



The future health continuum of dementia

A study into the impact of innovation on the health continuum of dementia in 2025

An ageing population, a larger demand on society?

Dementia impacts the individual, our families and our society strongly

In The Netherlands, 1 in 5 people develop dementia. This progressive disease is associated with a high decline in quality of life as a result of memory loss and a reduction of the ability of the brain to process information. Currently, 260.000 people are suffering from dementia. 300.000 informal caregivers (1,15 per patient), such as family members, are providing care for their loved ones. Due to an ageing population, in 2040 more than half a million people will suffer from dementia. Currently, the Netherlands spends a yearly total of 4,8 billion on treatment and care for dementia patients. The current reality is that dementia impacts the individual and the family strongly and takes up a huge share of our annual health care budget. The high costs of the disease are for a large part concentrated in the care for patients provided in nursing homes. Admission to a nursing home is being accelerated as a result of overburdening our informal caregivers. Public debate emphasizes the quality of care provided in nursing homes. This raises the question: **with an ageing population and associated costs of care, will we be able to uphold our level of quality of care?** Can we improve the dementia health continuum by upholding and increasing quality of care, quality of life, as well as reducing total expenditure?

This study looks into the **effects of innovation onto the health continuum of dementia**. A health continuum is defined as an integrated system of health care that follows a patient through time and a range of services. By taking the year 2025 as a reference point and looking back to today, we try to unravel the effect of technology and developments that will contribute to a dementia health continuum in which affordability and quality are balanced out.

This report guides the reader onto a journey through the health care continuum and provides an overview of innovations, technologies and startups that impact care and treatment of dementia. This report may assist health care providers in the formulation of a future proof innovation strategy.

The effects of innovation in 2025: a bird's eye view

Patients are diagnosed earlier

Improvement in diagnostic methods

Better cognitive tests and improved technological support facilitate early recognition of symptoms.

Effect

Ability to diagnose 3 to 6 years before the onset of the disease.



Care at home intensifies strongly, demand for nursing homes decreases

Technologies widely increase possibilities of home care

Supporting the informal caregiver through new business models providing cheaper and 24/7 forms of professional support. Innovations facilitate personalized care in supporting day structuring, care planning and location and activity tracking.

Effect

Supporting informal caregivers leads to a reduction in suffering from (perceived) overburden. Patients will be able to live at home for a longer period.



Progressiveness of the disease reduces

Personalization of care and medication

Personalization of adjusting to living with dementia, better medication and the development of technologies to plan care reduce progressiveness.

Effect

The progressiveness of the disease is reduced, quality of life is maintained for a longer period and life expectancy increases to more than the current average of 8 years.



Quality of life is maintained longer

Technologies increase quality of life in final stage of disease

Technologies ensure patient safety, enhance patient communication and contribute to joy and quality of life.

Effect

A smaller share of patients is receiving care in a nursing home, the quality of life will be maintained longer.



The report is built up along the four phases as described on this page. The report starts with a short summary describing the innovations and effects of innovations for each phase. The appendix covers each phase in-depth.

How today affects tomorrow: where do we start?

The need for new developments

The results of this study generate awareness on how new technologies are finding their way into the health care system. Health care providers will undoubtedly be affected: the progressiveness of dementia will reduce, patient and family wishes and demands will be better integrated into care planning and personalization of care comes into reach. The patient in the year 2025 will be more knowledgeable, will be mentally fit longer and will be looking for personalized care at home. A growing population and a limited budget spikes technological innovations. How can health care providers deal with a rapidly changing world?

Shared decision making between the patient (including family) and the professional gains importance. Due to the earlier diagnosis of the disease, the patient is better able to manage and plan his care. This enables the design of a better care plan. Shared decision making with the patient and its network optimizes the care plan. **Health care providers will guide the patient in planning their care in an early stage.**

An increased share of the patient population is living at home, hence more professional aid at home is needed. Health care providers will develop **new business models** like online marketplaces where patients' family can hire professional caregivers. **Blended care models will increase and the ties between patient and traditional organizations, and professional and traditional organizations will become less evident.**

The **distinction between care and well-being will fade out.** As patients live at home longer, care becomes more personalized and opportunities to plan care whilst still being able to, will lead to a blended model of support aimed at care and well-being. The delivery of services that enhance a patient's health as well as their well-being will be delivered in an integral system. Health care providers will need to **overcome traditional divides of services and become part of cooperative models, with the patient's personal care plan as a starting point.**

The increased use of technological innovations creates demand for **new jobs and an integrated approach to using technology.** For example: the data generated by technological aids such as wearables, will need to be monitored and analyzed. This asks for **an active technology strategy.** Professionals will also need to learn about the possibilities of making use of technological support aimed at increasing quality of life – looking at health as well as well-being. **Professionals need to be trained in making use of technological support** in their day-to-day work.

As the use of professional care at home will increase, care will be delivered via different channels. Healthcare providers should be aware that the **share of patients living in nursing homes will decrease, whereas the burden of disease increases.** This creates the need for more high-trained personnel in nursing homes and demands **strategic workforce planning.**

The innovation dilemma: from first steps to durable improvement

New technologies provide a beckoning perspective: earlier diagnosis, better and personalized care management and an overall increase of quality of care and life. Steps are already being taken at all sorts of different platforms. However, does technological improvement equal an improvement in quality for all parties involved? Several dilemma's arise, which need to be collectively thought through in order to find the right balance between the patient's, the health care provider's and society's perspective. This study provides food for thought.

Privacy and ethics

The patient's perspective

Wearables, monitoring and robotics greatly increase the opportunities for home care. Patient privacy and data ownership may become a sensitive issue when mental fitness reduces. The importance of a personal care plan increases largely.

The health care provider's perspective

Telecare and long-distance contact with patients and family will become more mainstream. How do we guarantee data privacy? Where do we draw the line between deciding in the patient's best interest based on monitoring insight, and letting the patient decide?

Society's perspective

The sheer amount of data generated provide a attractive perspective for developing a quality framework including measurements and statistics. Necessary privacy protocols need to be developed, where the added value of data analysis is weighed against personal privacy and patient wishes.

Investment and ownership

The patient's perspective

Whilst the added value of wearables and new techniques is evident, they require initial investment. Who will foot the bill? And will technology also be available for those with a smaller budget?

The health care provider's perspective

Being able to provide support for the patient and his family by means of technological aid will become a defining feature in the choice for a health care provider. Will early investment pay out in the long run?

Society' perspective

Ultimately, society as a whole benefits from better quality against lower expenditure. However, steps with regard to investment, regulation and policy must be taken in order to reach an economy of scale threshold.

Technology and people

The patient's perspective

Care becomes personalized – however, does that still include personal contact? Telecare and long-distance monitoring may limit personal contact strongly.

The health care provider's perspective

Technology creates possibilities for strategic personnel planning and improvement in productivity. However, it may also create (physical) distance towards the patient. What are the consequences for soft skills and personal contact with the patient and the family?

Society's perspective

Much effort is being invested in reducing loneliness among the elderly. Are these efforts countered by the introduction of technology in healthcare, thereby confining contact to the digital world?



Phase I – Diagnosis

This chapter provides a summary of the effect of changes that are expected for the first phase of the dementia health continuum in 2025. For a full report, see the appendix.



The potential to diagnose dementia before first symptoms arise, is promising

Diagnosis of dementia in 2015

Facts

- 12.700 people are diagnosed with dementia every year.
- Only 40-60% of the patient population is diagnosed with the disease when first symptoms are experienced.
- The average time between first symptoms and diagnosis of dementia is 14 months.
- Physicians use cognitive tests in combination with scanning technology to diagnose the disease.

Recognition of symptoms

- The results of memory tests used by GP's are subject to a high level of variability.
- The patients' environment may lack awareness of the disease. Dementia is still perceived as a taboo, which may inhibit recognition of symptoms and delays the process of proper care planning.

Diagnosis of the disease

- Underdiagnosis leads to delayed treatment of the symptoms.

Diagnosis of dementia in 2025

Forecast

- New technologies create the ability to detect **Alzheimer 3-6 years before its appearance**. This will result in a higher share of the patient population that is diagnosed with the disease as well as earlier recognition. This enables the patient and his network to manage and plan the care beforehand.

Recognition of symptoms

- **Enhanced knowledge sharing (1)** between professionals facilitate the diagnosis process.


Diagnosis of the disease

- Improved cognitive tests and practice based care will result in the **earlier recognition of the disease (2)**.
- Adaptation of new technologies will contribute to **improved diagnosis (3)** of the disease.

The next pages provides an overview of start ups aimed at the developments labeled 1, 2 and 3



Innovations create better and earlier insight for the patient as well as the physician (I)


Development	1. Enhanced Knowledge sharing
What does it do?	<ul style="list-style-type: none">▪ Online platforms are used to share knowledge and bring organizations/networks together. These platforms contain information about latest research, policy and practice. Platforms are available for physicians dealing with Alzheimer diagnostics.
Why is it important?	<ul style="list-style-type: none">▪ The use of these platforms increases collaboration across teams.▪ Quick access to knowledge and evidence accelerates the process to find answers to the questions about the biology behind dementia.
What is the effect?	<ul style="list-style-type: none">▪ Ability to identify people at risk of cognitive decline & dementia contributes to earlier recognition of the disease.
When can we use it?	<ul style="list-style-type: none">▪ Already. The platforms to share knowledge are already available.▪ Current adoption rate?
Involved companies	 Dementia Partnerships <small>Sharing knowledge, learning and innovation to improve health and care</small>



Innovations create better and earlier insight for the patient as well as the physician (II)




'The Harvard School of Public Health conducted surveys on public perceptions, early diagnostics testing and awareness of Alzheimer. The results show that almost 89% of the population, at the moment they start experiencing confusion and memory loss, would want to know whether these symptoms are caused by Alzheimer. On top of that, 95% of the people aged over 60 says that they would like to know if they had Alzheimer. If an early medical test becomes available in the future, 66% of the surveyed adults would like to get access to these tests (Cytos).'

'By the time symptoms are visible, Alzheimer may have been active in the brain for as long as twenty years, destroying memory centers silently (Neurotrack).'

Development	2. Earlier recognition of the disease
What does it do?	<ul style="list-style-type: none">▪ (Computer-based visual) cognitive tests may help physicians to predict the occurrence and onset of Alzheimer before it appears.▪ Software programs are providing information for physicians about evidence based treatment.
Why is it important?	<ul style="list-style-type: none">▪ The best way to optimize treatment of dementia is to detect it at an early stage, before significant neurological changes occur and patients are capable of devising their own care plan based on personal preferences and wishes.▪ Assist GP's in better recognition of Alzheimer by reducing the level of interpretation needed to judge results.
What is the effect?	<ul style="list-style-type: none">▪ An early detection of the disease is a precondition for better tailored care, a delay in onset of impairments and thereby an increased prospect of living at home and maintaining quality of life for a longer period.
When can we use it?	<ul style="list-style-type: none">▪ Not yet. Longitudinal studies demonstrate predictive accuracy for newly developed cognitive tests, eye-analysis methods are not approved by the FDA yet and are still undergoing further research.
Involved companies	<div>CYTOS  pacmed neurotrack</div>



Innovations create better and earlier insight for the patient as well as the physician (III)

Development	3. Improved diagnosis
What does it do?	<ul style="list-style-type: none">▪ Technologies that will diagnose dementia at a very early stage by capturing an analysis of eye-movements or by the non-invasive quantitative measurement of amyloid aggregates (also an eye analysis).▪ Software based technologies that probe the activity of millions of networked neurons that will give an indication of the existence of dementia. This is based on an image-recognition reaction-time approach.
Why is it important?	<ul style="list-style-type: none">▪ The possibilities for personalized care increase largely: treatment plans can be better adjusted to individual patients if they are diagnosed in the early stages.
What is the effect?	<ul style="list-style-type: none">▪ The ability to detect the disease before the onset of memory loss symptoms.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Non-invasive eye scanning demonstrates successful preclinical and clinical results.
Involved companies	 SACCADOUS  COGNOPTIX 



Phase II – Adjusting to living with dementia

This chapter provides a summary of the effect of changes that are expected for the second phase of the dementia health continuum in 2025. For a full report, see the appendix.



Due to better medication and care planning, the patient's quality of life increases

Adjusting to living with dementia in 2015

Facts

- Dementia is a progressive disease that causes quick delay in mental capabilities. Patients have to plan their care when they are still able to. Late diagnosis inhibits this process.
- This part of the disease is characterized by the occurrence of emotional problems; fear, sadness, insecurity etc.

Information & education

- Information is not easy accessible. This limits the distribution of knowledge and technological solutions, which are offered by a large amount of parties.

Planning & coordination of care

- A case manager often helps families to find their way through the non-transparent and dispersed sources of information and delivery of services.

Medication

- Whereas medication is involved in treatment, effectiveness in reducing brain deterioration and maintaining quality of life is limited.

Adjusting to living with dementia in 2025

Forecast

- Deterioration in brain activity will be delayed, which prohibits the progression of the disease.
- Reducing the progressiveness of the disease by means of personalized medicine reduces the burden of disease and experienced emotional stress and problems.

Information & education

- Dementia-friendly communities focus on transparent distribution of available knowledge in society (p. 49). Increasing the level of knowledge and acceptance society-wide will contribute to reducing patients' isolation.

Planning & coordination of care

- **Improved care planning (1)** helps patients and their families with planning their care according to their specific circumstances.


Medication

- **Treatment/medication for the disease (2)** increases the duration of the health continuum, reduces the burden of the disease and increases the patients' quality of life.

The next pages provides an overview of start ups aimed at the developments labeled 1 and 2



Innovations create opportunities for better planning and personalized medication (I)

Development	Improved care planning (1)
What does it do?	<ul style="list-style-type: none">▪ Software applications will manage care across the care continuum. They will be able to identify clients in need of care, their needs, establish a care plan, support their needs, manage and monitor results and outcomes. They contribute to an holistic approach and management plan.
Why is it important?	<ul style="list-style-type: none">▪ As people are diagnosed at an earlier stage, the planning of care becomes more important and effective.
What is the effect?	<ul style="list-style-type: none">▪ The care plan is better tailored to the patients needs.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Currently under development.
Involved companies	



Innovations create opportunities for better planning and personalized medication (II)

'Ybrain technology is an revolutionary method to modulate cognitive function simpler and safer than surgery or medication (Ybrain).'

An 'exergame' helps the elderly improving their balance in order to prevent falling incidents. With this game, people use a television to mimic an ice skating movement. A camera registers their movements and shows a virtual ice skating tour. After 6 weeks of practicing, balance is improved. The elderly participating in the study were enthusiastic about the game, up to the extent of practicing more than the prescribed 30 minutes three times a week (research center SPRINT/UMCG).

Development	Treatment / medication for the disease (2)
What does it do?	<ul style="list-style-type: none"> ▪ Development of drugs for halting the progression of the disease / cognitive decline and reversing of symptoms. ▪ Wearable devices that retrieve brain signal data. The information is analyzed by neuroscientists who will provide accurate and personalized simulation via a power current to keep the brain as healthy as possible. ▪ Serious gaming keeps the patient fit through 'exergaming' and helps prevent falling incidents. ▪ Open databases accumulate information about medical conditions, related clinical trials and early access programs around the globe and facilitate patients' request for drugs in development. ▪ Crowdsourcing enables the general public to participate directly in Alzheimer research, as perceptual tasks are very easy for humans, but still too complicated for machines. Via a game-like activity, the data analysis is crowdsourced.
Why is it important?	<ul style="list-style-type: none"> ▪ There are huge steps forward to be taken with regard to effective medication that will actually be able to halt the progression of the disease and possibly reverse symptoms.
What is the effect?	<ul style="list-style-type: none"> ▪ Brain deterioration will be reduced. ▪ Earlier access to potential cure/treatment via clinical trials and early access programs. ▪ Reduction of the time needed to develop a treatment for Alzheimer.
When can we use it?	<ul style="list-style-type: none"> ▪ Almost. Many treatments in the clinical trials stage are tested for efficacy (and safety) in selected populations of patients. ▪ Almost. Tests on increased brain activity as a result of wearable devices on people without dementia show an increase of brain activity with 30%, short-term memory increase with 15%, perceptual ability increase with 20% and mental strength increase with 20%. Currently they are performing Randomized Clinical Trial's (RCT's) for the effect on dementia. ▪ Almost. Exergame aimed at improving balance among the elderly is developed and in go-to-market stage (UMCG/RUG).
Involved companies	



Phase III – Intensified care at home

This chapter provides a summary of the effect of changes that are expected for the third phase of the dementia health continuum in 2025. For a full report, see the appendix.



The taking over of elementary tasks is inevitable, but supported strongly by technological solutions

Intensified care at home in 2015

Facts

- 35.000 people suffering from dementia are dependent on 24-hour care.
- Currently, around 70% of patients live at home with the support of an informal caregiver.
- There are around 300.000 informal caregivers in the Netherlands, with a ratio of 1,2 caregivers for each patient.
- On average, a professional is delivering care 6,6 hours a week. The informal caregiver is on average providing care 20 hours a week.
- More than half of the informal caregivers experiences a heavy burden and 3% of the informal caregivers are dealing with overburden.

Everyday tasks

- Supporting the patient in everyday tasks is a cause of overburden among informal caregivers.
- Patients get isolated from society due to fearfulness regarding their symptoms.

Keeping a day structure

- Behavioral problems can become more severe due to lack of day structure.

Safety at home

- (Informal) caregivers spend a lot of their time supervising the patient by being physically present.

Intensified care at home in 2025

Forecast

- It is expected that around 85% of patients will live at home.
- Online market places for professional caregivers contribute to better pay for the caregiver and reduction of cost for the family.
- A decrease in the amount of informal caregivers suffering from overburden.

Everyday tasks

- **Relieving (informal) caregivers (1)** via cheaper forms of professional support and the use of technological solutions.
- **Improved knowledge & understanding (2)** increase understanding of informal caregivers and reduce stress.

Keeping a day structure

- **Technological support for day structuring (3)** reduces stress and behavioral problems in patients.

Safety at home

- **Safety of the patient is increased (4)** by an increased use of location and action/activity tracking and will also relieve the burden of informal caregivers.

The next pages provides an overview of start ups aimed at the developments labeled 1-4.



The independency of patients with dementia increases and the informal caregiver is relieved (I)

'The use of animated pets in California is described as "a caregiving tool that can engage dementia patients and provide the calming effect that is often sought through medications, but without the side effects. Dramatic improvements are seen from symptomatically advanced dementia, unmanageable violent behavior and uncommunicative withdrawal to what is considered moderate dementia with a pleasant mood, high socialization and improved quality of life (Gerijoy).'

Development	Relieving (informal) caregivers (1)
What does it do?	<ul style="list-style-type: none"> ▪ Technologies will provide personalized, 24/7 (emotional) support and stimulate social interactions. Pet animations on tablets will trigger patients to start interacting. The information gained can be stored and used in the care process. ▪ Professional aid is provided via new business models. Online marketplaces of professional caregivers and medical students empower families to easily find, hire, manage and pay licensed caregivers. Via the use of introduction movies, families are indirectly meeting the people they will hire. ▪ Apps will help informal caregivers in planning care, as the planning can be easily shared with other family members. Also healthcare providers can be linked to the planning. Via these online agenda's, it can be notified when the informal caregiver is in need of extra support from family or friends.
Why is it important?	<ul style="list-style-type: none"> ▪ 24/7 professional care is expensive and therefore limitedly used. Informal caregivers are an important factor in providing 24/7 network support, which may cause overburden. Being able to better manage care and increase the independency of the patient, overburden is reduced.
What is the effect?	<ul style="list-style-type: none"> ▪ Reduction in (perceived) loneliness of the patient and therefore quality of life is improved. ▪ Relieve burden of the informal caregiver.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. New forms of professional aid (business model) are available on the market, such as Caren and Mantelaar. ▪ Already. Several companies offer pet animations and pets in order to provide emotional support for the patient.
Involved companies	



The independency of patients with dementia increases and the informal caregiver is relieved (II)


Development	Improve knowledge & understanding (2)
What does it do?	<ul style="list-style-type: none"> ▪ Virtual reality-glasses are used to let informal caregivers experience dementia-like symptoms. Via these glasses, they experience the situations people with dementia are experiencing every day and how the environment is reacting to them. In this way they are confronted with their own way of handling these situations. ▪ Apps based on a dementia-simulator to experience what it is like to suffer from dementia. Apps are developed that enable informal caregivers to ask questions how to deal with the patient in difficult situations. The app will provide tips in how to deal with these situations.
Why is it important?	<ul style="list-style-type: none"> ▪ Informal caregivers do not always understand the emotions and thoughts of people suffering from dementia. This gives rise to stressful situations and behavioral problems.
What is the effect?	<ul style="list-style-type: none"> ▪ Increased understanding reduces the level of stress and contributes to a reduction of perceived burden.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. Apps providing situation specific information are currently available in English and French. ▪ Almost. The virtual reality glasses are being tested in small groups of informal caregivers. It is expected that the glasses will be ready to be used in the end of 2016.
Involved companies	



The independency of patients with dementia increases and the informal caregiver is relieved (III)





'When evaluating the use of DayClocks, the most heard remark from the patients is that they absolutely do not want to loose the devise, because they got really attached to it (DayClocks).'

'While Alzheimer's may be incurable, recent studies have shown that mental stimulation in the form of regular reminders of past events could potentially slow down the progression of the disease (Samsung).'

Development	Technological Support for day structuring (3)
What does it do?	<ul style="list-style-type: none">▪ Apps / robots are (verbally) reminding patients about names, events, places, taking medicines and everyday tasks such as showering and eating. These technologies support the gaps in memory, by providing essential information when it is most needed. The provision of this information is combined with the use of colors, melodies and pictures in order to increase the understanding of the patient. It is also possible for the informal caregiver to leave personal notes for the robot, that are read out loud to the patient.
Why is it important?	<ul style="list-style-type: none">▪ Day structuring is important for patients with dementia as they are losing overview and are not able to rely on their memory. This results in a loss in control over their lives.▪ Good structure for the patient will reduce behavioral problems.▪ The loss in structure results in passivity. Due to this passivity, symptoms of dementia develop further and are enhanced in experience.
What is the effect?	<ul style="list-style-type: none">▪ These support mechanisms for the patients' memories result in prolonged independence and a decrease in behavioral problems.▪ Calmness in patients is increased.▪ Activity of the patient is increased.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Prototypes of the robots are tested in homes of people with dementia, in order to evaluate which functions should be included in the robot and which shouldn't. It is expected that the first products will be market ready around 2017.
Involved companies	



The independency of patients with dementia increases and the informal caregiver is relieved (IV)

Development	Safety of the patient is increased (4)
What does it do?	<ul style="list-style-type: none">▪ Location tracking is looking after loved ones in and outside houses via GPS, geofencing and motion tracking. Functionalities on these tracking devices enable direct contact with the patient if abnormalities occur.▪ Activity tracking without the use of cameras, but via sensors to track the patients' activities. Families are updated on patient behavior (using water heater, sleeping, going to the toilet etc.). Pro-active messages can be sent involving for example whether the patient returned home or when the patient is laying in bed for an abnormal long time.
Why is it important?	<ul style="list-style-type: none">▪ The high burden for informal caregivers is among others caused by the high amount of time needed to look after their loved ones and be physically present. Long-distance supervision and an alert system reduces this strongly.▪ Patients get isolated from society, due to the inability to go outside the house independently.
What is the effect?	<ul style="list-style-type: none">▪ Reduction in the worries of families and the burden of informal caregivers.▪ Enables patients to live independently.
When can we use it?	<ul style="list-style-type: none">▪ Already. Activity tracking and location technology are already available for private purchase.
Involved companies	   



Phase IV – Nursing homes

This chapter provides a summary of the effect of changes that are expected for the fourth phase of the dementia health continuum in 2025. For a full report, see the appendix.



When admitted into a nursing home, the burden of disease will have increased

Intensified care at a nursing home in 2015

Facts

- On average, people with dementia spend 2 years in a nursing home.
- In 2013, 82.000 patients were receiving care in a nursing home facility. Around 30% of the entire patient population lives in a nursing home.
- 1 in 7 people suffering from dementia spend the terminal phase in a nursing home. This phase is associated with the highest loss in quality of life (on average a loss of 71%).
- The largest part of total expenditure associated with dementia care is admission into nursing homes.

Patient-centered care

- Financial reasons limit the possibilities for personalized care, as nursing homes have to prioritize in managing their personnel's activities.

Activities

- People in nursing homes are very limited in their mobility and rarely perform physical exercise or move around.

Supervision

- Currently, technological support is limitedly used.

Intensified care at a nursing home in 2025

Forecast

- It is expected that the share of patients living in a nursing home, will decrease. The patient population will grow, however this effect doesn't outweigh the effect of living at home longer. In absolute numbers, demand for nursing homes will decrease. This results in a larger average burden of disease when patients are admitted; an on average shorter time spent in a nursing home; and a reduction in costs from a macro level perspective.

Patient-centered care

- **Increased joy & happiness for patients (1)** by using photo's and music from the patient for more tailored care and an increased quality of life.

Activities

- **Enhanced safety in nursing homes (2)** through the increased use of technological solutions will increase the ability of the patient to move around freely.

Supervision





- **Facilitation of professional caregivers (3)** supported by technological intervention possibilities. New management apps and training programs are facilitating the professional caregivers in performing their work.
- **Improved communication methods with patients (4)** increases opportunities to deliver personalized care.

The next pages provides an overview of start ups aimed at the developments labeled 1-4.



Technological innovations enhance the quality of life of patients in nursing homes (I)

'Research has shown that keeping patients active, decreases decline in patients' health and increase quality of health. However in a research in the south of the Netherlands, it was found that currently, 90% of the observation time, patients are sitting or lying down. This inactivity is causing a deterioration in the patients health.'




Development	Increased joy & happiness for patients (1)
What does it do?	<ul style="list-style-type: none"> ▪ Technological solutions make use of photo's and music in the form of photo collections and interactive paintings. Personal collections (based on life experience, hobby's, family, interests etc.) of patients' interests are used by caregivers to get a connection with their patients. ▪ Apps are developed that serve as a backup memory. The app detects when family or friends are nearby and will provide the patient with a photo of the person, indicating the relationship with him (e.g., son/sister).
Why is it important?	<ul style="list-style-type: none"> ▪ Improving quality of life for people with dementia in a nursing home has large added value, as people are in a terminal phase of life.
What is the effect?	<ul style="list-style-type: none"> ▪ Help professionals providing more patient-tailored care. ▪ Keeping patients as mentally as fit as possible. ▪ These innovations will not only be seen in nursing homes, but also in the home care setting.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. illi-engineering (technological solution) is already used in several nursing homes in the Netherlands. ▪ Not yet. The apps are still in the development phase.
Involved companies	   



Technological innovations enhance the quality of life of patients in nursing homes (II)

'Admission to a nursing home is a impactful decision. We are working hard to ensure that every day during the stay is as pleasant and safe as possible. This all in respect of privacy.'

'Sensing in nursing homes has the ability to improve the care delivered. The system has proven itself in practice in different Dutch nursing homes.'

Development	Enhanced safety in nursing homes (2)
What does it do?	<ul style="list-style-type: none"> ▪ Sensors will provide the caregiver with information about whether the patient has left the room, whether he got out of bed and provide fall detection. These sensors communicate with other applications. ▪ A smart software system that is linking all technologies used in the nursing home in one place. Enabling to deliver high quality of care with the support of domotics. Care systems like smart sensors, detection, domotics are connected in one dashboard providing one logbook.
Why is it important?	<ul style="list-style-type: none"> ▪ There are a lot of technological developments, and technology is offering more and more possibilities. However, these are all offered by different parties and are therefore not connected. True added value can be found in combining this information.
What is the effect?	<ul style="list-style-type: none"> ▪ Reducing time spent monitoring increases time to care for patients. ▪ More freedom and privacy the residents. ▪ The connection of the different technologies centralizes the optimization of the work process, and not the technology itself.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. Sensors to support the patient's safety in the nursing home are already on the market.
Involved companies	  



Technological innovations enhance the quality of life of patients in nursing homes (III)


'The primary reason to train your workforce is to improve patient care. However, a secondary mission is to reduce injuries and overburden among caregivers (Dementia Dynamics)'.

Development	Facilitation of professional caregivers (3)
What does it do?	<ul style="list-style-type: none"> ▪ Management apps that plan, track and manage activities of daily living and medication. Family members can also access the resident care information and get alerts and notifications. ▪ Training programs will provide nursing home staff with education to enter the patient's world and view it from the patients' perspective. Topics covered are; safety issues, caregiver stress, changes in behavior of patients and managing patient behavior.
Why is it important?	<ul style="list-style-type: none"> ▪ Staff in nursing homes have limited time available for their residents. With help from these management apps patients have more tailored and efficient care. ▪ Patients with behavioral problems don't always receive the right care on time. Reducing behavioral problems by means of improving communication methods and providing training programs helps to counter this effect.
What is the effect?	<ul style="list-style-type: none"> ▪ Improved quality of care as more time and money is available to deliver patient-centered care. ▪ Improved quality of life of those living with dementia as well as their caregivers.
When can we use it?	<ul style="list-style-type: none"> ▪ Already, but not in the Netherlands. Training programs from Dementia Dynamics. ▪ Almost. Carevium is distributing demo's.
Involved companies	 



Technological innovations enhance the quality of life of patients in nursing homes (IV)

'The instant translation of word to image brings the idea into a moment of conversation and has been found to be effective at stimulating memories, improving communication, mood and levels of engagement amongst people with dementia (See what I mean)'.

Development	Improved communication methods with patients (4)
What does it do?	<ul style="list-style-type: none">▪ Apps that translate words into pictures. Images retain their meaning long after the sense of the word has been gone.
Why is it important?	<ul style="list-style-type: none">▪ Increasing communication options and maintaining memory functions as long as possible adds to perceived independency.
What is the effect?	<ul style="list-style-type: none">▪ Communication with patients will be improved.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Improved versions of the app are being developed.
Involved companies	



In-depth analysis of
developments
within each phase



Phase I – Diagnosis

This chapter discusses the expected developments for the first phase of the dementia health continuum in 2025.

Firstly, this phase in the health continuum is described. Secondly, a comparison is provided between the current phase of the health continuum and the continuum in 2025. Thirdly, an overview is shown that provides information about the innovations that are going to change the current continuum. Lastly, preconditions are discussed in order to reach the optimized health continuum in 2025.



The best way to treat dementia is to detect it as early as possible

In combination with new technologies and enhanced knowledge sharing, patients will be diagnosed at an early stage – that is, even before onset and first symptoms. This will lead to an increased incidence. An earlier diagnosis will eventually lead to earlier adaptation to the disease and a increase in time spent in better health.

Improvement in the diagnosis rate is needed

Early diagnosis of the disease is a critical factor in the stabilization of the disease and delay of impairment. By improving the possibility of early adaptation to the disease, and earlier diagnosis eventually leads to lower admission rates in nursing homes and an increased perceived quality of life. In 2015 we are dealing with a relatively high level of underdiagnosis – sources vary, an underdiagnosis rate of between 40% - 60% is reported. Accordingly, the late diagnosis of the disease deprives patients of the possibility to make sufficient living arrangements.

Explanations for this low rate in diagnosis

- GPs are not always adequately recognizing symptoms of dementia due to problematic testing methods. Memory problems may be perceived as symptoms of ageing.
- Memory tests' results generate a high level of variability due to the level of interpretation needed in judging results.
- People experiencing symptoms correlated to the onset of the disease, don't always easily accept their deteriorating health status and hence may delay seeking assistance.
- Lack of awareness and knowledge of the disease are limiting the patient's social environment an early detection of dementia.

What types of innovations do we see?

Innovations aimed at improving diagnostic methods and providing support

- Improved cognitive tests, reducing variance due to decreasing the need for interpretation.
- Improved technological support for diagnosis.
- Technologies that support early recognition of symptoms, including providing support for patients and family – thereby contributing to the acceptance process.

Effect

Expectations are set to be able to diagnose the disease 3 till 6 years *before* the onset of the disease – that is, before first symptoms are experienced.

The next page provides an overview of developments that facilitate earlier recognition of dementia.



The potential to diagnose dementia before first symptoms arise, is promising

Diagnosis of dementia in 2015

Facts

- 12.700 people are diagnosed with dementia every year.
- Only 40-60% of the patient population is diagnosed with the disease when first symptoms are experienced.
- The average time between first symptoms and diagnosis of dementia is 14 months.
- Physicians use cognitive tests in combination with scanning technology to diagnose the disease.

Recognition of symptoms

- The results of memory tests used by GP's are subject to a high level of variability.
- The patients' environment may lack awareness of the disease. Dementia is still perceived as a taboo, which may inhibit recognition of symptoms and delays the process of proper care planning.

Diagnosis of the disease

- Underdiagnosis leads to delayed treatment of the symptoms.

Diagnosis of dementia in 2025

Forecast

- New technologies create the ability to detect **Alzheimer 3-6 years before its appearance**. This will result in a higher share of the patient population that is diagnosed with the disease as well as earlier recognition. This enables the patient and his network to manage and plan the care beforehand.

Recognition of symptoms

- **Enhanced knowledge sharing (1)** between professionals facilitate the diagnosis process.


Diagnosis of the disease

- Improved cognitive tests and practice based care will result in the **earlier recognition of the disease (2)**.
- Adaptation of new technologies will contribute to **improved diagnosis (3)** of the disease.

The next pages provides an overview of start ups aimed at the developments labeled 1, 2 and 3



Innovations create better and earlier insight for the patient as well as the physician (I)




Development	1. Enhanced Knowledge sharing
What does it do?	<ul style="list-style-type: none">▪ Online platforms are used to share knowledge and bring organizations/networks together. These platforms contain information about latest research, policy and practice. Platforms are available for physicians dealing with Alzheimer diagnostics.
Why is it important?	<ul style="list-style-type: none">▪ The use of these platforms increases collaboration across teams.▪ Quick access to knowledge and evidence accelerates the process to find answers to the questions about the biology behind dementia.
What is the effect?	<ul style="list-style-type: none">▪ Ability to identify people at risk of cognitive decline & dementia contributes to earlier recognition of the disease.
When can we use it?	<ul style="list-style-type: none">▪ Already. The platforms to share knowledge are already available.▪ Current adoption rate?
Involved companies	 Dementia Partnerships <small>Sharing knowledge, learning and innovation to improve health and care</small>



Innovations create better and earlier insight for the patient as well as the physician (II)




'The Harvard School of Public Health conducted surveys on public perceptions, early diagnostics testing and awareness of Alzheimer. The results show that almost 89% of the population, at the moment they start experiencing confusion and memory loss, would want to know whether these symptoms are caused by Alzheimer. On top of that, 95% of the people aged over 60 says that they would like to know if they had Alzheimer. If an early medical test becomes available in the future, 66% of the surveyed adults would like to get access to these tests (Cytos).'

'By the time symptoms are visible, Alzheimer may have been active in the brain for as long as twenty years, destroying memory centers silently (Neurotrack).'

Development	2. Earlier recognition of the disease
What does it do?	<ul style="list-style-type: none">▪ (Computer-based visual) cognitive tests may help physicians to predict the occurrence and onset of Alzheimer before it appears.▪ Software programs are providing information for physicians about evidence based treatment.
Why is it important?	<ul style="list-style-type: none">▪ The best way to optimize treatment of dementia is to detect it at an early stage, before significant neurological changes occur and patients are capable of devising their own care plan based on personal preferences and wishes.▪ Assist GP's in better recognition of Alzheimer by reducing the level of interpretation needed to judge results.
What is the effect?	<ul style="list-style-type: none">▪ An early detection of the disease is a precondition for better tailored care, a delay in onset of impairments and thereby an increased prospect of living at home and maintaining quality of life for a longer period.
When can we use it?	<ul style="list-style-type: none">▪ Not yet. Longitudinal studies demonstrate predictive accuracy for newly developed cognitive tests, eye-analysis methods are not approved by the FDA yet and are still undergoing further research.
Involved companies	  



Innovations create better and earlier insight for the patient as well as the physician (III)

Development	3. Improved diagnosis
What does it do?	<ul style="list-style-type: none">▪ Technologies that will diagnose dementia at a very early stage by capturing an analysis of eye-movements or by the non-invasive quantitative measurement of amyloid aggregates (also an eye analysis).▪ Software based technologies that probe the activity of millions of networked neurons that will give an indication of the existence of dementia. This is based on an image-recognition reaction-time approach.
Why is it important?	<ul style="list-style-type: none">▪ The possibilities for personalized care increase largely: treatment plans can be better adjusted to individual patients if they are diagnosed in the early stages.
What is the effect?	<ul style="list-style-type: none">▪ The ability to detect the disease before the onset of memory loss symptoms.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Non-invasive eye scanning demonstrates successful preclinical and clinical results.
Involved companies	 SACCADOUS  COGNOPTIX 



Prepare to adapt to new technologies, new patients, new demands

How does this affect health care providers: lessons learned

Provide opportunities for early care planning and personalized treatment plans.

New diagnostics solutions are being developed that carry the potential to drastically increase incidence, early recognition and early care planning possibilities. Physicians as well as the patient and surrounding family will update their methods and knowledge with the latest technologies to diagnose the disease. Patients and their family will become more actively knowledgeable and will become increasingly involved in the decision making process. For health care providers, this means that:

- Patients and family actively seek out information. Information and information channels used/provided by the health care provider, must be suited to actively inform patients still of full mental fitness.
- New services regarding the support of the patient and his family will aim at providing support and care planning, long before the onset of the disease. Planning in advance will increase in demand.
- The process of getting familiar with the patient, his or her wishes and the bond with the caretaker will take place long before the actual need for care arises.

The journey from today to the future: preconditions

Technological innovations are not able to overcome all the bottlenecks in the current health continuum.

Due to new technological solutions, the possibility of better and earlier diagnosis seems promising. However, new technologies are not eliminating all the bottlenecks in the current health continuum. It should be kept in mind that more is needed to optimize the diagnosis of dementia.

- Society will need to be open to discussing dementia and its consequences. Openness and awareness is stimulated by increasing knowledge sharing not only among patients but also family members and informal caregivers .This will contribute to lifting the taboo that still surrounds the disease. Stimulation of knowledge sharing will contribute to this development. Next to that, developments such as so-called ' dementia-friendly communities' can help (p. 49).
- Knowledge sharing amongst physicians isn't as mainstream as we would hope it to be. The added value of online platforms must be regarded in terms of improved patient care as well as increased quality and efficiency in behalf of the physician in order to reach the necessary adoption threshold for knowledge sharing platforms to become effective.



Phase II – Adjusting to living with dementia

This chapter discusses the changes that are expected for the second phase of the dementia health continuum in 2025.

Firstly, this phase in the health continuum is described. Secondly, a comparison is provided between the current phase of the health continuum and the continuum in 2025. Thirdly, an overview is shown that provides information about the innovations that are going to change the current continuum. Lastly, preconditions are discussed in order to reach the optimized health continuum in 2025.



As a result of earlier diagnosis, possibilities to adjust to life with dementia increase largely

This phase is characterized by the occurrence and worsening of symptoms. Adjusting to living with dementia is an important element in maintaining quality of life for as long as possible. Earlier diagnosis already facilitates this process. Being able to plan care and personalized treatment whilst mentally fit, will help adjusting to living with dementia. The development of better medication will contribute to delaying the disease's progression, which in turn will effectuate the ability of the patient to live at home with the disease.

Improvement in medication and care planning increases quality of life for the patient as well as the informal care giver

Currently, people diagnosed with dementia are faced with a life expectancy of on average 8 years starting from the diagnosis. The main focus of this part of the health continuum – adjusting to living with dementia – is aimed at proper facilitation of the admission in nursing homes. This is a result of diagnosing patients when they already find themselves in an advanced stage of the disease. Hence, options of home and life adjustments to remain at home for a longer period of time, are limitedly available.

Also, currently informal caregivers such as family members often deal with overburden. Late recognition of the disease and consequently, delayed medication and support put a large demand on the informal caregiver.

What types of innovations do we see?

Innovations aimed at slowing progression

- Slowing progression of the disease through more effective and more personalized medication planning and monitoring.
- Advanced care planning by making use of technological aids that facilitate communication with the physician, the family, the formal and the informal support system.

Effect

An increase in life expectancy and an increase in perceived quality of life for the patients himself as well as the informal support system (by means of reducing overburden).

The next page provides an overview of developments that facilitate better adaptation to living with dementia.



Due to better medication and care planning, the patient's quality of life increases

Adjusting to living with dementia in 2015

Facts

- Dementia is a progressive disease that causes quick delay in mental capabilities. Patients have to plan their care when they are still able to. Late diagnosis inhibits this process.
- This part of the disease is characterized by the occurrence of emotional problems; fear, sadness, insecurity etc.

Information & education

- Information is not easy accessible. This limits the distribution of knowledge and technological solutions, which are offered by a large amount of parties.

Planning & coordination of care

- A case manager often helps families to find their way through the non-transparent and dispersed sources of information and delivery of services.

Medication

- Whereas medication is involved in treatment, effectiveness in reducing brain deterioration and maintaining quality of life is limited.

Adjusting to living with dementia in 2025

Forecast

- Deterioration in brain activity will be delayed, which prohibits the progression of the disease.
- Reducing the progressiveness of the disease by means of personalized medicine reduces the burden of disease and experienced emotional stress and problems.

Information & education

- Dementia-friendly communities focus on transparent distribution of available knowledge in society (p. 49). Increasing the level of knowledge and acceptance society-wide will contribute to reducing patients' isolation.

Planning & coordination of care

- **Improved care planning (1)** helps patients and their families with planning their care according to their specific circumstances.


Medication

- **Treatment/medication for the disease (2)** increases the duration of the health continuum, reduces the burden of the disease and increases the patients' quality of life.

The next pages provides an overview of start ups aimed at the developments labeled 1 and 2



Innovations create opportunities for better planning and personalized medication (I)

Development	Improved care planning (1)
What does it do?	<ul style="list-style-type: none">▪ Software applications will manage care across the care continuum. They will be able to identify clients in need of care, their needs, establish a care plan, support their needs, manage and monitor results and outcomes. They contribute to an holistic approach and management plan.
Why is it important?	<ul style="list-style-type: none">▪ As people are diagnosed at an earlier stage, the planning of care becomes more important and effective.
What is the effect?	<ul style="list-style-type: none">▪ The care plan is better tailored to the patients needs.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Currently under development.
Involved companies	



Innovations create opportunities for better planning and personalized medication (II)

'Ybrain technology is an revolutionary method to modulate cognitive function simpler and safer than surgery or medication (Ybrain).'

An 'exergame' helps the elderly improving their balance in order to prevent falling incidents. With this game, people use a television to mimic an ice skating movement. A camera registers their movements and shows a virtual ice skating tour. After 6 weeks of practicing, balance is improved. The elderly participating in the study were enthusiastic about the game, up to the extent of practicing more than the prescribed 30 minutes three times a week (research center SPRINT/UMCG).

Development	Treatment / medication for the disease (2)
What does it do?	<ul style="list-style-type: none"> ▪ Development of drugs for halting the progression of the disease / cognitive decline and reversing of symptoms. ▪ Wearable devices that retrieve brain signal data. The information is analyzed by neuroscientists who will provide accurate and personalized simulation via a power current to keep the brain as healthy as possible. ▪ Serious gaming keeps the patient fit through 'exergaming' and helps prevent falling incidents. ▪ Open databases accumulate information about medical conditions, related clinical trials and early access programs around the globe and facilitate patients' request for drugs in development. ▪ Crowdsourcing enables the general public to participate directly in Alzheimer research, as perceptual tasks are very easy for humans, but still too complicated for machines. Via a game-like activity, the data analysis is crowdsourced.
Why is it important?	<ul style="list-style-type: none"> ▪ There are huge steps forward to be taken with regard to effective medication that will actually be able to halt the progression of the disease and possibly reverse symptoms.
What is the effect?	<ul style="list-style-type: none"> ▪ Brain deterioration will be reduced. ▪ Earlier access to potential cure/treatment via clinical trials and early access programs. ▪ Reduction of the time needed to develop a treatment for Alzheimer.
When can we use it?	<ul style="list-style-type: none"> ▪ Almost. Many treatments in the clinical trials stage are tested for efficacy (and safety) in selected populations of patients. ▪ Almost. Tests on increased brain activity as a result of wearable devices on people without dementia show an increase of brain activity with 30%, short-term memory increase with 15%, perceptual ability increase with 20% and mental strength increase with 20%. Currently they are performing Randomized Clinical Trial's (RCT's) for the effect on dementia. ▪ Almost. Exergame aimed at improving balance among the elderly is developed and in go-to-market stage (UMCG/RUG).
Involved companies	



Shared decision making becomes increasingly important

How does this affect health care providers: lessons learned

Shared decision making gains increased importance in the future health continuum

Due to the earlier diagnosis of the disease, the patient and his or her family are better able to manage and plan care. Shared decision making between the patient and the physician becomes increasingly important as an integral element in the health continuum.

The need for a case manager will reduce

Although the demand for care planning increases, new technological solutions enable patient and family to be in control of their care planning process. Availability of information will increase. Hence, the 'traditional' case manager will be replaced by the patient himself.

Physicians should be aware of improved medical solutions

A lot of effort is invested in the development of better medical solutions in order to reduce the progressiveness of the disease. In order to facilitate the development of these medical solutions, physicians can use online platforms that provide information about early access clinical trials.



Phase III – Intensified care at home

This chapter discusses the changes that are expected for the third phase of the dementia health continuum in 2025.

Firstly, this phase in the health continuum is described. Secondly, a comparison is provided between the current phase of the health continuum and the continuum in 2025. Thirdly, an overview is shown that provides information about the innovations that are going to change the current continuum. Lastly, preconditions are discussed in order to reach the optimized health continuum in 2025.



Technological and professional support reduces overburden of informal caregivers

The use of technological support and cheaper forms of professional care in this phase of the health continuum will reduce the burden of the disease for the patient as well as that of the informal caregiver. This enables the patient to live at home for a longer period of time.

Currently, for each patient on average, 1,2 informal caregivers take care of their family from 2 hours up to over 30 hours a week. Informal caregivers thereby form an important cornerstone of the health continuum. The support of others is needed as patients have more difficulty in performing their everyday tasks, and the need to assist with elementary tasks will increase. Frequent overpressure of the informal caregiver is perceived, as care for people with dementia is highly demanding. This calls for a system in which professional and informal care is balanced properly.

Patients with dementia often experience isolation at home

Isolation is a result of inability to participate in "normal" life. Results from the Alzheimer's society (2013) show that people with dementia often feel imprisoned in their own house. Two-thirds of people living with dementia at home quit their usual activities as they are scared to get confused or lost. Around half of the patient population is avoiding contact with neighbors, as they do not want to bother them. 35 percent only goes outside the house once a week and 10 percent only once a month. Therefore, it is concluded that this disease leads to a high level of isolation.

What types of innovations do we see?

Technological innovation leads to an education of the amount of informal caregivers suffering from overburden and greatly increases the possibilities to live at home whilst also needing care.

- Location and activity tracking increase possibilities of monitoring without being physically present. Informal care isn't bound to physical presence anymore and care can be distributed between caregivers more easily.
- Applications that enhance the awareness of the disease, which contributes to social awareness as well as information on how to handle symptoms of dementia.
- Smart day planning and support in day structuring greatly increase possibilities to live at home independently - with the perception of independence.

The next page provides an overview of developments that facilitate better adaptation to living with dementia.



The taking over of elementary tasks is inevitable, but supported strongly by technological solutions

Intensified care at home in 2015

Facts

- 35.000 people suffering from dementia are dependent on 24-hour care.
- Currently, around 70% of patients live at home with the support of an informal caregiver.
- There are around 300.000 informal caregivers in the Netherlands, with a ratio of 1,2 caregivers for each patient.
- On average, a professional is delivering care 6,6 hours a week. The informal caregiver is on average providing care 20 hours a week.
- More than half of the informal caregivers experiences a heavy burden and 3% of the informal caregivers are dealing with overburden.

Everyday tasks

- Supporting the patient in everyday tasks is a cause of overburden among informal caregivers.
- Patients get isolated from society due to fearfulness regarding their symptoms.

Keeping a day structure

- Behavioral problems can become more severe due to lack of day structure.

Safety at home

- (Informal) caregivers spend a lot of their time supervising the patient by being physically present.

Intensified care at home in 2025

Forecast

- It is expected that around 85% of patients will live at home.
- Online market places for professional caregivers contribute to better pay for the caregiver and reduction of cost for the family.
- A decrease in the amount of informal caregivers suffering from overburden.

Everyday tasks

- **Relieving (informal) caregivers (1)** via cheaper forms of professional support and the use of technological solutions.
- **Improved knowledge & understanding (2)** increase understanding of informal caregivers and reduce stress.

Keeping a day structure

- **Technological support for day structuring (3)** reduces stress and behavioral problems in patients.

Safety at home

- **Safety of the patient is increased (4)** by an increased use of location and action/activity tracking and will also relieve the burden of informal caregivers.

The next pages provides an overview of start ups aimed at the developments labeled 1-4.




The independency of patients with dementia increases and the informal caregiver is relieved (I)

'The use of animated pets in California is described as "a caregiving tool that can engage dementia patients and provide the calming effect that is often sought through medications, but without the side effects. Dramatic improvements are seen from symptomatically advanced dementia, unmanageable violent behavior and uncommunicative withdrawal to what is considered moderate dementia with a pleasant mood, high socialization and improved quality of life (Gerijoy).'

Development	Relieving (informal) caregivers (1)
What does it do?	<ul style="list-style-type: none"> ▪ Technologies will provide personalized, 24/7 (emotional) support and stimulate social interactions. Pet animations on tablets will trigger patients to start interacting. The information gained can be stored and used in the care process. ▪ Professional aid is provided via new business models. Online marketplaces of professional caregivers and medical students empower families to easily find, hire, manage and pay licensed caregivers. Via the use of introduction movies, families are indirectly meeting the people they will hire. ▪ Apps will help informal caregivers in planning care, as the planning can be easily shared with other family members. Also healthcare providers can be linked to the planning. Via these online agenda's, it can be notified when the informal caregiver is in need of extra support from family or friends.
Why is it important?	<ul style="list-style-type: none"> ▪ 24/7 professional care is expensive and therefore limitedly used. Informal caregivers are an important factor in providing 24/7 network support, which may cause overburden. Being able to better manage care and increase the independency of the patient, overburden is reduced.
What is the effect?	<ul style="list-style-type: none"> ▪ Reduction in (perceived) loneliness of the patient and therefore quality of life is improved. ▪ Relieve burden of the informal caregiver.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. New forms of professional aid (business model) are available on the market, such as Caren and Mantelaar. ▪ Already. Several companies offer pet animations and pets in order to provide emotional support for the patient.
Involved companies	



The independency of patients with dementia increases and the informal caregiver is relieved (II)


Development	Improve knowledge & understanding (2)
What does it do?	<ul style="list-style-type: none">▪ Virtual reality-glasses are used to let informal caregivers experience dementia-like symptoms. Via these glasses, they experience the situations people with dementia are experiencing every day and how the environment is reacting to them. In this way they are confronted with their own way of handling these situations.▪ Apps based on a dementia-simulator to experience what it is like to suffer from dementia. Apps are developed that enable informal caregivers to ask questions how to deal with the patient in difficult situations. The app will provide tips in how to deal with these situations.
Why is it important?	<ul style="list-style-type: none">▪ Informal caregivers do not always understand the emotions and thoughts of people suffering from dementia. This gives rise to stressful situations and behavioral problems.
What is the effect?	<ul style="list-style-type: none">▪ Increased understanding reduces the level of stress and contributes to a reduction of perceived burden.
When can we use it?	<ul style="list-style-type: none">▪ Already. Apps providing situation specific information are currently available in English and French.▪ Almost. The virtual reality glasses are being tested in small groups of informal caregivers. It is expected that the glasses will be ready to be used in the end of 2016.
Involved companies	



The independency of patients with dementia increases and the informal caregiver is relieved (III)





'When evaluating the use of DayClocks, the most heard remark from the patients is that they absolutely do not want to lose the device, because they got really attached to it (DayClocks).'

'While Alzheimer's may be incurable, recent studies have shown that mental stimulation in the form of regular reminders of past events could potentially slow down the progression of the disease (Samsung).'

Development	Technological Support for day structuring (3)
What does it do?	<ul style="list-style-type: none">▪ Apps / robots are (verbally) reminding patients about names, events, places, taking medicines and everyday tasks such as showering and eating. These technologies support the gaps in memory, by providing essential information when it is most needed. The provision of this information is combined with the use of colors, melodies and pictures in order to increase the understanding of the patient. It is also possible for the informal caregiver to leave personal notes for the robot, that are read out loud to the patient.
Why is it important?	<ul style="list-style-type: none">▪ Day structuring is important for patients with dementia as they are losing overview and are not able to rely on their memory. This results in a loss in control over their lives.▪ Good structure for the patient will reduce behavioral problems.▪ The loss in structure results in passivity. Due to this passivity, symptoms of dementia develop further and are enhanced in experience.
What is the effect?	<ul style="list-style-type: none">▪ These support mechanisms for the patients' memories result in prolonged independence and a decrease in behavioral problems.▪ Calmness in patients is increased.▪ Activity of the patient is increased.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Prototypes of the robots are tested in homes of people with dementia, in order to evaluate which functions should be included in the robot and which shouldn't. It is expected that the first products will be market ready around 2017.
Involved companies	



The independency of patients with dementia increases and the informal caregiver is relieved (IV)

Development	Safety of the patient is increased (4)
What does it do?	<ul style="list-style-type: none">▪ Location tracking is looking after loved ones in and outside houses via GPS, geofencing and motion tracking. Functionalities on these tracking devices enable direct contact with the patient if abnormalities occur.▪ Activity tracking without the use of cameras, but via sensors to track the patients' activities. Families are updated on patient behavior (using water heater, sleeping, going to the toilet etc.). Pro-active messages can be sent involving for example whether the patient returned home or when the patient is laying in bed for an abnormal long time.
Why is it important?	<ul style="list-style-type: none">▪ The high burden for informal caregivers is among others caused by the high amount of time needed to look after their loved ones and be physically present. Long-distance supervision and an alert system reduces this strongly.▪ Patients get isolated from society, due to the inability to go outside the house independently.
What is the effect?	<ul style="list-style-type: none">▪ Reduction in the worries of families and the burden of informal caregivers.▪ Enables patients to live independently.
When can we use it?	<ul style="list-style-type: none">▪ Already. Activity tracking and location technology are already available for private purchase.
Involved companies	   



A huge amount of support for patients and family will become available. Where and how to start? (I)

How does this affect health care providers: lessons learned

New business models are increasing affordable care for support at home

An increased share of the patient population is living at home, and therefore more professional aid at home is needed. However, traditional healthcare providers should be aware of the new business models that are used in delivering professional support at home, as they provide cheaper forms of care.

The focus on the patients' well-being needs to increase

The distinction between care and well-being needs to be reduced. The delivery of services that enhance patients' health as well as their well-being be delivered in an integral system.

The increased use of technological innovations creates the need for new types of professionals

The increased use of technological innovations creates space for new jobs to monitor and analyze data collected with wearables and monitoring. This creates opportunities for analysis on micro-level (patient) as well as macro-level (quality and outcome).

Why are we currently not using the available technological support?

There is a high potential in relieving informal caregivers by the use of technological solutions. As we can see on the previous pages, several developments are already available. Why aren't we using them?

- Innovations are currently not "simple" enough and do not have the perfect look and feel. There's a generation gap that's contributing to the problem: it is perceived that a lot of innovations are developed by young, fast, innovative people. The involvement of the elderly suffering from dementia is limited – or is perceived as being limited.
- Tailoring of the product is not optimized yet. New developments contain functionalities that are not needed for every patient. It is important to recognize that patients' needs develop and change as their disease progresses. The product should match and options for personalization are a plus.
- It is difficult to teach an elderly person, and especially someone with dementia, new things. It is therefore important that new technologies are thinking for themselves – as intuitive and smart as possible.
- For dementia patients, it is important to be able to understand why new things are appearing in their room, why a robot is an addition and not an intrusion, etc. Early planning facilitates this process.



A huge amount of support for patients and family will become available. Where and how to start? (II)

Things to keep in mind to facilitate implementation of technological innovations into the patients continuum

The earlier diagnosis of the disease will facilitate the adoption of technology in the health continuum, but will not ensure it. The following should be taken in to account to optimize the use of technology in the health continuum.

- Make use of **peer-contact between patients**. People will start using technological innovations if they see that others are using them.
- **Inform professionals** about the technological possibilities (GP, case manager, nurse etc.) and show them how the technologies are not going to reduce the personal touch in healthcare. Professionals can inform the patients and the informal caregivers about the possibilities.
- If patients get the opportunity to **perceive the improvements** offered by the new technologies, adoption of the technology will be increase.
- The innovation should **not have the appearance** that it is **especially developed** for people with dementia. Patients do not want to feel sick and disabled. *"My dementia is not that severe".*
- An application should be developed to **connect all the independent technologies**. This enhances the functionalities of all the different innovations. For example; *Piet is reminded to take a walk by his animated pet. Thereafter his GPS is tracking his location outside the house and a proactive message will be sent to the family when he arrives home. These functionalities from the different innovations should be linked into an integrated system".*

Awareness of the disease should be increased in society

It is important that society is aware of an increased amount of people with dementia still living at home. It is expected that increased social awareness will reduce the burden of informal caregivers.

A community with an increased social awareness of dementia is a **Dementia Friendly Community (DFC)**. The aim of a DFC is to be a place where people with dementia are understood, respected and supported, and be able to contribute to community life. This means that the people suffering from dementia are finding their way around safely, have access to facilities they are used to and maintain their social networks. An important aspect of these DFCs is to raise awareness among society and influence business and organizations to become more dementia friendly.

Results from the introduction of DFCs in England show that: *"It was demonstrated that through personal connections, as seen in the DFCs, people are helped to tackle the impact of a dementia diagnosis, it prevents isolation and the person maintains confidence, skills and contribution to support a better quality of life for a longer period of time. Thereby people seem to respond well to the opportunity to share their positive and negative experiences between peers."*



Phase IV – Nursing homes

This chapter discusses the changes that are expected for the fourth phase of the dementia health continuum in 2025.

Firstly, this phase in the health continuum is described. Secondly, a comparison is provided between the current phase of the health continuum and the continuum in 2025. Thirdly, an overview is shown that provides information about the innovations that are going to change the current continuum. Lastly, preconditions are discussed in order to reach the optimized health continuum in 2025.



As patients and family are better equipped to live at home, demand for nursing homes will decrease

Technological developments will increase quality of life for patients living in nursing homes, due to better patient-tailored care and enhanced safety of patients. In contrast, due to the increased possibilities of living at home, the amount of patients that end up in the nursing home will be reduced.

Providing patient-centered care is becoming more challenging

Informal caregivers are very important for people with dementia, but the burden for the informal caregiver to provide the care needed can become too large. At this point, the patient can be admitted into a nursing home.

There is a high variability in the duration and burden of the disease, and the needs of the patients alter strongly over time. The current care provision often doesn't provide an exact fit to the individual needs of the patients.

The developments in the phases before admission into a nursing home, also affect the patient population

A clear transition is seen in the health continuum that is facilitating the elderly suffering from dementia to live at home for a longer period of time. This will result in a decrease in the share of patients that will eventually live in a nursing home. On top of that, the patients that eventually do get an admission to a nursing home, are the patients with a heavier burden of disease. This will influence the care needed in the nursing homes, as this demands more from the nursing home staff.

What types of innovations do we see?

A smaller share of patients will eventually live in a nursing home, quality of life and patient safety improve.

- Sensors that ensure patient safety support the patient in perception of safety and help staff to be better able to manage their time as monitoring is taken over by technology.
- Innovative communication methods are aimed at verbal and visual forms of communication that increase possibilities for the patients to interact with their environment.
- Innovations that put emphasis on stimulating joyful experiences help patients maintain quality of life.

The next page provides an overview of developments that facilitate better adaptation to living with dementia.



When admitted into a nursing home, the burden of disease will have increased

Intensified care at a nursing home in 2015

Facts

- On average, people with dementia spend 2 years in a nursing home.
- In 2013, 82.000 patients were receiving care in a nursing home facility. Around 30% of the entire patient population lives in a nursing home.
- 1 in 7 people suffering from dementia spend the terminal phase in a nursing home. This phase is associated with the highest loss in quality of life (on average a loss of 71%).
- The largest part of total expenditure associated with dementia care is admission into nursing homes.

Patient-centered care

- Financial reasons limit the possibilities for personalized care, as nursing homes have to prioritize in managing their personnel's activities.

Activities

- People in nursing homes are very limited in their mobility and rarely perform physical exercise or move around.

Supervision

- Currently, technological support is limitedly used.

Intensified care at a nursing home in 2025

Forecast

- It is expected that the share of patients living in a nursing home, will decrease. The patient population will grow, however this effect doesn't outweigh the effect of living at home longer. In absolute numbers, demand for nursing homes will decrease. This results in a larger average burden of disease when patients are admitted; an on average shorter time spent in a nursing home; and a reduction in costs from a macro level perspective.

Patient-centered care

- **Increased joy & happiness for patients (1)** by using photo's and music from the patient for more tailored care and an increased quality of life.

Activities

- **Enhanced safety in nursing homes (2)** through the increased use of technological solutions will increase the ability of the patient to move around freely.

Supervision





- **Facilitation of professional caregivers (3)** supported by technological intervention possibilities. New management apps and training programs are facilitating the professional caregivers in performing their work.
- **Improved communication methods with patients (4)** increases opportunities to deliver personalized care.

The next pages provides an overview of start ups aimed at the developments labeled 1-4.



Technological innovations enhance the quality of life of patients in nursing homes (I)

'Research has shown that keeping patients active, decreases decline in patients' health and increase quality of health. However in a research in the south of the Netherlands, it was found that currently, 90% of the observation time, patients are sitting or lying down. This inactivity is causing a deterioration in the patients health.'




Development	Increased joy & happiness for patients (1)
What does it do?	<ul style="list-style-type: none"> ▪ Technological solutions make use of photo's and music in the form of photo collections and interactive paintings. Personal collections (based on life experience, hobby's, family, interests etc.) of patients' interests are used by caregivers to get a connection with their patients. ▪ Apps are developed that serve as a backup memory. The app detects when family or friends are nearby and will provide the patient with a photo of the person, indicating the relationship with him (e.g., son/sister).
Why is it important?	<ul style="list-style-type: none"> ▪ Improving quality of life for people with dementia in a nursing home has large added value, as people are in a terminal phase of life.
What is the effect?	<ul style="list-style-type: none"> ▪ Help professionals providing more patient-tailored care. ▪ Keeping patients as mentally as fit as possible. ▪ These innovations will not only be seen in nursing homes, but also in the home care setting.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. illi-engineering (technological solution) is already used in several nursing homes in the Netherlands. ▪ Not yet. The apps are still in the development phase.
Involved companies	   



Technological innovations enhance the quality of life of patients in nursing homes (II)

'Admission to a nursing home is a impactful decision. We are working hard to ensure that every day during the stay is as pleasant and safe as possible. This all in respect of privacy.'

'Sensing in nursing homes has the ability to improve the care delivered. The system has proven itself in practice in different Dutch nursing homes.'

Development	Enhanced safety in nursing homes (2)
What does it do?	<ul style="list-style-type: none"> ▪ Sensors will provide the caregiver with information about whether the patient has left the room, whether he got out of bed and provide fall detection. These sensors communicate with other applications. ▪ A smart software system that is linking all technologies used in the nursing home in one place. Enabling to deliver high quality of care with the support of domotics. Care systems like smart sensors, detection, domotics are connected in one dashboard providing one logbook.
Why is it important?	<ul style="list-style-type: none"> ▪ There are a lot of technological developments, and technology is offering more and more possibilities. However, these are all offered by different parties and are therefore not connected. True added value can be found in combining this information.
What is the effect?	<ul style="list-style-type: none"> ▪ Reducing time spent monitoring increases time to care for patients. ▪ More freedom and privacy the residents. ▪ The connection of the different technologies centralizes the optimization of the work process, and not the technology itself.
When can we use it?	<ul style="list-style-type: none"> ▪ Already. Sensors to support the patient's safety in the nursing home are already on the market.
Involved companies	  



Technological innovations enhance the quality of life of patients in nursing homes (III)


'The primary reason to train your workforce is to improve patient care. However, a secondary mission is to reduce injuries and overburden among caregivers (Dementia Dynamics)'.

Development	Facilitation of professional caregivers (3)
What does it do?	<ul style="list-style-type: none"> ▪ Management apps that plan, track and manage activities of daily living and medication. Family members can also access the resident care information and get alerts and notifications. ▪ Training programs will provide nursing home staff with education to enter the patient's world and view it from the patients' perspective. Topics covered are; safety issues, caregiver stress, changes in behavior of patients and managing patient behavior.
Why is it important?	<ul style="list-style-type: none"> ▪ Staff in nursing homes have limited time available for their residents. With help from these management apps patients have more tailored and efficient care. ▪ Patients with behavioral problems don't always receive the right care on time. Reducing behavioral problems by means of improving communication methods and providing training programs helps to counter this effect.
What is the effect?	<ul style="list-style-type: none"> ▪ Improved quality of care as more time and money is available to deliver patient-centered care. ▪ Improved quality of life of those living with dementia as well as their caregivers.
When can we use it?	<ul style="list-style-type: none"> ▪ Already, but not in the Netherlands. Training programs from Dementia Dynamics. ▪ Almost. Carevium is distributing demo's.
Involved companies	 



Technological innovations enhance the quality of life of patients in nursing homes (IV)

'The instant translation of word to image brings the idea into a moment of conversation and has been found to be effective at stimulating memories, improving communication, mood and levels of engagement amongst people with dementia (See what I mean)'.

Development	Improved communication methods with patients (4)
What does it do?	<ul style="list-style-type: none">▪ Apps that translate words into pictures. Images retain their meaning long after the sense of the word has been gone.
Why is it important?	<ul style="list-style-type: none">▪ Increasing communication options and maintaining memory functions as long as possible adds to perceived independency.
What is the effect?	<ul style="list-style-type: none">▪ Communication with patients will be improved.
When can we use it?	<ul style="list-style-type: none">▪ Almost. Improved versions of the app are being developed.
Involved companies	



Patients' increasing burden of disease demands the latest knowledge of technological support

How does this affect health care providers: lessons learned

The patients' burden of disease in a nursing home will increase, which will create the need for education and strategic workforce planning

A heavier burden of disease asks for a different workforce. Whereas the demand for nursing homes decreases, the job will become heavier, so to speak. Also, as the use of professional care at home increases, care will be delivered via different channels, like hiring professional care givers via online markets instead of via health care providers. This asks for a different skill set (soft as well as hard skills) and a different mix of personnel.

Make use of technology in order to prepare for the future patient

New technological developments have the potential to highly increase the quality of the patient's life. Health care providers can further create the opportunities to learn more about working with these innovations. By making use of technological innovations, a heavier caseload does not necessarily mean more, or more expensive personnel – incorporating technological skills into day-to-day work will define the future effective professional.

Resources

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Contacted professionals

1. VuMC (neurologist and researcher)
2. Alzheimer Nederland
3. Internal experts from KPMG Plexus

Startup scan approach in short

- National & international
- Recent startups (< 5 years)
- Example of keywords: dementia prevention, diagnosis, treatment, living at home, support

Top 5 startup databases:

- <https://angel.co>
- <http://spotrocket.co>
- <http://www.f6s.com>
- <https://www.owler.com>
- <http://crunchbase.com>



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