



Summary

MedTech can play a significant role in patients' health and quality of life. Devices such as scoot mobiles, wheel chairs, personal alarms and medication dispensers are vital for the autonomy and participation of people with impairments. A majority of frail elderly persons would not be able to live independently without their assistive devices. Patients with progressive muscular diseases dedicate private sponsorships to arrange for additional devices such as all-terrain vehicles, special bikes and wheelchair buses. These are illustrations of the importance of technology for patients' daily functioning and life.

In the past decade, new technologies including wearable devices have created an enormous potential to involve patients in care processes too. Miniature devices assist patients with measuring their vital values, improving self-management and freeing their agenda from hospital visits. Medical workers can monitor these values remotely and intervene when necessary. Patient data collected allow for an improved understanding of health processes and proactive diagnostics and interventions in the near future.

However promising, in the reality of Dutch healthcare the potential of medical technologies and devices for coordinated, patient-centred care is not fully exploited yet. Therefore, the Ministry of Health, Welfare and Sports (VWS) asked Ecorys to

explore the conditions for diffusion of MedTech-based, integrated and efficient care models for the benefit of patients.

Diffusion in healthcare is not a linear, mechanical process. It is the result of implementation decisions of healthcare providers. For this study, we developed an analytical framework to identify the main factors that influence providers' decisions to implement technological innovations in Dutch healthcare. We identified ten factors in four domains, based on the Consolidated Framework for Implementation Research and expert knowledge.

An exploration of the current state of play in Dutch healthcare shows that patients and healthcare professionals have a fairly positive attitude towards new technologies but do not perceive them as a reason for immediate action. Various studies of MedTech-based care practices show positive results on health effects. However, they comprise small patient populations, short periods of treatment and lack concise research methodologies. Current payment models do not offer incentives or even discourage the replacement or prevention of care. Providers (and payers) are slow in developing alternative payment systems. Healthcare professionals are reluctant to redesign existing care processes and do not perceive an urgent need to change. The lack of interoperability in existing information systems hampers data sharing between providers. In short,



neither stakeholders nor the healthcare system are well prepared to the new potential which is offered by MedTech.

The analysis of three case studies showed that implementation of efficient, patient-centred care involving MedTech is no easy task. The first case study: the ALS Care Network relies heavily on conventional medical approaches and faces slow implementation of MedTech in care practices. Second, Philadelphia and third, Slingeland/Sensire are examples of providers that implemented MedTech-based practices on a learning-by-doing approach. Philadelphia introduced 24/7 access to screen care as a partial replacement of personal coaching for people with cognitive impairments. Slingeland/Sensire introduced self-measurement of vital values by chronic patients in order to improve self-management. Data are monitored at a remote medical service centre. Healthcare professionals intervene when they observe signals of deterioration.

The reversal of care processes towards patient centeredness, prevention and health proved to be a social, rather than a technological innovation. Implementation was a difficult and expensive process. Charismatic leadership, tension for change and an articulate vision on MedTech-based solutions for care practices were critical factors to achieve change. The organisations all had solid market positions.

The case studies illustrate that current conditions are not supportive for implementation of MedTech-based, efficient care practices. Many barriers have to be overcome, within the provider organisations themselves, as well as in payment conditions and in creating an enabling technical environment.

The results they achieved are promising: a vast majority of patients are willing to engage in the new practices, patient satisfaction is high and health outcomes are improving. Chronic patients suffer less exacerbations and, as a consequence, hospitalisation rates fall. ALS patients get timely interventions to address disease progress. People with cognitive impairments feel more in control of their life. A salient feature in all case studies is that patients feel safer as a result of the connectivity the MedTech-based care practices offer. The care practices implemented by Philadelphia and Slingeland/Sensire improved efficiency of care as well as labour productivity.

Once implemented successfully, healthcare providers scale up the MedTech-based care practices within their firms, to other branches of care and other patient groups. Outside their organisation, they contribute to diffusion by actively sharing their experiences in personal and professional networks, conferences and publications. Additionally, the economies of scale needed for efficient use of their technological infrastructure is an effective incentive for provider-to-provider marketing.



The practical examples set by these innovators are valuable. They demonstrate that MedTech can facilitate patient-centred, high quality care. However, they also reveal that there are many barriers for implementation. In order to speed up diffusion, conditions for implementation should become more supportive for healthcare providers.

We conclude that MedTech offers potential for a fundamental paradigm shift in Dutch healthcare, organising care around patients and involving them actively in their care processes. However, this requires profound social innovations in healthcare practice. Diffusion strategies should focus on tackling barriers and creating attractors for healthcare providers to make patient-centred, MedTech-based practices an attractive option.

Based on the results of this study, we make a number of recommendations to improve diffusion of patient-centred care practices with the help of MedTech:





Introduction

At the basis of this report lies the statement from the Dutch coalition agreement that ‘good healthcare should be available to everyone, in the right place, and at the right time’¹. Medical technologies and devices (MedTech)² can play an important role in enabling this access to healthcare in the right place and time. Therefore, the Ministry of Health, Welfare and Sports (VWS) is preparing a vision on the role of MedTech, that will contribute to their policies and provide clarity to healthcare providers and industry. Ecorys was asked to explore the perspectives for diffusion of MedTech in innovative care delivery models to patients.

Healthcare in the right place

Healthcare and the definitions of ‘health’ and ‘disease’ have changed over the past few decades. The focus has shifted from ‘sickness and care’ to ‘health and behaviour’ and ‘people and society’. When in 1948 the WHO defined health as ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’, infectious diseases were

the main problem. Today, chronic and lifestyle diseases are much more prevalent³. Huber⁴ introduced the concept of ‘positive health’ in which health is no longer defined by ‘the absence of illnesses’ but seen as ‘the ability to adapt and self-manage, in light of the physical, emotional and social challenges of life’. Embracing this definition implies a different role of health professionals and changes in healthcare delivery. The information revolution empowered patients in health decision making. If people themselves play an important role in managing their physical and mental condition in the context of their daily life, the role of professionals shifts toward advisor, counsellor and coach to support their patients. Professionals should coordinate their services. The Institute of Medicine introduced the concept of team-based care, defined as the provision of healthcare services by two or more providers who work collaboratively with patients and their family to accomplish shared goals within and across settings to achieve coordinated, high-quality care⁵.

¹ Taskforce Zorg op de Juiste Plek (2018). De juiste zorg op de juiste plek: Wie durft?

² MDR legislation defines that medical devices comprise every instrument, apparatus, appliance, device, software, tissue or any other article that is used alone or in combination including every attachment and software that is required for its proper functioning, that is especially destined by the manufacturer to be used for diagnostic or therapeutic purposes, to be used for any of the following medical purposes:

- Diagnosis, prevention, monitoring, treatment or relief of diseases;
- Diagnosis, monitoring, treatment, alleviation or compensation of disease, disability or injury;
- Investigation, replacement or modification of an anatomical, physiological or pathological process;

- Control of fertilisation, when the intended effects in or on the body are not based on pharmacological or immunological substances nor by metabolism but may be supported by such substances.

³ <http://www.louisbolck.org/health-nutrition/integrative-medicine-3/new-concept-of-health>

⁴ Huber M, Knottnerus JA, Green L, et al. 2011. How should we define health? BMJ 2011;343:d4163.

⁵ Mitchall P, M Wynia, R Golden et al. 2012. Institute of Medicine. Core Principles and Values of Effective Team-based Health Care. Washington DC.



Other motives urge for changes in healthcare too. Healthcare expenses are increasing. Society is ageing. The availability of qualified staff is decreasing. A Taskforce composed of a wide representation of health professionals recently released a publication⁶ in which they urgently advocate to accelerate the movement towards ‘the right care in the right place’ to achieve better health outcomes and well-being in cost-effective ways. They define Healthcare in the Right Place as:

- Prevention of (more expensive) care;
- Moving the delivery of care (closer to people’s homes); and
- Replacing care (with other forms of care, like e-health).

The role of medical technology

We live in an era of rapid technological innovations. Digitisation, robotics and artificial intelligence have given rise to invasive changes in the way we communicate, our access to information and new devices we use in daily life. It is beyond doubt that technology has a great impact on healthcare. MedTech is relevant in the full care spectrum, from homecare and support to elderly people and chronically ill to high-complex specialised hospital care. It develops at an incredible speed: in the past 20 years, the majority of patent applications in Europe was related to the MedTech sector⁷.

⁶ Taskforce Zorg op de Juiste Plek. 2018. De juiste zorg op de juiste plek: Wie durft?

⁷ The Future of MedTech trend. Feb 2018. <https://www.medtechnews.com/features/the-future-of-medtech-trends/>

⁸ Idem.

New technologies like minimally invasive surgery, laparoscopic diagnostics and portable ECG appliances are widely used in hospital care. New trends like digitalisation, robotisation and miniature devices (wearables) to measure vitals like a person’s pulse, arterial oxygen saturation, heart rate variability, respiratory rates, vascular stiffness and blood pressure⁸ open new perspectives for chronic care and homecare too. High-tech walking aids, exoskeletons, brain-computer interfaces, socio-robots, domotics, digital communication, tele-monitoring and telemedicine are just some examples of MedTech that are expected to contribute to cost-effectiveness and high quality of care and offer a possible solution to labour shortages. Yet, the implementation of these new technologies is slower than anticipated in the Netherlands, as in most other western countries⁹.

In this study, we focus on the use of MedTech for efficient, high-quality care outside the hospital, in local and home-based care settings within the context of publicly financed Dutch healthcare.

Research questions

The Taskforce Healthcare in the Right Place considers the use of MedTech the appropriate way to promote health, achieve

⁹ Nivel. 2013. Technologie in de zorg thuis- nog een wereld te winnen. Ross et al. 2016. Factors that influence the implementation of e-health.



better quality of care and contribute to cost containment. In spite of numerous examples across the Netherlands, adoption and implementation of MedTech to redesign care delivery is not a widespread phenomenon yet. Diffusion of new technologies and medical devices in care practices is below expectations and potential, according to the Taskforce. Following up on the Taskforce, the Ministry of VWS requested Ecorys to answer the following research questions:

1. Taking the report of the Taskforce as a starting point, how can examples of efficient transmural care, labour savings and substitution of care that involve MedTech, be scaled up in the interest of patients?
2. What are necessary conditions to achieve this?
3. What are the reasons why this does not happen now (culture, misunderstandings, lack of cooperation, etc.)?

Research methodology

This study was conducted in the period June - August 2018. The methodology used consisted of four steps:

Firstly, we analysed the concept of technology diffusion in healthcare and constructed an analytical framework with the most relevant factors influencing diffusion, based on (inter)national research literature and expert opinions (chapter 2).

Second, we explored conditions for diffusion of innovations in Dutch healthcare, following the factors of our analytical framework. For this purpose, we conducted a desk study and interviewed resource persons from industry, care providers and Nictiz (chapter 3).

Third, we studied three cases to gain further insight into the dynamics of diffusion of MedTech-based practices. We interviewed care providers, patients and purchasers of care, as well as a potential adopter of the practice and consulted available documentation (chapter 4).

The case studies were selected in consultation with the ministry of VWS and represent the mechanisms to achieve healthcare in the right place as defined by the Taskforce (prevention, replacement and moving of care):

1. ALS Care Network

This Network is an example of the model aspired to combine high quality care and efficient delivery in Dutch healthcare¹⁰: a specialised (academic) centre for complex and highly specialised care, connected to regional care providers for less complex, regular care. We studied this case as an example of prevention of –more expensive – care.

¹⁰ RVZ. 2011. Ziekenhuislandschap 20/20.



2. DigiContact – screen care

The Taskforce mentions the efforts of Philadelphia, a care provider for people with cognitive impairments, as an example of efficient care. The organisation created 24/7 access to screen care for clients with ambulant support and is now applying it to other care practices. This case study represents the second mechanism identified by the Taskforce: replacement of care with other forms of care.

3. In the Picture!

Chronic patients that measure their vital functions at home with devices and validated questionnaires, learn to manage their condition. They share the information with a medical service centre and do not have to go to the hospital for periodic controls. This initiative of Slingeland hospital, Sensire homecare and insurance company Menzis is another practice described by the Taskforce as an example moving the delivery of care to people's homes.

In the fourth and final step, we processed and analysed the information gathered to identify and prioritise drivers and barriers for diffusion of MedTech-based healthcare practices (chapter 5).

In the final chapter, we answer the research questions and make recommendations to promote the use of medical technology and devices for patient-centred care.

An expert panel assisted the research team during consultations on the analytical framework (June) and preliminary analysis of research findings (August). The panel was composed by:

- Drs M Bruijnzeels – director Jan van Es Institute
- Prof Dr B Buurman - Professor Elderly Care – AMC UvA
- Prof Dr M Spreeuwenberg – Lector Zorg op Afstand, Zuyd University of Applied Sciences
- Drs M Timmen – director Vereniging Spierziekten Nederland and member of the Taskforce



Diffusion in Healthcare

Dutch healthcare is a complex, adaptive system. Diffusion of technology and devices in care practices is mainly the result of implementation choices made by healthcare providers. Diffusion strategy should therefore focus on creating enabling conditions for providers to make the desired choices. We elaborated an analytical framework to identify the main factors influencing implementation by providers in the Dutch healthcare system, based on literature and expert knowledge. We used the Consolidated Framework for Implementation Research and identified nine factors in four domains: characteristics of individual health care professionals, inner setting of healthcare organisations, outer setting and characteristics of the intervention.

Diffusion processes in healthcare

The central issue in this study concerns the diffusion of integrated healthcare practices based on MedTech. Diffusion of technology is defined as ‘the spread of the use of the technology across the relevant market in which prospective users (firms) operate’¹¹. The general pattern of diffusion is S-shaped: slow in its initial phase with few users (early adopters), speeding up in the next phase (early majority) and then levelling

off again¹². According to Stoneman, diffusion is essentially a process of change¹³.

The motive for this study is the perceived slow rate of diffusion of MedTech for decentralised healthcare practices. Slow rates of diffusion of technologies in healthcare have been studied before by Scott *et al* (2000) and Plsek *et al* (2001, 2003). Scott identified the need for robust evidence in medical practice and the fact that decisions by healthcare professionals are not purely driven by economic incentives as explanations¹⁴. Plsek *et al*^{15,16} analysed diffusion in healthcare on a system level. They state that the complex, adaptive nature of 21st century healthcare systems must be taken into account to understand the challenges of diffusion. Complex, adaptive systems comprise groups of individual agents that have a certain freedom to act and by their actions, affect the context of other, connected agents. These systems are characterised by diffuse boundaries; relationships play a central role; structures, processes and patterns are intertwined and actions are based on internalised, often implicit mental models.

This makes diffusion processes in healthcare unpredictable and often frustrating according to Plsek¹⁶: “one of the by-products of

¹¹ Serra Sastre, V. 2008. Technology Diffusion in Healthcare. London School of Economics.

¹² Rogers, E. 1983. The diffusion of innovations (3rd ed)

¹³ Stoneman, P and P A David. 2002 Adoption subsidies vs information provision as instruments of technology policy. In: The Economics of Technology Diffusion. P Stoneman (ed) Blackwell Publishers.

¹⁴ Scott. 2000. Economics of general practice. In: Handbook of Health Economics. AJ Culyer (ed) Elsevier Science BV.

¹⁵ Plsek P E. and T Greenhalgh. 2001. The challenge of complexity in health care. In: BMJ, Vol 323, 15 September 2001.

¹⁶ Plsek P E. 2003. Complexity and the adoption of innovation in health care.



the complexity of healthcare organisations is their remarkable resilience in the face of pressure, even when that pressure is for a positive change”. Coercive, linear strategies to achieve change are of little value in such systems. When external actors, with their own agenda, try to push change, the system will react by pushing back and assert its autonomy. It is more helpful to conceive diffusion as the result of adoption and implementation decisions, made by individuals and groups in their specific setting.

The Dutch healthcare systems resembles Plsek’s description of adaptive, complex systems: it comprises large numbers of healthcare provider organisations and professionals that are increasingly interconnected, enjoy considerable degrees of professional and organisational autonomy and have well-developed professional networks. In fact, Dutch government is adopting a diffusion strategy for MedTech-based practices that aims to convince and encourage healthcare providers. So far, focus has been on active information provision concerning new technologies and devices¹⁷ as well as the formulation of ambitious e-health goals¹⁸. The formation of the Taskforce is another impulse to the movement towards healthcare in the right place with the help of MedTech. Simultaneously, the

¹⁷ E.g. by the organisation of e-health weeks in 2017, 2018 and 2019.

¹⁸ <https://www.rijksoverheid.nl/onderwerpen/e-health/overheid-stimuleert-e-health>

¹⁹ Mair et al. 2012 Factors that promote or inhibit the implementation of e-health systems: an explanatory systematic review.

government negotiated cost containment agreements limiting the maximum growth of expenditures per sector (Hoofdlijnen akkoorden). These agreements are instruments that try to push delivery of care in the desired direction, i.e. to primary and homecare. So far, this has proved insufficient to speed up diffusion of MedTech.

Actual diffusion of MedTech-based practices in Dutch healthcare depends on the decision of providers to implement these practices. Thus, strategies to foster diffusion should focus on understanding the factors that drive these decisions.

Factors influencing implementation

Mair¹⁹, Ross²⁰ and Lau²¹ all studied the drivers and barriers for (technological) innovation in healthcare, based on systematic reviews of numerous case studies. The review of Ross, with a focus on e-health, is the most comprehensive and included 44 reviews (analysing hundreds of case studies) published between 2003 and 2014. She finds that results are highly comparable to those of Mair and Lau, and consistent over time, despite the rapid technological developments. They demonstrate that implementation of innovations in healthcare is a complex and multi-level phenomenon²².

²⁰ Ross et al. 2016. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update)

²¹ Lau et al. 2016. Achieving change in primary care – causes of the evidence to practice gap: systematic reviews of reviews.

²² Idem.



The Consolidated Framework for Implementation Research (CFIR) is a framework that integrates insights of different implementation theories and offers an overarching typology to promote the understanding of implementation across multiple contexts²³. Ross synthesised and categorised her findings according to the CFIR. For the purpose of this study, we built on Ross' work to construct our analytical framework including a total of nine factors (see table 1).

Table 1 Analytical framework – factors of influence on implementation of technological innovation

CFIR domain	Factors of influence on implementation	% cited
Characteristics of individuals	Knowledge & beliefs of individual professionals	70%
Inner setting	Compatibility with existing inner setting	66%
	Access to knowledge & information by individuals	55%
	Leadership engagement	23%
	Tension for change	No data
Innovation characteristic	Adaptability to systems in place	43%
	Costs	64%
Outer setting	External policies & incentives	36%
	Patient needs and preferences	11%

*% of reviews studied by Ross that cited this factor as important, either as a facilitator or barrier

²³ Damschroder et al. 2009. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science.

We selected the five most-cited factors in the reviews studied by Ross. In close consultation with our expert panel, we included four more factors for their perceived importance in the Dutch healthcare context: external policies and incentives, tension for change, leadership and patient needs. The framework is presented in Table 1. In the rest of this chapter, we briefly explain each of the nine factors.

Knowledge and beliefs of individual professionals is the factor most frequently found by Ross. The attitude of professionals, either positive or negative, plays an important role in the acceptance or rejection of innovations. Beliefs that an innovation will benefit patients, interest in technology and perceived usefulness of innovations foster positive attitude. Doubts that an innovation can improve patient care, clinical outcomes or the quality of medical practices are motivations behind negative attitudes. Convincing evidence can reduce these doubts. Finally, fear for a loss of autonomy, concerns of liability and patients' privacy and perceived threat of the patient-professional relationship are often mentioned as barriers too.

The *compatibility or fit with the organisation* and existing care processes is the secondly most cited factor. Here, the intertwinement of structure, processes and patterns mentioned by Plsek is at stake. Fear for a disruption of workflows and the



delivery of care and - in its slipstream - established professional roles are frequent barriers for technological interventions²⁴. The use of technological innovations is facilitated when workflow analysis are incorporated during design and implementation and when the innovations improve efficiency of an organisation. *Access to knowledge and information* refer to professionals' understanding and command of technological innovations. A lack of knowledge and apprehension of benefits of a technological innovation hampers adoption. Training and education help to overcome this barrier.

Leadership refers to "commitment, involvement and accountability of leaders and managers with the implementation of innovations", including managerial patience based on a long-term view²⁵.

Tension for change reflects the urgency that organisations perceive to change the current situation.

As for the innovation itself, both *adaptability* and *costs* are identified as important factors for their implementation (or the lack thereof).

Adaptability is "the degree to which an intervention can be adapted, tailored, refined or reinvented to meet local needs"²⁶. This includes interoperability of systems, which is particularly important for e-health interventions²⁷. There is wide agreement that the potential of integrated, affordable and high-quality care for patients depends on an easy exchange of information (patients' records, laboratory analyses, medical images, etc.)²⁸. Solving interoperability problems between medical information systems' constitutes one of the main challenges to achieve that²⁹.

Costs include the costs of the device or system and its implementation as well as the expected return on investment (ROI). In fragmented health care systems, the distinction between the business case on macro and stakeholder level is relevant. When investing parties do not share in the benefits of innovations or even see their revenues shrink, this is an

²⁴ Ross et al. 2016. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update)

²⁵ Damschröder, L et al. 2009. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science.

²⁶ CFIR Research team. 2014. Consolidated Framework for implementation research. www.cfirguide.org

²⁷ Kautsch M, M Lichon, & N Matuszak. 2016. Setting the scene for the future implications of key legal regulations for the development of e-health interoperability in the EU. *International Journal of Health Planning and Management*. Vol 32, issue 4.

²⁸ Calliope. 2010. EU e-health interoperability roadmap.

²⁹ Hammami R, H Bellaaj, Ah Hadj Kacem.. 2014 Interoperability for medical information systems: an overview. *Health and Technology Volume 4, Issue 3*, pp 261–272 |.



effective barrier for implementation³⁰. This aspect is closely linked to payment systems.

External policies and incentives include the external context in which technological innovations take place and include regulations and financial incentives provided by reimbursement systems. Ross (2016) found in her review that the absence of clear regulations and standards are a barrier for the implementation as healthcare professionals face uncertainty over the safety of patients, patient data and liability. As for financial incentives to facilitate innovation, different mechanisms can foster innovation, varying from incidental subsidies, financial sponsorships, reimbursement for adoption and pay-for-performance initiatives³¹.

Accurate knowledge and consideration of *patients' needs and preferences* and the way to meet these is vital if innovations are to improve patient outcomes³². Relatively few reviews mentioned patient needs as a factor of influence for implementation by provider organisations. Nevertheless, we have included this factor in our framework as patient needs are central to the healthcare system.

We used this framework as analytical tool in the remainder of the study to explore conditions for implementation in Dutch healthcare, analyse the case studies and structure our conclusions on perspectives for diffusion of innovative healthcare practices with the use of MedTech.

³⁰ Bodenheimer, Wagner and Grumbach. 2002. Improving primary care for patients with chronic illnesses. JAMA, Vol 288, No 15 p 1909-1914.

³¹ Ross et al. 2016. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update)

³² Damschöder, L et al. 2009. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science.



Conditions for MedTech implementation

Studies on health effects of MedTech-based practices and willingness of patient to engage in these practices are promising. MedTech devices to support daily functioning are widely accepted. Patients consider tele-services should be optional and complementary to personal care.

Healthcare professionals are aware of innovative MedTech and their potential for the future. However, they are overwhelmed by the abundance of solutions in the market. With a lack of clear strategic goals, they are reluctant to redesign care processes.

Many providers do not perceive an urgent need to change.

Return on investments in technology is unsecure under current reimbursement systems in curative (Zvw) and long-term care (Wlz). Providers (and payers) are not very successful in developing alternative payment systems. Existing information systems lack interoperability and do not facilitate data exchange.

Implementation climate in Dutch healthcare

In this chapter, we briefly discuss conditions for implementation of MedTech-based practices in Dutch healthcare. We follow the domains and factors of our analytical framework (see figure 1, p 11). Findings are based on desk study and interviews.

³³ V&VN. e-health in de praktijk. www.venvn.nl/Themas/e-health-in-de-praktijk.

³⁴ Nictiz.2018. Kies bewust voor e-health. e-health monitor 2017.

³⁵ NHG-Standpunt: e-health voor huisarts en patient. www.nhg.org/nhg-e-health.

³⁶ Nictiz.2018. Kies bewust voor e-health. e-health monitor 2017.

Characteristics of individuals

Knowledge and beliefs of professionals

The attitude towards MedTech varies for different professional groups. The Association of Nursing professionals (V&VN) are supportive and welcome new technologies as a means to increase quality and efficiency of care³³. Individual nurses indeed value technological innovations in their practices. They consider surveillance techniques, medication dispensers and telecare for double medication checks indispensable to sustain quality of care³⁴. NHG, the Association of Dutch General Practitioners (GP's) monitors technological developments like wearables with caution, as evidence on interventions is lacking³⁵. The vast majority of GP's also consider digital communication not apt for their patients³⁶. The Federation of Medical specialists (FMS) takes a more progressive stand towards healthcare in the right place, close to patients. They see self-management of patients combined with tele-diagnostics and monitoring as the future and have proposed these activities for reimbursement³⁷. With the increasing availability of data from practice as well as patients that use wearables, they view their future role in applied research. In order to achieve this, barriers in medical ethical and privacy regulations and finance must be tackled³⁸. Both GP's and

³⁷ www.demedischspecialist.nl/nieuws/"betrek-medisch-specialisten-en-patiënten-bij-ontwikkeling-e-health".

³⁸ Federatie Medisch Specialisten. 2017. De medisch specialist als onderzoeker. Position paper. www.demedischspecialist.nl.



specialists are alert on the effects of new services on their income³⁹.

Inner setting

Compatibility with existing care settings

Virtually all Dutch health professionals and healthcare providers have digitalised their patient registrations. They are used to digital communication with patients and at least some of their colleagues. Healthcare providers tend to view digital technology as a way to improve efficiency in their care processes and offer comfort services to their patients. Services such as online appointments, medication requests and reminder alerts are common practice.

New services that are disruptive to existing new care processes, like transferring points of service to patients' home, implementation of patients' self-measurement with MedTech devices or 24/7 screen contact, show low implementation rates⁴⁰ in spite of ambitious government goals⁴¹. In a comprehensive field research, the Council for Health and Society (RV&S) found that providers are hesitant to implement new care models, as it takes time, energy and costs. Besides,

³⁹ Idem; LHV, NHG, Nictiz. Handboek huisartsenpraktijk eConsult www.nhg.org/sites/default/files/content/nhg_org/uploads/nic_handboek_econsult_9.pdf

⁴⁰ Nictiz. 2018. Kies bewust voor e-health. e-health monitor 2017.

⁴¹ Minister en staatssecretaris van Volksgezondheid, Welzijn en Sport. 2014. Brief aan de Voorzitter van de Tweede Kamer betreffende e-health en zorgverbetering. Den Haag: Ministerie van Volksgezondheid, Welzijn en Sport.

they often lack competences to manage change⁴². Literature confirms that changing to new, integrated delivery models imply considerable transition costs for providers. These investments can be cost-effective, but only over the long run⁴³. New care models that involve various providers face additional complications: mutual trust, leadership and personal relationships often interfere with cooperation and partnership⁴⁴.

Access to knowledge and information by individuals

Abundant publicity on MedTech devices in healthcare and updates of professional associations⁴⁵ have created general awareness among health professionals that new technologies and devices are either available or upcoming and hold a promise for the future. During interviews and expert sessions, healthcare professionals confirmed that they perceive an overwhelming amount of MedTech in the market. They find it hard to judge how to articulate these to care practices. Health professionals and MedTech industry alike stressed the need for trials in the context of healthcare practice to discover the potential and benefits. However, healthcare providers and insurance companies are reluctant to invest in trials without

⁴² RV&S. 2017. Implementatie van e-health vraagt om durf en ruimte. Briefadvies.

⁴³ Mose, JN and CB Jones. 2018. Alternative payment models and team-based care. NCMJ Vol 79, No 4.

⁴⁴ RIVM. 2017. Proeftuinen populatiegerichte aanpak: nu en in de toekomst. Tussenrapportage Landelijke Monitor Proeftuinen.

⁴⁵ See websites Federation of Medical Specialists, NHG, Actiz, V&VN.



plausible evidence of financial and social return on investment⁴⁶.

Ongoing research is steadily increasing available knowledge and information on the effects of MedTech in healthcare practice^{47,48}. The elaboration of appropriate research methods is indispensable in bringing uniformity in research design and develop solid evidence⁴⁹.

Training institutions respond and increasingly include MedTech in their curricula for medical professions in vocational and higher education⁵⁰. Still, many stakeholders consider that adaptation of curricula is too slow. Balancing education and labour market demand is a precarious issue in transition periods. Implementation of MedTech in healthcare practices defines the uptake of students and young professionals with MedTech skills. At present, nursing students in vocational training e.g. have a hard time finding practicing opportunities for these new professional skills in care settings⁵¹.

Leadership engagement

The successful implementation of an innovation requires the commitment, involvement and accountability of leaders and managers. In a complex system like healthcare, this asks for leadership that 'defines what future should look like, aligns people with this vision and inspires them to realise this vision despite the obstacles'⁵². Kotter emphasises that leadership can start with one or two persons but critically depends on the degree to which they manage to inspire others to collective leadership and persistently pursue the chosen direction⁵³.

Tension for change

Rising costs, increasing disease burden and projected labour shortages are often-cited causes for urgency in healthcare on a macro level. In the context of the CFIR, tension for change refers to the micro level: does the organisation perceive an immediate need to change its working practices? Research reveals that at the micro level, a sense of urgency to change current care practices is often lacking⁵⁴.

⁴⁶ RVS. 2017. Implementatie van e-health vraagt om durf en ruimte. Briefadvies 17-01

⁴⁷ Nivel. 2013. Technologie in zorg thuis. ZIN. 2017. Evaluatie van e-health technologie in de context van beleid.

⁴⁸ Sanyal et al. (2018) Economic evaluations of e-health technologies: A systematic review.

⁴⁹ ZIN/Nictiz. 2017. Evaluatie van e-health technologie.

⁵⁰ E.g. Universities of Twente, Maastricht, Rotterdam, Nijmegen, Hogescholen Amsterdam, Zuyd, Windesheim and ROC's.

⁵¹ Interview A Mulder, Actiz.

⁵² Kotter, J.P. (1996) Leiderschap bij verandering, Academic service. Cited in: Barnhoorn H, H Vrieling. 2012. Effectief leiderschap in de Nederlandse gezondheidszorg. Een kwestie van hard werken.

⁵³ Idem.

⁵⁴ RIVM. 2017. Proeftuinen populatiegerichte aanpak: nu en in de toekomst. Tussenrapportage Landelijke Monitor Proeftuinen.



Innovation characteristics

Adaptability to systems in place

The lack of interoperability of health information systems in place is a serious barrier for innovation at present. The potential that new technologies offer for integrated, affordable and high quality care for patients requires data sharing (patients' records, laboratory analyses, medical images, etc.). The large amounts of health data collected by patients with devices to measure vitals such as pulse, heart rate, weight, blood pressure and glucose levels at home also represent an enormous value for medical science and will allow for proactive and personalised healthcare in the near future.

The healthcare professionals, researchers and MedTech providers that we interviewed all agreed on the urgent need to solve interoperability issues and create uniform standards. The lack thereof hampers cooperation and is a major obstacle to involve healthcare providers in trials⁵⁵. Dutch government and healthcare sector cooperate closely to facilitate safe and efficient exchange of information. They elaborate standards and certify providers that comply with these standards. The perspective is to allow a personal and interactive health environment (PGO) for all inhabitants. Stakeholders consulted

⁵⁵ Susan Janssen, RIVM. Personal comment.

⁵⁶ Ecorys. 2018. The future of the medical technology market.

⁵⁷ Dingena Spreeuwenberg, M. 2018. Van zorg op afstand naar zorg dichtbij – Limburg als e-health innovatie regio. Inaugurele rede. Zuyd Onderzoek.

during this study value these efforts but also expressed their concern that a lack of compliance will persist and agree that firm direction is necessary to solve the interoperability problem. A national solution in line with international developments is considered desirable but hard to achieve. Shrinking trust in government as well as ongoing technological developments press for alternative solutions⁵⁶. Meanwhile, regional information networks are developing along with regional initiatives for coordinated care⁵⁷. Medical specialists propose information networks with their patient groups, MedTech developers and supported by a Chief Medical Information Officers (CMIO's)⁵⁸.

Costs

Acquisition costs are hardly mentioned as a barrier to implement MedTech. Only Wlz-financed institutions find prices a limiting condition for novel devices such as socio-robots and high-tech walking aids. As newcomers and relatively small purchasers on the Medtech-market, care institutions feel insecure⁵⁹. Actiz suggested that 'market position' as an additional factor of influence on MedTech implementation too.

⁵⁸ www.demedischspecialist.nl/nieuws/"betrek-medisch-specialisten-en-patiënten-bij-ontwikkeling-e-health".

⁵⁹ Interview A Mulder and H Mulders, Actiz.



ROI in MedTech is a more widespread problem and bears close relation to reimbursement systems. This subject is elaborated on further under 'external policies and incentives'.

Outer setting

External policies & incentives

Providers of long-term care and GP's consulted during this study and miss information on quality, effectiveness, safety and privacy aspects on the wide variety of MedTech solutions in the market. For example, the Dutch Association of GP's (NHG) does not include self-monitoring devices in guidelines for point-of-care treatments as research yields ambiguous results on their usefulness⁶⁰. This is a barrier for implementation in the medical world ruled by guidelines and protocols.

Stricter privacy and quality regulations are being put into place in the European context⁶¹. Enhanced transparency and quality guarantees are favourable for healthcare providers that consider the use of MedTech in innovative healthcare practice. On the other hand, the stricter requirements of the MDR and IVDR may hamper MedTech innovations from small and

⁶⁰ NHG.2015. Richtlijn Point of Care testing (POCT) in de huisartsenzorg.

⁶¹ AVG, Verordening (EU)2017/745 en Verordening (EU)2017/746, 5 april 2017.

⁶² Ecorys.2018. The future of the medical technology market. In preparation.

⁶³ Min VWS. 2016. Het Nederlandse zorgstelsel.

medium enterprises (SMEs) and create potential market entry barriers.⁶².

Financial incentives in healthcare are organised in various legal frameworks⁶³. Municipalities implement the Acts on Public Health (WPG), Social Support (Wmo 2015) and Youth (Jeugdwet). Competing insurance companies are responsible for curative care services (Zvw). Long-term care (Wlz) is organised by non-competing regional Care Administration Offices (Zorgkantoren). In all legal frameworks, private, competing provider organisations deliver care and support.

These legal frameworks, with different regulations, budgets and purchasers, create barriers for coordinated care that transcends frameworks. In the context of MedTech, the problematic handling of medical aids and devices is illustrative⁶⁴.

Payment systems are important instruments to manage care: they should stimulate healthcare professionals, providers and insurance companies to improve quality and efficiency of care. Traditionally, reimbursement systems in Dutch healthcare heavily rely on fee-for-service payments. The rigidity of fee for service payment has serious flaws⁶⁵: it hampers tailoring

⁶⁴ Min VWS. 18 mei 2018. Kamerbrief Afspraken hulpmiddelen, woningaanpassingen en verhuizingen; Berenschot. 2018. Veranderagenda knelpunten Wmo hulpmiddelen.

⁶⁵ RV&S. 2017. Nyfer. 2012. Integrale zorg in de buurt – meer gezondheidsresultaat per euro payment. The Millbank Quarterly, Vol 79, No 2. P 149-177 Robinson, J C. 2001. Theory and practice in the design of physician.



services to a patient's need, it is an effective barrier for innovation (as new services are not included in the product and price list) and bears no relation to the quality or outcomes of care. The new challenges that healthcare faces today, with emphasis on chronic care and renewed focus on autonomy and participation in society, call for new financial incentives that focus on quality and health outcomes, patient engagement and cost-effectiveness^{66 67}. Bundled payment models seem more apt for team-based integrated care. They consist of a comprehensive compensation for all care involved in a care cycle for a specific condition⁶⁸. It encourages providers to organise integrated, multidisciplinary care, holds the entire provider team accountable for outcomes and motivate cost reduction at practice level.^{69, 70}

However, the transition away from present payment conditions is a complex issue. Eijkenaar (2014) recommends a gradual and decentralised design of new payment models at the regional level in close cooperation with the healthcare providers⁷¹.

⁶⁶ RVZ. 2011. Sturen op gezondheidsdoelen.

⁶⁷ Busse R and N Mays. 2008. Paying for chronic disease care.

⁶⁸ Alternative Payment Model Framework and Progress Tracking (APM FPT) WorkGroup.2016. ALTERNATIVE PAYMENT MODEL (APM) FRAMEWORK Final White Paper.

⁶⁹ Mose, JN and CB Jones. 2018. Alternative payment models and team-based care. NCMJ Vol 79, No 4.

⁷⁰ Porter, ME and RS. Kaplan. 2016, How to Pay for Health Care. Harvard Business Review, Jul-Aug Issue 2016.

Dutch government has been working on a redesign of payment models for quite some time. Since 2015, revision of regulations on youth care and social support have granted local governments considerable freedom to organise and finance care the way they deem most appropriate in the local context, within the budget constraints set by central government⁷². Financial models for devices include leasing and acquisition⁷³.

Reimbursements in Zvw and Wlz still largely consist of fee for service models. Central redesign of new payment models is complicated as both frameworks include many different types of care and delivery structures are fragmented. In 2007, a major innovation was accomplished with the introduction of bundled payments ('ketenbekostiging') for some chronic conditions in primary care. Local organisations of GP's ('zorggroepen') receive a comprehensive payment to coordinate the care cycle for chronic patients. The care cycles are highly protocolled leaving little room for flexible organisation. Immediate treatment costs did not go down. However, improved quality of care and prevention of complications now generate savings in specialised care⁷⁴.

⁷¹ Eijkenaar, F. (2014, March 11). Verwacht niet teveel van 'pay-for-performance' in de zorg.

⁷² Staatsblad van het Koninkrijk der Nederlanden. 2014. Wet Maatschappelijke Ondersteuning 2015. Jrg 2014, nr 280; Staatsblad van het Koninkrijk der Nederlanden. 2014. Besluit Jeugdwet. Jrg 2014, nr 441.

⁷³ VNG. 2014. Handreiking inkoop hulpmiddelen.

⁷⁴ Hendriks S, et al .2016. Ketenzorg werkt wel!



Since 2008, Dutch Health Authority (NZA) allows a 3-year period to experiment with new care arrangements and develop financial innovations for Zvw and Wlz⁷⁵. Several experiments ('proeftuinen') are ongoing. Progress is slow: healthcare providers and payers prefer to remain with the fee for service system. Technological innovations are included on a similar basis. Insurance company CZ pays a fixed monthly amount per patient for the use of a medication dispenser that increases therapy adherence⁷⁶. Heart Watch, based on self-management by patients, is reimbursed on a subscription basis⁷⁷.

Public Private Partnerships between healthcare providers and MedTech companies may offer perspectives for MedTech-based patient-centred care. This financing model is gaining importance in the hospital market where providers have developed a well-informed position as MedTech purchasers in the past decade⁷⁸. In the incipient market for home-based MedTech applications, these financial models are not yet common⁷⁹.

Extended contract periods (3 years) and shared savings agreements are the main innovations used to incentivise efficiency in specific care processes. Most payment models are still volume-driven⁸⁰.

In Wlz, financial innovations focus on increased patient engagement in healthcare choices⁸¹. Health Deal Academy Het Dorp is an experiment to explore technological options in care⁸².

The Nza did not include e-health services as reimbursable services up till 2017 as they were supposed to increase efficiency of existing services. This discouraged the use of MedTech as prevention of care resulted in a loss of revenues. Labour-saving MedTech technologies translated into higher costs and less income for providers⁸³. Commencing in 2017, NZa changed its policy and authorised an increasing range of e-health services to remove this barrier for the implementation of e-health⁸⁴.

Patient needs and preferences

⁷⁵ NZa. Innovatie voor kleinschalige experimenten - BR/REG-17163.

⁷⁶ CZ. 2016. Financiering van technologie in de zorg – de visie van CZ. <http://www.invoorzorg.nl/interview-Financiering-van-technologie-in-de-zorg-de-visie-van-CZ.html>.

⁷⁷ Menzis/FocusCura. 2018. Playbook Zorginnovatie.

⁷⁸ Interview Niels de Bruijn – CLB Integrated Solutions.

⁷⁹ Interview Martine Poulussen – Menzis.

⁸⁰ RIVM. 2017. Proeftuinen populatiegerichte aanpak: nu en in de toekomst Tussenrapportage Landelijke Monitor Proeftuinen.

⁸¹ Min VWS.2016. Waardig leven met zorg. 26 februari 2016.Kamerbrief. 930368-147878-LZ..

⁸² Min VWS.2017. Langdurige zorg. Kamerstuk 34014. Nr 177.17 mei 2017.

⁸³ RV&S. 2017. Implementatie van e-health vraagt om durf en ruimte Briefadvies.

⁸⁴ NZa. Wegwijzer bekostiging e-health https://puc.overheid.nl/nza/doc/PUC_3654_22/1/



Knowledge and consideration of patients' needs and preferences and the way to meet those needs is vital if healthcare is to improve patient outcomes⁸⁵. This field of knowledge is largely unexplored as patient involvement in development and assessment of MedTech from early stages on is not standard practice yet⁸⁶, though this is vital to take into account patients values and morals and utilise their experience and knowledge⁸⁷.

Conventional devices seem well adapted to patients' needs. MedTech to support mobility, personal care and safety at home (such as walkers, aids for elastic stockings, stair lifts and personal alarms) are widely accepted and highly valued among patients. The use of sensors at home is somewhat lower. However, intentions for future use equal conventional devices⁸⁸. These devices contribute significantly to people's autonomy. In 2012, SCP found that 57% of physically impaired Wmo clients stated that they would not be able to live independently without their devices⁸⁹.

Patients' attitude towards MedTech options for self-management is positive but actual use is low^{90 91}. Chronic patients reveal considerable willingness to participate in self-management, varying from 40% (patients with rheumatism) to 71% (patients with diabetes)⁹². Once patients have experience with MedTech-based self-monitoring, they are positive. On beforehand, they do not see clear advantages⁹³. In both studies, patients stressed the e-health should be complementary to personal care and that patients' engagement in technology-based health practice should be optional.

Use of MedTech-based health interventions differs along socio-economic and demographic lines. Huygens⁹⁴ found that willingness of Dutch patients to use online medical services is related to age, education and digital capacities. In the USA, older people and lower SES engage less in e-health activities⁹⁵. A 'digital divide' may increase differences in access to health services. On the other hand, digital health services may also reduce the digital gap: in Italy, telemedicine and the use of the internet to monitor patients with chronic disease increased

⁸⁵ Damschöder, L et al. 2016.

⁸⁶ EPF. 2013. Patient involvement in HTA in Europe.

⁸⁷ Wale J et al. 2017. Why patients should be involved in health technology assessment.

⁸⁸ Nivel. 2013. Technologie in de zorg thuis. Nog een wereld te winnen.

⁸⁹ SCP. 2013. De ondersteuning van Wmo aanvragers en hun mantelzorgers in 2012

⁹⁰ Hofstede J et al. 2014. Knowledge, use and attitude toward eHealth among patients with chronic lung diseases.

⁹¹ Huygens, MWJ. 2017. A patient perspective on e-health in primary care.

⁹² Idem.

⁹³ Hofstede J et al. 2014. Knowledge, use and attitude toward eHealth among patients with chronic lung diseases.

⁹⁴ Huygens, MWJ. 2017. A patient perspective on e-health in primary care.

⁹⁵ Kontos, E, D Blake, Wen-Ying, S Chou and A Prestin. 2014. Predictors of e-health Usage: Insights on The Digital Divide From the Health Information National Trends Survey 2012. J Med Internet Res. 2014 Jul; 16(7): e172.



social and technological inclusion of elderly patients in rural areas⁹⁶.



⁹⁶ Romano MF, Sardella MV, Alboni F, Russo L, Mariotti R, Nicastro I, Barletta V, Di Bello V. 2015. Is the digital divide an obstacle to e-health? An analysis of the

situation in Europe and in Italy. *Telemed J E Health*. 2015 Jan;21(1):24-35. doi: 10.1089/tmj.2014.0010.



Case studies

In this chapter, we present the results of our case studies. We found that the ALS Care Network uses conventional medical approaches as well as patients initiatives to increase (access to) technologies and devices. ALS treatment traditionally relies heavily on medical technology and assistive devices to keep patients active. Professionals and patients see potential in new devices and digital communication to further improve treatment and autonomy of patients.

Philadelphia and Slingeland/Sensire are examples of providers that implemented innovative practices in a learning-by-doing process. Implementation was a difficult and expensive process. Charismatic leadership, tension for change and an articulate vision on MedTech-based solutions for care practices proved critical to achieve change. The organisations have solid market positions.

ALS Care Network

Sources: interviews with Leonard van den Berg (professor experimental neurology - coordinator ALS Centrum/UMCU), Reinout van Vliet (rehabilitation specialist/Roessingh Enschede), Conny van der Meijden (ALS patient), www.ALS-centrum.nl, Benchmark rapport (2018), www.ALSopdeweg.nl

The ALS Care Network is a network of professional caregivers and patient organisations for people that suffer from ALS, PSMA and PLS. These progressive neuro-muscular diseases

ALS Care Network bundles professionals and patients efforts to maintain autonomy and enable a normal life for people suffering from progressive neuro-muscular diseases. Therapies for physical and mental well-being and a variety of devices support patients in daily life. These include electric wheelchairs, voice amplifiers and speech computers, adjustments to their homes, hands-free toilets, artificial respiration, feeding tubes and transport facilities, etc. Patients are looking forward to new technologies such as brain-computer interfaces and exoskeletons.

Since devices are crucial for patients, timing is important. ALS Care Network developed a digital support to assist patients in their decision-making process. Ongoing digital communication between patients and professionals is elaborated now to further improve timing of therapies and additional devices.

are rare disorders that affect motoric neurons, resulting in a progressive failure of muscles. Patients are usually between 40 and 60 years old. On average, people may live up to 3 years with ALS and between 5-8 years with PSMA, while PLS progresses slowly. No effective therapies to cure these disorders are available yet. Patient populations in the



Netherlands total an estimated 1500 people for ALS, 200 for PSMA and 100 for PLS.

The Dutch ALS Centre (part of Utrecht Medical Centre) bundles knowledge, expertise and research on ALS, PLS and PMSA. For most patients, diagnosis is confirmed here. After diagnosis, regional rehabilitation centres are responsible for treatment. These centres have a specialised ALS rehabilitation team, including rehabilitation doctors, physiotherapists, occupational therapists, speech therapists, dieticians and social workers. The aim of the ALS teams is to help avoid complications and enable patients to stay active as long as possible.

In 2016, the ALS Care Network was established. Its aim is to provide the best care possible to ALS patients and their families. The Network builds on the existing cooperation between the Dutch Association of Rehabilitation specialists (VRA), the ALS Centre, organised patients (Patients Association Spierziekten Nederland and ALS Patients Connected) and the Netherlands ALS Foundation. The ALS Centre is the specialised knowledge centre and ensures that peripheral professionals are kept updated on the latest insights and treatments. Knowledge sharing and diffusion include the organisation of an annual congress, courses and the production of educational materials.

⁹⁷ Min VWS. 2018. . Afspraken hulpmiddelen, woningaanpassingen en verhuizingen Kamerbrief 1338858-176386-DMO Berenschot. 2018. Veranderagenda knelpunten Wmo hulpmiddelen Analyse knelpunten Wmo-hulpmiddelen.

Regional ALS teams play a pivoting role in the care process as they coordinate integrated care for patients. Since 2017, the ALS Care Network introduced quality marks for rehabilitation teams that comply with the criteria for good ALS care, to create transparency for patients. The Network has recently opened up to membership of homecare institutions too.

ALS patients are heavily dependent on assistive devices as their condition progresses. Increasing limitations in mobility, speech and personal care capacities affect their daily functioning. With the help of an electric wheelchair, communication device, hands free toilet etc, patients are able to maintain their autonomy and participation. They look forward to devices such as exoskeletons and brain-computer interfaces that give them access to new opportunities.

Introduction of new medical technologies

An interesting example of a new technological tool developed by ALS Care Network is the virtual house tool. ALS patients need an increasing range of assistive devices as their disease progresses. It is important that these devices arrive on time. Devices are supplied by municipalities (Wmo), the insurance company (Zvw) or by institutions for intramural care (Wlz). This fragmentation is a serious limitation and causes major inconveniences and delays⁹⁷. ALS patients are sometimes



deprived of communication as they lose their speech-support appliance when passing from Zvw to a Wlz institution.

In addition, patients sometimes delay the process themselves. Accepting that another device is necessary can be emotional as it confronts patients and their family with the deterioration in condition. Patients may also lack information on available tools and their fit in their houses. When people start to explore their options, it helps if they can visualise existing tools and their function in daily life. The ALS Centre developed a virtual house tool to support patients' decision-making (www.thuis-als-thuis.nl). ALS Foundation provided funding.

ALS Patients Connected offers patients additional access to devices. They created a platform where patients can borrow and return different types of devices and transport facilities ("ALS on the road").

Within the ALS Network, professionals and patients see opportunities to use new medical technologies in treatment and daily support. As progress of the disease is fast and irregular, ongoing communication with patients offers chances to adjust treatment and assistive devices more closely to patient needs. Together with patients and informal caregivers, the ALS Centre developed and tested an ALS home measurement app that enables patients to register critical health information such as weight, wellbeing and physical functioning (walking, dressing,

swallowing, speech) at home and share the data with their treating physician on a web platform. The system generates alerts if values show critical changes such as weight loss or reduced speech. Hoogstraat Rehabilitation and UMC Utrecht conducted a pilot that was evaluated positively by both patients and practitioners. Results show that home monitoring with the ALS app changes treatment of the ALS treatment team and allows timely prediction of devices that the patient needs. Care can be tailored to the patient's needs and closely follow the pace of disease progression. Alerts allow for immediate action. By keeping a close eye on the lung function and weight, the rehabilitation doctor can discuss with the patient and informal carer whether the patient wants artificial respiration and a feeding tube. Ventilation and a feeding tube can extend the lifespan of people with ALS.

The next phase of testing will include more than 40 ALS patients treated at UMC Utrecht by mid-2018. Expansion of the test to more patients and therapists from other ALS treatment teams will take place in a later phase. Patient experience and cost/benefit effects will be monitored in order to elaborate a business case. The process will take some more years. It is hoped that the home measurement app will be formally included in the treatment of ALS and its reimbursement (DBC). Utrecht University funded development of the home measurement app.



Regional rehabilitation teams also see potential in closer monitoring of patients with the miniature equipment for measurement (wearables) now available in the market. For implementation, however, they have to wait until sufficient evidence is available and technology is included in guidelines and reimbursement of treatment. Sometimes incidental funding opportunities for innovation allow the acquisition of technological equipment. Roessingh rehabilitation centre in Enschede bought a minilab for lung functions with innovation funds. It saves patients a visit to the lung specialist and reduces costs of care. By now, data collected over the years provide a source of study material to identify predictor values and improve treatment.

New technologies also offer opportunities for further integration of the Care Network. Safe Skype or phone connections would facilitate consultation with the ALS Centre, livestreaming of seminars and presentations increase their accessibility for professionals in the region.

Diffusion of knowledge and innovations

ALS Care Network offers some favourable conditions for implementation and diffusion of new technologies. It is a well-established structure for knowledge and information sharing between professionals and with patients. The ALS Network structure fosters diffusion of knowledge and innovations in two ways:

Presentations at annual conference

Once a year, the ALS Centre Netherlands organises an ALS Congress for all caregivers of people with ALS, PSMA and PLS. During the ALS congress, care providers and researchers share their results and best practices to ensure improved patient care.

E-learning for ALS teams and home care teams

The e-course 'Introduction ALS' is a basic training for all caregivers. There are also e-courses available about 'Rejuvenating with ALS', 'Recognizing unrealistic illness perceptions' and 'Influencing unrealistic illness perceptions'. The ALS Centre Netherlands has also developed two accredited advanced courses on important themes in healthcare: 'Breathing and breathing support in ALS' and 'Last phase of life in ALS'. Regional ALS teams dictate these courses, which also cover (new) medical technology.

Another advantage of the ALS Care network is that patients are always involved in the development of innovations and projects by the ALS Centre. This way the new technology is in line with the needs and wishes of patients, improving conditions for use in daily practice.

A disadvantage of the Network structure is that procedures to improve treatment processes with medical technologies require a long time before they reach implementation phase. Before a new technology / intervention is implemented in daily practice,



evidence has to be collected to assess the value added. For this reason, scientific studies (such as randomised controlled trials and reproducibility / validity studies) are necessary. The setup, execution, analyses, synthesis and publication of these studies is time and resource consuming (and highly dependent on funding opportunities). This is normal procedure and guarantees the safety, efficacy and (cost) effectiveness of therapies that enter the healthcare market. However, it also causes delays for the introduction of new technology in care practices.

◀ Concentrating knowledge development at the academic centre of the Network also delays the involvement of regional rehabilitation centres. Thus, their learning experience about both new technology and its implications for care processes is limited. The ALS Centre is aware of this problem and feels the need for a coordinator so their MedTech (and other) projects can be implemented in closer cooperation with regional rehabilitation centres.

ALS patients are mostly young and used to an active life. The disease suddenly confronts them with serious impairments. They and their families are very motivated to fight the disease. They are more than ready for medical technology. However, many health professionals experience a new technology as an additional workload (they need to learn something new) and it

takes time to gain their interest, convince them of its value added and generate the will to apply it.

Finally, a difficulty to resolve for the ALS network is that regional organisations have financial agreements with different health insurance companies. The use of certain technology, for example the HOME monitoring app, costs money (including staff costs). Whether a rehabilitation centre is able to cover those costs highly depends on their financial agreements. Furthermore, buying new technology by institutions / hospitals is expensive and rehabilitation centres need to make choices in which technology they want to invest.





DigiContact Support on demand

Sources: interviews with Kamiel Zijderveld (manager DigiContact), Bianca Kwant (coach Philadelphia), Yvonne Wiebes (project leader Middin), unnamed (client Philadelphia), Tim Wolters (policy officer Wmo – Woerden/ Oudewater), Philadelphia in 2017 (annual report)

In 2015, Philadelphia foundation implemented a new concept for ambulant support to people with cognitive impairments. Clients live outside institutional residences and receive professional support and guidance. Up till 2015, support was entirely based on regular contacts between clients and their personal coach. Philadelphia's new service model is more diverse and include personal coach-client contacts, courses, group meetings and 24/7 contact opportunity. Courses treat subjects that aim to reinforce people's capacities and reduce vulnerability, e.g.: how to build social a social network, sexuality, healthy life styles, first aid capacities and cooking. Group meetings take place in locations of Philadelphia. 24/7 contact offers clients access to advice and support when they need it (Digicontact). Around 800 clients (of 1200 total) are now connected to DigiContact. Client satisfaction on the new service is high. Connectivity provides a feeling of safety. It is good to know there is always someone to talk to when you feel low. Alternatively, it also offers practical advice, such as how to fix the computer or how to interpret an official letter. The device

Philadelphia Foundation is an organisation that supports people with cognitive impairments. It has 6400 employees and yearly revenues total around 350 million euro. Total client population is 7850. Around 15% (1200 persons) receive ambulant coaching support financed by local governments.

is easy to handle and there is hardly any waiting time. Whereas there is plausible evidence that contact on demand increases quality of support, systematic outcome measurements to establish effects in terms of autonomy, participation and quality of life of clients are not available.

Leadership and vision

Philadelphia changed its service model at the occasion of a major change in government policies: ambulant support was decentralised from a national legal framework (Awbz) to the legislative responsibilities of local governments (Wmo 2015). Policy focus changed towards reinforcement of autonomy and participation of people with impairments. Budget cuts accompanied decentralisation. Central government called upon municipalities and providers to develop innovative approaches.



Wmo 2015 offered ample flexibility in its policies to allow for innovation.

Philadelphia decided to concentrate its services in 60 municipalities (from the former 150) and had to lay off personnel. Compensations per client fell by approximately 30%. Still, the Board of directors decided to take the challenge and develop a modernised support concept to maintain quality of care. Including new communication options was key to their concept: clients should have immediate access to advice when needed.

Attitude of professionals

As available evidence on telecare in ambulant support was scarce, Philadelphia commenced trials in 2014 to explore the potential of online communication. Clients and their coaches were equipped with tablets. This did not work out very well. The tablet alone did not guarantee immediate communication as coaches had limited availability due to ongoing normal work and working hours. Soon, the organisation decided to set up a separate unit that offered round the clock access for clients: DigiContact. New, specialised personnel was recruited for these 24/7 support services. DigiContact had a difficult start. There was a lot of resistance within the organisation. With pending dismissals, personnel viewed that technology was replacing their jobs. Client participation started with 300 clients (30%).

Adaptation to inner setting

Professional coaches gradually adopted the new service model. It took time and effort to achieve this. The role of the professionals has changed from personal coach to coordinator of support for clients. Their caseload has increased. By now, 66% of all clients have included DigiContact in their service arrangement. DigiContact turns out to be useful not only to offer immediate support but also, frequent online contact of clients is a way to identify more structural client needs (such as lack of social contacts). These signals serve to tailor support to these needs.

Payment arrangements

Payment models for DigiContact vary according to contracting conditions of municipalities. In 2015, most municipalities contracted support products by volume and price. Philadelphia has managed to negotiate an all-in price for its service mix with several municipalities. This allows the organisation to adjust the composition of services to the specific needs of clients. In Amsterdam, Philadelphia recently engaged in a contract based on lump-sum financing that covers support for all clients, including a shared risk/shared savings component. If requested, DigiContact services can be purchased as a single product, by other provider organisations or by local governments.



Results so far

DigiContact can help to solve labour shortages as it alleviates the work of personal coaches, who now handle a higher caseload. Due to a lack of systematic outcome measurements, no solid information on the effects of Philadelphia's new service model on clients is available.

As for cost-effectiveness, Philadelphia faced losses during implementation of DigiContact. Experience proved that fixed costs of the 24-hour staffed facility needs a minimum scale of 2500-3000 clients with current prices.

Diffusion

The necessity to extend the scale of services has turned DigiContact into a driver for diffusion of telecare to other care providers. DigiContact is an independent firm now and actively explores the potential for telecare. Pilots are conducted with other care providers of mostly the same sector but also in other fields of care like a recent pilot with telecare for dementia patients and their caregivers.

MiddIn Foundation is the first organisation that followed and adopted DigiContact in its support concept. The organisation offers support to some 5200 people with cognitive impairments in the region of The Hague and Rotterdam. One of their employees learnt about DigiContact and informed the

organisations innovation team. MiddIn was already experimenting with screen contact as a way to improve quality of support and to alleviate work burden for their coaches. Coaches and clients had been equipped with tablets but that did not bring about change. Philadelphia's experience seemed an interesting input to build upon.

After meetings with the Philadelphia staff, MiddIn started a pilot to gather more information and knowledge about telecare in daily practice and to get better acquainted with Philadelphia itself. An employee of MiddIn with a high trust of colleagues was stationed at the DigiContact centre to cooperate with Philadelphia's team. This proved highly successful and created a close link between both organisations.

During the trial, 50 clients and their coaches were included to explore the effects of DigiContact. Experiences were closely monitored. Monthly meetings to exchange experiences were organised. After 6 months, an independent evaluator found high client satisfaction both technically (handling and quality of connection) and support-wise: 60 to 70% of all clients experienced more safety and personal control. Coaches reported that their relation with clients and job satisfaction remained intact while their caseload had increased. Based on these results, MiddIn decided to implement DigiContact. At the institutional level, MiddIn has made elaborate agreements with DigiContact including the permanent



stationing of MiddIn personnel at DigiContact and a shared-savings agreement if scale can be further increased.

Within the organisation, the implementation of this innovation is a careful process that requires time and attention in order to win the (sceptical) coaches for the innovation, elaborate tailor-made arrangements for each client and make sure telecare results in substitution of tasks for the coaches. Once they acquire experience, most professionals become enthusiastic about DigiContact. MiddIn estimates DigiContact can also be a useful tool for clients with guided work. The organisation will actively bring DigiContact to the attention of other provider organisations. MiddIn is positive that the concept of communication on demand, at any time of day or night, soon will become mainstream among providers.

In the picture!

Selfmanagement in chronic care

Sources: interviews with Erwin Bomer (Director Care Policy Slingeland Hospital), Daniel Winkeler (change manager Room to..), Saskia ter Hennepe (Programme manager Sensire), Joop Bremer (COPD patient) and Richard Snelder (general practitioner), Playbook Zorginnovatie (2018) of FocusCura and Menzis, websites of Slingeland hospital and Sensire

Slingeland hospital is a regional hospital with 320 beds. It forms part of Santiz, a provider organisation with two hospitals that deliver all hospital care for a major part of the region. Slingeland has some 2.000 employees. Yearly revenues total around 160 million euros. Slingeland plans to build a new hospital within the next years with a 20% reduction of hospital beds.

Sensire is a large home care provider and has several nursing homes in the eastern part of The Netherlands. Sensire has a majority position on the regional market. It has 3.000 employees and revenues total around 125 million euros a year.

Slingeland hospital and Sensire homecare joined forces in the Achterhoek region and implemented an innovative care model for chronic patients that suffer from severe COPD and heart failure. The aim is to improve health outcomes for patients, improve quality of care and reduce costs. Instead of periodical checks at the hospital, patients are equipped with devices and validated tools for self-management: weight balance with bluetooth, blood pressure monitor and the CTQ questionnaire to



register vital health indicators. Blood saturation measurement will be included as soon as a validated device is on the market. The provider of technology offers these devices in a complete package, including an app that guides patients through consecutive measurements and facilitates data deliverance to the remote Medical Service Centre (MSC). Installation of the package at patients' homes and calibration to personal values is also included in the provider's service. At the MSC, nurses control data. When health values deteriorate, they contact the patient via screen contact to check and give advice. If necessary, a specialised nurse takes remote contact or pays a visit at the patient's home. Consultation with or referral to the medical specialist are options in serious situations. Patients can also contact the MSC themselves for advice. This care model proves effective: ongoing monitoring, early detection and immediate care when necessary prove to be effective in the prevention of exacerbations. Hospital visits and hospitalisations have fallen considerably. Patient satisfaction is high: people feel safer knowing that they are 'in the picture' of health professionals.

As simple as it may sound, redesign and implementation of this care process took several years, and it is still an ongoing process of learning and adaptation.

Leaders with a vision

Slingeland hospital is located in the Achterhoek, a region faced with a decreasing population. Shortages of labour in the healthcare sector prompted the need to increase labour productivity. Leading professionals in Slingeland and the homecare organisation shared a vision on chronic care, built on monitoring and self-management of patients. They were convinced that this approach for chronic care would promote health and was feasible with the new medical technologies available. It also offered a solution for problematic labour shortages.

Investing in professionals and knowledge development

In 2012, they held a series of brainstorm and inspiration sessions with nursing personnel to create awareness that the lack of qualified personnel made current practices unsustainable in the long run. In inspiration sessions, nurses were informed on an array of technological options and their potential was discussed. For most nurses, this information was new and it took time to foster belief and readiness in the teams for new care concepts based on technology. After about a year, trials started with small groups of patients to explore possibilities in practice. Four types of care were included: wound care, COPD, oncology and heart failure. Patients were trained to measure health indicators, appropriate home equipment was selected and tested on validity, digital



communication channels were tested as well as the impact of the care model on communication patterns between patients and professionals as well as between professionals.

In 2015, trials were taken to a next level with the help of an external change manager. Two patient groups were selected for further implementation and development of the new care concept: COPD and heart failure. More patients were included to assess reliable outcomes. The experiences developed during years of trials were translated into descriptions and guidelines for new care processes between Sensire and Slingeland formalized agreements on cooperation. Specialised nurses changed the hospital for a mobile office: cars equipped with high quality connections. The establishment of MSC Naast as a new business unit was another critical improvement. Health outcomes of patients were closely monitored and registered. This step was important as soon, a significant reduction of hospitalisations became visible, boosting motivation of professionals struggling with the implementation of new practices and technologies. A critical requirement to expand trials was the freedom to experiment in a transmural context.

A new payment model

The health outcomes achieved (preliminar as they were) and a detailed redesign for new practices convinced insurance company Menzis that this innovative approach held a promise. Involvement of insurance companies was crucial as the

financial feasibility of the new care model depended on new reimbursement mechanisms. As the new model improved health outcomes and prevented care, conventional payment did not reward but rather punish providers: less hospitalisations and hospital days resulted in lower revenues. Also, the investments in new technologies needed to be addressed.

Slingeland hospital, Sensire Homecare and Menzis joined efforts to develop a new financing arrangement that would offer a sustainable alternative for all parties involved in the innovative practice. The new payment model was to replace existing payments for hospital, homecare provider and medical specialists, should shift incentives from delivery of care to prevention and health promotion and include the investments in medical technology. Even with the best of intentions, it took stakeholders a full two years to elaborate a payment model that was acceptable for all parties included. The formula agreed upon consists of a standard budget for all COPD patients and a separate one for all heart failure patients for a duration of three years. The budget includes all costs of the care cycle, whether delivered by Sensire or Slingeland, and is based upon expected cost reductions achieved with In the picture!, quality of care and investment costs. If real costs exceed the budget (e.g. as a result of more hospitalisations than expected), Menzis and Sensire/ Slingeland share these on a 50/50 basis. If costs stay below budget, savings are shared likewise. Thus, all parties are incentivized to make a success of the new approach.



Technological aspects In the picture!

Patients use a weight balance with Bluetooth, blood pressure monitor and the CTQ questionnaire to register vital health indicators. Blood saturation will be included as soon as a validated device becomes available. An online application guides patients through the steps of the measurement procedure. At the end of the procedure, data are sent to the MSC with just one click. iPads are the communication tool for patients. Devices were selected based on available information and manually tested on validity, comparing values with trusted professional equipment.

The Medical Service Centre built an autonomous information system to register and store data and communicate with all professionals involved in the care cycle. This decision was inspired e lack of interoperability between existing information systems used by professionals involved,. The perspective is to develop towards Personal Health Environments (PGO's), that should align all information systems. Additional investments include wifi and 4G connection in cars of specialized nurses.

gives both providers time to adjust to these changes with a gradual implementation

Results so far

About 85% of all patients invited, join In the Picture! For an estimated 15%, handling the technology is a barrier. By now, 120 patients with severe COPD and 210 with heart failure participate in In the picture! Patient satisfaction is high: people feel safer as they have close contact to health professionals and get better insight in their condition. This is linked to the gravity of their condition: exacerbations causing shortness of breath or irregular heart symptoms are highly unpleasant experiences and can in fact be life-threatening. Professionals expect that interest of patients with more lenient symptoms may be lower as no immediate urgency is perceived. The professional-patient communication proves to be an essential component of the concept. Whereas initially, the care concept was built on coaching patients until self-management capacities were acquired, patients insist on maintaining in contact with the MSC.

Importantly, the contract has a three-year duration. In the picture! will result in less care delivered by Slingeland whereas Sensire might deliver more care. The prolonged contract period

Health outcomes improve and hospitalization rates have dropped for patients of both conditions. However, it is not clear



yet how these effects will evolve over a longer period of time. For COPD patients, the initial drop in hospitalizations levelled out as time elapsed.

Costs of the care cycles are expected to decrease slightly: standard budget is around 5% below average costs for these patient groups before In the Picture! was introduced. However, the contract has only started in 2017 and it still remains to be seen if the targeted reduction in hospital costs will be achieved.

Labour productivity has increased considerably. Patient/professional ratio has gone up for both Sensire and Slingeland.

Work in progress

In the picture! is an inspiring example of what can be achieved with hospital@home care. Theoretical exercises indicate that a considerable part of care presently delivered in Dutch hospitals can be delivered at home⁹⁸. The professionals involved relate with enthusiasm about their experiences but also acknowledge that the journey to get there was difficult. It required changing long-time habits, a rearrangement of tasks, get acquainted to working in a network setting and in the beginning, overcome annoyance with bad internet connections. Discovering and refining working processes and team-based work has been a demanding process for professionals. Saskia ter Hennepe (Sensire) stresses the importance of this process and states that this is part of the success on In the Picture! now: "I do not

think our concept can be simply 'scaled up'. Other providers and professionals will have to go through a similar process and by doing so, grow into their new roles and find out what works for them".

In the picture! itself is still subject to further improvements. Incentivized by the cost reduction targets, Slingeland develops new life style interventions. In one such example, COPD patients are trained to play the harmonica as respiration techniques are useful to control exacerbations. In close cooperation with local governments, the hospital appointed a 'sports broker' to refer patients with chronic conditions or fertility problems to regional sport facilities. Patients receive coaching to incorporate physical movement into daily life patterns and health effects are monitored.

Cooperation with GP's has to be developed further. Doubts exist as to whether tele-monitoring is overtreatment for patients with mild conditions and the existing division of tasks between GP's and specialists are issues that have to be resolved. Especially young GP's are interested to participate.

Business models are still developing too. Sensire and Slingeland have formalised their cooperation within In the picture! and signed the contract with Menzis as one single party. The effects of this partial vertical integration are yet to be

⁹⁸ Gupta Strategists. 2016. No Place Like home.



seen. Sensire transformed its MSC into an independent organisation, 'Naast', that offers a variety of telecare services to third parties and individuals.

Diffusion of the experience

Diffusion of the new practice by In the picture! occurs in different ways. First of all, Slingeland and Sensire are exploring the possibilities to expand In the Picture! to other patient groups (diabetes and Parkinson; intra-firm diffusion). Other healthcare providers and professionals are informed through personal contacts and professional networks. In 2017, the Dutch Association of Hospitals (NVZ) included an article on In the picture! in its annual industry report. In 2018, In the Picture! was granted the Value-Based Health Care "Primary Care Award". A symposium on In the picture! was organised last April and attracted some 300 medical professionals and healthcare managers.

Menzis is actively promoting the new payment model as an important financial innovation. In the Picture! is also included in the Playbook Care Innovation that Menzis recently published on innovative healthcare delivery opportunities.

Finally, MSC Naast is developing into a platform-based enterprise that delivers an array of medical tele-services for healthcare providers and individuals all over the country. Two hospital organisations are now exploring the possibilities to

Intra-firm diffusion of technology

Diabetes and Parkinson patients are new patient groups considered for inclusion in In the Picture!

Diabetes patients can measure their vital values with a blood glucose monitor, a blood pressure monitor and a weight balance with blue tooth. Additionally, they can register the insulin (units) administered and medication

For Parkinson patients, validated questionnaires are available to monitor musculoskeletal and mental functioning. Medication effect registrations provide insight in pharmaceutical aspects of the therapy

Once a technology mindset has been introduced, new options become manifest in other branches of hospital care too. Slingeland engaged in a study on 'smart patches': plasters with sensors that register vital functions of hospitalized patients.

The Beatrix hospital, partner of Slingeland in the Santiz group, uses 'smart glasses' to provide wound care at patients' home. Via a built-in camera a specialized caregiver assists the homecare nurse in assessment and treatment of wounds.



Summary

Introduction

Diffusion

Present context

Case studies

Analysis

Conclusions

Literature

Contributors

implement MedTech-based self-monitoring with tele-monitoring for chronic patients.





Dynamics of Implementation

Based on the analysis of the case studies, we find that implementation of MedTech-based, patient-centred care practices depends on healthcare organisations that embark on a learning-by-doing approach. However, conditions are not supportive at present. Healthcare organisations have to convince professionals and patients, and elaborate and implement new working processes. They have to arrange technological infrastructure, data exchange and communication. Existing reimbursement systems do not offer return on these investments. Healthcare organisations have to gather evidence and elaborate a business case. Only then, they can start negotiations with insurance companies or municipalities on alternative payment models.

It takes healthcare providers with strong, visionary leadership to achieve the implementation of these practices. Besides, a solid market position is required as transition involves risks and investments. 'Characteristics of the organisation' is included as an additional factor in our analytical framework.

Central versus decentral approaches

Our case studies illustrate two mechanisms that can bring about implementation of patient-centred practices with the use of MedTech: the conventional centralised approach of the ALS Care Network and the decentral initiatives of healthcare providers in 'DigiContact' and 'In the picture!'

⁹⁹ The subsidy scheme "Promising care quicker to patients" aims at accelerating the introduction of MedTech to the healthcare market by improved procedures for assessing (cost) effectiveness and admittance to insurance benefit package. Min

A common denominator in all cases is that health professionals see potential to improve care practice with new technologies available. In particular, the concepts of connectivity and ongoing, real-time information are attractors as they allow for early, accurate and targeted interventions.

Conventional approach - security first

The ALS Care Network demonstrates that following conventional procedures, a long trajectory to gather information and knowledge on the intervention (evidence) precedes actual implementation in healthcare practice⁹⁹. If evidence is convincing, the next step is to include the MedTech-based practice in existing working processes (guidelines) and ensure that financial incentives (adequate payment arrangements) are in place. During this process, professionals are informed via academic channels such as conferences and publications so that MedTech-based treatments gradually become part of professional knowledge and beliefs.

Slow as it may seem, this procedure adequately addresses the inherent cautiousness in healthcare decision-making, motivated by patient safety and cost-effective use of public resources. However, it does not foster a rapid spread of MedTech in care practices.

VWS. 21 mei 2018. Kamerbrief Subsidieregeling "Veelbelovende zorg sneller bij de patient".



The role of ALS patients and their families is intriguing: they are highly motivated and well organised. They are successful in mobilising private sponsorships to facilitate additional access to devices and means of transport (like wheelchair buses) as these play an essential role for the autonomy and participation of patients.

Innovators – learning by doing

The cases of Philadelphia and Slingeland/Sensire show that implementation of innovative care practices using MedTech develop faster when individual healthcare providers opt for a learning-by-doing process. In both cases, charismatic leaders with a strong conviction that their healthcare practice can benefit from modern technologies, utilised an urgent need to bring about change. Technology itself was not a driver but rather a facilitator for change.

These providers are innovators and had to take huge risks as most other factors were not supportive when they set off for implementation:

- professionals in their organisation had little knowledge and sometimes an adverse attitude towards the intervention;
- solid evidence on health outcomes of the new practice was lacking;
- knowledge on patient needs, preferences and ability to handle the new practice was lacking;

- the new care model was not compatible with existing work processes but required fundamental changes;
- initial investments in technology were high;
- existing reimbursement models were not adequate or even, in case of Slingeland, contrary to the new practices;
- due to a lack of interoperability of existing information systems, new systems and interfaces had to be built to enable data sharing.

The innovators managed to mobilise collective leadership and resolve these obstacles. They raised awareness and knowledge on potential benefits of MedTech among personnel, developed new care processes and redefined professional roles in field trials; explored patients interest and possibilities to engage in new practices, collected initial evidence on results, made risk-bearing investments in infrastructure, technology and information systems and invested in renegotiating payment models.

As Philadelphia, Slingeland and Sensire all have a solid market position; they could face the risks and costs associated with the new care model. Small providers or providers facing stronger competition may not be able or willing to tolerate these levels of risk. Characteristics of the organisation turn out to be an



important factor of influence, as was suggested earlier in our study¹⁰⁰. We included this factor in our analytical framework.

In summary, we see that provider organisations acting as innovators counted with multiple barriers for the implementation of the new MedTech-based care practice. The combination of strong leadership with vision, an urge for change and solid market conditions were decisive drivers (see table 2).

Table 2 Factors influencing implementation by innovators

CFIR domain	Factors of influence on implementation	Conditions
Characteristics of individuals	Knowledge & beliefs of individual professionals about the intervention	-
Inner setting	Compatibility with existing inner setting	- -
	Access to knowledge & information by individuals	- -
	Leadership engagement	+ +
	Tension for change	+ +
	Characteristics of the organisation	+ +
Innovation characteristics	Adaptability to systems in place	- -
	Costs	-
Outer setting	External policies & incentives	- -
	Knowledge on patient needs and preferences	- -

++ + (very) strong driver 0 no influence - - - (very) strong barrier

¹⁰⁰ Interview A Mulder, Actiz.

Social innovation

The *change to a new care concept* proves, to have deep impact on all professionals and organisations involved. Transferring responsibilities to patients invoked a redesign of working practices, rearrangement of responsibilities and new professional roles and patterns of cooperation. Breaking with long time habits, imprinted since study, is difficult and takes time. Erwin Bomers states the implementation of their new practice is a social rather than a technological innovation¹⁰¹.

Payment models

Adequate payment models are a crucial requirement for sustainability of the new practice.

In the context of Wmo, municipalities enjoy considerable freedom in the way they contract services. Philadelphia and MidIn both report a movement of towards bundled payments. The city of Amsterdam even introduced population-based payments. These payment mechanisms are favourable for the implementation of MedTech-based service models as they allow providers flexibility in organising their services and offer incentives for efficiency. Monitoring of health outcomes deserves closer attention to avoid that focus is entirely on minimising costs and affects quality of care.

¹⁰¹ Erwin Bomers/Slingeland Personal comment.



In Zvw, no adequate payment models were available to sustain the efforts of Sensire and Slingeland. A new payment model was negotiated with Menzis. The result is one of the first comprehensive, value-based payment models in Dutch healthcare: a bundled payment model for the complete care cycle of specific patient groups during three years, including outcome targets in terms of hospital admittances and hospital days as well as patient satisfaction. The shared-risk character of the contract incentivises providers to improve efficiency and health outcomes.

◀ This financial innovation is a highly valuable asset as it offers an elaborate, concrete example of a value-based payment model that replaces existing fragmented, volume-driven reimbursement in Dutch healthcare.

The financial innovation came at a high cost for both providers. They invested considerable time in engineering the payment model. In the meantime, they suffered losses as conventional reimbursement systems stayed in place. While the ongoing experiment translated in better health outcomes and less hospitalisations, Slingeland's revenues went down.

Cost-effectiveness

It is hard to make statements on the cost-effectiveness of the MedTech-based interventions as implemented in both case studies. From a short-term perspective, they are cost-effective

for the purchaser of care: quality increased and prices remained stable (Digicontact) or even decreased (In the picture!). However, long-term effects are not yet clear. In the picture! now includes patients with severe conditions. They are highly willing to engage in self-management and savings are immediate as exacerbations were frequent among these patient groups. Including other patient categories may result in less willingness to engage and savings by prevention will come late. Improved quality of chronic-care in primary settings generated savings after 10 years. The issue as to how to target tele-monitoring services to the right patient categories and avoid overtreatment is open to debate.

▶ From a provider's perspective, cost-effectiveness of the new care practice can only be achieved in the long term. The indirect costs involved with the transition were considerable and direct care revenues do not provide return on those investments. The business case for Sensire and Slingeland depends on the revenues of MSC Naast and exploitation results of the new hospital.

Payment models play an important role in the cost-effectiveness (so far) of both care models. Bundled payments put a fixed price on the care cycle and prove to be effective incentives for replacement and prevention of care. Under fee for service payment, it will be harder to achieve this as volume-related incentives persist. Self-management and tele-monitoring



may well be implemented as additional service to patients. As long as volume-based payment systems stay in place, medical technologies and devices may enhance quality of care but not result in efficiency gains.

International research shows miscellaneous results for the cost-effectiveness of new medical technologies and devices¹⁰².

Drivers for diffusion

Our case studies show that diffusion of the innovative practices occurs in various ways.

Firstly, provider organisations implemented the patient-centred practice to widen its application to other activities within their organisation (intra-firm diffusion).

The stakeholders involved actively communicate on the MedTech-based practices to other healthcare providers and professionals through personal and professional networks, publications, professional meetings like symposia and congresses.

Another mechanism for diffusion arises from the search for economies of scale of the communication and medical service centre. This proves to be an effective incentive for provider-to-provider marketing.

¹⁰² Jeurissen, P et al. 2018. Betaalbare zorg. Celsius academie.

By now, three years after both cases started implementation of their innovative practice, one organisation is effectively implementing DigiContact and several others are exploring the option or running pilots. In the Picture! has attracted the attention of many and two hospital provider organisations are exploring tele-monitoring options in chronic care in cooperation with MSC Naast.

Real-world labs

The new practices implemented by innovators constitute 'living labs' that improve conditions for implementation by other healthcare providers. Innovators are proud of their achievements. They actively inform their colleagues in person and by professional media and by doing so contribute to general knowledge and beliefs on MedTech of healthcare professionals in the country.

The established practices generate process and business information that is useful for other providers that consider implementation of similar practices. Information on health outcomes and patients' response generate evidence on MedTech-based care processes.

The communication and data centres established may prove important assets as they are developing into platform-based enterprises that offer expertise at the intersection of digital



technologies and health services. Providers will be able to purchase these services in the market and can avoid high front-end investments. Marginal costs of these services will decrease as volumes rise. In a competitive market, prices will go down. The financial innovation in the cure sector (Zvw) offers a new payment model that can serve as a benchmark for efficiency of chronic care cycles.

Interoperability of systems, on the other hand, remains a challenge that affects efficiency and effectiveness of services.

Barriers remain

The achievements of innovator providers are important and reflect high intrinsic motivation. However, innovators are scarce. They represent an estimated 2-3% of the market¹⁰³.

For a significant impact of MedTech on healthcare, the early majority of providers has to be reached. This market segment is more demanding: their willingness to adopt and implement MedTech-based care practices for improved quality and efficiency of care will depend on the attractiveness and comfort of this option. At present, the balance of drivers and barriers is clearly disadvantageous for implementation of MedTech-based practices. While innovators are prepared to resolve many barriers, early majority providers will not be prepared to pledge similar efforts.

¹⁰³ Moore, E. 1983. The diffusion of innovations (3rd ed)

Within the context of Wmo, this balance is changing. Solutions such as Digicontact appeal to municipalities and providers alike as they intuitively value the concept of connectivity. Professionals will become acquainted with technological innovations as they spread in the market. Labour shortages provide an incentive to use technological innovations. The fact that support services are delivered by single provider organisations, is an additional advantage.

Payment models are flexible as local governments have discretionary power. Convincing new services will find their way to the social support market. Municipalities that introduce bundled payment arrangements provide incentives for further development and implementation of MedTech-based services as providers gain by improving efficiency.

In curative care (Zvw) perspectives for transformation of care practices with the use of MedTech and devices are less positive. Barriers for transformation are higher, a redesign of working practices is required to achieve patient-centred care and multiple provider organisations have to cooperate. Providers have to make pre-investments to gather information on costs and benefits and elaborate on a business case. Insurance companies have to be convinced of the cost-effectiveness of the MedTech-based care practice. This



process takes years and there are no guarantees for success on beforehand.

Under the present payment model, new care practices that rely more heavily on patient engagement and primary care, result in perceived 'losses' for a hospital as their revenues go down. Still, most providers are not willing to change to new models such as bundled or population-based payment¹⁰⁴. The risk-bearing character of these models may explain their reluctance. In spite of macro concerns on rising costs and labour shortages, many providers do not feel a 'sense of urgency' to change current practices¹⁰⁵.

The lack of interoperability of information systems is another barrier that prevents the option to simply 'plug & play' and try new options.

Given these conditions, a rapid diffusion of new, Med-Tech based care models is unlikely. In order to speed up diffusion, the attraction of such models to providers should increase. Focus on the appealing aspects, such as positive health outcomes, connectivity and labour savings should be the starting point. At the same time, conditions for implementation of MedTech-based, patient-centred care should be significantly improved.

¹⁰⁴ RIVM.2017. Proeftuinen populaitegerichte aanpak: nu en in de toekoms. Tussenrapportage Landelijke Monitor Proeftuinen.

¹⁰⁵ Idem



Conclusions

In this final chapter, we formulated answers to the research questions based on the insights acquired during our study. We did this from the perspective of Dutch healthcare as a complex, adaptive system, as described by Plsek¹⁰⁶. In complex systems, diffusion and uptake of technology and devices is the result of adoption and implementation decisions, made by individuals and groups of healthcare professionals in their specific setting.

It is impossible to 'steer' the process of diffusion. Diffusion strategies will be successful to the extent that they succeed in identifying attractors, incentives and providers that are receptive for the desired change, and manage to create enabling conditions for these providers to start transformation to patient-centred, coordinated care processes.

Transformation processes will be gradual. Most revolutions in healthcare are the consequence of many small changes¹⁰⁷. A step-by-step process allows to control risks and learn from experience. Once a first step is taken successfully, intra-firm diffusion is likely to proceed.

Strategies to foster diffusion should focus on understanding the factors that drive implementation decisions of healthcare providers and create enabling conditions that will lead to the desired outcome. After answering the research questions, we

provide our recommendations to improve diffusion strategies for MedTech-based, patient-centred care.

The Taskforce 'Healthcare in the right place' calls for a movement towards coordinated, efficient and patient-centred practices in healthcare, utilizing the potential that MedTech offers. Taking the report of the Taskforce as a starting point, how can examples of efficient transmural care, labour savings and substitution of care that involve MedTech, be scaled up in the interest of patients?

We found that at present, conditions are not supportive for implementation of MedTech-based care practices in Dutch healthcare. Transformation to new working patterns is demanding and expensive. Existing payment models do not reward these efforts, new payment models are not considered attractive by most providers. Professionals do not feel a need to explore the potential of (new) technologies and devices. Growing evidence is still classified as fragmented as uniformity in design and appropriate methodologies for research are lacking.

Healthcare organisations in the cases we studied, defied these adverse conditions and successfully developed patient-centred practices with the help of MedTech. They are organisations with a dominant market position. Their charismatic and visionary

¹⁰⁶ Plsek, P. E. (2003). Complexity and the Adoption of Innovation in Health Care.

¹⁰⁷ Jeurissen, P et al. 2018. Betaalbare zorg. Celsius Academie.



leaders have formulated clear strategic goals and used an urge to change to implement transformation to MedTech-based and patient-centred practices. Technology was a facilitator, not a driver for implementation.

Implementation was achieved at high costs for the innovators, mainly due to the indirect costs of the transformation process. These include training and coaching of professionals and patients, the elaboration of radically new practices and care processes, redefining professional relationships, conducting systematic trials to gather evidence and setting up infrastructure for data management or communication.

The reversal of care processes centred around the patient and focused on prevention, proves to be a social innovation with deep impact on care processes, patterns and structures, mental models, professional roles and relationships.

The case studies show promising results. The vast majority of chronic patients was willing to engage in self-management using technological devices. Health outcomes improved: patients suffered less exacerbations and, as a consequence, hospitalisation rates fall. ALS patients get timely interventions to address disease progress. People with cognitive impairments feel more in control of their life. Patient satisfaction is high and labour productivity and efficiency increase. A striking feature in

all case studies is that patients feel safer as a result of the connectivity the MedTech-based care practices offer.

Once implemented successfully, providers scale up care practices involving Medtech within their organisations to other domains of care and support, transcending legal barriers (Wlz, Participation Act) or to other patient groups.

Stakeholders involved: healthcare providers and professionals, patients and the insurance company, are proud of their achievements and actively communicate about their patient-centered practice facilitated by MedTech. They inform other healthcare providers and professionals through personal and professional networks, publications, professional meetings like symposia and congresses.

In two case studies, providers had to establish infrastructure for screen communication and tele-monitoring of patient data, as none was available. The need for economies of scale to sustain this infrastructure proves to be an effective incentive for provider-to-provider marketing. Both centres are developing into a platform-based enterprise that acts on the interface of digital technologies and medical services.

The successful practices established are important to show real-world results in actual care practices. They contribute to the evidence base. They yield business information that is



useful for healthcare providers that consider implementation of MedTech-based, patient-centred care practices. The availability of screen-communication and tele-monitoring services in the market, offered by the centres established, is a facilitator for implementation by other healthcare providers as they can avoid infrastructural investments.

However, the case studies also demonstrate that providers face many barriers for the implementation of patient-centred practices with the help of MedTech. The basic challenge to speed up diffusion is to tackle these barriers in order to facilitate implementation of patient-centred practices with the use of MedTech and make these an attractive option for healthcare providers.

What are necessary conditions to achieve the diffusion of examples of efficient transmural care, labour savings and substitution of care that involve MedTech?

Diffusion in healthcare is the result of implementation decisions of providers. In order to promote the implementation of patient-centred practices with medical technology and devices, these practices must match with the vision and strategic goals of healthcare providers. Implementation of these practices must offer benefits for providers. Payment models should motivate the implementation of the desired practices.

Therefore, conditions to achieve diffusion should take into account the strategic goals of healthcare providers. Providers that consider efficient, labour saving and preventive MedTech-based care practices supportive to their vision and goals, should meet enabling conditions: transformation to these practices should be more attractive than other options (including doing nothing).

An **inherent appeal of MedTech**-based practices lies in the connectivity and real-time data flows they offer. These concepts attract the interest of professionals and patients alike and are much more congruent with 21st century than the static, intermittent procedures (such as periodic visits and checks) often used in chronic care. This appeal is a main attractor to foster development and implementation of MedTech-based practices.

However, there is a gap to bridge between technology and technology-based care processes. Many professionals lack knowledge, expertise and time to 'translate' technology into technology-based care practices. Technology developers deliver devices but fail to develop care concepts and service designs.

MedTech-based practices offer a solution to resolve or mitigate **labour shortages**. This aspect is an important attractor for healthcare providers that face a lack of qualified personnel and



can help resolving their problem. These providers represent a receptive context for change. Tailored support of payers and/or government to create enabling conditions for implementation is likely to result in desired outcomes as there is a common ground for change.

Sufficient **evidence** on the added value, clinical effectiveness, labour savings or cost-effectiveness of MedTech-based interventions helps healthcare providers and payers to make implementation decisions on MedTech-based practices. Real-world practices yield bits and pieces of information. Systematic collection and disclosure of this data will support providers in their decision-making process and will create more transparency for patients and decision-makers in healthcare.

Capacity – in competences as well as in time – to **manage change** is a prerequisite for implementation of MedTech-based efficient care practices. As demonstrated in the case studies, implementation requires specific competences, dedication and time. ALS Care Network identified the need for a change manager, trials for In the Picture started to pay off once an external change manager was contracted. Philadelphia had a change manager to elaborate and implement screen support. MiddIn, adopter of Digicontact, has a permanent team for innovation and development of their care practices. Change, let alone a social innovation reverting professional-centred to patient-centred care, requires time, expertise and effort. This

investment pays off as replacement and substitution are addressed explicitly in the new care design.

Adequate payment models should offer a fair compensation for the care cycle and promote prevention, replacement or substitution of care. Such models encourage efficiency of the entire care cycles and incentivize health outcomes, and the adoption of MedTech that contributes to health outcomes or efficiency. In Zvw and Wlz, present fee-for-service conditions prove inadequate. For every technology-based care process, NZa has to approve a new 'product'. This is a time-consuming process but most importantly, incentives remain on the volume of care instead of health outcomes.

Value-based or bundled payments offer better perspectives for efficient and effective healthcare practices with optimal use of MedTech. However, providers are reluctant to adopt these models as fee-for-service reimbursement offers more comfort and less risks.

A financial **compensation for transformation** to patient-centred care practices that involve MedTech is a useful incentive. Transformation is a process that takes years and brings considerable costs for providers (training and coaching of professionals and patients, ongoing evaluation and adjustment, negotiating adequate payment models, etc.). As transformation towards patient-centred, efficient care models is



an investment that benefits the healthcare system as a whole, healthcare providers should not bear these costs alone.

Mergers and formal cooperation agreements between provider organisations will occur when coordinated, patient-centred care practices develop, as the case studies illustrate. This is inevitable and even desirable to create integrated delivery structures and reduce the present fragmentation.

Assistive devices play a central role in the autonomy and participation of patients with physical impairments. The present fragmentation of responsibilities between different legal frameworks and payers must not be detrimental to these patients but should be resolved between payers.

Health data infrastructure is an important prerequisite to share data for individual patients and their caregivers. The availability of large quantities of data is a valuable resource to develop preventive, integrated healthcare in the near future. The lack of **interoperability of information systems** hampers data sharing. At present, healthcare providers that cooperate to deliver patient-centred care solve interoperability problems on an ad hoc basis. However, this has a cost and can be an additional barrier for diffusion of these practices. Consortium-

¹⁰⁸ Ecorys. 2018. The future of the medical technology market.

¹⁰⁹ Kahneman, D. (1991). "Loss Aversion in Riskless Choice: A Reference Dependent Model". Quarterly Journal of Economics 106 (4): 1039–1061.

based systems applying blockchain technology seem to bear a promise for the near future¹⁰⁸.

What are the reasons why diffusion does not happen now (culture, misunderstandings, lack of cooperation, etc.)?

Diffusion processes in healthcare are unpredictable, especially in the phase from innovators to early majority. Diffusion is the result of decisions made by healthcare providers. In our study we found that many factors in different domains influence these decisions and most of them are not supportive for the desired outcome: the implementation of efficient, labour saving care models making use of MedTech.

Under the present circumstances, providers face many risks and uncertainties involved in the implementation of patient-centred, coordinated care processes: which results can they expect? How will patients react? What are the costs involved with transformation? Will there be return on investments? How will cooperation with other providers work out? Behavioural economics show that loss aversion is a strong motive to discourage investments¹⁰⁹. The uncertainties that surround the implementation of MedTech also poses demands on the mutual trust, personal relationships and leadership that are essential in ensuring cooperation between healthcare providers¹¹⁰.

¹¹⁰ RIVM. 2017. Tussenevaluatie proeftuinen populatie gebonden bekostiging.



MedTech-based practices are not the only strategy to achieve efficient, patient-centred care. In Dutch healthcare, substitution of hospital care to primary care has been the dominant strategy during the past decades. Hospital providers, GP's and payers that are fully devoted to replace hospital care to primary practices, may want to give priority to this transition and consider opportunities for MedTech-based practices later on.

Business cycles matter too. A GP who is a few years away from retirement, will not be inclined to invest in new working practices whereas a young GP may have new ambitions. Plans for a new hospital may spur interest in MedTech-based practices or alternatively, a newly-built hospital may have the opposite effect.

A whole new generation of medical workers has grown up in the digital information era. That may cause an unprecedented impulse to the use of new medical technologies and devices.

Patients may become an important factor driving MedTech-based practices. Once they discover the comfort and positive effect on their health, providers may consider these services to be a competitive advantage. At present, however, patients do not have a clear idea of the advantages of MedTech-based practices as they are not common practice yet.

Diffusion strategies ask for leadership with managerial patience. Most technologies take years to mature¹¹¹. The medical world has an inherent caution. The challenge for diffusion is to identify receptive providers and facilitate enabling conditions for implementation of patient-centred care practices with the use of MedTech.

Recommendations

Facilitate field labs

Many healthcare professionals and providers see the inherent appeal and potential that medical technologies and devices offer for patient-centred, efficient care processes. However, they lack the knowledge, expertise and time to elaborate technology-based care processes. Industry, for its part, delivers technology but lacks expertise to develop care concepts and service designs. Providers as well as industry express the need for trials with MedTech in real-world conditions.

At present, tight budget controls discourage both payers and providers to invest in trials with insecure outcomes. However, such trials are indispensable to develop efficient and effective care practices. As the case studies show, technology alone does not make the difference. It needs to be articulated with patients, professionals and processes to make sensible care practices and service designs. Only then will providers be able

¹¹¹ Went et al. 2015. Mastering the robot. WRR.



to draft a business case and approach payers to discuss implementation.

Government subsidies should facilitate field labs in care settings, co-financed by industry and providers themselves. Field labs should have an applied character and take place in real-world care settings. They must result in feasible MedTech-based care practices, service designs and business cases that can be presented to payers for implementation.

Labour productivity as attractor

Healthcare providers looking for new working practices to solve a lack of nursing and medical personnel, offer a receptive context for change towards patient-centred care using MedTech. A learning community can offer these providers information, advice and insight into the results of MedTech-based care practices already implemented. A learning community also fosters the exchange of ideas between professionals, which is an important channel for diffusion.

Ensure systematic evidence

In spite of increasing information on effects of patient-centred, MedTech-based care practices, evidence is still classified as scarce and scattered as uniform research designs are lacking. The Dutch National Healthcare Institute (ZIN) proposes to develop new methods that address the dynamic, social nature of MedTech-based care practices to reduce uncertainty,

facilitate decision-making and support innovation in healthcare. This initiative is of great value as it will provide the tools to build a solid evidence base from implementation practices and provide healthcare providers and payers with information for their implementation decisions

Facilitate change management

Even when interested, healthcare providers often lack the skills and time to manage change. This frustrates innovation processes. The case studies underline the importance of specialised change managers. The presence of a government-financed change professional at the regional level to explore the interest and potential for MedTech-based practices among providers and patients, assist in organising experiments and manage implementation of change, can remove this barrier and prove a catalyst to initiate the aspired movement.

Make value-based payment models more attractive

Value-based models such as bundled payments are preferable to volume-driven payment as they encourage efficiency, allow flexibility in care cycles including the use of MedTech and offer incentives to promote health. Until now, healthcare providers and payers have been reluctant to adopt these payment models. Value-based models should have a comparative advantage to become an attractive alternative. One way to achieve this is to allow value-based contract periods that are substantially longer (e.g. 5-6 years) than fee-for-service



contracts. This mitigates risks for providers as well as insurance companies and care administration offices.

Resolve legal barriers for patients with devices

Different legal frameworks and payers are responsible for the supply and service of devices for patients. This results in frequent inconveniences for patients that affect their health and participation. In order to prevent that patients pay the price for institutional flaws, legal service norms for delivery and service of devices can help. Patients should also have a legal right to keep their devices as long as they need them, irrespective of changes in residence or legal framework. Payers can arrange costs on the institutional level.

Monitor organisational change

Patient-centred care practices with the use of MedTech are likely to bring about organisational changes. Given the current fragmentation, especially vertical integration like in the Slingeland/Sensire case may result in more agile delivery structures. This process should be monitored in order to learn from experiences, identify and adjust obstacles in rules and regulations that hamper cooperation and correct market imperfections that may arise.

Target compensations for transformation

New cost containment agreements (Hoofdlijnen akkoorden; yet to be formalised) reduce growth of hospital revenues, propose MedTech-based practices to increase efficiency and include

funds to facilitate transformation. This instrument ‘pushes’ for the desired change. According to Plsek, the system will ‘push back’: every hospital organisation will claim compensation for transformation on its own terms.

If this instrument is to achieve change towards patient-centred care practices with the use of MedTech, insurance companies should target these transformation funds to hospitals that make the desired movement to prevention and replacement of hospital care in cooperation with homecare providers and with the use of MedTech.

Reward outstanding providers

Another incentive to diffusion is to reward a (limited) number of provider groups or regions with outstanding progress in MedTech-based, patient-centred care processes. One way to do this is to contribute to a consortium-based health information system with blockchain technology. This will allow to develop experience with this promising new alternative for management and sharing of data by a designated group of stakeholders and boost their motivation.



Literature

ALS Centrum Nederland. 2018. Benchmarkrapport. 'Kwalitatief goede ALS behandelteams'

Alternative Payment Model Framework and Progress Tracking (APM FPT) Work Group. 2016. ALTERNATIVE PAYMENT MODEL (APM) FRAMEWORK Final White Paper

Berenschot. 2018. Veranderagenda knelpunten Wmo hulpmiddelen Analyse knelpunten Wmo-hulpmiddelen

Bodenheimer, T. Wagner and Grumbach. 2002. Improving Primary Care for Patients With Chronic Illness. JAMA, 288(14), 1909–1914. <https://doi.org/10.1001/jama.288.14.1775>

Busse R and N Mays. 2008. Paying for chronic disease care. In: Nolte, E and M McKee (eds), Caring for people with chronic conditions: a health system perspective. Open University Press, Maidenhead. pp 195-221

Calliope. 2010. EU e-health interoperability roadmap

CFIR Research team. 2014. Consolidated Framework for implementation research. www.cfirguide.org

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. 2009. Fostering

implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implementation Science, 4(1). <https://doi.org/10.1186/1748-5908-4-50>

De Jonge, H. 2018, May 18. Kamerbrief over afspraken hulpmiddelen, woningaanpassingen en verhuizingen [Kamerstuk]. Retrieved from <file:///C:/Users/TEMP/Downloads/kamerbrief-over-afspraken-hulpmiddelen-woningaanpassingen-en-verhuizingen.pdf>

Dingena Spreeuwenberg, M. 2018. Van zorg op afstand naar zorg dichtbij – Limburg als e-health innovatie regio. Inaugurale rede. Zuyd Onderzoek

Ecorys. 2018. The future of the medical technology market – addressing challenges and utilising opportunities (in preparation)

Eijkenaar, F. 2014, March 11. Verwacht niet teveel van 'pay-for-performance' in de zorg. Retrieved from <https://www.socialevraagstukken.nl/verwacht-niet-teveel-van-pay-for-performance-in-de-zorg/>

EPF. 2013. Patient involvement in HTA in Europe



Gupta Strategists. 2016. No Place Like home. Retrieved from https://gupta-strategists.nl/storage/files/Gupta_strategists-Overig-studie-No-place-like-home.pdf

Hammami, R., Bellaaj, H., & Hadj Kacem, A. 2014. Interoperability of healthcare information systems. The 2014 International Symposium on Networks, Computers and Communications, 4(3), 261–272. <https://doi.org/10.1109/sncc.2014.6866536>

.Hofstede J, J de Bie, B van Wijngaarden, M Heijmans. 2014. Knowledge, use and attitude toward eHealth among patients with chronic lung diseases. In: International Journal of Medical Informatics: 2014, 83(12), 967-974

Huber M, Knottnerus JA, Green L, et al. 2011. How should we define health? *BMJ* 2011;343:d4163

Huygens, MWJ. 2017. A patient perspective on e-health in primary care Critical reflections on the implementation and use of online care services. PhD Univ Maastricht

Informatieberaad. 2016. Outcome-doelen informatieberaad. Retrieved from <file:///C:/Users/TEMP/Downloads/Outcomedoelen+Informatieberaad+dec2016.pdf>

Jeurissen P, H Maarse, M Tanke (eds) 2018. Betaalbare zorg. Celsius Academie

Kautsch, M., Lichoń, M., & Matuszak, N. 2016. Development of Publicly Funded e-health in Poland: Barriers and Opportunities. *Economics & Sociology*, 9(3), 28–40. <https://doi.org/10.14254/2071-789x.2016/9-3/3>

Kiers, B. 2017, November 20. NZa wil waardegedreven bekostiging van zorg. Retrieved from <https://www.zorgvisie.nl/nza-wil-waardegedreven-bekostiging/>

Kontos, E, D Blake, Wen-Ying, S Chou and A Prestin. 2014. Predictors of e-health Usage: Insights on The Digital Divide From the Health Information National Trends Survey 2012. *J Med Internet Res.* 2014 Jul; 16(7): e172.

Kotter, J.P. 1996. *Leiderschap bij verandering*, Academic service. Cited in: Barnhoorn H, H Vrielink. 2012. *Effectief leiderschap in de Nederlandse gezondheidszorg - Een kwestie van hard werken*

LaPointe, J. (n.d.). Understanding the Value-Based Reimbursement Model Landscape. Retrieved from <https://revcycleintelligence.com/features/understanding-the-value-based-reimbursement-model-landscape>



Lau, R., Stevenson, F., Ong, B. N., Dziedzic, K., Treweek, S., Eldridge, Murray, E. 2015. Achieving change in primary care—causes of the evidence to practice gap: systematic reviews of reviews. *Implementation Science*, 11(1). <https://doi.org/10.1186/s13012-016-0396-4>

LHV, NHG, Nictiz. Handboek huisartsenpraktijk eConsult www.nhg.org/sites/default/files/content/nhg_org/uploads/nic_handboek_econsult_9.pdf

Mair, F. S., May, C., O'Donnell, C., Finch, T., Sullivan, F., & Murray, E. 2012. Factors that promote or inhibit the implementation of e-health systems: an explanatory systematic review. *Bulletin of the World Health Organisation*, 90(5), 357–364. <https://doi.org/10.2471/blt.11.099424>

Medical Devices Regulation', Verordening (EU) 2017/745 van 5 april 2017

Menzis / FocusCura. 2018 Playbook Zorginnovatie

Met Zandvoorts initiatief “COPD in de buurt” wonen ouderen met COPD veilig thuis. 2017, March 30. Retrieved from <http://www.invoorzorg.nl/ivz/interview-Met-Zandvoorts-initiatief-COPD-in-de-buurt-wonen-ouderen-met-COPD-veilig-thuis.html>

Min van Volksgezondheid, Welzijn en Sport. 2014. Brief aan de Voorzitter van de Tweede Kamer betreffende e-health en zorgverbetering. Den Haag: Ministerie van Volksgezondheid, Welzijn en Sport.

Min van Volksgezondheid, Welzijn en Sport. (n.d.). Stimuleren gebruik e-health. Retrieved from <https://www.rijksoverheid.nl/onderwerpen/e-health/overheid-stimuleert-e-health>

Min VWS. 2016. Het Nederlandse zorgstelsel

Min VWS. 2016. Waardig leven met zorg. 26 februari 2016. Kamerbrief. 930368-147878-LZ

Min VWS. 2017. Langdurige zorg. Kamerstuk 34014. Nr 177.17 mei 2017

Min van Volksgezondheid, Welzijn en Sport. 2017, June 28. Elektronische gegevensuitwisseling in de zorg: De Wet cliëntenrechten bij elektronische verwerking van gegevens in de zorg. Retrieved from <file:///C:/Users/TEMP/Downloads/Wet+elektronische+verwerking+van+gegevens+20170620.pdf>



Min VWS. 18 mei 2018. Afspraken hulpmiddelen, woningaanpassingen en verhuizingen; Kamerbrief 1338858-176386-DMO

Min VWS. 21 mei 2018. Subsidieregeling Veelbelovende Zorg Sneller bij de Patiënt; Kamerbrief 1322198-174978-Z

Mitchall P, M Wynia, R Golden et al. 2012. Institute of Medicine. Core Principles and Values of Effective Team-based Health Care. Washington DC

Moore, G. A. 1991. Crossing the Chasm. New York City, The United States of America: HarperCollins.

Mose, JN and CB Jones. 2018. Alternative payment models and team-based care. NCMJ Vol 79, No 4

NHG-Standpunt: e-health voor huisarts en patient. www.nhg.org/nhg-e-health

Nivel. 2013. Technologie in de zorg thuis- nog een wereld te winnen

Nictiz.2018. Kies bewust voor e-health. e-health monitor 2017

Nyfer. 2012. Integrale zorg in de buurt – meer gezondheidsresultaat per euro payment.

NZa. Innovatie voor kleinschalige experimenten - BR/REG-17163

NZa. Wegwijzer bekostiging e-health https://puc.overheid.nl/nza/doc/PUC_3654_22/1

Peeters, J., Wieggers, T., De Bie, J., & Friele, R. 2013. Technologie in de zorg thuis: nog een wereld te winnen!. Retrieved from <https://www.nivel.nl/sites/default/files/bestanden/Rapport-Technologie-in-de-zorg-thuis.pdf>

Philadelphia in 2017 (annual report). www.philadelphia.nl

Plsek P E. and T Greenhalgh. 2001. The challenge of complexity in health care. In: BMJ, Vol 323, 15 September 2001

Plsek, P. E. 2003. Complexity and the Adoption of Innovation in Health Care. Retrieved from <https://www.nihcm.org/pdf/Plsek.pdf>

Porter, ME and RS. Kaplan. 2016, How to Pay for Health Care. Harvard Business Review, Jul-Aug Issue 2016

Raad voor Volksgezondheid en Samenleving. 2017. Implementatie van e-health vraagt om durf en ruimte: Briefadvies. Retrieved from



file:///C:/Users/TEMP/Downloads/implementatie-van-e-health-vraagt-om-durf-en-ruimte%20(1).pdf

Raad voor Volksgezondheid en Zorg. 2011. Sturen op gezondheidsdoelen

RVZ. 2011. Ziekenhuislandschap 20/20. Niemandland of droomland?

Rijksinstituut voor Volksgezondheid en Milieu. 2016. Proeftuinen populatiegerichte aanpak: nu en in de toekomst. Retrieved from <https://www.rivm.nl/dsresource?objectid=d143f61c-ed04-4d4b-a1f3-426170a10d46&type=pdf&disposition=inline>

RIVM. 2017. Proeftuinen populatiegerichte aanpak: nu en in de toekomst. Tussenrapportage Landelijke Monitor Proeftuinen

Robinson, J. C. (2001). Theory and Practice in the Design of Physician Payment Incentives. *The Milbank Quarterly*, 79(2), 149–177. <https://doi.org/10.1111/1468-0009.00202>

Rogers Everett. 1983. *The diffusion of innovations* (3rd ed)

Romano MF, Sardella MV, Alboni F, Russo L, Mariotti R, Nicastro I, Barletta V, Di Bello V. 2015. Is the digital divide

an obstacle to e-health? An analysis of the situation in Europe and in Italy. *Telemed J E Health*. 2015 Jan;21(1):24-35. doi: 10.1089/tmj.2014.0010

Ross, J., Stevenson, F., Lau, R., & Murray, E. 2016. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). *Implementation Science*, 11(1). <https://doi.org/10.1186/s13012-016-0510-7>

Sanyal, C., Stolee, P., Juzwishin, D., & Husereau, D. 2018. Economic evaluations of e-health technologies: A systematic review. *PLOS ONE*, 13(6). <https://doi.org/10.1371/journal.pone.0198112>

Scott.2000. Economics of general practice. In: *Handbook of Health Economics*. AJ Culyer (ed) Elsevier Science BV

Serra Sastre, V.2008. *Technology Diffusion in Healthcare – a microeconomic analysis of the NHS*. London School of Economics.

Spoelman, W. A., Bonten, T. N., De Waal, M. W. M., Drenthen, T., Smeele, I. J. M., Nielen, M. M. J., & Chavannes, N. H. (2016). Effect of an evidence-based website on healthcare usage: an interrupted time-series study. *BMJ Open*, 6(11). <https://doi.org/10.1136/bmjopen-2016-013166>



Staatsblad van het Koninkrijk der Nederlanden. 2014. Wet Maatschappelijke Ondersteuning 2015. Jrg 2014, nr 280
Staatsblad van het Koninkrijk der Nederlanden. 2014. Besluit Jeugdwet. Jrg 2014, nr 441

Stoneman, P and P A David. 2002 Adoption subsidies vs information provision as instruments of technology policy. In: The Economics of Technology Diffusion. P Stoneman (ed) Blackwell Publishers

Taskforce Zorg op de Juiste Plek. 2018. De juiste zorg op de juiste plek: Wie durft?

The Future of MedTech trend. Feb 2018. <https://www.medtechnews.com/features/the-future-of-medtech-trends>

VNG. 2014. Handreiking Inkoop Hulpmiddelen. Afwegingen, uitdagingen en mogelijkheden voor gemeenten bij de inkoop van Wmo-hulpmiddelen

V&VN. e-health in de praktijk. <https://www.venvn.nl/Themas/e-health-in-de-praktijk>

Wale J, A M Scott, B Hofmann , S Garner. 2017. Why patients should be involved in health technology assessment. International Journal of Technology Assessment in Health

Care, Vol 33, Issue 1.
<https://doi.org/10.1017/S0266462317000241>

Went, R., Kremer, M., & Knottnerus, A..2015. Mastering the robot: the future of work in the second machine age. Retrieved from http://englishbulletin.adapt.it/wp-content/uploads/2015/12/Mastering_the_Robot_Web.pdf

Wouters, M., Swinkels, I., Sinnige, J., De Jong, J., Brabers, A., Van Lettow, Van Gennip, B. (n.d.). Kies bewust voor e-Health: e-Health monitor 2017. Retrieved from https://www.nictiz.nl/wp-content/uploads/2018/03/1_e-health-monitor-2017.pdf

ZIN/ Nictiz.. 2017. Evaluatie van e-health-technologie: in de context van beleid. Retrieved from <file:///C:/Users/TEMP/Downloads/Evaluatie+van+e-health-technologie-web.pdf>

<http://www.allesisgezondheid.nl/content/positieve-gezondheid>

<https://www.demedischspecialist.nl/onderwerp/e-health>

<http://www.louisbolk.org/health-nutrition/integrative-medicine-3/new-concept-of-health>



Contributors

Members expert panel

Prof Dr Bianca Buurman
Drs Marcel Timmen
Prof Dr Marieke Spreeuwenberg
Drs Marc Bruijnzeels

Members stakeholder group

Payam Abrishami (ZIN)
Desiree Beaujean (NHG)
Jan Benedictus (Patiëntenfederatie)
Fred Benning (IGJ)
Caroline Emmen (Nefemed)
Marcel Heldoorn (Patiëntenfederatie)
Susan Janssen (RIVM)
Anja Moonen (Zilveren Kruis)
Hans Paalvast (ZIN)
Dirk Pekelharing (Firevaned)
Roelf van Run (Nefemed)
Samuël Smits (Gupta)
Wilma Venes (Essity).

Professionals interviewed

Jaco van Duivenbode – Nictiz
Annemarie Mulder – Actiz
Henny Mulders – Actiz
Mirjam de Bruijn - DiagNed

Niels de Bruijn – CLB Integrated Care
Marie-Hélène Schutjens - DiagNed
Edwin Dekker – FME
Lianne Raap - FME

Persons interviewed for case studies

Kamiel Zijderveld (manager DigiContact)
Yvonne Wiebes (projectleider Middin)
anonymous (client Philadelphia)
Bianca Kwant (coach Philadelphia)
Tim Wolters (policy officer Wmo – Woerden en Ouderwater),

Leonard van den Berg (professor experimental neurology -
coordinator ALS Centrum/UMCU)
Reinout van Vliet (rehabilitation specialist/Roessingh Enschede)
Conny van der Meijden (ALS patient),

Erwin Bomer (Director Care Policy Slingeland Hospital)
Daniel Winkeler (change manager Room to)
Saskia ter Hennepe (Programme manager Sensire)
Joop Bremer (COPD patient)
Richard Snelder (general practitioner),