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Analysis of multidisciplinary clinical practice in cancer care and factors related to the professional roles of the care teams: A qualitative and quantitative evaluation in the framework of the Catalan Health System

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ANALYSIS OF MULTIDISCIPLINARY CLINICAL PRACTICE IN CANCER CARE AND FACTORS RELATED TO THE PROFESSIONAL ROLES OF THE CARE TEAMS

A QUALITATIVE AND QUANTITATIVE EVALUATION IN THE FRAMEWORK OF THE CATALAN HEALTH SYSTEM

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Para Roxana y Néstor

(mis padres)

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Abbreviations

APNs Advanced Practice Nurses

CNS Clinical Nurse Specialist

CRM Circumferential Resection Margin

CRT Chemoradiotherapy

ECCO European Cancer Organization

ESMO European Society for Medical Oncology

ICN International Council of Nurses

OECI Organization of European Cancer Institutes

CRC Colorectal Cancer

LAR Low Anterior Resection

LARC Locally advanced rectal cancer

MDTs Multidisciplinary Teams

MRI Magnetic Resonance Imaging

MTM Multidisciplinary Team Meeting

NCCP National Cancer Control Plan (NCCP).

NP Nurse Practitioner

TME Total Mesorectal Excision

SCPRT Short-course Preoperative Radiotherapy

SNHS Spanish National Health System

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This doctoral thesis is presented as a compendium of three scientific articles, which are framed within the main and specific objectives. These studies have been carried out in collaboration with the research group on cancer health services of the Bellvitge Biomedical Institute (IDIBELL) and the Catalonian Cancer Strategy of the Catalan Department of Health.

1. **Darinka Rivera**, Joan Prades, Josep M. Borràs, Luisa Aliste, Paula Manchon-Walsh. Multidisciplinary team meetings and their impact on survival in rectal cancer. Population-based study in Catalonia (Spain). European Journal of Surgical Oncology. 2024 Sep 12;50(12):108675. 108675. https://doi.org/10.1016/j.ejso.2024.108675
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2. **Darinka Rivera,** Joan Prades, Sonia Sevilla-Guerra, Josep M Borràs. Contextual factors influencing the implementation of advanced practice nursing in Catalonia, Spain. *International Nursing Review*. 2024; 71(2):309-317 https://doi.org/10.1111/inr.12866
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3. Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montserrat Martín-Baranera, **Darinka Rivera Villalobos,** Lena Ferrús-Estopa. How do healthcare professionals and managers view the role of the advanced practice nurse? *International Nursing Review*. 2024; 71(2):335-351 https://doi.org/10.1111/inr.12906
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Abstract

Introduction: The last 20 years have seen significant progress in cancer control, driven by multiple advances in different areas such as technology, surgery procedures, medical treatments, but also by innovation in the delivery and organization of cancer services. As more specialists and professionals become involved, the challenges of management, coordination and communication between multiple specialists and levels of care increase. As a result, complexity and the likelihood of fragmented care naturally grow. Therefore, to better address the growing complexity and improve outcomes, health systems have sought innovative ways to deliver high-quality cancer care more effectively and efficiently. These innovations include the development of collaborative approaches, such as implementing specialized care through multidisciplinary teams for each tumor type, and advanced practice nurse roles. Multidisciplinary teams are recognized as the gold standard for organizing care and to treat cancer at all stages, which is specially reflected at multidisciplinary team meetings as the main decision-making body. However, despite the abundance evidence supporting their positive impact, their independent benefit on survival is still scarce and controversial. In addition, multidisciplinary team meetings have been promoted and implemented in Catalonia over the last decades, but an evaluation of their potential benefits at a local level is needed. In parallel to the development of multidisciplinary teams, advanced practice nurses have been integrated into oncology care in Catalonia. Advanced practice nurses bring great value to health systems. Nevertheless, their implementation has been uneven and without any kind of recognition and/or regulation at the regional or national level. The optimal integration into the healthcare workforce of the role depends on the environment surrounding their implementation. However, little attention has been paid to understanding the characteristics of the specific context in which their development and integration take place in Catalonia or Spain.

Hypothesis: The specific organization of multidisciplinary cancer teams influences the performance of professional roles, particularly those of advanced practice nurses, and affects the outcomes of the decision-making process of treated patients.

Principal objective: To analyze the impact of multidisciplinary clinical practice in cancer care and factors related to professional roles, particularly those of advanced practice nurses in care teams.

Methods: This research consisted of two phases. During phase 1, with the aim to assess the impact of multidisciplinary team meetings on clinical outcomes, a population-based cohort study was carried out in patients undergoing surgery for primary rectal cancer with curative intent. The data was derived from three clinical audits conducted in Catalonia from 2011 to 2020. The primary outcome was 2-year survival. Multivariable Cox regression analysis was used to assess the hazard ratio for death in patients whose cases were discussed in a preoperative MTM versus cases which were not discussed. Phase 2 aimed to gain an in-depth understanding of the factors related to the integration of advanced practice nurses in Catalonia. First, a qualitative descriptive study was conducted using a framework of contextual factors to explore the perspectives of 14 advanced practice nurses working in public hospital cancer care in Catalonia by means of semistructured interviews. Second, a cross-sectional study using a reliable and valid scale (EVOHIPA) was applied to explore the perspectives of 162 advanced practice nurses and 584 members of the multidisciplinary and manager team regarding advanced practice nurses in public hospitals in Catalonia.

Results: The first study showed that the lack of discussion of the case at a preoperative multidisciplinary team meeting was associated with a 22% higher likelihood of dying to two years. Likewise, the odds of being discussed in the preoperative multidisciplinary team meeting were higher in patients with more advanced stages and in the most recent audit periods. The second study revealed that the organization, implementation process, and performance of clinical practice among advanced practice nurses working in cancer care in Catalonia are strongly context dependent. In this regard, the hospital environment where they are introduced shapes their professional profile, job title,

available resources and type of recognition. Their autonomy to exercise their role depends on the support and extent of integration with the specific multidisciplinary team they work with. Likewise, the absence in the field of advanced practice nursing of professional or scientific associations at the local or national level is an external factor that may accentuate the current development. The third study showed a high level of agreement among participants regarding statements about the contribution of advanced practice nurses to improving continuity of care between levels and processes, as well as adopting a more patient-centered approach. A high level of agreement was also observed in statements related to the need to clarify their professional profile and hierarchical dependence at the organizational level. However, a lower level of agreement was observed regarding statements about the legal support for expanding the scope of practice and autonomy of advanced practice nurses.

Conclusions: The findings provide relevant insights supporting the organizational development of the delivery of care within a multidisciplinary context, as well as the importance of considering the critical role of the environment for the optimal implementation of advanced practice nurses within the Catalan healthcare system.

Implications for health policy: In the light of the results of this research, further formalization of multidisciplinary team meetings and advanced practice nurses should be considered to better support their integration and promote high-quality cancer care.

Resum

Introducció: En els últims 20 anys s'han produït avanços significatius en el control del càncer, impulsats per múltiples avanços en diferents àrees com la tecnologia, els procediments quirúrgics, els tractaments mèdics, però també per la innovació en la prestació i organització dels serveis oncològics. A mesura que intervenen més especialistes i professionals, augmenten els reptes de gestió, coordinació i comunicació entre múltiples especialistes i nivells assistencials. En conseqüència, la complexitat i la probabilitat d'una atenció fragmentada augmenten de manera natural. Per tant, per a abordar millor la creixent complexitat i millorar els resultats, els sistemes sanitaris han buscat formes innovadores de prestar una atenció oncològica d'alta qualitat de manera més eficaç i eficient. Aquestes innovacions inclouen el desenvolupament d'enfocaments col·laboratius, com la implantació de cures especialitzades a través d'equips multidisciplinaris per a cada tipus de tumor, i rols d'infermeria de pràctica avançada. Els equips multidisciplinaris estan reconeguts com el *gold standard* per a organitzar l'atenció i tractar el càncer en totes les seves fases, la qual cosa es reflecteix especialment en els comitès de tumors com a principal òrgan de presa de decisions. No obstant això, malgrat l'abundant evidència que dona suport al seu impacte positiu, el seu benefici independent sobre la supervivència és encara escàs i controvertit. A més, els comitès de tumors s'han promogut i implementat a Catalunya durant les últimes dècades, però és necessària una avaluació dels seus beneficis potencials a nivell local. Paral·lelament al desenvolupament dels equips multidisciplinaris, les infermeres de pràctica avançada s'han integrat en l'atenció oncològica a Catalunya. Les infermeres de pràctica avançada aporten un gran valor als sistemes sanitaris. No obstant això, la seva implantació ha estat desigual i sense cap mena de reconeixement i/o regulació a nivell regional o nacional. La integració òptima d'aquest rol professional en el personal sanitari depèn de l'entorn que envolta la seva implantació. No obstant això, s'ha prestat poca atenció a la comprensió de les característiques del context específic en el qual té lloc el seu desenvolupament i integració a Catalunya o a Espanya.

Hipòtesi: L'organització específica dels equips multidisciplinaris oncològics influeix en l'acompliment de les funcions professionals, en particular les de les infermeres de pràctica avançada, i afecta als resultats del procés de presa de decisions dels pacients tractats.

Objectiu principal: Analitzar l'impacte de la pràctica clínica multidisciplinària en l'atenció oncològica i els factors relacionats amb els rols professionals, particularment els de les infermeres de pràctica avançada en els equips assistencials.

Mètodes: Aquesta recerca va constar de dues fases. Durant la fase 1, amb l'objectiu d'avaluar l'impacte de les reunions de l'equip multidisciplinari en els resultats clínics, es va dur a terme un estudi de cohorts de base poblacional en pacients sotmesos a cirurgia per càncer de recte primari amb intenció curativa. Les dades procedien de tres auditories clíniques realitzades a Catalunya entre 2011 i 2020. El resultat primari va ser la supervivència a 2 anys. Es va utilitzar una anàlisi multivariable de regressió de Coix per a avaluar el quocient de risc de mort en pacients els casos de les quals es van discutir en un comitè de tumors preoperatori enfront dels casos que no es van discutir. La fase 2 tenia com a objectiu conèixer en profunditat els factors relacionats amb la integració de les infermeres de pràctica avançada a Catalunya. En primer lloc, es va realitzar un estudi qualitatiu descriptiu utilitzant un marc de factors contextuals per a explorar les perspectives de 14 infermeres de pràctica avançada que treballen en l'atenció oncològica hospitalària pública a Catalunya mitjançant entrevistes semiestructuradas. En segon lloc, es va aplicar un estudi transversal utilitzant una escala fiable i vàlida (EVOHIPA) per a explorar les perspectives de 162 infermeres de pràctica avançada i 584 membres de l'equip multidisciplinari i directiu respecte a les infermeres de pràctica avançada als hospitals públics de Catalunya.

Resultats: El primer estudi va demostrar que la falta de discussió del cas en el comitè de tumors preoperatori s'associava amb un 22% més de probabilitat de morir als dos anys. Així mateix, la probabilitat de ser discutit en el comitè de tumors preoperatori va ser major en els pacients amb estadis més avançats i en els períodes d'auditoria més recents. El segon estudi va revelar que l'organització, el procés d'implementació i el desenvolupament de la pràctica clínica entre les infermeres de pràctica avançada que treballen en l'atenció oncològica a Catalunya depenen en gran manera del context. En

aquest sentit, l'entorn hospitalari en el qual s'introdueixen configura el seu perfil professional, el seu lloc de treball, els recursos disponibles i el tipus de reconeixement. La seva autonomia per a exercir la seva funció depèn del suport i del grau d'integració amb l'equip multidisciplinari específic amb el qual treballen. Així mateix, l'absència en l'àmbit de la infermeria de pràctica avançada d'associacions professionals o científiques a nivell local o nacional és un factor extern que pot accentuar el desenvolupament actual. El tercer estudi va mostrar un alt nivell d'acord entre els participants en relació amb les afirmacions sobre la contribució de les infermeres de pràctica avançada a la millora de la continuïtat assistencial entre nivells i processos, així com a l'adopció d'un enfocament més centrat en el pacient. També es va observar un alt nivell d'acord en les afirmacions relacionades amb la necessitat d'aclarir el seu perfil professional i la dependència jeràrquica a nivell organitzatiu. No obstant això, es va observar un menor nivell d'acord en les afirmacions sobre el suport legal per a ampliar l'àmbit de la pràctica i l'autonomia de les infermeres de pràctica avançada.

Conclusions: Les troballes proporcionen perspectives rellevants que donen suport al desenvolupament organitzatiu de la prestació sanitària dins d'un context multidisciplinari, així com la importància de considerar el paper crític de l'entorn per a la implementació òptima de les infermeres de pràctica avançada dins del sistema sanitari català.

Implicacions per a la política sanitària: A la llum dels resultats d'aquesta recerca, s'ha de considerar-se una major formalització dels comitès de tumors i de les infermeres de pràctica avançada per a secundar millor la seva integració i promoure una atenció oncològica d'alta qualitat.

Resumen

Introducción: En los últimos 20 años se han producido avances significativos en el control del cáncer, impulsados por múltiples avances en diferentes áreas como la tecnología, los procedimientos quirúrgicos, los tratamientos médicos, pero también por la innovación en la prestación y organización de los servicios oncológicos. A medida que intervienen más especialistas y profesionales, aumentan los retos de gestión, coordinación y comunicación entre múltiples especialistas y niveles asistenciales. En consecuencia, la complejidad y la probabilidad de una atención fragmentada aumentan de forma natural. Por lo tanto, para abordar mejor la creciente complejidad y mejorar los resultados, los sistemas sanitarios han buscado formas innovadoras de prestar una atención oncológica de alta calidad de manera más eficaz y eficiente. Estas innovaciones incluyen el desarrollo de enfoques colaborativos, como la implantación de cuidados especializados a través de equipos multidisciplinares para cada tipo de tumor, y roles de enfermería de práctica avanzada. Los equipos multidisciplinares están reconocidos como el *gold standard* para organizar la atención y tratar el cáncer en todas sus fases, lo que se refleja especialmente en los comités de tumores como principal órgano de toma de decisiones. Sin embargo, a pesar de la abundante evidencia que apoya su impacto positivo, su beneficio independiente sobre la supervivencia es todavía escaso y controvertido. Además, los comités de tumores se han promovido e implementado en Cataluña durante las últimas décadas, pero es necesaria una evaluación de sus beneficios potenciales a nivel local. Paralelamente al desarrollo de los equipos multidisciplinares, las enfermeras de práctica avanzada se han integrado en la atención oncológica en Cataluña. Las enfermeras de práctica avanzada aportan un gran valor a los sistemas sanitarios. Sin embargo, su implantación ha sido desigual y sin ningún tipo de reconocimiento y/o regulación a nivel regional o nacional. La integración óptima de este rol profesional en el personal sanitario depende del entorno que rodea su implantación. Sin embargo, se ha prestado poca atención a la comprensión de las características del contexto específico en el que tiene lugar su desarrollo e integración en Cataluña o en España.

Hipótesis: La organización específica de los equipos multidisciplinares oncológicos influye en el desempeño de las funciones profesionales, en particular las de las enfermeras de práctica avanzada, y afecta a los resultados del proceso de toma de decisiones de los pacientes tratados.

Objetivo principal: Analizar el impacto de la práctica clínica multidisciplinar en la atención oncológica y los factores relacionados con los roles profesionales, particularmente los de las enfermeras de práctica avanzada en los equipos asistenciales.

Métodos: Esta investigación constó de dos fases. Durante la fase 1, con el objetivo de evaluar el impacto de los comités de tumores en los resultados clínicos, se llevó a cabo un estudio de cohortes de base poblacional en pacientes sometidos a cirugía por cáncer de recto primario con intención curativa. Los datos procedían de tres auditorías clínicas realizadas en Cataluña entre 2011 y 2020. El resultado primario fue la supervivencia a 2 años. Se utilizó un análisis multivariable de regresión de Cox para evaluar el cociente de riesgo de muerte en pacientes cuyos casos se discutieron en un comité de tumores preoperatorio frente a los casos que no se discutieron. La fase 2 tenía como objetivo conocer en profundidad los factores relacionados con la integración de las enfermeras de práctica avanzada en Cataluña. En primer lugar, se realizó un estudio cualitativo descriptivo utilizando un marco de factores contextuales para explorar las perspectivas de 14 enfermeras de práctica avanzada que trabajan en la atención oncológica hospitalaria pública en Cataluña mediante entrevistas semiestructuradas. En segundo lugar, se aplicó un estudio transversal utilizando una escala fiable y válida (EVOHIPA) para explorar las perspectivas de 162 enfermeras de práctica avanzada y 584 miembros del equipo multidisciplinar y directivo respecto a las enfermeras de práctica avanzada en los hospitales públicos de Cataluña.

Resultados: El primer estudio demostró que la falta de discusión del caso en el comité de tumores preoperatorio se asociaba con un 22% más de probabilidad de morir a los dos años. Asimismo, las probabilidades de ser discutido en el comité de tumores preoperatorio fueron mayores en los pacientes con estadios más avanzados y en los periodos de auditoría más recientes. Asimismo, la probabilidad de ser discutido en el comité de tumores preoperatorio fue mayor en los pacientes con estadios más

avanzados y en los periodos de auditoría más recientes. El segundo estudio reveló que la organización, el proceso de implementación y el desarrollo de la práctica clínica entre las enfermeras de práctica avanzada que trabajan en la atención oncológica en Cataluña dependen en gran medida del contexto. En este sentido, el entorno hospitalario en el que se introducen configura su perfil profesional, su puesto de trabajo, los recursos disponibles y el tipo de reconocimiento. Su autonomía para ejercer su función depende del apoyo y del grado de integración con el equipo multidisciplinar específico con el que trabajan. Asimismo, la ausencia en el ámbito de la enfermería de práctica avanzada de asociaciones profesionales o científicas a nivel local o nacional es un factor externo que puede acentuar el desarrollo actual. El tercer estudio mostró un alto nivel de acuerdo entre los participantes en relación con las afirmaciones sobre la contribución de las enfermeras de práctica avanzada a la mejora de la continuidad asistencial entre niveles y procesos, así como a la adopción de un enfoque más centrado en el paciente. También se observó un alto nivel de acuerdo en las afirmaciones relacionadas con la necesidad de clarificar su perfil profesional y la dependencia jerárquica a nivel organizativo. Sin embargo, se observó un menor nivel de acuerdo en las afirmaciones sobre el apoyo legal para ampliar el ámbito de la práctica y la autonomía de las enfermeras de práctica avanzada.

Conclusiones: Los hallazgos proporcionan perspectivas relevantes que apoyan el desarrollo organizativo de la prestación sanitaria dentro de un contexto multidisciplinar, así como la importancia de considerar el papel crítico del entorno para la implementación óptima de las enfermeras de práctica avanzada dentro del sistema sanitario catalán.

Implicaciones para la política sanitaria: A la luz de los resultados esta investigación, se debe considerar una mayor formalización de los comités de tumores y de las enfermeras de práctica avanzada para apoyar mejor su integración y promover una atención oncológica de alta calidad.

I. INTRODUCTION

Despite the substantial progress made in cancer screening, genomics, medications, surgical techniques and survival of patients, cancer remains a major and growing public health challenge (1). It is already responsible for an estimated one in six deaths worldwide, and its burden will continue to increase by at least 60% over the next two decades, straining health systems and communities (2). Cancer is expected to be the leading cause of death in Europe by 2035 (1) and although the incidence of cancer in Spain is lower than in the rest of the European Union (EU), it is the second cause of the death in the general population (3). In addition, the COVID-19 pandemic has severely disrupted prevention, cancer programs, service delivery and treatment, delaying diagnosis and vaccination, and affecting access to medicines; portending a future increase in cases (4). Hence, efforts in cancer control planning are positioned as a national and global public health priority. Nevertheless, cancer control strategies are very complex and require a comprehensive approach and simultaneous coordination of several elements at different levels throughout the cancer continuum, from primary prevention to survivorship and palliative care. On the one hand, there are population-based preventive strategies and, on the other hand, those that seek to respond to the impact on the organization and care of people suffering from cancer. This thesis will focus on two topics included in the second group of strategies, namely multidisciplinary care and new roles of the nursing profession.

The following introduction will begin with an overview of multidisciplinary cancer care as a way to organize cancer services for improved clinical organization and better operational delivery of cancer care. Subsequently, the implementation of the multidisciplinary team (MDT) approach as the gold standard in oncology care and the relevance of MDT meetings (MTM) as the main structure for decision making will be introduced. First from an international perspective, including the main outcomes related to the MDTs and MTMs and then in the local context. Thereafter, rectal cancer will be outlined as a natural example of multidisciplinary management and as a study case for the importance of the MDT approach. Finally, the concept of advanced practice nurse (APN) as a key professional role within multidisciplinary cancer care will be reviewed, focusing on its implementation and the contextual factors that influence their development first internationally and then locally.

1. The multidisciplinary clinical practice in cancer care

The organization in the provision of cancer services can be considered a laboratory for many organizational changes in healthcare at micro, meso and macro levels (5). Cancer care is highly complex and has unique features that makes organization and planning of health services a key element to delivering high quality cancer care beyond the individual quality of each therapy (6). For example, the complexity becomes evident when considering the long list of possible interventions, the need of coordination of numerous of professionals, the combination of different therapeutic strategies and levels of care involved, particularly in the context of ongoing integration of research, the role of genetics, genomics and personalized therapies. Consequently, the clinical organization and operational delivery of oncology services have been significantly restructured in the last decades towards new organizational models. The best approach to the organization of cancer care is through MDTs specialized in a particular oncologic pathology. This change has marked a clear shift from a situation in which different specialties work separately within their own silos to a model based on MDTs of specialists working together for integrated care (7).

1.1 Multidisciplinary teams and meetings to address complexity

The widespread introduction of MDTs in cancer care has its origins in 1995 in the United Kingdom (UK) through the publication of the Calman-Hine report, a comprehensive report that set out seven principles for a new structure of cancer care and clinical organization for service delivery within the UK (12). The main driver of why a cancer policy felt necessary at that time was due to the considerable variability in survival outcomes and various other shortcomings of cancer care in the UK for which there was no obvious justification (8,9). The report emphasized the importance of the specialized multidisciplinary consultation and management in the clinical organization of cancer services (10), proposing that all cancer patients should be seen by surgeons specialized in their type of cancer and working within MDTs that included diagnostic specialists and also led by nurses specialized in oncology (11). The report had a major impact on cancer policy, helping to guide the progressive transformation and development of cancer services not only in the UK but also internationally.

In particular, the clinical complexity of oncology care increased substantially when the importance of specialization by tumor disease and concentration of care became apparent due to its relationship with better long-term outcomes (12). On top of that, a rapid expansion of several potential treatments led to therapeutic dilemmas about optimal treatment plans and how they should be presented to patients (13). It was in this context, where the importance of an organizational context with a multidisciplinary approach by teams specialized in a specific pathology became evidently necessary. In this regard, MDTs were introduced as a response to the increasing complexity of the oncology management, where it is important to involve all key professional groups in making clinical decisions for individual patients (14). MDTs are considered the gold standard for organizing cancer care at all stages. Ideally, they are organized in a way that consistently brings together all healthcare professionals involved in the whole process of patient care, from diagnosis over treatment to the follow-up (15). This change is reflected especially in the central role of MTMs as the main decision-making body (16). These periodical meetings between professionals from diverse disciplines play a crucial role in streamlining care coordination, formulating comprehensive and personalized treatment plan options for patients. Although their specific membership and implementation may vary according to cancer types, they are usually attended by the most appropriate specialist for the diagnosis and stage of cancer (e.g., oncologists, surgeons, radiologists, pathologists and nurses). Also, the presence of an extended community of health professionals may be required (e.g., psychologists and/or nutritionists).

Furthermore, MTMs not only provide a platform where professionals bring their specialized expertise and collaboration to the clinical decision-making process at the micro level. They also extend to strategic collaboration at the meso and/or macro level with objectives related to quality improvement, inter-organizational coordination or integrated service delivery at the local, regional or international level (17). For example, MTMs discuss and integrate best practices, develop consensus-based clinical guidelines, improve care processes between hospitals and allow the patient to transition between different levels of care in a fluid and borderless manner. This type

of experience is reflected in the European cancer networks, with several experiences in European health systems, such as in Italy, Belgium, Spain (17) and the UK (18).

1.2 Quality and Outcomes

The delivery and organization of oncology practice in specialized MDTs, including the integration of MTMs as an essential part of treatment planning, is considered a hallmark of good cancer practice (19). In fact, MDTs and MTMs have been extensively included by accreditation and quality systems in cancer care, such as the accreditation procedure from the Organization of European Cancer Institutes (OECI)(20), the National Accreditation Program for Rectal Cancer from the American College of surgeons (21) and the basic requirements of a Specialist Breast Centre (20), among others. Additionally, international organizations, cancer patient advocacy and scientific societies consider them an essential quality criterion for optimal oncology practice (22–26). For example, the provision of oncology care by specialized MDTs — ideally as part of an oncology network — is included as one of the 10 general rights defined as basic requirements within the European code of oncology practice proposed by the European Cancer Organization (ECCO) to improve health outcomes (27). Also, several national guidelines recommend the importance of the discussion of all newly diagnosed patients in an MTM independently of age or stage of the disease (28–30).

The multidisciplinary teamwork approach has emerged in parallel with the implementation of several changes in the delivery of cancer care (e.g., specialization of healthcare professionals, changes in treatment protocols, advances in surgery, centralization of care), which make it particularly complex to determine its independent benefit in health outcomes. Nevertheless, previous studies have shown that this approach contributes positively to multiple dimensions in different types of cancer in terms of process and clinical outcomes. For example, enhancing patient recruitment to clinical trials (31,32), improving access by reducing time between diagnosis and treatment (33), and offering education opportunities for health professionals (34). Regarding the clinical outcomes, the implementation of MTMs enhances the adherence to multidisciplinary clinical guidelines (35,36), improves the diagnosis and decision-making on the treatment plan (37,38) and the survival of cancer

patients (39,40). Particularly, its impact on survival is more limited and uneven across different cancer types. As an example, however, in the case of breast cancer, the seminal work by Kesson et al. compared the introduction of MDTs in one health area in Scotland with a health area without MDTs. The study involved a total population of 13,722 women treated for breast cancer, showing that breast cancer mortality was 18% lower in the area with MDTs compared to the area without their introduction (41).

Despite the efforts and evidence supporting its impact, the implementation of MTMs in clinical practice remains challenging. Its optimal implementation requires to take into account organizational aspects such as time consumption, number of professionals involved, task and responsibilities, and information and communication technologies, among others (7,42). These logistical and organizational aspects have an impact on the quality of the decision-making process (43). Indeed, the characteristics of an effective MDT have been recommended (44) and specific tools for their assessment have been developed. For example, the MDT-OARS (Observational Assessment Rating Scale) is an observational tool to assess the performance of MTDs (45), the AEMAC is a web-based tool to facilitate the self-assessment of MTMs in terms of their internal organization and scope of care (46), the MDT-QuIC is a tool to improve the quality of the decision-making process (47).

Alongside with the implementation of MDTs, the role of cancer nurses has been evolving through the concept of APN roles (48). The practice of APN roles is characterized by the application and integration of theoretical and evidence-based knowledge, encompassing education, direct clinical practice, research and management (49). APNs play a crucial role as part of the MDTs in cancer care, contributing to care coordination, psychological support, symptom management and follow-up, among various other interventions (50). However, their formal recognition and inclusion within MDTs only exists in some countries (24).

1.3 Implementation of multidisciplinary clinical practice in Spain and Catalonia

In Spain, the Spanish National Health System (SNHS) has recognized and promoted MDTs as a quality criterion in cancer care since 2006 (51). This was the first strategic

document at the national level that indicated that cancer patients should be diagnosed and treated in the context of an MDT. Moreover, the document indicated the implementation of MTMs as the main structure for diagnosis and treatment planning in all centers providing oncology care. However, unlike other countries, in Spain the health policy of their integration over the years has occurred without a specific regulation, an establishment of minimum quality criteria or organizational frameworks for the optimal practice and implementation within the SNHS (e.g., composition, attendance, data collection resources or mechanisms or tools for their assessment) (52). In addition, as a country with a decentralized healthcare system and where the healthcare centers have substantial management independence, their implementation at the national level has been implemented mainly on a cooperative basis (53). As a result, significant variability in their formalization and *modus operandi* exist between centers and territories (46).

This variability in the degree of development and work dynamics was especially reflected in the study by Prades et al. (53). The study showed that the MTMs in Spain could be qualitatively classified into three models of development of multidisciplinary cancer care: advisory committee, formal co-adaptation and integrated care process regarding their team capabilities and nature of interaction between professionals rather than specific forms of organization (table 1).

Table 1. Models of co-operation in multidisciplinary cancer care.

	1. Advisory committee	2. Formal co-adaptation	3. Integrated care process
Cases submitted (approx.%)	"Complex" cases or off-protocol: 10%-50%	All "possible" cases: 50-80%	Initial source of clinical assessment: 90%-100%
Patient access to team	Treatment (initiated or not)	Diagnosis or treatment	Suspect or diagnosis *(early access)*
Nature of agreements	Recommendations	Consensus decisions not always implemented	Binding decisions defended by the team
Professional team roles	Negative perception	Chair, tumor board coordinator	Chair, coordinator, nurse case manager
Impact on clinical process management	Minor changes	Some segments of care	Whole process (cross-boundary frequent)
Specialist participation	No diagnostic specializations	Absences due only to timetable problems	Professionals associated with a clinical committee
Junior doctors and nursing role, in terms of attendance	Considered inappropriate	Open meeting, participation encouraged	Mandatory presence
Hospital executive board role	Lack of interest	Acknowledgement without express support	Express support (room, clerk, etc.)
Presence in health system	40%	50%	10%

Source: modified from Prades et al. 2011 (53)

Nevertheless, within the context of high variability of its practice, it is important to notice the important influence that the research in the field has had and the support of the scientific societies at a European and Spanish level for a formalization of the national multidisciplinary care development. These factors have promoted and recognized MDTs as quality criteria and health priority in cancer care (15,52). This is particularly reflected in the institutional declaration in favor of the development of interdisciplinary cancer care in Spain (54), in which several Spanish scientific societies from different medical and other health professional fields in oncology have acknowledged their commitment and support for the formalization of an multidisciplinary approach as a quality standard and as the best approach to take decisions regarding to the diagnosis, treatment and support of cancer patients within the SNHS.

For its part, the Catalan Cancer Strategy has been systematically promoted since 2001 and recognized MDTs as the cornerstone of quality in cancer care organization in their consecutive oncological plans in Catalonia (28,55,56). In fact, as a sign of its active commitment, multiple actions have been carried out for the formalization of MDTs in the Catalan health system. These actions include the initial development of Clinical Practice Guidelines in cancer care, the evaluation of clinical outcomes through clinical audits, the support for the implementation of a nurse-led case management model, the centralization of surgery, the participation of Catalan reference hospitals in the European Reference Network for rare adult and pediatric tumors and hereditary diseases, amongst others (56).

2. Multidisciplinary Management of Rectal Cancer

Colorectal cancer (CRC) is the third most frequent cancer worldwide (57), and despite improvements in survival, it remains the second leading cause of cancer death in Europe in general and specifically in Spain (58). The risk of CRC can be reduced by several modifiable risk factors, such as avoidance of smoking, high alcohol consumption, unhealthy diet, excess body weight and physical inactivity (59). The incidence is mainly concentrated in people aged 70 years and older, though in recent years it has been increasing in younger adults in some high-income populations

(60)(61). In Catalonia CRC remains the second most common cancer in men and women. However, when they are considered jointly, CRC is the most common (56). Rectal cancer accounts for approximately one third of all CRC.

Anatomically, the rectum is the last portion of the large intestine, located immediately after the sigmoid colon. It has an approximate length of 15 centimeters and can be divided into 3 sections (proximal, medium, and distal). Consequently, rectal cancer is categorized as low (up to 5cm), middle (>5 to 10 cm) or high (>10 cm up to 15 cm) (62).

The past decades have seen substantial progress in rectal cancer treatment and management, partly due to advancing knowledge of the anatomy and pathophysiology of the disease along with new surgical techniques and the use of neoadjuvant chemoradiation. Hence, the key cornerstone of success has been the collective effort towards multidisciplinary management (63). In this sense, the combination of multimodal treatments and available surgical options have positioned MDTs as an essential element of rectal cancer care to improve outcomes (25). To fully understand the importance of the multidisciplinary management of the disease, it is necessary to review the main treatment options.

2.1 Treatment overview

The ideal treatment plan is a multifaceted process that requires consideration of patient preferences, tumor characteristics, intent of the surgery and functional outcomes (64). However, the stage, tumor location and mesorectal involvement are the main factors that will determine the therapeutic approach and treatment options. The TNM (Tumor, Node, Metastasis) *Classification of Malignant Tumors* (8^{th} edition) is the most used to classify the aggressiveness of rectal cancer (Table 2). The stage of the disease is grouped according to the different T, N and M stages (Table 3).

Table 2. TNM Clinical Classification

T (tumor)	**N** (node)	**M** (metastasis)
TX: Primary tumor cannot be assessed	**NX:** Regional lymph nodes cannot be assessed	**M0:** No distant metastasis
T0: No evidence of primary tumor	**N0:** No regional lymph node metastasis	**M1:** Distant metastasis
Tis: Carcinoma *in situ*: Invasion of lamina propria	**N1:** Metastasis in 1-3 regional lymph nodes	**M1a:** Metastasis confined to one organ (liver, lung, non-regional lymph node(s)) without peritoneal metastases
T1: Tumor invades submucosa	**N1a:** Metastasis in 1 regional lymph node	**M1b:** Metastasis in more than one organ
T2: Tumor invades muscularis propria	**N1b:** Metastasis in 2-3 regional lymph nodes	**M1c:** Metastasis to the peritoneum with or without another organ involvement
T3: Tumor invades subserosa or into non-peritonealised pericolic or perirectal tissues	**N1c:** Tumor deposit(s), e.g. in the subserosa, satellites, or in non-peritonealised pericolic or perirectal	
T4: Tumor directly invades other organs or structures and/or perforates visceral peritoneum	**N2:** Metastasis in 4 or more regional lymph nodes	
T4a: Tumor perforates visceral peritoneum	**N2a:** Metastasis in 4 -6 regional lymph nodes	
T4b: Tumor directly invades other organs or structures	**N2b:** Metastasis in 7 or more regional lymph nodes	

Source: modified from Brierley et al. (65)

Table 3. Stage grouping of colon and rectal cancer. TNM Pathological Classification

Stage	Classification
Stage 0	Tis N0 M0
Stage I	T1, T2 N0 M0
Stage II	T3, T4 N0 M0
Stage IIA	T3 N0 M0
Stage IIB	T4a N0 M0
Stage IIC	T4b N0 M0
Stage III	Any T, N1 or N2 M0
Stage IIIA	T1, T2 N1 M0
	T1 N2a M0
Stage IIIB	T1, T2 N2b M0
	T2, T3 N2a M0
	T3, T4a N1 M0
Stage IIIC	T3, T 4 a N2b M0
	T4a N2a M0
	T4b N1 N2 M0
Stage IV	Any T Any N M1
Stage IVA	Any T Any N M1a
Stage IVB	Any T Any N M1b
Stage IVC	Any T Any N M1c

Source: modified from Brierley et al. (65)

2.1.1 Imaging

Over the years, the role of high-quality imaging has increasingly become critical in guiding rectal cancer treatment decisions. Specifically, the high-resolution pelvic magnetic resonance imaging (MRI) is considered the most accurate preoperative test for defining locoregional clinical staging (62,66). High-quality MRI allows the assessment of various factors that are crucial for surgical planning and can potentially predict outcomes. These include the detection of the distance to the circumferential resection margin (CRM), which is a well-known factor to predict local recurrence, distant metastases and patient survival (67). MRI makes it possible to determine the penetration of the tumor into the mesorectum (T sub-stage classification), the extramural vascular invasion and the nodal stage (62,64). In this sense, preoperative high-resolution MRI is fundamental to patient selection for neoadjuvant chemoradiotherapy (CRT) treatment, successful total mesorectal excision (TME) surgery and limiting overtreatment of patients with CRT (63). Therefore, it should be carried out to select patients for the respective preoperative management and to define the extent of surgery (62).

2.1.2 Pathology

The contributions of pathologists play a critical role in the clinical treatment of rectal cancer. Prior to surgery, they perform a detailed preoperative study of the tumor (based on the biopsy) and prepare a pathology report for discussion at the MTM (13). For mesorectal resection, they perform the pathological evaluation, which includes macroscopic evaluation of the specimen (with photographic registration), evaluation of the quality of the TME, the status of the CRM and regional lymph nodes (62). In this regard, for example, the presence of a positive CRM — defined as the presence of tumor at 1mm or less from the resection margin — has been described as one of the most important factors influencing local and distant metastasis (69,70). Hence, the pathologist can gather prognostic information on the quality of the surgery, local and overall recurrence, overall survival and the potential need for adjuvant treatment (64). Likewise, pathologists contribute to the audit and learning processes of surgeons and radiologists (71).

To improve the quality of the pathology report it has been suggested that a proforma report should be used routinely such as the one by the Royal College of Pathologist (62).

2.1.3 Surgical treatment

Surgery is considered the curative method of choice for rectal cancer and can be used alone or combined with neoadjuvant and/or adjuvant treatment. The main goals of surgery are to give local control and avoid local recurrence, to cure the patients and give long term survival, to preserve sphincter function (defecation), bladder and sexual functions and to maintain or improve the quality of life of the patients (72).

In general rectal surgery that produces an optimal TME is considered the cornerstone of curative rectal cancer management (73). This surgical technique allows for radical resection of the tumor and preservation of the pelvic autonomic nerves which are essential to maintain urogenital and anorectal functions (63). During the last decades numerous studies have shown the independent benefits of the excision of this fatty tissue encompassing the rectum, called the mesorectum. It contains vital lymph nodes and blood vessels through which tumors may spread. This surgical approach significantly enhances loco-regional tumor control compared to a conventional resection technique. Findings have revealed a reduction in 5-year recurrence rates up to 5-7% in some cases (72,74).

Depending on the individual patient, the tumor characteristics and the application of the TME principles, different surgical techniques can be performed (75). For tumors situated in the upper third or middle section of the rectum, a low anterior resection (LAR) is typically performed. To protect the lowest anastomosis, a temporary stoma is often required.

For tumors situated in the distal third of the rectum, three techniques can be performed: LAR, abdominoperineal resection (APR) or Hartmann's procedure. Historically this location often prompted an APR, necessitating a permanent colostomy. However, given that LAR provides sphincter conservation without compromising oncological outcomes, its preference is clear whenever feasible (72,76). Ultimately, Hartmann's procedure remains a consideration only when a low colorectal

anastomosis is unsuitable due to patient-specific factors such as advanced age, significant comorbidities, previous fecal incontinence, or extensive tumor metastasis.

In the case of very early cancers T1 with low risk (T1, N0, M0 without adverse features like G3, V1, L1) (62), local excision with transanal endoscopic microsurgery (TEM) is recommended because it can provide oncologic results similar to those achieved with TME but with fewer postoperative complications and with the possibility of preserving anorectal sphincter (62,77).

2.1.4 Neoadjuvant/adjuvant treatment

In rectal cancer neoadjuvant radiotherapy is recommended because it reduces the risk of local recurrence after surgery by more than 50% even with optimized TME (78).

There are two general standard approaches to preoperative therapy:

- short-course preoperative radiotherapy (SCPRT) with a total dose of 25 Gy - 5 Gy during 1 week, followed by immediate surgery (62). It is recommended that not more than 10 days pass from the beginning of the SCPRT.
- Long-course CRT with a dose of 45-50 Gy delivered in 25-28 fractions, considering the use of a further boost with 5.4 Gy in 3 fractions (62).

Both approaches have been shown to improve locoregional tumor control compared with surgery alone (63). Despite international discussion of which approach is more suitable, the guidelines of the European Society for Medical Oncology (ESMO) (62) recommend the use of either SCPRT or CRT and acknowledge that there is not a rigid definition of which sub-stages (T-N) require SCPRT or CRT. Instead, the guidelines suggest the selection of the approach based on the positive CRM at TME surgery. In this context, CRT is recommended when there is a predicted risk of positive CRM and/or incomplete (R0) resection status (62).

Adjuvant treatment is not routinely administered in rectal cancer patients. Postoperative CRT could be selectively utilized in patients who have not undergone preoperative RT and unexpectedly present adverse outcomes after primary surgery. This includes perforation in the tumor area, CRM + and incomplete mesorectal excision among other signals of high risk of local recurrence (62).

Lastly, in patients with locally advanced rectal cancer (LARC) the neoadjuvant treatment followed by TME is considered the standard treatment because of its positive short and long-term outcomes. However, there are many potentials complications linked to radical surgery such as immediate postoperative complications (e.g. intestinal obstruction, hemorrhage, chylous effusion) (79). Likewise, 60- 90% of that patients may experience low anterior resection syndrome along with high stoma rates, both of which can profoundly affect quality of life (80). On the other hand, these patients also have a high rate of life-threatening distant metastases (81). Hence, different approaches are being investigated to improve the quality of life and reduce the rate of distant metastasis in these patients, especially in those with good response to preoperative treatment.

One of these approaches is called the 'watch and wait' approach. Previous reports suggest that among 10%-40% of patients will achieve a clinical complete response after preoperative SCPRT or CRT (62,79). Although there is no universal agreement on the criteria to define a clinical complete response, the observation of a significant primary tumor response to neoadjuvant therapy in some patients has led to the idea of organ-preserving strategies in selected patients or a 'watch and wait' approach (82). This approach is under study and needs close and rigorous surveillance in selected patients. The ESMO guidelines stress that the 'watch and wait' approach remains unproved and that more controlled prospective studies are needed to validate it (62). However, the report suggests the possibility of consider it under strict surveillance in frail, high-risk patients or those who refuse radical surgery (62).

Another approach under study in the management of patients diagnosed with LARC is called total neoadjuvant therapy (TNT). The TNT concept attempts to deliver both induction chemotherapy (before the neoadjuvant treatment) and consolidation chemotherapy (after CRT or SCPRT) with the aim to reduce the risk of micrometastases, improve tolerance to treatment and increase the possibility of clinical complete response (81,83). However, the benefits of TNT are controversial and the ESMO guidelines have not discussed this approach.

2.2 Multidisciplinary rectal cancer management

To ensure the best clinical management of the complex care needed by rectal cancer patients, it is recommended that care should be organized in a highly qualified MDT (71). This is especially reflected in the central role of the MTM as the main decision-making body (16). These regular meetings are held with the aim of reaching consensus and discussing diagnosis, clinical management and follow-up through personalized and evidence-based clinical decisions (15,68). MTMs are especially relevant in rectal cancer, since, as described above, a combination of multimodality treatments is available, often administered based on clinical findings, preoperative MRI-based staging and histopathology (63). Even more so, considering that the type of treatment chosen can have a significant impact on the patient's quality of life (e.g., sexual, bowel and urinary functions). Thus, MTMs provide a necessary forum for discussion among the healthcare professionals involved, making it possible to offer a personalized and high-quality treatment plan for rectal cancer patients (84).

These meetings must be attended at least by the most appropriate members to properly treat rectal cancer patients. The ECCO recommends a 'core' MDT, consisting of dedicated members from eight disciplines: gastroenterology and endoscopy, pathology, radiology or imaging, surgery, radiotherapy, medical oncology, nursing and interventional radiology (25). Furthermore, the ECCO emphasizes that 'expanded' members, such as geriatricians, psycho-oncologists, and nutritionists, should attend as needed.

Although their implementation varies at the international level and across European countries (19), MTMs are thought to enhance care performance and optimize patient outcomes (85). Particularly for rectal cancer, MTM discussions of the preoperative MRI have shown significantly reduced positive CRM in rectal cancer patients (86). Likewise, the study of Brannstrom (87) showed that patients discussed in MTMs improved preoperative staging versus those who were not discussed (96% *vs.* 63%). The study also demonstrated that MTMs are an independent factor to properly use neoadjuvant radiotherapy even when adjusted by age and comorbidities (87). Others studies have shown that MTM discussions improved the used of preoperative MRI and also the staging of the patients who were discussed was more complete (87). Moreover, MTMs

facilitate quality improvement trough data collection, which could allow audits to monitor outcomes (88).

However, despite the international support and acceptance of the implementation of MTMs, the evidence for the independent effect of MTMs on survival in CRC remains controversial. In fact, no impact on survival has been demonstrated in rectal cancer (63). Several studies have failed to find any independent benefit associated with MTMs for colorectal (89) and rectal cancer survival (90,91), whereas others have shown a positive relationship between survival outcomes and the MTM discussion in patients with colorectal cancer for survival after three years (92,93) and five years (40,94). Limitations in study designs such as the use of comparison groups during different time periods (11,14), difficulties in adjusting for potential confounders (95), and small sample sizes (91) may have contributed to the controversial results in the literature. In addition, research to date has focused primarily on the general CRC population, with no distinction between those with rectal and colon cancer. Indeed, a recently published meta-analysis of many cancer types showed the positive impact of MTMs on colorectal cancer outcomes, but only a few small studies focused on rectal cancer (96).

3. The concept of the Advanced Practice Nurse

Technological transformations, population aging, and the increased burden of chronic diseases have led to a global recognition of the need to transform health systems. This transformation includes optimizing the use of human resources, including through the promotion of healthcare roles that respond to the new needs of the population (97,98). One such role is that of the so-called advanced practice nurse (APN).

The concept of the APN, as an initial role, emerged in 1965 in the United States with the objective of providing health care to the pediatric population in rural areas due to difficulties related to the access to health services and the shortage of primary care physicians (99). Due to their positive impact, these roles were later incorporated into the general primary care population and various other settings in the USA (100). Since their first introduction, the global integration of APN roles has been growing (101). Their integration into the healthcare workforce has been seen as a strategy for

healthcare systems to better address the changing needs of populations with complex conditions, improve access and quality of care, and reduce costs in the face of aging and the rising prevalence of chronic diseases (102,103). However, the driving force behind the introduction of APNs is diverse and determined by the specific characteristics of each country in which they are implemented.

In the literature, there are two main approaches to the expansion of the scope of the practice of nurses (102). One approach is task-shifting, implying that some tasks or activities (e.g., referrals, diagnoses, chronic disease monitoring) are moved from highly qualified health workers (usually physicians) to nurses with additional training, to improve efficiency and to address staffing shortages in healthcare systems (104). The other approach is task supplementation, which means that nurses take on complementary roles that minimally exist or did not exist before with the goal of improving the quality of care and responding to patient needs (e.g., coordination roles, eHealth monitoring, case management) (102). Maier et al. (102) also describe that the distinctions between both APN roles are often blurred and may intersect. Nonetheless, they both share a foundation in advanced nursing education and an expanded scope of practice.

In particular, the study of Delamaire et al. (105) reviewed the integration of APN roles in 12 OECD developed countries finding four main reasons behind the introduction of APN roles: Workforce issues (shortage of doctors); Responding to the changing needs of the population; Containing the growth of healthcare spending; Improving the career prospects of nurses.

3.1 Definition of the Advanced Practice Nurse

The 2020 guidelines of the International Council of Nurses (ICN) defines an APN as “a generalist or specialized nurse who has acquired, through additional graduate education (minimum of a master’s degree), [an] expert knowledge base, complex decision-making skills and clinical competencies,” signaling that the specific characteristics are shaped by the context in which they are credentialed to practice (106). The ICN highlights that what makes the roles advanced is the ability to integrate the direct clinical practice with research (evidence based practice), leadership,

education and advanced clinical management (107). For this research, the ICN definition of APN is the one used in this thesis.

Characteristics of the clinical practice of an APN are an extended or broader level of practice, encompassing case management, advanced assessment, judgment, reasoning skills, ability to manage complex health problems, decision making and interprofessional collaboration (106). Furthermore, APNs may plan, coordinate, evaluate and implement actions to enhance healthcare services. Their level of autonomy and scope of clinical practice is determined by the country specific professional regulation. For example, in some countries, APNs can be the first point of contact for patients and families. Moreover, under specific regulatory and legislative mechanisms, they can have the legal authority to admit patients to hospitals, refer patients to other professionals or to prescribe medications and specific treatments (108). In other countries, their scope of practice and autonomy is more limited, e.g., they cannot be a first point of contact and they only have the authority to renew drugs, but not to prescribe them (109).

Along these lines, although at the international level, the development and the scope of practice of APN roles vary enormously. Globally, the two most common types of APNs are the Clinical Nurse Specialist (CNS) and the Nurse practitioner (NP). Although both roles (CNS and NP) have much in common, the NP is clearly characterized by working autonomously (106)(108). Additionally, NPs are educated to diagnose and treat health conditions, can prescribe medication and have an added emphasis on disease prevention and health management (106,108). They can practice in both primary care and acute care settings. The CNS, on the other hand, is characterized as a an expert nurse who provides consultation and specialized care, especially to individuals with complex health problems in a specialized area (e.g., geriatrics, oncology, diabetes) (110). Their practice focuses on advanced specialized nursing care and a systems approach that combines direct and indirect clinical service delivery (106). They collaborate with patients and different healthcare professionals as members of an interprofessional healthcare team to provide high quality care (110). They usually work in hospitals or outpatient, emergency, or long-term settings.

3.2 Advanced practice nurses in the context of different healthcare systems

The international development of APN roles has been a major trend in healthcare systems worldwide (111,112). However, the evidence shows that there is considerable variation in their deployment on an international scale. After more than 60 years of the growing presence of APNs, the adoption of these roles occurs at different stages and speeds of development even within the same country (113). For example, there are pioneering countries such as the United States, Canada, Australia and the UK that have a long tradition with years of work and development in this area, while other countries are still at an incipient stage of development. Also, the number of APNs in countries where they are well-established varies, reaching more than one hundred thousand in the United States, while other countries have more modest numbers (102,111).

Over the years, several studies have attempted to document their evolution and expansion across the globe, showing that there are variations in the role's title, functions, regulation, education and practice structures under which APNs provide care (111). For example, the study of Heale et al. (114) identified 52 APN roles in 26 countries, involving nurse specialists, clinical nurse consultants, nurse midwifes, CNSs, APNs and NPs among other professional tittles. Variability in the development of APNs, their education and their scope of practice are also reflected in the study of Maier et al. (102), which provided an analysis of APNs in 37 OECD and EU countries in primary care (Table 4).

In Europe, as in the rest of the world, there are countries that are leading the way in the establishment of APNs, such as Ireland, Finland and the Netherlands. In other countries, like France, they have been recently recognized and regulated at government level in the French healthcare system (as of 2018). In France, the integration of APN roles was tailored to the needs of the French population. The objective has been to improve access to care and quality care pathways in four specific areas: (1) Mental health and Psychiatry, (2) Oncology and Haemato-oncology, (3)

Prevention and common polypathology in primary care, and (4) Chronic kidney disease, kidney transplantation and dialysis (115). The French definition of the APNs is in line with the ICN definition but there are two main clear differences established at a national level: the APN does not intervene as a first point of contact and cannot establish a medical diagnosis. To exercise their clinical practice, a minimum of 3 years of work experience as a general nurse is required and they can only work in the specific field of intervention in which they have completed the accredited educational program at a Master level (120 ECTS) (115). In the same article, Colson and colleagues point out that no national strategy has been established for their implementation (115). In this regard, national implementation plans are described as being fundamental for an optimal implementation (116).

Table 4. NP/APN advanced practice and education in selected OECD countries and EU countries in primary care.

	Countries	NP/APN education	Advanced Clinical Practice, as per SoP
Established: NP/APN Working at high levels of advanced clinical practice	Australia, Canada, Finland, Ireland, Netherlands, New Zealand, United States, United Kingdom (England, N. Ireland, Scotland, Wales)	✓	Authorized to perform all the following clinical activities: ▪ Prescribing medications ▪ Medical diagnosis & health assessment ▪ Ordering medical tests & exams ▪ Treatment decisions ▪ Panel of patients ▪ Authorized to refer patients ▪ First point of contact
Emerging: (few) NP/APN education programs, but practice not at advanced clinical level	Austria, Belgium, Croatia, Cyprus, France, Germany, Iceland, Israel, Lithuania, Norway, Spain, Sweden, Switzerland	**(✓)** Emerging*	Level of advanced clinical practice is more restricted than above, authorized to perform a limited set of advanced clinical activities, usually under physician oversight
Other extended nursing roles, but practice not education at NP/APN level	Belgium***, Czech Republic, Denmark, Estonia, Italy, Latvia, Luxembourg, Malta, Poland, Portugal, Slovenia, ****Hungary	No**	Limited advanced clinical practice, authorized to perform a limited set of clinical activities, usually under physician oversight

Notes: SoP: Scope-of-Practice, *Few or recent NP/APN programs established at universities or universities of applied sciences. **No NP/APN education programs, but additional specializations and trainings for nurses *** Belgium (Flamish part with APN education, French part without). ****Hungary is in the process of implementing APN educational programs (as of 2017). *Source:* Modified from Maier et al. (102).

However, significant variation exists in the level and extent of establishment of these roles across European healthcare systems (117). For example, a recent study conducted by the European Federation of Nursing (EFN) revealed that there is a lack of clarity of the concept of an APN and, therefore, of the competencies and scope of practice associated with the role depending on the country in which it is exercised. In this sense, the definition, requirements, educational level and training were very different between European countries (101). For example, educational preparation based on the European Credit Transfer and Accumulation System (ECTS) ranged between 130 ECTS in Ireland or higher in the Netherlands (240 ECTs), down to 40 ECTS in others like Albania. In addition, the lack of a regulatory model impedes the mobility of these nurses between countries.

3.3 Advanced practice nurses in cancer care

The need of integrated care for patients with cancer also triggered the opportunity for the emergence of APN roles in the early 1990s primarily in cancer care of English-speaking countries (118). Over the years, they have subsequently been adopted along the whole cancer continuum. In fact, a recent scoping review revealed that the APN roles in cancer care are diverse and may be focused on (119):

- A specific type of cancer (e.g., head and neck, breast)
- Phase of the cancer continuum (e.g., prevention, survivorship)
- Type of treatment (e.g., immunotherapy, radiotherapy)
- Cancer population (e.g., adolescent and young adults)
- Specific type of care (e.g., palliative)

Therefore, the roles of APNs in oncology care provide a variety of interventions which have a positive impact on patients and cancer care services in general. For example, a recent literature review by Kerr et al. (50) shows that APNs contribute to improved information provision, service coordination, symptom management, psychological support, and patient satisfaction in various types of cancer (50). Likewise, in palliative care, a randomized controlled trial including 322 patients with different advanced

cancer types (lung, breast, genitourinary, gastrointestinal) compared clinical outcomes of patients receiving usual oncology care versus those receiving interventions from APNs (120). More specifically, the intervention was an active follow up primarily given by telephone at least monthly to identify active issues, make or coordinate appropriate referrals, educate patients and family about key palliative care principles, symptom management, communication, and advance care planning (120,121). The results showed significantly higher score of quality of life for symptom intensity and depressed mood in the intervention group (120). Other clinical trials focusing on patients who have undergone surgery for gynecologic cancer also show that patients who receive a follow-up by APNs significantly improve symptoms of distress, decrease uncertainty and improve physical and mental quality of life (122).

Other studies have reported that oncology APNs are a valuable member of MDTs that bring specific added value to cancer care. For instance, Alessy and colleagues (123) analyzed the data of 100,885 colorectal, lung, breast and prostate cancer patients who responded to the National Cancer Patient Experience Survey between 2010 and 2014 in the NHS of England. The findings revealed that being derived to an APN was strongly associated with being more involved in the treatment decisions (123). And, also with an overall better experience in care coordination and all aspects of care (123). Likewise, the study of McConkey (124) in Ireland, where urology patients consult with the APN in an outpatient setting reported an improved patient ability to better understand, cope with, and manage their health status.

Also, the study of Drudge-Coates (125) evaluated the implementation of a Urology Nurse Practitioner led service in the NHS of the UK over a three-year period. The results showed that their implementation decreased the waiting times for an initial appointment with a physician-led service by 52%, which also resulted in cost savings (125). Also, oncology APNs can effectively contribute to patient-reported outcome measures (PROMs) data (126). For example, a randomized controlled trial in surviving breast cancer patients showed that APN interventions in the surveillance of these patients over an 18-month follow-up time can provide a timely assessment of

important symptoms that would otherwise go untreated until the next scheduled visit. (127).

Nevertheless, despite the evidence showing their positive impact on improving oncology care services and further demonstrating that the APN roles are integrated into oncology care, their development and implementation in health systems has followed the same trend as APN roles in general. Their deployment has been uneven and surrounded by lack of consistency and clarity in terms of roles, job titles, scope of practice and education requirements (119,128). Some scientific Nursing Associations such as the Canadian Association of Nurses in Oncology (CANO/ACIAO), the Oncology Nursing Society (ONS) and the European Oncology Nursing Society have contributed through standards of practice and competencies related to advanced nursing practice in oncology (49,129,130). Nevertheless, there is significant variation in their development in cancer care internationally (128) and their existence varies considerably across Europe at present (24,49).

3.4 Role development in Catalonia and Spain

In Spain, as in many other countries, the constant aging of the population and increase in chronic diseases and multimorbidity have generated the need to reorganize and optimize the resources of the national health system (131). Within that reorganization, several strategies that seek to respond to chronicity, new models of care and nursing roles have emerged over the years, among them APNs.

However, a hatching of different titles (e.g., liaison nurse, referent nurse, clinical nurse, nurse case manager, APN) and functions has emerged in each region of the country. For example, in 2018 a study covering 46 public hospitals in Catalonia reflected a variety of 21 role titles of nurses, working in a more specialized area than a general nurse (132). The most frequent titles were referral nurse, nurse case manager, clinical nurse and advanced practice nurse, all of which performing similar tasks.

There is a great confusion in terms of titles, functions, competencies, and professional and academic development in the implementation of APN roles in the SNHS. The lack of systematic planning and/or regulation of nursing human resources at the national or local level have contributed to expanding the scope of practice of the nursing profession without clear directions. In practice, each hospital or healthcare institution has delineated their own APN design, professional profile, and educational requirements. As a result, responsibilities remain unclear and may vary between regions or organizations (133).

Today the Spanish government recognizes only two categories within the nursing profession: generalist nurses and specialist nurses in six specific fields of care (geriatric, pediatric, family and community care, mental health, occupational health, obstetric-gynecological care). There is no certification or accreditation system for another nursing role that is linked to educational requirements and/or a protected title. Therefore, in the absence of any kind of regulation to differentiate and recognize the expansion of nursing practice in Spain and Catalonia, during the last two decades different initiatives have tried to better conceptualize and clarify the concept in the national and local context. For example, in 2015 the study by Sastre-Fullana et al. (134) sought to delineate a competency framework for APNs based on a consensus of experts using the Delphi method. As a result, 12 competency domains were proposed: research and evidence-based practice, clinical leadership and consulting, autonomy for professional practice, and expert clinical judgment, among others.

Since 2018, Andalusia has implemented APN roles in areas where there are no nursing specialties (case management, patients with ostomies, chronic wounds and with complex oncological processes) but where there is a need for a specialized and advanced nursing care (135). They have also defined access criteria, competencies and minimum postgraduate training required.

For its part, in Catalonia in 2016, Comellas' doctoral thesis (136) sought to understand the meaning given to the APN concept in the hospital setting in the Catalan context. The results reflect a wide variety of interpretations of the concept, both by nurses and

managers or other referents. In 2017 the research of Sevilla-Guerra et al. (137) explored the different instruments utilized at an international level to differentiate APNs from other nursing roles (137). Then, they translated and culturally adapted the modified Advanced Practice Role Delineation tool to the Spanish context (138).

The Autonomous University of Barcelona initiated in 2019 an academic nurse research project called IPA.CAT with the aim to identify nurses who meet the international criteria to be considered APN in Catalonia (139). The study included 1209 potential APNs from 126 healthcare facilities, from which 269 APNs (22%) were identified. The study showed that most of these nurses were working in specialized care, primary and community care, chronic conditions, ageing and end-of-life care, and mental healthcare without any formal recognition or regulation (133).

Particularly, the literature on the developmental context of APNs in Spain is sparse and limited to Catalonia, where a comparative study was carried out in the Canadian region of Quebec (140). The results of the study indicate that the implementation of APNs in Catalonia has been driven by the need to improve access and more personalized care. Common barriers between both countries were interprofessional opposition, misreading of the role and organizational limitations, among others (140). Likewise, the findings suggest that the development process was marked by inertia, and the authors pointed out that further reporting of the specific contextual factors that influence the development and implementation of the APNs is needed.

The IPA.CAT project has recently proposed a model for APNs in Catalonia, including aspects regarding their regulation, organization and educational requirements (141).

3.4.1 Advanced practice nurses in cancer care

APNs in oncology in Catalonia have developed mainly through the case management model (28). However, the knowledge of the APNs deployment in oncology is scarce in the national and/or local context.

For instance, the work of Vila et al. (142) proposed a curriculum for the role of advanced breast cancer clinical nurses. Serra-Barril's thesis has recently contributed to the first research that has assessed the level of development of APNs in cancer care in Catalonia (143). The findings revealed that competency domains related to direct clinical practice, consultation, collaboration and interprofessional relations are well developed by APNs, while domains related to leadership, research, evidence-based practice and quality improvement are not (144). Hence, the results suggest barriers and challenges for the full development of oncology APNs in Catalonia. Furthermore, they found that oncology APNs in Catalonia are perceived by the multidisciplinary team members as a crucial member of MDTs (145). Likewise, APNs improve patient safety and follow-up, facilitate the care process and coordinate the different stages of care, which have an impact on the efficiency care delivery (145). In the same way, from the patients' perspectives, APNs respond to their needs and improve their wellbeing.

3.5 The relation between context and design for advanced practice nurses

International variations in the integration of APN roles throughout different healthcare systems can be explained, in part, by the fact that the process represents a complex intervention, which entails multiple challenges and is sensitive to the specific environment in which its implementation takes place (116). In this regard, their integration requires the consideration and integration of multiple contextual factors at the micro, meso, and macro levels for successful implementation and long-term sustainability (146). Other authors have identified contextual factors as key determinants for optimal implementation, such as education and training, organizational support, multiprofessional collaboration, regulation, and payment policies (103,147). Damschroder et al. defined context as "the set of circumstances or unique factors that surround a particular implementation" (148). This set of unique factors is not a backdrop for implementation, but rather influences, interacts, facilitates or constrains the implementation (149). These factors may include available resources, the type of recognition, the professional training, community involvement or the healthcare model, among others (150). The interaction of these contextual factors explain variations in the clinical practice and the implementation process of

APNs (151), which create a unique context that acts as barrier in one setting and facilitator in another (149).

From that perspective, contextual factors can be decisive in the optimal design and implementation of APN roles. However, the published literature shows that in most cases their integration and development across the globe has been carried out without taking into consideration context-relevant evidence to better support their design, planning and integration into healthcare systems (152,153). Likewise, knowledge about contextual factors influencing their implementation in various clinical settings or fields are often limited (140), and mainly confined to Anglo-Saxon countries (102). Accounting and understanding the local contextual factors surrounding the implementation of APN roles in different environments is vital. Bringing to light specific contextual elements or structures is critical to better understand the key elements that hinder or facilitate implementation, and to better address the challenges of the implementation to the local context in which they operate (151).

Given that context is a multidimensional concept, fully embracing its multiple elements and dimensions necessary to globally understand the contextual determinants surrounding an intervention is a challenge. In this sense, the literature shows that there is considerable variation and multiple models, theories and/or frameworks that can be found to understand and explain what influences the implementation process and its outcomes (151). For example, Tomoaia-Cotisel et al. (150) developed a framework for contextual factors to support the reporting of key contextual factors in complex healthcare phenomena and to enhance both internal and external validity. It classifies the most important contextual factors into five domains: (1) the practice, (2) the broader organizational context, (3) the external environment, (4) the implementation pathway, and (5) the motivation for implementation.

Therefore, on one hand, the rationale to conduct this research is based on the scarce and controversial evidence for the independent effect of MTMs on survival in colorectal cancer at the local and international level. On the other hand, little is known about the context-specific factors related to the APNs integration in Spain and

Catalonia. Hence, this project aims to analyze the impact of multidisciplinary clinical practice in cancer care and factors related to professional roles, particularly those of advanced practice nurses in care teams.

II. HYPHOTESIS

2.1 *General hypothesis*

The specific organization of multidisciplinary cancer teams influences the performance of professional roles, particularly those of advanced practice nurses, and affects the outcomes of the decision-making process of treated patients.

2.2 *Specific hypothesis*

1. The coverage of preoperative multidisciplinary team meetings in rectal cancer patients has increased from 2011 to 2020.

2. Audit period and stage are associated with access to preoperative multidisciplinary team meetings.

3. Discussion at the preoperative multidisciplinary team meeting is associated with an increased likelihood of survival.

4. Contextual factors are determinants for the organization, implementation and performance of clinical practice among oncology advanced practice nurses in Catalonia.

5. Healthcare professionals have different perspectives regarding advanced practice nurses in Catalonia.

III. OBJECTIVES

3.1 Main objective

To analyze the impact of multidisciplinary clinical practice in cancer care and factors related to professional roles, particularly those of advanced practice nurses in care teams.

3.2 Specific objectives

1. To evaluate the coverage trends of preoperative multidisciplinary team meetings in in rectal cancer patients undergoing surgery with a curative intent between 2011 to 2020 in Catalonia.

2. To analyze factors associated with access to preoperative multidisciplinary team meetings in rectal cancer patients undergoing surgery with a curative intent between 2011 to 2020 in Catalonia.

3. To assess the impact of preoperative multidisciplinary meetings on survival in rectal cancer patients undergoing surgery with a curative intent between 2011 to 2020 in Catalonia.

4. To explore the contextual factors that influence the organization, implementation, and performance of clinical practice among oncology advanced practice nurses in public hospitals in Catalonia.

5. To explore the professional perspectives of health care professionals regarding advanced practice nurses in public hospitals in Catalonia.

IV. MATERIAL, METHODS, AND RESULTS

4.1 ARTICLE 1

Title	*Multidisciplinary team meetings and their impact on survival in rectal cancer. Population-based analysis in Catalonia (Spain)*
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Multidisciplinary team meetings and their impact on survival in rectal cancer. Population-based analysis in Catalonia (Spain)

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ABSTRACT

Background: Multidisciplinary team meetings (MTMs) are considered a pillar of cancer care; however, evidence of the independent benefit of MTMs on survival in rectal cancer is controversial.
Methods: This population-based cohort analysis included patients undergoing surgery for primary rectal cancer with curative intent. We drew data derived from three clinical audits conducted in Catalonia from 2011 to 2020. The primary outcome was 2-year survival. Multivariable Cox regression analysis was used to assess the hazard ratio for death in patients whose cases were versus were not discussed in a preoperative MTM.
Results: A total of 5249 patients were included (66.1 % male, 58.3 % aged 60–79 years, 63.2 % receiving anterior resection): 4096 cases were discussed in a preoperative MTM, and 1153 were not. Multivariable Cox proportional hazards regression analysis showed that the MTM group had better survival than those with no preoperative MTM (hazard ratio 1.22, 95 % confidence interval 1.02–1.48), after adjusting for potential confounders.
Conclusions: Preoperative MTM may be associated with improved survival in patients with rectal cancer in Catalonia. Efforts to ensure universal access to MTMs for all newly diagnosed patients should be supported.

1. Introduction

Colorectal cancer (CRC) is the third most frequent cancer worldwide [1], and despite improvements in survival, it remains the second leading cause of cancer death in Europe in general and specifically in Spain [2]. Incidence is concentrated in people aged 70 years and older, though in recent years it has been increasing in younger adults as well [3]. Rectal cancer accounts for approximately one third of all CRC.

The past decades have seen substantial progress in rectal cancer treatment and management, partly due to advancing knowledge of the anatomy and pathophysiology of the disease along with new surgical techniques. However, another major development is related to the delivery of cancer care, with a clear shift from a situation in which different specialties work separately within their own silos to a model based on multidisciplinary teams (MDTs) of specialists working together for integrated care [4]. This change is reflected especially in the central role of multidisciplinary team meetings (MTMs) as the main decision-making body [5]. These periodic meetings are held between health care professionals from different medical specialties related to a specific tumor disease, with the aim of reaching consensus on the diagnosis, clinical treatment, and follow-up through personalized, evidence-based clinical decisions [6,7]. This is particularly relevant in rectal cancer, where a combination of multimodal treatments and surgical options are available and are often delivered according to clinical findings and staging based on preoperative magnetic resonance imaging (MRI) [4,8].

Although MTMs have been promoted by accreditation and quality systems in cancer care [6,9], evidence for the independent effect of MTMs on survival in colorectal cancer remains controversial. Specifically in rectal cancer, no impact on survival has been demonstrated [4]. Different studies have failed to find any independent benefit associated with MTMs for colorectal [10] and rectal cancer survival [11,12], whereas others have demonstrated a positive relationship between the MTM discussion and survival outcomes in patients with CRC for survival at three years [13,14] and five years [15,16]. Limitations in study

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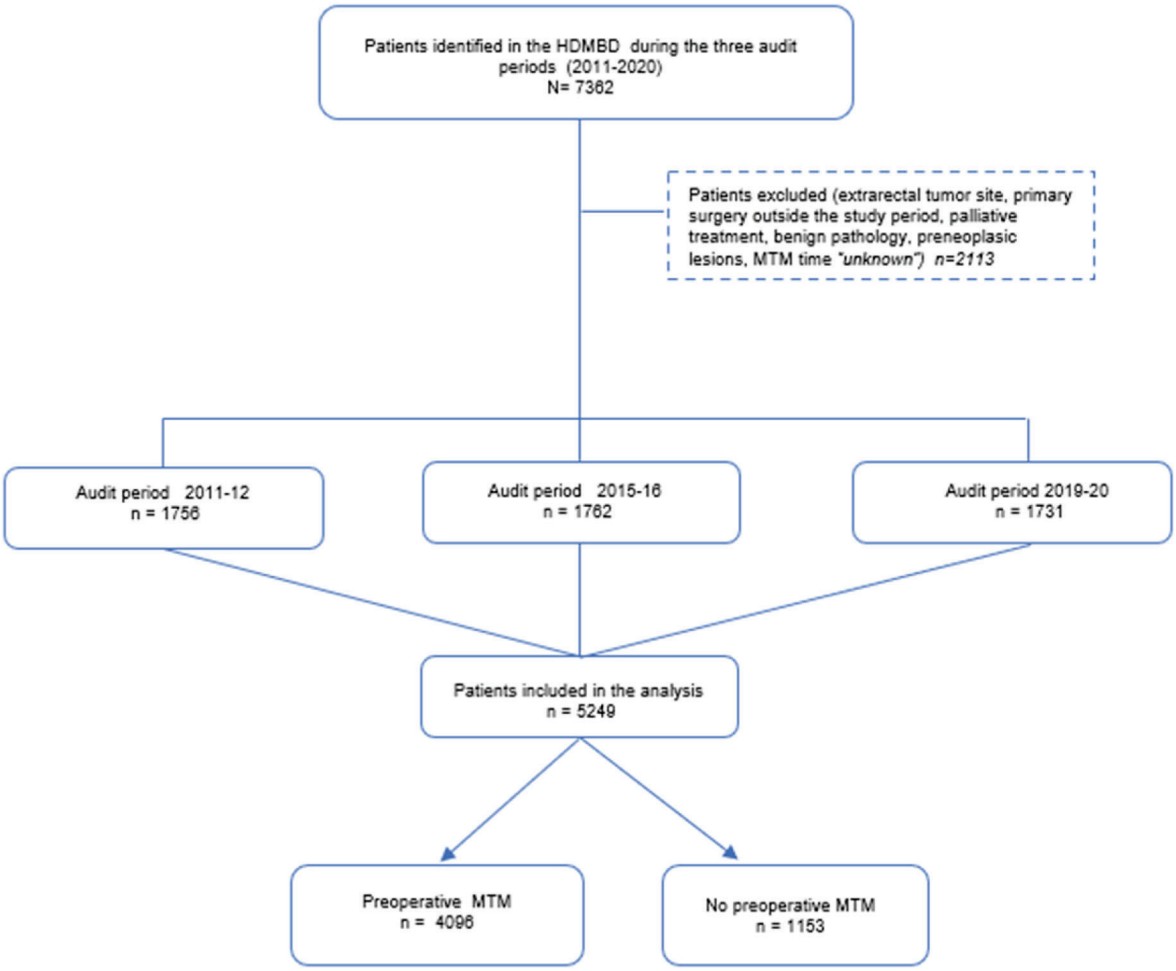

Fig. 1. Patient selection flow chart. The study sample was divided into preoperative MTM and no preoperative MTM. Exclusion criteria are listed. HDMBD Catalonian Hospital Discharge Minimum Basic Data, MTM Multidisciplinary team Meeting.

designs like the use of retrospective comparison groups during different time periods (before and after introduction of MTMs) [11,14], difficulties in adjusting for important potential confounders [17], and relatively small sample sizes [12] may have contributed to the inconsistent findings in the literature. Moreover, research to date has focused primarily on the general colorectal cancer population, with no distinction between those with colon and rectal cancer.

To improve the quality of cancer care, the Catalan cancer plan has systematically promoted MTMs since 2001 in Catalonia (Spain). These meetings include all medical and healthcare professionals related to a specific cancer, such as medical oncologists, surgeons, radiologists, pathologists, and nurses [7,18]. In addition, based on a full cycle of population-based clinical audits, a strategy of centralization of rectal cancer surgery in the public system of Catalonia was implemented in 2011 [19–21]. This strategy reduced the service providers to authorized hospitals that receive a specific reimbursement for performing the complex surgery procedure.

The heterogeneous results of published research and the limited evidence in rectal cancer in particular support the need for further investigation of the impact of preoperative MTMs in patients with rectal cancer. The aim of this study was to assess the role of preoperative MTMs in rectal cancer, including the trends and the factors associated with access to this service modality and the association with survival in patients undergoing surgery with a curative intent.

2. Methods

2.1. Study design

This multicenter retrospective population-based cohort study drew data derived from three mandatory clinical audits conducted between 2011 and 2020 at all public hospitals in Catalonia, under the auspices of the Catalan Cancer Plan. The audits capture the individual-level records of all people covered by the public healthcare system who underwent surgery for primary rectal cancer with curative intent in this region of Spain [20]. The study was performed in accordance with the Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of Bellvitge University Hospital (PR204/23). Reporting followed the STROBE guidelines for Strengthening the Reporting of Observational Studies in Epidemiology [22].

2.2. Study population and data sources

Using the Catalan Hospital Discharge Minimum Basic Data Set (HDMBD) and the International Classification of Diseases, 9th (ICD-9) and 10th revisions (ICD-10) (Supplementary Table 1), we identified all patients aged 18 or older with primary rectal cancer who underwent surgery with a curative intent for the first time during three clinical audits periods: 2011–2012, 2015–2016 and 2019–2020, at any public hospital in Catalonia. Exclusion criteria were: extrarectal tumor site, primary surgery outside the study period, palliative treatment, benign pathology, and precancerous lesions. We also excluded patients in

Table 1
Characteristics of the study sample according to case discussion in preoperative multidisciplinary team meeting.

Variables	Preoperative MTM (N = 4096)	No preoperative MTM (N = 1153)	p	Total (N = 5249)
	n (%)	N (%)		N (%)
Sex				
Male	2746 (67)	723 (62.7)	**0.017**	3469 (66.1)
Female	1350 (33)	430 (37.3)		1780 (33.9)
Age (years)				
< 60	974 (23.8)	275 (23.9)	0.074	1249 (23.8)
60-79	2402 (58.6)	660 (57.2)		3062 (58.3)
≥ 80	720 (17.6)	217 (18.8)		937 (17.9)
ASA				
I	202 (4.9)	57 (4.9)	**<0.001**	259 (66.1)
II	2174 (53.1)	608 (52.7)		2782 (53.0)
III	1507 (36.8)	368 (31.9)		1875 (35.7)
IV	92 (2.2)	40 (3.5)		132 (2.5)
Unknown	121 [3]	80 (6.9)		201 (3.8)
Audit period				
2011-12	1187 (67.6)	569 (32.4)	**<0.001**	1756 (100)
2015-16	1402 (79.6)	360 (20.4)		1762 (100)
2019-20	1507 (87.1)	224 (12.9)		1731 (100)
Stage				
I	560 (13.7)	188 (16.3)	**<0.001**	748 (14.3)
II	672 (16.4)	187 (16.2)		859 (16.4)
III	2133 (52.1)	533 (46.2)		2666 (50.8)
IV	435 (10.6)	77 (6.7)		512 (9.8)
Unknown	296 (7.2)	168 (14.6)		464 (8.8)
T stage				
T0	16 (0.4)	10 (0.9)	**<0.001**	26 (0.5)
T1	135 (3.3)	72 (6.2)		207 (3.9)
T2	613 (15.0)	187 (16.2)		800 (15.2)
T3	2670 (65.2)	690 (59.8)		3360 (64.0)
T4	644 (15.7)	182 (15.8)		826 (15.7)
Tis	10 (0.2)	10 (0.9)		20 (0.4)
Tx	2 (0.0)	0 (0.0)		2 (0.0)
Unknown	6 (0.1)	2 (0.2)		8 (0.2)
Tumor site				
Proximal rectum (12–15 cm)	953 (23.3)	290 (25.2)	**<0.001**	1243 (23.7)
Middle rectum (7–11 cm)	1778 (43.4)	461 (40)		2239 (42.7)
Distal rectum (0–6 cm)	1269 [23]	324 (28.1)		1593 (30.3)
Unknown	96 (2.3)	78 (6.8)		174 (3.3)
Neoadjuvant treatment				
Yes	2607 (63.6)	569 (49.3)	**<0.001**	3176 (60.5)
No	1489 (36.4)	584 (50.7)		2073 (39.5)
Surgical operation				
Local surgery	182 (4.4)	91 (7.9)	**<0.001**	273 (5.2)
Anterior resection	2599 (63.5)	720 (62.4)		3319 (63.2)
Transanal mesorectal excision	285 (7.0)	102 (8.8)		387 (7.4)
Abdominoperineal resection	791 (19.3)	168 (14.6)		959 (18.3)
Hartmann procedure	183 (4.5)	49 (4.2)		232 (4.4)
Others	56 (1.4)	23 (2.0)		79 (1.5)

ASA American Society of Anesthesiologists (ASA) score, MTM multidisciplinary team meeting, *statistical significance, $p < 0.05$.

whom preoperative MTM discussion (yes/no) could not be determined based on clear statements in their medical records, as including these patients may have produced artifactual effects. Furthermore, the roughly 10 % of patients receiving health care from private hospitals were not included.

Data were derived from a comprehensive review of patients' clinical records by trained external auditors, who retrieved the data for the three periods using the same purpose-designed form, with clear instructions and definitions. The instrument was previously validated, and methods are described in detail elsewhere [19].

2.3. Variables

Patient characteristics collected for the present study were: sex, age, American Society of Anesthesiologists (ASA) score; clinical pre-surgical staging based on the *TNM Classification of Malignant Tumors, 7*th *edition,* tumor site, classified according to distance between tumor and anal verge (distal rectum: 0–5 cm, middle rectum: 6–11 cm, and proximal rectum: 12–15 cm); and surgical and neoadjuvant treatment. The main explanatory variable was the performance (yes/no) of a preoperative MTM, and the main outcome of interest was two-year survival. We performed a linkage with the central registry of the insured population of Catalonia in May 2023 in order to update the vital status of all patients at two years from the date of surgery. The coverage rate of preoperative MTM was the secondary outcome.

2.4. Statistical analysis

First, we performed a descriptive analysis of the total study population by group (preoperative MTM and no preoperative MTM) and compared groups using the chi-squared test. Categorical variables, including patient age (<60, 60–79, ≥80 years), were expressed as absolute and relative frequencies. Next, a bivariable analysis was used to assess trends for each categorical variable in the different audit periods using the chi-squared test. Univariable and multivariable logistic regression were then carried out to examine the variables associated with preoperative versus no preoperative MTM, with results expressed as an odds ratio (OR) with 95 % confidence intervals (CIs). For the survival analysis, a multivariable Cox proportional hazards model was used to calculate the hazard ratio (HR) with 95 % CIs for differences in survival between the two groups. The date of surgery was use as the starting point for the survival analysis. We adjusted the model for the following covariates: sex, age group, ASA score, audit period, clinical

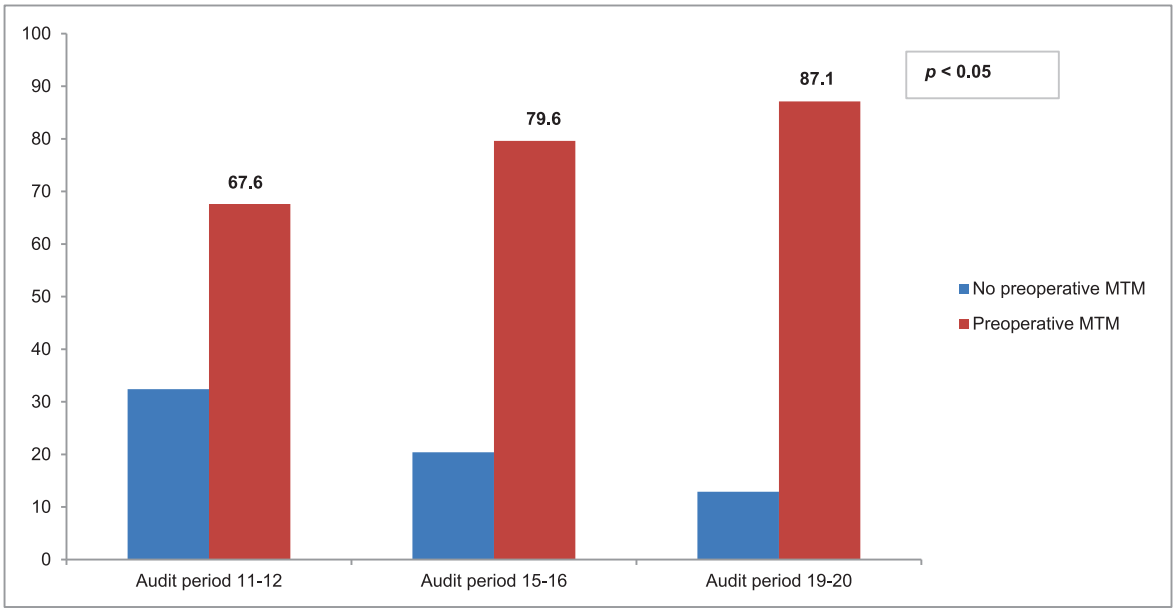

Fig. 2. Coverage of preoperative MTMs over 3 study periods.

pre-surgical staging (TNM), tumor site, and surgical procedure. A conditional overall survival analysis was carried out excluding patients who died within one month of surgery, as this allowed the exclusion of patients with a particularly poor prognosis. For all tests, two-tailed *p* values of less than 0.05 were considered statistically significant. Analyses were conducted using SPSS software, version 21.

3. Results

3.1. Patient characteristics

An initial sample of 7362 patients were identified by the HDMBD between the first audit period (2011-12) and the last audit period (2019–2020). Presentation time in the preoperative MTM was unknown for 153 patients. The patient selection flow chart and reasons for exclusion are presented in Fig. 1. The final sample comprised 5249 patients, whose characteristics are summarized in Table 1. Altogether, 4096 (78 %) patients' cases were discussed at preoperative MTM, while 1153 (22 %) were not. Most patients in both groups were men and aged 60–79 years. The most frequent tumor site was the middle rectum, and most underwent anterior resection.

3.2. Coverage trends for preoperative MTMs

The number of patients who underwent primary rectal cancer surgery in each audit remained steady over time. However, the coverage rate of patients whose case was discussed at preoperative MTM increased significantly over time, from 67.6 % during the first audit period to 87.1 % during the last (chi-squared $p < 0.05$). This trend was independent of stage, tumor site, and neoadjuvant treatment (chi-squared $p < 0.01$) (Supplementary Table 2). Fig. 2 illustrates the coverage trends over time.

3.3. Factors associated with case discussion at preoperative MTM

In the multivariable analysis, patients were significantly more likely to have their case discussed at preoperative MTM in the 2019-20 audit period (adjusted OR [aOR] 3.93, 95 % CI 3.27–4.73; Table 2) and the 2015-16 audit period (aOR 2.01; 95 % CI 1.70–2.36; Table 2) compared with the first audit period. Similarly, the likelihood of preoperative MTM discussion increased with clinical stage (taking stage I as a reference, stage II: aOR 1.35, 95 % CI 1.06–1.72; stage III: aOR 1.40; 95 % CI 1.15–1.71; stage IV: aOR 2.33, 95 % CI 1.72–3.16; Table 2). Age was not associated with discussion at preoperative MTM ($p > 0.05$; Table 2).

3.4. Impact of the preoperative MTM

The multivariable Cox proportional hazards regression analysis showed that preoperative MTM discussion was an independently predictive of two-year survival (adjusted HR [aHR] 1.22, 95 % CI 1.02–1.48; Table 3). Fig. 3 shows the corresponding survival curves for the two groups. Compared with the third audit period, significantly lower survival was observed in 2011-12 (HR 1.29, 95 % CI 1.08–1.55; Table 3); however, the statistical significance did not hold in the adjusted model (aHR, 1.16, 95 % CI 0.95–1.41; Table 3). Higher ASA classification, higher clinical stage, abdominoperineal resection, Hartmann procedure, and other types of surgical procedures were independently associated with lower survival at two years.

Once we excluded the patients who died within a month of surgery (resulting sample n = 5190), preoperative MTM discussion remained an independent protective factor for two-year survival (aHR 1.27, 95 % CI 1.05–1.54). Overall, the multivariable adjustment barely changed the HRs (Supplementary Table 3).

4. Discussion

In this population-based retrospective cohort study, the lack of discussion of the case at a preoperative MTM led to a 22 % higher likelihood of dying to two years, after adjusting for patients' age, sex, ASA scale, audit period, TNM stage, tumor site and type of surgical procedure. The odds of being discussed in the preoperative MTM were higher in patients with more advanced tumor stage and in the most recent audit periods. These outcomes were observed in a population setting in which surgery for rectal cancer has been centralized from the first audit period of the study [20].

The results of our study are concordant with previous population-based studies that have demonstrated a positive independent relationship between MTM discussion and survival outcomes in patients with CRC [13,15–17]. For instance, in France, Rollet et al.'s [16] study in 3999 CRC patients found that those who were not discussed at the MTM had 2.8 times lower overall survival (OS) compared with those who

Table 2
Factors associated with case discussion in preoperative multidisciplinary team meeting.

Variable	N	Univariable analysis		Multivariable analysis	
		OR (95 % CI)	*p*	OR (95 % CI)	*p*
Sex					
Female	1780	1		1	
Male	3469	1.21 (1.06–1.37)	<0.001*	1.15 (0.99–1.33)	0.054
Age (years)					
< 60	1249	1		1	
60 - 79	3062	1.03 (0.88–1.21)	0.74	1.10 (0.93–1.31)	0.26
≥ 80	937	0.94 (0.77–1.18)	0.53	1.02 (0.82–1.28)	0.84
ASA					
I	259	1		1	
II	2782	1.01 (0.74–1.37)	0.96	0.98 (0.71–1.36)	0.92
III	1875	1.16 (0.84–1.58)	0.37	1.09 (0.78–1.54)	0.61
IV	132	0.65 (0.40–1.04)	0.074	0.72 (0.43–1.19)	0.2
Unknown	201	0.43 (0.28–0.64)	<0.001*	0.64 (0.42–0.99)	**0.046***
Audit period					
2011-12	1756	1		1	
2015-16	1762	1.87 (1.60–2.18)	<0.001*	2.01 (1.70–2.36)	**<0.001***
2019-20	1731	3.22 (2.72–3.83)	<0.001*	3.93 (3.27–4.73)	**<0.001***
Stage					
I	748	1		1	
II	859	1.21 (0.96–1.52)	0.11	1.35 (1.06–1.72)	**0.015***
III	2666	1.34 (1.11–1.63)	0.002*	1.40 (1.15–1.71)	**0.001***
IV	512	1.90 (1.41–2.54)	<0.001*	2.33 (1.72–3.16)	**<0.001***
Unknown	464	0.59 (0.46–0.76)	<0.001*	0.47 (0.36–0.61)	**<0.001***
Tumor site					
Proximal rectum (12–15 cm)	1243	1		1	
Middle rectum (7–11 cm)	2239	1.17 (0.99–1.39)	0.06	1.08 (0.91–1.29)	0.36
Distal rectum (0–6 cm)	1593	1.19 (1–1.43)	0.06	1.16 (0.96–1.4)	0.12
Unknown	174	0.38 (0.27–0.52)	<0.001*	0.38 (0.26–0.54)	**<0.001***

SA American Society of Anesthesiologists (ASA) score, MTM multidisciplinary team meeting, OR odds ratio, CI confidence Interval, 95 %. *statistical significance, $p < 0.05$.

were; this association became markedly weaker (but still significant) after excluding patients who died within three months of the diagnosis. In Taiwan, a nationwide cohort study in 25,766 patients reported that MTM discussion improved patient survival by 10 % in the CRC population [17]. In Scotland, a population-based study including 586 patients also showed an association between MTM and improved survival, but only in patients with advanced CRC [15]. In China, Li et al.'s population-based study showed that having an MTM was an independent predictor of better OS [24], and a recently published meta-analysis showed the protective effect of MTM discussions in CRC patients, although 8 of the 15 included studies showed no significant effect [25]. The different probabilities of survival may be explained, in part, by the characteristics of the population, as most previous studies have focused on the general CRC population or have been restricted to patients with advanced or metastatic disease. Moreover, there are inherent healthcare system differences between settings, which limit a generalized comparison. To the best of our knowledge, ours in one of the largest studies on this topic to date, adding to the existing literature that addresses the benefit of preoperative MTM on survival in a surgically treated rectal cancer population.

Other studies have failed to demonstrate an independent benefit for MTMs on survival in patients with CRC [10–12]. However, the comparison of groups in different time periods (before and after introduction of MTMs) may have confounded the findings due to changes over time in treatment protocols and surgical procedures, among others [11]. In addition, these studies were relatively small and not population-based [10–12]. Nevertheless, even faced with non-significant findings, the authors of these studies maintain a positive stance toward the practice/integration of MTMs in cancer care. For example, Basso and colleagues [10] indicated that it would be simplistic to conclude that MTMs do not have an impact on survival, because their analysis showed that MTM discussion in patients who underwent liver resection for colorectal liver metastases led to higher surgical rates in patients with more advanced diseases and reduced the median duration of chemotherapy and post-operative morbidities. Thus, the benefits of MTM discussions go beyond the survival outcome and encompass better coordination among the health professionals involved in care. In addition, they highlighted the fact that patients whose case was not discussed at an MTM underwent more surgery despite evidence of disease progression—a well-known predictor of a negative prognosis—compared to patients with MTM discussion, suggesting a less organized clinical pathway. Likewise, Palmer et al. [12] concluded that MTMs increased the proportion of patients receiving neoadjuvant treatment and improved cancer-specific endpoints, thus improving local control and survival in rectal cancer patients.

Our results show a significant, positive association between MTMs and survival. However, this is probably not a direct causal effect, but rather the result of a set of factors implicit in MTMs, such as improved coordination and organization of a specialized team and interdisciplinary work [26], greater adherence to multidisciplinary clinical guidelines [5,27], and greater concentration of cases derived from the centralization policy in Catalonia [20]. These factors work together in improving outcomes [28].

The results show a clear and significantly increasing trend in coverage rates between the first and last audit period (67.6 %–87.1 %); however, these rates are somewhat lower than those reported elsewhere. For example, in Belgium reported a 91 % coverage rate of MTM discussion in rectal cancer patients in 2011 [29], the same rate reported in the Netherlands for CRC patients in 2015–2016 [30]. These figures contrast with the 67.6 % and 79.6 % coverage observed in our study, respectively, for the same years. Our results are more consistent with the increased coverage reported in France, where the proportion of cases discussed in MTMs rose from 66 % in 2005–2006 to 88 % in 2010–2014 [16]. In Belgium, the high coverage rates may be a result of the specific inclusion of these meetings in the reimbursement system since 2003 [29]. In the same line, in France the law now stipulates that the MTM is a mandatory condition in patients receiving chemotherapy, radiotherapy, and cancer surgery [16]. On the other hand, in Catalonia MTMs are neither regulated by law nor financially supported. The remarkable increase in the coverage rate, then, is more likely due to the progressive implementation of multidisciplinary care, which has been promoted by the national cancer plan since 2005 and by the Catalan cancer plan since 2001, in alignment with the policy statement on multidisciplinary cancer care in Europe, which defines MTMs as the core component in cancer care organization [7]. Furthermore, the improved coverage could be partly driven by the contribution that clinical audits have had on the quality of care in rectal cancer [19,20]; these audits since 2011 may help explain the increasing coverage of MTM in our region and its better registration in patients' health records, the source of our data in this study.

Unlike the three population-based studies previously mentioned [16,27,28] in our cohort, more advanced disease increased the probability preoperative MTM, and very advanced age (≥80 years) was not a risk

Table 3
Impact of the preoperative multidisciplinary team meeting on two-year mortality.

Variable	N	Univariable analysis		Multivariable analysis	
		HR (95 % CI)	*p*	HR (95 % CI)	*p*
Preoperative MTM					
Yes	4096	1		1	
No	1153	1.17 (0.98–1.39)	0.08	1.22 (1.02–1.48)	**0.029***
Sex					
Female	1780	1		1	
Male	3469	1.02 (0.87–1.20)	0.78	0.96 (0.81–1.12)	0.58
Age (years)					
< 60	1249	1		1	
60-79	3062	1.76 (1.39–2.22)	<0.001*	1.58 (1.24–2.00)	**<0.001***
≥ 80	937	3.92 (3.07–5.01)	<0.001*	3.08 (2.37–3.99)	**<0.001***
ASA					
I	259	1		1	
II	2782	1.80 (1.03–3.14)	0.039*	1.39 (0.79–2.45)	0.25
III	1875	3.88 (2.23–6.76)	<0.001*	2.40 (1.36–4.23)	**0.002***
IV	132	7.46 (3.99–13.92)	<0.001*	4.22 (2.27–7.99)	**<0.001***
Unknown	201	4.18 (2.23–7.81)	<0.001*	2.67 (1.41–5.03)	**0.002***
Audit period					
2019-20	1731	1		1	
2011-12	1756	1.29 (1.08–1.55)	0.006*	1.16 (0.95–1.41)	0.147
2015-16	1762	1.01 (0.83–1.22)	0.948	0.95 (0.78–1.15)	0.571
Stage					
I	748	1		1	
II	859	1.48 (1.07–2.05)	0.018*	1.25 (0.90–1.75)	0.19
III	2666	1.52 (1.15–2.01)	0.003*	1.54 (1.15–2.07)	**0.004***
IV	512	4.27 (3.15–5.78)	<0.001*	4.06 (2.96–5.58)	**<0.001***
Unknown	464	1.95 (1.38–2.77)	<0.001*	1.94 (1.35–2.79)	**<0.001***
Tumor site					
Proximal rectum (12–15 cm)	1243	1		1	
Middle rectum (7–11 cm)	2239	1.10 (0.90–1.34)	0.34	1.12 (0.91–1.38)	0.28
Distal rectum (0–6 cm)	1593	1.21 (0.98–1.49)	0.078	1.04 (0.82–1.32)	0.75
Unknown	174	1.31 (0.87–1.98)	0.21	0.79 (0.51–1.22)	0.28
Surgical operation					
Anterior resection	3319	1		1	
Local surgery	273	0.83 (0.55–1.25)	0.38	0.94 (0.60–1.46)	0.77
Transanal mesorectal excision	387	0.98 (0.71–1.36)	0.91	1.16 (0.83–1.63)	0.39
Abdominoperineal resection	959	1.79 (1.50–2.15)	<0.001*	1.64 (1.32–2.02)	**<0.001***
Hartmann procedure	232	3.13 (2.41–4.05)	<0.001*	2.12 (1.62–2.77)	**<0.001***
Others	79	3.37 (2.25–5.05)	<0.001*	3.42 (2.27–5.18)	**<0.001***

ASA American Society of Anesthesiologists (ASA) score, MTM multidisciplinary team meeting, HR hazard ratio, CI confidence Interval, 95 %. *statistical significance, $p < 0.05$.

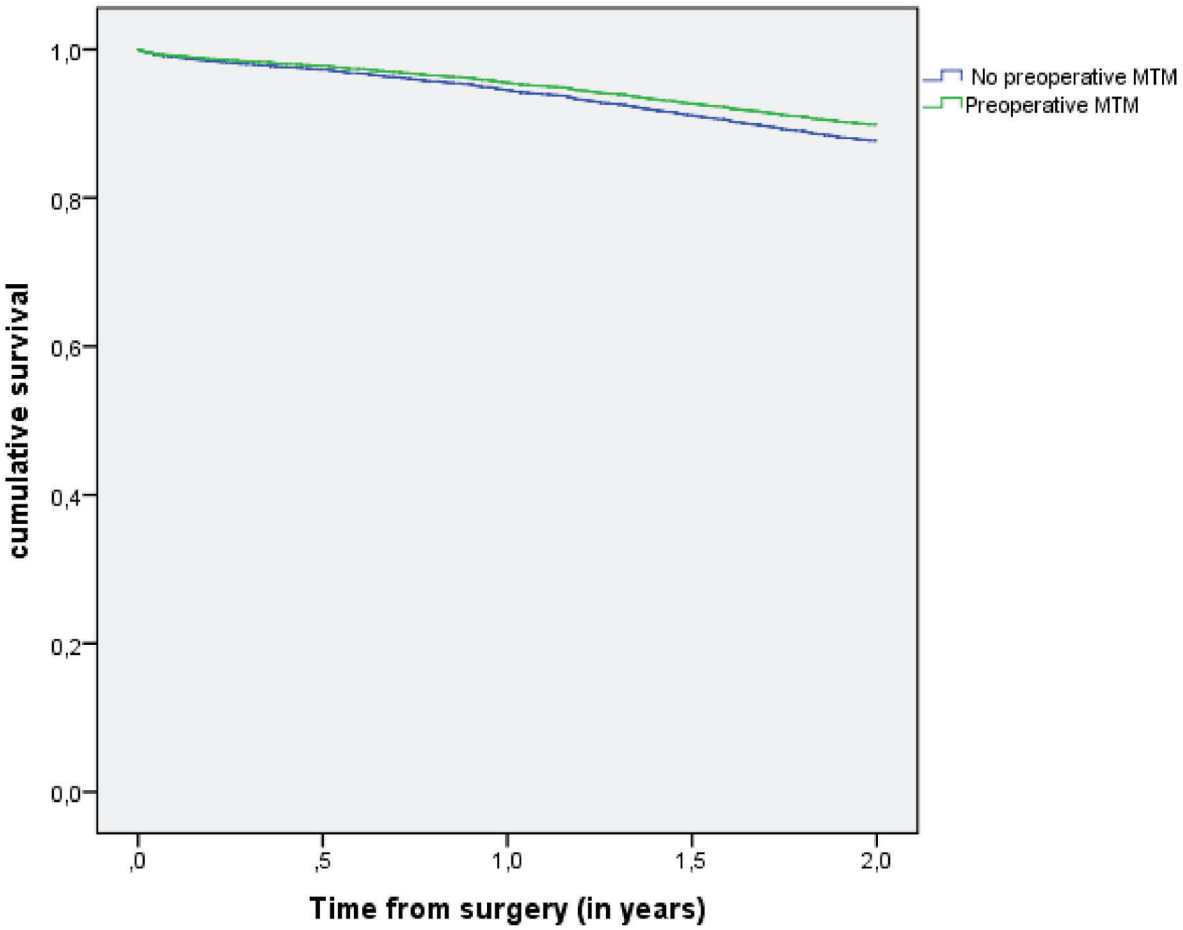

Fig. 3. Overall survival according to performance of preoperative multidisciplinary team meeting (MTM).

factor for no preoperative MTM. However, these differences could be related to the fact that our study did not include patients under palliative treatment, which probably limited the inclusion of very old patients in addition to those with a terminal prognosis, inflating the prevalence of patients with stage I, II and III disease. Despite this, the lack of association with age and stage in our analysis is a positive outcome, in accordance with the Catalan guidelines for cancer care [18] and several other national guidelines from countries like Australia [23] and the USA [31], which call for discussion of all newly diagnosed patients with CRC in an MTM, independently of age or stage.

The results of our study should be interpreted in light of its potential limitations, beginning with its retrospective nature. To minimize possible inaccuracies in data collection, a team of trained professionals used purpose-designed instruments designed to improve the quality and standardization of the data collected. Secondly, around 10 % of patients with rectal cancer in Catalonia undergo surgery in private centers, which were not included in the study. However, our study did include the nearly 90 % of the population from the public health care system and was representative of the population. Third, no data were collected systematically about the characteristics of the health professionals attending the meetings or on the decisions made. Despite these limitations, this study represents one of the largest population-based cohort studies investigating the impact of MTMs in rectal cancer patients. Moreover, unlike other studies, we adjusted for important potential confounders such as the surgical technique, which is one of the most important factors related to survival in rectal cancer patients.

5. Conclusions

Our results suggest that preoperative MTMs may be associated with improved survival in patients with rectal cancer in Catalonia. This probably is not a direct causal effect, but rather the result of a set of factors implicit in MTMs. However, our results support the importance of universal access to mandatory MTMs in all newly diagnosed patients.

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CRediT authorship contribution statement

Darinka Rivera: Conceptualization, Data curation, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Joan Prades:** Conceptualization, Methodology, Writing – review & editing. **Josep M. Borràs:** Conceptualization, Methodology, Supervision, Writing – review & editing. **Luisa Aliste:** Conceptualization, Data curation, Methodology, Formal analysis, Writing – review & editing. **Paula Manchon-Walsh:** Conceptualization, Data curation, Methodology, Formal analysis, Supervision, Writing – review & editing, All authors: Final revision of the manuscript.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejso.2024.108675.

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Supplementary material

Supplementary Table 1. Codes used to identify study population

Audit period 2011-12	Audit period 2015-16	Audit period 2019-20
International Classification of Disease (ICD) codes		
ICD-9 diagnostic code 154 (all positions) ICD-9 procedure codes 45.76, 46.1 and 48.6 (all positions)	ICD-9 diagnostic code 154 (all positions), ICD-9 procedure codes 45.76, 46.1 and 48.6 (all positions).	ICD-10 diagnostic codes C19, C20, C218 or main diagnosis combination C180, C181, C182, C183, C184, C185, C186, C187, C188 and/or C189 and secondary diagnosis C19, C20, C218 ICD-10 procedure codes 0DBP0ZZ, 0DBP3ZZ,0DBP4ZZ, 0DBP7ZZ, 0DBP8ZZ, 0DTP0ZZ, 0DTP4ZZ, 0DTP7ZZ i/o 0DTP8ZZ
TNM Classification of Malignant Tumors		
7th edition	7th edition	8th edition

Supplementary Table 2. Characteristics of the population by audit period and group

	2011-12 (n=1756)			2015-16 (n= 1762)			2019-20 (n=1731)		
	MTM +	**MTM -**	**p**	**MTM +**	**MTM -**	**p**	**MTM +**	**MTM -**	**p**
N (%)	1187 (67.6)	569 (32.4)		1402 (79.6)	360 (20.4)		1507 (87.1)	224 (12.9)	
Sex									
Male	773 (69.2)	344 (30.8)	0.057	965 (80.4)	235 (19.6)	0.20	1008 (87.5)	144 (12.5)	0.44
Female	414 (64.8)	225 (35.2)		437 (77.8)	125 (22.2)		499 (86.2)	80 (13.8)	
Age (years)									
< 60	259 (68)	122 (32)	0.54	347 (78.7)	94 (21.3)	0.53	368 (86.2)	59 (13.8)	0.58
60-79	708 (67.7)	338 (32.3)		831 (80.4)	202 (19.6)		863 (87.8)	120 (12.2)	
≥ 80	220 (67.1)	108 (32.9)		224 (77.8)	64 (22.2)		276 (86)	45 (14)	
ASA									
I	65 (72.2)	25 (27.8)	0.35	63 (78.8)	17 (21.3)	**0.034**	74 (83.1)	15 (16.9)	**<0.001**
II	599 (67.7)	286 (32.3)		770 (79.8)	195 (20.2)		805 (86.4)	127 (13.6)	
III	392 (67.9)	185 (32.1)		525 (80.9)	124 (19.1)		590 (90.9)	59 (9.1)	
IV	40 (72.7)	15 (27.3)		32 (66.7)	16 (33.3)		20 (69)	9 (31)	
Unknown	91 (61.1)	58 (38.9)		12 (60)	8 (40)		18 (56.3)	14 (43.8)	
Stage									
I	168 (62.5)	101 (37.5)	**<0.001**	137 (71)	56 (29)	**<0.001**	255 (89.2)	31 (10.8)	**<0.001**
II	225 (66.2)	115 (33.8)		216 (85.7)	36 (14.3)		231 (86.5)	36 (13.5)	
III	602 (67.9)	284 (32.1)		774 (81.8)	172 (18.2)		757 (90.8)	77 (9.2)	
IV	178 (78.4)	49 (21.6)		139 (89.1)	17 (10.9)		118 (91.5)	11 (8.5)	
Unknown	14 (41.2)	20 (58.8)		136 (63.3)	79 (36.7)		146 (67.9)	69 (32.1)	
T stage									
T0	2 (40.0)	3 (60.0)	**<0.001**	4 (40.0)	6 (60.0)	**<0.001**	10 (90.9)	1 (9.1)	**<0.001**
T1	29 (48.3)	31 (51.7)		27 (56.3)	21 (43.8)		79 (79.8)	20 (20.2)	
T2	144 (65.2)	77 (34.8)		197 (73.5)	71 (26.5)		272 (87.5)	39 (12.5)	
T3	775 (68.6)	354 (31.4)		965 (81.8)	214 (18.2)		930 (88.4)	122 (11.6)	
T4	232 (70.1)	99 (29.9)		206 (82.7)	43 (17.3)		206 (83.7)	40 (16.3)	
Tis	3 (50.0)	3 (50.0)		2 (33.3)	4 (66.7)		5 (71.4)	2 (28.6)	
Tx	1 (50.0)	1 (50.0)		0 (0.0)	0 (0.0)		1 (100.0)	0 (0.0)	
Unknown	1 (50.0)	1 (50.0)		1 (50.0)	1 (50.0)		4 (100.0)	0 (0.0)	
Tumor site									
Proximal rectum (12-15 cm)	254 (65.3)	135 (34.7)	**0.008**	337 (77.3)	99 (22.7)	**<0.001**	362 (86.6)	56 (13.4)	**<0.001**
Middle rectum (7-11 cm)	496 (67.3)	241 (32.7)		627 (81.9)	139 (18.1)		655 (89)	81 (11)	
Distal rectum (0-6 cm)	397 (71.5)	158 (28.5)		437 (79.5)	113 (20.5)		435 (89.1)	53 (10.9)	
Unknown	40 (53.3)	35 (46.7)		1 (10)	9 (90)		55 (61.8)	34 (38.2)	
Neoadjuvant treatment									
Yes	730 (71.2)	295 (28.8)	**<0.001**	944 (83.5)	186 (16.5)	**<0.001**	933 (91.4)	88 (8.6)	**<0.001**
No	457 (62.5)	274 (37.5)		458 (72.5)	174 (27.5)		574 (80.8)	136 (19.2)	
Surgical operation									
Local surgery	34 (48.6)	36 (51.4)	**<0.001**	33 (53.2)	29 (46.8)	**<0.001**	115 (81.6)	26 (18.4)	**<0.001**
Anterior resection	804 (66.3)	409 (33.7)		895 (81.3)	206 (18.7)		900 (89.6)	105 (10.4)	
Transanal mesorectal excision	-	-		121 (72.5)	46 (27.5)		164 (74.5)	56 (25.5)	
Abdominoperineal resection	284 (74.9)	95 (25.1)		264 (81.7)	59 (18.3)		243 (94.6)	14 (5.4)	
Hartmann procedure	53 (71.6)	21 (28.4)		66 (83.5)	13 (16.5)		64 (81)	15 (19)	
Others	12 (60)	8 (40)		23 (76.7)	7 (23.3)		21 (72.4)	8 (27.6)	

ASA American Society of Anesthesiologists (ASA) score, MTM multidisciplinary team meeting, *statistical significance, p <0.05

Supplementary Table 3. Impact of preoperative multidisciplinary team meeting (MTM) on 2-year mortality (excluding patients who died within 1 month after the surgery), N = 5190

		Univariable analysis		Multivariable analysis	
	N	**HR (95% CI)**	***p***	**HR (95% CI)**	***p***
Preoperative MTM					
Yes	4052	1		1	
No	1138	1.16 (0.97-1.40)	0.10	1.27 (1.05-1.54)	**0.016***
Sex					
Female	1762	1		1	
Male	3428	1.01 (0.86-1.19)	0.90	0.94 (0.79-1.11)	0.47
Age (years)					
< 60	1246	1		1	
60 - 79	3038	1.71 (1.35-2.16)	**<0.001***	1.57 (1.23-1.99)	**<0.001***
≥ 80	905	3.53 (2.74-4.55)	**<0.001***	2.88 (2.20-3.76)	**<0.001***
ASA					
I	259	1		1	
II	2771	1.72 (0.98-3.01)	0.057	1.35 (0.77-2.38)	0.30
III	1840	3.50 (2.01-6.10)	**<0.001***	2.19 (1.25-3.89)	**0.007**
IV	123	5.91 (3.10-11.25)	**<0.001***	3.48 (1.80-6.75)	**<0.001***
Unknown	197	3.78 (2.00-7.19)	**<0.001***	2.54 (1.33-4.84)	**0.005**
Audit period					
2019-20	1714	1		1	
2011-12	1722	1.23 (1.02-1.50)	**0.034***	1.07 (0.87-1.32)	0.53
2015-16	1754	1.05 (0.86-1.29)	0.604	0.98 (0.79-1.19)	0.83
Stage					
I	741	1		1	
II	849	1.51 (1.07-2.14)	**0.019**	1.32 (0.92-1.89)	0.13
III	2640	1.59 (1.18-2.14)	**0.002**	1.61 (1.18-2.20)	**0.003**
IV	505	4.68 (3.40-6.44)	**<0.001***	4.56 (3.26-6.37)	**<0.001***
Unknown	455	1.93 (1.33-2.81)	**<0.001***	1.89 (1.29-2.79)	**0.001**
Tumor site					
Proximal rectum (12-15 cm)	1229	1		1	
Middle rectum (7-11 cm)	2219	1.13 (0.92-1.40)	0.24	1.15 (0.93-1.42)	0.21
Distal rectum (0-6 cm)	1573	1.22 (0.98-1.52)	0.080	1.05 (0.81-1.34)	0.73
Unknown	169	1.17 (0.74-1.85)	0.51	0.71 (0.44-1.15)	0.16
Surgical operation					
Anterior resection	1101	1		1	
Local surgery	62	0.9 (0.43-2.20)	0.97	0.98 (0.61-1.56)	0.93
Transanal mesorectal excision	167	0.92 (0.54-1.58)	0.92	1.06 (0.74-1.52)	0.77
Abdominoperineal resection	323	1.92 (1.39-2.65)	**<0.001***	1.65 (1.32-2.06)	**<0.001***
Hartmann procedure	79	2.33 (1.38-3.94)	**0.002**	2.12 (1.59-2.81)	**<0.001***
Others	30	5.59 (3.14-9.94)	**<0.001***	3.55 (2.31-5.46)	**<0.001***

ASA American Society of Anesthesiologists (ASA) score, HR hazard ratio, CI confidence Interval, 95%. *statistical significance, p <0.05

4.2 Article 2

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ORIGINAL ARTICLE

Contextual factors influencing the implementation of advanced practice nursing in Catalonia, Spain

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Abstract

Background: Advanced practice nurse (APN) roles bring great added value to health systems. However, their integration into the health workforce and the sustainability of the role depend on contextual factors surrounding their implementation.

Aim: To explore the contextual factors that influence the organization, implementation, and performance of clinical practice among oncology APNs in Catalonia (Spain).

Methods: This is a descriptive qualitative study. A framework of contextual factors was applied to explore the perspectives of 14 oncology APNs in public hospitals in Catalonia by means of semistructured interviews. Data were analyzed according to the thematic analysis approach. The COREQ checklist was used to report the study.

Results: APNs in cancer care strongly depend on the hospital environment where they are introduced. Recognition by the multidisciplinary team, the existence of mentoring experiences, and networking between APNs are critical factors that can help or hinder the development and autonomy of the APNs. Likewise, support from nursing managers and directors is decisive in defining the professional profile, establishing accountability mechanisms, and securing financial resources, including economic recognition. Factors related to the external environment can also contribute, including a standardized national APN model and scientific societies.

Conclusions: Contextual factors around clinical practice, institutional structures, and professional networks are crucial determinants for adequately integrating APNs at the health system level.

Implications for nursing policy: Professional bodies and national nursing organizations should lay the groundwork for defining standards of practice and advocate for specific regulations. In addition, financial recognition and accountability mechanisms to assess the impact of their contribution should be a priority to ensure sustainability and APN satisfaction.

KEYWORDS

Advanced practice nursing, barriers, cancer, context, contextual factors, implementation, nursing, qualitative research, Spain

INTRODUCTION

As nurses represent the largest cadre of healthcare workers, the World Health Organization (WHO) advocates for actions to recognize and maximize their contributions, honing their scope of practice and functions to provide services within interdisciplinary teams. Indeed, strengthening the nursing workforce is considered crucial for achieving the Sustainable Development Goals, universal health coverage and meeting the current and future health needs of the population (World Health Organization, 2021). International nursing and health organizations support the development of APNs to improve healthcare access, quality, and health outcomes (ICN, 2020; WHO, 2020). There is a mounting body of evidence that

demonstrates their impact and unique value for the health system in general and in cancer care in particular (Molassiotis et al., 2021). However, the adoption of this role presents different stages and speeds of development even within the same country (Unsworth et al., 2022).

The integration of APNs into the healthcare system is a complex and context-dependent process (Schober, 2017). The International Council of Nursing (ICN) defines an APN as "a generalist or specialized nurse who has acquired, through additional graduate education (minimum of a master's degree), [an] expert knowledge base, complex decision-making skills and clinical competencies," signaling that the specific characteristics are shaped by the context in which they are credentialed to practice (ICN, 2020).

Studies have highlighted contextual factors as key determinants for proper implementation, such as role clarity, organizational support, and educational requirements (Casey et al., 2019). Context can be defined as "the set of circumstances or unique factors that surround a particular implementation" (Damschroder et al., 2009), which may include professional training, resources, the healthcare provider/team, ownership of the practice, community involvement, and the healthcare model, among others (Tomoaia-Cotisel *et al.*, 2013). The interplay of these contextual factors can explain variations in clinical practice, the implementation process, and APN outcomes (Nilsen & Bernhardsson, 2019), acting as barriers in one setting and facilitators in others (Pfadenhauer et al., 2017). However, knowledge of the deployment of APNs is mainly limited to a small number of countries such as the United States, Canada, and Australia (Maier et al., 2017).

Spain is one country where the APN role has emerged with great force over the last decade to address unmet needs requiring enhanced nursing care; however, no specific regulatory framework or national implementation plan has been developed. As a result, the roles and responsibilities of APNs remain unclear in practice and may vary within organizations (Sevilla Guerra et al., 2021). The inability of health systems to capitalize on APNs' clinical competencies and skills and the lack of recognition afforded to them are related to the lack of specific legislation (Sevilla Guerra et al., 2018). Nevertheless, little attention has been paid to gaining an in-depth understanding of the characteristics of the specific environments in which their integration and development take place. The literature on the developmental context of APNs in Spain is sparse and limited to Catalonia, where a comparative study was carried out in the Canadian region of Quebec (Jean et al., 2019). The findings suggest that the APN development process in Catalonia was marked by inertia, and they recognized that further reporting of the specific contextual factors that influence their development and implementation is needed. In fact, a recent health plan for this region included strategic actions to better define new health professional profiles, including APNs, in parallel with the establishment of a network of reference centers for oncology (Department of Health of Catalonia, 2021). Other authors have also argued that the adequate integration and recognition of APNs should be a priority for nursing workforce planning in Spain (Sevilla Guerra et al., 2021).

As the implementation of APNs is a process influenced by cultural drivers and requires changes at numerous levels, understanding it requires fully grasping contextual elements and their dynamics. In this study, we used Tomoaia-Cotisel et al.'s (2013) framework for contextual factors, developed to support the reporting of key contextual factors for complex phenomena in health care and to improve the internal and external validity of research (Table 1). It classifies the most important contextual factors into five domains: (1) practice, (2) the broader organizational context, (3) the external environment, (4) the implementation pathway, and (5) the motivation for implementation.

The present study was conceived to contribute to the optimal implementation and knowledge about deployment of the APNs in Spain. Specifically, we aimed to explore professional perspectives about the contextual factors that influence the organization, implementation, and performance of clinical practice among APNs working in cancer care in Catalonia (Spain).

METHODS

Study design

This study used a qualitative, descriptive design and semistructured interviews, in order to explore the contextual factors influencing the organization, implementation, and performance of clinical practice in oncology APNs in public hospitals in Catalonia. This approach allows discovering and understanding a phenomenon, a process, or the perspectives and worldviews of the people involved (Bradshaw et al., 2017). The study is reported using Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Tong et al., 2007).

Sample and setting

This study took place from February 2020 to January 2021 in Catalonia (population 7.7 million), a region of north-eastern Spain, where the Catalan Health System provides universal health care. A purposive sample was used to recruit 14 oncology APNs. The sample was drawn from two types of settings where oncology APNs work in Catalonia: (i) general hospitals, where cancer care includes disease-based tumor boards, varying degrees of professional specialization, and resources such as intensive care units and radiation oncology machines; and (ii) university teaching hospitals, which have disease-based tumor boards made up of highly specialized professionals and resources such as high-scale radiation oncology, molecular diagnosis, and hemato-oncology services. In order to achieve the maximum representativeness of the phenomenon under study, based on the two settings described above we used three eligibility criteria (Berenguera Ossó *et al.*, 2014):

TABLE 1 Themes and examples of contextual factors.

Domains Level specific	Description
1. Practice	Characteristics that describe the clinical or practice setting related to experiences of the staff and patients (e.g., clinician demographics, attitude, training, and recognition type)
2. Larger organization context	Factors related to the larger organization with which an individual's practice is associated (e.g., structural capabilities, leadership style, degree of integration, and contractual arrangements)
3. External environment	The health care system, policy, and community milieu relevant to the project (e.g., community characteristics, political authority, level of coordination/involvement with community, payment model(s), grant, or external financial support)
Cross-cutting themes	
4. Implementation pathway	The specific elements and processes of an intervention, including operational changes and feedback loops (e.g., experience with transformation, burnout, adaptive reserve, provision of a safe place to experiment and even fail, assistance received, and main intervention objectives and outcomes)
5. Motivation for implementation	Key personal, organizational, and cultural drivers of change at multiple levels (e.g., patient experience, quality, cost of care, and incentives)

Source: Modified from Tomoaia-Cotisel et al. (2013).

- Oncology APNs working in specific cancer services: (i) area for frequent tumors (e.g., breast, lung, and colorectal) in general hospitals (n = 4); (ii) area for frequent tumors in teaching hospitals (n = 6); and (iii) area for infrequent tumors (e.g., neuroendocrine) or for specific cancer treatment processes (e.g., immunotherapy) in teaching hospitals (n = 4).
- At least three years' experience as APNs, in order to compare mature experiences.
- A maximum of two participants per hospital in order to avoid over-representation of some discourses (Cypress, 2017).

The sample selection and composition were enabled by the provision of a database from a multicenter cross-sectional study carried out in Catalonia by Sevilla et al. (2021), which helped identify 269 APNs in the Catalan Health System, 19 of whom worked in the oncology field. Based on this database, 14 APNs from eight different general (n = 4) and teaching hospitals (n = 10) in cancer care were contacted. We used this database because it is the first and the only study that exists in Catalonia that has made it possible to identify, in a measurable and evidence-based manner, nurses who align with the international requirements to be considered APNs in the context of the study.

Data collection

Before initiating the interviews, the principal investigator (DR) contacted 14 APNs by telephone or email to briefly introduce himself as a nurse and researcher, explain the aims of the study, and invited them to participate. After accepting the invitation, the date and time for the interview were set. The semistrictred individual and lasted for 50 min (on average). DR conducted the 14 interviews; 11 took place in person in a quiet room in the hospitals where the APNs worked, and three were via videoconference (Zoom) due to the circumstances of the pandemic. The encounters followed an interview guide (Supplementary Material), were endorsed by all researchers, and reflected the framework for contextual factors proposed by Tomoaia-Cotisel et al. (2013), as mentioned above.

Ethical considerations

The study was approved by the research ethics committee of the Bellvitge University Hospital (PR241/22). Prior to each interview, participants were informed that it would be recorded; that all personal data and information provided would be confidential and used exclusively for this study; and that only the research team would have access to the data. The consent form was formally handed out and signed before starting the interview.

Data analysis

All interviews were audio-recorded and transcribed verbatim by the DR following the criteria of data confidentiality; the recording and transcript were compared to check veracity repeatedly. The first and second authors (DR and JP) conducted the analysis. Two researchers (DR and JP) independently coded and categorized all data by means of thematic analysis (Berenguera Ossó et al., 2014), using ATLAS.ti 9 software. They verified the congruence of the coding and the interpretation by reviewing the transcripts in both the preanalytical and analytical phases. Categorization was based on the five domains of the framework for contextual factors proposed by Tomoaia-Cotisel et al. (2013) (Table 1). All researchers discussed the preliminary results. Data collected during the interviews appeared to have reached saturation as no new themes emerged.

Rigor and trustworthiness

We followed the four principles identified by Lincoln and Guba (1985) and highlighted by Bradshaw et al. (2017) for qualitative description research. To address transferability and confirmability, we provide a rich description of the sample and study setting. The characteristics of the participants are included. Likewise, to reinforce confirmability and credibility, a thick representation of quotations is presented to illustrate the finding, the data were analyzed independently by two authors (DR and JP), who reached a consensus on the themes. The interview script was consulted and discussed among all members of the research team, ensuring their validity and relevance, considering that the second author is a senior researcher in qualitative methods and the third is an expert in the field of advanced practice nursing. There was no relationship between the participants and researchers.

RESULTS

Fourteen oncology APNs from regional teaching and general hospitals were included. Most were women, and half were aged 40 to 49 years. Overall work experience as a registered nurse ranged from 6 to 20 years. All of them had a master's degree in oncology nursing (Table 2). The results were structured in five categories based on Tomoaia-Cotisel et al.'s (2013) framework for contextual factors and summarized in Table 3.

Practice

Participants described their scope of clinical practice as being delineated according to the specificities of the local conditions, the field of clinical practice, the specific needs of each organization, and the constantly changing needs they define together with their multidisciplinary teams (MDTs). They reported that their job title depends on the hospital or service where they work. For example, only a few participants held the title of advanced practice nurse in their organization.

> "My job title changes in every hospital I work in. In practice, we're advanced practice nurses, but every [center] does it their own way." (Participant 9)

Regarding the details of the job description, half of the participants reported having a document that formalized their functions and activities (e.g., standardized job description). Most indicated that the range of activities and functions was commonly defined only after years of work when experience and practice enabled them to defend and shape the role they play.

> "It was done backwards: first the jobs were created and then the roles were defined based on what you were doing." (Participant 12)

TABLE 2 Characteristics of the sample (n = 14).

Variable	n	(%)
Gender		
Women	13	93%
Men	1	7%
Age group, years		
26–29	1	7%
30–39	–	–
40–49	7	50%
50–59	4	29%
60–64	2	14%
Academic degree		
Master's degree in oncology nursing	14	100%
Master's degree in advanced practice nursing	4	29%
PhD student	2	14%
Hospital setting		
General hospital	4	29%
Teaching hospital	10	71%
Clinical practice field		
Breast	3	21%
Lung	3	21%
Neuroendocrine	1	7%
Immunotherapy	1	7%
Colorectal	2	14%
Transplant of hemopoietic progenitors	1	7%
Multiple myeloma	1	7%
Genitourinary	2	14%
Overall experience as a registered nurse		
6–10	2	14%
11–20	4	29%
> 20	8	57%
Years in current position		
0–5	4	29%
6–10	4	29%
11–20	6	42%

Participants reported that the degree of autonomy and responsibilities in clinical practice differed even within the same center. They explained that this competency is likely to be closely related to the needs, support, and boundaries established jointly with the MDTs. The existence of clinical protocols was described as a positive element for clinical practice that has allowed some APNs to work with greater autonomy and systematization, and such tools were more frequent among the participants in teaching hospitals.

> "With the team you work with, you define and organize how to act in a specific clinical situation, because there are patterns that are repeated

TABLE 3 Findings for contextual factors.

Domains Level specific	Contextual factors
1. Clinical practice	- Role clarity: job title consensus and job description (core competencies, tasks, functions, and scope of practice) at the hospital level - Definition of specific professional training path - Need for mentorship programs - Flexibility and support by the MDT for role development - Interdisciplinary work (joint establishment of clinical protocols)
2. Larger organizational context	- Lack of accountability of the role (outcomes/impact) - Lack of professional networking (professional isolation, lack of interaction) - Nursing managers' support and commitment - Logistical and financial resources - Opportunities for professional development in place - Nursing union opposition
3. External environment	- No scientific nursing associations playing a role in the development of the APN roles - Lack of networks at local or national level in the advanced practice nursing field - No regional or national APNs reference core competency standards in cancer care
Cross-cutting theme	
4. Implementation pathway	- Acknowledgment of the APN role by the MDT
5. Motivation for implementation	- Absence of a strategic or well-structured plan

> in patients. So protocolizing it makes it much more fluid and thus also greatly enhances the independence of nursing." (Participant 13)

On the other hand, they indicated that no specific training path has been established regionally or nationally for APNs. The educational trajectory was described as unspecific and marked by great personal effort. Several also indicated the need to have a mentor or reference nurse whom they could call on for support and/or guidance. In addition, they said that because their degree of autonomy and responsibilities vary, it was difficult to carry out training or clinical practice stays that could help deepen their knowledge and ties in the professional field.

> "We can't create synergies with other places because the roles are completely different, so we're here and we help each other out, and the training we can do is rather external. I did the advanced practice master, and because of everything you lack and what you have learned on a day-to-day basis, sometimes we learn through blows and experience, but I lacked the scientific basis for what we do." (Participant 1)

Larger organization context

Participants described nursing and care management units as the main bodies responsible for introducing their position, playing a fundamental role in planning and control at the organizational level. However, half of them felt that they had not received specific support for performing their work, although neither had it been hampered. Few participants indicated having a specific coordinator, who was described as a newly created figure.

At the same time, none of the participants indicated that they had a formal accountability mechanism for their activity as APNs. This fact is critical, because for several of them, being able to demonstrate the added value of their work was important. They indicated their real workload is not fully reflected, in the sense that some of their clinical tasks (triage, referrals) along with their coordination, research, and educational activities were generally not recorded as such.

Likewise, the participants felt that their professional development at the organizational level was conditioned by the value that their nursing managers assigned to their role. They reported that any changes at the institutional level could affect their work positively or negatively in terms of the support or the resources available to them; for example, some reported feeling professionally undervalued due to the lack of physical resources, such as a work office. However, the point of inflection for them with regard to their professional recognition has been the increasing demand, working hours, and workload, which is not matched by their remuneration. Only 3 of the 14 participants indicated that they received some type of salary bonus for the position they held.

On the other hand, in terms of the prerequisites to work in the position, most participants took on their current role more than 10 years ago, and their hiring processes were not based on a specialization that specifically qualified them for a job as an APN. They did mention, as a nonexclusive requirement, having had previous postgraduate training. However, they pointed out that for new posts, their health organizations had already begun to request specific requirements, including appropriate postgraduate training at the very least. However, some participants highlighted that the unions set limits when trying to define an APN profile.

> "When I started in the breast unit, they asked for a nurse, we did an interview, but there was nothing in writing about what they asked for. Now, yes, we have what is called a job description, and when there is a job vacancy, our hospital is beginning to consider it." (Participant 8)

A final relevant point is the low degree of professional relationships that exist between APNs at the hospital level. Just a few of the participants reported having some type of periodic contact with other APNs at the same institution (e.g., monthly meetings and training sessions). Most did not have any support from their managers for creating professional bodies at the organizational level that could facilitate their interaction. Participants noted an absence of organized clinical meetings and training processes that could help to generate links and benefits in terms of learning, networking, and greater synchronization in professional tasks. On the other hand, some of them happened to share an office with other APNs, a fact that was described as a positive and highly valued opportunity to facilitate constant interaction.

> "What we do informally is that I share my office with four more colleagues, and sometimes when you have a clinical case or a specific situation in a patient, this space allows you to comment and discuss it with them." (Participant 1)

External environment

Only the participants who worked in areas dedicated to infrequent tumors or an oncological therapeutic process in teaching hospitals indicated that they actively participated in a working group at the local level or a professional network at the national and/or international level, and only half of these were directly related to advanced practice. A few mentioned some occasional contacts with an external working group and/or with a professional network at the local or national level, and a significant share of the participants reported not having any type of professional contact at an external level that was related to advanced oncology or nononcology practice. Indeed, many were unaware of the existence of possible professional networks in their specific field of development.

> "I always pay a lot of attention to the Australians. I always look into what they're doing, because here I have few references." (Participant 13)

Implementation pathway

The experiences of APNs who started more than 10 years ago differ from those who started more recently. The former followed a long road to achieving the level of advanced practice they perform today. In their stories, they often refer to hard beginnings and fighting for the definition of their innovative role. The generalized lack of awareness and clarity about their role and its functions meant that most had to start out by proving themselves and the value of their work as APNs within the MDTs and among the nursing profession.

> "My beginnings were really tough. My fellow nurses boycotted me and so did the doctors because they expected something they sometimes confused with administrative assistance, with helpfulness." (Participant 2)

In contrast, the participants with more recent experience did feel supported and integrated into the MDTs from the start. In fact, it was not uncommon for their medical colleagues to be the ones to request an advanced practice nurse from the nurse management and to recognize them as a fundamental and irreplaceable member of the MDT. In addition to their added value as APNs, many have also assumed clinical tasks that were traditionally provided by physicians. In fact, the participants described a positive relationship with physicians and linked the support from the MDTs with the integration and long-term sustainability of their role.

> "My current experience [proves that] If the service behind you doesn't believe in you, it won't allow you to grow." (Participant 7)

Motivation for implementation

Regardless of the care context, only the participants who had started as APNs in the previous five years reported that the implementation of their role was associated with specific objectives related to a clear scope of practice. On the contrary, the vast majority began to work under coordination objectives related to generic care processes in terms of the disease or highly focused on case management functions, which over time evolved into advanced practice forms. This fact is reflected in the hiring processess which were not very specific until recently in terms of the competencies requested or the activities and/or functions to be carried out.

> "First, it all began as a circuit where I coordinated unit operation and patient access to rapid diagnosis, but little by little over the years, more and more functions started falling on me to do." (Participant 10)

DISCUSSION

The findings show that the organization, implementation process, and performance of clinical practice among APNs working in cancer care in Catalonia (Spain) are strongly context dependent. In this sense, the hospital environment where they are introduced shapes their job title, professional profile, available resources, type of support, and recognition.

Likewise, the relationship with the multidisciplinary team is a key factor determining the level of APNs' autonomy. The influence of the immediate environment could also be accentuated by the absence of external and local scientific and/or professional networks in the field of advanced practice nursing. Moreover, the results highlight several contextual factors with the potential to facilitate or hinder the implementation process of APNs in cancer care (Table 3).

The implementation of oncology APNs in Catalonia took place in the absence of strategic planning criteria or following international recommendations. This void left the door open to the influence of other factors, also described elsewhere, for example, the confusion related to the absence of a title, job descriptions, or scope of practice, with effects on patients and other professionals as well as on APNs themselves (Casey et al., 2019). Likewise, the low level of interaction among APNs, often in a context of macro hospital services, points to the lack of both on-the-job mentoring experiences and their potentially positive impacts on APNs' career development, job satisfaction, and patient outcomes (Ann de Villiers et al., 2019). This study adds new insights into how the APN role is evolving in Spain and the complex interplay of multiple local contextual factors that influence the development of the role, beyond any specific government support or top-down approach at the country level.

Our findings support the need to implement policy strategies that tackle the variability observed in APN practice. Firstly, nursing organizations must pursue consensus-based regulations and the development of regional and/or national APN models that can be implemented in all centers. This process should bring to light the opportunity costs derived from maintaining the highly atomized status quo, taking into account the high degree of corporatism and trade union pressure that characterize the nursing profession in Catalonia and Spain. This change cannot be made by the oncology community alone; it must be done by the nursing profession in general. In the process of defining the APN role, international experiences can be instrumental, informing the design of a nationally agreed model, shaping the core concepts of advanced practice nursing, and setting an example for competency mapping or activity analysis tools (Schober, 2017). For instance, the Consensus Model for APRN (Advanced Practice Registered Nurse) regulation in the United States illustrates how collaboration, agreements, and representation of nursing leaders and professional organizations at a country level can contribute to regulating the integration of APNs nationwide (Stanley et al., 2009). Health authorities should be involved in this process as well, serving as guarantors and exercising indirect control through what has been called "regulated trust" (Mesman et al., 2017). Indeed, a model for APNs has recently been proposed in Catalonia (Sevilla Guerra et al., 2023).

Secondly, the reality of each cancer disease has a specific weight, but MDTs are important for all of them. In line with the results of the present study, the most viable political strategy for the development and recognition of oncology APNs may be to formalize and protect their functions within MDTs. Thus, as proposed by Serena et al. (2018) for the oncology field, clarification of the oncology APN role could be a driver for defining the tasks and scope of practice among all the different professionals involved in cancer care. In turn, scientific societies related to both cancer care and the cancer plan must prioritize the APN perspective, in the same way that they demanded the formalization of the MDTs over a decade ago (Prades et al., 2015). One way or another, any implementation or updating process that takes place at the meso-management level—led by nursing managers and directors—would be conditioned by having a previously agreed-upon consensus model, as outlined above.

Third, participants described the lack of an accountability mechanism for their work as APNs. Yet, investing in outcome evaluations for this role is vital and lends support to the rationale for their implementation and development (Unsworth et al., 2022). Supporting new research on the effectiveness of APNs is worth considering. For example, in Ireland, demonstrating the impact of improving access to health services provided by APNs in chronic care helped to reinforce the national rollout of the model to the nursing workforce (Brady Anne Marie et al., 2022). Research should thus be understood as an investment to enhance long-term progress and sustainability.

Finally, the academic qualifications needed by APNs must be considered. At the international level, the ICN considers postgraduate training to be a basic requirement for the proper development of APNs, with a master's degree being the minimum recommended as entry level to practice (ICN, 2020). Although all of the participants in the present study had the minimum master's level education required, some of them described that 10 years ago their hiring processes were not always based on a specialization that specifically qualified them for a job as oncology APNs. The relatively recent participation of nurses in specialty education, master's degrees, and the recent integration of advanced practice nursing master's programs in the last five years in Spain have all greatly enhanced the conceptualization of advanced practice nursing and generated local examples and evidence for this level of practice in Spain (Sevilla Guerra et al., 2021). Even the failures seen around critical local events can be viewed as opportunities for sensitive discussion and learning about how to avoid similar situations in the future and to increase the odds of successfully realizing complex transformations in health care (Best et al., 2012). Therefore, local and national efforts are needed to develop a regulatory framework that standardizes the minimum academic requirements for APNs in oncology and other healthcare settings, establishes the basis for cogent regulations that protect both patients and providers, and lays the groundwork for national and international benchmarking.

LIMITATIONS

Regarding the limitations of our study, first, the existence of oncology APNs in Catalonia is currently limited to highly specialized hospital contexts, so experiences in the oncology field in remote or rural areas are not represented, nor

are the different contextual factors that could emerge from these contexts. Second, we did not seek the perspectives of patients, nursing managers, decision-makers, or policymakers in the field of cancer, which could have complemented the exploration of contextual factors. Despite these limitations, the results of the study underscore the importance of considering the influence of the healthcare and scientific context in the integration of APNs into the health workforce.

CONCLUSIONS

Understanding the local contextual factors surrounding the development and implementation of oncology APNs has brought to light critical factors around the practice, organizational, and scientific context that hinder the implementation process in Catalonia. These findings can provide the basis for effective workforce planning and the incorporation of a highly specialized professional who brings great added value in a dynamic context. Policy strategies need to address the main contextual factors, such as establishing a consensus on basic concepts and practice standards for APNs as a new role in the health system. Policies should also tailor implementation processes to the specific clinical field of interest, such as oncological care. Our results can serve to inform other countries where APNs have just been introduced on the need to consider the complexity of the process and on the key aspects needed for a successful implementation process.

Implications for nursing policy

Translating our results and the strategic knowledge generated therein into local contexts could support regulatory and implementation processes for APNs. Our study reflects a reality in which hospital managers, teams, and nursing managers are key stakeholders whose involvement in planning will condition the successful implementation and integration of APNs into the healthcare system, insofar as APN roles should always be tailored to the specific context where they operate. National nursing organizations can make strong contributions in that regard, defining standards of practice and advocating for formal regulation and policy dialogue. Also, from an early stage of development, it is vital to invest in assessing the impact of the APN role on patient outcomes and health systems. This could facilitate financial recognition, long-term sustainability, satisfaction, and regulation of APNs.

AUTHOR CONTRIBUTIONS

Study design: Darinka Rivera, Joan Prades, Sonia Sevilla Guerra, Josep M. Borras. *Data collection*: Darinka Rivera. *Data analysis*: Darinka Rivera, Joan Prades. *Study supervision*: Sonia Sevilla Guerra, Josep M. Borras, Joan Prades. *Manuscript writing*: Darinka Rivera, Joan Prades, Sonia Sevilla Guerra, Josep M. Borras. *Critical revisions for important intellectual content*: Darinka Rivera, Joan Prades, Sonia Sevilla Guerra, Josep M. Borras.

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CONFLICT OF INTEREST STATEMENT

No conflict of interest has been declared by the authors.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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Supplementary material

Supplementary table 1. Interview script

1. Generally, how would you describe the context framing the clinical practice you carry out?
2. Does the definition of the APN professional profile have a clear impact on circumscribing your position and the scope of clinical practice in your center?
3. Please describe the level of integration of your role into the team work and the center as a whole.
4. Is there a specific framework for APNs' supervision? Do you account for your activity/results and receive feedback as an APN?
5. Could you highlight the purpose, level of interaction and coordination with regards to other APNs in your hospital?
6. Are you involved with your scientific society or belong to a nursing group that promotes advanced practice nursing?
7. What was your professional pathway to becoming an oncology APN like? What kind of support and/or recognition can you highlight (e.g. logistical, economic)?
8. What needs do you think motivated the implementation of APN roles in oncology?

4.3 Article 3

Title	*How do healthcare professionals and managers view the role of the advanced practice nurse?*
Authors	Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montserrat Martín-Baranera, Darinka Rivera Villalobos, Lena Ferrús-Estopa.
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ORIGINAL ARTICLE

How do healthcare professionals and managers view the role of the advanced practice nurse?

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Abstract

Background: Advanced practice nurses (APN) growth depends on the implementation and acceptance of APNs in each country.

Introduction: Given the diversity of the different contexts and varying population health needs where APNs are developing, this study focuses on exploring the viewpoints of the multidisciplinary and management team who have worked with APNs in public hospitals in Catalonia, Spain.

Methods: A cross-sectional study with previously identified APNs, health professionals, and health managers. EVOHIPA, a valid and reliable scale, was used. The STROBE checklist was followed.

Findings: The results showed high levels of agreement among the 746 participants (predominantly physicians and nurses), with statements relating to the APN's contribution in enhancing care continuity and processes, resulting in safer and more patient-centered care. The results showed low levels of agreement with statements relating to legal support for the APN position, regulation, and practice scope.

Discussion: The study provides discussion elements and reflection to determine the axes on which it will be necessary to act to promote APNs and their conditions of service in the context of practice within hospital teams.

Conclusion: The study highlights the differences in opinion on APN roles among health professionals and managers who have worked with APNs and allows exploring expectations about current changes in workflows and clinical activities among healthcare team members.

Implications for nursing and health policy: Results highlight the importance of fostering a common understanding among healthcare teams to maximize the benefits of collaborative work and recognize the significant contributions of APNs within the multidisciplinary team.

Health policy plays a crucial role in recognizing and promoting the contribution of APNs within hospital healthcare teams, acknowledging their autonomy and expertise in improving patient outcomes.

KEYWORDS
Advanced practice nursing, cross-sectional study, multidisciplinary team, nursing, teamwork

INTRODUCTION

New healthcare models are being generated to respond to current and future health problems, such as those arising from the COVID-19 pandemic, the aging of the population, the increasing prevalence of chronic diseases, and multimorbidity. In addition, there is a growing focus on healthy living, preventing, improving health outcomes, and empowering home

care services as opposed to hospitalization. In recent years, the demand for advanced practice nurses (APN) has increasingly grown (Schober, 2018) and described as the "sleeping giant" (Heale & Rieck Buckley, 2015, p. 2) because of its potential to increase access and quality of healthcare (Schober, 2019). However, their appropriate implementation requires changes at multiple levels, including political involvement and legal regulation. APN involves an advanced level of clinical practice (Casey et al., 2019). The APN is defined as "a generalist or specialised nurse who has acquired, through additional graduate education (minimum of a master's degree), the expert knowledge base, complex decision-making skills and clinical competencies for Advanced Nursing Practice, the characteristics of which are shaped by the context in which they are credentialed to practice" (ICN, 2020, p. 6).

Many countries, where APNs have been established, are at different stages of development (World Health Organization, 2020). The International Council of Nurses (ICN) stated that "the global community recognizes, supports and invests in nurses and nursing to lead and deliver health for all" (ICN, 2019, p. 1). At the ICN NP/APN Congress de Dublin (2022) Dr. Tedros, General Director of WHO, identified the APN as central to the global response to promoting and protecting health. Besides, the Strategic Direction for Nursing and Midwife 2021–2025 (WHO-Europe, 2021) identifies in service delivery the need to enable nurses to contribute to service delivery in interdisciplinary healthcare teams. However, beyond the requirements and scope of the practice, it is also necessary to understand the context of influence and the challenges faced in the full development of APNs. Understanding the environment where there are success stories is essential for knowledge transfer and the development of new APN roles in different territories. This directive necessitates an understanding of expectations and views to allow APNs to operate at their fullest potential and to contribute, to the greatest extent possible, to the delivery of healthcare in both collaborative and self-directed work. Accordingly, this study aims to explore the viewpoints of the multidisciplinary and management team who worked with APNs in public hospitals in Catalonia (Spain) which intends to capture the importance of defining the aspects, judgments, and perspectives among the main actors in the Catalan healthcare system in the field of hospital care.

BACKGROUND

In Spain, APN development is lagging behind in comparison with other countries. The lack of legislation limits the APN's development and role recognition. Nurses can graduate with a Master's degree or one of six nursing specializations that are supported by the Department of Health and require an internal residency of two years in the specific field of care (pediatric, geriatric, mental health, family and community care, maternal and obstetrics care, and occupational health). However, the Spanish healthcare system does not have a specific set of rules for the admission or certification of APN jobs at the national level.

Some healthcare institutions and hospitals have implemented their own criteria to define and access APNs' job positions. These criteria may vary among them in terms of job descriptions and person specification, which creates an uneven implementation of the role. Previous studies have shown the existence of nurses who meet the international requirements to be an APN (Gutiérrez Martí & Ferrús Estopà, 2019; Sevilla Guerra et al., 2021), but its development and recognition have been uneven and depend on the specific context or institutions where this has been implemented.

A comparative study of the environment where the APN has been implemented in Quebec and Spain (Jean et al., 2019) allowed a careful understanding of the contextual factors influencing the development and implementation of APNs in both countries. These results are similar to other studies internationally (Fatemi et al., 2020), and it was generally stated that, most of the time, the predisposition and the willingness of physicians to accept change could influence the new integration of APN into the multidisciplinary team (Kraus & Dubois, 2016). Transferring patient care from within professions is a challenge for continuity of care that can lead to professional or personal opposition and professional competitiveness, which was shown to be a major barrier (Jean et al., 2019). The difficulties in fully understanding the dynamics of how context, opinions, and acceptance from other health professionals influence APNs' work are complex and require further study.

Study aim

The study aims to investigate the viewpoints of both the multidisciplinary team and the management team regarding the role of APNs in public hospitals in Catalonia, Spain. The specific objectives were:

- To explore the characteristics of the environment in which APNs are developed.
- To explore the views of the multidisciplinary and management team on their work with APNs related to (1) role activities, (2) development and teamwork, (3) leadership, (4) efficiency, (5) support, (6) recognition, (7) organizational model, and (8) regulation.
- To identify the axes on what it will be necessary to act in order to promote APNs and contribute to the clarification of the role within the context of the study.

METHODS

Study design

The study was conducted with an exploratory cross-sectional design and included a descriptive and analytical analysis. The

study had a previous phase, which included the development of a scale aimed at health professionals and care managers who worked and shared health goals with APNs. This was the "health professional's view of APNs in acute hospital scale" (original language acronym EVOHIPA) (Gutiérrez Martí & Ferrús Estopà, 2021). The STROBE checklist was used to report the study.

Sample and setting

The study population was composed of 209 clinical nurses working at hospitals who had previously been classified as nurses who met the international standards to be APNs (Sevilla Guerra et al., 2021). The study also targeted all health professionals (ward nurses, allied health professionals, doctors, and other health professionals from the multidisciplinary team) and care managers (chief nursing officers, hospital directors, head of services, and ward managers) who have worked with them. A snowball methodology was used in 38 acute care centers and hospitals in Catalonia, Spain. Catalonia is an autonomous community located in southwestern Europe with a population of approximately 7.8 million inhabitants.

The study population was asked to complete the EVOHIPA scale and to invite their multidisciplinary and management team to fulfill the scale. At the same time, hospital directors were contacted and invited to participate and disseminate the study within the target population. The participant APNs and hospital directors invited 655 health professionals and care managers who have worked with them in their hospital or other collaborating teams.

Variables

Independent variables collected were age, gender, profession, years of experience within the profession, work position, years developing their current job, name of the job, specialty or field of work, and level of care of the hospital. Dependent variables were the 41 multiple-choice statements of the EVOHIPA scales grouped into eight dimensions: (1) role activities, (2) development and teamwork, (3) leadership, (4) efficiency, (5) support, (6) recognition, (7) organizational model, and (8) regulation.

Data collection

In this study, three questionnaires were utilized to collect data, focusing on sociodemographic information (two of them) and the EVOHIPA scale. The first sociodemographic questionnaire was distributed to the 209 identified APNs working in public hospitals. The second sociodemographic questionnaire targeted health professionals and managers who had collaborated with the APNs.

For the APNs, participation involved not only responding to the EVOHIPA scale but also sharing information about the research project with other professionals they had worked with. This approach aimed to expand the reach and engagement of the study within the healthcare setting.

Nursing directors from 38 hospitals were invited to participate in the project through email communication. They were requested to complete the EVOHIPA scale and, in addition, to extend the invitation to other relevant personnel, including care managers, heads of service, and coordinators who had collaborated with the APNs.

By utilizing these three questionnaires and employing a cascading invitation approach, the study sought to gather valuable insights from both APNs and other healthcare professionals and managers who had first-hand experience working with APNs. This comprehensive data collection strategy aimed to ensure a well-rounded understanding of viewpoints and perspectives related to the role of APNs in public hospitals in Catalonia, Spain.

The EVOHIPA scale explores the process of examining and understanding different viewpoints, opinions, beliefs, and perspectives that healthcare professionals may hold regarding APNs. It involves delving into the various ways people perceive, interpret, and respond to a given situation, concept, or/and statement given by the scale. It aims to identify the level of agreement in eight dimensions between participants in these statements related to working with APNs in a Likert scale with six answer options: 6 = strongly agree, 5 = strongly agree, 4 = somewhat agree, 3 = somewhat disagree, 2 = strongly disagree, 1 = strongly disagree; and a seventh "no answer" option. The previous stage of the study included semistructured interviews with 31 professionals: managers, doctors, and nurses who had worked with APNs. The analysis of the interviews resulted in the final 41 statements about APN's environment, work, and value. The final EVOHIPA scale showed a content validity index of 0.974, excellent confiability (George & Mallery, 2003), and a global Cronbach alpha of 0.947 reliability (Gutiérrez Martí & Ferrús Estopà, 2021). Reliability for the eight dimensions was as follows: role activities (0.86), development and teamwork (0.88), leadership (0.83), efficiency (0.85), support (0.86), recognition (0.58), organizational model (0.83), and regulation (0.81). Data were collected in 2021.

Ethical considerations

The questionnaires contained information regarding the commitment to confidentiality, and all participants had to give written informed consent. The Ethics Research Committee of the Autonomous University of Barcelona approved the study (EXP. CEEAH 5578).

Data analysis

In the initial descriptive analysis, the means and standard deviations for the quantitative variables were calculated, and the absolute and relative frequencies for the qualitative ones

were presented. To describe the answers to each of the questions on the EVOHIPA scale, the number and percentage of responses for each item have been described by grouping the "strongly agree" and "agree" categories, and the "strongly disagree" and "disagree" categories; thus, the results are presented using the respective percentages of responses within the different grouped categories. Answers on the EVOHIPA scale were compared according to different factors (gender, professional group, place of work) and the responses of the APNs were also compared with those of the different groups of professionals who have worked with them. All statistical comparisons were performed keeping the original score of each of the items (1 to 6), using the nonparametric Kruskal–Wallis test. Statistical tests have been presented as contrasts of bilateral hypotheses, and statistical significance has been established at p values equal to or less than 0.05. The analysis was made using R statistical software version 3.6.2.

RESULTS

Participants and descriptive data

A total of 746 health professionals, care managers and APNs participated in the study. 162 APNs (77, 5% response rate) from 34 different hospitals and 584 health professionals and care managers (87, 8% response rate) from 36 health centers responded to the questionnaire. There was representation of all types of hospitals. The distribution of participants and ratios of APN per participant are presented in Supplementary Information S1.

Regarding APNs, there were 87.7% women, and their average age was 48.31 years (SD = 8.9). Participant health professionals and managers (hereafter health professionals) were mainly women (73.8%) with a mean age of 46.2 years (SD 10.1). Besides, 51.4% are nurses and 40.1% are doctors with an average professional experience within the profession of 21.1 years (SD = 10.3), and 56.7% had more than 20 years of experience. The sociodemographic characteristics of participants are shown in Table 1.

Results of the views of the multidisciplinary and management team

The results of the EVOHIPA scale, which comprises 41 statements aimed at health professionals and APNs, were analyzed based on eight dimensions and grouped according to the degree of agreement for each statement. The significance of the findings was assessed using the Kruskal–Wallis test, and the outcomes are presented in Table 2. The statistical analysis reveals varying views across the eight dimensions among different job positions, with some dimensions showing significant differences and others exhibiting consistent mean scores. The dimensions of "role activities," "leadership," "support," "acknowledgment," and "regulation" presented the

TABLE 1 Sample characteristics ($n = 746$).

Variable	Health professionals *n* (%)	APNs *n* (%)
Age group		
< 40	154 (26.4)	24 (14.8)
40–55	283 (48.5)	96 (59.3
> 55	147 (25.2)	42 (25.9)
Profession		
Nurse	300 (51.4)	162 (100.0)
Doctor	234 (40.1)	–
Administrative	9 (1.5)	–
Physiotherapist	8 (1.4)	–
Social worker	8 (1.4)	–
Nutritionist	7 (1.2)	–
Psychologist	4 (0.7)	–
Health care assistance	4 (0.7)	–
Occupational therapist	2 (0.3)	–
Others*	8 (1.4)	–
Experience within the profession		
< 10 years	91 (15.6)	11 (6.8)
10–20 years	162 (43.3)	19 (11.7)
> 20 years	332 (56.7)	139 (81.5)
Work position		
Advanced practice nurse	0 (0.0)	162 (100.0)
Senior doctor	157 (26.9)	–
Nonspecialist care nurse	126 (21.6)	–
Nursing manager	80 (13.7)	–
Head of service or unit	57 (9.8)	–
Specialist nurse	47 (8.0)	–
Medical or nurse director	26 (4.5)	–
Deputy medical or nursing director	9 (1.5)	–
Case manager	8 (1.5)	–
Social worker	8 (1.5)	–
Administrative	8 (1.5)	–
Nutritionist	7 (1.2)	–
Junior-resident doctors	6 (1.0)	–
Physiotherapist	6 (1.0)	–
Process manager	6 (1.0)	–
General manager	5 (0.9)	–
Health care assistance	5 (0.9)	–
Resident nurse	3 (0.5)	–
Psychologist	3 (0.5)	–
Occupational therapist	2 (0.5)	–
Others**	15(2.6)	–

(Continues)

TABLE 1 (Continued)

Variable	Health professionals *n* (%)	APNs *n* (%)
Time in current position		
< 10 years	243 (41.6)	80 (49.4)
10–20 yeas	207 (77.1)	66 (40.7)
> 20 years	134 (22.9)	16 (9.9)
APN-regulated specialty		
Without regulated specialty	–	131 (80.9)
Nurse specialist in obstetrics-gynecology	–	5 (3.1)
Nurse specialist in mental health	–	5 (3.1)
Nurse specialist in geriatrics	–	5 (3.1)
Family and community specialist nurse	–	2 (1.2)
Occupational health specialist nurse	–	3 (1.9)
Nurse specialist in pediatrics	–	11 (6.8)
Field of work		
Medical field	313 (53.6)	124 (76.5)
Surgical field	157 (26.9)	32 (19.7)
Management, teaching, and quality	45 (7.7)	0 (0.0)
Other care areas	69 (11.8)	6 (3.7)

*Pharmacists, coordinators, and quality or safety technicians.
**Emergencies and occupational health.

most significant differences in views among different job positions.

In the dimension of "role activities," there are statistically significant differences ($p = 0.009$) in how different job positions view the role activities of APNs. In terms of specific statements, differences were found in the view of APNs' ability to solve complex care problems, contributing to continuity of care and making complex decisions autonomously. The job position with the highest mean score is "manager," followed closely by "medical or nurse director or deputy director." "Senior and junior-resident doctor" and "others" have slightly lower mean scores compared with other job positions. Some aspects such as leading research projects and applying scientific evidence have notable differences among job positions but were not statistically significant.

In relation to the "development and teamwork" dimension, no statistically significant differences among job positions were found. This suggests a relatively consistent view across job roles regarding the collaborative and developmental aspects of APNs. A high agreement is observed regarding APNs advising and supporting general nurses during decision-making, fostering alliances with other professionals to benefit patients, and sharing expert knowledge with their teams (Supplementary Information S2). There is a significant difference ($p = 0.039$) among job positions regarding APNs working as a team with other health professionals.

Although there is no overall significant difference in the dimension of "leadership," specific aspects like leading multidisciplinary teams and clinical leadership show significant differences ($p < 0.05$) among job positions. The positions of "medical or nurse director or deputy director" and "head of service or unit" tend to have higher mean scores in aspects related to leading multidisciplinary teams, clinical leadership, and motivating professionals based on best practices. Twenty percent of APNs do not agree that they are recognized as the main reference person by the rest of the team, and although there is no significant difference ($p = 0.82$) among job positions in this aspect, the mean scores are relatively consistent across job positions, indicating a similar view of APNs as clinical references.

In terms of the "efficiency" dimension, no statistically significant differences were mentioned within this dimension, and neither significant differences were mentioned between this dimension and the other dimensions. Results show large agreement that APNs serve as effective and efficient resources to address healthcare needs, for both chronically ill patients and other acute health problems. The lowest level of agreement in the dimension is found by the job position of "senior and junior –resident doctor" and the fact that performing and interpreting diagnostic tests by APNs could lead to increased efficiency for the health system (Figure 1).

The results within the "support" dimension highlight variations in views among different job positions ($p < 0.05$) in various aspects of support for APNs. The positions of "manager" and "medical or nurse director or deputy director" consistently exhibit higher mean scores across different aspects of support, indicating stronger agreement with the implementation and recognition of APNs. The "head of service or unit" and "senior and junior-resident doctor" positions also generally show positive views of support for APNs, while the "others" category reflects a favorable overall perception of support from a diverse range of roles. Approximately half of the participants believe that professional unions do not fully support the implementation of APNs. Mean scores across job positions are relatively consistent in this aspect, with no significant differences observed.

In relation to the "recognition" dimension, there is a significant difference ($p = 0.016$) among job positions in the acknowledgment of APNs' expertise and knowledge. The positions of "manager" and "medical or nurse director or deputy director" consistently exhibit higher mean scores across different aspects of recognition, indicating stronger agreement with the acknowledgment of APNs' expertise and knowledge, as well as their contribution to patient care. Results also show high agreement that ignorance of the potential of APNs acts as a barrier to their successful implementation.

Regarding the "organizational model" dimension, while there is no overall significant difference, some aspects within

TABLE 2 Results obtained by statement and job position, according to the Kruskal–Wallis test. mean (SD).

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
Role activities	5.43 (0.72)	5.42 (0.54)	5.23 (0.83)	5.38 (0.70)	5.24 (0.60)	5.49 (0.48)	5.57 (0.50)	5.63 (0.44)	5.40 (0.69)	**0.009**	**<0.05**
Advanced practice nurses are trained to solve complex care problems.	5.5 (0.7)	5.4 (0.8)	5.2 (1)	5.7 (0.5)	5.4 (0.6)	5.7 (0.5)	5.7 (0.6)	5.7 (0.4)	5.5 (0.8)	**0.000024**	**<0.05**
Advanced practice nurses contribute to improving the continuity of care between levels and between processes, with the aim of providing safer and more patient-centered care.	5.6 (0.7)	5.8 (0.4)	5.7 (0.6)	5.6 (0.5)	5.5 (0.6)	5.9 (0.4)	5.8 (0.5)	6 (0.2)	5.7 (0.6)	**0.003**	**<0.05**
Advanced practice nurses make complex decisions autonomously.	5.3 (0.9)	5.2 (0.8)	4.9 (1.2)	5.2 (1.1)	5.2 (0.8)	5.4 (0.8)	5.5 (0.7)	5.5 (0.7)	5.2 (1)	**0.000124**	**<0.05**
Advanced practice nurses lead their own research projects that can provide evidence on aspects of healthcare practice.	5.3 (1)	5.3 (0.8)	4.9 (1.2)	5 (1.2)	5.1 (0.7)	4.9 (1.1)	5.4 (0.8)	5.3 (0.9)	5.2 (1)	0.064	
Advanced practice nurses apply scientific evidence and improve care practice.	5.4 (0.8)	5.4 (0.6)	5.3 (1)	5.4 (0.9)	5.2 (0.8)	5.5 (0.7)	5.5 (0.6)	5.6 (0.7)	5.4 (0.8)	0.497	

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
Development and teamwork	5.73 (0.63)	5.86 (0.28)	5.76 (0.61)	5.85 (0.40)	5.71 (0.45)	5.86 (0.31)	5.86 (0.35)	5.84 (0.39)	5.79 (0.52)	0.768	
Advanced practice nurses participate in the health professional training programs.	5.3 (1)	5.5 (0.8)	5.4 (0.9)	5.3 (1.1)	5.1 (0.7)	5.5 (0.7)	5.5 (0.7)	5.3 (0.8)	5.4 (0.9)	0.445	
Advanced practice nurses are referents and advise other health professionals in relation to their area of expertise.	5.4 (0.9)	5.7 (0.5)	5.4 (0.9)	5.4 (1)	5.4 (0.7)	5.7 (0.7)	5.7 (0.5)	5.6 (0.7)	5.5 (0.8)	0.06	
Advanced practice nurses advise general nurses and support them in their decision-making.	5.4 (0.9)	5.7 (0.6)	5.5 (0.9)	5.6 (0.6)	5.3 (0.8)	5.5 (0.8)	5.6 (0.7)	5.5 (0.7)	5.5 (0.8)	0.193	
Advanced practice nurses work as a team with other health professionals.	5.5 (0.8)	5.7 (0.5)	5.7 (0.7)	5.7 (0.6)	5.3 (0.7)	5.7 (0.5)	5.6 (0.7)	5.9 (0.3)	5.6 (0.7)	**0.039**	**<0.05**
Advanced practice nurses form alliances with other professionals for the benefit of their patients.	5.6 (0.8)	5.6 (0.6)	5.5 (0.8)	5.6 (0.6)	5.4 (0.7)	5.7 (0.5)	5.6 (0.6)	5.9 (0.3)	5.6 (0.7)	0.399	
Beyond direct patient care, advanced practice nurses provide support and impart expert knowledge to the members of the care team with whom they work.	5.5 (0.8)	5.5 (0.6)	5.4 (0.9)	5.5 (0.7)	5.1 (0.7)	5.7 (0.6)	5.6 (0.6)	5.6 (0.6)	5.5 (0.8)	0.133	

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidisciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	*p* < 0.05
Acceptance of advanced practice nurses is related to their ability to work as a team.	5.4 (0.9)	5.5 (0.8)	5.5 (0.8)	5.6 (0.7)	5.2 (0.7)	5.4 (0.6)	5.5 (0.7)	5.4 (0.8)	5.4 (0.8)	0.424	
Leadership	5.55 (0.83)	5.71 (0.60)	5.41 (01.05)	5.67 (0.60)	5.37 (0.77)	5.76 (0.46)	5.72 (0.56)	5.73 (0.61)	5.57 (0.82)	0.19	
Advanced practice nurses can lead multidisciplinary teams and some care devices.	5.4 (0.9)	5.4 (0.8)	5.3 (1)	5.6 (0.7)	5.2 (0.8)	5.6 (0.7)	5.5 (0.7)	5.8 (0.4)	5.4 (0.9)	**0.01**	**<0.05**
Advanced practice nurses exercise clinical leadership in the work groups in which they participate.	5.1 (1)	5.3 (0.8)	4.9 (1.2)	5.3 (0.7)	4.8 (0.8)	5.4 (0.7)	5.3 (0.8)	5.1 (0.9)	5.1 (1)	0.055	
The leadership of advanced practice nurses encourages the motivation of other professionals to work based on best practice.	5.3 (1)	5.4 (0.8)	5.1 (1.2)	5.3 (0.9)	4.8 (0.8)	5.4 (0.8)	5.5 (0.7)	5.5 (0.8)	5.3 (1)	**0.035**	**<0.05**
Advanced practice nurses are recognized as clinical references by the rest of the team.	5 (1.1)	5.1 (0.8)	5 (1.1)	5.1 (0.9)	4.9 (0.8)	5.2 (0.7)	5.2 (0.9)	5 (0.8)	5.1 (1)	0.82	
Efficiency	5.65 (0.77)	5.72 (0.56)	5.57 (0.81)	5.78 (0.46)	5.51 (0.67)	5.79 (0.37)	5.77 (0.57)	5.87 (0.23)	5.67 (0.69)	0.06	
Advanced practice nurses are an effective and efficient resource for responding to the needs of both chronic patients and other processes such as oncology.	5.4 (0.9)	5.6 (0.7)	5.6 (0.8)	5.6 (0.6)	5.4 (0.7)	5.6 (0.6)	5.7 (0.5)	5.7 (0.5)	5.5 (0.7)	0.405	

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
Advanced practice nurses contribute to the efficiency and sustainability of the health system by reducing waiting lists or admissions to emergency rooms.	5.1 (1.1)	5.3 (0.9)	5.3 (1)	5.5 (0.7)	5.1 (0.8)	5.3 (0.9)	5.4 (0.7)	5.6 (0.7)	5.3 (1)	0.164	
Advanced practice nurses can help reduce hospital stays for patients.	5.3 (1)	5.5 (0.7)	5.2 (1)	5.5 (0.7)	4.9 (0.7)	5.5 (0.7)	5.4 (0.9)	5.4 (0.7)	5.3 (0.9)	0.068	
The fact that some advanced practice nurses also perform and interpret diagnostic tests that other professionals usually perform (eg ultrasounds) leads to increased efficiency for the health system.	5.2 (1)	5 (1.3)	4.9 (1.3)	5.3 (1)	5.1 (0.9)	5.3 (0.8)	5.2 (1.1)	5.3 (0.8)	5.1 (1.1)	0.201	
I think that the implementation and recognition of nurses who do advanced practice is a good measure to make the health system more efficient.	5.6 (0.7)	5.7 (0.6)	5.6 (0.8)	5.6 (0.7)	5.4 (0.7)	5.8 (0.4)	5.7 (0.5)	5.8 (0.4)	5.6 (0.7)	0.158	
Support	4.73 (01.33)	5.19 (0.93)	5.20 (01.03)	5.24 (01.04)	5.48 (0.60)	5.56 (0.65)	5.42 (0.69)	5.13 (0.93)	5.12 (01.08)	**0.002**	**<0.05**
The implementation of nurses who do advanced practice has the full support of the intermediate nursing commands of my institution.	4.8 (1.2)	4.9 (1)	4.8 (1.2)	4.7 (1.2)	4.7 (1)	5.7 (0.6)	5.4 (0.8)	4.5 (1.3)	4.9 (1.1)	**0.0000001**	**<0.05**

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
Within the institution where I work, the implementation of advanced practice nurses has the full support of the doctors with whom they share healthcare processes.	4.5 (1.3)	5 (1.1)	5.2 (1.1)	4.9 (0.9)	4.9 (0.8)	4.8 (1.1)	4.9 (1)	4.9 (0.9)	4.9 (1.2)	**0.000003**	**<0.05**
Within the institution where I work, the implementation of advanced practice nurses has the support of social agents (unions).	4.3 (1.3)	4.6 (1)	4.7 (1.2)	4.6 (1.2)	4.7 (0.8)	4.7 (1.1)	4.6 (1)	4.6 (1)	4.5 (1.2)	0.178	
The implementation of advanced practice nurses has the full support of the managers of my institution.	4.3 (1.4)	4.9 (1.1)	4.6 (1.3)	4.7 (1.2)	4.5 (0.8)	5.4 (0.7)	5.1 (0.9)	4.7 (1)	4.7 (1.2)	**0.00002**	**<0.05**
The implementation of the figure of the advanced practice nurse has the full support of the nurses in the institution where I work.	4.9 (1.1)	4.9 (1)	5.1 (1)	5.2 (0.8)	4.8 (0.5)	5.4 (0.7)	5.1 (0.8)	5 (0.8)	5 (1)	0.11	

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
Acknowledgment	5.48 (0.70)	5.55 (0.54)	5.45 (0.76)	5.41 (0.80)	5.45 (0.66)	5.79 (0.35)	5.74 (0.45)	5.72 (0.36)	5.55 (0.65)	**0.016**	**<0.05**
The nursing management of the institution where I work considers the expertise and knowledge that advanced practice nurses bring to the care processes assigned to them essential.	4.9 (1.2)	5.1 (1)	4.7 (1.3)	4.7 (1.3)	5.1 (0.8)	5.7 (0.5)	5.6 (0.6)	5.4 (0.8)	5.1 (1.1)	**2,60E−11**	**<0.05**
In the institution where I work, advanced practice nurses are recognized and respected, and their proposals are taken into account.	4.6 (1.3)	5.1 (0.8)	4.9 (1.2)	4.9 (1.2)	4.7 (0.8)	5.4 (0.9)	5.2 (0.9)	5 (0.8)	4.9 (1.1)	**0.000041**	**<0.05**
Advanced practice nurses create a close therapeutic bond with patients and their families, who see them as a trusted professional and reference for their health process.	5.4 (0.9)	5.5 (0.7)	5.6 (0.8)	5.6 (0.7)	5.4 (0.6)	5.7 (0.6)	5.7 (0.6)	5.9 (0.3)	5.6 (0.7)	**0.009**	**<0.05**
Ignorance of the potential of the advanced practice nurse is a barrier to its implementation.	5.4 (0.8)	5.2 (1.1)	5.3 (1)	5.2 (1)	4.8 (0.9)	5.4 (0.7)	5.4 (0.7)	5.6 (0.9)	5.3 (0.9)	0.088	

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
The research activities of advanced practice nurses are underdeveloped due to lack of time and recognition of their contributions.	5.3 (0.9)	4.9 (1.1)	5.1 (1)	5.2 (0.9)	4.9 (1.1)	5 (1)	5.1 (0.9)	5.2 (1.2)	5.1 (1)	0.345	
Organizational model	5.83 (0.56)	5.94 (0.32)	5.78 (0.63)	5.82 (0.57)	5.65 (0.65)	5.94 (0.20)	5.90 (0.29)	5.97 (0.16)	5.85 (0.51)	0.105	
Advanced practice is an opportunity for professional growth for nurses in the healthcare field.	5.7 (0.7)	5.7 (0.5)	5.6 (0.6)	5.6 (0.7)	5.4 (0.6)	5.8 (0.4)	5.8 (0.5)	5.8 (0.4)	5.7 (0.6)	0.125	
The organizational model of health institutions will have to be rethought to clarify the roles and professional profile of advanced practice nurses.	5.5 (0.8)	5.5 (0.7)	5.2 (0.9)	5.5 (1)	4.9 (1)	5.6 (0.5)	5.5 (0.7)	5.5 (0.7)	5.4 (0.8)	**0.007**	**<0.05**
It is a priority to define well the jobs of nurses who do advanced practice, to clarify their scope of action and their hierarchical dependence.	5.5 (0.8)	5.7 (0.5)	5.4 (0.8)	5.7 (0.7)	5.3 (0.7)	5.6 (0.7)	5.8 (0.5)	5.7 (0.4)	5.6 (0.7)	**0.002**	**<0.05**
The Department of Health should promote policies that encourage the creation of advanced practice nurse jobs.	5.6 (0.7)	5.7 (0.5)	5.5 (0.8)	5.7 (0.6)	5.2 (0.8)	5.8 (0.4)	5.7 (0.5)	5.9 (0.3)	5.6 (0.7)	**0.012**	**<0.05**
Regulation	5.79 (0.46)	5.69 (0.42)	5.52 (0.79)	5.71 (0.56)	5.30 (0.88)	5.58 (0.55)	5.76 (0.45)	5.83 (0.30)	5.68 (0.58)	**0.000192**	**<0.05**
The workplace of advanced practice nurses should be regulated at the occupational level.	5.6 (0.7)	5.6 (0.7)	5.5 (0.9)	5.6 (0.7)	5.3 (0.8)	5.7 (0.5)	5.7 (0.7)	5.8 (0.4)	5.6 (0.7)	0.109	

(Continues)

TABLE 2 (Continued)

	*Clinical nurse	Head of service or unit	Senior and junior-resident doctor	**Core healthcare team	***Multidis-ciplinary health care team	Medical or nurse director or deputy director	****Manager	*****Others	Total	*p*	$p < 0.05$
Advanced practice nurses, in their daily practice, are not legally supported to develop their role to its full extent.	5.2 (1)	4.9 (0.8)	4.9 (1.2)	5.1 (1.1)	4.5 (1)	4.7 (1.3)	4.9 (1.2)	5.1 (0.8)	5 (1.1)	**0.012**	**<0.05**
The regulation of the advanced practice of nurses should include aspects such as the request for diagnostic tests, the formulation of clinical diagnoses and the autonomous prescription within the scope of knowledge.	5.3 (0.9)	4.8 (1.1)	4.6 (1.4)	5.1 (1.1)	4.5 (1.1)	5 (1.2)	5.4 (0.7)	5.5 (0.9)	5 (1.1)	**5,39E−10**	**<0.05**
Advanced practice nurses should receive a recognized financial supplement.	5.5 (0.9)	5.6 (0.9)	5.3 (1)	5.5 (0.8)	5.2 (1)	5.5 (1)	5.5 (1)	5.9 (0.3)	5.5 (0.9)	**0.001**	**<0.05**
It would be necessary to standardize and adapt the training programs aimed at nurses who do advanced practice to be able to respond to complex healthcare needs.	5.6 (0.7)	5.7 (0.5)	5.5 (0.8)	5.8 (0.4)	5.3 (0.8)	5.6 (0.5)	5.7 (0.5)	5.7 (0.4)	5.6 (0.7)	**0.041**	**<0.05**
Advanced practice nurses should be accredited by a competent body recognized by the health administration.	5.7 (0.6)	5.6 (0.7)	5.5 (0.8)	5.6 (0.6)	5.1 (0.7)	5.5 (1)	5.6 (0.6)	5.7 (0.6)	5.6 (0.7)	**0.036**	**<0.05**

Note: In bold, statistically significant ($p < 0.05$) factors associated with performance of APN activities.
The maximum score value was 6.
*Clinical nurse: APN, nonspecialist care nurse, specialist nurse, resident nurse.
**Core healthcare team: nutritionist, health care assistant, occupational therapist, physiotherapist, and psychologist.
***Multidisciplinary healthcare team: social worker, administrative, and pharmacist.
****Manager: nursing manager, process manager, general manager.
*****Others: emergencies, occupational health, and case manager.

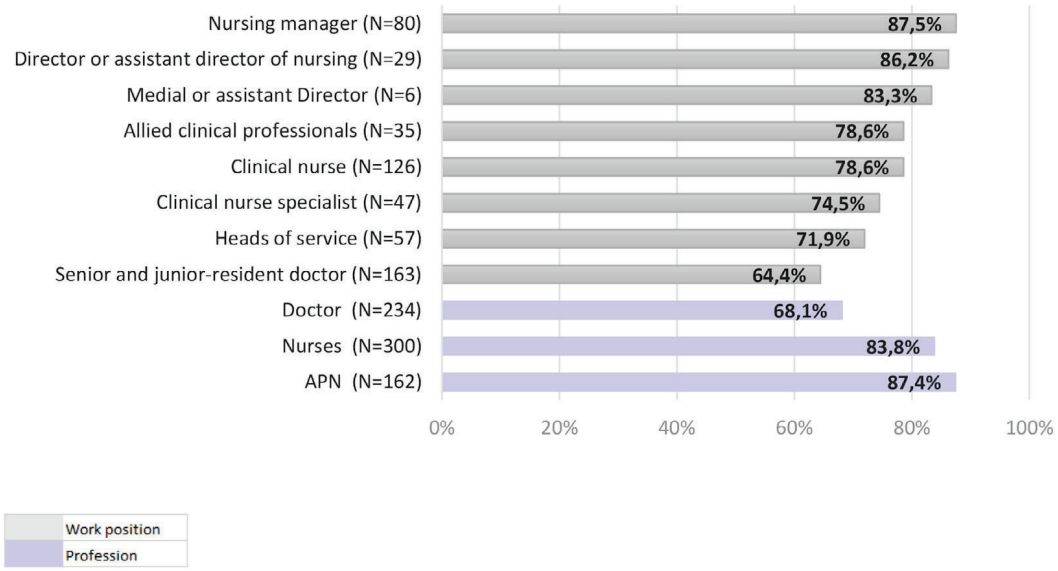

FIGURE 1 The fact that some APNs also perform and interpret diagnostic tests that are routinely performed by other professionals (e.g., ultrasounds) leads to increased efficiency for the health system.

this dimension show significant differences ($p < 0.05$) among job positions. This dimension addresses the need to define roles, responsibilities, and support structures for APNs within the healthcare organization (Supplementary Information S3). There is a consensus (over 90%) that defining the roles of APNs is a priority to clarify their scope of practice and hierarchical dependence. Similarly, there is unanimous agreement that the Department of Health should promote policies encouraging the creation of jobs for APNs.

Finally, concerning the "regulation" dimension, there are statistically significant differences ($p = 0.000192$) in how different job positions view the regulation of APNs. The positions of "head of service or unit" and "medical or nurse director or deputy director" exhibit higher mean scores, suggesting greater agreement that APNs are not legally supported to develop their role fully. Although the positions of "manager" and "medical or nurse director or deputy director" show higher mean scores, indicating stronger agreement that the regulation of APNs should include aspects such as requesting diagnostic tests, formulating clinical diagnoses, and autonomous prescription and that training programs for APNs should be standardized and adapted to respond to complex healthcare needs. They also agree that a competent body recognized by the health administration should accredit APNs.

DISCUSSION

The results of the study reveal valuable insights into the viewpoints of health professionals and APNs regarding various dimensions of the APN role in public hospitals in Catalonia, Spain. The dimensions of "role activities," "leadership," "support," "acknowledgment," and "regulation" appear to be the ones with the most significant differences in views among different job positions. These differences highlight the importance of considering diverse views when implementing and recognizing the role of APNs within the healthcare system.

Results showed that APNs demonstrate clear roles and engage in a variety of role activities, with strong support particularly from managers and medical/nurse directors. The statistically significant differences in role activities among job positions suggest that different roles perceive variations in the clarity and scope of advanced practice nurses' responsibilities. This could reflect differences in views and understanding of the role's contributions across healthcare teams. In addition, different job positions hold varying views on the skillset and capabilities of APNs. These differences could stem from diverse perspectives on the extent to which APNs are equipped to handle complex healthcare challenges and safer care, consistent with previous research (Soh et al., 2021). For example, recent legislation permits APNs to practice independently (Depriest et al., 2020). This does not completely abandon the idea of collaborative work with other professionals, but it grants APNs greater autonomy. Some may argue that collaborative practice regulations are necessary to protect patient safety and quality of care; however, these regulations could hinder healthcare access and quality of some services (Hansen-Turton & Rothman, 2022).

This is consistent with the results of the "development and teamwork" dimension. The absence of significant differences in development and teamwork scores suggests a relatively consistent view of APNs' involvement in collaborative efforts and professional growth opportunities across various roles. This indicates a shared recognition of the importance of teamwork and continuous development. As previous research has shown, in an effective multidisciplinary team, experts come to

rely on each other's expertise and care for each other's safety (Tabern, 2020).

The significant differences in "leadership" views highlight distinct viewpoints among different job positions and professionals regarding the leadership abilities of APNs. Although some roles may acknowledge their leadership qualities, others might have reservations about their leadership roles within healthcare teams. For example, the fact that they perform and interpret diagnostic tests that are usually performed by other professionals leads to increased efficiency in the health system but was not fully agreed upon despite evidence from previous studies (Htay & Whitehead, 2021).

The lack of statistically significant differences in the efficiency dimension suggests that various job positions share similar views on the efficiency-enhancing contributions of APNs. However, slight variations in mean scores could indicate subtle differences in the extent to which these contributions are valued. Significant differences in the support dimension for APN implementation also reveal diverse opinions among job positions regarding the integration of APNs into healthcare systems. Previous studies have shown that there were limitations for APNs that included a lack of support from managers (McKenna et al., 2015) or physicians (Casey et al., 2019) and that their acceptance was related to their ability to build relationships with other professionals and teamwork skills. This can defer from the results in the dimension of development and teamwork and highlights the need for addressing varying levels of support and recognition among different roles.

With regard to "recognition," significant differences in this dimension underscore varying views among job positions regarding the APN's expertise, proposals, and patient relationships. This could reflect differing levels of awareness and appreciation for the impact of APNs on patient care. Kilpatrick et al. (2011) specified that managers play an important role in mobilizing resources, guiding expectations of APN roles in teams and within organizations, and facilitating team processes. These results fail to fully recognize the crucial contribution of multidisciplinary teams and care managers in effectively deploying APNs to enhance the delivery of healthcare services to patients and families. Medical/nurse directors or deputy directors positions support the "acknowledgment" dimension and have the potential to enhance how APNs contributions and expertise are recognized and respected in institutions.

Failing to understand its potential is holding it back, and while there was a broad consensus that the institution's "organizational model" will need to be reengineered and jobs will need to be defined to clarify functions, professional profile, and the APN's hierarchical structure, some participants disagreed with this statement. The statistically significant differences in "regulation" suggest differing viewpoints concerning the necessity of workplace and legal regulations, role definitions, training, and financial recognition for APNs. These differences emphasize the need for a comprehensive and standardized regulatory framework. Having a defined scope of practice as part of their credentialing process is considered best practice (ICN, 2020), and legal support to develop the APN role fully is necessary (ICN, 2020; WHO, 2021).

Limitations

Undoubtedly, the pandemic situation that has surrounded the entire study has influenced the contribution of those who were invited to participate. In addition, it was planned to start data collection at the same time when a COVID wave occurred and possibly hindered the participation of APNs, health professionals, and managers who in other circumstances would have done so.

IMPLICATIONS FOR NURSING AND HEALTH POLICY

This study shows the viewpoints of APNs among health professionals and care managers who have worked with them. It is essential to communicate to the healthcare workforce that advanced practice represents a process of development within the field of nursing to meet the needs of patients and the healthcare system. Results show the need for collaborative work and recognition of the contributions made by each member of multidisciplinary teams, promoting a common understanding to optimize the benefits of APN-led care.

Resembling countries where APNs are not regulated, there is a need to define the model of advanced practice nursing to minimize the great diversity in the recognition and definition of APNs. Health policy should recognize the crucial role of APNs in hospital healthcare teams, necessitating legal recognition and support to empower their autonomy and expertise, ultimately leading to improved patient outcomes.

CONCLUSIONS

Given the great variability that exists in the development of the APN role and the different rhythms of implementation, the study demonstrates the differences in opinion among health professionals and care managers who have worked with APNs in hospitals in Catalonia (Spain).

Although there are shared views in some dimensions, there are notable divergences in others. These variations could arise from differences in roles, responsibilities, professional backgrounds, and views on the role of APNs within healthcare teams. Addressing these variations and fostering a common understanding can contribute to better collaboration and utilization of APNs' potential in delivering patient-centered care and improving healthcare systems.

These results allow for exploring the views about changes in workflows and clinical tasks among professionals, and these also emphasize that the broader health needs are wide enough to allow nursing to grow and be self-sufficient as part of an integrated healthcare workforce. In addition, the study highlights the challenges associated with the development and expansion of new and innovative care roles to address current healthcare challenges, which will necessitate legal support

for the development of APNs' role. Health professionals and care managers who have experience with APNs hold differing views, with some acknowledging the fundamental importance of APNs but cautioning against granting them excessive autonomy. This diversity of these views offers valuable insights into the expectations and hesitations surrounding changes in clinical workflows and responsibilities among healthcare professionals. This expansion is crucial given the broad spectrum of health needs that can be effectively addressed by nurturing the role of nursing. It becomes evident that legal support will be indispensable for the robust development of the APN role, acknowledging its potential contributions to addressing present healthcare challenges effectively.

Lastly, the study sheds light on the diverse views of health professionals and care managers regarding APNs in Catalonia, providing essential insights into potential changes in clinical workflows and emphasizing the significance of nursing's growth and integration within the healthcare system. The findings further underscore the necessity of legal support to ensure the successful development and expansion of the APN role, meeting the evolving healthcare needs of the population.

AUTHOR CONTRIBUTIONS

Study design: Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montse Martín-Baranera, Lena Ferrús Estopà, Darinka Rivera Villalobos. *Data collection*: Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montse Martín-Baranera, Lena Ferrús Estopà, Darinka Rivera Villalobos. *Data analysis*: Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montse Martín-Baranera, Lena Ferrús Estopà, Darinka Rivera Villalobos. *Study supervision*: Lena Ferrús Estopà. *Manuscript writing*: Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montse Martín-Baranera, Lena Ferrús Estopà, Darinka Rivera Villalobos. *Critical revisions for important intellectual content*: Sonia Sevilla Guerra, Adelaida Zabalegui, Montserrat Comellas Oliva, Mercè Estrem Cuesta, Montse Martín-Baranera, Lena Ferrús Estopà, Darinka Rivera Villalobos.

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CONFLICT OF INTEREST STATEMENT

The authors have declared no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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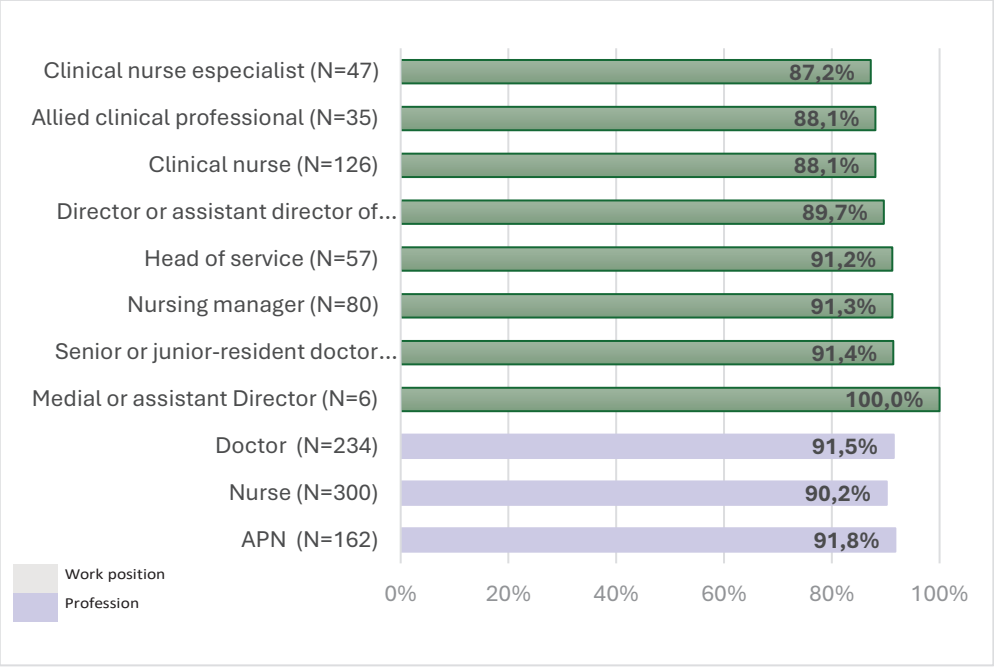
Supplementary material

Supplementary information 1. Distribution of participating hospitals (n=36), professionals (584) and APN (162) by hospital type

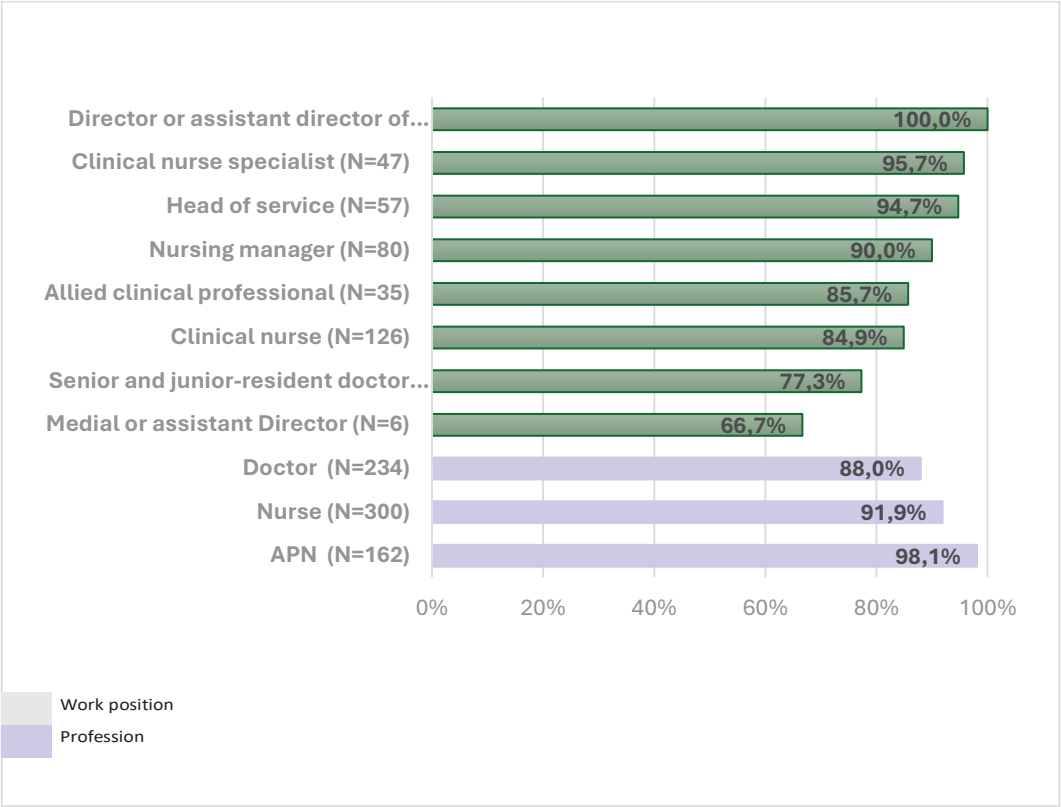
Type of hospital	n health professionals	n APNs	Ratio Professional/ APN
District hospital	110 (18.8)	20 (12.3)	5.5
Provincial hospital	180 (30.8)	60 (37.0)	3
National referral hospital	227 (38.9)	58 (35.8)	3.9
Specialized hospital	62 (10.6)	22 (13.6)	2.8
Private	-	2 (1.2)	-
Others	5 (0.9)	-	-

* Others: Primary health centers and collaborating companies.

Supplementary information 2: Comparison of the percentages of "High degree of agreement" of the APN with the different groupings of professionals and managers for the statement: The acceptance of advanced practice nurses is related to their ability to work in a team by profession and work position



Supplementary information 3: Comparison of the percentages of "High degree of agreement" of the IPA with the different groupings of professionals and managers for the statement: The organizational model of health institutions will have to be rethought to clarify the functions and the professional profile of advanced practice nurses.



V. DISCUSSION

The last 20 years have seen significant progress in cancer control, driven by advances in technology, surgery procedures, medical treatments, new areas of care, such as survivorship, but also by innovation in the delivery and organization of cancer care (154). As more specialists and professionals become involved, the challenges of coordination, management and communication between multiple specialists and levels of care increase. As a result, complexity and the likelihood of fragmented care naturally grow. Consequently, to better address the growing complexity and improve outcomes, health systems have sought innovative ways to deliver high-quality cancer care more effectively and efficiently. These innovations include the development of collaborative approaches, such as implementing specialized care through MDTs for each tumor type, and APN roles (155).

International organizations, healthcare accreditation systems and professional associations, among others, consider MDTs to be the gold standard and a hallmark of good clinical planning and practice in cancer care (15,20,156). Initially their development was strongly driven by the need for a high-quality healthcare workforce specialized in each tumor type, with the goal of improving outcomes and providing patients with a coordinated view of their diagnosis and treatment plan. However, the pivotal role of MDTs has increased markedly over the years. The concept of multidisciplinary team-based care is not only considered fundamental to clinical management but is also seen as the best way to organize the oncologic process and the delivery of cancer care in general. For example, while many countries are concentrating care and implementing structured networks, among other measures, MDTs are at the core of all these efforts (1). In parallel to the development of multidisciplinary teams, APNs have been integrated into oncology care (48). APN roles are diverse in cancer care and include a variety of different interventions such as care coordination, routine follow-ups, symptom management, genetic risk assessment and palliative care, among others (128).

Overall, our results reveal that there has been a positive implementation of MDTs over the years in Catalonia, which have been progressively integrated into clinical practice. This implementation of MDTs has been reflected through the significantly increased coverage trends for preoperative MTMs from the first audit period (67.6 %; 2011-12)

to the last (87.1%; 2019-20) in the first study of this thesis. These findings are in accordance with the recommendations of the Catalan Cancer Plan (28). Also, the results are in line with previous evidence supporting the positive contribution of MTMs in improving clinical outcomes (16,41). In this regard, the first study shows a significant, positive association between MTMs and improved survival in rectal cancer patients. Hence, our results reinforce the critical role of MTMs in the care of cancer patients. Within this multidisciplinary context, our findings reveal that oncology APNs are recognized as a fundamental member of MDTs. In fact, the results of the second study of this thesis support that MDTs have sometimes been the actual leverage for the development of APNs in cancer care in Catalonia. Likewise, in the third study we show that the contribution of APNs to a more integrated, efficient and patient-centered approach was well recognized among MDT members and managers. However, at the same time, our results present a lack of formal recognition and a high variability in clinical practice, job title, and the scope of practice of APNs in the Catalan health system.

The current landscape in the implementation of APNs may be partly related to the lack of quality standards and auditing of the multidisciplinary clinical practice in Spain and Catalonia. In this regard, our results support that attention should also be given to how these teams are functioning to improve quality. For example, the constitution of MDTs, the roles and tasks of healthcare professionals are poorly defined, including those of APNs. This ambiguity can cause confusion, miscommunication between health professionals and patients, resulting in lower performance and poorer care (147,157). Indeed, the findings of the third study of this thesis show a high degree of agreement among participants regarding the importance of clarifying APN roles, as well as their scope of practice and their hierarchical dependence. The implementation of APNs often requires a reallocation of competencies, skills and tasks among other nursing roles and healthcare professionals within and across professional and institutional boundaries (103). In this way, gaps and overlaps are avoided.

Therefore, the findings of the studies that are part of this doctoral thesis provide, on one hand, relevant insights supporting the organizational development of care delivery within a multidisciplinary context. On the other hand, they also support the

importance of considering the critical role of the environment for the optimal implementation of APNs in the healthcare system.

The results of each study were already discussed in the published articles. Hence, this section will focus on the discussion of critical points of the findings and their implications for improving the quality and uptake of these organizational innovations. First, the optimal components at the internal organizational level will be discussed (point 5.1), followed by the relevance and development at the health system level (point 5.2). Furthermore, potential limitations and strengths of the studies will be included (point 5.3).

5.1 Multidisciplinary team meetings: a central component of the process of care

While there is no international consensus and/or single definition of a high-quality MTM performance, there are different quality criteria related to MTMs. Over the last years, studies have shown that there are different factors that can affect negatively or positively the efficiency and quality of the decision-making process in MTMs (158). A recent systematic review has reported numerous elements that may influence, such as good communication, team culture, attendance, disciplinary diversity, and organizational and logistical aspects, among others (159). For example, team composition, working methods and workloads are related to measures of MTM effectiveness and the quality of clinical care (160). Likewise, another systematic review showed that lack of organizational support, low attendance, poor team working, and lack of leadership lead to lack of information and the deterioration of the decision-making process (161). In addition, improving the quality of cancer care also means putting patients at the center of care (25,162). Previous authors have emphasized that patient preferences are rarely considered in the decision-making process (163). Therefore, understanding what impacts the performance of MTMs and how it can be made more efficient is critical to quality improvement (43).

In this regard, a central dimension of an effective and high-quality MTM is the team culture and its dynamics (44). These two aspects include effective communication, respect and trust between members, as well as a positive environment that foster equal participation of all members (44). Nevertheless, the literature reports that, in

practice, MTMs are highly hierarchically structured, which negatively affects the equal participation of all members, and results in only a few predominant participants leading the meeting (158,164). This hierarchy affects the participation of less experienced physicians. For example, this is shown in an interview study that sought to identify facilitators and barriers to conducting high-quality oncological MTM in Denmark (7). The study reported that less experienced physicians felt that highly hierarchical meetings negatively affected their participation and the contribution of their expertise to the meeting. Likewise, this hierarchy often results in the exclusion of allied health professional that may attend the meeting (165), as well as in the contribution of nursing and in bias toward biomedical information (158). This is detrimental to really work as a team, but more importantly, it negatively impacts the treatment planning of patients. In this regard, existing research shows that most of the decisions made are predominantly based on clinical information without taking into account the patient's preferences, which are often not discussed or considered (161,163). Decisions that take into account co-morbid health issues and patient choice are more likely to be implemented, as such decisions are clinically more appropriate and acceptable to patients (158,163,166). The lack of systematic consideration of patients' preferences has been pointed out by several studies as a negative factor for the implementation of the decisions made and for a more holistic view of the patient and their needs (158).

Previous research has related the improvement of teamwork and team dynamics to the presence or the absence of other organizational factors. On the one hand, the importance of effective leadership and the clear delimitation of the roles and tasks of its members have been pointed out. In particular, the clarification of the person chairing the meeting and their responsibilities has been described as fundamental for the optimal organization and functioning of MTMs (44). It is also important that this person has a leadership style that ensures and encourages open discussions, promoting contributions from all members (158), as well as the management of conflicts and conflicting personalities. Moreover, the important role of the chairperson is described in an interview study with members of the MDT in Spain (52). In the study, participants report that the type of leadership exercised by the chair is critical to

promote consensus and equal participation of all attendees (52). Similarly, other studies suggest that this role could be assumed by different team members on a rotating basis, and ideally with a backup (159). Teams with shared leadership are more likely to be effective (160).

On the other hand, both the formal inclusion of APNs as core members of MDTs and the participation of extended members (as needed) in the MTMs have been described as key aspects to improve the consideration of the patient's perspective in the decision-making process (68). Observational studies have shown that APNs may provide information related to patient choices and/or psychosocial factors, also acting as patient advocates during MTMs (167). This is relevant, given that previous literature reviews have reported that only 4% of MTM discussions include holistic patient information (158). In this regard, a study involving more than 1,600 MDT members in the UK revealed a high degree of agreement among participants regarding the central role of APNs as patient advocates and in a more patient-centered care (166). These findings are also consistent with our results that APNs contribute to a more patient-centered approach in the healthcare system.

Lastly, it is important to mention that other organizational and logistics elements have been identified as critical aspects to be considered for an effective MTM. For example, the need of support to have protected time to prepare for and attend MTMs within working hours (52,166). Lack of support at the organizational level to attend MTMs is often described as an obstacle and is recommended as an area for organizational improvement to ensure effective meetings (158). Well-prepared and structured information of the cases (including images and pathology results) to be discussed at MTMs is vital (159). Likewise, the existence of administrative support and good minutes has been emphasized. Additionally, the use of information and communication technologies, such as clinical decision support systems and virtual MTMs also play an important role to take into account in the execution and organization (42). Virtual MTMs, for example, have increased significantly after COVID.

5.2 The role of cancer policies, professional organizations and accreditation systems in promoting best practices

MTMs are matrix structures that result from the collaboration and integration of different clinical departments or specialties that often do not have an organizational entity within hospitals. Therefore, the support of the healthcare system, professional organizations and accreditation systems is fundamental to give them structure and greater formalization. Many countries have reorganized their health services to provide cancer care based on MDTs through the main instrument of cancer policy-making: the National Cancer Control Plan (NCCP). However, the degree of formality of MTMs varies greatly from country to country. For instance, the use of multidisciplinary oncology consultations (MOC) in Belgium is related to the funding that hospitals receive and the registration of patients in the National Cancer Registry. In countries like Spain, the implementation of multidisciplinary care has been supported by clear standards in the NCCP. However, it has also been characterized by the lack of compulsory mechanisms or specific service requirements, even though the law mandates that all hospitals should have MTMs for the most prevalent diseases. The absence of specific standards has not allowed auditing and improving teamwork during the last years. For example, there is no clear definition or evaluation of the professionals who should be part of the MTMs, or whether the decisions taken are implemented, and if not, why not. As described earlier in this section, the quality of the decisions made in MTMs is influenced by several contextual factors, such as communication, structure and organizational aspects. In fact, the influences of some of these factors (e.g. role clarity, accountability, logistical and organizational support) were reflected in our results through the variability observed in the integration of oncology APNs in Catalonia.

Our results support the need to address and prioritize the implementation of policy strategies to promote multidisciplinary care more effectively and consistently. The implementation of policy strategies is essential for improving the care offered to patients and for the further formalization of MDTs in healthcare systems. This has also the potential to foster collaboration across various healthcare disciplines and to better

implement and capitalize on the knowledge and skills of new professional roles within the Catalan healthcare system. In this regard, health systems and stakeholders operating from a macro perspective have used different instruments to stimulate the development of MDTs in cancer care. These different tools include national standards, accreditation requirements or system evaluation tools, which are not mutually exclusive. In a context of centralization of care, where many EU countries, including Spain, are concentrating care on highly complex procedures or diseases, MDTs are seen as the basis. One example of this is the creation of Reference Centers, Services and Units in Spain (168). For example, they have been used to concentrate expertise in, and cases of, sarcoma. Additionally, there are performance standards that the Ministry of Health evaluates every 5 years. One of these standards is multidisciplinary care.

International experiences such as those of Cancer Care Ontario (CCO) in Canada, as well as in Australia or France, can be instrumental and may play a key role in benchmarking actions to set quality standards at the national policy level. For example, the CCO has developed quality standards, tools and templates to guide healthcare professionals and hospitals in implementing and improving multidisciplinary clinical practice in the Canadian healthcare system (169). The CCO guidelines describe specific aspects related to the optimal execution of the meetings, such as a clear definition of the members of the core and extended team (170). Also their roles and responsibilities in MTMs, among multiple other aspects, are defined. In addition, the government requires that all these organizational criteria can be addressed in internal protocols of each hospital at the institutional level (169,170). Moreover, to provide clarity and support for the inclusion of nursing as a core member of MTDs, they developed a strategic document outlining the role of nursing and, in particular, the role of APNs within MDTs and MTMs specifically (171). Similar quality standards have also been developed in Australia, with clear MTM standards in lung, breast and ovarian cancer (172). In France, MTM quality standards and auditing are managed by the regional oncology networks (173).

Likewise, organizations at the international and national level have used the requirements of external accreditation systems to improve the quality of service delivery in cancer care, such as the OECI international accreditation program (20). For instance, OECI considers MDTs as the basis of its model for obtaining accreditation as either a Cancer Center or Comprehensive Cancer Center. Likewise, the accreditation process includes a comprehensive evaluation of quality standards related to multidisciplinary clinical practice. These quality standards include the implementation of specific guidelines for MTMs, ensuring that MTMs cover all tumor types and follow established internal protocols, with the necessary structure and facilities for the meetings. Additionally, there should be a periodic review of these standards, outcomes, procedures and indicators (4). Moreover, the accreditation also assesses compliance with the inclusion of APN roles in the cancer healthcare workforce. The ECCO expert group strongly recommends this type of international accreditation systems to ensure high quality cancer care (24,25)(24).

Also, system evaluation tools have also been developed to improve and evaluate MTMs in different aspects. For example, the MDT-QuIC tool assesses the quality of the decision making process (47). The MDT-OARS tool to assess the performance of MTDs (45). Another tool is the MDT-FIT (Multidisciplinary Team Feedback for Improving Teamwork), which has proven useful in the UK (158). In the Spanish context, the use of the web-based AEMAC (Autoevaluación de Equipos Multidisciplinares de Atención al Cáncer) tool has been promoted (46). The web-based Self-Assessment of Multidisciplinary Cancer Care teams aims to help members of the MDTs, healthcare professionals and managers to self-assess the MTMs within 5 specific dimensions: (1) Preparation and organization of the MTM, (2) MTM decision-making process, (3) Continuity of the care process, (4) Organizational context, and (5) Transversal roles and team cohesion (46).

All these national standards, accreditation systems and system evaluation tools could serve as a benchmark to develop and adapt guidelines for optimal multidisciplinary clinical practice at the local and/or national level. Also to identify best practices,

implement improvements, collect data, as well as to monitor and review MTMs through key performance indicators in the national context. During this process of establishing quality standards, it would be important to assess and/or explore current practices beforehand to identify barriers and local facilitators of optimal multidisciplinary clinical practice and execution of the MTMs. This may help to better adapt and make the design of policy recommendations and implementation more effective to the local context where they operate. Likewise, in line with our findings, the inclusion of the APNs within MDTs should not be taken for granted. Therefore, their perspective must be prioritized within the NCCP to give them a formal seat at the table, foster their contributions, and emphasize the benefits of APN-led care in the field of cancer care. Additionally, our results suggest the need for national or local scientific nursing organizations to play a leadership role in the development of consensus-based policy strategies that can promote regulation. For example, they can promote the design of a nationally agreed model (including specific requirements to work as APN), a competency map, and/or activity analysis tools. These types of policy strategies are important for shaping the core concepts of advanced practice nursing and promoting regulation. On top of that, they provide a common understanding within the nursing community, managers, policy makers or decision-makers at regional or national level.

Lastly, since the first introduction of MTMs, the oncologic landscape has changed markedly. There has been a steady increase in patient volume and complexity (e.g., chronic diseases, multimorbidity, and the need of psychosocial support), which has implied, for example, to organize on the basis of pathological sub-type, as in the case of bone sarcoma. An optimal performance of the MTM and its organization, as described earlier in this section, is not readily apparent. Finding the best way to optimize them, while still offering the best service to patients in this new context, is not simple but important. For instance, it should be considered that higher workloads and very long meetings negatively impact the quality of the discussion (159) where those cases that remain at the end of the list during the meeting are generally less discussed (7).

Therefore, some researchers have proposed some potential strategies for the optimization of the MTMs. In this regard, one option proposed in a population-based study including more than 100.000 cases of patients in the Netherlands (174). It was to divide patients into three categories: (1) High complexity (low volume) cases, who should be discussed by national or regional expert teams; (2) Low complexity (high-volume) cases with a good performance status, to be discussed by local panels with only a few medical specialists; (3) Regular tumor-specific MTMs (174). Other strategies are being considered in the UK (175). Considering that MTM attendance is very strict in the UK, one of the proposals is that all patients should have access to MTMs, but that they should be divided into two groups: (1) those cases in which a full MTM is required, for example due to clinical complexity or psychosocial issues, (2) those cases in which patients do not follow well established (previously defined) clinical pathways and, therefore, do not require a full discussion in an MTM (175). In practice, this would require the establishment of a pre-therapeutic MTM triage to identify patients who do not need a full MTM, which would allow more time to be spent on more complex cases (176).

However, based on the benefits of access to MTMs shown in both this research and others, it is important that optimization measures should not be a potential source of inequality. Indeed, this concern has already been reflected among MDT members in the UK, where a national survey was conducted to analyze the opinion about the potential optimization of MTMs (177). The survey revealed broad support for approaches that enable optimization to focus on more complex cases. However, the majority of the participants were concerned about the potential impact of not fully discussing all patients in terms of the quality and safety of their care (177). Also, the results underscored the idea that optimization strategies may not be possible for all tumor types. For example, the agreement was lower among MDT members for head and neck, colorectal, and pediatric tumors.

Therefore, any of these potential strategies needs to be thoroughly evaluated to tailor the delivery of high-quality cancer care. In this sense, how to improve the effectiveness of MTMs while maintaining quality and safety requires further study. However, quality

measurement must be an integral part of the possible implementation of any of these strategies (including patient outcomes) (162).

5.3 Limitations

The results of the studies that are part of this thesis should be interpreted taking into account possible limitations. In the first study, a team of trained professionals used instruments specifically designed to improve the quality and standardization of the data collected to minimize possible inaccuracies in data collection. Secondly, the analysis did not include approximately 10% of the population undergoing surgery in the private sector. However, our study included nearly 90% of the population from the public healthcare system, making the results representative. Third, no data were collected systematically about the healthcare professionals attending the meetings or of the characteristics of the decisions made. Despite these limitations, unlike other previous population-based studies, we adjusted for important potential confounders such as the surgical technique. This is considered one of the most important factors related to survival in rectal cancer patients undergoing surgery. Moreover, our study represents one of the largest studies analyzing the impact of MTMs in rectal cancer patients.

Regarding the limitations of the second study, the perspectives from other possible stakeholders such as nurse managers, patients, policy makers or other professional groups, which could have complemented the exploration of contextual factors, were not sought. Likewise, as the integration of APNs in Catalonia is currently limited to highly specialized hospital contexts, the findings do not represent contextual factors that could arise from experiences in rural or remote areas. Despite these limitations, the sample of oncology APNs was complete and representative at the time that the study was conducted. In addition, the results highlight the importance of considering the influence of the specific environment on the optimal integration of APNs into the healthcare system.

In the third study, the main limitation was the pandemic context surrounding the study, which limited participation in the study. Despite this, the sample was

representative and provides valuable insights into different perspectives regarding APNs in eight crucial dimensions.

5.4. Implications for health policy

In the light of the findings that are part of this thesis, it would be important to consider further formalization of multidisciplinary team meetings and advanced practice nurses in cancer care at the local and national level. For example, by standardizing the minimum quality requirements of the decision-making process in MTMs:

- Detailed definition of the composition of the MDTs: disciplines of the core and extended team, including APN roles among the core team members. It is also important to ensure that MTMs are attended by specialists who know the patient to be discussed.
- Definition of roles and responsibilities of each team member, including the chairperson and those with administrative or logistical support functions.
- Ensure that the necessary infrastructure for the meeting is in place. Including consideration of technology and equipment that may be required for proper discussion and visualization of relevant data for all members.
- Consideration of the organizational aspects necessary for optimal execution of the MTM (e.g. protected time for health professionals to prepare the cases to be discussed).
- Standardized minutes to collect and include all necessary information for discussion. For example, they should consider comorbidities, patient preferences and psychosocial assessment.

Greater formalization of MTMs promotes quality by ensuring minimum requirements for the organization, information and attendance at MTMs. Standardization is also necessary to be able to evaluate the process and outcomes of this service modality. Consequently, auditing can impact access to MTMs.

On the other hand, our results support the need for further formalization and standardization of the APN roles at both the local and national levels. Some measures that could be implemented in pursuit of this regard are:

- Design of a nationally agreed-upon model that defines the basic yet important core concepts of advanced practice nursing, such as the minimum academic qualification for practice at the master's level.
- Establishment of regulatory mechanisms at the health system level, taking into consideration the criteria in the previously mentioned consensus model to facilitate organic progress.
- Demonstrate the impact of APNs on health outcomes in the oncology setting at the local or national level. This would better support their integration, as well as long-term sustainability.
- Development of local networks and/or working groups in the field of advanced practice nursing to promote strategic collaboration and networking among APNs.
- Development of scientific nursing associations in the field of advanced practice nursing, which can take an effective leadership role and advocate for specific regulation. Likewise, it is recommended that these associations work in close cooperation with researchers, nurse stakeholders, health workforce planners and relevant ministries (e.g. finance and education) (117).
- Systematic efforts are needed for continuous monitoring and comprehensive understanding of the factors that hinder or facilitate APN implementation at local level in different settings including cancer care. This could allow for better addressing implementation challenges and generate strategies adapted to local needs.

Lastly, the implementation of MDTs and APNs are evidence-based innovations that have demonstrated great benefits in the delivery of services in cancer care. To foster their adoption, the literature suggests that health financing reforms could serve as powerful policy instruments to incentivize and facilitate their uptake among multiple providers (112).

5.5 Future Research

Based on the results of this research, future areas of analysis include:

- An analysis of the barriers and facilitators of multidisciplinary team meetings to better adapt the implementation and design of policy recommendations.
- Optimization of multidisciplinary team meetings to better accommodate the increasing number of patients and challenges in the delivery of high-quality cancer care.
- Evaluate the impact of APN-led care on health outcomes in cancer care. This may facilitate long-term sustainability, recognition, regulation and satisfaction of advanced practice nurses.

VI. CONCLUSIONS

1. The multidisciplinary management of rectal cancer patients has increased significantly over time in Catalonia.

2. A more advanced tumor stage and recent audit periods in rectal cancer patients are factors associated with higher odds of being discussed in the preoperative multidisciplinary team meetings.

3. Preoperative multidisciplinary team meetings are associated with improved survival of patients with rectal cancer in Catalonia.

4. Contextual factors around clinical practice, institutional structures, and professional networks are crucial determinants for adequately integrating advanced practice nurse roles into the health workforce in Catalonia.

5. Factors related to the external environment, including scientific societies and a standardized national advanced practice nurse model might play a role in the optimal implementation of advanced practice nurse roles.

6. Successful advanced practice nurse implementation requires the explicit consideration of contextual factors that may impede and/or facilitate the organization, implementation process and performance of clinical practice.

7. It is perceived that advanced practice nurses contribute to improving continuity of care between levels and processes, as well as promoting a more patient-centered approach within the Catalan Health System.

8. It is necessary to clarify and provide a common understanding of the professional profile, scope of practice and hierarchical dependence of the advanced practice nurses within public hospitals in Catalonia.

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