Adopt, adapt or abandon: Health care providers' beliefs matter. Using the NASSS framework to analyse the implementation of four technology-supported person-centred care initiatives from the perspectives of health care providers

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Abstract

Background: Technology support and patient-centred care are the new mantra for health care programmes in Western societies. While few argue with the overarching philosophy of patient-centred care nor with the potential of information technologies, there is less agreement on how to make them a reality in everyday clinical practice. In this paper, we investigate how individual health care providers at four innovation arenas in Scandinavia experienced the implementation of technology-supported person-centred care for persons with long-term care needs by using the new analytical framework Nonadoption, Abandonment and challenges to the Scale-Up, Spread, and Sustainability of health and care technologies (NASSS). We also discuss the usability and sensitivity of the NASSS framework for those seeking to plan, implement and evaluate technology-supported health care programmes.

This study is part of an interdisciplinary research and development project called Patients and Professionals in Partnership (2016 - 2020). It originates at one of nine work packages in this project.

Method: The main data consist of ethnographic field observations at the four innovations arenas and 29 interviews with involved health care providers. To ensured continuous updates and status on work at the four innovation arenas, we have also participated in a total of six annual networks meeting arrange by the project.

Results: While the NASSS framework is very useful indeed for identifying and communicating challenges with adoption and spread of technology-supported person-centred- care initiatives, we find it less sensitive towards capturing the dedication, enthusiasm and passion for care transformation that we found among the health care providers in our study. When it comes to technology-supported person-centred care, the point of no return has passed for the involved health care providers. To them, it is already a definite part of the future of healthcare services. How to overcome barriers and obstacles is pragmatically approached.

Conclusion: Increased knowledge about the health care providers and their visions as potential assets for care transformation might be critical for those seeking to plan, implement and evaluate technology-supported health care programmes.

Background

Governments across the Western world, together with private enterprises, health care providers and patient organisations, are emphasising the need for healthcare to be more explicitly centred on the needs of the individual patient, prioritising the philosophy and practise of person-centred care (PCC) as the core of new and effective models of care delivery [1–5]. PCC is particularly acknowledged as a key component of quality healthcare for chronically ill patients [6, 7]. The hallmark of PCC is partnerships between patients and health care providers in order to enhance patients' active, day-to-day involvement in their health [8]. Such interactions do not require face-to-face visits but may be ensured by using computer technologies [9, 10]. In fact, health information technologies are important facilitators for PCC [11, 12]. In

this paper, we investigate how health care providers experienced the implementation of technology-supported PCC for chronically ill patients by using the new analytical framework Nonadoption, Abandonment and challenges to the Scale-Up, Spread, and Sustainability of health and care technologies (NASSS) [13].

The rationale for implementing technology-supported PCC relates to the general development trends of most Western societies, such as demographic changes, growing social and cultural inequalities and greater health expectations. Governments expect an increase in both the absolute number of and proportion of elderly individuals in the population, many with chronic and complex medical conditions, and have invested in technology-supported solutions to meet these societal changes [14, 15]. In Nordic countries, the Danish health authorities' state that the only option is increased digital collaboration [4], while the Norwegian authorities refer to digitalisation as a means of increasing patient involvement and democratisation [5].

While few would argue with the overarching philosophy of PCC, nor with the potential of information technologies, there is less agreement on how to make technology-supported PCC a reality in everyday clinical practice. Researchers argue that there is a significant gap between the enthusiasm, high hopes and expectations of policy makers, managers and IT developers and the challenges of technology implementation in actual practices [16], and they point to the need for new studies of what happens in clinical practices when governments try to modernise healthcare services with the help of information technology. Studies can better inform decisions about health policies, programmes and practices [17] and aid those seeking to design and implement such initiatives to identify and address key challenges [13, 18, 19]. There is both a need to understand how complex practices are made workable and integrated in context-dependant ways [20] and for theorising on challenges and failures to adopt or normalise technology-supported programmes [18]. Even now, seemingly well-functioning technology trials tend to fail final implementation into daily practices, and that failure of technology implementation is often not due to individuals alone [21]. Studies must therefore look into the dynamic interaction between health personnel, patients, the technology in use, team functioning and the economic, governance and regulatory factors in the implementation process [21, 22]. All these factors and more may be facilitators or barriers in implementation processes.

In this paper, we will contribute to the implementation debate by empirically exploring, comparing and theorising the experiences of individual health care providers in four arenas where digital technologies have been implemented to support PCC for persons with long-term needs. The rationale for focussing on the experiences of the involved health care providers is that while policymakers, managers and IT developers may invest in technology-supported PCC, it is up to health service employees to enact it in practice [23], and knowledge about staff acceptance is still limited [24]. We do this by applying the new NASSS framework [13]. We will also discuss the usability and sensitivity of the NASSS framework for those seeking to plan, implement and evaluate technology-supported health care programmes.

Study context

There is little disagreement in Nordic countries that the public should pay for the most important services in education, health and social services [25]. The healthcare services build on a classical Nordic welfare model, combining financing and provision of universally accessible services, mainly within the public sector [26]. The countries also rank high on the OECD list of health spending per capita [27], and the population is generally well-educated with high levels of Internet access [28]. Consequently, Nordic countries are particularly interesting for studying technology-supported PCC initiatives.

This study is part of a research and development project called Patients and Professionals in Partnership (3P) [29]. 3P was funded from 2015 to 2020 through a grant from a cross-regional health research fund owned by the four Norwegian Regional Hospital Trusts (Helseforsk). The purpose of 3P is to answer the urgent call from health institutions, health care providers and health authorities and to radically re-design care delivery for patients with long-term and complex needs. Based on the principles of the chronic care model [30–32], 3P includes four Nordic initiatives that have implemented PCC models, all of which take advantage of new technologies and radical organisational redesign to transform classical, profession-centric healthcare systems towards citizen-centric health delivery systems.

Prior to the 3P project, the four initiatives, which we refer to as innovation arenas, were autonomous PCC initiatives with independent funding and management, following project logic with a launch date for the innovation and an ending date of the project. The arenas are in different health care trusts, three in Norway and one in Denmark. All share the vision of using innovative technology to develop healthcare that is truly citizen-centred; is coordinated, proactive and planned; has one point of contact; uses interdisciplinary teams; and is a learning care system. The aim of 3P is to validate and verify the prerequisites that support a whole healthcare system redesign towards the quadruple aim of improved outcomes, improved care experiences, improved professional experiences and reduced costs [33]. This paper originates at one of nine work packages in the project, the implementation study, and is led by social scientists.

Theoretical approach

The NASSS framework considers seven domains (the illness/condition, the technology, the value proposition, the adopter system, the organisations, the wider context and the interaction between them), and the complexity of each component is essential to predict and evaluate the success of technology-supported healthcare programmes [13]. The framework encourages complex thinking about technological innovations in healthcare, aiming to generate a rich narrative of events unfolding in a real-world setting. It illustrates a variety of challenges across all domains, each classified as either simple (straightforward and predictable with few components), complicated (multiple interacting components or issues) or complex (dynamic, unpredictable, not easily disaggregated into constituent components). It demonstrates how technology programmes characterised by complicatedness prove difficult but not impossible to implement, while those characterised by complexity in multiple NASSS domains rarely, if ever, become mainstreamed.

Using theoretical frameworks can help theorise on, predict and evaluate the success of interventions and processes in healthcare [34], and we use them to capture the heterogeneity of social interactions in a naturalistic rather than experimental way [16]. In this paper, we use NASSS as a theoretical framework to explore the embedding and integration of four technology-supported PCC initiatives from the perspectives of health care providers; concurrently, we use the empirical studies to inform theory development by exploring the usability of the theoretical constructs.

Additionally, the 3P project consists of nine separate work packages and has practised ongoing interaction with the project management team, the key health care providers and the interdisciplinary researcher group. The first and the last author are responsible for the implementation study. As sociologists facilitating interdisciplinary discussions about implementation science, we have explored the applicability and usefulness of NASSS as a framework for engagement and knowledge sharing within an interdisciplinary audience.

Methods

The study design is abductive and explorative, based on an understanding that there is almost inevitably a crucial gap between what is possible to deliver technically and the nuanced, flexible and often unpredictable nature of human activity [16].

Data collection

In the period between 2016 and 2018, we visited each innovation arena at least once. During these field visits, the first and last author stayed in the local towns for 3–5 days to obtain in-depth knowledge about the innovation arena and its wider context. We observed the health care providers in naturalistic settings and explored their working environment, the technologies present, the buildings, the rooms and the room layout. We also investigated the interactions between professionals, departments, institutions and levels of care. In addition, we looked at the local communities and municipalities, the towns, the local infrastructures and the surrounding geographies. The description of the innovation arenas builds on the field visits.

The main data consist of interviews with involved health care providers. The interview guide was semi-structured and informed by both by the preliminary observations and the NASSS framework. We conducted 29 interviews with nurses, physiotherapists, occupational therapists, nutritionists, doctors, logisticians, IT personnel, clinical and administrative managers and local policy makers. Most interviews were individual interviews, but a few were group interviews with two or more participants. A total of 36 heath care providers were interviewed. Most participants where heavily involved in one of the innovation arenas and familiar with the 3P project. To some extent, they were also familiar with our research. We started the interviews by asking them to tell us their own stories about the technology-supported PCC initiative and stressed that they should take their time, that there were no right or wrong answers. Most interviews were between 60 and 90 minutes long and took place, primarily, at the informants' workplaces,

typically a private office or a meeting room at a hospital or municipal care centre. All informants signed an informed consent form.

Throughout the span of the 3P project (2016–2020), we participated in six of the seven network meetings arrange by the project. The four arenas arranged 1–2 meetings each, while the project management was responsible for the kick-off meeting and the end-of-project symposium, scheduled for December 2020. Each meeting lasted for 2–3 days and gathered around 40 participants, consisting of the project managers and the key health care providers at the four innovation arenas, local actors involved in similar technology-supported initiatives, local and national policy makers and the 3P researchers. Some network meetings included site visits. All meetings included lectures, group work and social gatherings. Hence, the network meetings ensured continuous updates and status on work at the four innovations as well as feedback on the preliminary research findings.

This paper originates at one of nine work packages in the 3P project. The 3P project applied ethical approval from the Regional Committee for Medical and Health Research Ethics North, nr.017/1084/REK nord, but ethical approval was not required for this work package. The data-protector officer at the University Hospital of North Norway did approve the study. All methods were carried out in accordance with relevant guidelines and regulations.

Analysis

We recorded and transcribed all interviews. The first and third author initially coded the data inductively. We coded the data from each innovation arena separately. Then we met to discuss the emerging findings via systematic reading and deductive coding informed by our on-site observations and the NASSS framework. After completing data coding for all innovation arenas, we met again to discuss and compare the findings and the applicability of the seven domains across the arenas. Towards the end of the analytical work, we debated the usefulness and sensitivity of the NASSS framework on our existing empirical material.

Results And Discussion

In Norway and Denmark, equal access to high-quality health and care services is a legal right for all citizens. The Nordic health and care services are prevailingly public amenities, tax funded and with low patient imbursement [35]. The services are organised into primary and secondary care. In Norway, nursing homes, general practitioner (GP) offices and home care services are part of primary care, while hospitals fall under secondary care. At the time of this research, the primary care services consisted of 426 self-governing municipalities, while the secondary care services were organised into four independent health trusts and included 24 main hospitals. In Denmark, the primary care services consist primarily of nursing homes and homecare services in 98 self-governing municipalities, while five independent health care trusts are responsible for a total of 66 hospitals and all the GP services in the country.

Innovation arena 1

Innovation arena 1 provides technology-supported PCC to patients with chronic obstructive pulmonary disease (COPD) living in a municipality close to the capital. COPD is a lung condition characterised by breathing difficulties due to damage to the air sacs in the lungs (emphysema) and long-term inflammation of the airways (chronic bronchitis). The innovation consisted of a specific care model developed by the key health care providers. The aim of the model was to enable the highest possible degree of independent, individualised and active living for patients with chronic conditions by providing instant access to relevant health services when needed. The model is visualised as a funnel. It consists of six categories in which the patient, which the model refers to as a citizen, is monitored and assisted virtually or physically, either at home or within the health services depending on his/her current health condition. Each of the six categories represents a definite level of care, and patients move between levels depending on their current conditions. Level 1 is the optimal level for patients, representing mobility and individualised daily living under full self-control. At this level, patients are virtually supported by the response and coordination centre, which is the one point of contact for the patients and is responsible for monitoring each patient for vital COPD indicators. If a patient's condition worsens, he/she can activate the one point of contact to obtain virtual assistance instantly by a nurse or a doctor (e-doctor) (level 2). If virtual assistance is not enough, the patient is moved to level 3. At this level, a professional (typically a nurse) will come to the patient's home and perform different kinds of examinations, including ECG and blood samples, and videoconference with the e-doctor. If the e-doctor decides to intensify the treatment, the patient is moved to level 4, where the person is 'outmitted'. This means that the patient is still at home but receiving intensive online monitoring and treatment. If this is not enough, the e-doctor admits the patient either to the local health clinic (level 5) or to the hospital (level 6).

Innovation arena 2

Innovation arena 2 is part of a research and development project and offers technology-supported PCC for COPD patients in their homes for the first 14 days after hospital discharge. The innovation is a nurse-led telemedicine service, delivering PCC through remote monitoring of vital COPD indicators and frequent videoconferences with COPD patients at home. The virtual care involves nursing, physiotherapy, occupational therapy and nutritionist care. The telemedicine service was placed in a local hospital in a small town and was available for COPD patients living in the local town and in neighbouring municipalities. The hospital is an individual institution organised as part of the health trusts' university hospital, which also managed the innovation arena. The technology-supported PCC model was developed and tested in a previous project at the same hospital. The current project included a randomised controlled trial to evaluate whether the telemedicine service would reduce COPD-related hospital admissions (number and length of hospitalisations) and improve the quality of life for the COPD patients receiving technology-supported PCC at home.

Innovation arena 3

This arena offers technology-supported PCC care to COPD patients living at home. The telemedicine innovation was tailored to COPD patients in acute situations or with worsening chronic conditions who

are living in municipalities within a specific geographic area. The redesign of care involved the establishment of an interdisciplinary team from primary and secondary care with the COPD patient as the core team member.

At the time of our research, the innovation arena was in a start-up phase and had recruited few patients. Nurses at a telemedicine centre located in a municipal nursing home ran the service. They could monitor vital COPD indicators from the centre and communicate virtually with the patients, who used personal tablets as the means of communication from their homes. The innovation was a result of close collaboration between the local university, several of the municipalities in the region, one nursing home and the two hospitals in the region.

Like arena 2, arena 3 originated from a previous technology-supported PCC project. However, the focus was explicitly explorative, aiming to cultivate the previous innovation, expand the telemedicine services geographically, and open the online services for new groups of patients. The main hypothesis was ‘Care over distance (telemedicine) for COPD patients will enhance patient empowerment from inclusion until four weeks after treatment; the tablet will also increase the feeling of security’.

Innovation arena 4

This arena is a collaboration between a university hospital and the healthcare services in a few nearby municipalities. It emphasises the need for interdisciplinary teams and collaboration and includes nurses, physiotherapists, occupational therapists, pharmacists, nutritionists and doctors from municipal and hospital services working as a unified team with the patient, continuously placing emphasis on what is important for the individual patient. The target group was elderly and frail patients with multiple or chronic conditions at risk of acute (re)hospitalisation. The redesign was to coordinate the care for these patients, above all the transference between primary and secondary services. The innovation was patient centeredness and holistic, proactive care, and the services were mobile. Hence, health care was provided in patients’ homes, municipal health care institutions and hospitals. To support PCC, the health care providers had access to both municipal and hospital electronic health records (EHRs), and the arena applied an explorative approach towards patient-facing technologies. The aim of arena 4 was a radical redesign of the current healthcare services, including exploring which technologies were useful in fulfilling the PCC vision.

Domain 1 – The condition

The first NASSS domain addresses the clinical condition, impending comorbidities, and the sociocultural aspects of the condition, exploring if the patients are appropriate candidates for the use of this technology. It recognises that only a fraction of potential end users are assessed by their clinicians as suitable for the technology and that the condition often is considered clinically high risk, unpredictable or atypical (e.g., complicated by comorbidities or sociocultural factors, especially cognitive or health literacy considerations).

In our study, three of the innovation arenas target patients with COPD, while the fourth provides care for elderly and fragile patients with comorbidities. Across the arenas, health care providers agreed that COPD patients with both simple and complex comorbidities were well suited for technology-supported PPC. They argued that the disease often leads to anxiety, insecurity, loss of appetite and inactivity and that technology use was counteractive through easy and frequent accessibility and visual support from health care providers. One asserted that 'it is not morally sound not to take advantage of the possibilities in technology-supported healthcare' (informant 1). This informant argued that increased knowledge about the complexity of a condition and its interdependencies increases the significance of remote monitoring, as distance monitoring provides better assessment of when hospitalization is necessary, when small adjustments in treatment were sufficient or just when talking to the patient was enough. Another said, 'I think it is best suited for patients in early stages of COPD; however, very ill patients need it even more' (informant 2). This informant continued by emphasising, 'each COPD patient, but particularly very sick patients, needs to feel safe and secure and get quick responses from professionals' (informant 2), indicating that technology support could provide safety and security to very sick patients with complex comorbidities.

Contrary to the COPD arenas, in the innovation arena where the condition was comorbidity and frailty, the health care providers problematised technology support for patients with complex conditions. Here, they had tested different tools for digitised patient-provider communication but had not implemented a specific technology yet. Several argued that the frailest patients were too frail to manage this technology's use.

According to NASSS, complex conditions and complexity in an underlying condition are associated with non-adoption, abandonment or limited usefulness of the technologies. Conditions like dementia or multi-morbidity often make a patient unable or unwilling to use the supplied technologies [13, 36]. In our study, the health care providers described COPD on a continuum from easy to severe, and they acknowledged that patients often had additional challenges, such as anxiety, malnutrition, isolation and depression. However, they did not problematise COPD as too complex for technology support at any level of severity. Fragility, on the other hand was described as too complex for technology support. It is interesting to note that the most experienced users when it came to technology support where the once least concerned about the complexity of the condition.

Domain 2 - The technology or technologies

This domain addresses questions about the material and technical features of the technology, the knowledge generated or made visible by technology, the knowledge and support needed to use the technology and the sustainability and supply models.

The technologies used in the three COPD arenas can be defined as freestanding telemedicine solutions, involving iPads and monitoring devices in patients' homes and videoconference systems at nurse-led call centres. The technologies opened a virtual dialogue between the patients and the providers, including medical, nursing, physiotherapy, nutritional and occupational therapy tasks. They did so by sending

biometric data from the patients' homes to the healthcare system and sending advice and instructions or reminders from the healthcare system back to the patients. All the COPD arenas used locally developed software, which allowed easy access to technical expertise and potentially critical, technical issues to be resolved in an ongoing way.

We witnessed complaints or dissatisfaction with the technology at only one arena. Here, health care providers complained about the quality of the videoconferencing technology. One said, 'sometimes you only see part of the patient's head, as the patient doesn't know how to place the iPad properly. There is a range of technical issues. The picture is not clear, or the patient's face appears green. We can't trust it be accurate' (informant 3). At another arena, nurses could control the patient-facing iPads remotely from the call centre, and they emphasised the usefulness of this functionality. One said, 'If the patient is not able to touch the screen of the iPad and the green telephone icon, we are able to oversteer it, so the patients only need to sit down in front of the iPad' (informant 4). Here, they did not complain about any technical challenges. Rather, they described the technology as accurate, trustworthy, and sufficient for shared decision-making and high-quality care. Close monitoring of changing symptoms made medication and adjustment of medication accurate, and video communication made it easy to assess patient needs, including determining if the patient was okay or if he/she needed more intensive care, like hospitalisation.

According to the health care providers, COPD often comprises fluctuating energy and respiration levels. These conditions were moderated by the technology as it allowed increased self-determination and minimised stress related to travels to doctor's appointments. It also minimised stress related to feelings of guilt and shame over having COPD, as COPD is a stigmatised condition, even regarded as self-inflicted, something that could make patients reluctant to see their doctors. Other health care providers highlighted the advantage of seeing and monitoring patients in their everyday environments and not in an institutional context. For example, a therapist said,

Many patients sink back in their chair; this makes it more difficult to breathe. When we can observe them in their own chair and own living room while they are actually doing normal and everyday things, it is easier to give accurate instructions, to help them make adjustment for a better sitting position for breathing or to perform exercises to ease breathing adjusted to their actual environment. (Informant 4)

The technology innovation in arena 4, which was targeting elderly and frail patients with multiple or chronic conditions, was a complex procedure of documenting in two different EHR systems, one for primary care and one for secondary care. At the time of this research, they had not implemented any specific technology for remote monitoring yet. The use of iPads or similar technologies for remote care was optional. The aim was to use commercial, off-the-shelf technologies, and at the time, just a few staff members had tested iPads for remote communication, and only for staff to staff interaction. The iPads had not yet been used for patient-provider interaction. In general, the health care providers were positive about technology and remote care if it was beneficial for PCC. A few described video communications as useful between the nurses visiting the patients' homes and the occupational or physiotherapists at the workplace. Such virtual visits provided the therapists with important knowledge, for example, on potential

obstacles, like thresholds, steep stairways, or narrow bathrooms that would need readjustment, without travelling to the patients' homes.

The NASSS framework equalises technology complexity with non-adoption or limited use [13, 37]. Our data reveal some variation among the arenas when it comes to technology satisfaction. However, it is our understanding that this variation reflects stages of the implementation processes rather than differentiated levels of technical complexity. The arenas in the late or final phases had the most adjusted technologies and the most experienced users. Here, the health care providers had few technical challenges, and none complained about poor quality or complex user interfaces; they had also established better routines for technology deficits than the other arenas. In the arenas in the late phases of implementation, the technologies were straightforward, predictable and simple to use.

Nevertheless, in line with Tolf et al (2020) [38], our study also demonstrates how technology assessments are not solely related to the simplicity, functionality and accuracy of the technology itself; they also enhance assessment of the care provided through technology support. Strongly motivated by providing proper PCC, the health care providers in arena 4 had adopted what they described as a cumbersome and time-consuming procedure of documenting in two different EHR systems.

Domain 3 - Value proposition

The third NASSS domain considers the value of the innovation and for whom it generates value. It questions whether a new technology is worth developing in the first place and includes both the upstream values that follow the supply-side logic of financial markets and investments decisions and the downstream values that follow the demand-side logic of health technology appraisal, reimbursement and value for the patients.

In our study, some of the project leaders and managers expressed concern about the upstream value proposition of the innovation. One said, 'It [the current initiative] is not the only reason to carry out this project. We ought to set up a technical platform that can be of use for initiatives beyond this project to justify the resources' (informant 5). This project leader saw the innovation arena as part of a greater whole and acknowledged the need to make the technology profitable for the investors to achieve adoption, spread and scale-up. Another highlighted the importance of developing economically sustainable technology: 'The technology itself must become economically sustainable. Today it is very expensive, and time consuming to update and maintain the technology. This must be sorted out, otherwise the initiative will fail' (informant 6). These two observations reflect how some of the project leaders saw the upstream value proposition of technology development as critical, emphasising how new technology must possess qualities that allow for commercial trade after the end of the project period. Despite the voiced concerns, only one of the innovation arenas indicated that it had developed an explicit business model, including a planned distribution of reimbursements.

A couple of the health care providers from primary care problematised the potential of increased cost with PCC. They referred to situations where COPD patients were assigned to technology support at home,

after hospitalisation. A few of these patients had not received municipal homecare services previously; consequently, it appeared that the technology-supported PCC increased rather than decreased costs, at least in the short term. At the time of this research, there was no way of knowing if the innovation enrolled new patients and thereby increased costs or if these patients would have been enrolled to homecare services anyway due to the increased severity of their COPD condition.

While a few managers were concerned with the importance of economically sustainable technology, health care providers in general were engaged in downstream values. Some even conveyed scepticisms concerning the ability to render easily recognised economic gains and criticised the ubiquitous focus on business models in healthcare. One asked rhetorically, 'which part of the healthcare services should benefit economically from new e-health innovations?' (informant 7). Another stated, 'When you present at conferences, the first question asked is "What is your business model?"' (informant 8), dejectedly explaining why developing a sustainable business model is challenging. 'Today, municipalities do not get any reimbursement from using e-health technology. The general practitioner can use interdisciplinary reimbursement and the hospitals might save money from reduced stays in hospitals; however, to let a nurse do the job of a doctor, that yields no economic benefit' (informant 8).

Across the four arenas, the true value proposition was improved quality of life for the patients. The health care providers also described technology-supported PCC work as fulfilling and enjoyable for themselves as professionals: 'I observe how the use of the technology contributes to better lives for the patients, which is very fulfilling for me, too' (informant 9). In addition, they described technology-supported PCC as a useful approach to meet the so-called silver tsunami, indicating an increased number of elderly individuals with chronic conditions.

According to NASSS, complexity in the value proposition is associated with limited adoption. It is our understanding that there was a mismatch between the upstream and the downstream value proposition at all four arenas, materialised through emphasising improved quality of life for the patients as the true value proposition of the innovations rather than business models and specific plans for commercial spread of the technology.

Domain 4 - The adopter system (staff)

The fourth NASSS domain is about adoption and continued use of the technology by the patients, the patients' next of kin and the staff. Since our study is about health care providers' experiences, we have explored the staff's adoption or abandonment of technology-supported PCC, including staff engagement with the vision, if they used the technologies or not and if they had concerns about threats to their professional role, scope of practice or identity.

Most of the staff—in fact, all the informants in our study—were positive towards technology-supported PCC. All talked about PCC as something exclusively positive. At one innovation arena, the key initiators were nicknamed 'the Three Musketeers', illustrating their dedication towards the vision and each other. At another arena, the opponents, fighting for the same grants, had sarcastically labelled the initiative 'the

castle in the air' to highlight the idealistic dimension of the innovation. The health care providers embraced technology-supported PCC to such an extent that the authors decided to reread the interview data, explicitly looking for blind spots, nuances or discrepancies in the positive attitudes. Their passion for care transformation also differ from Kadesjö Banck and Bernhardssons study, using the NASSS framework to explore therapists and mangers experiences during a pilot implementation of internet-delivered cognitive behaviour therapy for insomnia in psychiatric health care in Sweden [39] .They report that the key barrier for adoption concerned the adopters of new technology, particularly the therapists and their competing demand leading to low prioritisation of the technological innovation

However, the reread confirmed our initial analysis. Furthermore, it made us aware of the distinction between how the involved staff described their own feelings towards technology-supported PCC and how they described colleagues' and others' attitudes towards the same phenomenon. The latter group was portrayed as far less convinced than the former. To convince others about the significance of PCC compared to traditional care was described as a continuous struggle. It was also a distinction between the health care providers committed to clinical work and those with managerial duties. While the first group, to a larger extent, referred to its own experiences and aims within the innovation arena, the second group was more visionary, referring to 'the acknowledged need for care transformation' and 'the bright future of technology-supported PCC'. To them, adoption was complex and unpredictable by nature. The current innovations were portrayed as pieces of the puzzle of the healthcare services for the future.

Although an overall positive attitude among staff, it is useful to differentiate between the health care providers' visions for PCC and their experiences with technology support. In the arenas at which the technologies were up and running, the staff were exclusively positive about technology support, describing it as physically and emotionally beneficial for the patients. The remote monitoring ensured accurate clinical care, and the one point of contact ensured safety and security. A few even argued that proper PCC involve technology support. The staff at the arenas for which technology support was less developed were also unambiguously positive towards PCC; however, they were a bit more ambiguous towards technology support. While some described it as unethical not to use technology, others emphasised that technology needed to be handled with care. It could and should not replace face-to-face care.

Some of the health care providers described technology-supported PCC as an entirely new way of approaching the patient. One said, 'I had to learn how to do this. I asked my colleagues a lot in the beginning' (informant 10). Being involved in technology-supported PCC projects did not only mean learning new tasks; it also meant that established routines and professional roles were up for revision. One nurse said, 'The best thing is that we have much easier access to the e-doctors than we have to regular doctors; the e-doctors are at hand when we need them' (informant 11). Others emphasised the professional advantages of working interdisciplinarily. One said, 'I like working as a team' (informant 12). However, there were challenges in all the arenas, as one informant emphasised:

To work patient centred, we need truly interdisciplinary teams. We need competent nurses and doctors that can see the whole picture. Health issues, social matters, organisational aspects, and so on. Doctors are often not interested in telehealth solutions. PCC and telehealth require a new approach. You must think like a health minister to see the whole patient and his or her situation; most doctors are not trained to think holistically. (Informant 8)

In addition to non-adoption and abandonment due to usability challenges by staff, the NASSS framework refers to staff concerns about threats to their scope of practice, or to the safety and welfare of the patients, and even fear of job loss. In our study, the staff favoured the vision of technology-supported PCC. Some had even sacrificed full-time positions or worked without payment at times to fulfil the vision. Most argued that technology-supported PCC would benefit the patient, themselves as professionals, the healthcare system and society as a whole. It is our understanding that despite setbacks and struggles with adoption and continued use, the involved staff's commitment to the innovations was solid.

Domain 5 - The organisation(s)

The fifth NASSS domain refers to the capability and readiness of organisations for innovations. It addresses the organisations' capacity to embrace any service-level innovation, the readiness for a specific technology and the interdependencies between organisations.

In all four innovation arenas, the involved organisations had extended expertise with managing and implementing projects. Some had dedicated research and development departments, and two arenas were led by professional project leaders employed in such departments. Consequently, it seemed like the involved organisations were capable and ready for the innovations. However, the health care providers experienced that while the organisations were capable of and ready for innovation projects, they were not ready for long-term changes and the transformation of day-to-day practices: 'It [the innovation] worked very well as a project. When it needed to be adopted as part of daily practise, on the other hand, it became very difficult' (informant 12).

According to the health care providers, challenges with transitioning from a project to normalised care were to a large extent related to a lack of funding. While funding was taken care of and agreed on during the project phase, the demand on cost-benefit analysis increased after this phase. All expressed concern about tight budgets and short-term funding. Some described disputes about resources within the organisation, others financial rigidity or the lack of collaboration between institutions, organisations and levels of care. At three of the innovation arenas, COPD patients received specialist services at home. Hence, they disrupted the established division of care, where local municipalities have operating responsibility for homecare services and regional healthcare trusts are responsible for specialist services. At one of these arenas, the hospital was responsible for the initiative during the project phase and covered its cost though project funding. Some health care providers worried that this funding arrangement was a barrier to adoption and spread. In Norway, home care is usually managed and funded by primary care services in the local municipalities, and the health care providers worried that during the everyday struggle over budgets and resources within the hospital, the management would not prioritise

home care services or services not decreed by law. Several used the concept of ‘silo mentality’ or ‘silo organisation’ when referring to the division of labour and economic responsibility between primary and specialist care. One said,

It is always the same, money talks [...] The development is sad really, because it is not all about money; what about quality of life? For a chronically ill patient, cancer, COPD or heart failure, you name it, just staying at home, that is great! I do acknowledge that it is an economic issue. The effect of the service must be demonstrated to justify the money spent. So, I guess it will depend on the results of the study [the informant refers to an ongoing study in which they measure number of days spent at the hospital and number of re-admissions to the hospital, and compare COPD patients receiving technology-supported PCC at home with COPD patients without PCC]. However, I reckon, for the hospital, the effect must be substantial, to justify paying wages for all the involved professionals. To prove increased quality of life is not enough to keep the service up and running. (Informant 13)

While the health care providers described the involved organisations as capable and ready for handling projects, they were described as less capable of and ready for paying for new technology-supported PCC practices within tight day-to-day budgets. The silo organisation between primary and secondary care was described as badly equipped for cross-institutional and cross-professional technology-supported PCC initiatives, particularly the complex interdependencies within and between departments and institutions related to who should pay for and who should benefit from new services.

Domain 6 - The wider context

This domain relates to the simplicity, complicatedness or complexity of the wider institutional and sociocultural context of the innovation. In our study, it became evident that the current policy strategies and funding models at local, regional, and national levels were simultaneously promoting and impeding the adoption and spread of the innovations. Across the four arenas, health care providers talked about the governmental promotion of e-health and PCC synchronously to uttering concerns about how local, regional and national governing made secure funding of the innovations complicated.

In one arena, the previous mayor and city council had committed to the innovation and contributed financially to the initiative. Everything ran smoothly until a new mayor and a new city council were nominated. For this arena, a new local government meant that the expected funding and municipal support at first became uncertain, then disappeared.

Another arena applied an explicit regional focus for its technology-supported PCC model. It consisted of a telemedicine centre staffed with highly trained COPD nurses delivering technology-supported PCC to patients in their homes, either in the local municipality or in one of the neighbouring municipalities. Here, some of the health care providers described municipal governing as complex and potentially interfering with successful adoption. The region consisted of numerous municipalities with relatively few COPD patients each and was therefore also in short supply of high-quality expertise on COPD care. Hence, this region was assessed as particularly suitable for high-quality COPD care at a distance. Nevertheless,

during implementation, it became evident that for some of the small municipalities in this region, investing in the homecare services was more than providing proper heath care for the citizens; it also meant potential employment within the municipality. Paying a neighbouring municipality for remote COPD care was weighted against local employment in home care, and therefore also the numbers of taxpayers within the municipality. In this region, the advantage and disadvantage of technology support were considered in a wider municipal context. For small municipalities, the cost-benefit analysis for technology-supported PCC included a wider context than the healthcare services.

Some health care providers also talked about how national e-health politics, policy guidelines and procurement projects enabled the adoption and spread of technology-supported innovations. Nordic governments are taking a pivotal role in technology development and implementation, aiming for national, standardised systems accessible for all health care organisations and institutions. Even if there were no national policies for technology-supported PCC at the time of our research, health care providers across the arenas talked about how e-health policies and politics could affect the adoption and spread of their innovations. In one arena, the informants said there was a rivalry between competing telemedicine services; therefore, the choice of vendor on national governmental level could determine the future of the innovation.

As NASSS demonstrate, an organisation's failure to move from a successful demonstration project to a fully mainstreamed service that is widely transferable and persists in the long term does not only relate to the work within the innovation arenas but also to the wider context of the innovations. However, contrary to NASSS, it is our interpretation that despite attitudinal, financial and policy challenges at all the innovation arenas, the staff continues to promote the innovations.

7) The interaction between the domains

While the six domains above can be distinguished analytically, the reality of any technology implementation project is that at an empirical level the domains is inextricably interlinked and dynamically evolving. The seventh domain is about how much scope there is for adapting and co-evolving the technology and the service over time.

In our study, the health care providers across the arenas were eager to co-evolve the innovation. As one of the informants exclaimed, 'there is no way around technology-supported PCC. It is here to stay!' (informant 14). This statement is representative for most of the health care providers in this study. At the same time, we have demonstrated that all the NASSS domains, except the first two, comprise complicated or complex conditions that could alter implementation. It is interesting to note that at present, only one of the four technology-supported PCC initiatives has been adopted into everyday practice; however, in a modified manner, one is abandoned, two continue as new innovation projects and one of these has moved to a new location and health care trust. Still, it does not seem to affect the health care providers' commitment to and belief in technology-supported PCC. On the contrary, it seems like the challenges with implementation and adoption have armoured their vison of PCC. To many, the current project and innovation arena are just one piece in a larger puzzle of care transformation for the future.

Study strengths and limitations

This study is part of the 3P project (2016–2020) consisting of nine separate work packages. 3P has been practising ongoing network meetings with the project management team, the key health care providers and the interdisciplinary researcher group throughout the project period, thus ensuring continuous dialog and feedback on our preliminary findings. Familiarity with the context can be an asset and contribute to deeper discussions in the interviews as well as in the analysis. On the other hand, closeness to the field over time, can also be a limitation, it might have affected the interviews, analysis, and interpretation of the results.

We have used the NASSS framework to analyse the health care providers experiences with technology-supported patient-centred care initiatives. There are a few alternative frameworks that could have been used and that target staff perspectives explicitly e.g., the Normalization Process Theory (NPT). We tested NPT in the early stages of the study and found it less intuitive translated to the interdisciplinary audience in the 3P project.

Conclusion

In our experience, the seven NASSS domains are a feasible analytical framework for systematising, categorising and comparing health care providers' experiences with technology-supported PCC initiatives. The seven domains are comprehensive and easily translated to an interdisciplinary audience, and the framework is useful for throwing light on the levels of complexity and the main challenges for sustained adoption at each of the innovation arenas and identifying key challenges for adoption and spread across the arenas. It is useful to generate a rich and situated narrative of the multiply influences on a complex program, hence the NASSS framework is useful for those seeking to plan, implement and evaluate technology-supported health care programmes.

While the NASSS framework is useful for identifying and communicating challenges with adoption and spread of the four technology-supported PCC initiatives, we find it less sensitive for capturing the dedication, enthusiasm and passion for care transformation that we found among the health care providers in our study. It is our interpretation, when it comes to technology-supported PCC, the point of no return has passed for the key health care providers. To them, technology-supported PCC is already a definite part of future health care services. How to overcome barriers and obstacles and implement it in large scale is pragmatically approached. This study emphasis the need for increased knowledge about the health care providers and their visions as potential assets for care transformation might be critical for those seeking to plan, implement and evaluate technology-supported health or social care programmes. We believe health care providers are essential for care transformation and for the development of new and superior ways of treating patients in the future.

Declarations

Ethics approval and consent to participate

This paper originates at one of nine work packages in the 3P project. The 3P project received ethical approval from the Regional Committee for Medical and Health Research Ethics North, nr.017/1084/REK nord, but ethical approval was not required for this work package. The data-protector officer at the University Hospital of North Norway did approve the study. All informants signed an informed consent form.

Availability of data and materials

The data that support the findings are held by Stein Olav Skrøvseth, Director, Norwegian Centre for E-Health Research, but restrictions apply to their availability. The data were used under license for the current study; thus, they are not publicly available. However, data can be obtained from the authors upon reasonable request and with the permission of the Norwegian Centre for E-Health Research.

Competing interest

The authors have no known conflict of interest to disclose.

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Authors' contribution

KD and LK conceived the paper and carried out all aspects of the data collection. KD and LK conducted the data analysis, KD wrote the first draft of the manuscript, and revisions were made together with GRB and LK. The three authors approved the final version.

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