovations might continue to support increased care access during and after the pandemic (see Case Study 1).

At the end of May 2020, the Ministry of Health started a national consultation involving all stakeholders for improving care organisation and remunerations (‘*Ségur de la santé*’) (Ministry of Health, 2020a), in particular

[1] *This did not occur immediately. In early days of the pandemic, while public hospitals were flooded and under high tension, private clinics in the same regions were underutilised and waiting for patients, although some lent their nursing staff to public hospitals. In some regions, instead of mobilising local capacity, patients were transferred by medical trains and helicopters to less affected regions.*

in public hospital settings (where the relative wage of nurses is one of the lowest in OECD countries) (OECD, 2019a). Despite the agreement to improve the working conditions of caregivers (especially nurses and elderly care providers), there was very little investment in their wages and home care workers were initially forgotten in May. The government, facing the second wave, had to launch an emergency recruitment campaign in October for supporting long-term care in nursing homes. But many facilities still lacked adequate resources by the end of the year.

The pandemic has also shed light on the unpreparedness of healthcare workforce for a pandemic. Since the H1N1 pandemic in 2009, when the government was accused of over-reacting by massively stocking masks and vaccines, the policy of consecutive governments has been to reduce the dedicated national reserve. The responsibility for stocking personal protective equipment (PPE) was henceforth transferred to individual care providers (hospitals, medical centres, etc.), public or private, but the obligations for self-employed health professionals were not clear. During the first wave of the pandemic, many care providers in the community (including GPs) did not have any PPE, and had to stop working. The government used the limited national reserve of masks to protect hospital workers and then gradually for GPs. Many professionals had to wait until the end of the lockdown to access PPEs. In order to support frontline professionals, the Ministry of Health launched a national telephone hotline to provide mental health support to health professionals working with COVID-19 patients either in hospitals, in community-based settings or in nursing homes (in April). This is the first time that the mental health of the healthcare workforce has been publicly taken into account at the national level, although psychological distress among healthcare workers has been a longstanding problem. For instance, before the COVID-19 pandemic, surveys among resident physicians has indicated a striking psychological distress (Fondation Jean Jaurès, 2020).

Table 5. Synthesis of positive and negative points regarding resilience and sustainability of the French health system in terms of workforce

	Sustainability	Resilience
Strengths	▪ Increase in the number of healthcare workforce over time ▪ High level reflexions on the configuration of the health workforce, task shifting and new professional roles	▪ Flexibility in developing alternative solutions for patients during the COVID-19 pandemic (online consultations, back-up by medical care reserve or private hospital workforce…) ▪ Public-private partnerships in the hospital sector
Weaknesses	▪ Permanent geographical disparities ▪ Hard working conditions and low salaries in public facilities, especially for nurses and long-term care workers ▪ A task-based rather than competency-based definition of health professionals remunerated on a fee-for-service basis	▪ Weak primary care and multidisciplinary training ▪ Inflexible staffing across organisations/sectors ▪ Underutilisation of nurses' competencies in the ambulatory sector ▪ Low staffing levels in long-term care facilities

4.3 Recommendations

- Recommendation 3A: To change legal definitions of health professionals, referring to competencies and missions rather than exclusively predefined procedures;

- Recommendation 3B: To encourage cooperation and flexibility in care provision (task shifting) by appropriate remuneration and career perspectives for all health workers (new modes of payment);
- Recommendation 3C: To renew the education curriculum to introduce multidisciplinary training reinforcing the recognition of the competencies of different health workers (including paramedics);
- Recommendation 3D: To strengthen the role and missions of nurses in the health system with appropriate level of payment and different career opportunities (specialisation, etc.);
- Recommendation 3E: To level up wages of workers in the health and social care sector (including caregivers at home) working with frail elderly to sustain long-term care provision;
- Recommendation 3F: To invest in new professions which are necessary to support new care organisations and tele-health solutions.

5. Domain 4: Medicines and technology

5.1 Medicines and technology for health system sustainability

France is Europe's fourth largest pharmaceutical manufacturer; the revenue generated by this industry reached €60 billion in 2019, with half of this consisting of exports (Leem, 2020a). In particular, in recent years, medical technologies and the e-health industry have been growing rapidly. In 2016, the e-health market passed €2 billion and there are a growing number of start-ups in the health area.

All newly available medicines in the market, whether authorised nationally or at the European level, have to go through a centralised process of health technology assessment (HTA) in several stages in order to be reimbursed by the SHI. First, the Transparency Committee of the French National Health Authority (*Haute Autorité de Santé*, HAS*)* assesses the level of clinical effectiveness (*Service Médical Rendu*, SMR) which determines the reimbursement rate, considering the drug's efficacy, disease severity, and the impact of the drug in terms of public health (HAS, 2020). If the drug is judged eligible for reimbursement, the same committee assesses the added clinical benefit of the new drug relative to existing treatments (*Amélioration du Service Médical Rendu*, ASMR). The prices of drugs are then negotiated between each pharmaceutical company and an economic committee for healthcare products (*Comité économique des produits de santé*, CEPS). Negotiations take into account the added clinical benefit and, for a sub-set of medicines with potentially high impact on expenditure cost-effectiveness of the drug (but without using a fixed threshold per QALY as in the UK), as well as the price of comparable products and the anticipated volumes of sales. For innovative medicines (ASMR I to III) only, the list price cannot be lower than the lowest of the 4 main European markets (UK, Italy, Spain, Germany) and the CEPS can rely on a medico-economic analysis provided by the committee for economic evaluation and public health (*Commission d'évaluation économique et de santé publique,* CEESP). Expected sales volumes are set for each product through negotiations with the pharmaceutical company which can agree to refund any excess revenues to the SHI if sales exceed those forecasted for the first year following commercialisation. Furthermore, there is a macro-level control of drug expenditures regulated by the social security financing bill which sets targets of expenditure growth for the drugs reimbursed by the SHI in the following year (currently +0.5%). This is not a hard budget but a threshold beyond which companies pay discounts to SHI. This short-term macro level steering of drug expenditures is criticised by the pharmaceutical industry as being unfavorable for innovation, since the total expenditure target does not consider the performance of different medications in contributing to overall health system goals (in reducing the need for hospital care for example). Moreover, there is a great margin for increasing efficiency in pharmaceutical spending. The low use of generic drugs, which represent only 30% of the market volume in France, against 81% in Germany and 85% in Britain, means that spending on older drugs could be more beneficially geared towards newer and better treatments (OECD, 2019c).

While there are well-defined regulatory pathways for drug access to the market ensuring effectively quality and safety standards and stewardship of medicines, the process for effective market access was slow. In recent years, there have been numerous drug innovations, especially in the field of oncology, for which this process appears to be long (more than 500 days on average after the marketing authorisation vs. 180 days as recommended by a EU directive) (Leem, 2020b). In hospitals, the development of innovative treatments is paid by a specific budgetary allocation which covers the general cost of innovation-related activities and technologies on an experimental basis (such as artificial hearts, new-generation ear implants, etc.) and the costs of new expensive drugs are not included in DRG prices of hospitals but paid separately. There are also specific payments to ensure quick access to particularly innovative drugs which have not yet been authorised on the market. The early access scheme, called temporary access for treatment (*Autorisation temporaire d'utilisation*, ATU) was considered to be too complex and has been reformed recently (in 2021). The idea is to simplify the procedures to improve access to drugs which have not yet received their marketing authorisations and to guarantee compassionate access for drugs which are used outside of their main indication, but the actual rules to be followed are not published yet. In 2020, the HAS also launched an action plan for improving the assessment of innovative medicines to increase equity of access to the most innovative and effective drugs

but also the long-term accountability. It made a number of key recommendations, such as utilisation of conditional medical evidence reviews in the short-term, long-term monitoring of medications in real-life conditions, focus on the extent of the added value and systematic involvement of patients and consumers point of views (HAS, 2020).

Despite some positive developments in ensuring universal access to safe and effective medicines, there are growing concerns about drug shortages in France. Shortages reported to the ANSM have increased by a multiple of 20 over the past decade, and have affected vaccines, antibiotics, drugs for Parkinson's disease and cancer. In July 2019, the Ministry of Health presented a four-year roadmap to tackle such shortages. The roadmap proposes four strategies: 1. Increasing transparency and communication channels between stakeholders, by generalising a platform allowing pharmacists to notify, in real time, any shortage to manufacturers and wholesalers; 2. Preventing and better managing shortages, with the possibility for pharmacists to substitute out-of-stock medicines of major therapeutic importance with equivalent alternatives and reinforcing controls of the distribution of drugs facing shortages; 3. Reinforcing national and European coordination, in particular, by increasing the regulatory powers of ANSM and standardising legislations across countries; 4. Strengthening national governance by creating a steering committee with representatives of all stakeholder groups, to ensure continuous monitoring of drug shortages and propose measures to reduce them.

Besides medicines and drugs, France has been investing in digital health. Tele-health (tele-consultations, tele-expertise) has been reimbursed in the same way as normal consultations by the SHI since 2018 under specific conditions (within usual gatekeeping care pathways, etc.). This put France at a considerable advantage during the first wave of the pandemic: when the SHI eased the conditions of tele-consultations, many doctors could quickly join the existing platforms. Moreover, France benefits from a rich digital health data heritage with an exhaustive medico-administrative database where all healthcare consumptions reimbursed by the SHI fund are integrated with a unique patient identifier. This national electronic health database (*Système national des données de santé*, SNDS) is used by the SHI fund to closely monitor healthcare utilisation and expenditures and to make annual recommendations for improving the healthcare system. A Health Data Hub (HDH) was recently set-up to serve as a one-stop shop for health data, and to allow linking administrative data with other data sources including clinical data and results of laboratory tests. However, despite the resources put into HDH, access to these data remains a big challenge for researchers because of legal and technical barriers. The difficulties in accessing and exploiting health data reduces the capacity for improving public health, comparing treatments in real life, identifying problems of efficiency and quality and for encouraging organisational and care innovation.

Moreover, the share of the public budget allocated to health research has been decreasing over time (National Assembly, 2019). The level of public funding for health research is about half of that in Germany and decreased by 28% between 2011 and 2018, while this increased by 11% in Germany and 16% in the United Kingdom over the same period (CAE, 2021). Concurrently, the attractiveness and international impact of French universities in the field of health have been declining. Traditionally, health research is characterised by a strong separation between the public and private sectors with limited public-private research partnerships (CAE, 2021). However, the sanitary crisis has moved the traditional frontiers between the two sectors with the development of new public-private partnerships to overcome healthcare challenges provoked by COVID-19 (such as https://www.coalitioncovid.org). Moreover, the number of patents filed has been increasing. In 2019, the French National Institute for Health and Medical Research was the institute which filled the highest number of patents at the European Patent Office in pharmaceutical sector and the third in biotechnology (EPO, 2019).

5.2 Medicines and technology for health system resilience

During the first wave of the COVID-19 pandemic in France, patients who suffered from severe forms of the disease required weeks of artificial ventilation and large quantities of drugs used for induced coma and resuscitation. This was also the case in many countries, which increased the overall international demand for these types of drugs. Starting in mid-March, the ANSM issued a warning regarding potential shortages of a

few drugs used in ICU. As a consequence, an action plan was launched quickly with three main focuses: 1. Set-up of an information system allowing to oversee stock in all hospitals and the exchanges between them; 2. Active purchasing by the state of available stock from pharmaceutical companies; and 3. The production and internalisation of the manufacturing process, through the purchase of raw materials and their production by national manufacturers or hospital pharmacies (Borowczyk and Ciotti, 2020). While there have been some concerns about ICU drugs in hospitals during the first wave of the pandemic, this quick reaction appears to have avoided strong shortages of such drugs. It is also estimated that the minimal stock of antiviral drugs maintained in France might not be enough to answer all needs if a pandemic requires their use (which was not the case for the COVID-19).

Moreover, there has been a gradual decline over time in the priority given to the prevention of pandemics and hence in strategic reserves of protective equipment (PE). When the pandemic hit, national stocks of PE were insufficient, and it turned out that ambulatory self-employed health professionals did not have enough masks. As a consequence, during the first wave of the pandemic, many care providers in the community did not have any protective equipment. The strong reliance on a few international providers, especially from China, has also hindered the possibility to quickly increase the national stocks. During the first wave, France did not have a high testing capacity either. Interestingly, this is linked to the lack of clear strategy for testing in the community and the slow administrative process, rather than a lack of capacity. Initially, tests were only carried out in the hospital laboratories for inpatients, and not as a screening tool in the general population which could help with early identification and isolation of patients. Despite a dense network of public and private medical laboratories in the community, which stated that they could carry out tests, the administration took a long time deciding which tests could be used and giving authorisations to non-medical public labs (veterinary, etc.) which could support the testing strategy (Borowczyk and Ciotti, 2020). In May, the government gave authorisations to all laboratories and made tests free for all of the population. In early September, about 1 million tests per week were performed in France. While medical laboratories in some regions were overwhelmed by the high demand for tests in October, the introduction of new antigenic tests which are carried out in pharmacies reduced the pressure.

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The development of digital technology during the COVID-19 crisis, however, has been remarkable. Tele-consultations have been strongly supported by the SHI fund, which declared that all online consultations (including care not related to COVID-19 and by non-physician providers) would be reimbursed at 100% until the end of 2021. The use of tele-consultations increased exponentially to account for 11% of all consultations in March and almost 30% in April, in comparison to 1% before the crisis (SHI, 2020a, 2020b). Many hospitals also developed tele-monitoring programmes to maintain patient care outside of the hospital, often in collaboration with ambulatory physicians (see for instance Case Study 1). This is expected to have enhanced resilience during the crisis and to change medical practice in the long-term anchoring of digital health solutions.

Table 6. Synthesis of positive and negative points regarding resilience and sustainability of the French health system in terms of medicines and technology

	Sustainability	Resilience
Strengths	▪ Strong national HTA with economic cost-benefit analyses incorporated into the process (value-based approach) ▪ Specific procedures to give access to innovative treatments ▪ Long-term investment in digital health & data	▪ Quick reaction to the strains on drugs during the COVID-19 crisis with a dedicated action plan (participation of the state in the procurement process) ▪ Strong support for tele-health solutions which enabled patient care continuity and may have longer-term impact in reinforcing patient centred care
Weaknesses	▪ Low national production capacity in preventive materials and some essential drugs and raw materials ▪ Low generic medication use ▪ Low public funding for fundamental health research ▪ Cautious evaluation process which does not encourage innovation	▪ Lack of sufficient stockpiles of PPE, medicines and other consumables to deal with the pandemic ▪ Difficulty in accessing health data for research ▪ Weak collaboration between universities and start-ups ▪ Slow administrative process

5.3 Recommendations

- Recommendation 4A: To develop a multi-solutions framework to guarantee availability of essential drugs (ensuring multiple providers and routes) with transnational (notably European) collaborations;
- Recommendation 4B: To strengthen the HTA capacity to improve the decision-making process in order to accelerate access to innovation;
- Recommendation 4C: To increase public funds allocated to health research, both fundamental and organisational, and to continue efforts to strengthen collaborations between universities and start-ups;
- Recommendation 4D: To evaluate and generalise innovative tele-health solutions developed during the crisis for improving patient care in the long-term.

6. Domain 5: Service delivery

In France, healthcare provision relies heavily on private providers. Ambulatory care is mainly provided by private, self-employed health professionals (doctors, nurses, dentists and medical auxiliaries) working in their own solo practice or in health/medical centres and hospital outpatient departments. Inpatient care is delivered both by public hospitals and private for-profit and non-profit hospitals. Historically, there is a high level of freedom in care delivery and utilisation: patients are free to choose their care provider, either public or private, with no limit on the frequency of visits, and without mandatorily needing a referral to access hospital and specialist care. Physicians in the ambulatory sector are free to choose their place of practice which creates chronic access problems, in particular, in rural areas. Most providers are paid on a fee-for-service basis, which means that there is little interest to control volume, costs, or invest in prevention, health promotion, and care coordination. France also ranks very low among the OECD countries for spending on health promotion and prevention (OECD, 2019b).

6.1 Service delivery for health system sustainability

The lack of coordination between ambulatory, hospital, and social (long-term) care providers has long been recognised as a major drawback in terms of cost-control and quality and sustainability of care provision (WHO, 2018). Uncoordinated care coupled with the high degree of independence and choice for both providers and patients represents a risk for sustainability of the health system. The system is also highly hospital-centric: France has one of the highest hospital discharge rates (186 per 1,000 inhabitants) in the OECD area (OECD, 2019c), representing almost half of total health spending.

Traditionally, primary care providers have lacked a focus on prevention or adherence to clinical guidelines (Schoen *et al*., 2009). In the last decades, two major reforms aimed at strengthening primary care provision have been the initiation of a voluntary gatekeeping scheme in 2004, and the introduction of a pay-for-performance (P4P) scheme for ambulatory physicians in 2010[2]. However, none of these reforms had a significant impact on improving care patterns (Naiditch and Dourgnon, 2009; Bras, 2020).

In recent years, therefore, France has been encouraging more collaboration in primary care through multidisciplinary group practices. Compared to traditional (solo) general practice, group practice improves the quality and efficiency of care provision with more emphasis on prevention and care coordination (Mousquès and Daniel, 2015). Several initiatives and financial incentives have been introduced in the past decade and, despite slow uptake and variations across regions as to the size and distribution of these practices, more than 60% of general practitioners work in a group practice today (Ministry of Health, 2019). This should facilitate the innovation of care models by integrating a more diverse mix of professionals and reconfiguring service delivery in the future. In addition, an increasing share of health professionals (including physicians) in these centres prefer to work on a salary basis rather than on a fee-for-service basis, which is perceived as a barrier for developing coordination and cooperation between health professionals.

In the hospital sector, the introduction of a tailored DRG-based payment system in the mid-2000s has boosted productivity, but it has also created new problems related to quality and appropriateness of care. Since 2003 both the number of beds per capita and the average length of stay fell down significantly with an increase in ambulatory surgeries. However, avoidable hospital admissions, readmissions and emergency visits has increased visibly over this period especially for the elderly (Bricard *et al,.* 2020). The macro-level management of hospital expenditures with national-level expenditure targets for hospital care (see Domain 2) created an opaque environment for hospitals since prices (revenues) are set as a function of macro-level objectives and

[2] *Introduced for general practitioners in 2010 and generalised to all ambulatory physicians in 2012 (*Rémunération sur objectifs de santé publique*).*

activity, increasingly independent of costs and quality at the hospital level. This budgetary management is also adopted at the hospital level and led providers to concentrate on volume rather than on quality objectives.

Concurrently, several recent policies have been aimed at increasing local coordination between healthcare providers. These include the creation of local hospital groups (*Groupement hospitalier de territoire*, GHT) and the development of regional/local care networks (*Communautés professionnelles territoriales de santé*, CPTS) incorporating hospital and primary care physicians, nurses, and other professionals (including social workers, administrative staff, etc.). Since 2019, new payment models have also been tested on an experimental basis, including bundled payments, which allows for funding to be shared between primary care providers and hospitals. These reforms which aim to improve the continuum of care throughout the entire patient care pathway and to reduce competition between local care providers are likely to accelerate with the COVID-19 crisis. The local hospital groups encourage reorganisation of hospital services around local population allowing hospitals to share their resources and activity by specialising on certain services. Currently, these groupings concern only public hospitals while almost half of surgery in France is provided by private clinics.

France has been particularly backward in monitoring and reporting publicly the quality of care across settings. While important progress has been made for collecting data on quality, in particular security, of care in hospitals, most indicators are focused on process. Major indicators such as 30-day readmission rates, mortality and adverse events are not monitored regularly across providers or across regions/territories. More recently, data on patient experience in hospitals were collected but data on costs of providers are rare and benchmarking of efficiency and care quality is discouraged even when data are available. This reduces France's capacity to identify problem areas as well as good practices to push forward policies for improving care quality and efficiency.

6.2 Service delivery for health system resilience

The initial hospital-centred management of the pandemic contributed to the increase in the risk of saturation faced by hospital services. Hospitals have shown great resilience in reinforcing their capacity quickly and maintaining essential services. However, this has only been possible at the cost of generalised deprogramming of non-urgent care (through a hospital emergency plan) and at the cost of caring for non-COVID and chronic patients, without any common definition of priority populations.

The fragmented nature of care organisation and provision had a direct impact on the resilience of all care providers (Borowczyk and Ciotti, 2020). During the early days of the pandemic, all suspected cases of COVID-19 were referred to hospitals which were the main actors in treating these patients. The role of primary care physicians in the prevention, management and treatment of COVID-19 cases was not clear at all. Many of them, including general practitioners, stopped working in the first weeks of the pandemic because of the lack of clear protocols. Some health professionals, such as physiotherapists or dentists, were not considered as pivotal at that stage and were unable to work for two months until the end of the first lockdown.

The pandemic has particularly affected medical residential facilities for the elderly (nursing homes) which have paid a heavy price. Despite the launch of an emergency plan (on March 6) these long-term care facilities were helpless in the face of the pandemic. The measures put in place appeared late and were often inappropriate considering the reality of these facilities which had limited medical personnel and were insufficiently equipped to take care of their residents. The COVID-19 crisis highlighted the necessity of strengthening the care provision and coordination in these facilities where working conditions are challenging and remuneration is low.

Despite these limitations, many healthcare actors showed great resilience and innovative abilities throughout the pandemic. It has encouraged more flexibility through telemedicine in the community and in hospitals. The rapid increase in tele-health solutions, including tele-monitoring and online consultations, helped to expand access to care, reduce disease exposure among staff and patients, and reduce patient demand on hospitals.

Despite the ongoing strikes in February 2020, the hospital sector also showed a great ability to adapt with quick training and mobilisation of health workers with the onset of the pandemic. It also shifted the traditional divide between the public and private sectors and the traditional boundaries between medical professions. In the early days of the pandemic, while public hospitals were under stress, private clinics in the same regions were under-utilised and waiting for patients. In some regions, initially, instead of mobilising local capacities, patients were transferred by medical trains and helicopters to public hospitals in less affected regions, including in neighbouring countries. Regional health authorities have gradually included private capacity in their planning and provided temporary authorisations for setting up intensive care units in private hospitals. Public-private collaborations have become more fluid in the second wave, since the networks of public and private physicians, developed during the first wave, were mobilised quickly this time. These networks allowed for the referral of COVID-19 and/or other patients from public to private hospitals. Some private hospitals also opened their operation rooms to public surgeons for routine surgery.

In order to improve its resilience and sustainability, the French system needs to ensure that care providers are working together with the same quality and efficiency objectives in a more collaborative approach. France also needs to cultivate a health prevention and promotion culture providing the means necessary for a strong public health plan.

Table 7. Synthesis of positive and negative points regarding resilience and sustainability of the French health system in terms of service delivery

	Sustainability	Resilience
Strengths	▪ High level of choice in healthcare delivery, both public and private ▪ Recent policies encouraging group practice and local care networks	▪ Relatively quick boosting of public-private hospital capacity ▪ Quick adoption of novel tele-health solutions
Weaknesses	▪ Highly fragmented care provision, with little collaboration between professionals across sectors ▪ Weak prevention and health promotion culture ▪ Health governance by volume rather than quality and outcomes	▪ PPE and safety protocols were not available quickly across all sectors ▪ Failure to include primary care providers in the early pandemic response ▪ Failure to ensure all the care for non-COVID-19 patients

6.3 Recommendations

- Recommendation 5A: To increase the share of health resources devoted to prevention, early detection and treatment with targeted training programmes for all care providers;
- Recommendation 5B: To have a holistic approach to care provision locally, with more flexibility in organising health services across settings for the local population;
- Recommendation 5C: To use available data and refined indicators for benchmarking the quality of care (by disease areas) across settings, in particular to monitor and diffuse indicators which capture patient experience in and out of hospitals including readmissions, complications rates, inappropriate prescriptions, etc. (for specific patient groups) across local areas and providers;
- Recommendation 5D: To strengthen healthcare provision in nursing homes for the elderly taking into account the health needs and preferences of the residents by establishing stronger links with other healthcare providers;

- Recommendation 5E: To define priority health services to protect/maintain in emergency.

7. Case study 1. Optimising the location of health services delivery

Covidom: remote monitoring of COVID-19 patients to reduce hospital emergency visits in the greater Paris region

Coralie Gandré, Zeynep Or

https://www.covidom-idf.fr/

Context

In France, during the early days of the COVID-19 pandemic, all suspected cases were referred to hospitals. This is because the role of primary care physicians in managing COVID-19 cases was not clear, and initially all suspected patients were visiting or calling the hospital emergency services (Ministry of Health, 2020b). The emergency rooms and hospitals became saturated very quickly, in particular in the Parisian region where the virus was highly prevalent. Consequently, patients having signs of COVID-19 were asked to stay at home if they did not present any severe symptoms (such as respiratory problems). This 'stay at home' policy had some risks because patients with mild symptoms could get worse quickly if they were not monitored. Moreover, many patients would still go to the hospital as they needed to be reassured about their symptoms. Very early in March 2020 (six weeks after the first identified case in France), the Parisian hospitals group (AP-HP) developed a digital solution which facilitated the monitoring of COVID-19 patients at home. In collaboration with the regional union of health professionals (URPS), which represents the self-employed physicians in the ambulatory sector in the Parisian region, they promoted patient care at home in order to reduce pressure on hospitals (AP-HP, 2020).

Goal

This case study explores the main features of this mobile application programme which aimed at supporting patient care through better follow-up at home. We examine how this programme improved care provision and coordination of providers in the Parisian area and question how this type of tele-health model can be adapted to other situations for improving the health system sustainability and resilience. This case study also highlights how an external shock can sometimes act as a catalyst for change.

Relevant Domains

- Workforce (domain 3)
- Service delivery (domain 5)

Overview of the case

The Covidom application was developed by hospital physicians in Paris, under the lead of a professor of cardiology, supported strongly by the direction of the Parisian hospitals group (AP-HP), and in collaboration with ambulatory physicians. The primary objective of the application was to unclog hospital emergency rooms and to avoid hospitalisations by providing safe home monitoring for patients with mild forms of COVID-19. The application further supported primary care physicians in following-up with

COVID-19 patients, and assisting their patients in case of a complication. It was first piloted during one week on patients discharged from two hospital wards and then extended to all discharged patients (in order to avoid readmissions) and those in the community. Covidom is available for free on the AppStore and on Google Play. All discharged patients who agree to download the application are included in the programme and their health status is monitored until they are totally recovered.

In the community, the application is offered to patients who have tested positive and the platform offers the possibility of connecting with different health professionals. Patients can subscribe to the mobile app where they fill in a daily questionnaire on their health status (temperatures, dyspnoea, etc.). The programme, therefore, relies on an active participation of patients. Their answers to the questionnaire are analysed by an algorithm which sends alerts (red, orange or green), depending on the evolution of patient's health, to the Covidom platform. The platform functions with different types of professionals:

- *Remote surveillance health workers* (RSW): are medical or paramedical students. They call all the patients who have an orange or red alert, learn about their problem and propose an appropriate solution. Based on the level of alert, patients either receive health advice (including psychological support) by phone, an online medical consultation, with a physician in community or a specialist in hospital, or are visited by emergency ambulance services.
- *Reference physicians of the platform*: respond to questions from patients filtered by the RSW. They may directly advise patients, contact patients' usual physician (general practitioner) or ambulance services if necessary.
- *Tele-operators*: are non-medical professionals who help patients use the platform. They help them set-up an account and offer technical assistance. They also call and support patients who do not have internet access or cannot use a smartphone.
- *Data scientists*: manage daily dashboards and process the data to forecasts flows and probability of adverse events.
- The platform is also supported by *administrative staff* organising the recruitments, training of workers and regular reporting.

The platform was financed by the AP-HP and initially (during the first wave) almost everybody worked as volunteers. Since June 2020, the RSW and tele-operators are remunerated. The functions of the platform have also evolved over time. During the second wave, tracing and isolating contacts also became part of the objectives. The platform, in collaboration with the SHI fund, allows positive cases to be followed and advises the contacts of positive cases (to test and isolate). The Regional Health Agency (ARS) funds Covidom for contact tracing.

Around 10,000 physicians, both general practitioners in the community and hospital practitioners from the Parisian region, can include their patients in the programme. By mid-November 2020, about 700,000 persons in the Parisian region have been included in the programme (including contacts of positive cases) and more than 300,000 alerts have been treated by the platform.

Innovative features

The Covidom app presents several innovative features.

Collaborative bottom-up approach. Covidom was developed by physicians in AP-HP in collaboration with other health professionals at the local level including in particular ambulatory care physicians and those working in private hospitals. The platform is managed by a group of medical professionals and

system operators in a horizontal manner. This explains the wide participation of professionals in the programme.

Patient oriented and flexible design. The application is very simple and intuitive to use both for patients and professionals. It was considered to be the best operational proposal by the URPS, which was examining other proposals from the region. The application focuses on the needs of patients (rather than on epidemiology or research). The platform represents a new form of tele-monitoring including a despatching platform for actions to be performed based on patients' health indicators. The system also has innovative scalability features. The number of staff involved is adjusted continuously as a function of the number of alerts received on the app on the basis of real-time data.

Skill-mix. The tele-monitoring platform changes the traditional roles of health professionals and requires new /different competencies (both medical and non-medical) to ensure patients' follow-up.

Continuous evaluation. The Covidom platform is an experience-based system which is continuously evaluated and modified based on feedback. It has a strong focus on accountability with a close monitoring of the satisfaction of patients, of professionals working on the platform and a continuous evaluation of the algorithms used to identify patient alerts (signals of health deterioration). A number of quality and outcome indicators (impact on emergency services, rate of complications in included patients…) are calculated to provide regular feedback on the performance of the system to the ARS and to the Ministry of Health.

Analysis: how the programme can help to improve resilience and sustainability of the health system

The Covidom application was developed at a time when the hospital system was under great pressure and close to saturation, meaning that the sustainability of hospitals was under threat. This programme, therefore, helped to reduce patients' anxiety and assisted them to stay at home safely by organising remote health support. While there is no external impact evaluation published yet, the programme seems to be associated with a reduction in emergency visits to hospitals, length-of-stay in hospital and costs (analyses carried out with data from the platform is in process of publication). 92% of the patients and 95% of the physicians who used the application reported to be very satisfied or satisfied. The rapid development and implementation of the platform, which involves all health care providers in the region, demonstrates the resilience of the local health system in the context of a healthcare crisis. Beyond the COVID-19 pandemic, a patient-centred approach, providing more remote care options for patients, can help to reduce reliance on hospitals and increase the resilience of the health system. The application could easily be used to monitor patients after hospitalisation and hence contribute to a reduced length of stay in hospital. Patients with chronic conditions would also benefit from better monitoring of their health status and potential risk factors.

Key findings/recommendations

This type of platform which integrates different types of healthcare and non-healthcare professionals ensures that patients can be cared for remotely. The tele-monitoring by a platform connecting hospital and ambulatory care professionals has the potential to improve quality of life and care for patients, as well as for strengthening the sustainability of care provision. In the Parisian region, the health shock created by the COVID-19 pandemic has been an accelerator of progress in remote patient care at home by breaking the traditional barriers between hospital and ambulatory care providers. The success of Covidom is explained by the strong involvement of all health professionals who also participated in the construction and governance of the programme. This collaboration is likely to continue beyond COVID-19 pandemic. The AP-HP and the URPS are working on extending this programme for monitoring patients at home after a surgery and patients with chronic conditions, such as diabetes. These initiatives are

supported by the Ministry of Health, within the budget for pilots proposing innovations in care organisation (see Domain 5: Service Delivery). The platform has also been collaborating with a technical school for generalising Covidom application to other regions in France, by adapting it to regional contexts, and to other diseases. The medical team of Covidom has also been in contact with medical teams in Tunisia, Germany and the United States to help spread awareness of the programme.

However, the generalisation of this type of care model will also require investment in new types of professionals (such as tele-operators, etc.) for whom it will be necessary to develop appropriate training and funding models. Moreover, as for all digital e-health programmes, on-going investment in digital health literacy at the national scale is an important prerequisite which is not encountered in all social and age groups.

Overall, the application and the platform of Covidom not only helps to provide virtual primary and specialty care at home while the health system is under stress from COVID-19, but also helps to create new bridges between health professionals working in hospitals and in the community. It would be important to sustain this movement on a long-term basis, beyond the current COVID-19 crisis. This will require identifying the factors of success and anticipating the needs for future workforce, new professionals and funding to support novel remote care solutions.

What can be improved?

Integration with social care. This type of home monitoring programme could also help maintain the health of elderly people at home who are supported by formal or informal helpers. Currently the platform does not involve social care workers. Their formal involvement could help to have a more holistic approach, but the fragmented governance of health and social care providers make this challenging.

Language options. Health professionals involved in the platform found particularly challenging to involve patients who did not speak French in the programme. Adaptations of the Covidom app in different languages would allow including migrant populations who have been particularly affected by the COVID-19 given their greater employment in high-risk jobs. Covidom's IT team is aiming to propose a multilanguage platform in 2021.

Limitations

This case study was carried out during the second wave of COVID-19 in France when there was a second national lockdown. All the interviews were conducted via video-conference or telephone. We did not have the possibility to observe the actual functioning of the platform by doing observational work on-site. The data presented here come from the platform. There is, yet, no external evaluation which can establish the precise impact of the programme on hospitalisations. An independent impact evaluation is commissioned by the APHP in 2021.

Persons interviewed

- Professor Patrick Jourdain, Head of the Cardiology department in University Hospital Bicêtre, and director of the Covidom platform
- Dr Laurent de Bastard, general practitioner and URPS representative
- Dr Alexandre Bleibtreu, hospital practitioner specialised in infectious diseases (AP-HP)
- Ms Estelle Horiszny, medical student and remote surveillance health worker

8. Case Study 2. Enhancing the quality of health services

Early diagnosis and treatment of chronic kidney disease: A patient-centred approach

Damien Bricard, Coralie Gandré, Zeynep Or

Context

Chronic kidney disease (CKD) is a long-term condition in which the kidneys gradually lose their ability to function. In 2017, there were 697.5 million cases of CKD worldwide, resulting in 1.2 million deaths. Over the past three decades, the incidence and mortality associated with CKD has been increasing continuously because of the increasing prevalence of risk factors associated with CKD: diabetes, hypertension, obesity and ageing. As CKD becomes more common, the number of patients with end-stage kidney disease (ESKD), who require renal replacement therapy, has also increased. In France, it is estimated that around 5.7 million adults have CKD, and about 82,300 patients, or 1,232 per million inhabitants, are treated for ESKD, either by dialysis (56%), or transplant (44%). The prevalence of ESKD in France, at 1,246 per million inhabitants is one of the highest in Europe (Kramer *et al.*, 2018). Healthcare spending for the management of ESKD amounted to 4.2 billion euros in 2018. With costs of about 53,000 euros per patient per year, the economic stakes of ESDK are among the highest of all chronic conditions (SHI, 2020c).

Given the vast burden of global morbidity and mortality associated with CKD, it is very important to develop primary and secondary prevention strategies focusing on early detection and treatment in order to slow the progression towards ESKD. For patients with ESKD, the most effective and efficient care strategies are primarily kidney transplantation, then dialysis, favouring proximity to home and self-management methods whenever possible (HAS, 2014). In France, CKD presents significant challenges in terms of care management and access to adequate treatments. While France has one of the highest rates of transplantation per capita in Europe, there are regional and social disparities associated with access to transplants and dialysis (Le Neindre *et al*., 2018). Surveys also highlight significant discontinuities in patient care pathways, a lack of comprehensive response including early treatment, and poor referral to home dialysis.

Goal

This case study examines how the regional network NEPHROLOR in the Lorraine area has developed a comprehensive prevention strategy incorporating patients, medical laboratories in the community, primary care providers and nephrologists. We aim to understand the key aspects which have contributed to improving patient care and how this model helps to improve the sustainability and resilience of the health system.

Relevant Domains

- Workforce (domain 3)
- Service delivery (domain 5)

Overview of the case

NEPHROLOR is a regional network, in Lorraine (Grand-Est region), which aims to improve the experience and outcomes of patients across the entire CKD care pathway, from early diagnosis to follow-up after a transplant (https://www.nephrolor.fr). The local area covered by the network is characterised by a high

prevalence of CKD (around 1,700 case per million inhabitants against 1,200 on average in metropolitan France) and a low density of nephrologists (with therefore little competition between providers) (Le Neindre *et al.,* 2018). The network covers all 13 kidney centres in the Lorraine area, involving more than 50 nephrologists, a couple of hundred nurses and the general practitioners in the area, and serves annually more than 3,000 ESKD patients and several thousand CKD patients at earlier stages of the disease.

The platform develops programmes that target different stages of the patient journey to support patients and care providers involved in CKD, in order to:

- produce data to improve local knowledge of CKD and the epidemiological situation in Lorraine;
- support prevention, early diagnosis and treatment of patients with CKD;
- promote patient-led self-management education programmes;
- develop targeted programmes to improve care for ESKD patients (through actions varying from patient education, registration for the waiting list for transplant, monitoring of patients, shared follow-up of recipients);
- inform patients on treatment options for ESKD and support them to choose the modality that best matches their life plan;
- support clinical research on CKD, particularly on patient satisfaction with regard to their care, the quality of life of patients, and impact of different treatment and prevention strategies;
- invest in technologies that improve communication and access to information (telemedicine, shared medical files, etc.);
- contribute to continuing training of professionals involved in the management of chronic renal failure.

History

The platform, created in 2002, initially targeted transplant recipients and those on dialysis. Attention has shifted over time towards early detection and prevention with the objective of identifying patients in early stages of the disease and preventing complications. Since 2009, a comprehensive approach to CKD has been promoted locally, which integrates prevention and continuous education of patients and health professionals.

Innovative features

Patient-centred approach. The platform is organised around patients in the care network. Patient representatives are part of the steering board of NEPHROLOR driving the programmes. They have also been involved, from very early on, in focus groups expressing their needs and contributing to build programmes for improving self-monitoring and self-care skills. In 2012, the network created a patient education (PE) programme in which volunteer trained patients (called "resource patients[3]") can become co-facilitators of PE workshops in pair with a caregiver (paramedic). The contribution of "resource patients" in the PE programme was evaluated and shown to be effective in improving the adherence and satisfaction of patients who benefited from PE, as well as paramedics involved in the sessions. The network also provides training to PE for paramedics working in the community (nurses, dieticians, psychologists, pharmacists). The Regional Health Agency (ARS) financially support the network's PE programmes to cover more patients, including those with Stage 4 and 5 CKD. In 2017, the NEPHROLOR

[3] *They do not like the term "expert patient" which implies a hierarchy between patients. They prefer to use the term "resource patient".*

network was awarded the "Health User Rights" label by the Grand-Est region for its PE project. More recently, the network has invested in equipment to provide PE online which has accelerated since the first wave of the COVID-19 pandemic.

Early diagnosis and treatment. Early diagnosis of CKD patients has been a major objective for NEPHROLOR. The network, in collaboration with the medical laboratories in the area, developed an algorithm for identifying patients at risk of CKD based on their test results. Patients identified by the laboratories can contact a nurse coordinator who organises a consultation with patients' primary care doctor, and then an evaluation by nephrologists. Following this, a personalised care plan is developed; depending on the situation, the patient can be followed by their GP and/or a nephrologist with regular annual check-ups.

Information technology system (IT). The REIN register (*Réseau Epidémiologique et Information en Néphrologie*) is an information system for patients and health professionals, decision-makers and institutions concerned by CKD in the field of public health. The Lorraine region, through the Nephrolor network, was a precursor to the Kidney Register set up in 2002 and has become exhaustive at the national level since 2010. These data are essential today for identifying different care practices and pathways, encouraging early treatment and coordination of professionals, avoiding adverse events and improving patient satisfaction. During the first wave of the pandemic, NEPHROLOR published weekly situation reports which informed both care providers and patients on the epidemiological situation. Some of the first international publications on the risk of COVID-19 for ESKD patients and treatment options came out thanks to the REIN register (Caillard *et al.*, 2020; Couchoud *et al.*, 2020).

The information system also allows medical files to be shared between primary care physicians, nephrologists and coordinating nurses (but not patients).

Tele-monitoring. NEPHROLOR had developed some of the first online patient monitoring and consultation programmes in early 2000s for patients on dialysis or after a transplant. However, these programmes, developed on *ad hoc* research funding, stopped due to the lack of continuous funding. In 2013, the platform resumed the previous programmes with a research grant from the Ministry of Health. Online monitoring programmes allow patients to manage their disease with the support of an application and a regular nurse follow-up (supported by other professionals when needed). The data collected from the online platforms are used to calculate patient level indicators and help to prevent adverse events. The parameters entered by the patients are examined by different professionals regularly who can adjust the treatment quickly when necessary.

Quality Evaluation. NEPHROLOR works hard to encourage a quality evaluation culture. All actions are implemented and evaluated in order to identify and share good practices ("evaluation is a virtuous circle ..."). There is a strong focus on measuring patient experience and satisfaction. The network has developed one of the first patient experience questionnaires specifically for CKD patients (PREMs) (Nguyen Thi *et al.*, 2008) that has been adopted by several other teams abroad. The patient education programmes have also undergone an evaluation. A number of quality indicators (access to the transplant waiting list, etc.) are developed and published regularly in annual public reports. NEPHROLOR also provides feedback to each facility in the network on their results compared to the regional benchmark, but this information is not available to patients.

Analysis: how the network can help to improve resilience and sustainability of the health system

The network is in the Grand-Est region, which was one of the first and most affected areas in France from the first wave of COVID-19. Initially the risk of having a severe form of a COVID-19 infection was not clear for CKD patients; as a result, ESKD patients were quite anxious. Nurse coordinators of the network called all the patients who had a transplant recently, and tele-consultations were organised rapidly using the existing programmes. The network was also crucial for quick development of a forum where care providers could share daily information and treatment strategies during the crisis. The information system appeared to be instrumental in understanding the risk among different patient groups and in defining specific treatment protocols. The information provided by NEPHROLOR to health professionals and to patients was also essential in understanding the local epidemiological situation, risks, fatality rates and adaptations of treatment protocols. During the first wave, all transplantations were stopped for two-and-a-half months at the national level. The international publications from the network were instrumental in showing the situation for CKD patients and assuring care continuity during the second wave of the pandemic. All of the facilities in the region continued their delivery of transplants during the second wave, albeit at a slower rate due to restrictions, while this was not the case for all hospitals in France.

NEPHROLOR may contribute to the sustainability of the system by enabling a greater emphasis on prevention and patient education. The programmes developed by the network are funded by *ad hoc* research grants and by the regional quality improvement fund of the ARS. There is no economic evaluation of the potential savings from reducing complications of CKD, or hospitalisations but the rate of emergency dialysis, which was quite high initially in the region, was one of the lowest in Lorraine in 2017 (Le Neindre *et al.*, 2018). It is expected that home tele-monitoring enables better control of clinical and biological parameters as well as improved perceived health status and quality of life of patients (Thilly *et al.*, 2017). This better control should also limit emergency consultations and hospitalisations, helping to contain healthcare expenditure, and compensating for the financial investment in the telemedicine system.

Key Findings/ Recommendations

The frequency of kidney failure is increasing in all countries due to longer life expectancy and the rise in the prevalence of diabetes, an event that can be delayed or prevented if detected early. Prevention contributes to better management of this disease and can help to reduce the cost of ESKD which has been increasing consistently worldwide.

The holistic approach to prevention promoted by this network can be easily reproduced in other regions in France and beyond. The targeted programmes proposed for assuring early diagnosis and treatment of patients with CKD have relatively low costs and can improve greatly both quality of life and care outcomes of patients. Governance of the platform, giving patients the central place, is a factor of patient empowerment and should be supported/promoted in all regions. Innovative patient education programmes are relevant to CKD patients not only in France but also in other countries. They can be developed in different care settings and can allow slowing the progress of the disease, helping patients to better manage their illness and to reduce the need for more invasive care. New tele-monitoring technologies can be cost-effective solutions and improve patients' mobility, quality of life, while reducing adverse events and costs of visits for patients. Patients' needs and preferences should be monitored closely while developing these programmes to have the expected outcomes.

Finally, an effective information system, providing local level data on specific patient groups, appears to be essential for supporting healthcare providers and patients during a pandemic and assuring the resilience of the healthcare system. Collective development and management of the Kidney register, including patient quality indicators, should inspire data collection and use for other patient groups in France. Many of the attributes of the network (patient centred approach, focus on early diagnosis and prevention, telemedicine, collaboration between professionals, etc.) are relevant for patients with other

chronic disorders. An economic evaluation of the impact of the network in terms of patient outcomes and care utilisation may help the adoption of measures developed in other areas.

What can be improved?

Multidisciplinary care provision. About half of the patients with CKD also have diabetes, but the diabetic specialists are little involved in the network. It would be important to reach out to different care providers involved by creating targeted programmes to raise awareness on the issues for patients with multiple diseases.

Quality monitoring. The platform provides regular data and indicators to care providers to give feedback on their practice and outcomes. However, these data are not available for patients who have limited public information on the performance of different care facilities and dialysis centres. Given the complexity of the care provision and the multitude of professionals involved in following CKD patients, it is necessary to develop risk-adjusted indicators of quality taking into account patient experience all along the care pathway.

Funding. Currently in the French system, where most care providers are paid on a fee-for-service basis, there is little incentive to develop preventive activities. Since the end of 2019, a bundled payment has been gradually implemented to finance a prevention package for patients diagnosed with ESKD. The bundle covers hospital/specialist consultations, nurse visits, and interventions for patient education for patients with severe CKD (Stages 4 and 5). The objective is to finance multidisciplinary hospital teams including a nurse, but also psychologists, dieticians, etc., to improve care provision. While this reform is a strong step forward for improving prevention for ESKD patients, it does not recognise the role of early detection and preventive actions at earlier stages of the disease contrary to the focus made on this in the NEPHROLOR network.

Limitations

This case study was carried out during the second wave of COVID-19 in France when there was a national lockdown. All the interviews were conducted via video-conference or telephone. We did not have the possibility to observe the actual functioning of the caregivers and patients by doing observational work on-site.

Persons interviewed

- Professor Luc Frimat, Head of the nephrology department of the Nancy Research Hospital and president of the Francophone society of nephrology, dialysis and transplantation
- Dr Carole Ayav, Public health physician, coordinator of the network
- Ms Corinne Bouin, Nurse involved in the network
- Mr Pascal Févotte, Resource patient, involved in patient education programmes
- Ms Joëlle Jacquart, Resource patient, involved in patient education programmes

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