

ANMCO POSITION PAPER: The reorganization of cardiology in times of the SARS-CoV-2 pandemic

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KEYWORDS

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The COVID-19 pandemic represents an unprecedented event that has brought deep changes in hospital facilities with reshaping of the health system organization, revealing inadequacies of current hospital and local health systems. When the COVID-19 emergency will end, further evaluation of the national health system, new organization of acute wards, and a further evolution of the entire health system will be needed to improve care during the chronic phase of disease. Therefore, new standards for healthcare personnel, more efficient organization of hospital facilities for patients with acute illnesses, improvement of technological approaches, and better integration between hospital and territorial services should be pursued. With experience derived from the COVID-19 pandemic, new models, paradigms, interventional approaches, values and priorities should be suggested and implemented.

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Introduction

In December 2019, a new coronavirus appeared in Wuhan, China. The epidemic rapidly spread throughout China, involving the rest of Asia and Europe, until it became ubiquitous. On 3 March 2021, the confirmed cases worldwide were 114 975 672 and deaths 2 554 416¹ of which 98 635 in Italy.² On 12 January 2021, Italy registered 123 693 infected health workers.³

The epidemic spread so quickly that all the national health systems were caught completely off guard, including the Italian system, consequently exposing the already existing serious issues in the health system and in the re-definition of the hospital and non-hospital organizational structures, until the limit of saturation of patient rescue and support capabilities.

National health context

The COVID-19 pandemic has represented, and still represents, an exceptional, unforeseen, and unexpected event, which caught everyone off guard: public decision makers, healthcare workers, pharmaceutical, and non-pharmaceutical industries.

The consequences are before everyone's eyes: hospitals are overburdened, causing the disruption of their organization, deficiency of the territorial system in all its articulations, all made worse by the lack of a unique and unified approach to the problems that have emerged, but faced with territorial and social inequalities.

We are now paying the toll of the impairment, over the last few years, of our National Health Service (NHS). According to the NHS statistical yearbook recently disclosed, comparing the year 2018 to 2013,⁴ 74 hospital wards, 413 outpatient surgeries and ~13 500 hospital beds (of which 10 000 in public hospitals) have been lost. In addition, there has also been a 22 246 decrease in staff, a reduction of general practitioners, of free-choice paediatricians, and other medical specialists (anaesthesiologists, radiologists, infectious disease specialists, pulmonologists, and cardiologists). The COVID-19 pandemic has also revealed the obvious and dramatic issue of a lack of programming, in the last 10-20 years, regarding the medical needs of specialists and general practitioners (GP). This critical concern, more crucial for some specialties, has involved the cardiological community in many Italian regions. Last year alone, the Ministry of Health approved the offer of about 4000 new extra contracts, compared to the year 2019, for specialistic formation at national level.

In May 2020, the Italian regions were asked to provide an estimate of the medical needs for each single specialty. Unfortunately, the increase in the number of trainees in schools of specialization, implemented from the Academic Year 2020-21, will bear its fruits only in 4-5 years. The same critical issue regards the lack of GPs, intensified by the extremely high number of retirements predicted in the next few years, and the shortage of professional care personnel. According to the 2020 report of Organization for the Economic Cooperation and Development (OECD), we can note that Italy ranked among the last positions pertaining

to the nurses/residents ratio: 5.7/1000 residents compared to an 8.2/1000 present in other OECD countries, while the northern European countries show an average of over 10 nurses per 1000 residents. The data regarding physicians, in line or even above the OECD average, should be interpreted not only on the basis of the physician/population ratio, but above all on the physician/hospital ratio.

In relation to the much-debated issue of health digitalization, which is an extremely timely topic as it could implement the flexibility of the NHS towards the population, by offering new organizational models and sustainable care services, we note the total incapacity of our system to face the greatly needed technological adjustments in our hospitals. This is mostly due to the lack of economical investments, which has always affected this sector. All this, results in the failure to achieve individual pathways to define, monitor, and update individual assistance plans and to connect all the key players of the health system. It is clear that, in this context, it was impossible not to notice the organizational and structural deficiencies not only to face Covid-19 emergency but also to continue to manage non-COVID-19 diseases, in particular, those with greater epidemiological and prognostic impact, such as cardiovascular and oncological diseases, and to take charge of the management of chronicity.

Government investments, currently planned and fueled by European funds, if used correctly, will offer the opportunity to permanently improve the organizational structure of the NHS.

The epidemiological impact of cardiovascular diseases

The cardio-cerebrovascular diseases, despite a decrease in mortality in the past few years, continue to represent the principal cases of morbidity, disability, and mortality.

According to the data published by the National Institute of Statistics (ISTAT), in 2018 the cardio-cerebrovascular diseases caused 220 456 deaths, of which 28% were attributable to ischaemic heart disease and 25% to other cardiovascular diseases.⁵ The cardiovascular diseases represent the most frequent cause of hospitalizations in Italy, equal to 863 505 hospitalizations in ordinary regime (14.3% of the total). Among the more frequent causes of hospitalizations, heart failure (165 426 admissions), followed by percutaneous coronary angioplasty (129 538 admissions) and acute myocardial infarction (35 511 hospitalizations)^{6,7} (Figure 1).

The epidemiological trend of cardiovascular diseases during the SARS-CoV-2 pandemic

The pandemic impact of severe acute respiratory syndrome from coronavirus (SARS-CoV-2) has been particularly devastating in the cardiovascular field. Recent data demonstrate a drastic decrease of about 30-40% in hospitalizations for acute coronary syndrome and heart failure.^{8,9} We observed serious delays in the use of medical care of patients suffering from ST-segment elevation myocardial infarction (STEMI) in seeking hospital care, as well as a sharp decline

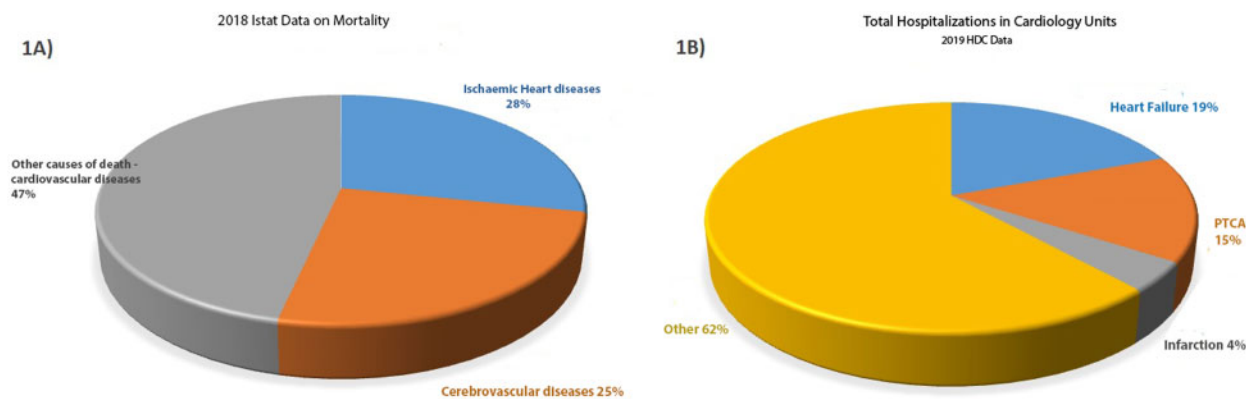


Figure 1 Epidemiological impact of cardiovascular diseases. (A) Istat data on cardio-cerebrovascular disease mortality. (B) Hospitalization data on cardiovascular diseases in Italy in relation to the 2018 Hospital Discharge Cards (HDC). (C) PTCA, percutaneous transluminal coronary angioplasty.

of hospitalizations for non-ST-segment elevation myocardial infarction (NSTEMI), for pulmonary embolism, stroke, and coronary artery bypass.¹⁰

This reduction has not only involved acute cardiovascular diseases but also, and above all, those in elective treatment. The data of the Piedmontese section of the Italian Society of Interventional Cardiology (GISE) underlined the collapse of recourse to interventional and structural cardiology; both coronary and structural procedures have fallen by 47.5% and 79.8%, respectively.¹¹ In particular, between March and April 2020 compared to the same period of the previous year,¹¹ an 84.7% reduction was observed in the number of percutaneous transcatheter implants of aortic valve prosthesis and a 50% reduction in the number of mitralic clip procedures. In Italy, an important reduction in cardiac surgery activities was also reported during the COVID-19 pandemic, in fact, cardiac surgery remained active in many facilities only for emergency treatments.¹² With particular reference to the cardiovascular field, a study by the Italian Society of Cardiology,⁸ conducted in 54 Italian hospitals, assessed the trend of hospitalizations in coronary intensive care units during the week of 12-19 March 2020, noting a significant reduction in the admissions rate and an increase of mortality for STEMI, compared to same period of 2019 (from 4.1% to 13.7%). It has also been reported a significant increase, over the same period, of extra-hospital cardiac arrests with significantly worse prognosis compared to the pre-pandemic period.^{13,14} The reasons for such a significant reduction in hospital admissions are still unclear, although perhaps largely related to the patients' fear of contracting the infection during the hospital stay. Certainly, the delay in diagnosis and treatment will have consequences also on cardiovascular morbidity and mortality in the medium to long term, therefore, we will have to be prepared to address this scenario in the near future.

Besides hospitalizations, outpatient activities were also cut by more than 50%; for example, the follow-up of patients with coronary syndrome, heart failure, atrial fibrillation treated with anticoagulants, or with cardiological devices.

Rehabilitation cardiac activities have also experienced a very sharp reduction. A survey of the Italian Association of

Preventive and Rehabilitation Clinical Cardiology (AICPR), conducted in 75 cardiac rehabilitation centres, showed that during the COVID-19 pandemic, only 14% of these remained active, while the other 86% had to suspend (25%) or drastically reduce (61%) their patients' recovery programmes.¹⁵

All this accounts for the high-mortality rate recorded in the population during this pandemic period. In fact, the deaths could be related to the severe septic impairment caused by the coronavirus, to the reduced percentage of patients adequately treated for their comorbidities, and to the reduced activities for acute/chronic pathologies other than COVID-19, such as cardiovascular diseases.^{16,17}

Administrative data from Emilia Romagna have highlighted a 17% increase in deaths from cardiac causes occurring in out-of-hospital settings during the first 2020 semester, recording a 62% peak in April during the national lockdown.¹⁸

Once again, the causes of this upsurge in the national cardiovascular mortality rate, which has practically cancelled years of cardiovascular prevention activity, is most likely due to the reduction of hospitalizations for acute coronary syndromes and to the increase in the number of out-of-hospital cardiac infarction. Further causes could be attributed to the reduction of the number of cardiac check-ups, of the therapeutic and diagnostic services, and the consequential reduction of both the physicians therapeutic adherence (adherence to the guideline indications) and patients adherence (adherence to therapeutic prescriptions), to the medium-long-term cardiovascular sequences of COVID-19, as well as to the negative effects of the lockdown on cardiovascular health (physical inactivity, weight gain, and psychological stress).¹⁹

Cardiology in post-COVID-19 era: hospital and territory

Revision of the structural, organizational, and technological aspects

Once the COVID-19 emergency is over, it will be impossible to go back to the same pre-pandemic conditions; a new vision of the NHS, of the organization of acute care facilities,

of the evolution of the health system will be necessary, if not essential, to adequately face hospitalizations of chronic nature (*Table 1*).

It is essential to reiterate the role of the hospitals focused on acute care, but that need appropriate upgrading in all of the various technological aspects, as well as the need for more human resources, and presumably directed towards a major flexibility and modularity of a structural and organizational nature.

The time has come to:

- propose adequate new staff standards, so as to properly face the management of acute cardiovascular diseases, but also unpredictable situations in case of pandemic situations;
- adapt acute care structures by establishing observational 'grey' zones and isolation areas;
- enhance technological facilities (a suitable number of echocardiographs, non-invasive ventilation systems, electrocardiogram (ECG) data transmission systems, and transmission of medical reports and radiological images);
- guarantee proper assistance in all the various health-care contexts, by transferring all the less complicated activities to hospital day-service so as to reserve resources for the more critical patients;
- apply the departmental cardiovascular model, not implemented in all hospitals, also in regard to hospital and territory, which would allow to guarantee proper consistency and continued pathways, and also share the available resources and educational processes;
- implement and structure diagnostic and therapeutic care pathways (DTCP) for the more frequent cardiovascular diseases (ACS, heart failure, arrhythmias, post-ACS), to facilitate the connection among the various players involved in the management of patients and that can 'build' an effective bridge towards the territory to guarantee an adequate healthcare plan. In the DTCP, the role of the nursing staff should be exploited, especially with respect to counselling and verification of the adherence;
- guarantee structured cardiac pathways for the care of discharged patients directly from the emergency room (ER), avoiding unnecessary admissions, such as congestive heart failure, atrial fibrillation, other supraventricular arrhythmias and syncope, manageable in the ER;
- redesign the clinical networks established in the light of the lived experience, redefine not only the roles of Spoke and Hub centres, but also of the local hospitals;
- extend the clinical networks, established in the early 2000's for STEMI, to other cardiovascular diseases, both time-dependent and not (STEMI, acute aortic syndrome, out-of-hospital cardiac arrest, cardiogenic shock, arrhythmias, cardiomyopathies, etc.);
- invest in digital health to allow the creation of a network between the discharge wards and patients, between hub and spoke centres and among the various specialists involved in the management of acute and chronic multimorbid patients, not only during the pandemic, but planning for the future of an NHS based on continued cure processes between hospital and territory and integrated in a real multidisciplinary management;

- give support to colleagues involved in COVID-19 areas. It is necessary for cardiologists, while maintaining their own professional specificity, to give their stable support in COVID-19 areas (consultations and active contributions to the shifts).

Using Big Data for new phases health planning

Big Data can be defined as a huge set of data provided for analytical approaches, which can reveal models, associations, or underlying trends. Big Data are characterized by volume (huge amount of data), variety (data coming from various sources, and in different forms), speed (quickly collected data), and accuracy (uncertain data precision).

Electronic Health Record

Big Data sources are various, the Electronic Health Record (EHR) represents the most important source in the human health field. The potential of the EHR is certainly enormous as it offers the opportunity to collect and aggregate data. The data can derive from a single health professional, as from an operative unit or from a hospital, but can also be collected from the health systems.

Administrative Data

The Big Data are also supplied by administrative data, collected by health professionals mostly for the billing of admissions and medical services. This data can also be collected for analytical purposes, hence satisfying the definition of Big Data.

The Big Data obtained from the EHRs and from administrative sources, often present limitations: the data are often incomplete, they use non-standard definitions, do not always capture the severity of the illness, and are often less accurate compared to clinical registries. However, they allow an analysis of the entire population which largely compensates the intrinsic structural limitations, and the implementation of their systematic use will be very useful to improve the data bank coming from the electronic health records and from the administrative data to obtain the information, which can result in a better analysis and more significant studies. An incisive implementation programme of these data banks is imperative, in line with what is already being done in other European countries and in the USA, it is the only way to advance from the current passive management of healthcare to a proactive clinical systematic governance of the NHS, to 'business intelligence' and to medical research and healthcare planning.²⁰

Unfortunately, from a regulatory point of view, both as medical and executive class we are still unprepared to use these systems effectively and securely.

A further, mandatory step, will be the use of artificial intelligence as a structural component of the system. All of this will be possible only through the implementation of the digital health management project.

The critical situation we are still living during the ongoing pandemic has further emphasized the deficiencies in our system, such as the difficulty to evolve from the traditional patient management in hospital units or in surgeries,

to define structured networks of communication and confrontation among different specialties, the recurrent impossibility to obtain the necessary clinical information of the patients, very often isolated in their homes. Remote-controlled tools and fragmented clinical activities of virtual communication and confrontation within clinical networks are now being applied but we are still very far from a new and revolutionary construction management model of the Italian health system.

Clinical registries

Clinical registries collect data from various clinical contexts, using standardized definitions. The registries have increased enormously and are used for comparative analysis of quality management in the participating centres. One of the major limitations of the registries is that the collection of the data is not generally linked to the workflow. The data are often collected late, partially or totally from the EHR. As a matter of principle, it is possible to create a collection of structured data in parallel with the workflow and collect it as it is generated.

Imaging data

The storage of static and in-movement medical images in digital instead of analogic format is progressively increasing. This data can be analysed, and interpreted, through artificial intelligence and neural networks.

Artificial intelligence and machine learning

The concept of Big Data and artificial intelligence are often considered the same thing, but actually they are conceptually distinct. Artificial intelligence is a very difficult concept to define because of our limited capacity to define human intelligence. However, it may be described as a set of tasks coming from informative

systems, which in turn derive from human cognitive activity, such as a decision-making process, voice recognition, language translation, and visual perception. Very important for Big Data is the way artificial intelligence can use the data, using a specific type of artificial intelligence called automatic learning, to guide the medical decision process. (Figure 2). Automatic learning can be defined as a software that becomes more accurate in foreseeing results without the need to be specifically reprogrammed. It is however very difficult to imagine leaving the decision-making process to a machine alone, not in the next few years at least; the final word of the process remains responsibility of the physician.

What we can say with a certain rationality is that Big Data and artificial intelligence will change medicine in the next few decades. Both offer high potential to precision medicine initiative and can be used increasingly by the health systems to analyse ‘business intelligence’, useful to determine the medical needs of health professionals, of the resources and for strategy planning, consequently making a deep impact on the provision of healthcare and on public health (Table 2).

Evolutionary priorities of the health system that need implementation for a more effective management of chronic diseases

Reprogramming the outpatient activities

Many of the issues registered during the various stages of the COVID-19 pandemic are linked to the territory’s insufficient response to the health needs, issues, which surfaced unpredictably, never having occurred in the past. These issues needed rapid and effective responses. The failure to respond appropriately have put hospitals under a very high and alarming pressure compelling them to carry the burden of the major part of the healthcare regarding SARS-CoV-2 infection.

On the other hand, during the peak of the health emergency, many activities were suspended, not only in hospitals but also in the territory, screening and monitoring activities were reduced or downright suspended. The suspension/reduction of outpatient activities is having and will certainly continue to have a significant impact on healthcare because of the delay in diagnosis and treatment, in particular, for the more complex patients with comorbidities and fragility and also on the organization of general health services.

With the flattening of the COVID-19 curve, the outpatient elective activities will be able to resume at full capacity and, therefore, a way to dispose of the waiting lists will need to be found, hoping in the arrival of new resources and the evaluation and implementation plans for clinical appropriateness, in line with what is happening in some Italian regions.

We support the opinion that allocating a significant proportion of the resources, that will be made available to the NHS thanks to the European funds, to the territory, will produce significant changes and guarantee value. However, it will be necessary to have a structural change plan and a governance of the territory, necessarily involving and sustaining hospitals

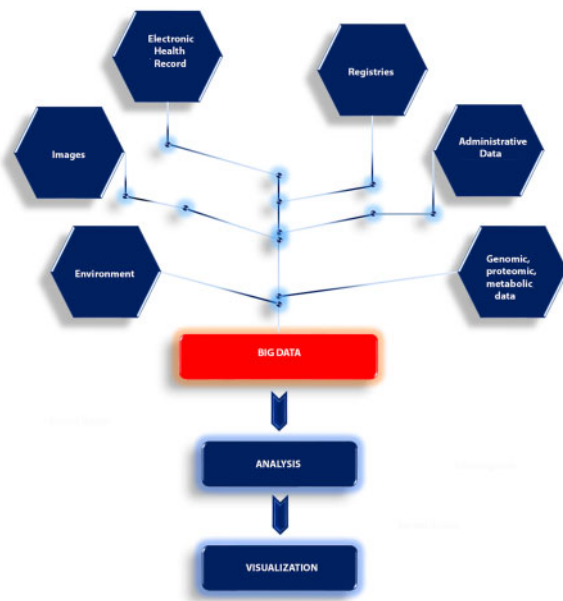


Figure 2 Big Data Trend from its origin to storage, analysis, and visualization.

Table 1 Revision of the structural, organizational, and technological aspects: issues and possible solutions

Current issues	Proposals for possible solution
Insufficient personnel	Introduce adequate personnel standards for the management of acute cardiovascular diseases and unpredictable emergencies
Structural inadequacy of some acute care facilities	Set up observational 'grey' zones, isolation areas while waiting for the final diagnosis, multidisciplinary management of Covid-19 areas. Create sub-intensive COVID-19 areas for acute, positive COVID-19 patients.
Technological inadequacy	Adapt the technological equipment (echocardiographs, non-invasive ventilation systems, ECG, and radiological images tele-transmission systems)
Partial inappropriateness in care contexts	Transform in day service/day hospital the less complex activities, reserving resources for the more critical patients
Eterogenous cardiological departmental models	Apply the cardiovascular departmental model, also in connection between hospital and territory, ensuring homogeneity continuity of paths, sharing of resources and training processes
Lack of sharing and implementation of DTCP	Structure and implement DTCP for ACS, heart failure, arrhythmias, post-ACS (facilitate connection among the players, build an effective 'bridge' towards the territory, nursing staff valorization)
Transversal model of service provision	Guarantee structured pathways for patients discharged from the ER (heart failure, atrial fibrillation, and other arrhythmias, syncope)
Inadequacy of the clinical networks on the basis of the pandemic experience	Redesign the clinical networks and roles of Hub and Spoke centres and 'nearby' hospitals. Extend STEMI networks to other diseases both time-dependent and non (NSTEMI, acute aortic syndromes, out of hospital cardiac arrest, cardiogenic shock, arrhythmias, cardiomyopathies)
Inadequacy of the health digital system	Invest in digital healthcare (creation of networks between discharge wards and patient, between hub and spoke centres and among the different specialists involved. Continuity between hospital and territory, multidisciplinary integration).
Mostly internal medicine management of COVID-19 areas	Support colleagues in COVID-19 areas (consultations and active contribution to shifts), in consideration of the frequent cardiovascular involvement in COVID-19 patients (to be considered as a systemic disease with multidisciplinary management).

ACS, acute coronary syndrome; DTCP, diagnostic and therapeutic care pathways; ER, emergency room; NSTEMI, myocardial infarction without persistent ST elevation; STEMI, myocardial infarction with persistent ST elevation.

Table 2 Examples of Big Data studies

Classification	Specific resource	Example
Electronic health record	Hospital-university medical centre	Electronic health record data to develop and validate outcome prediction models
Administrative data	Hospital discharge card	Comparative analysis of effectiveness between pharmacological and non-pharmacological interventions
Registries and integrated clinical studies	Creation of dedicated national and regional registries	Derivation and validation of predictive outcome models (mortality for all causes, mortality due to cardiovascular causes, re-infarction, etc.)
Imaging	Advanced cardiac echography, computerized coronary tomography, magnetic resonance	Acquisition of imaging data for the multi-parametric definition of cardiovascular and non-cardiovascular diseases
Integration of different types of data	Magnetic resonance, genetic data, biomarkers and clinical registries	Identification of cardiac arrhythmias via smartwatches, patient monitoring via telemedicine
Machine learning	Hospital registries	Classification of patients with cardiovascular disease

as well. The objective is to ensure that the excellent clinical results produced by increasingly efficient and very well organized hospitals, are not lost at the time the patients are discharged. To reach this ambitious goal, it will also be necessary to invest on the territory and create a continuity of care and an integrated network between hospital and territory, also through the use of digital platforms (*Table 3*).

The activities will have to be continuously monitored and governed by the strategic company board, which will have to acquire an efficient 'data group' to provide the necessary information to address interventions, improvement plans, 'business intelligence' investments in a targeted form, on the basis of health indicators, health targets, organizational needs, and clinical outcomes.

Table 3 Implementation of the evolutionary priorities of the health system to guarantee a more effective management of the chronic patient: issues and possible solutions

Current issues	Possible solution proposals
<p>Reprogramming of outpatient surgery activities</p> <p>Suspension/reduction of outpatient surgery activities and the negative impact on health</p>	<p>Determine the procedure to dispose of the waiting lists, add resources, evaluate and implement appropriateness, allocate (based on a project of structural changes and governance) a share of the resources, create a continuity care and integration network between hospital and territory using digital platforms. Implement telemedicine. Management of chronic cardiac patients</p>
<p>Hospital-territory integration</p> <p>Failure to indicate both the 2016 National Chronicity Plan and of the 2020-25 National Prevention Plan</p>	<p>Create a link between Hospital Cardiology and territory (professional mobility, with common pathways and booking agendas). involve accredited private hospitals, establish hospital-territory transmural cardiology departments (alternatively Co-ordinate outpatient cardiological hospital-territory activities on behalf of the cardiological unit of origin), structured connection between hospital cardiology and General practice (common digital platforms) involve cardiologists in accredited private hospitals, synergy among cardiology, GPs and nursing staff within the territory, structured connection between cardiologists and other specialists (common digital platforms), Co-ordinate training activities</p>
<p>Digital health and telemedicine</p> <p>Non-homogenous use within national territory, need for clear and structured rules and procedures, formal heterogenous recognition</p>	<p>Enforce the NIH document 'Interim Indications for telemedicine Care Services during the COVID-19 Medical Emergency' in favour of chronic patients, invest, determine pathways, and fees that acknowledge the value of the services at National level, the use of telemedicine in all its different forms (televisits, teleconsultations, telemonitoring, teleassistance) cultural and organizational change (to pursue the goal of appropriate management of chronic patients), the important role of non-medical staff, 'virtual' trials</p>

GP, general practitioner; NIH, National Institute of Health.

With the help of digital tools, it could be implemented in every single patient a comprehensive and unified strategy of intervention as a result of sharing between specialists in the single or different disciplines, even belonging to different hospitals, giving the right role and responsibility to each one.

It is necessary to drastically reduce the phenomenon of 'syndrome of Ulysses' (the patient who sails between hospital and territory looking for a specialist or an instrumental examination), the redundancy of visits and examinations, the multiplication of drugs and therapeutic choices, a consequence of fragmented management for single organ or disease in highly complex patients.

Hospital-territory integration

Resuming the indications of both the 2016 National Chronicity Plan and of the 2020-25 National Prevention Plan, it will be mandatory to define shared paths between specialist and general medical practice, between hospital and territory, with the necessary involvement of nursing and socio-sanitary staff (social workers, physiotherapists, psychologists), who can play a key role in improving patient adherence to the recommended treatment and the patient empowerment.

As for cardiology, these are the proposals:

- create a close connection between hospital and outpatient cardiology surgeries on the territory, also through the mobility of professionals, with shared

pathways and booking agendas. Private accredited hospitals should also be involved as several facilities dispense a very important proportion of cardiac outpatient services;

- evaluate the possibility of establishing transmural cardiology departments in healthcare facilities, taking into account the project of the Italian Association of Hospital Cardiologists (ANMCO).²¹ Alternatively, the objective to coordinate outpatient cardiological activities between hospital-territory by the cardiological reference hospital, should at least be considered;
- a structured connection between hospital cardiology and GPs should be realized through a common digital platform (i.e. send out an alert to the GP in case of patient admission, teleconsultation, medication reconciliation through the electronic health records, etc.);
- ensure the involvement of cardiologists in 'Health Houses' (i.e. by cadenced consultation activities and clinical case reports discussion in functional territorial associations). The growing number of these facilities, through the cardiological know-how, offers the opportunity within the territory, not only for the implementation of structured programmes of primary cardiovascular prevention (i.e. application of risk score, anti-smoking centres, asymptomatic atrial fibrillation screening, etc.) but also to share programmes and appropriate pathways for the management of the complex chronic cardiac patient. These programmes should be realized synergistically

among cardiologists, GPs, and nursing staff within the territory;

- realize a structured connection between cardiologists and other specialists (diabetologists, pulmonologists, nephrologists, etc.) through common digital platforms or systematic synchronous or asynchronous remote consultations in case of chronic patients with comorbidity. The objective being to improve the appropriateness of the pathways and to reduce the redundancy of exams and medical visits while concurrently formulating shared clinical programmes;
- develop not only clinical and organizational DTCPs for the continuity of care among different clinical contexts to reach common health objectives but also shared paths in different clinical contexts, coordination of educational activities, continuous comparison within the same and/or different disciplines for a real multidisciplinary management of chronic patients with comorbidity.

Digital health and telemedicine

The COVID-19 health emergency has led to a greater use of telemedicine and certain applications, although in a very fragmented way and without structured pathways. Both the medical staff and patients have had to resort to digital communication and exchange of information. During the health emergency, the National Institute of Health developed the document 'Interim guidance for telemedicine care services during the Covid-19 health Emergency', which provides indications for the realization of telemedicine services, especially to ensure continuity of interventions for chronic patients; substantial investments are being allocated for this purpose.²²

However, there is the need, now arising, to determine pathways and fees that include and recognize the value of telemedicine services at a national level within the diagnostic and care pathways.

The use of telemedicine in its various forms of implementation, including tele-examination, teleconsultation, remote monitoring, or assistance, implicates not only economic investments but, once again, a cultural and organizational transformation that allows us to continue taking charge of patients, bringing medicine to their homes, especially for the most fragile patients, that provides structured management protocols and entrusts an important role to non-medical actors.

Another interesting aspect, which gives an idea of the current dynamism of health and medical research, is represented by the 'virtual' ongoing trials. These are promoted and managed by the big digital communication companies and coordinated by authoritative figures of the scientific community. Amazon, Apple, Google, and Facebook are financing and conducting trials in which patients never leave their homes; all occurs electronically, including the enrolment. A European example is the 'adaptive platform trial', conducted by Oxford University in the COVID-19 context (acronym PRINCIPLE ISRCTN86534580).

Areas of priority for the use of telemedicine

Currently, in the majority of cardiology units, telemedicine is used mainly for the remote monitoring of patients with implantable devices (pacemakers, defibrillators, loop

recorders) with persistent obstacles related to the lack of human dedicated resources, and issues in regard to tariff reimbursement and privacy legislation.

Patients with chronic heart failure, in the context of which there are already published experiences which have documented significant benefits in terms of adherence to recommended treatments,^{23,24} improvement of the quality of life,^{25,26} and hard endpoints, such as a reduction in hospitalizations and mortality,²⁷⁻³¹ can certainly benefit from remote management, which allows to have, through a tele-visit, information on clinical parameters (i.e. information on symptoms, New York Heart Association classification, diuresis, blood pressure, and heart rate) with the possibility of teletransmission of an ECG, with the help of nursing figures. By means of use of different sensors, in a wide phase of development, would be also possible to ensure continuous monitoring of vital parameters in patients with heart failure during the phases of increased instability of the disease.

- The monitoring of clinical and metabolic parameters, follow-up, and therapy personalization could easily be obtained in diabetic patients at high cardiovascular risk.
- The diabetologist, cardiologist, or nephrologist could easily confer with the GP, and therefore make available their opinion on chronic patients with comorbidity and a complex clinical situation.

Appropriateness

The topic of appropriateness, of intervention priorities, of timing and frequency of medical check-ups, and diagnostic examinations, must be strongly re-proposed at this stage of organizational challenge and of difficulty to obtain the necessary health resources. All of this can be determined through the various DTCPs and the implementation of individual assistance plans.

It is desirable to implement a paradigm shift with the transition from a prestational logic (often inappropriate) to that of taking charge of the patient. It is widely demonstrated that the problem of waiting lists cannot be resolved only by increasing the supply if you do not also act on the appropriateness of exam requests, avoiding redundancy and duplication of requests.

Improvement, in relation to this never resolved issue, can only occur by the implementation of various factors: agreeing with GP the criteria of appropriateness and prioritization of requests, taking charge of more complex patients, supporting GP decisions, activating digital platforms for teleconsultation among specialists and GPs (Table 4).

Conclusions

A new health paradigm based on values

After the COVID-19 experience, new models, new paradigms, new interventional trajectories new values, and priorities are needed:

Table 4 Appropriateness: issues and possible solutions

Current issues	Possible solutions
The answer to the health needs depend inevitably on the ratio between the possibility to offer services and the number of requests, often inappropriate.	<ul style="list-style-type: none"> • The diminution of the waiting lists require a reduction of the inappropriate number of requests, especially in a moment of organizational challenge. Re-proposing and structuring a collaborative pathway that leads to the appropriateness of indications, of timing and of the indications for diagnostic examinations through the application of DTCP and the implementation of IAP. • Implementation of a paradigm shift with the transition from a logic of the service (often inappropriate) to that of taking charge of the patient. • Coordinate with GPs the criteria of appropriateness and prioritization of requests, taking charge of more complex patients, supporting GP decisions, activating digital platforms for teleconsultation among specialists and GPs.

DTCP, diagnostic and therapeutic care pathways; GP, general practitioner; IAP, individual assistance plan.

- The value of organization including the application of what has been envisaged but not yet realized: cardiovascular departments, hopefully transmural, between hospital and territory, implementation of DTCP, of multidisciplinary pathways to facilitate a true integration between hospital and territory.
- The technological value with targeted investments not only in hospital but also in the territorial context and with acquisition, now undepressible, of telemedicine tools that bring the doctor to the patient, without giving up humanization of care.
- The value of the appropriateness of the interventions, which could lead to a real rationalization of these, of the demand and supply.
- The social value aims to overcome the territorial inequalities and inconsistencies, correcting the limits of regional federalism in healthcare.

Summary

The COVID-19 pandemic has represented, and still represents, an exceptional, unforeseen, and unexpected event, which has caused deep changes in hospital facilities and a disruption of their organization, highlighting the deficiencies of the hospital and territorial systems in all its articulations. Once we overcome the COVID-19 emergency, a new vision of the National Health Service, and a new organization of acute care facilities, it will be necessary to adequately address the taking charge of the chronicity.

It will be necessary to provide for new standards for healthcare professionals, to adapt acute care facilities, to reinforce the technological equipment and features, and encourage integration between hospital and territory. After the COVID-19 experience new models, new paradigms, new interventional trajectories, new values, and new priorities are required.

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Appendix

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