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TELEMEDICINE AS A SUPPORT TOOL IN REMOTE AND OPERATIONAL SETTINGS - A QUALITATIVE STUDY WITH EARLY-CAREER PHYSICIANS AND NURSES

Angeliki Chandrinou

Supervisor/s:

Panagiotis Bamidis, Prof., Aristotele University of Thessaloniki

Stergiani Spyrou, Dr., Aristotele University of Thessaloniki

Date: 27/02/2026



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Dedication / Acknowledgements

To the late Angeliki Vekkou, who guided me along the path of peace and spiritual quest.

To my mother, Panagiota, who has consistently served as a source of strength and support throughout my life.

To the chosen one of my heart, Konstantinos, and to my little daughter Katerina, who instilled in me a profound sense of patience, courage, and determination, and above all, imbued my life with a deep sense of love.

Furthermore, acknowledgement is extended to those who transform impediments into opportunities, and who labour diligently and discreetly to facilitate the advancement of health to previously unexplored domains.

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My appreciation also extends to all those who supported me during this process, both academically and personally.

Abstract

Background: The delivery of healthcare in remote and operational settings presents persistent challenges related to limited resources, geographic isolation, and restricted access to specialized medical expertise. Telemedicine has emerged as a promising digital health intervention to support healthcare professionals working under such conditions.

Aim: This qualitative study explores how telemedicine functions as a support tool for early-career physicians and nurses delivering care in rural healthcare facilities and operational medical contexts in Greece, including military-related environments.

Methods: Using a qualitative research design, semi-structured interviews were conducted with early-career healthcare professionals (n=7) to capture their experiences, perceptions, and practices related to telemedicine-supported clinical decision-making. The data were analyzed using thematic analysis, enabling the identification of key themes related to clinical support, workflow integration, technological challenges, professional confidence, and perceived impact on care delivery.

Results: Findings suggest that telemedicine contributes to enhanced clinical confidence, improved access to specialist guidance, and perceived improvements in patient management, while also revealing socio-technical challenges such as connectivity limitations, workflow disruptions, and training needs.

Conclusion: By focusing on the lived experiences of early-career clinicians, this study contributes to the understanding of telemedicine as a socio-technical support mechanism rather than solely a technological solution. The findings have implications for healthcare organizations and policymakers seeking to design, implement, and scale telemedicine services in remote and operational healthcare settings.

Keywords: Telemedicine, Digital health, Remote healthcare, Qualitative research, Early-career clinicians

JEL Classification Codes: I11, O33

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Glossary

AI	Artificial Intelligence
TAM	Technology Acceptance Model

Introduction

General background

The digital transformation of healthcare has accelerated significantly over the past decade, driven by advances in information and communication technologies, evolving patient needs, and systemic pressures on health systems (Satou et al., 2017). Telemedicine has been identified as a significant innovation within the domain of digital health, with the potential to address spatial and organizational constraints that are prevalent in contemporary healthcare delivery models. The field has attracted considerable attention from relevant stakeholders, indicating the emergence of a promising solution to the challenges faced in the delivery of healthcare services. Telemedicine refers to the use of digital communication technologies to provide clinical support, consultation, diagnosis, and decision-making across geographical distances (Kaintura & El Hussein, 2024).

While telemedicine initiatives have been widely implemented in urban and tertiary care contexts, their relevance is particularly pronounced in remote and operational settings, where healthcare professionals often work with limited resources, reduced staffing, and constrained access to specialist expertise. In such environments, digital technologies are not merely efficiency-enhancing tools but may constitute essential mechanisms for maintaining safe and effective healthcare delivery (Grigsby & Sanders, 1998).

In Greece, geographic dispersion, island regions, rural communities, and operational healthcare contexts such as military operations present unique challenges for healthcare provision (Konidari et al., 2025). These settings create a critical need for innovative service delivery models that can support frontline clinicians, particularly those with limited professional experience.

Health needs and service delivery challenges

As Wilcox et al. (2023) demonstrate, structural and contextual constraints characteristically exert a direct influence on the quality and safety of care in remote and operational healthcare settings. It has been reported that a number of challenges are recurrently encountered in rural and operational medical environments. These include limited diagnostic infrastructure, shortages of the medical workforce, time-critical decision-making and professional isolation. For early-career physicians and nurses, these challenges may be further amplified by reduced clinical experience and limited opportunities for in-person supervision or mentoring (Dymmott et al., 2022).

In operational healthcare contexts, such as military-related medical services, clinicians are often required to manage acute and complex cases under conditions of uncertainty, logistical constraints, and heightened responsibility (Ali et al., 2025; Madsen et al., 2023; Poropatich et al., 2010). These findings underscore the significance of dependable support systems that can extend clinical expertise beyond physical limitations.

Conventional models of healthcare delivery, which depend heavily on co-located specialist teams, often prove to be inadequate in such contexts. Consequently, healthcare systems are increasingly exploring telemedicine as a means to bridge expertise gaps, support decision-making, and enhance continuity of care across diverse and challenging environments (Ali et al., 2025; Alsabri et al., 2025; Carradinha et al., 2026; Moyo, 2025; Parveen et al., 2025).

The role of telemedicine in remote and operational settings

Telemedicine is now widely recognized as a vital tool for providing healthcare in remote and challenging environments (Pamplin et al., 2019). It facilitates access to specialist advice, supports diagnostic processes, and enables collaborative clinical decision-making. Beyond its technical capabilities, telemedicine is transforming professional practices, workflows, and the relationships and responsibilities within healthcare systems.

For healthcare professionals at the beginning of their careers, telemedicine may function as a form of clinical supervision, offering real-time or asynchronous guidance that supports learning, confidence-building, and patient management (Jordan & Shearer, 2019). However, the effectiveness of telemedicine depends not only on technological performance but also on organizational integration, user acceptance of process changes, and alignment with clinical workflows (Madsen et al., 2023).

Understanding telemedicine as a socio-technical intervention—embedded within professional practices and organizational contexts—is therefore essential for evaluating its role and impact in remote and operational healthcare settings (Carradinha et al., 2026; Glueckauf et al., 2018).

Identifying the research gap

Despite the growing body of literature on telemedicine, existing research has predominantly focused on patient outcomes, cost-effectiveness, or large-scale implementation outcomes (Gajarawala & Pelkowski, 2021). A small number of studies have started to explore the experiences of healthcare professionals using telemedicine in rural and remote settings (Dymmott et al., 2022; Wilcox et al., 2023). However, there is still a significant lack of research

addressing early-career clinicians working under operational constraints, especially in geographically isolated or militarized environments.

Moreover, studies often approach telemedicine as a technical solution rather than exploring how it is experienced, adopted, and integrated into everyday clinical practice (Greenhalgh et al., 2020). There is a notable lack of qualitative research that captures the perspectives of early-career physicians and nurses who rely on telemedicine as a primary source of clinical support in remote and operationally constrained healthcare settings.

Justification and relevance of the current study

This study addresses the identified gap by exploring telemedicine through the lived experiences of early-career healthcare professionals working in remote and operational settings in Greece. By adopting a qualitative approach, the research provides in-depth insights into how telemedicine supports clinical practice, shapes professional confidence, and interacts with organizational and technological conditions.

The findings are expected to contribute to the fields of digital health and healthcare management by informing about the design and implementation of telemedicine systems that are responsive to the needs of frontline healthcare professionals. The study is particularly relevant for policymakers, healthcare organizations, and military or rural health services seeking to leverage telemedicine as part of broader digital transformation strategies.

Chapter 1. Conceptual Framework and Terminology

1.1. Introduction

This chapter outlines the key concepts and terminology that underpin the present study. Establishing a clear conceptual framework is essential in qualitative research, as it provides a shared understanding of how central terms are used and interpreted throughout the thesis. Rather than presenting a formal theoretical model, this chapter clarifies the operational meaning of concepts relevant to telemedicine, remote and operational healthcare delivery, and early-career healthcare professionals.

The conceptual framework of the study is grounded in the practical realities of healthcare delivery in geographically and operationally constrained environments. It focuses on telemedicine as a support mechanism embedded within clinical practice, organizational processes, and professional roles.

1.2. Telemedicine

Telemedicine refers to the use of information and communication technologies to support the delivery of healthcare services across geographical distance (WHO, 2010). In clinical practice, telemedicine may include synchronous or asynchronous communication between healthcare professionals, such as telephone consultations, video conferencing, and the exchange of medical images or clinical information by using a specific telemedicine platform (Tuckson et al., 2017; WHO, 2019).

In the context of this study, telemedicine is conceptualized primarily as a professional support tool rather than a patient-facing service. It enables early-career clinicians working in remote or operational settings to access specialist advice, clinical guidance, and decision support from experienced healthcare professionals located in central healthcare facilities.

This definition reflects a realistic understanding of telemedicine as it is applied in everyday clinical practice, focusing on its role in supporting healthcare professionals under conditions of limited local expertise.

1.3. Remote and operational healthcare settings

Remote healthcare settings are characterized by geographic isolation, limited healthcare infrastructure, and reduced access to specialized medical services. In Greece, such settings include rural health centers, island-based facilities, and other locations distant from tertiary hospitals. According to OECD & European Observatory on Health Systems (2025), the country's mountainous and insular morphology imposes structural barriers to healthcare access in these regions. Telemedicine networks have been deployed to bridge these disparities, especially across 43 island areas (Greek Ministry of Health, 2018).

Operational healthcare settings refer to environments in which healthcare delivery occurs under conditions shaped by organizational, logistical, or operational constraints. These may include military

medical services and other structured operational contexts where clinicians must provide care within predefined systems, protocols, and resource limitations (Madsen et al., 2023).

In both remote and operational settings, healthcare professionals are often required to manage a wide range of clinical situations with limited on-site support. Telemedicine is therefore positioned as a mechanism that extends clinical capacity beyond physical boundaries (Madsen et al., 2023; Tsou et al., 2021).

1.4. Early-career physicians and nurses

For the purposes of this study, early-career physicians and nurses are defined as healthcare professionals who have completed their formal education relatively recently and are practicing without advanced clinical specialization. These clinicians often hold significant clinical responsibility while still developing professional confidence and experiential knowledge (Dymmott et al., 2022; Wilcox et al., 2023).

Early-career healthcare professionals working in remote or operational settings may face additional challenges related to professional isolation, limited mentorship, and reduced opportunities for in-person supervision (Yan, 2022). Understanding how telemedicine supports this group provides insight into both clinical practice and professional development within constrained healthcare environments.

1.5. Telemedicine as a Support Tool

In this study, telemedicine is considered a support tool that operates across multiple dimensions of healthcare delivery. These include clinical decision-making, workflow coordination, access to expertise, and professional reassurance.

Rather than viewing telemedicine solely as a technological intervention, this study adopts a socio-practical perspective that recognizes the interaction between technology, users, and organizational context. Telemedicine is thus understood as part of a broader system of care that shapes how healthcare professionals perform their roles in challenging environments.

This conceptualization enables the study to explore not only the utilization of telemedicine, but also how it is integrated into everyday practice and its impact on clinicians' perceptions of safety, competence, and support.

1.6. Conceptual boundaries of the study

The present study focuses on the experiences of healthcare professionals with limited professional experience in the use of telemedicine and does not aim to evaluate clinical outcomes, cost-effectiveness, or patient satisfaction. The emphasis is placed on clinicians' perspectives, practices, and

interpretations of telemedicine as part of their working environment. By clearly defining these conceptual boundaries, the study maintains a focused analytical scope aligned with its qualitative design and research objectives.

Chapter 2. Theoretical/analytical framework

2.1. Purpose of the theoretical/analytical framework

The purpose of this chapter is to outline the perspectives that inform the interpretation of the empirical data collected in this study. The study adopts a flexible analytical framework as opposed to the application of a single, rigid theoretical model. The purpose of this is to provide a basis for the exploration of early-career health professionals' experiences with telemedicine in remote and operational settings.

The theoretical orientation of the study is realistic and applied, with the objective of supporting understanding of how telemedicine is perceived, adopted, and integrated into everyday clinical practice. These perspectives are employed to inform interpretation during the discussion phase; however, they do not dictate the process of coding or the development of themes during data analysis.

2.2. Technology acceptance in healthcare contexts

Digital health interventions, including telemedicine, are shaped not only by their technical capabilities but also by users' perceptions, attitudes, and experiences. One of the most widely used frameworks for understanding the adoption of technology in healthcare is the Technology Acceptance Model (TAM). The Technology Acceptance Model suggests that users' acceptance of a technology is influenced primarily by two factors: perceived usefulness and perceived ease of use. In healthcare settings, these perceptions are closely linked to clinical workflows, professional responsibilities, and the perceived impact of technology on patient care (Al-Momani & Ramayah, 2025).

In the context of this study, TAM is not applied as a predictive or quantitative model. Instead, its core concepts are used as sensitizing concepts that support the interpretation of participants' accounts. For instance, clinicians' descriptions of telemedicine as beneficial for decision-making or as challenging to use due to technical constraints can be interpreted in the context of perceived usefulness and ease of use.

2.3. Practice-based perspectives on healthcare delivery

While technology acceptance frameworks assist in explaining initial engagement with digital tools, they do not fully capture how technologies are used in complex, real-world clinical environments. Consequently, the study also draws on practice-based perspectives in healthcare research.

Practice-based approaches emphasize that healthcare delivery is shaped by everyday routines, professional roles, organizational structures, and contextual constraints (Dymmott et al., 2022). From this perspective, telemedicine is not viewed as a standalone technology but as something that becomes meaningful through its use in practice.

Applying a practice-based lens enables the study to explore the integration of telemedicine into clinical workflows, the manner in which it fosters collaboration between professionals, and its impact on decision-making processes within operational constraints. This standpoint is especially pertinent in remote and operational contexts, where formal procedures and informal practices frequently coexist.

2.4. Integrating technology acceptance and practice-based perspectives

The analytical framework of this study combines elements of technology acceptance and practice-based perspectives in order to provide a more comprehensive understanding of telemedicine use. Technology acceptance concepts offer a theoretical framework for understanding how clinicians perceive and engage with telemedicine, while practice-based perspectives provide insight into the integration of telemedicine within everyday clinical work.

Together, these perspectives support an analysis that considers both individual perceptions and broader organizational and contextual factors. This integrated approach aligns with the study's focus on telemedicine as a support tool that operates within socio-technical systems rather than as a purely technical solution.

2.5. Role of the framework in data analysis

The theoretical and analytical framework informs the interpretation of findings generated through thematic analysis. It does not determine the themes in advance but rather supports the discussion of how identified themes relate to existing concepts in digital health and healthcare delivery (Braun & Clarke, 2021; Green et al., 2025).

During analysis, themes emerging from the data are examined in relation to issues such as perceived usefulness, integration into practice, professional confidence, and organizational context. This approach ensures that the findings remain grounded in participants' experiences while being situated within relevant analytical perspectives (Nilsen, 2015; Ross et al., 2016).

Chapter 3. Methodology

Building on the conceptual and analytical framework outlined in the previous chapters, this chapter describes the qualitative methodology used to explore healthcare professionals' experiences with telemedicine in remote and operational settings.

3.1. Study design

This study employs a qualitative research design using semi-structured interviews to explore how telemedicine is experienced and used as a support tool by early-career physicians and nurses working in remote and operational healthcare settings. Qualitative research is particularly suitable for an in-depth understanding of participants' experiences, perceptions, and everyday practices (Green et al., 2025; Tong et al., 2007). Rather than aiming to measure predefined variables, this approach enables an in-depth understanding of how participants interpret and make sense of telemedicine-supported healthcare delivery.

The study is exploratory in nature, focusing on how telemedicine supports clinical work, decision-making, and professional confidence in contexts characterized by geographical isolation and limited access to on-site specialist expertise. Qualitative interviews allow participants to describe their experiences in their own words and to highlight aspects of telemedicine use that they consider most relevant to their clinical practice.

3.2. Study setting and context

The study is situated within remote and operational healthcare settings in Greece, including rural healthcare facilities and operational medical environments associated with military healthcare delivery. These settings are characterized by limited diagnostic resources, reduced staffing, and restricted access to specialist medical support.

Healthcare professionals working in such contexts are often required to manage a wide range of clinical conditions while operating under time pressure and professional isolation. Telemedicine is commonly used in these environments to facilitate communication with specialists based in central hospitals and to support clinical decision-making.

The study adopts a socio-technical perspective, recognizing that telemedicine use is shaped not only by technological capabilities but also by organizational processes, professional roles, and contextual constraints. This perspective provides a framework for understanding how telemedicine is experienced and integrated into everyday clinical practice within remote and operational healthcare settings.

3.3. Study population

The study population consists of early-career physicians and nurses working in remote and operational healthcare settings. For the purposes of this research, early-career professionals are defined as clinicians who have completed their formal education within recent years and who are practicing without advanced medical or nursing specialization.

Participants have direct experience using telemedicine as part of their clinical work to obtain advice, guidance, or decision support from more experienced or specialized healthcare professionals. Focusing on early-career clinicians allows the study to explore telemedicine not only as a clinical tool but also as a source of professional support in challenging practice environments.

3.4. Participant recruitment

Participants were recruited using purposive sampling, a sampling strategy commonly used in qualitative research to identify individuals with relevant experience related to the research question. Eligibility criteria included professional role (physician or registered nurse), early-career status, and experience with telemedicine use in remote or operational settings.

Potential participants were invited to take part in the study through electronic communication. Recruitment materials provided clear information regarding the purpose of the study, voluntary participation, anonymity, and data handling procedures.

The data collection period occurred between December 2025 and January 2026. Recruitment concluded when seven early-career physicians and registered nurses had participated (n=7), which was considered sufficient for this small, exploratory study given the constrained and difficult-to-access professional context.

3.5. Interview content

Data were collected using a semi-structured interview guide developed specifically for this study. The interview guide was designed to ensure consistency across participants while allowing flexibility for individual experiences to be explored in depth. The interview guide drew on themes and domains reported in prior qualitative studies of clinicians' telehealth experiences and was adapted to the aims and context of the present study (Goldberg et al., 2021).

The interview questions were organized into five thematic areas that reflect key dimensions of telemedicine use in remote and operational healthcare settings:

1. professional role and prior experience with telemedicine, focusing on participants' background and familiarity with telemedicine prior to their current role;

2. organizational workflows and communication processes, exploring how telemedicine is integrated into everyday clinical practice, including communication pathways and coordination with specialist services;
3. technical and operational challenges, examining technological reliability, operational constraints, and factors influencing the feasibility of telemedicine use;
4. clinical decision-making and professional development, addressing how telemedicine supports clinical judgement, confidence, and learning in challenging contexts; and
5. perceived benefits, limitations, and future potential of telemedicine, capturing participants' motivations for use, perceived value, and views on future development.

All questions were open-ended, encouraging participants to provide reflective and experience-based responses grounded in their everyday clinical practice.

3.6. Interview procedures

Interviews were conducted using an asynchronous online format via a secure electronic questionnaire platform. Asynchronous interviews have been recognized as a methodologically valid strategy in qualitative research, particularly when flexibility, participant accessibility, and secure communication are essential (Bruch et al., 2025). Thus, this approach allowed participants to complete the interview at a time and pace that suited their professional obligations and working conditions. In addition, the asynchronous format was selected to minimize time pressure and to accommodate the unpredictable schedules associated with remote and operational healthcare work. Participants were able to review and revise their responses prior to submission, thereby maintaining control over the content of their contributions.

Prior to participation, all participants provided informed consent electronically. Demographic information was collected separately from the main interview content. No identifying personal or organizational information was collected, and participants were informed that they could withdraw from the study at any time without consequence.

3.7. Analysis

The dataset consisted of written responses submitted through the online interview platform. Interview data were analyzed using thematic analysis, following the approach described by Braun and Clarke. Thematic analysis was selected because it allows for the identification and interpretation of patterns and themes across qualitative data while remaining flexible and accessible for applied healthcare research.

The analysis followed a systematic process that included:

- familiarization with the data through repeated reading of interview responses,

- initial coding of meaningful segments of text,
- grouping of related codes into broader themes,
- reviewing and refining themes to ensure coherence and relevance to the research questions.

The analysis was conducted iteratively, allowing emerging insights to inform ongoing familiarization with the data and refinement of themes. The interpretation of the identified themes was informed by the analytical perspectives described in Chapter 3. This approach supports a close connection between the data and the resulting findings.

All interview responses were originally provided in Greek. Quotations presented in this thesis have been translated into English by the author, with the aim of preserving the original meaning and tone. Generative AI tools were used to support translation from Greek to English and for language polishing (academic proofreading). All AI-assisted outputs were reviewed, edited, and finalized by the author, who remains fully responsible for the accuracy of translations and the final wording of the thesis.

3.8. Ethical considerations

The study was conducted in accordance with ethical principles governing qualitative research. Participation was voluntary, and informed consent was obtained from all participants prior to data collection. Anonymity was ensured by avoiding the collection of personal identifiers or sensitive organizational information.

Given the operational nature of some healthcare settings included in the study, particular care was taken to avoid questions that could lead to the disclosure of classified, institutional, or operationally sensitive information. Data were stored securely and accessed only by the researcher.

3.9. Trustworthiness of the study

To enhance the trustworthiness of the study, attention was given to transparency in data collection and analysis procedures. The use of a semi-structured interview guide and a systematic thematic analysis process support consistency across participants.

Reflexive awareness was maintained throughout the research process, with the researcher acknowledging their role in data interpretation. Clear documentation of analytical decisions contributes to the credibility and dependability of the findings. In addition, an audit trail was maintained throughout the analysis process. This included keeping brief coding notes and records of coding decisions, as well as iterative revisiting of codes and candidate themes to ensure internal coherence and alignment with the dataset. This supported transparency in how themes were developed and refined over time.

To enhance analytic rigor and transparency, we maintained an audit-oriented record of analytic decisions throughout the thematic analysis process. This included keeping structured notes on coding choices, theme development, and revisions during repeated familiarization with the dataset, as well as documenting why particular codes were merged, renamed, or reallocated across themes. Theme development was conducted iteratively, with recurring revisiting of coded extracts and the wider dataset to check that themes remained coherent and adequately supported by participant accounts.

In addition, the analytic narrative was grounded in the data through the purposeful selection of illustrative quotations, allowing readers to assess how interpretations were derived from participants' responses. We also engaged in reflexive awareness by noting how prior familiarity with telemedicine and the study context could shape interpretation, and by returning to the raw text to ensure that claims remained closely connected to the participants' accounts rather than assumptions.

As interview responses were provided in Greek, all quotations presented in English were translated by the author. To preserve meaning and tone, translations were produced with attention to semantic equivalence and contextual nuance, and the Greek originals were retained in the analytic dataset to allow cross-checking during writing.

Chapter 4. Research Findings

4.1. Introduction

This chapter presents the empirical findings from the qualitative study exploring telemedicine as a support tool for early-career physicians and nurses working in remote and operational healthcare settings in Greece. Interview data were collected through asynchronous, written responses submitted via a secure online questionnaire platform. The analysis examined how telemedicine is used in routine practice, the challenges encountered, and the ways it shapes clinical decision-making and professional confidence in resource-constrained contexts.

The findings are organized around five themes aligned with the domains of the semi-structured interview guide. While these domains provided an initial structure, the analysis remained inductive within each domain, allowing subthemes to emerge from participants' accounts.

4.2. Overview of themes

Initial analysis of the interview data identified five thematic areas, broadly aligned with the structure of the semi-structured interview guide. These thematic areas capture key dimensions of the participants' experience with telemedicine:

- Theme 1: Professional role and experience with telemedicine – participants' roles, early-career positioning, and baseline familiarity with telemedicine.
- Theme 2: Organizational processes and communication workflows – how telemedicine is initiated, information is exchanged, and guidance is incorporated into clinical care.
- Theme 3: Technical and operational challenges – connectivity, equipment limitations, and practical barriers in constrained settings.
- Theme 4: Clinical decision-making and professional development – telemedicine as a mechanism for second opinions, reassurance, learning, and confidence-building.
- Theme 5: Perceived benefits, limitations, and future potential – overall value, areas for improvement, and expectations regarding long-term integration

Each thematic area is presented below with illustrative excerpts from the interview data.

4.3. Theme 1: Professional role and experience with telemedicine

Participants described working as first-line clinicians in settings characterized by limited on-site resources and restricted access to specialist support. Their responsibilities included triage, initial assessment, and management of a broad range of clinical presentations (e.g., acute illnesses, minor trauma, and urgent conditions), often under time pressure. As one participant noted:

“My role is to welcome the crew when they have any medical problems and treat them.” (Participant 4, Physician).

One participant highlighted the types of clinical presentations commonly encountered in first-line care:

“The most common cases are respiratory infections and injuries.” (Participant 5, Physician).

Several participants described limited formal exposure to telemedicine prior to their present placement. It was reported by several participants that they had no prior experience, while others described only informal familiarity with consumer video-calling tools rather than structured telemedicine services:

“Before I started working, I had not received any relevant experience on telemedicine beyond platforms such as Skype...” (Participant 3, Physician).

“When I was working shifts in the ED... I would take over the phone and many times I would send a picture or a cardiogram... to tell me his opinion.” (Participant 4, Physician).

This was described as contributing to an initial learning curve, particularly in the absence of prior structured telemedicine exposure.

Telemedicine was frequently framed as an extension of clinical capacity, allowing early-career staff to access expert input when professional isolation was most strongly felt. As one participant noted:

“Before this placement, I had no real experience with telemedicine... now it’s a core part of how I seek guidance.” (Participant 2, Nurse).

Participants linked their initial lack of telemedicine experience with a learning curve and a gradual increase in comfort as telemedicine became part of routine clinical support.

4.4. Theme 2: Organizational processes and communication workflows

Participants described telemedicine as a multi-channel communication process rather than a single technology. Common modalities included telephone calls, video calls, and the exchange of images or documents through a dedicated telemedicine platform. In some cases, participants also referred to using general-purpose messaging applications to transmit images when necessary.

“...but most of the time I use image or file exchange.” (Participant 4, Physician).

Across participants, the workflow was commonly described as four sequential steps: (1) clinical assessment and identification of the need for specialist input; (2) contacting a central hospital-based clinician or on-call service; (3) transferring relevant information (history, vital signs, and where possible, images or test results); and (4) receiving advice, implementing recommendations, and planning follow-up. This was often described as a situational decision rule, where simpler cases were handled via direct phone contact, while more complex situations triggered a more structured telemedicine process:

“If it is something simple, I just call the corresponding specialist doctor... If it is something more complex, I call the hospital’s ED and ask for the telemedicine...”

(Participant 4, Physician).

The process was often described as pragmatic and time-sensitive, shaped by operational constraints and the availability of the receiving clinician, as one participant explained:

“There is the doctor of the ED and as far as I know, a predetermined team of doctors and the head nurse...” (Participant 4, Physician).

Telemedicine also supported interprofessional coordination within the local clinical team. Nurses described supporting assessment, documentation, and information transfer, particularly when the physician was managing multiple tasks. This coordination role was particularly visible in information preparation and transfer. As one participant summarized:

“Communication is usually by phone, sometimes with images... we share what we have, get guidance, and then act.” (Participant 1, Nurse).

4.5. Theme 3: Technical and operational challenges

Technical and operational constraints were highly salient in participants’ narratives. Connectivity instability emerged as the most frequently cited barrier, including intermittent signal, low bandwidth affecting video quality, and periods with no reliable network access. As one participant stated succinctly:

“Unstable network—or no network at all.” (Participant 2, Nurse).

Others described how signal variability could disrupt communication, noting *“Unreliable signal quality and stability”* (Participant 1, Nurse) and the need to make situational adjustments to regain connectivity.

While several participants reported generally adequate connectivity under routine conditions,

“By the standards of an onboard company, the connection was excellent.” (Participant 2, Nurse),

they emphasized that performance was not consistent across contexts or missions. One participant highlighted how upgrading infrastructure could substantially improve stability:

“In the last mission, an upgraded satellite [participant named the company] connectivity network was used, which had impeccable quality and stability.”
(Participant 5, Physician).

At the same time, operational realities could still lead to interruptions, such as

“A network outage... due to a failure of the ship’s personnel.” (Participant 5, Physician),

indicating that reliability depended not only on technology but also on human and organizational factors.

Beyond connectivity, equipment performance and maintenance demands also shaped what could realistically be done through telemedicine. Participants described occasional device-related failures, including camera problems:

“A technical problem we encountered was the use of the camera which did not work... and turned out to be due to cable wear.” (Participant 3, Physician).

In contrast, many felt comfortable using the tools after brief familiarization:

“After a corresponding one-hour training, it was very easy to use the corresponding means of telemedicine.” (Participant 3, Physician),

suggesting that usability was often achievable, but reliability and upkeep remained key constraints.

Participants also noted that sustaining competence required periodic rehearsal and accessible guidance, particularly given long intervals between deployments and rotating staff. As one participant explained,

“There is comfort in the use of technological means, however maintenance - repetition of training is required... when there are long periods of time between missions.”
(Participant 3, Physician).

Relatedly, another emphasized the need for structured onboarding for newly assigned personnel:

“...because staff are rotating... training is required to immediately provide training to new staff added to the mission.” (Participant 5, Physician).

Practical aids were also valued, with one participant noting that,

“The use of a printed detailed guide helps to repeat and resolve questions.” (Participant 3, Physician).

Despite these constraints, participants described adaptive strategies to maintain communication and clinical support. These included switching modalities (e.g., video to phone), repeated connection attempts, and timing non-urgent transmissions to periods of better connectivity. One participant described persisting through technical difficulties:

“Yes, I have a problem but after insistence I managed to connect and communicate with the doctor.” (Participant 2, Nurse).

Others described operational workarounds, such as repositioning or route adjustments to regain a signal:

“The ship had to make a small maneuver to catch a better signal.” (Participant 4, Physician).

Taken together, participants emphasized that telemedicine effectiveness depended not only on the technology itself but also on infrastructure reliability, maintenance practices, training continuity, and workflow design within the operational environment.

4.6. Theme 4: Clinical decision-making and professional development

Telemedicine was consistently described as improving clinical decision-making by enabling rapid access to second opinions and specialist guidance. Participants reported that this support reduced uncertainty, strengthened risk assessment, and increased confidence when managing cases beyond their routine experience. As one participant put it, telemedicine provided:

“...an additional sense of safety for the patient and for me.” (Participant 2, Nurse).

Several accounts framed telemedicine as a safety net that decreased the sense of professional isolation. One participant described how access to specialist input supported both emotional reassurance and clinical accountability:

“It makes me not feel alone, even though I am very far from the land and even further away from a large hospital.” (Participant 4, Physician).

Others expressed a similar reliance on the availability of expert support, emphasizing that simply knowing guidance was accessible was reassuring:

“It clearly creates a sense of security for both health and other staff, while strengthening the sense of confidence...” (Participant 4, Physician).

This sense of support was often linked to greater confidence when managing responsibility in austere settings, where clinicians felt the weight of decision-making more acutely.

Participants also highlighted the role of telemedicine in strengthening the perceived safety of care delivery and providing reassurance when clinical trajectories were uncertain. In situations where the evolution of a case could not be fully anticipated, access to specialist consultation was described as protective:

“As a healthcare professional, I felt reassured that if any possible uncertain development of an incident... there would be an immediate response through the communication by a specialist doctor.” (Participant 5, Physician).

In addition, telemedicine was described as supporting clinical decision-making during acute or complex episodes by enabling real-time consultation and clarifying management plans, including during surgical or urgent scenarios:

“I asked for telemedicine from the hospital and to talk to a surgeon.” (Participant 4, Physician).

Beyond immediate case support, participants described telemedicine as an informal learning mechanism. Through repeated exposure to specialist reasoning and recommendations, early-career clinicians reported improvements in clinical judgment, communication, and confidence in handling similar cases in the future. One participant stated directly,

“Clearly I have learned and improved.” (Participant 2, Nurse),

while another described how confirmation from specialists reinforced both competence and reassurance:

“He reassured me and gave me advice... it was important that I got a confirmation.”
(Participant 4, Physician).

This learning effect was often framed as cumulative: clinicians felt better prepared for future incidents because prior telemedicine-supported cases provided a reference point for action and decision-making.

Notably, even participants who had not encountered a dramatic adverse event still emphasized the broader psychological value of telemedicine in operational settings. One participant noted,

“I don’t remember any incident,” (Participant 7, Nurse),

yet described the reassurance provided by knowing that specialist support was available when needed. Similarly, another participant highlighted the everyday benefit of connectivity to expert support in isolated environments:

“In an important tool that relieves you just to be there... you know you’re not alone on another continent with around 200 crew.” (Participant 7, Nurse).

These accounts underscore how telemedicine functioned not only as a clinical decision-support tool but also as a mechanism that strengthened confidence and resilience in remote and high-responsibility contexts.

4.7. Theme 5: Perceived benefits, limitations, and future potential

Participants expressed strong perceived usefulness of telemedicine as a support tool for remote and operational healthcare delivery. Key perceived benefits included timely access to specialist expertise, improved patient safety, and strengthened confidence among local staff. As one participant noted,

“There is a second opinion, we feel more secure.” (Participant 1, Nurse).

Similarly, telemedicine was described as enhancing clinical decision-making in practice:

“Great help in clinical decision.” (Participant 4, Physician).

Participants also emphasized the value of rapid access to specialized input, particularly when local resources were limited:

“The possibility of immediate advice from a specialist doctor in remote units - ships that have only one doctor without a specialty or even only a nurse.” (Participant 3, Physician).

Beyond immediate decision-support, participants framed telemedicine as beneficial for the wellbeing and resilience of frontline clinicians working in isolated settings. Several accounts emphasized reduced professional isolation and increased reassurance, captured in the statement:

“The feeling that you are not alone in the middle of the sea.” (Participant 5, Physician).

Participants also linked telemedicine to increased confidence and learning:

“It helps me to gain more confidence in myself and also to learn.” (Participant 4, Physician).

In addition, telemedicine was described as particularly relevant in Greece due to geographic dispersion and uneven access to specialist services:

"I think it is the best tool for Greece based on the islands it has." (Participant 2, Nurse).

However, participants also identified socio-technical limitations that constrained telemedicine effectiveness in operational contexts. Connectivity and signal instability were recurring concerns, with participants reporting that:

"Signal interruptions." (Participant 1, Nurse)

and emphasizing the centrality of reliable infrastructure such as

"The stability and quality of the internet connection on ships." (Participant 6, Nurse).

Alongside connectivity, limited diagnostic capacity was perceived as a major constraint. Participants frequently suggested that strengthening point-of-care diagnostics would enhance the usefulness of telemedicine-supported advice, noting, for example,

"I think that ideally there should be an X-ray machine, as well as a blood analyzer."
(Participant 1, Nurse)

and

"A portable X-ray system should also be included." (Participant 6, Nurse).

One participant also highlighted that additional solutions were needed to integrate portable diagnostics into routine telemedicine workflows:

"A portable X-ray... did not belong to the telemedicine system, so a procedure is needed to transfer the image to the system." (Participant 4, Physician).

Recommendations focused on improving connectivity, expanding and integrating telemedicine applications, and strengthening training and readiness. Participants called for:

"More regular seminars and better network." (Participant 2, Nurse)

and suggested improving digital tools and interoperability:

"Expand telemedicine applications and facilitate file sharing through the application."
(Participant 5, Physician).

Others proposed integrating telemedicine with portable diagnostic devices and streamlining data transfer:

"Connecting the system to a special portable X-ray... as well as with a blood gas analyzer." (Participant 5, Physician),

and ensuring that hospital-side systems could interconnect more seamlessly:

“All the devices of the hospital should be able to be connected... and not require the transfer of files with a usb stick from one device to another.” (Participant 5, Physician).

Participants also emphasized workforce readiness through more structured training, including short learning opportunities during deployments:

“Think about taking small lessons during this trip.” (Participant 4, Physician).

Looking ahead, participants widely anticipated telemedicine becoming an established and enduring feature of healthcare delivery in constrained settings. Some emphasized continuity and scalability across different remote contexts, stating:

“I like and I wish that all doctors had this possibility whether they are on a ship, on an island or in a rural village.” (Participant 4, Physician).

Notably, one participant expressed little desire for fundamental change:

“I wouldn’t change anything.” (Participant 7, Nurse)

suggesting that, despite recognized limitations, telemedicine was viewed as both practical and necessary for sustaining remote and operational healthcare delivery.

4.8. Summary of Findings

The findings indicate that telemedicine operates primarily as a socio-technical support mechanism for early-career clinicians working in remote and operational healthcare settings in Greece. Rather than being experienced as a single “tool,” telemedicine was described as a set of communication practices that extend local clinical capacity by enabling timely access to specialist expertise, reassurance, and guidance.

Throughout Theme 1, participants positioned themselves as first-line clinicians with broad responsibility, often working under time pressure and with limited on-site resources. Most reported limited formal exposure to telemedicine prior to their current placement, describing a learning curve that gradually diminished as telemedicine became integrated into routine clinical support. This early-stage professional context shaped how telemedicine was valued: not only for clinical input, but also for confidence-building and reduced professional isolation.

Theme 2 showed that telemedicine use was embedded in pragmatic workflows. Participants described a multi-channel process (telephone, video, platform-based exchange, and when needed ad hoc image transmission via messaging applications), typically following a sequence of assessments,

contacting a central service, transferring relevant information, receiving advice, and planning follow-up. These workflows were shaped by operational constraints, the availability of the receiving clinician, and the need for rapid decision-making. Telemedicine also supported interprofessional coordination within local teams, with nurses playing a visible role in information preparation, documentation, and transfer.

Theme 3 highlighted that telemedicine effectiveness was contingent on infrastructure reliability and operational readiness. Connectivity instability and intermittent signal were the most frequently cited barriers, affecting video quality and sometimes limiting communication altogether. Participants also described equipment limitations and maintenance issues that influenced what could realistically be achieved through telemedicine, while noting that basic usability was often achievable following brief familiarization. The need for repeated training, onboarding of rotating staff, and accessible guidance (e.g., printed instructions) emerged as practical requirements for sustaining competence over time.

Theme 4 emphasized telemedicine's role in clinical decision-making and professional development. Participants described telemedicine as a safety net that reduced uncertainty, supported risk assessment, and increased confidence when managing cases beyond routine experience. Access to specialist confirmation and guidance was framed as both clinically and emotionally significant in high-responsibility settings, contributing to reassurance and perceived accountability. Repeated exposure to specialist reasoning and recommendations also functioned as an informal learning mechanism, strengthening future preparedness.

Lastley, Theme 5 captured a broadly positive overall appraisal of telemedicine's usefulness, alongside clear socio-technical limitations and improvement priorities. Participants viewed telemedicine as especially relevant in Greece due to geographic dispersion and uneven access to specialist services. Key recommendations focused on strengthening connectivity, improving secure and easy file-sharing, enhancing interoperability with diagnostic devices, and establishing more structured and continuous training. Overall, participants anticipated telemedicine becoming an enduring feature of healthcare delivery in constrained environments, valued not only for access to expertise but also for sustaining frontline clinicians working under pressure.

Conclusion

This study explored telemedicine as a support tool for early-career physicians and nurses delivering care in remote and operational healthcare settings in Greece. Using asynchronous, semi-structured written interviews and thematic analysis, the study examined how telemedicine is experienced in everyday clinical practice, what enables or constrains its use, and how it shapes clinical decision-making and professional confidence in resource-constrained contexts.

Overall, the findings suggest that telemedicine is experienced less as a discrete technology and more as a socio-technical capability embedded in workflows, professional roles, and infrastructural conditions. Participants described telemedicine as enabling timely access to specialist input and second opinions, strengthening perceived safety, and reducing the sense of professional isolation that can accompany early-career practice in geographically and operationally constrained environments. Telemedicine also appeared to function as an informal learning mechanism, with repeated exposure to specialist reasoning supporting confidence and future preparedness.

At the same time, telemedicine's supportive value was clearly dependent on context. Connectivity instability and variable network availability remained a central barrier, influencing which communication modalities were feasible and how reliably specialist advice could be obtained. Participants' accounts also pointed to practical requirements for sustainable use, including device reliability and maintenance, periodic training and rehearsal (particularly in environments with rotating staff and long intervals between deployments), and accessible guidance materials. These findings underscore that telemedicine effectiveness is not determined solely by the presence of a platform or devices, but by the alignment of technology with operational workflows and readiness practices.

From a healthcare management and digital transformation perspective, the findings have several practical implications. First, telemedicine services in remote and operational settings should be designed for multi-channel resilience, recognizing that clinicians may need to shift between modalities (e.g., video to telephone) depending on network conditions. Second, operational protocols for escalation, documentation, and information transfer can strengthen consistency and reduce delays when time-critical decisions are required. Third, training should be treated as an ongoing readiness function rather than a one-time event, supported by short refreshers, simulation-based exercises where feasible, and structured onboarding for newly assigned personnel. Finally, participants' recommendations suggest that integrating telemedicine with point-of-care diagnostic capacity and improving interoperability and secure file-sharing could meaningfully enhance the usefulness of specialist guidance in practice.

The study has limitations that should be considered when interpreting the findings. The sample was small (n=7) and context-specific, reflecting the difficulties of recruiting clinicians in constrained and difficult-to-access operational environments. Data were self-reported and collected asynchronously in written form, which supports flexibility and participant control but may reduce opportunities for real-time probing and clarification compared with synchronous interviews. In addition, interview responses were originally provided in Greek and translated into English by the author, which may introduce subtle shifts in nuance despite efforts to preserve meaning and tone.

Future research could build on this study by including larger and more diverse samples across different remote and operational contexts, and by incorporating the perspectives of specialists and coordinators in central hospitals who provide telemedicine support. Comparative designs (e.g., rural facilities versus operational deployments) could clarify which challenges are primarily infrastructural and which are organizational. Finally, mixed-methods approaches could complement experiential findings with service-level data (e.g., response times, communication modality use, escalation patterns) to better inform telemedicine governance and quality improvement in constrained settings.

To conclude, telemedicine was perceived by early-career clinicians as a valuable support mechanism that strengthens clinical confidence, access to expertise, and perceived safety in remote and operational healthcare delivery. However, realizing this value consistently requires attention to the socio-technical conditions of use, especially infrastructure reliability, workflow integration, training continuity, and operational readiness, so that telemedicine functions as a sustainable component of healthcare delivery in constrained environments.

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Annexes

Annex A. Semi-Structured Interview Protocol

Asynchronous online semi-structured interviews

(via email, Google Forms).

Purpose

To explore the experiences, challenges and perceptions of healthcare professionals (physicians and nurses with limited professional experience) regarding the use of telemedicine to provide medical advice and support in isolated care settings, where there is no direct access to specialist physicians.

General Instructions

The interview is semi-structured; it acts as a guide, not a rigid questionnaire.

The interviewer:

- explains the purpose of the interview, its duration (~30 minutes) and the assurance of anonymity,
- requests verbal consent to record,
- uses the questions flexibly, adapting them according to the flow of the discussion.

Topic Areas and Indicative Questions

1. Introduction – Work Context and Experience with Telemedicine

Purpose: To capture the professional profile and general experience of the participant.

1. Tell me a little about your role and the type of cases you usually deal with or have dealt with.
2. What experience did you have with telemedicine before starting your work on the ship or the isolated health unit?
3. How do you currently use telemedicine to receive medical support or guidance?

2. Organization – Workflow and Communication Processes

Purpose: To understand the practical procedures, means and collaboration with the central medical center.

4. How is/was communication with the specialist usually done? (e.g. by phone, via video, exchange of images or files, special telemedicine platform?)

5. What are/were the main steps from the moment the need for telemedicine consultation arises until receiving the answer?
6. What difficulties or delays have you/had you encountered in communication or in the transfer of information?

3. Technical and Operational Challenges

Purpose: To investigate the reliability of the technology and the ability of users to handle it.

7. How would you describe the stability and quality of the technological connection you use/used?
8. Have you encountered technical problems at critical moments? How did you manage them?
9. How comfortable are you in using technological tools (camera, microphone, sending images or exams, telemedicine platform)? Is there any need for additional training?

4. Clinical Experience – Utilizing Telemedicine in Practice

Purpose: To highlight how telemedicine affects clinical judgment, education and quality of care.

10. Tell me about a case where telemedicine has substantially helped in making a decision or in treating a patient or incident.
11. Have there been cases where telemedicine has not helped or created uncertainty?
12. How does telemedicine affect your sense of safety and confidence when dealing with difficult cases?
13. Do you feel that you have learned or improved professionally through this process?

5. Perceptions – Benefits, Limitations and Suggestions for Improvement

Purpose: To record attitudes, feelings and ideas about the future of telemedicine.

14. What do you consider to be the greatest advantages of telemedicine in your work?
15. What are the main disadvantages or difficulties that need to be overcome?
16. If you could change something in the telemedicine system, what would you suggest? (whether it concerns technology, training or the way of communication).
17. Do you believe that telemedicine can develop into a permanent tool for supporting health personnel in remote environments?

Conclusion

Thank you for participating.

- Is there anything else you would like to add?
- If you would like us to contact you again for clarification, you can optionally leave your contact details.

Annex B. Demographics Form

(to be used before the interview begins)

Participant Code: _____

(e.g. Participant 1, Nurse; Participant 3, Physician - for doctor or nurse, instead of name)

Interview Date: _____

1. Occupation / Role

☐ Doctor ☐ Nurse ☐ Other (specify): _____

2. Years since graduation from school

☐ <1 year ☐ 1–2 years ☐ 2–3 years ☐ 3–4 years ☐ 4–5 years

3. Years of service on a ship or remote unit

☐ <1 year ☐ 1–2 years ☐ 2–3 years ☐ 3–4 years ☐ 4–5 years

4. Training/seminars related to telemedicine (if any)

☐ Yes ☐ No

If Yes, which ones? _____

5. Previous experience with telemedicine before current placement

☐ None ☐ Limited ☐ Frequent

6. Means used for telemedicine communication

(you may select more than one)

☐ Telephone ☐ Video call ☐ Online application ☐ Sending images or files via social media applications

☐ Other _____

7. Estimated frequency of telemedicine contacts

☐ Rarely (≤ 1 /month) ☐ Occasionally (2–4/month) ☐ Frequent (≥ 1 /week)

8. Type of cases that typically require teleconsultation

E.g. injuries, infections, acute cases, emergencies, etc.

9. Gender (optional)

☐ Male ☐ Female ☐ Other ☐ I do not wish to answer

10. Age group (optional)

☐ < 25 ☐ 25–30 ☐ 31–35 ☐ > 35

Note: *The data is collected anonymously, without any identifying information. It is used only for sample description and research analysis.*

Annex C. Consent Form for Participation in Interview

Research Title:

Telemedicine as a support tool in remote and operational settings: A qualitative study with early-career physicians and nurses

Researcher: Angeliki Chandrinou

Postgraduate Program: ManagiDiTH

Contact: acuin@isc-te-iul.pt

Purpose of the Research

This research aims to explore the experiences, challenges and views of healthcare professionals regarding the use of telemedicine to support clinical care in isolated or operational settings.

What is included in the participation

- I will participate in an interview lasting approximately 25–30 minutes, which can be conducted in person, by phone or online.
- The interview will be audio-recorded (with my consent) for transcription and analysis purposes only.
- No personal or service-related information (name, location, unit, etc.) will be collected.

Confidentiality and Anonymity

- All information will remain confidential and will be used exclusively for academic purposes.
- My responses will be presented anonymously and in aggregate form.
- The recorded files will be stored securely and deleted after the analysis is complete.

Voluntary Participation

- Participation is completely voluntary.
- I may refuse to answer any question or withdraw at any time without any consequences.

Consent

Having been informed of the purpose and procedure of the interview:

☐ I agree to voluntarily participate in the research.

☐ I agree to have the interview recorded for analysis purposes.

Participant's name (optional): _____

Date: _____

Annex D. Non-plagiarism declaration

I hereby declare that the Thesis titled “Telemedicine as a support tool in remote and operational settings: A Qualitative study with early-career physicians and nurses” submitted to the ManagiDiTH – Master of Managing Digital Transformation in the Health Sector:

- Has not been submitted to any other Institute/University/College
- Contains proper references and citations for other scholarly work
- Contains proper citation and references from my own prior scholarly work
- Has listed all citations in a list of references.

I am aware that violation of this code of conduct is regarded as an attempt to plagiarize, and will result in a failing grade (F) in the programme.

Date: 27/02/2026

Signature: 

Name: ANGELIKI CHANDRINO