BMC Health Services Research

RESEARCH

Open Access

Facilitators, barriers, and recommendations for the implementation of a digital-based case management program: the perspective of Portuguese stakeholders

Marta Ferreira[1*], Joana Seringa[2†] and Rui Santana[2†]

Abstract

Background Population aging has led to an increase in chronic conditions, highlighting the need for new healthcare models. Digital tools can increase accessibility and promote universal healthcare coverage. This study aimed to identify facilitators, barriers, and recommendations for implementing a digital-based case management (CM) program.

Methods A qualitative descriptive design was used, employing the eDelphi method to gather insights from stakeholders. The process involved two rounds of data collection and a third round of consensus assessment, with responses processed and analysed in Excel.

Results This study involved 12 experts, mostly females, aged 41–50 years, with diverse health sector experience. Key concerns included digital literacy and insufficient investment in digital infrastructure, while the importance of digital training was emphasised. Consensus was achieved, with over 70% agreement among participants.

Conclusions The findings offer a clear framework for developing a CM program using digital tools, aligning with literature and current projects.

Keywords Case management, Digital tools, Public health, EDelphi, Universal health coverage, Integrated care

Background

Population aging has been increasing in recent decades. The population aged 65 and over has doubled through the Organisation for Economic Co-operation and Development (OECD) countries [1]. The assessment is that it will continue to rise, with considerable impacts on the demographic evolution [2]. By 2030, the number of older people needing care worldwide will increase by 100 million [1]. We live on average ten years longer than our parents' generation and almost two decades longer than our grandparents do [3].

Aging causes older adults to live with potential frailty alongside chronic illnesses, affecting their quality of

†Joana Seringa and Rui Santana contributed equally to this work.

*Correspondence:
Marta Ferreira
martahpferreira@outlook.pt
[1]NOVA National School of Public Health, NOVA University Lisboa, Lisbon, Portugal
[2]Public Health Research Centre, Comprehensive Health Research Center, NOVA National School of Public Health, CHRC, REAL, NOVA University Lisboa, Lisbon, CCAL, Portugal

life throughout their lives and [2] becoming the leading cause of morbidity and mortality [4]. Chronic conditions combine genetic, physiological, environmental and behavioural factors. The main types are cardiovascular, oncological, and chronic respiratory diseases and diabetes [1, 5], which represent a significant disability burden among the general population [1]. They are a growing pandemic worldwide and a public health problem challenging social and economic development [2].

Case management and multimorbidity

Demographic changes are the main drivers for transition processes in healthcare [6], for example care models such as CM. Health systems are overwhelmed and still unequipped to support people managing multiple chronic diseases [7]. The current system is fragmented, with insufficient communication and collaboration [3] requiring a patient-centred integrated approach that is effectively coordinated with the health system, social services, and families and communities [8]. The transition from hospital care (HC) to primary health care (PHC) should use effective care models promoting better coordinated information flow between providers [9].

CM is an integrated care model with a dynamic and collaborative approach that establishes a better link between HC and PHC. CM assesses needs and organises care with individualised care plans, which include patients and family [10, 11].

A care model adapted to patients' needs with chronic diseases, bringing greater coordination to healthcare areas [12] and greater patient and professional satisfaction, with clinical and functional gains [10]. The case manager, a PHC doctor or a nurse, is responsible for the monitoring plan, management of episodes and system interactions [2]. CM is currently a mainstay of models used in PHC for people with multimorbidity [7]. Promotes shorter hospital stays, recovery is assisted remotely, and the decision process is shared between healthcare professionals and patients [2].

CM involves important areas of public health, such as population ageing, accessibility to services, health literacy and patient empowerment. From the perspective of the Sustainable Development Goals, goal 3—Quality Health—more specifically, goal 3.8— "Promoting access to quality essential health services"—is the most aligned with this care model and digital health [13].

Case management and digital health

There are several definitions for digital health technology. Nevertheless, the driving principle is remote health support to overcome geographical barriers. This approach is expected to advance the health of individuals and communities, from disease prevention to diagnosis and treatment, contributing to health education, data analysis and research [14].

Technology has enabled the proactive identification of those most at risk and the creation of digital engagement platforms, empowering self-care and support in managing chronic illness [3]. Information and communication technologies (ICT) can help defragment services, improve information systems, and encourage the remote monitoring of patients [4, 15].

Different telehealth technologies such as telephones, text messages, e-mail contacts on tablets and/or computers, and eHealth mobile applications, could be applied [2], allowing the engagement of health information in monitoring the population's health [16].

A digital interoperable information infrastructure should include all care settings accessible to healthcare providers, integrating PHC, HC and long-term care for an effective and dynamic organisation, as perceived in the CM model. This avoids duplication of efforts [3] and further visits to the hospital [2], reducing healthcare costs.

The importance of these tools in CM was highlighted in public health emergencies as a care strategy, e.g., the SARS-COV2 pandemic, to avoid disruptions in care, which is crucial for remote care [10].

The World Health Assembly Resolution on Digital Health recognised the value of digital technologies in contributing to universal health coverage [14]. Also advised countries and stakeholders to direct efforts towards a consistent eHealth vision aligned with each country's health priorities and resources and create a framework for monitoring and evaluating eHealth [8]. The 2030 Agenda for Sustainable Development highlights that using ICT will make health services and data more accessible to people, enabling sustainable health systems and universal health coverage [8].

Nonetheless, transitions to new practices require changes in behaviour, and it is necessary to add value for the desired change or action [14]. Professional education and training, as well as financial, legal, and operational changes, are needed [16].

There is still little evidence on how to care for individuals with chronic diseases [7] and insufficient information on CM with the assistance of digital tools [17]. To understand the complexities of using digital tools in CM, we should be aware of the motivations, barriers and resistance that can affect their use within CM programs [14].

So, the research question was defined as follows: "What are the possible facilitators, barriers, and recommendations in implementing a CM program based on digital tools?" To answer this question, the main objective was to understand the stakeholders' perspectives on implementing a CM program using digital tools. Specific objectives were underlined, such as understanding the facilitators and barriers to implementing a CM program

using digital tools, identifying the recommendations for referred implementation, and identifying the guidelines for implementing such a program via digital tools.

Methods

There is an increased need for qualitative research in public health. It has demonstrated value and usefulness in developing knowledge [18] and exploring the perspectives of key stakeholders, patients, and healthcare professionals, including case managers and healthcare administrators [10]. This is difficult to describe through correlation indices and other statistical equations [18], thus making the qualitative methodology the most appropriate for the phenomenon under study.

Defined as a classic Delphi, an eDelphi is performed completely online. Convenient, time- and cost-saving, it allows experts to participate regardless of geographic location or time zone, leading to a faster response time and ease in data management [19, 20].

Consensus methods, such as the Delphi method, aim for a general agreement or convergence of opinion around a topic. They are used for problem solving, idea generation, or establishing potential solutions and answers to a question [19]. Additionally, it is often used in complex issues with uncertain, incomplete knowledge and little evidence [19, 21]. It is conducted in clinical care, public health, health promotion, and health education. A consensus is considered the primary outcome of the Delphi study [21], in most studies after two rounds [19, 20]. Consensus definition and operationalisation varies from study to study, depending on the research objectives [19], allowing participants to revise the study's data and ascertain which answers and data are valid [22].

Various measures are used to define consensus. Most research refers to a consensus value, a number or percentage representing agreement [19, 21]. According to previous studies, the percentage of agreement varies widely, although values between 70% and 80% are usually adopted and considered rigorous [20].

To achieve the proposed objectives and answer the research question, a qualitative method with a descriptive study design was used, employing an eDelphi consensus technique. This was the strategy for compiling data to answer the three key elements of this research: facilitating factors, barriers and recommendations of a digital-based CM program.

Concerning the eDelphi method, there are no clear guidelines regarding the definition of the panel members or the size of the panel and how many rounds should be performed [19–21], although this study adapted some guidelines recently published on Delphi methodology [23, 24].

The selected population comprised of a purposive sampling strategy of experts with relevant experience in the field of integrated care who engaged in the implementation of programmes and projects regarding support for caregivers and case management for patients with multimorbidity. The experts were selected on the basis of relevant experience in scientific research and/or having a practical background (e.g., medicine, nursing, managerial, or policy making). The eDelphi method was especially significant in this investigation because the experts selected were geographically distant across several regions of Portugal.

After approval by the Ethics Commission of the NOVA National School of Public Health of NOVA Lisbon University (case number nº 05/2024), an invitation was sent to 20 experts via e-mail. Information on the study and the research team, the collection of data and the Forms survey link was specified in the previously mentioned email.

The first page of the Forms survey was the informed consent form, followed by sociodemographic characterisation of the experts and ten open-ended questions for the first round.

The first round was conducted for a longer period of time so that there were at least 10 to 12 participants. Studies refer to an average of 10 to 20 or more participants for more stable results [19–21].

Personalised follow-ups were available if participants had any questions throughout the study. Reminders were sent to nonrespondents after one week during the rounds, resulting in a total of three reminders. Should there be no answer, no further contacts were made.

The Delphi survey was conducted in two rounds to gather expert opinions on the application of digital tools in case management programs. The first round aimed to explore the potential, advantages, disadvantages, and key factors influencing the use of digital, as well as the recommendations for implementation of these programs.

After analysing the responses from the first round, several areas required further exploration, leading to a second round. A new e-mail was sent to the participants, with the second-round information and a Forms survey link for the three additional questions. Among the 12 participants, nine answered maintaining a representative balance of the expert types who participated in the first round. This round focused on more specific issues, such as digital literacy, interoperability, and essential information for structuring the program.

A third round was implemented for the experts to review the answers and assess consensus. For this phase it was developed a Forms, with thematic analysis of the answers from both rounds, using a Likert scale [19, 20, 25]. The aim of the consensus adopted was a percentage of at least 70% [19, 21, 25], comprising answers of strongly agree and agree [19, 25].

The use of central tendency measures, such as the mean, median and mode, to define consensus is

recommended [20, 21]. Some authors state that the mean is unreliable due to the influence of outliers [20], so for the definition of consensus, only the median and mode were used to verify whether the 70% objective was accomplished.

All 12 participants were invited to access and review the answers in this third round.

The eDelphi was conducted from May 2024 to September 2024. All rounds were completed electronically and anonymously. The participants had no knowledge of who the other participants in the Delphi panel were.

The data from the three rounds were stored in an Excel document, which was used to process the participants' responses. The content analysis was conducted by adapting the guidelines of thematic analysis [26, 27]. It was organised into text segments, which were then grouped into categories and subcategories. The last phase involved the verification and interpretation of the data, confronting it with the research objectives and theoretical framework [18, 26, 27].

Results

A total of 12 experts agreed to participate in this study.

Characterisation of the population

Most of the participants were female ($n=7$). The most representative age group was 41–50 years ($n=7$), followed by 31–40 years ($n=2$) and 51–60 years ($n=2$). There was one participant from the 61–70 years age group. Most professionals were nurses ($n=7$), followed by health administrators ($n=2$) and college professors ($n=2$). One was a doctor.

The workplaces were diverse; some participants worked in healthcare centres ($n=4$), others worked in teaching institutions ($n=3$), and some worked in local health units in primary care ($n=2$). The remaining worked in local health unit in hospital care ($n=1$), in local health unit in the administration council ($n=1$), and central administration ($n=1$). All participants were of Portuguese nationality.

The results are presented on the basis of the number of participants who mentioned the categories and subcategories found in the qualitative data analysis. Some answers did not have all the information requested, or the participants gave several options to the question at hand.

First eDelphi round

The first round was structured with ten questions and open-ended responses. For the first question, all the participants answered affirmatively about the existing potential for implementing digital tools in a CM program.

The second question referred to which tools can be used in different phases of CM: referral, monitoring and evaluation. In the referral phase, participants ($n=3$) mentioned that existing tools are already available in the programs/apps used in the health systems, e.g., "S-Clinico", SIGA (adaptation) and Exchange. Others have suggested the use of AI to predict and evaluate the degree of risk ($n=2$). One participant recommended the use of online questionnaires. For the monitorisation phase, the participants mentioned apps with the possibility of assembling and aggregating information ($n=3$), e.g., the business intelligence (BI) platform, with alerts for a change in the patient's health state. There were also comments ($n=3$) about scales embedded in the programs, with key questions and the definition of a number of registries adapted to each patient. In the evaluation phase, the participants mentioned online questionnaires and forms to create health indicators ($n=3$). Additionally, existing programs that, with the help of AI, can work on indicators, e.g., in result analysis ($n=2$), were mentioned. On the other hand, participants mentioned existing tools that can be used but are not adapted to CM ($n=2$).

Regarding the tools recommended for communicating with patients, participants indicated existing tools: the telephone/cellular phone ($n=5$), the e-mail ($n=4$), the "WhatsApp" and text messages ($n=3$), and video calls/videoconference ($n=2$). The development of communication apps customised to the care provided and to patients was also proposed ($n=2$). Additionally, it was mentioned a program with a questionnaire or forms with intuitive answers ($n=2$). Further mentions of telehealth tools (teleconsultation, telemonitoring) with alerts for swifter communication ($n=2$) were provided.

The next five questions were assembled into a table (Table 1) to aid in the perception of the answers given by the participants. The content analysis revealed that the experts divided some of their perspectives into three elements: patients, health professionals and health systems/health institutions. The categories and subcategories presented have some examples of answers given by the participants.

For the implementation and operationalisation of a CM program, considering the training/education necessary for health professionals, the participants suggested four areas: education and training in the use of technology equipment, digital tools and apps ($n=8$); education in digital communication strategies ($n=4$); training in CM with the use of digital tools ($n=2$); and data management ($n=2$).

For the last question of the first round, guidance necessary to support the implementation of a CM program using digital tools, we found that the answers were divided into two elements: health professionals and health systems/health institutions. They were distributed accordingly in the following table (Table 2).

Table 1 Facilitating factors, barriers and recommendations in implementing a CM program using digital health tools

Theme	Elements	Categories		Subcategories	
Advantages of applying digital tools in a CM program	Patients	Accessibility (*n* = 7)	"Easy accessibility to professionals"; "faster response to patient's requests;""easy accessibility";	Communication (*n* = 2)	"(…)facilitating communication between professionals and patients"
		Proximity to professionals and services (*n* = 6)	"Feeling of support and continuous security on the part of users;" "close and immediate contact without needless travel time, remote monitoring"		
	Health Professionals	Intervention (*n* = 9)	"I consider it important for monitoring and screening situations for more immediate intervention"; "support in the organisation and prioritisation of care"	Interoperability (*n* = 2)	"(…) better support in case management by professionals;" "Greater efficiency in the transmission of information between professionals involved."
	Health System/Health Institutions	Sustainability (*n* = 6)	"(…) likely reduction in response time;""(…) reduction of time and costs. It is a sustainable measure;""Maximise human and material resources."		
		Research (*n* = 2)	"(…) collection and processing of information;""(…) with evaluation and continuous improvement with data collection and processing"		
Disadvantages of applying digital tools in a CM program	Patients	Digital illiteracy (*n* = 5)	"The difficulty in using technology, digital illiteracy"; "The lack of digital literacy"		
		Data protection (*n* = 2)	"The risk of compromising privacy"; "data protection"		
		Dehumanisation of care (*n* = 2)	"Dehumanisation of care"; "the feeling of dehumanisation of care on the part of the patients;"		
	Health Professionals	Access to digital equipment (*n* = 3)	"(…) failure of digital resources.;""(…) the difficulty in the access equipment;"		
		Change patient communication (*n* = 2)	"(…)decreased empathy and the ability to understand patients' needs/wants/expectations"		
	Health System/Health Institutions	Failure of digital resources (*n* = 4)	"Limitation of data storage bases;""(…) conditions related to the speed and accessibility of internet networks;""(…) failure of digital resources."		
Facilitators in implementing a CM program using digital tools	Patients	More proximity (*n* = 4)	"Support for trained informal caregivers (…);""Greater proximity (…)"	Accessibility to health care (*n* = 2)	"Care organisation model adapted to the needs of the person and family, real-time monitoring"
	Health Professionals	Intervention efficiency (*n* = 6)	"The ability to simplify processes (…) it can facilitate professionals' activities;""(…) quick communication and active participation."		
	Health System/Health Institutions	Better health policies (*n* = 3)	"(…) leaders, boards of directors open to new models of care." (…) "promote better health policies/directives of decision-making."	Cost reduction (*n* = 2)	"Facilitating cost management (…)"
				Innovation (*n* = 2)	"Interest in innovation(…);""(…)technological evolution, the use of AI"

Table 1 (continued)

Theme	Elements	Categories		Subcategories	
Barriers to implementing CM program using digital health tools	Patients	Digital illiteracy (*n* = 8)	"(…) the level of digital literacy of patients;""(…) difficulties in using these tools (…);""(…) the absence or insufficient digital literacy (…)"	Acceptance of digital tools (*n* = 3)	"Refusal by the less digitally literate who are the target population of care"; "Patient acceptance (…) and use of technology"
	Health Professionals	Digital illiteracy (*n* = 6)	"Availability of human resources with digital knowledge/literacy;" "Digital illiteracy still exists among both users/patients and professionals (…)"	Acceptance of digital tools (*n* = 2)	"The professionals themselves wanting to implement them"
	Health System/Health Institutions	Inadequate digital resources (*n* = 5)	"Inadequacy of digital tools;""(…) the lack of interoperability of systems that can make the process time-consuming."; "(…) availability of adequate equipment (…)"		
		Decision makers (*n* = 2)	"Boards of directors that are not open to new models of care;""(…) health policies/directives of decision-making bodies not adequate to this care organisation"		
Recommendation/ suggestion for a CM program using digital health tools	Patients	Digital training (*n* = 3)	"Provide close integration regarding digital technologies with patients and families upon admission."; "(…) training of informal caregivers in its use, family involvement in the dissemination of information"		
		Situation Diagnosis (*n* = 3)	"Assess well the needs of the people targeted by the program and ask them what is most important to them."		
	Health Professionals	Digital training (*n* = 6)	"Training professionals for this type of care models and digital support tools.;""Promotion of training for professionals on case management methodology".		
	Health System/Health Institutions	System interoperability (*n* = 5)	"(…)a single program with interoperability between the different programs (.);""(…) provide tools for case management, preferably integrated into the Sclinico system"		
		Assistance from Health management (*n* = 4)	"Decision makers provide the necessary conditions for implementation/execution (…);""Definition of digital health tools to be implemented."	Investment on CM (*n* = 3)	"Rising awareness among boards of directors about these cares models;""(…) financial support for implementing this type of program."

Table 2 Guidance and support in the implementation of a CM program based on digital tools

Theme	Elements	Categories	
Guidance for the implementation of a case management program	Health Professionals	Technical guidance/ training in CM (*n* = 4)	"Guidelines would be needed regarding how to operate the application/ program, inclusion and exclusion criteria, and how to act in the event of an anomaly in the functioning of digital media."
		Good practice guidelines (*n* = 4)	"A manual of best practices for using digital tools in case management.;" "(…) generic guidelines on target patients who can most benefit from these programs, the profile of case managers and instruments that can be used."
	Health System/Health Institutions	Guidance for health management (*n* = 5)	"Specialised management with an interdisciplinary management team (…);" "These programs cannot all be the same. They must be adapted to the localisation and practice (…)""Guidance for health policies, government entities."

Second eDelphi round

The second round was structured into three questions with open-ended answers, with the answers of nine experts.

With various mentions of digital literacy, the participants were asked how digital illiteracy could be minimised, both among patients and health professionals. Most participants mentioned the importance of training for patients and professionals (*n* = 5); others noted the support of family members and/or professionals (*n* = 2). Some participants also indicated the importance of health communication in the context of digital processes (*n* = 4) and in the context of technical support, standardisation, and reorganisation of digital processes (*n* = 2). One participant referred to a national digital literacy program.

With respect to interoperability among professionals and how to promote it, participants suggested the development of an information platform or a system of information and communication ($n = 6$). Others suggested a systems organisation process for information sharing ($n = 3$), and one proposed a single electronic registry for all involved in the patient's care process.

The final question was about the information that should be included in the structure of a CM program on digital tools for patients and for monitoring and evaluation indicators. Most of the answers recommended indicators related to assessing the quality of care ($n = 4$) and healthcare utilisation ($n = 3$). Some referred to individual care plans ($n = 3$) and the development of monitoring and evaluation tools, e.g., defining appropriate scales for CM ($n = 2$). The participants also indicated the use of patient-related experience measures (PREMs), patient-reported outcome measures (PROMs), and other patient satisfaction evaluation tools/questionnaires ($n = 4$).

Consensus evaluation

All 12 participants answered the third-round questionnaire.

Upon review of the participants' data, it became clear that most items reached consensus, with the overall agreement exceeding the previously mentioned 70%. Both the median and mode are 100%.

Consensus can be analysed in the following table (Table 3), where the information regarding the expert's data review was assembled.

Discussion

This study sought to understand the stakeholders' perspectives when a CM program using digital health tools was implemented. Over a two-round process, consensus was reached in most categories. The eDelphi panel provided insight into what the facilitators and barriers might be and identified the recommendations and guidelines for implementing a CM program using digital tools. Contributions for recommendations and suggestions for guidance and training were also identified, alongside some essential points for a structure and which tools might be used at each stage of a CM program using digital tools.

In the first question, the experts added some commentaries, referring to the implementation of digital tools:

> *(…) will largely depend on the digital literacy of users (caregivers and patients), access to hardware, software and internet access.*

Others highlighted that the digital tools in CM are essential and relevant.

> *(…) to help optimise the intervention of professionals in this area.*

The digital tools should be centralised and interconnected within the digital health ecosystem, allowing for better interoperability and intervention for health professionals, as well as information needed in the different stages of CM. To implement these technologies, development of strategies adapted to individuals and professionals are needed, in line with the adjustment of clinical information systems [15]. This will promote better coordination, integration and continuity of care between professionals with opportunities for interoperability and digital data sharing, which are essential in CM [4]. A participant stated the need to regulate nurses, specialists in community nursing, to execute care management functions regarding the CM model. The case manager, who is usually a nurse, accompanies the patient and is in contact with the multidisciplinary team, which allows for the early identification of needs [11].

Facilitators, barriers and recommendations

The advantages and facilitators pointed out by the participants are similar. The experts stated that digital tools will enable more proximity to services and health professionals, becoming beneficial for CM. According to authors, one of the main benefits is rapid access to healthcare, which is becoming an essential instrument towards universal health coverage and the integration of care, especially for chronic diseases [28]. It guarantees, to rural and remote populations [29], equity in access to healthcare [28]. The CareWell program demonstrated that digital tools increased patient empowerment and home support, contributing to better coordination between patients and professionals [30]. Regarding the benefits of digital tools for adequate intervention in CM, an insight study of the ICARE4EU project reported that among professionals using eHealth, the management processes improved (95%), acknowledged that care integration increased (93%), and that the quality of care provided increased (86%). In accordance with the findings of the experts, the same study reported the cost efficiency of digital tools in CM (76%) [4].

The barriers to applying digital tools in a CM program disclosed by experts were identified in a study by the Portuguese Association of Hospital Administrators. Technical infrastructures were identified as the main obstacle, along with problems in broadband coverage or limited internet access and poor telehealth literacy, for both professionals and patients [28]. Another study indicated that patients with support, guidance, and training expressed better relationship with digital tools, increasing their digital literacy [31]. WHO has identified barriers to the implementation of telehealth, such as a lack of funding

Table 3 Consensus– Overview of the results

		Agreement		Neutral	Disagreement		
		Strongly Agree	Agree		Disagree	Strongly disagree	Consensus percentage
Existing potential for applying digital tools in a CM program		83,33%	16,67%				100,00%
Referral, monitoring and evaluation							
Referral	Use of existing Sclinico, SIGA and Exchange tools, e.g.	41,67%	58,33%				100,00%
	AI capability for risk prediction	75,00%	25,00%				100,00%
Monitoring	Information and data aggregation tools, like BI platform	75,00%	25,00%				100,00%
	Use of scales, even those existing in programs	91,67%	8,33%				100,00%
Evaluation	Use of health indicators	83,33%	16,67%				100,00%
	Use existing programs with AI to analyse data	83,33%	16,67%				100,00%
	The tools already exist but are not adapted to CM	25,00%	41,67%	33,33%			66,67%
Recommended tools for patient communication							
Already existing such as telephone/mobile phone, e-mail, WhatsApp, SMS and videoconference		58,33%	41,67%				100,00%
Development of apps targeted and adapted to the user or intuitive questionnaires		66,67%	33,33%				100,00%
Teleconsultation and telemonitoring with alerts		91,67%	8,33%				100,00%
Advantages of applying digital tools in a CM program							
For Patients	Greater accessibility to health services	83,33%	16,67%				100,00%
	Greater proximity to professionals and services	75,00%	25,00%				100,00%
	Better communication	66,67%	33,33%				100,00%
For health professionals	Better intervention	66,67%	16,67%	16,67%			83,34%
	Better interoperability	83,33%	16,67%				100,00%
For Health System/Health Institutions	Greater sustainability	83,33%	16,67%				100,00%
	Promote investigation	75,00%	16,67%	8,33%			91,67%
Disadvantages in applying digital tools in a CM program							
For patients	Digital illiteracy	33,33%	50,00%	8,33%		8,33%	83,33%
	Concerns about data protection	8,33%	83,33%		8,33%		91,66%
	Dehumanisation of care			25,00%	50,00%	25,00%	0,00%
For health professionals	Access to digital equipment	16,67%	50,00%	8,33%	16,67%	8,33%	66,67%
	Change patient communication	25,00%	41,67%		25%	8,33%	66,67%
For Health System/Health Institutions	Failure of digital resources	41,67%	41,67%	8,33%	8,33%		83,34%
Facilitators in applying digital tools in a CM program							
For patients	More proximity	66,67%	33,33%				100,00%
	Accessibility to healthcare	75,00%	25,00%				100,00%
For health professionals	Intervention efficiency	50,00%	33,33%	8,33%	8,33%		83,33%
For Health System/Health Institutions	Better health policies	50,00%	25,00%	25,00%			75,00%
	Cost reduction	58,33%	33,33%	8,33%			91,66%
	Innovation	83,33%	16,67%				100,00%
Barriers to applying digital tools in a CM program							
For patients	Digital illiteracy	41,67%	58,33%				100,00%
	Acceptance of digital tools	41,67%	50,00%	8,33%			91,67%
For health professionals	Digital illiteracy	16,67%	50,00%	8,33%	25,00%		66,67%
	Acceptance of digital tools	25,00%	50,00%	16,67%	8,33%		75,00%
For Health System/Health Institutions	Inadequate digital resources	41,67%	58,33%				100,00%
	Decisions about inadequate health policies in CM	25,00%	75,00%				100,00%

Table 3 (continued)

		Agreement		Neutral	Disagreement		
		Strongly Agree	Agree		Disagree	Strongly disagree	Consensus percentage
Recommendations for applying digital tools in a CM program							
For patients	Digital training	50,00%	50,00%				100,00%
	Situation diagnosis	83,33%	8,33%	8,33%			91,66%
For health professionals	Digital training	83,33%	16,67%				100,00%
For Health System/Health Institutions	System interoperability	83,33%	16,67%				100,00%
	Assistance from health management	91,67%	8,33%				100,00%
	Investment in CM	83,33%	16,67%				100,00%
Necessary training for professionals							
Education and training concerning the use of technology equipment, digital tools and apps		75,00%	25,00%				100,00%
Education in digital communication strategies		83,33%	16,67%				100,00%
Training in CM with digital tools		83,33%	16,67%				100,00%
Data management		75,00%	25,00%				100,00%
Support for the implementation of a case management program							
For health professionals	Technical guidance/training in CM	83,33%	16,67%				100,00%
	Good practice guidelines	83,33%	16,67%				100,00%
For Health System/Health Institutions	Guidance for health management	83,33%	16,67%				100,00%
Suggestions for minimising digital illiteracy							
For patients	Patient training	50,00%	50,00%				100,00%
	Support of family members and/or professionals	75,00%	25,00%				100,00%
	Health communication to disclose digital processes	75,00%	25,00%				100,00%
For health professionals	Training for health professionals	75,00%	25,00%				100,00%
	Technical support, standardisation and reorganisation of digital processes	100,00%					100,00%
	National program in digital literacy	66,67%	25,00%	8,33%			91,67%
How to promote interoperability and communication among professionals							
Development of an information platform or a system of information and communication		50,00%	50,00%				100,00%
Systems process and organisation for information sharing		75,00%	25,00%				100,00%
Single electronic registry		58,33%	33,33%	8,33%			91,66%
Information that should be included in the structure of a CM program based on digital tools							
Indicators related to the assessment of quality of care		91,67%	8,33%				100,00%
Healthcare utilisation indicators		100,00%					100,00%
Use of the individual care plan		91,67%	8,33%				100,00%
Monitoring and evaluation tools (e.g., defining appropriate scales for CM)		100,00%					100,00%
Use of PREM and PROM, and other patient satisfaction evaluation tools/questionnaires		91,67%	8,33%				100,00%

to develop and support telehealth programmes; deficient infrastructure, such as equipment and/or connectivity; and a lack of legislation/regulations in telehealth programmes. Furthermore, health institutions are not aligned with this transformation because of inadequate decision making in this type of care organisation [29]. Another issue is non-investment in digital resources, which hampers information exchange and communication [5].

For recommendations and suggestions, the experts indicated the importance of digital training for both patients and professionals. The ICARE4EU project recommended an educational program, "eHealth Education," to provide patients with the necessary digital health

literacy skills and promote training opportunities to family, caregivers and health professionals [3, 31]. Regarding systems interoperability, studies defend that tools should be implemented within the ecology of existing systems [32], an appropriate design methodology contributing to interoperability [6].

Guidelines for the structure of a CM program using digital tools

The participants contributed ideas to the structured design of a CM program.

For the three phases of a CM program, the suggestions were diverse. From already existing tools available in the programs/apps used in health systems to AI's help in predicting and evaluating the degree of risk. Furthermore, the utilisation of AI to extract indicators for result analysis is suggested, as it processes and analyses large amounts of data more efficiently and identifies patterns with predictive capacity. AI will drive improvements in the care process, from chronic and oncological diseases to risk assessment [28]. A study revealed that Denmark, Israel and the Netherlands are using AI on electronic medical records data for automatic alerts or actions and predictive analytics [33].

The monitorisation phase mentions apps with the possibility of assembling information, e.g., the BI platform. Several projects have been documented using a BI platform. One is the development of an analytical resolution of databases for hospital morbidity, which is also used to monitor surgical lists and hospital occupation estimates. Another project using the BI platform is an information hub, aggregating data from existing health databases, e.g., production, pharmacy, and clinical management, assembling more than 500 health indicators [34]. These projects show the applicability of this tool in assembling the information health monitorisation indicators needed for this phase of CM.

In the evaluation phase, it was suggested that indicators from existing programs be extracted for result analysis with the help of AI. According to one study, AI/machine learning is operational in eight countries to find and extract relevant data to assist in clinical decision-making, support administrative processes or even manage workflow [33]. From another perspective, the development of a unique health registry for all professionals involved in CM was suggested. In line with this, the Unique Clinical Process project, developed by a Portuguese regional health system, is a tool that will allow complementarity and integration of the public, private and social sectors in the provision of healthcare for health professionals [35]. On the other hand, Norway developed a national document-sharing infrastructure for eHealth documents across organisations. In the future, it will expand, providing access to data for health providers and patients [33], demonstrating that this integration for clinical and data analysis is helpful for prevention, monitoring, and treatment purposes [36].

With respect to patient communication, the most suggested tools were the telephone/cellular phone, e-mail, "WhatsApp," text messages and video calls. A study reported that in Denmark and Finland, e-mail for consultations has been mandatory since 2009. Communication via e-mail between doctors and patients is a routine part of healthcare [36]. Other studies reported that patients appreciated having multiple methods of contacting health providers, such as e-mail access [7].

Support and guidance in implementing CM program using digital tools

The support for the structure of the CM program based on digital tools indicated by the experts can also be used in the previously mentioned phase of the CM program. Experts reported that the information to be included should be an assessment of the quality of care and healthcare utilisation indicators. There are also indications for the use of PREM and PROM. Studies have shown that patient-reported outcomes are important measures of effectiveness for multimorbidity in CM programs [28], evaluating patient experience and/or information about health status and the perspective of quality of life [37].

On the subject of guidance, the importance of technical training in CM digital tools and good practice guidelines was underlined by experts. A study revealed that evidence-based telehealth-assisted practical guidelines and manuals for nurses and healthcare providers are needed to improve practices [17]. Another study revealed a set of steps for CM programs based on digital tools with more specific practical points, such as digital guidelines and intervention planning, for better operational application and implementation of CM programs [10].

The need for training and education to implement and operationalise a CM program, such as training in the use of new technologies and/or digital tools for health professionals, was emphasised. Some authors emphasised that case managers should have prior training [38, 39]. A scoping review revealed that efforts to improve nurses' CMs' technology-related skills are recommended [17]. Another consideration is the topic's inclusion in the curriculum of health courses [40].

With respect to interoperability among professionals, most participants suggested the development of an information platform or a system of information and communication to promote greater interoperability. In England, there is an information sharing app (STREAMS) available to teams that manage health surveillance, e.g., doctors and nurses, to monitor patients' health status [2]. The NOMHAD eHealth system is specifically designed for the care of patients with multimorbidity. It has an

internet interface for physicians and nurses and an app for patients [41]. In terms of interoperability, a Portuguese CM program developed an application with computer alerts for the health team [42].

Highlights from the consensus

Consensus was reached for most items above 70%, although some items did not generate consensus, such as in the evaluation phase of a CM program, the reference to existing tools that can be used but are not adapted to CM, with a rate of agreement below the designated threshold, suggesting that most participants believe that there are already existing digital tools that can be adapted to the CM program.

Another disagreement was in the category of the disadvantage of applying digital tools to a CM program. The item dehumanisation of care did not achieve any agreement. In contrast, the research revealed that patients and professionals feared that the patient–nurse relationship could become depersonalised [32]. There was also a fear of condescending and impersonalised communication [29] and that technology would replace in-person contact [5]. For health professionals, experts disagreed on access to equipment and changes in communication with patients, not reaching the designated agreement rate. However, studies have shown that communication can be hampered by limited access to electronic health records or patient portals. Confidence regarding how to use digital tools would also hinder interaction with patients [5], and health professionals fear that it will change their approach towards patients [32].

The last item that did not reach an agreement was in the category of barriers, more precisely, for health professionals, being in disaccord that professional digital illiteracy could be considered a barrier. A study from the Portuguese Association of Hospital Administrators mentioned above revealed that poor telehealth literacy [28] and a lack of interest in learning or change [29] are considered barriers for professionals.

Although some of the findings may have been discussed previously in the literature, this study provides significant contributions, particularly in how it addresses the complexities and practicalities of digital case management programs from the perspective of stakeholders. It explores the existing knowledge on digital tools and its applicability to case management and adds value by focusing on the stakeholders' perspectives, something that has often been underexplored in the literature. Also offers a more nuanced understanding of the challenges and opportunities that digital case management programs face, and allows for a more comprehensive approach to improving such programs. The recommendations identify practical solutions that can be adopted by practitioners, policymakers, and developers of digital tools. This aspect of the research is particularly important as it bridges the gap between theoretical knowledge and actionable strategies. Therefore, while some of the findings are extensions of prior knowledge, this study offers a unique contribution for the actionable recommendations it provides, and the specific context of digital tools in case management, which together contribute to advancing the field.

Strengths and limitations

The main strength of this study is the eDelphi method. It permitted swift cooperation from the experts in answering the questionnaires, as they resided in different geographical areas. Regarding the limitations, there might be selection bias concerning the experts approached to participate. Although this study was aimed at a larger and more heterogeneous group, some of them did not accept or ignore the invitation to participate in this study. With a larger sample size, the results could have been more robust. The limited professional diversity may have influenced perspectives on facilitators, barriers, and recommendations for digital case management. Future studies should include a broader range of healthcare professionals for diverse viewpoints. Additionally, the study's specific national context may limit the generalizability of the findings. Further research in different settings could explore how these factors affect the adoption of digital case management tools.

Conclusion

With digital transformation and revolution at our doorsteps, there is concern about digital literacy and the importance of training and education regarding the use of digital tools.

This study showed content that can be used as guidelines for developing a CM program based on digital tools, indicating what might be facilitators of and barriers to its implementation. Additionally, its topics must be considered when implementing digital tools in healthcare for better-adapted interventions and care. More research and studies are needed to consolidate evidence-based knowledge in this area. Studies need to take on the patients' perspective so that a more adapted intervention to their needs is tailored. We recommend, in addition, a large study comprising all local health units so that there can be information more specific to a determined area for adequate guidelines.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-025-12445-x.

Supplementary Material 1

Acknowledgements
Not applicable.

Authors' contributions
All authors contributed equally to this work.

Funding
This research was funded by Fundação para a Ciência e Tecnologia (FCT, Portugal) through national funds to the Associated Laboratory in Translation and Innovation Towards Global Health REAL (LA/P/0117/2020).

Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Study is in compliance and in accordance with the Helsinki Declaration and was approved by the Ethics Commission of the NOVA National School of Public Health, NOVA Lisbon University. Informed consent to participate was obtained from all of the participants in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 2 December 2024 / Accepted: 18 February 2025
Published online: 01 July 2025

References

1. OECD. Health at a Glance 2023 [Internet]. OECD publishing, editor. Paris: OECD. 2023. (Health at a Glance). Available from: https://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2023_7a7afb35-en
2. Ribeiro MJ. Saúde digital: Um sistema de Saúde Para O século XXI. 1ª. Araújo A. editor. Lisboa: Fundação Francisco Manuel dos Santos; 2019.
3. Dias CCC. Pandemia: resiliência do sistema de Saúde. 1ª. Edições Almedina. editor. Coimbra: Edições Almedina; 2021. pp. 32–78.
4. Melchiorre MG, Papa R, Rijken M, van Ginneken E, Hujala A, Barbabella F. eHealth in integrated care programs for people with multimorbidity in Europe: Insights from the ICARE4EU project. Health Policy (New York). 2018;122(1):53–63. [cited 2023 Nov 27]. Available from: https://pubmed.ncbi.nlm.nih.gov/28899575/
5. Fjellså HMH, Husebø AML, Storm M. eHealth in care coordination for older adults living at home: scoping review. J Med Inter Res. 2022;24. JMIR Publications Inc. [cited 2024 Jan 28]. Available from: https://pubmed.ncbi.nlm.nih.gov/36256831/
6. Harst L, Timpel P, Otto L, Richter P, Wollschlaeger B, Winkler K et al. Identifying barriers in telemedicine-supported integrated care research: scoping reviews and qualitative content analysis. J Publ Health (Germany). 2020;28(5):583–94. [cited 2024 Jan 28]. Available from: https://www.researchgate.net/publication/332415463_Identifying_barriers_in_telemedicine-supported_integrated_care_research_scoping_reviews_and_qualitative_content_analysis
7. Moody E, Martin-Misener R, Baxter L, Boulos L, Burge F, Christian E et al. Patient perspectives on primary care for multimorbidity: an integrative review. Health Expect. 2022;25:2614–27. Wiley; [cited 2024 Feb 2]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9700181/
8. World Health Organisation. Global strategy on digital health 2020–2025. World Health Organisation, editor. Geneva; 2021 [cited 2024 Apr 19]. Available from: https://www.who.int/publications/i/item/9789240020924
9. World Health Organisation. WHO global strategy on people-centred and integrated health services Interim Report. 2015. [cited 2023 Dec 10]. Available from: https://www.afro.who.int/sites/default/files/2017-07/who-global-strategy-on-pcihs-main-document_final.pdf
10. Béland S, Dumont-Samson O, Hudon C. Case management and telehealth: a scoping review. Telemed e-Health. 2022;28;11–23. Mary Ann Liebert Inc.; [cited 2023 Nov 28]. Available from: https://pubmed.ncbi.nlm.nih.gov/33847524/
11. Santana RA, Belo A, Gaspar C, Almeida C, Seringa J, Papança M. Handbook de Integração de Cuidados. 1a edição. Coimbra: Edições Almedina; 2021.
12. Lewis RQ, Checkland K, Durand MA, Ling T, Mays N, Roland M et al. Integrated care in England– what can we learn from a decade of national pilot programmes? Int J Integr Care. 2021;21(4). [cited 2024 Jan 28]. https://doi.org/10.5334/ijic.5631
13. BCSD Portugal. Objetivos de Desenvolvimento Sustentável. 2022 [cited 2023 Dec 3]. Available from: https://ods.pt/ods/
14. World Health Organisation. WHO guideline recommendations on digital interventions for health system strengthening. World Health Organisation, editor. Geneva; 2019 [cited 2024 Jan 20]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK541905/
15. Park EJ. Telehealth technology in case/disease management. Lippincott's Case Manage. 2006;11(3):175–82. [cited 2023 Nov 28]. Available from: https://pubmed.ncbi.nlm.nih.gov/16738470/
16. OECD. Digital Health. 2023 [cited 2023 Dec 3]. Available from: https://www.oecd.org/health/health-at-a-glance/
17. Joo JY, Liu MF. A scoping review of telehealth-assisted case management for chronic illnesses. Western J Nurs Res. 2022;44:598–611. SAGE Publications Inc.; [cited 2023 Nov 27]. Available from: https://pubmed.ncbi.nlm.nih.gov/33890848/
18. Néné M, Sequeira C. Investigação Em Enfermagem - Teoria e prática. Lisboa: Lidel-Edições Técnicas; 2022.
19. McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. Int J Clin Pharm. 2016;38:655–62. Springer Netherlands; [cited 2024 Feb 2]. Available from: https://link.springer.com/article/10.1007/s11096-016-0257-x
20. Shang Z. Use of Delphi in health sciences research: a narrative review. Medicine (United States). 2023;102(7): E32829. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9936053/
21. Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: How to decide its appropriateness. World J Methodol. 2021;11(4):116–29. [cited 2023 Dec 12]. Available from: https://pubmed.ncbi.nlm.nih.gov/34322364/
22. Brady SR. Utilising and adapting the Delphi method for use in qualitative research. Int J Qual Methods. 2015;14(5). [cited 2024 Aug 30]. Available from: https://journals.sagepub.com/doi/10.1177/1609406915621381
23. Spranger J, Homberg A, Sonnberger M, Niederberger M. Reporting guidelines for Delphi techniques in health sciences: a methodological review. Zeitschrift fur Evidenz, Fortbildung und Qualitat im Gesundheitswesen. 2022;172:1–11 Elsevier GmbH.
24. Jünger S, Payne SA, Brine J, Radbruch L, Brearley SG, Equator N. Guidance on Conducting and REportingDElphiStudies (CREDES)in palliative care: Recommendations based on a methodological systematic review. 2017. [cited 2024 Sep 30]. Available from: https://www.equator-network.org/reporting-guidelines/credes/
25. Kansal A, Latour JM, See KC, Rai S, Cecconi M, Britto C et al. Interventions to promote cost-effectiveness in adult intensive care units: consensus statement and considerations for best practice from a multidisciplinary and multinational eDelphi study. Crit Care. 2023;27(1). [cited 2024 Aug 29]. https://doi.org/10.1186/s13054-023-04766-2https://ccforum.biomedcentral.com/articles/
26. Byrne D. A worked example of Braun and Clarke's approach to reflexive thematic analysis. Qual Quant. 2022;56(3):1391–412. [cited 2024 Sep 30]. Available from: https://journals.sagepub.com/doi/10.1177/16094069231205789
27. Naeem M, Ozuem W, Howell K, Ranfagni S. A Step-by-step process of thematic analysis to develop a conceptual model in qualitative research. Int J Qual Methods. 2023;22. [cited 2024 Sep 30]. Available from: https://link.springer.com/article/10.1007/s11135-021-01182-y#Sec1
28. Pedrosa A, Magalhães T. Tecnologias e a sua adoção na saúde. In: Edições Almedina, editor. Cuidados de Saúde de Proximidade. 1a. Coimbra; 2021. pp. 59–66.
29. Wilson J, Heinsch M, Betts D, Booth D, Kay-Lambkin F. Barriers and facilitators to the use of e-health by older adults: a scoping review. BMC Public Health. 2021;21(1). [cited 2024 Jan 15]. Available from: https://doi.org/10.1186/s12889-021-11623-whttps://bmcpublichealth.biomedcentral.com/articles/
30. Mateo-Abad M, Fullaondo A, Merino M, Gris S, Marchet F, Avolio F et al. Impact assessment of an innovative integrated care model for older complex patients with multimorbidity: The carewell project. Int J Integr Care.

2020;20(2). [cited 2024 Jan 28]. Available from: https://doi.org/10.5334/ijic.4711
31. Wiwatkunupakarn N, Aramrat C, Pliannuom S, Buawangpong N, Pinyopornpanish K, Nantsupawat N et al. The integration of clinical decision support systems into telemedicine for patients with multimorbidity in primary care settings: scoping review. J Med Inter Res. JMIR Publications Inc.; 2023;25. [cited 2024 Jan 28]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10365574/
32. Öberg U, Orre CJ, Isaksson U, Schimmer R, Larsson H, Hörnsten Å. Swedish primary healthcare nurses' perceptions of using digital eHealth services in support of patient self-management. Scand J Caring Sci. 2018;32(2):961–70. [cited 2024 Jan 28]. Available from: https://www.researchgate.net/publication/320089932_Swedish_primary_healthcare_nurses%27_perceptions_of_using_digital_eHealth_services_in_support_of_patient_self-management
33. Slawomirski L, Haywood P, Cravo T, Hashiguchi O, Steentjes M, Oderkirk J. Progress on implementing and using electronic health record systems: Developments in OECD countries as of 2021. OECD Health Working Papers. 2023;(160). https://doi.org/10.1787/4f4ce846-en
34. Pedrosa A. Business intelligence Na Saúde. In: Edições, Almedina, editors. Transformação digital Na Saúde. 1st ed. Coimbra: Edições Almedina; 2021. pp. 179–87.
35. PAFIC. O SESARAM ganhou o primeiro prémio do Integrated Care Award (ICA). 2023. [cited 2024 Aug 16]. Available from: https://www.pafic.pt/processo-clinico-unico-do-sesaram-distinguido/
36. Melchiorre MG, Papa R, Quattrini S, Lamura G, Barbabella F. Integrated Care Programs for People with Multimorbidity in European Countries: EHealth Adoption in Health Systems. Biomed Res Int. 2020. [cited 2024 Feb 2]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7168691/
37. Lopes H. Valor Em Saúde: uma Nova era Na Avaliação de desempenho. In: Robalo M, editor. Uma Nova Gestão Em serviços de Saúde. 1a. Lisboa: Edições Sílabo; 2024. p. 247–78.
38. Klaehn AK, Jaschke J, Freigang F, Arnold M. Cost-effectiveness of case management: a systematic review. Am J Managed Care. Ascend Media; 2022;28:E271–9. [cited 2024 Mar 19]. Available from: https://www.ajmc.com/view/cost-effectiveness-of-case-management-a-systematic-review
39. Amdie FZ, Woo K. The use of mHealth technology for chronic disease management the challenges and opportunities for practical application. Wounds Int. 2020;11(2):32–8. [cited 2024 Jan 15]. Available from: https://woundsinternational.com/journal-articles/the-use-of-mhealth-technology-for-chronic-disease-management-the-challenges-and-opportunities-for-practical-application/
40. Castro Gomes Braz PG, Silva Carvalho Vila V, Neves HCC. Strategies for case management in transitional care in emergency services: scoping review. Rev Bras Enferm. 2020;73Suppl 5(Suppl 5):e20190506. [cited 2024 Jan 15]. Available from: https://www.scielo.br/j/reben/a/tHQgh8PqLnZxzQ7ZpV9XVps/?lang=en
41. Chacornac M, Faoro A, Texereau J, Billoet C, Hominal S. Performance of an eHealth (NOMHAD) system comprising telemonitoring, telenotification, and telecoaching for patients with multimorbidity: proof-of-concept study. JMIR Form Res. 2022;6(3). [cited 2024 Jan 15]. Available from: https://formative.jmir.org/2022/3/e32205/
42. Belo A. Programa de Gestão de Caso Doentes crónicos com multimorbilidade. In: Edições, Almedina, editors. Cuidados de Saúde de proximidade. 1st ed. Coimbra: EdiçõesAlmedina; 2021. pp. 157–68.

Publisher's Note