Coordination Mechanisms from Telemedicine Practices: Three Case Studies in Italy

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Abstract

Although telemedicine practices may be traced back to decades ago, their real potential has only been recognized during Covid-19 outbreak. As the pandemic has abated, the implementation of telemedicine has revealed many managerial considerations that are crucial for its optimal deployment. The technical and social connotation of telemedicine is central for both understanding and promoting its implementation. This dual nature has been shown to peculiarly affect the organization of work, in particular coordination among health professionals. This study investigates which coordination mechanisms are enacted within telemedicine services among health professionals and how these mechanisms unfold to achieve collective performance within these services. To do that, three case studies, concerning telemedicine services provided by public healthcare organizations in the Italian context, were analysed. Results shed novel light on coordination mechanisms enacted within telemedicine services and their integrated conditions, meant as the instruments through which coordination mechanisms unfold to achieve collective performance. Practical implications are discussed to support managers

in interpreting how coordination mechanisms work within telemedicine services and consequently how to effectively design them.

Keywords – Coordination, Organization, Telemedicine, Healthcare

Paper type – Academic Research Paper

1   Introduction

Although telemedicine practices may be traced back to decades ago (Hjelm & Julius, 2005), their real potential has only been recognized in recent years. Covid-19 pandemic acted as catalyst for the awareness and diffusion of telemedicine, which – during lockdown – had essentially become the only possible manner to provide non-urgent medical services (Lukas et al., 2020).

This unprecedented awareness on telemedicine has led to the introduction of related policies and investments, addressing issues such as public reimbursement, data privacy, infrastructures, etc. (Bokolo, 2021). The Italian context is representative in this sense, as telemedicine has been central in the process of reform of the Italian National Health System (NHS), mainly through the National Recovery and Resilience Plan[1].

As the pandemic has abated, the implementation of telemedicine has revealed many managerial considerations, which are crucial for its optimal deployment. The complexity of integrating telemedicine within current practice is linked to the extension of the concept itself. In fact, telemedicine has been defined as the *provision of health services at distance*[2] and it is substantially characterized by a technological connotation (mainly related to digital technologies), as well as social implications (Bashshur et al., 2011).

The dual technical and social-related connotation of telemedicine is central for understanding and promoting its implementation (Khodadad-Saryazdi, 2021). In particular, this dual nature has been shown to peculiarly affect the organization of work (Barlow, 2015; Khodadad-Saryazdi, 2021; Nicolini, 2006, 2007). Nicolini (2006) argues how telemedicine affects coordination, through task shifting in the form of delegation of medical work towards non-medical roles (e.g. nurses) and affecting the "geography of care delivery". Thus, coordination emerges as a central concept for understanding how medical work changes with the introduction of telemedicine, both from a theoretical and practical standpoint.

From a theoretical viewpoint, the significance of telemedicine lies in its capacity to embody the sociomaterial entanglement of technology and service, thus serving as peculiar and example case for our understanding of coordination (Orlikowski, 2007).

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[1] Available at: https://www.governo.it/sites/governo.it/files/PNRR.pdf
[2] Available at: https://apps.who.int/iris/handle/10665/357828

However, this potential has not been fully explored, with respect to studies related to other technological domains in healthcare settings (see, for example, Sergeeva et al., 2020).

From a practical perspective, understanding how coordination mechanisms unfold within telemedicine services is of paramount importance for their effective design. This is particularly significant given the growing prevalence of telemedicine services in various national healthcare systems. The Italian NHS, for instance, calls for further coordination among healthcare professionals – including specialist doctors, general practitioners (GPs), and nurses – both within and across organizations. In this regard, the responsibility of ensuring coordination falls on the new roles and organizations established through healthcare system reforms[1]. To that end, it is essential for healthcare providers offering telemedicine services to work toward process and organizational convergence.

Finally, over the years, the scientific literature in the medical field has extensively discussed the matter of coordinating care with a pragmatic approach, often aimed at gathering evidence of the efficacy and effectiveness of integrated and coordinated care. Several articles have addressed this concern in diverse specializations, including – among others – diabetes (Northwood et al., 2022), cardiology (Doughty et al., 2002), gastroenterology (Chey et al., 2021), oncology (Kaasa et al., 2018). There is also evidence linked to the introduction of telemedicine within coordinated or integrated care (see, for example, Hays & Skootsky, 2022; Palmer et al., 2021; Pluymaekers et al., 2021; Silva-Cardoso et al., 2021; Sinsky et al., 2021; Tourkmani et al., 2021). This underscores the presence of an empirical problem, which offers the opportunity to analyse the issue from a theoretical viewpoint and derive practical conclusions with a more distinctly managerial approach.

Given these premises, this study investigates *which coordination mechanisms are enacted within telemedicine services among health professionals and how these mechanisms unfold to achieve collective performance within these services.*

An overview on the main relevant issues concerning the empirical setting is hereby provided and the theoretical framework adopted within the study is then discussed. As our understanding related to the objective of the study is limited, a multiple case study

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[1] More information available at:
https://www.quotidianosanita.it/allegati/allegato1655970392.pdf

methodology was adopted to gather data from the actors involved in the phenomenon under investigation (Gioia et al., 2013) "within its real-life context" (Yin, 2013). Results are presented and discussed, along with conclusions and limitations of the study.

2   Background

2.1 Telemedicine

One of the currently most acknowledged definitions of Telemedicine is provided by the World Health Organization, which delineates it as the *provision of health services at a distance*[1]. The key feature of telemedicine consists in the physical distance between the actors involved within the telemedicine service, which is typically enabled by digital technologies.

Although the very definition of telemedicine is debated, the taxonomy proposed by Bashshur et al. (2011) clarifies a set of issues that are relevant for this research. Their taxonomy is based on three intersectional dimensions: technology (synchronicity, network and connectivity), functionality (diagnosis, consulting, monitoring and mentoring) and applications (treatment, specialty, disease and site).

The authors wished for the recurrence to a coherent and unified taxonomy not only for scholars, but also for policymakers. This taxonomy is in fact still far from be achieved (Harst et al., 2022), as it can also be noticed by different definitions given to specific telemedicine services among international policies (Edmunds et al., 2017). However, the proposed taxonomy conceptually shows the multi-faced structure of telemedicine, which can be intrinsically considered as a set of technologies, functionalities and applications integrating traditional healthcare service delivery (Bashshur et al., 2011). In other terms, telemedicine can be meant as an "integrated system of healthcare delivery" , both in presence and at distance, through the deployment of digital technologies (Bashshur, 1995).

Therefore, telemedicine comprises a plethora of different specific typologies of services, such as teleconsultation and telemonitoring. Practical definitions of different common types of telemedicine services are provided in Annex 2 (Glossary).

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[1] Available at: https://apps.who.int/iris/handle/10665/357828

2.2 Coordination mechanisms: the adopted framework

To investigate how telemedicine changes coordination mechanisms within healthcare services provision, the framework proposed by Okhuysen & Bechky (2009) was exploited. The authors define coordination mechanisms as *the organizational arrangements that allow individuals to realize a collective performance*. Five coordination mechanisms were identified as recurrent in the literature and conceptualized as plans and rules, objects and representations, roles, routines, and proximity.

However, it is argued that coordination mechanisms alone fail to provide a comprehensive view of "how" these mechanisms work. The need for a further level of conceptualization stems from: i) the emergence of different approaches depending on the object of analysis (Crowston, 1997; Gittell, 2000); ii) the "embeddedness of findings in particular contexts", i.e. the fact that past research has investigated coordination mechanisms on a variety of empirical context, resulting not only in a fragmented terminology, but in a difficult comparability among findings; iii) a lack of focus on the means through which coordination mechanisms are enacted, i.e. "how" they happen.

Therefore, Okhuysen & Bechky (2009) went further and identified the three *integrating conditions* depicted in Table 1, through which agents achieve collective performance.

Table 1. Integrating Conditions for Coordination: definitions

Integrating condition	Definition
Accountability	It answers to the question "who" is responsible for specific elements of the task
Predictability	It enables interdependent parties to anticipate subsequent task-related activities, by knowing what the elements of the task are and when they happen
Common understanding	It provides a shared perspective on the whole task and how individuals' work fits within the whole

Source: adapted from Okhuysen & Bechky (2009)

Each of these conditions can be achieved through a combination of coordination mechanisms, which are reported in Table *2*.

The specific approach taken in the precent research is coherent with the perspective of Crowston's work (Crowston, 1997; Malone & Crowston, 1990, 1994), which focuses on task interdependence in situations in which resources are shared among agents, or tasks

need to be divided into sub-tasks in order for goals to be accomplished. Therefore, the empirical focus is medical and health professionals' work.

Table 2. Integrating Conditions for Coordination and their Relationship to Coordination Mechanisms

	Accountability	Predictability	Common understanding
Plans and rules	Defining responsibilities for tasks	Defining responsibilities for tasks Resource allocation	Developing agreement
Objects and representations	Scaffoldings Acknowledging and aligning work	Scaffolding	Direct information sharing Creating a common perspective
Roles	Monitoring and updating		Substitution Creating a common perspective
Routines	Hand-off work	Task completion/stability	Bringing groups together Developing agreement
Proximity	Visibility: monitoring and updating Familiarity: developing trust	Familiarity: anticipating and responding	Familiarity: store of knowledge

Source: Okhuysen & Bechky (2009)

3   Methods

To address the research question, a multiple case study methodology was employed, focusing on coordination mechanisms in telemedicine services as units of analysis.

Following the recommendations for multiple case study theory building (Eisenhardt 1989; Eisenhardt and Graebner 2007), within- and cross-case analyses were performed (Yin, 2013). Cases were selected through empirical sampling, considering the geographical area and legal nature of the organizations where services are provided.

In Italy, Regions have considerable autonomy in defining the organizations of health services delivery, and healthcare provision takes place at various institutional levels, such as Local Health Authorities (LHAs) and hospitals, which follow partially different institutional criteria. All cases were selected in the Italian context to control for policy, political, and regulatory factors that might affect the provision of telemedicine services. Three cases, namely North-East, North-West, and Centre (NE, NW, and CE), were chosen to limit potential biases (Eisenhardt and Graebner 2007) and gather stronger

insights (Eisenhardt 1989). Each service includes teleconsultation, telemonitoring and tele-expertise.

Their main features are shown in Table 1. More information is available in Annex 1.

Table 1: Features of the three case studies

Feature/Case	NE	NW	CE
Geographic Area	Northern Eastern Italy	Northern Western Italy	Central Italy
Juridical nature of the organization	LHA	Hospital within LHA	LHA
Dimension	300 patients involved	300 patients involved	4,000 patients involved
Type of patients	Patients with (low risk) heart failure	Diabetics	Various (cardiology, endocrinology, psychology, etc.)
Interviewees	Project Manager (interviewed twice), Doctor (interviewed once) and Nurse (interviewed once)	Doctor (interviewed once)	Doctor (Head of Digital Transformation) (interviewed twice)

To ensure robust data collection, multiple sources of evidence were relied upon, including primary data, such as semi-structured interviews, and secondary data, such as reports, online news articles, and websites.

The interviewees for this study included individuals who were both healthcare professionals and managers. For the region of NE, the three professionals interviewed were a Project Manager, a doctor, and a nurse. In NW and CE, the interviewed doctors held prominent managerial positions, which are commonly referred to as "hybrid" roles in previous studies (see, for example, Mcgivern et al. (2015).

The information from the interviews has been complemented by several other sources of evidence, including institutional websites, academic papers, newspaper articles, and practitioners' reports. The convergence of evidence, which emerged from data triangulation, has strengthened construct validity (Jick, 1979).

After transcribing the interviews verbatim, they were analysed following the Gioia Methodology (Gioia et al., 2013), identifying theory-driven codes, categories, and themes.

4   Findings

Findings are described based on the integrating conditions for coordination mechanism identified by Okhuysen & Bechky (2009).

4.1 Accountability

By defining who is responsible for specific tasks or sub-tasks, accountability enables clarity for organization members with respect to their shared responsibilities in reaching a common goal (Okhuysen & Bechky, 2009).

Plans and rules contribute to accountability by defining task responsibilities. In Project-NE, effort was put in defining formal procedures concerning the management of patients through telemedicine tools and to make professionals aware of them:

> *"We are defining detailed internal procedures and we are pushing to make them public, so that each professional will be aware of what are their responsibilities."* – Project Manager, NE

Moreover, the roles of pre-existing actors within the organization were "updated". This is particularly true for nurses, who have experienced job enlargement more than other professionals. New professional figures were established as well: within Project-NE, dedicated project managers were assigned to specific parts of the project:

> *"While there is an ongoing negotiation on tasks and activities, which is redistributing tasks and activities among nurses, specialized doctors and GPs, [...] the coordinating role for technical deployment were assigned to dedicated Project Managers."* – Doctor, NE

Within Project-NW, telemedicine has been integrated within integrated pathways for chronic patients. These pathways describe the journey of the patient and the responsibilities for each actor who deals with the patient:

> *"We have defined two integrated care pathways: the first one for patients with hyper-glycemia that are firstly treated with urgence; the other one concerns patients with insulin infusers, who are followed also through telemedicine services."* – Doctor, NW

Therefore, the evidence suggests that:

Proposition 1: Within telemedicine services, accountability is accomplished through the design of new procedures, the definition of new roles and the revision of existing ones.

4.2 Predictability

Predictability enables organizational agents to anticipate the sequence of tasks related to activities, knowing which tasks will be performed and when (Okhuysen & Bechky, 2009).

In Project-NE, the telemedicine platform has a specific functionality that allows health professionals to view which tasks have been carried out and to "activate" new ones, i.e. to request other professionals to perform another task:

> *"Through our platform it is possible for health professionals to [...] view and activate tasks, through a task planner."* - Nurse, NE

The interviewed doctor for Project-NW has highlighted that the availability of data gathered through telemonitoring allows for professionals to understand more easily which tasks are needed to be performed:

> *"Being able to regularly view the data concerning patients managed within the project, it is easy for nurses and doctors to define when it is appropriate to intervene."* - Doctor, NW

Finally, Project-CE has developed informative materials and tutorials for both health professionals and patients, consisting in presentations and short videos. Although their purpose is mainly informative, these materials are substantially protocols and they contribute to create a sequence of interdependent actions that should be clear to all the agents:

> *"These videos and materials are available through a QR code. They are useful to understand the overall process, with a step-by-step approach and they are very easy to follow. [...] We also have extended versions, e.g. the one for tele-expertise is 29 pages long."* - Doctor, CE

Thus, evidence points out that:

Proposition 2: Within telemedicine services, predictability is achieved through representations of task advancement and patients' status, enabled by the telemedicine platforms themselves, and through protocols establishing sequences of actions.

4.3 Common understanding

Common understanding is meant as a shared perspective on overall activities and shared goals (Okhuysen & Bechky, 2009).

In Project-CE, common understanding was meant as the understanding of the overall required sub-tasks that make up the overall health service, through both the formalization of procedures and the possibility to visualize the overall process within the platform.

> *"Managing the process through the platform allows to see the unpacking of the different activities (e.g. booking, paying, doing a visit). Now everyone can understand the overall process, with respect to traditional services. Now you can be mad at the patient or to your colleagues knowing that you were right."* - Doctor, CE

Moreover, different professional figures typically intervene in managing care for chronic patients, in both acute situations of follow-ups. The interviewed doctor of NW pointed out that different perspectives are intrinsic of different professional backgrounds. However, the possibility to monitor, visit and manage patients remotely contributes to set appropriate priorities for intervention, both physically and remotely.

> *"Without telemedicine it was difficult for surgeons and clinical doctors to have a common view on the patients, as they prioritize their part of the pathway. It is still difficult, but we are developing agreement."*- Doctor, NW

In the Italian context, much effort is being put on aligning goals between the hospital setting and the territorial setting. In this sense, within Project-NE telemedicine is viewed as a tool to share information as it was not previously done, creating a bridge among actors in different settings.

> *"Usually there has been a lack of direct communication with hospital doctors. This project was born with the aim of not working in silos."* - Project Manager, NE

In conclusion, findings indicate that:

Proposition 3: Within telemedicine services, common understanding is enabled by new channels for communication and information provision, as well as the possibility for each actor to "visualize" and understand the overall process.

5   Discussion

The three cases allowed to gather evidence to improve our understanding on coordination mechanisms enacted within telemedicine services in public healthcare organizations.

From a theoretical perspective, the sociomaterial connotation of telemedicine, which defines its technological and service nature (Bashshur et al., 2011), are fundamental for

comprehending the impact of telemedicine on enacted coordination mechanisms. Telemedicine platforms function as coordinating objects and representations, while coordination is enacted also as rules, procedures, and roles defined within telemedicine services.

The purpose of the present study was not only to identify the coordination mechanisms used, but also to further our understanding on how these mechanisms fulfil the three integrated conditions conceptualized by Okhuysen & Bechky (2009).

Accountability, which refers to the awareness of organizational agents regarding their responsibilities for each task and sub-task, depended on the presence of formal procedures associated with telemedicine services. Management took the initiative to promote the diffusion and awareness of these procedures among health professionals. The introduction of telemedicine services in Italy necessitated the revision of pre-existing roles, which are now being distributed among professionals, such as GPs and nurses. Additionally, new roles have been introduced to manage technological deployment and coordination among settings. Finally, integrated pathways, which include telemedicine services, functioned as procedures that define tasks and responsibilities for each agent involved in patient care.

Predictability, which refers to the ability of agents to anticipate tasks or sub-tasks in space and time, was achieved through detailed protocols, which should be easily accessible by professionals, which contribute to clarifying the sequence of actions needed to provide the overall service. The availability of data through telemedicine platforms enables health professionals to anticipate when it is appropriate to intervene, thus providing predictability. Finally, task planners specifically provide professionals a tool to activate tasks and foresee them to some extent.

Finally, a shared understanding of tasks and objectives relies on the possibility of visualizing and comprehending the overall process of service provision through technology. Furthermore, the availability of data provides a common view on priority setting for professionals who typically have a siloed view of their piece of the process. Lastly, the possibility of communicating and exchanging data among hospital and territory actors activates a virtuous channel that aims to build bridges between these two domains (although these bridges are still a "work in progress").

The examination of the coordination mechanisms that are enacted and "how" they satisfy these conditions offers relevant practical implications. The three integrating conditions are derived from a formal and emergent view of coordination mechanisms.

Thus, when designing formal coordination mechanisms for telemedicine services, managers must be aware of how these mechanisms operate among professionals to be effective. It is not sufficient to merely clarify the tools, procedures, and overall formal arrangements; rather, it is necessary to link coordination mechanisms to the integrating conditions to enable their optimal implementation. Understanding how accountability, predictability, and common understanding arise from the organization is a key component of the design of coordination mechanisms.

Within the empirical setting under examination, the evidence is associated with relatively small projects that are currently being implemented. While it already emerged how coordination mechanisms are linked to the integrating conditions, it is also clear that more must be done to enhance their effectiveness. Given the nature of healthcare organizations, accountability is challenging as the structure of belief of professionals affects their perception of accountability "sticking" it to their traditional view. With regard to predictability, the consolidation of these services should contribute to creating "new routines" for health professionals. Finally, common understanding is likely the most overlooked integrating condition, but it is also arguably the most relevant at present time. The awareness of how each actor's contribution is linked to the overall process and objectives is one of the primary missing links between the enactment of coordination mechanisms and their effectiveness.

6   Limitations and future directions

The present study is currently at an initial phase and requires further evidence to support its conclusions. The three case studies will be deepened with more evidence, and additional case studies will be added with a replication logic. To support the reliability of the findings, it would be beneficial to examine case studies related to healthcare providers in various geographical locations and with different legal structures, such as private healthcare providers. By doing so, the evidence linked to the results will be strengthened.

In the future, it is desirable to collect sufficient evidence to discuss not only the coordination mechanisms in use and how they function, but also how they develop over time or with maturity (attributing them the meaning of "organizing structures" as defined by Okhuysen & Bechky (2009)). It would also be useful to examine the dynamics between formal arrangements and emergent practices, deepening the interpretation based on the existing debate.

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Annex 1: The three selected case study

Case study 1: North-East (NE)

"North-East" (NE) is a publicly funded Local Health Authority (LHA) that serves as the sole healthcare provider within its designated regional territory, which renders it an essential entity of the region itself. Its mandate is to manage and coordinate healthcare and social welfare activities throughout the Region. Notably, the Region holds unique regulatory autonomy within the constraints of the Italian constitution. The regional territory is predominantly mountainous, and there are numerous scattered settlements throughout the area. The LHA and the region have a longstanding focus on digital transformation in healthcare, as evidenced by their creation of dedicated strategic support entities.

Project-NE is a service provided by NE, a healthcare organization operating in collaboration with the region and other supporting bodies. This service is specifically designed to address the growing number of chronic heart failure patients, which poses a significant challenge to the healthcare system for the coming years.

The project enables healthcare professionals, such as cardiologists and cardiology unit nurses, to conduct teleconsultations and telemonitoring of chronic heart failure patients. A web-based clinical dashboard provides healthcare professionals with comprehensive data while patients are provided with a smartphone app that includes specific functionalities prescribed by the cardiologist. The platform integrates digitally connected devices, such as implantable devices and smartwatches, to provide healthcare personnel with real-time patient data for a complete clinical overview. The dashboard allows healthcare professionals to monitor patient data and registered parameters, schedule and initiate video calls, and share multimedia files.

Currently, three local healthcare hospitals and clinics manage over 300 chronic heart failure patients within this telemedicine service.

Case study 2: North-West (NW)

"North-West" is a publicly funded LHA situated in the most densely populated Italian Region. It encompasses one of Italy's largest hospitals, in terms of hospital beds, and provides comprehensive clinical and surgical specialties organized across more than 50

departments. As an LHA, NW also encompasses territorial clinics that provide both health and social care services, with the mission of integrating specialty and social care.

Project-NW is a service designed for patients with diabetes, both type I and II, and it is delivered via a telemedicine platform, allowing teleconsultation and telemonitoring. Teleconsultations are meant for follow-up consultations to monitor therapy and receive specialist prescription. Telemonitoring enables continuous gathering of data related to diabetes-related parameters from sensors. The service was initially developed in NW hospital in collaboration with the Region and has the potential to expand to other healthcare providers. Over 300 patients are currently involved in this project.

The platform used for these services is integrated with the regional Electronic Health Record (EHR), providing access to the patient's entire clinical history. The platform also allows for real-time uploading and viewing of attachments, including documents, images, and videos exchanged between the doctor and the patient.

Case study 3: Centre (CE)

"Centre" is a publicly funded LHA located in one of the most populated Regions of Centre Italy, which provides medical care to over 500,000 citizens. The region encompasses a vast territory of over 3,000 square kilometres, with less than 100 towns and a population density of less than 150 individuals per square kilometre.

The Project-CE has been implemented in the primary hospital of "Centre" as well as in smaller public clinics specialized in specific medical practices within the territory. Telemedicine services have been integrated into various clinical specialties, including cardiology, psychology, dermatology, and endocrinology.

Teleconsultations are commonly used for follow-up appointments and recurrent meetings with chronic patients across various specialties, while telemonitoring is spread for detecting specific parameters, such as glycaemia. To increase accessibility to specialized physicians in remote and isolated areas, such as small towns, a tele-expertise project has been initiated. This project enables GPs to discuss their patients with specialized physicians located in the primary hospital, receiving feedback and suggestions without the need to travel long distances.

Finally, an ECG telerefertation service is provided, which involves a nurse visiting a patient's home and using specialized equipment to transmit the results of the

electrocardiogram to a cardiologist at the hospital in real-time. The cardiologist can then request further tests from the nurse as needed.

Annex 2: Glossary

Telemedicine service	Definition
Teleconsultation	Medical consultation to a patient taking place remotely through the employment of digital technologies. In the Italian context is referred to as "televisit" and it may be provided under specific circumstances, e.g. periodical consultations for chronic patients
Tele-expertise	Consultation between doctors who are not in the same physical location concerning the status of a patient, via digital technologies. In the Italian context it is referred to as "teleconsultation"
Telemonitoring	Patient monitoring service involving the use of devices (sensors, wearables, etc.) to gather data from patients concerning clinical parameters
Telerefertation	Provision of a clinical medical report, involving a healthcare professional supporting the patient in performing a specific clinical exam in presence and a doctor providing a medical report based on gathered data