

# **CORĒHEALTH: OPERATING CENTER OF TELEMEDICINE FOR CHRONIC DISEASES AND CLINICAL NETWORKS OF APULIA REGION**

Giovanni Gorgoni, Pasquale Notarangelo and Vito Petrarolo  
*AReSS Puglia – Regional Agency for Health and Social Care of Apulia,  
Lungomare Nazario Sauro, 33 – 70121 Bari, Italy*

## **ABSTRACT**

The COVID-19 emergency has given a great acceleration to the transformation processes of remote health pathways (telemedicine), which Apulia had already begun to pursue with the POR Puglia 2014-2020 from which CORĒHealth, established at AReSS, derives directly. CORĒHealth is characterized by: Web-cloud platform with HL7-FHIR interoperability; Televisit, Teleconsultation, Telemonitoring, Telecooperation and Teleconferencing; Device traceability system; Clinical repository; Patient Synoptic; Central Alarms; Mobile App for the Citizens (Android and iOS); Integration with the Regional Health Information System, Electronic health record, etc. The APP promotes the patient's involvement in the care process: keeping in touch with his/her specialist doctor and caregiver (video calls and chat); consult the agenda of the televised programs with patient's care team; view his/her treatment plan; enter the vital parameters that are communicated to the doctor in real time; manage their clinical diary and possibly share it with the care team; facilitate the measurement of compliance with the treatment path (drug intake, lifestyle). Each patient is assigned a treatment plan based on the specific Integrated Care Pathway(s) for their pathologies; the medical team, based on the specific needs, can provide patients with a kit of medical devices (e.g. oximeter, multiparameter, scale, sphygmomanometer, ecg, etc.), interoperable with the control unit, suitable for real-time detection and monitoring of the salient vital parameters that allow constant detection and monitoring, and possible intervention by virtue of the automatic alarm system the control unit is equipped with. From January 2022 the transformation of the Apulian Oncological Network into a digital key was started and therefore the training of the operators of the Oncological Guidance Centers and the Breast Units and the enrollment of about 23,000 cancer patients (approx. Breast). Another fundamental element of the CORĒHealth is the systematic approach in Continuing Training and Consolidation of Digital Skills to enable informed access of all the actors involved to new digital technologies. And this is why AReSS has launched a virtuous path of training, change management and digital literacy for all users (medical and administrative teams) and patients.

## **KEYWORDS**

Telemedicine, Value Based Care, Change Management, Custom Treatment Plan, Patients Empowerment, Digital Health Innovation

## **1. INTRODUCTION**

When we started planning and designing the application model of digital healthcare in the Apulia Region, expectations were high, but the result that is there for all to see today was absolutely unexpected. The vision and design skills are certainly of enormous importance, but the emergency due to the pandemic has further accelerated, allowing even the most reluctant to perceive how much the use of digital technology in the healthcare world is a primary and now unavoidable objective.

In fact, in recent years, the Apulia Region has undertaken to meet the new and ever-increasing health needs of the Apulian citizens and to adapt the local health services, in compliance with the criteria of quality and sustainability. In this context, one of the fundamental drivers of innovation lies in the propulsion to make healthcare processes more efficient and in the improvement of the diagnostic-therapeutic outcome associated with the use of innovative ICT technologies.

The COVID-19 emergency has given a great boost to the transformation processes of remote health pathways (telemedicine), which Puglia had already begun to pursue with the POR Puglia 2014-2020; the launch of the experimental experiences of using telemedicine platforms in Puglia, therefore, starts from

afar, and is based on the initiatives already undertaken previously in the context of the HLCM projects (HLCM Program Agreement - Health Life-Cycle Management - TITLE II ) and TALISMAN (Personalized assistance technologies for improving the quality of life - PON Research and Innovation 2014/2020 and FSC - winner of the Digital Innovation Award in Healthcare 2021), both based on the now tested process of taking charge of the patient of the historic Care Puglia project, and culminating in the H-casa COVID-19 platform and in the Operations Center of Chronicities and Clinical Networks of the Apulia Region (CORēHealth).

## **2. THE ESTABLISHMENT OF THE CORēHEALTH**

The Apulia Region in a pioneering way, by DGR n. 1088 of 2020/07/16, established the Regional Operating Center of Telemedicine of Chronic Diseases and Clinical Networks within AReSS (Regional Agency for Health and Social Care of Apulia), also providing the operational guidelines for the promotion and dissemination of the telemedicine in the health service and authorizing the financing of the information-technological infrastructure for the first start-up phase of the Operation Center.

The Agency followed up on the mandate conferred by the Region and, through acceptance of the Consip SPC Cloud Lot 1 Framework Contract, developed the infrastructure, the platform and the Mobile APP (available on the Android and iOS stores) of the Operating Center, called CORēHealth. Subsequently, with Resolution of the CEO n.65 of 07/04/2021, AReSS Puglia published the Guidelines for the Management of Outpatient Services in Telemedicine, transposing the "National indications for the provision of services in Telemedicine" approved by the Conference standing for relations between the State, the Regions and the Autonomous Provinces in the session of 2020/11/17. The document defines and regulates the procedures (recipients of the service, services, delivery methods, etc.) aimed at the creation of some specific telemedicine services for people who need remote health checks, such as, for example, televisit/health video call, remote control of devices in specific areas e.g. cardiology, diabetes, specialist teleconsultation, territorial health and social teleservices.

CORēHealth is part of the Regional Health Services Network by dialoguing and cooperating with the various institutional and operational stakeholders of the area and is the institutional and operational reference for all e-Health initiatives implemented by Apulia. The Regional Operating Center, in its full operational mode, provides for central coordination of the various ehealth solutions implemented region wide, guaranteeing technological interoperability and plurality of services; so it works as a Service Provider for regional e-Health services. To this end, periodic working tables have been organized to involve, compare and implement operational plans for new services to be developed. From an institutional point of view, the DGR 1088/2020 has identified the regional coordination for telemedicine and the main stakeholders belonging to the network of regional health services. Furthermore, these stakeholders are flanked, depending on the topic of discussion at the board and on the basis of specific interests, also by: Patients' associations, health trade unions, private healthcare associations (e.g. clinics, studios multi-specialist, etc.), manufacturers of medical devices and healthcare information systems and other stakeholders. The involvement is extended to almost all subjects belonging to the regional social-health sector.

The trial phase of CORēHealth, which ended in December 2021, focused on 4 regional pilot projects: Oncology Department of the San Paolo Hospital in Bari (about Breast cancer), Thalassemia Center in Brindisi (about Thalassemia), Putignano District (about Diabetes and Hypertension) and Local Health Authority of Taranto (rural medicine). As of January 2022, training of "COrO" and Breast Unit providers, enrollment of approximately 23,000 cancer patients (about breast), and initiation of a change management and digital literacy process involving both the care team and patients has begun. Another key element of CORēHealth is the systematic approach in Continuing Training and Digital Competence Consolidation to enable informed access of all the actors involved to new digital technologies. For this, AReSS has initiated a virtuous path of training, change management and digital literacy for all users (medical and administrative teams) and patients. Among the results to be achieved in the near future:

- Extension of the Telemedicine service to all chronic diseases in the Apulia Region;
- Apulian Oncological Network: training and enrollment started (about 200,000 oncological patients in Apulia);
- Rare Diseases: pilot project launched with the Rare Disease Center - Thalassemia of ASL Brindisi (around 23,000 rare disease patients in Puglia);

- Chronic: the pilot project of Putignano district of Local Health Authority of Bari, about Diabetes/Hypertension District started (about 1.7 ml of chronic patients in Apulia).

## 2.1 The Objectives of The Corēhealth

Through the CORēHealth we want, first of all, to promote the centrality of the citizen-patient and this requires that the entire social assistance and protection network, the various actors who are involved in it, cooperate effectively and assiduously, with the aim of protecting their well-being and health, guaranteeing the satisfaction of their main needs and their active inclusion as a conjunction.

The CORēHealth, therefore, must operate as an enabling factor for the realization of this basic prerequisite, guaranteeing: an extensive digitization of processes, consistent with the reference organizational models (regional and corporate, district and clinical networks) in the local area, aimed at maximizing the adoption of the new system by operators by focusing on usability aspects and optimizing the feeding activities of the new system (operators will only have to enter the data necessary for the specific process they are carrying out and not those that are already available in other systems, which can be retrieved via, for example, integration mechanisms); the interaction between all the actors involved (e.g. GPs, pathology networks, accredited care providers, third-sector entities, etc.) and therefore, a "unified" taking care of the patient's needs, with particular reference to complex needs; a monitoring of processes, of the clinical-epidemiological and economic aspects to support both the continuous improvement of services offered and regional social-health planning. It is also necessary to always be aware that e-Health is not the end, but the tool to achieve the ultimate goal: to meet the health and well-being needs of citizens.

Critical success factors need to be addressed for the realization of this transformation: citizen-patient centricity, data centricity, overall system governance, digital skills enablement, and finally, innovative financing methods. Another key element is the systematic approach in continuous training and digital skills building to enable informed access of all the actors involved to the new digital technologies: among the enabling factors of digital health, the digital skills spread to all professionals are undoubtedly an essential strategic element. And it is for this reason that ARESS, by joining the Consip Framework Contract «DIGITAL HEALTHCARE - Clinical-Assistance Information Systems» - Lot 6 has designed a path of change management, training and digital literacy of all users of the system (medical, administrative teams) and patients, so that CORēHealth does not remain a mere tool, albeit technologically advanced, but represents a real organizational shift toward a new way of caring for chronic patients with benefits for both patients and caregivers.

The necessary skills that should be strengthened are above all digital managerial skills, to plan, govern and optimize the digital transformation process. The objectives of the Operating Center, therefore, are:

- To refine, through the digitization of processes, the regional organizational model of prevention, care and treatment of its frail citizens and/or those with chronic diseases in accordance with the provisions of the "National Plan of Chronicity" which identified the adoption of telemedicine models, techniques and tools as opportunities for improvement and benefits;
- Centralize citizens' epidemiological data on a single platform, as well as the entire process of taking charge and managing the defined prevention, assistance and treatment plans;
- Promote the cooperation and collaboration of all the structures and professional figures involved in the process of prevention, assistance and care of citizens according to the various levels of responsibility and action;
- Integrate the entire network of regional services with particular reference to the "clinical networks of rare diseases" and the "Oncological Orientation Centers (COro)";
- Make the telemedicine network more efficient (definition of the operational processes of the Service Center and the Delivery Centres) for the management of data, reports and reports acquired through Telemonitoring, Televisit, Teleconsultation and Telecooperation healthcare tools;
  - Have full health, organizational and economic governance of the interventions and plans activated;
  - Strengthen the relationship with the citizen and improve the citizen's perception of services.

## 2.2 The Management of Patient Care

The platform will enable each Supply Center (District, COrO, Rare Disease Centre, etc.) to manage its clients according to defined and suitably modeled processes. The platform manages various methods of "Request/Access" to the services offered by the Control Unit:

- By integrating the medical records of GPs /PCPs (Primary Care Pediatricians): the proposed system allows GPs and PCPs to use the platform made available or, alternatively, their own medical records to fill out requests for taking charge, or the request to activate services to be provided to their patients, and transmit this request to the district services through bidirectional specifications. The GP/PCP has a constant update on their medical office software of the status of their requests and their patient's entire course of care;

- Through the platform by the Supplying Centres: the proposed system allows authorized and suitably profiled operators from COrOs, Rare Disease Centers and Districts to register an acceptance request in the system and start the process according to regional regulations;

- Through APP or WEB PORTAL: the system provides specific services to enable the publication of a citizen-facing service for reporting a need and, as was the case of the COVID-19 emergency, to enable the citizen to fill out a pre-triage questionnaire and be contacted by competent health services;

- Through the platform or through specific services with the hospital structures: the system provides hospital facilities with specific communication tools with the Delivery Centers for the management of "Hospital-Territory Continuity of Care". Requests will be visible from the Delivery Centers on the platform through a dashboard that allows for total operational governance of the requests received, the different phases of intake, the different types of Diagnostic Therapeutic Assistance Plans ("PDTA") activated, their distribution throughout the territory, and other information that allows Coordination Centers to govern and manage the patients in their care in a simplified way.

In the logical model of CORĒHealth, the various stakeholders, can access the platform (back office and/or mobile APP) for patient enrollment, clinical assessment, protocol and treatment plan definition, and subsequent follow-up plan. The platform makes all the information available in the clinical repository and through interoperability tools it interacts with the services of: alarm center, logistics platform, patient synoptic, televisit/telemonitoring as well as with third-party systems (e.g. diagnostic systems, reporting systems, prescription systems, electronic booking systems, etc...)

## 3. THE CORĒHEALTH TECHNOLOGY

CORĒHealth can be summarized in three macro-blocks: 1 - AReSS Service Center: the facility responsible for the management and maintenance of the entire information system; 2 - Dispensing Centers / Clinical Networks: the structures of the Health Service (authorized or accredited, public or private, GPs / PCPs, specialist clinics, etc.) who manage the relationship with citizens through the management of all phases of the process of taking charge and providing the services provided by the Diagnostic Therapeutic Care Plans; 3 - The telematic platform.

From a more strictly technical point of view, the platform implements an application solution that enables the model at a regional level, implementing the technological transformation towards a cloud environment, as well as the re-engineering and migration of its application systems on the Cloud infrastructure of the Service Center of Innovapuglia (in-house provider of the Region). The project includes, among other technological components, the following [Figure 1]:

- Platform for the management of chronicities and clinical networks;
- Televisit, Teleconsultation, Telemonitoring, Telecooperation and Teleconference Platform;
- Televisit and teleconsultation system;
- Device traceability system;
- Clinical repository;
- Patient Synoptic: certified medical device for the collection of parameters and clinical data;
- AReSS Alarm Center for centralized monitoring by the Agency;
- HL7 FHIR Interoperability Platform for integration management;
- Mobile App for Citizens, with guaranteed access via SPiD/eIDAS, which favors their involvement in the care process: keeping in touch with their specialist doctor and caregiver (video calls and chat); consult the

agenda of scheduled televisits with patient’s care team; view the treatment plan; enter the vital parameters that are communicated to the doctor in real time; promote the measurement of adherence to the treatment pathway (drug intake, lifestyle), etc.;

- Integration with the Regional Health Information System (“Edotto”);
- Integration with the EHR (Electronic Health Record) and with the LIS, Oncological Screening, RIS/PACS systems (in the planning phase).

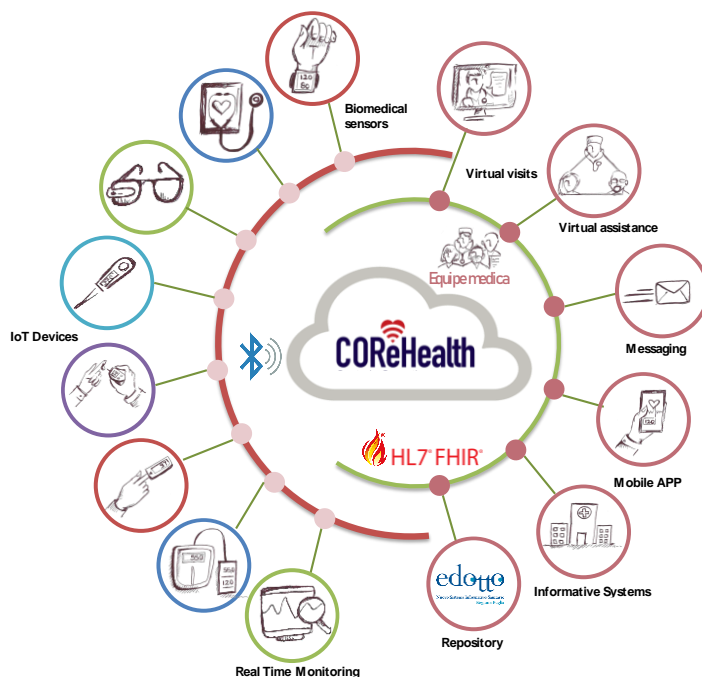


Figure 1. Interoperability of the COReHealth

Each patient is assigned an Integrated Care Pathway (“PAI”) based on the specific treatment plans of their pathologies (Diagnostic Therapeutic Care Plan) and, if necessary, a medical device kit, interoperable with the Unit, for the detection and monitoring of key vital parameters. In fact, The medical team, based on specific needs, can provide patients with a medical device kit (tablet, pulse oximeter, multi-parameter, scale, etc.), interoperable with the Unit, suitable for real-time detection and monitoring of vital parameters, salient features that enable constant detection and monitoring and possible intervention by virtue of the automatic alarm system with which the control unit is equipped.

### 3.1 Corēhealth It Architecture

CORēHealth thus provides the care team with a web-cloud (backoffice) platform available for the telematic management of their patients by offering, among the main services: personalized patient monitoring paths (Telemonitoring), Teleassistance, Televisit, Teleconsultation and Remote Health Collaboration, digitized services for taking charge, personalization and management of patient care plans, logistics/warehouse management of medical device kits [Figure 2].

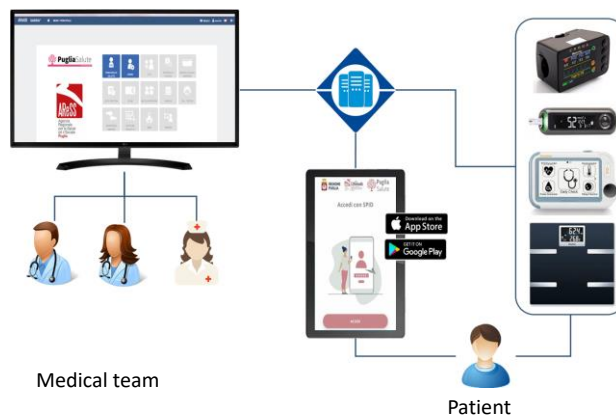


Figure 2. CORēHealth IT Architecture logical model

### 3.1.1 Corēhealth Server Farm Infrastructure

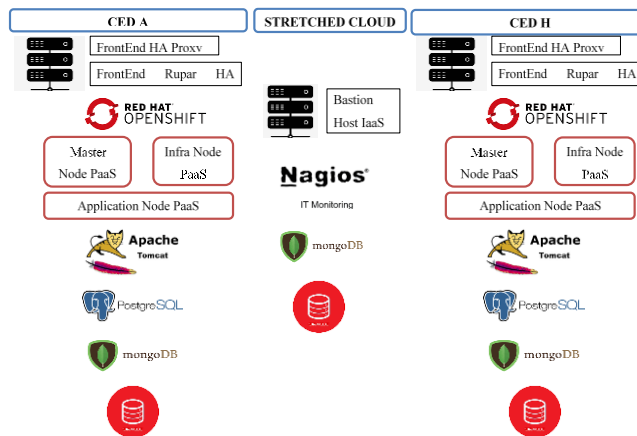


Figure 3. CORēHealth server farm architecture

Figure 3 illustrates the "physical" architecture of the CORēHealth central unit that resides on Innova Puglia's cloud. The cloud, dedicated to the plant, features 3 distributed nodes: CED A, CED H and the Stretched cloud configured together in High Availability. The PaaS platform is based on the Red-Hat Openshift system capable of easily integrating both open source and off-the-shelf products and projects. For each application component or service, within the solution, an "architectural template" is instantiated, which is the set of all the technological and operational components necessary for the functioning of the given component or service. The two nodes CED A and CED H are "orchestrated" by the Stretched Cloud characterized by the monitoring application, based on Nagios, and by the Bastion Host for the protection of the entire infrastructure. The CED A and the CED H are configured in mirror replication and in particular contain the following VMs: Oracle DB; Mongo DB; PostgreSQL DB; Apache Tomcat Web Server; OpenShift nodes (Master Nodes, Infra Node, Application Nodes, Front-End proxy in High reliability on local network and RUPAR (Unitary Network of the Apulia Regional Public Administration)).

In order to guarantee high security and availability of application services (not only of systems), easy scalability and adaptability to dynamic needs in terms of performance and a projection towards Business Continuity and Disaster Recovery solutions, even cross-site with high automation, the proposed technological architecture provides for the virtualization of systems capable of ensuring the provisioning of IaaS infrastructural elements, and the virtualization of applications using containers, through the adoption of the PaaS platform for container management (based on open standards such as Docker and Kubernetes) Enterprise level: Red Hat OpenShift. The solution is proposed with a high availability configuration through node redundancy (Master, Infra, Application). The Control Unit thus contemplates all the non-functional features that the new Platform must have (e.g. usability, security, compliance with the Privacy legislation,

etc.), maximizes usability by users, ensures full satisfaction of all dimensions of ICT system security, complies with privacy regulations - GDPR: General Data Protection Regulation - and is consistent with the "privacy by design and by default" principle. The Center ensures the operational continuity of the system, also in line with the relevant AgID (Agency for Digital Italy) Guidelines, to guarantee the availability of all the elements that contribute to the functioning of the information systems (e.g. ICT resources, logistical conditions, etc.) and it operates on an adequate and robust technological infrastructure at Innova Puglia's Regional Data Centers. The plan defines the integration standards with the Regional Health Information Systems and through the interoperability platform can be integrated with the reference regional information systems, such as: Regional Single Registry System; Electronic Prescription System; Single Booking Systems ("CUP")/ Diaries/ Specialist booking systems; Reporting systems; Medical Devices for Telemonitoring; Regional Single Sign On system; Regional Repository/DHR; External systems of Accredited Structures and Third Sector for the assignment of Diagnostic Therapeutic Care Plan; Medical office SW (GP/PCP). Among the platform's special features is also the acquisition of compliance certification in terms of web accessibility according to AGiD guidelines and relevant legislation ("Legge Stanca" and D.lgs 82/2005, Code for Digital Administration). The Veeam Backup suite is used for backup, which allows to backup and recover instances directly in the cloud.

### 3.1.2 Corēhealth App Mobile

The Citizen Mobile App (with SPiD/eIDAS access) is also available on the Android and iOS stores [Figure 4]. The mobile app allows, for the first time, the patient to have a series of functions in the palm of his hands: televisit diary, his/her treatment plan, sending and historical archive of his/her vital parameters in real time, diary, therapeutic adherence questionnaires, help-desk service, etc... Further developments are planned with the release of a series of additional features such as the integration of laboratory tests, electronic booking, electronic payments, etc ...

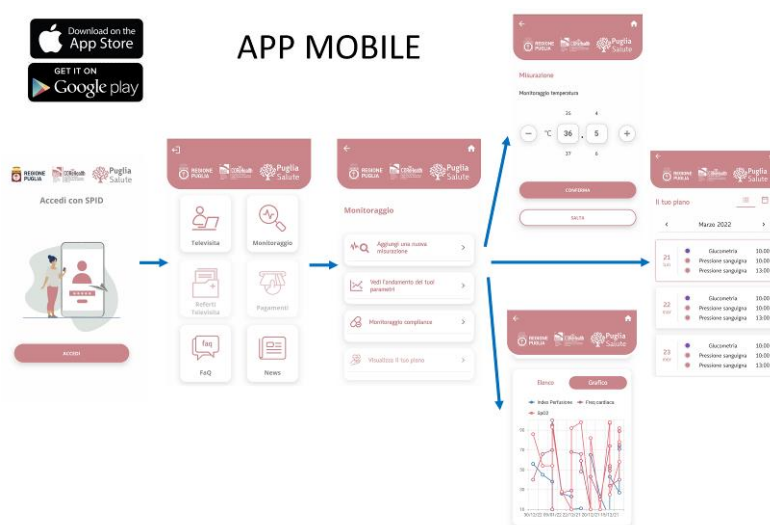


Figure 4. CORēHealth APP mobile interfaces

## 4. CONCLUSIONS

Telemedicine, now considered one of the key components for improving citizens' health, is a historic opportunity to be seized thanks to the NRRP which intends to create a real ecosystem in this regard, through a national enabling platform (implemented by the National Agency for Regional Health Services -AGENAS) and vertical regional implementations. The Apulia Region (during the Presentation at the Permanent Conference for relations between the State, the regions and the autonomous provinces, last 2 March) was identified by the Minister for Technological Innovation and Digital Transition to develop, together with

the Lombardy region (Flag Regions), the applications for the provision of Telemedicine services nationwide under M6C1 of the Italian National Recovery and Resilience Plan, (NRRP).

CORēHealth overturns the traditional patient care pathways, bringing, for the first time, digital innovation directly into their hands (App Mobile) enabling them to have their own medical history, their care plan and maintain a constant, regulated dialogue with their doctor, medical team and care giver, as well as being able to take the most appropriate measurements for the management of pathology/ies. Doctors can manage the clinical history of their patients in an integrated environment, optimizing care time, reducing inappropriate access to hospital facilities, developing their professional skills, including digital skills, according to a multidisciplinary approach to care taking with a single common point of access, reducing the distance between hospital and territory, and moving the care activities of chronically ill patients to an environment as close as possible to the patient's home.

In November 2022 the Apulia Region received the "Innovation in Digital Health" award, organized by AGENAS, the National Agency for Regional Health Services, and SICS, publisher of the journals *Quotidiano Sanità* and *Popular Science*, for the regional telemedicine platform CORēHealth. CORēHealth was also included among the best practices of the AGENAS's PON GOV chronicity (2014-2020) as a simultaneous investment to improve the use of and access to ICT Technologies and strengthen the institutional capacity of public authorities.

## REFERENCES

- Gorgoni G., Maglio G., Notarangelo P., Petrarolo V. (2022). Article. *Agenda Digitale.eu*, CORēHealth: com'è fatta la centrale di telemedicina pugliese
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Award. *Forum PA Sanità 2022*. CORēHealth - La centrale Operativa Regionale di Telemedicina della Regione Puglia
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Abstract. *XLVI Congress of the Italian Association of Epidemiology 2022*. "Telemedicina made in Puglia: la Centrale Operativa delle Cronicità e delle Reti Cliniche (CORēHealth)"
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Poster. *XLVI Congress of the Italian Association of Epidemiology 2022*. Telemedicina made in Puglia: la Centrale Operativa delle Cronicità e delle Reti Cliniche (CORēHealth)
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Award. *Digital360Awards*. Non-winning finalist. CORēHealth: Centrale Operativa Regionale delle Cronicità e delle reti Cliniche della Regione Puglia
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Award. *Innovation in Digital Health, Building Biotech Bridge*. CORēHealth
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Poster. *17 th Forum Risk Management in Sanità 2022*. Arezzo (Italy) CORēHealth: La Centrale Operativa delle Cronicità e delle Reti Cliniche della Regione Puglia
- Gorgoni G., Notarangelo P., Petrarolo V. (2022). Poster. *10 th Anniversary - Euregha*. CORēHealth — Telemedicine operations center for chronic conditions and clinical networks